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14,434	220	28,118	26	3302	544	6515	477	8744	19	11,060	575	13,081	885
16,667	30	28,163	147	3326	339	6519	10	8778	96	11,073	285	13,097	549
16,924	24	28,435	145	3357	363	6529	496	8781	622	11,099	724	13,183	880
17,619	13	28,450	579	3394	352	6533	260	8903	701	11,108	233	13,218	884
19,735	18	28,507	170	3395	212	6554	18	8913	161	11,128	757	13,276	876
20,765	200	28,508	160	3477	276	6556	340	8958	406	11,179	721	13,291	826
20,766	291	28,509	161	3617	578	6557	545	8960	365	11,184	881	13,294	838
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26,573	17	1791	285	5395	201	8041	369	10,284	298	12,331	830	14,115	14
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26,939	113	2113	79	5620	889	8184	416	10,484	870	12,469	574	14,311	8
27,034	30	2127	286	5646	344	8193	214	10,485	745	12,480	831	14,312	8
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27,226	171	2495	79	5735	260	8287	95	10,592	212	12,583	934	14,351	4
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27,587	151	2521	277	5797	500	8300	648	10,611	720	12,653	267	14,393	9
27,592	89	2627	412	5799	89	8325	483	10,616	708	12,667	838	14,403	7
27,624	97	2641	97	5901	496	8331	346	10,645	624	12,677	703	14,439	9
27,676	147	2682	369	5931	405	8336	999	10,655	763	12,709	499	14,508	9
27,683	283	2683	97	5978	577	8399	617	10,661	580	12,710	701	14,516	3
27,687	174	2702	207	5998	145	8400	617	10,667	774	12,745	113	14,541	5
27,688	100	2813	746	6012	9	8416	268	10,771	742	12,766	31	14,544	2
27,718	144	2914	229	6034	149	8438	81	10,774	352	12,785	807	14,660	8
27,755	145	2947	27	6114	297	8481	477	10,777	778	12,881	230	14,663	2
27,774	167	3003	340	6138	161	8532	288	10,790	1313	12,906	803	14,725	4
27,787	31	3019	342	6173	453	8540	12	10,791	765	12,908	840	14,740	12
27,905	276	3023	370	6211	260	8541	11	10,793	638	12,927	1063	14,743	5
27,939	141	3036	352	6279	550	8555	488	10,795	484	12,966	425	14,750	7
28,003	97	3055	209	6411	88	8594	566	10,867	425	12,976	147	14,770	9
28,042	209	3061	352	6448	477	8600	941	10,911	897	12,988	721	14,805	9
28,053	550	3087	346	6449	550	8675	428	11,024	692	13,026	807	14,812	9
28,054	550	3134	350	6452	9	8677	207	11,027	9	13,034	89	14,814	9
28,056	269	3200	149	6461	433	8682	634	11,035	745	13,068	696	14,820	8
28,074	151	3276	16	6496	545	8734	358	11,058	264	13,073	884	14,824	4

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4,835	33	16,721	1082	18,220	478	19,963	940	22,111	875	23,852	278	25,752	413
4,858	286	16,757	836	18,236	1021	20,020	1209	22,137	1267	23,864	933	25,761	477
4,874	1032	16,799	623	18,242	154	20,025	1029	22,140	1015	23,866	477	25,768	1460
4,931	778	16,821	545	18,279	650	20,029	1050	22,163	87	23,873	938	25,771	940
4,937	960	16,824	1072	18,280	696	20,040	1209	22,193	896	23,874	1051	25,773	592
14,940	221	16,834	893	18,281	256	20,046	1178	22,200	15	23,875	1051	25,808	1448
14,950	1134	16,845	969	18,322	89	20,057	1165	22,201	1112	23,923	1455	25,809	1063
15,028	906	16,871	870	18,329	1105	20,089	1214	22,218	1261	23,927	1366	25,847	1391
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15,206	407	17,036	1005	18,590	1117	20,401	1205	22,455	1265	24,213	1382	26,125	1148
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15,269	260	17,087	1391	18,610	828	20,462	997	22,555	1244	24,278	1328	26,168	1470
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15,384	1015	17,171	234	18,808	807	20,592	1194	22,615	941	24,403	702	26,309	1455
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15,417	27	17,206	972	18,817	1255	20,631	277	22,672	1250	24,437	1204	26,344	1197
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15,500	980	17,265	81	18,887	214	20,805	1215	22,864	1033	24,505	719	26,459	1242
15,552	977	17,271	99	18,908	745	20,819	836	22,903	832	24,508	708	26,551	1458
15,555	17	17,277	502	18,923	25	20,822	548	22,986	149	24,531	941	26,649	1064
15,560	999	17,279	1104	18,945	1105	20,880	1145	22,992	724	24,555	721	26,657	1152
15,570	889	17,303	1038	18,954	1097	20,893	1133	23,010	1320	24,556	1228	26,700	1450
15,571	418	17,324	1038	18,962	1017	20,895	621	23,013	1022	24,589	710	26,729	831
15,625	343	17,327	707	18,965	1001	20,907	1156	23,038	713	24,607	1373	26,762	148
15,641	490	17,340	866	18,997	1108	20,911	1053	23,039	1267	24,611	684	26,814	453
15,643	552	17,342	95	19,016	891	20,919	1094	23,107	1307	24,620	820	26,822	768
15,647	935	17,345	497	19,080	1196	20,975	1193	23,108	1459	24,631	434	26,842	1033
15,658	624	17,348	695	19,081	1368	20,993	514	23,110	1121	24,703	1002	26,845	766
15,661	550	17,354	1001	19,086	685	21,007	1216	23,111	223	24,709	879	26,858	1193
15,736	934	17,380	932	19,087	1037	21,010	408	23,127	1327	24,716	1380	26,867	167
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15,989	1015	17,611	1057	19,169	1144	21,202	226	23,225	1018	24,816	1366	27,126	565
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16,055	407	17,637	168	19,213	1005	21,293	836	23,238	709	24,839	1393	27,132	1460
16,065	618	17,642	1250	19,217	1103	21,369	1239	23,313	549	24,841	703	27,135	1215
16,076	1000	17,649	718	19,249	346	21,374	408	23,348	1293	24,897	838	27,155	1032
16,087	642	17,655	1066	19,257	170	21,418	546	23,351	1167	24,899	365	27,164	514
16,148	576	17,690	26	19,285	678	21,419	825	23,410	1300	24,903	483	27,165	514
16,198	142	17,718	1063	19,297	1040	21,421	1239	23,419	422	24,919	354	27,201	960
16,199	420	17,771	341	19,332	582	21,450	1214	23,434	1001	24,945	575	27,217	1458
16,210	359	17,818	1002	19,349	941	21,497	497	23,437	1301	25,019	1365	27,231	565
16,211	499	17,830	1082	19,366	83	21,554	203	23,439	1315	25,027	564	27,266	557
16,217	1095	17,862	1097	19,386	1063	21,578	555	23,440	1315	25,082	1453	27,357	719
16,220	1004	17,889	1095	19,391	1174	21,579	687	23,441	1315	25,114	587	27,360	777
16,224	277	17,914	870	19,395	1241	21,580	554	23,442	1307	25,118	704	27,364	958
16,225	98	17,928	650	19,419	479	21,581	1003	23,532	687	25,121	444	27,408	678
16,229	95	17,937	713	19,459	1159	21,582	1239	23,534	701	25,138	516	27,431	876
16,240	935	17,951	1057	19,483	780	21,584	1391	23,547	559	25,146	1455	27,432	691
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16,313	1037	18,064	171	19,696	1053	21,737	405	23,629	1102	25,321	1199	27,582	615
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LIST OF JOURNALS ABSTRACTED, WITH ABBREVIATIONS USED, AND ADDRESSES OF PUBLISHERS.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Agricultural Ledger	Agric. Ledger	Reporter on Economic Products to the Government of India, Calcutta.
Allgemeine Zeitschrift für Bierbrauerei und Malzfabrikation	Allgem. Z. Bierbrau. u. Malzfabr.	Michaelerstrasse 25, Vienna XVIII/₁.
American Chemical Journal	Amer. Chem. J.	The Johns Hopkins Press, Baltimore, Md., U.S.A.
Analyst	Analyst	Simpkin, Marshall, Hamilton, Kent, and Co., Ltd., 10, James Street, Haymarket, London, S.W.
Annalen der Chemie	Annalen	C. F. Winter'sche Verlagshandlung, Leipsig, Germany.
Annales de Chimie Analytique	Ann. Chim. Analyt.	M. Crinon, 45, Rue Turenne, Paris, 3e.
Annales des Falsifications	Ann. Falsific.	11, Rue d'Athènes, Paris.
Archiv der Pharmazie	Arch. Pharm.	Selbstverlag des Deutschen Apotheker-Vereins, Berlin, Germany.
Berichte der Deutschen Chemischen Gesellschaft	Ber.	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W., 6, Germany.
Berichte der Deutschen Pharmazeutischen Gesellschaft	Ber. deuts. Pharm. Ges.	Verlag von Gebr. Bornträger, Berlin, W. 35. Schöneberger Ufer 12A, Germany.
Biedermann's Zentralblatt für Agricultur Chemie	Biedermann's Zentr.	O. Leiner, Konigstrasse, 26B, Leipsig, Germany.
Bio-chemical Journal	Bio-chem. J.	Bio-chemical Dept., The University, Liverpool.
Biochemische Zeitschrift	Biochem. Zeits.	Verlag von J. Springer, Berlin, N. 24. Monbijouplatz 3.
Board of Trade Journal	Bd. of Trade J.	Messrs. Wyman and Sons, Fetter Lane, London, E.C.
Brewers' Journal	Brewers' J.	F. W. Lyon, Eastcheap Buildings, Eastcheap, London, E.C.
British and Colonial Druggist	Brit. and Col. Drug.	44, Bishopsgate Without, London, E.C.
Bulletin de l'Association Chimique de Sucre et de Distillerie	Bull. Assoc. Chim. Sucr.	M. le Trésorier, 156, Boulevard Magenta, Paris, 10e, France.
Bulletin de la Société Chimique de Belgique	Bull. Soc. Chim. Belg.	M. J. Wauters, Palais du Midi (Galerie du Travail, 7), Brussels.
Bulletin de la Société Chimique de France	Bull Soc. Chim.	Masson et Cie., 120, Boulevard Saint-Germain (6e), Paris.
Bulletin de la Société Française de Photographie	Bull. Soc. Franç. Phot.	51, Rue de Clichy, Paris, 9e.
Bulletin de la Société Industrielle du Nord de la France	Bull. Soc. Ind. Nord	Rue de l'Hôpital Militaire 116, Lille, France.
Bulletin de la Société Industrielle de Mulhouse	Bull. Soc. Ind. Mulhouse	Berger-Levrault et Cie., 5, Rue des Beaux-Arts, Paris.
Bulletin de la Société d'Encouragement pour l'Industrie Nationale	Bull. Soc. d'Encour.	Secrétariat, Rue de Rennes 44, Paris, France.
Bulletin of the College of Agriculture, Tokyo Imperial University, Japan	Bull. Coll. Agric., Tokyo	Director of the College of Agriculture, Tokyo Imperial University, Japan.
Le Caoutchouc et le Gutta-Percha	Caoutchouc et Gutta-Percha	A. D. Gillard fils, 49, Rue des Vinaigriers, Paris, X.
Chamber of Commerce Journal	Ch. of Comm. J.	Oxford Court, Cannon Street, London, E.C.
Chemical News	Chem. News	E. J. Davey, 16, Newcastle Street, Farringdon Street, London, E.C.
Chemical Trade Journal	Chem. Trade J.	Davis Bros., Danes Inn House, 265, Strand, London, W.C.
Chemiker-Zeitung	Chem.-Zeit.	Dr. G. Krause, Cöthen, Anhalt, Germany.
Chemische Industrie	Chem. Ind.	Weidmann'sche Buchhandlung, Zimmerstrasse 94, Berlin, S.W., Germany.
Chemische Revue über die Fett- und Harz-Industrie	Chem. Rev. Fett-Ind.	Dr. Maschke, Wallenstein und Co., G.m.b.H., Catherinestrasse 16, Hamburg, Germany.
Chemisches Zentralblatt	Chem. Zentr.	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W., 6, Germany.
Chemist and Druggist	Chem. and Drug.	42, Cannon Street, London, E.C.
Collegium	Collegium	K. Schorlemmer, Huttenstrasse 7, Worms am Rhein, Germany.
Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences	Comptes rend.	Imprimerie Gauthier-Villars, Quai des Grands Augustins 55, Paris.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Comptes-Rendus des Travaux de Laboratoire de Carlsberg	Comptes-rend. Trav. Lab. Carlsberg	H. Hagerup, Copenhagen.
Deutsche Zuckerindustrie	Deuts. Zuckerind.	Verlag der Gesellschaft. Die Deuts. Zuckerindustrie, Berlin.
Electrician	Electrician	G. Tucker, Salisbury Court, Fleet Street, London, E.C.
Elektrochemische Zeitschrift	Elektrochem. Zeits.	M. Krayn, Kurfürstenstrasse 11, Berlin, W.
Engineer	Engineer	S. White, 33, Norfolk Street, London, W.C.
Engineering	Engineering	C. R. Johnson, 35 and 36, Bedford Street, Strand, London, W.C.
Engineering and Mining Journal	Eng. and Min. J.	505, Pearl Street, New York City.
Färber-Zeitung	Färber-Zeit.	Julius Springer, Monbijou-Platz 3, Berlin, N., Germany.
Foreign Office Annual Series (Cons. Reports)	F. O. Ann. Series	Wyman and Sons, Fetter Lane, London, E.C.
Gazzetta Chimica Italiana	Gazz. chim. ital.	La Direzione della "Gazzetta Chimica," Via Panisperna, 89, Rome.
Gerber	Gerber	VI/$_2$ Gumpendorferstrasse 89, Wien, Austria.
Gummi-Zeitung	Gummi-Zeit.	Geschäftsstelle der "Gummi-Zeitung," Blucherstrasse 31, Berlin, S. 61, Germany.
Hopper-Seyler's Zeitschrift für Physiologische Chemie	Z. physiol. Chem.	Verlag von K. J. Trübner, Strassburg, Germany.
Imperial Institute Journal and Bulletin	Imp. Inst. J. *or* Bull. Imp. Inst.	Imperial Institute, London, S.W.
India-Rubber Journal	India-rubber J.	Maclaren and Sons, 37 and 38, Shoe Lane, London, E.C.
International Sugar Journal	Int. Sugar J.	N. Rodger, Office of "The Sugar Cane," Mossburn Buildings, Altrincham, Manchester.
Journal of Agricultural Science	J. Agric. Sci.	University Press, Cambridge.
Journal of the American Chemical Society	J. Amer. Chem. Soc.	C. L. Parsons, New Hampshire College, Durham, N.H., U.S.A.
Journal of the American Leather Chemists' Association	J. Amer. Leather Chem. Assoc.	American Leather Chemists' Assoc., Easton, Pa., U.S.A.
Journal of Biological Chemistry	J. Biol. Chem.	2427-9, York Road, Baltimore, Md., U.S.A.
Journal of the Chemical Society of London, Transactions and Proceedings	Chem. Soc. Trans. *or* Chem. Soc. Proc.	Gurney and Jackson, 10, Paternoster Row, London, E.C.
Journal of the Chemical, Metallurgical, and Mining Society of South Africa	J. Chem. Met. Soc., S. Africa	F. Rowland, 9, Transvaal University College Building, Eloff Street, Johannesburg.
Journal de Chimie Physique	J. Chim. Phys.	Gauthier-Villars, 55, Quai des Grands Augustins, Paris.
Journal of the College of Science, Imperial University of Tokyo, Japan	J. Coll. Science, Tokyo	Director of the College of Science, Tokyo Imperial University, Japan.
Journal of the Franklin Institute	J. Franklin Inst.	The Actuary, The Franklin Institute, Philadelphia, Pa., U.S.A.
Journal für Gasbeleuchtung und Wasserversorgung	J. Gasbeleucht.	R. Oldenbourg, Glückstrasse 8, München, Germany.
Journal of Gas Lighting	J. Gas Lighting	W. King, 11, Bolt Court, Fleet Street, London, E.C.
Journal of Industrial and Engineering Chemistry	J. Ind. Eng. Chem.	C. L. Parsons, New Hampshire College, Durham, N.H., U.S.A.
Journal of the Institute of Brewing	J. Inst. Brewing	Harrison and Sons, 45, Pall Mall, London, W.
Journal of the Institution of Mechanical Engineers	J. Inst. Mech. Eng.	Storey's Gate, Westminster, S.W.
Journal of the Russian Physical-chemical Society	J. Russ. phys.-chem. Soc.	Laboratoire de Chimie, Université Imperiale, St. Petersbourg, Russia.
Journal of Physical Chemistry	J. Phys. Chem.	W. D. Bancroft, Ithaca, N.Y., U.S.A.
Journal de Pharmacie et de Chimie	J. Pharm. Chim.	Imprimerie F. Levé, Rue Casette 17, Paris.
Journal für praktische Chemie	J. prakt. Chem.	J. A. Barth, Rossplatz 17, Leipsig, Germany.
Journal of the Society of Arts	J. Soc. Arts	G. Bell and Sons, York House, Portugal Street, London, W.C.
Journal of the Society of Dyers and Colourists	J. Soc. Dyers and Col.	E. T. Holdsworth, 10, Merton Road, Bradford, Yorks.
Leather	Leather	Leather Trades Publishing Co., Hop Exchange, Southwark Street, London, S.E.
L'Industria Chimica	L'Ind. Chimica	Associazione Chimica Industriale, Via Roma 28 (Galleria Nazionale Scale A), Turin, Italy.
Mémoriale des Poudres et Salpêtres	Mém. Poudres et Salpêtres	Gauthier-Villars, 55, Quai des Grands Augustins, Paris.
Metallurgical and Chemical Engineering	Metall. and Chem. Eng.	Electrochemical Publishing Co., 239, West 39th Street, New York City, U.S.A.
Metallurgie	Metallurgie	W. Knapp, Halle a. S., Germany.
Mining Magazine	Mining Mag.	819, Salisbury House, London, E.C.
Mining World	Mining World	Monadnock Building, Chicago, Ill., U.S.A.

JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER.
Mittheilungen aus dem königlichen Materialprüfungsamt zu Gross-Lichterfelde West	Mitt. k. Materialprüf.	Julius Springer, Monbijou-Platz 3, Berlin, N., Germany.
Mittheilungen aus der Centralstelle für wissenschaftlich-technische Untersuchungen	Mitt. Centralst. Wiss.-techn. Unters.	Prof. Dr. W. Will, Neu-Babelsberg, bei Berlin, Germany.
Mittheilungen des technischen Gewerbemuseums in Wien	Mitt. techn. Gew. Museums	Hörlgasse 5, Wien, IX/$_1$, Austria.
Monatshefte für Chemie der kaiserlichen Akademie der Wissenschaften, Wien	Monatsh.	K. Gerold's Sohn, Barbaragasse 2, Wien, I, Austria.
Moniteur Scientifique	Monit. Scient.	Dr. G. Quesneville, 12, rue de Buci, Faubourg St. Germain, Paris.
Oesterreichische Chemiker-Zeitung	Oesterr. Chem.-Zeit.	Pestalozzigasse 6, Wien I, Austria.
Oil, Paint, and Drug Reporter	Oil, Paint, and Drug Rep.	100, William Street, New York City, U.S.A.
Paper Making	Paper Making	5, Ludgate Circus Buildings, London, E.C.
Papier-Fabrikant	Papierfabr.	Otto Elsner Verlagsges., Berlin, S., 42.
Papier-Zeitung	Papier-Zeit.	C. Hofmann, Potsdamer Strasse 134, Berlin, W. 9, Germany.
Petroleum	Petroleum	Verlag für Fachtliteratur, Motzstrasse 63, Berlin, W. 30.
Pharmaceutical Journal	Pharm. J.	Pharmaceutical Soc. of Great Britain, 72, Great Russell Street, London, W.C.
Philippine Journal of Science	Philippine J. Sci.	Bureau of Science, Manila, Philippine Islands.
Philosophical Magazine and Journal of Science	Phil. Mag.	Taylor and Francis, Red Lion Court, Fleet Street, London, E.C.
Photographic Journal	Phot. J.	Harrison and Sons, 45, Pall Mall, London, S.W.
Proceedings of the American Electrochemical Society	Proc. Amer. Electrochem. Soc.	39, South Tenth Street, Philadelphia, Pa., U.S.A.
Proceedings of the American Institute of Mining Engineers, *and also* Bulletin	Proc. Amer. Inst. Min. Eng.: Bull. Amer. Inst. Min. Eng.	S.W. Corner of Seventh and Cherry Streets, Philadelphia, Pa., U.S.A.
Proceedings of the American Society of Civil Engineers	Proc. Amer. Soc. Civ. Eng.	220, West 57th Street, New York City, U.S.A.
Proceedings of the Engineers' Society of Western Pennsylvania	Proc. Eng. Soc. W. Pa.	2511, Oliver Building, Pittsburg, Pa., U.S.A.
Proceedings of the Faraday Society	Proc. Faraday Soc.	The Secretary, Victoria Embankment, London, W.C.
Proceedings of the Institution of Civil Engineers	Proc. Inst. Civ. Eng.	The Secretary, Great George Street, London, S.W.
Proceedings of the Institution of Mining and Metallurgy	Proc. Inst. Min. and Met.	Salisbury House, London, E.C.
Proceedings of the Royal Society	Roy. Soc. Proc.	Harrison and Sons, 45, Pall Mall, London, S.W.
Recueil des Travaux Chimiques de Pays-Bas	Rec. Trav. Chim. Pays-Bas.	A. W. Sijthoff, Leiden, Holland.
Revue Générale des Matières Colorantes	Rev. Gen. Mat. Col.	L. Lefèvre, Treuil sur Seine (S. et O.), France.
Revue de Métallurgie	Rev. Mét.	H. Dunot and E. Pinat, 49, Quai des Grands-Augustins, Paris.
School of Mines Quarterly	Sch. Mines Quart.	T. H. Harrington, Columbia University, New York.
Science Abstracts	Science Abst.	E. and F. N. Spon, Ltd., 57, Haymarket, London, S.W.
Scientific American	Scient. Amer.	361, Broadway, New York City, U.S.A.
Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften	Sitzungsber. Kgl. Preuss. Akad. Wiss.	Verlag der Königlichen Akademie der Wissenschaften, Berlin.
Sprechsaal	Sprechsaal	Verlag von Müller und Schmidt, Coburg, Germany.
Stahl und Eisen	Stahl. u. Eisen	A. Bagel, Jacobistrasse 5, Düsseldorf, Germany.
Tonindustrie-Zeitung	Tonind.-Zeit.	Dreysestrasse 4, Berlin, N.W. 21, Germany.
Transactions of the American Ceramic Society	Trans. Amer. Ceram. Soc.	The Secretary, Columbus, Ohio, U.S.A.
Transactions of the American Foundrymen's Association	Trans. Amer. Foundrymen's Assoc.	R. Moldenke, Watchung, N.J., U.S.A.
Transactions of the Australian Institute of Mining Engineers	Tr. Austral. Inst. Min. Eng.	57–59, Swanston Street, Melbourne, Victoria, Australia.
Transactions of the English Ceramic Society	Trans. Engl. Ceram. Soc.	Victoria Institute, Tunstall, Staffordshire.
Transactions of the Institute of Metals	Trans. Inst. Metals	Institute of Metals, Caxton House, Westminster, London, S.W.
Transactions of the Mining Institute of Scotland	Tr. Min. Inst. Scot.	Andrew Reid and Co., Ltd., Newcastle-on-Tyne and London.
Transactions of the North of England Institute of Mining and Metallurgy	Tr. N. Eng. Inst. Min. and Met.	Newcastle-on-Tyne.

Journal.	Abbreviation.	Address of Publisher.
Tropenpflanzer	Tropenpflanzer ..	Unter den Linden 43, Berlin N.W., Germany.
West Indian Bulletin	West Ind. Bull. ..	Imperial Dept. of Agriculture, Barbados, W.I
Wochenblatt für Papierfabrikation	Wochenbl. Papierfabr.	Güntter-Staib in Bieberach a. d. Riss, Württemburg, Germany.
Wochenschrift für Brauerei ..	Woch. f. Brau. ..	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany.
Zeitschrift der allgemeine Oesterreichische Apotheker-Verein	Z. Allgem. Oesterr. Apoth.-Ver.	Spitalgasse 31, Vienna IX/$_2$, Austria.
Zeitschrift der analytischen Chemie	Z. anal. Chem. ..	C. W. Kreidel's Verlag, Wiesbaden, Germany.
Zeitschrift für angewandte Chemie	Z. angew. Chem. ..	Julius Springer, Monbijou-Platz 3, Berlin, N., Germany.
Zeitschrift der anorganischen Chemie	Z. anorg. Chem. ..	Verlag von L. Voss, Leipzig, Germany.
Zeitschrift für Chemie und Industrie der Kolloide	Z. Chem. Ind. Kolloide	Verlag von T. Steinkopff, Dresden A. 21, Germany.
Zeitschrift des Vereins der deutschen Zucker-Industrie	Z. Ver. deut. Zuckerind.	Vereins-Direktorium, Kleiststrasse 32, Berlin, W. 62, Germany.
Zeitschrift für das gesammte Brauwesen	Z. ges. Brauw. ..	R. Oldenbourg, Glückstrasse 8, München, Germany.
Zeitschrift für das gesammte Schiess- und Sprengstoffwesen	Z. ges. Schiess- u. Sprengstoffw.	J. F. Lehmann, Paul Heysestrasse 26, München, Germany.
Zeitschrift für Elektrochemie und angewandte physikalische Chemie	Z. Elektrochem. ..	W. Knapp, Mühlweg 19, Halle a.S., Germany.
Zeitschrift für Farben-Industrie	Z. Farben-Ind. ..	Verlag für Textil-Industrie, Kotthuser Ufer 39/40, Berlin, S.O. 26, Germany.
Zeitschrift für öffentliche Chemie	Z. öffentl. Chem. ..	A. Kell's Buchhandlung, Marktstrasse 19, Plauen i. V., Germany.
Zeitschrift für physikalische Chemie	Z. physik. Chem. ..	W. Engelmann, Mittelstrasse 2, Leipzig, Germany.
Zeitschrift für Riech- und Geschmackstoffe	Z. Riech- und Geschmackst.	Hygienische Verlag, Marienstrasse 23, Leipzig, Germany.
Zeitschrift für Spiritusindustrie..	Z. Spiritusind. ..	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany.
Zeitschrift für Untersuchung der Nahrungs- und Genussmittel	Z. Unters. Nahr. u. Genussm.	Julius Springer, Monbijou-Platz 3, Berlin, N., Germany.
Zeitschrift für Zuckerindustrie in Böhmen	Z. Zuckerind. Böhm...	Die Administration, Heinrichsgasse 27, Prag, Bohemia.

ERRATA, 1910.

Issue.	Page.	Column.	Line from Top	Line from Bottom.	Errata.
No. 1—Jan. 15	12	2	29	..	*Add* "A. J. Boult, London. From W. H. Bradley, Chicago."
" "	14	2	Title of 3rd abstract		*For* "K. Thies" *read* "K. Thiess."
No. 2—Jan. 31	73	2	..	9	*For* "$CaSiO_4$" *read* "$CaSO_4$."
" "	74		Table II.		*Delete* $\begin{matrix}\text{"Notes"}\\ SiO_2\end{matrix}$ *and for* "Al_2O" *read* "Al_2O_3."
No. 3—Feb. 15	158	1	Title of 2nd abstract		*For* "1905, 132," *read* "1905, 1302."
" "	174	1	..	19	*For* "216,908" *read* "216,906."
No. 4—Feb. 28	222	2	..	11	*For* "440,843" *read* "404,843."
" "	236	2	Title of 1st patent		*After* "London" *insert* "From J. Moir, Johannesburg."
No. 5—Mar. 15	254	1	3 to 5	..	*Delete the words* "the silica . . . . 24 hours' heatings."
" "	254	1	..	3	*For* "carbonate" *read* "sulphate."
" "	254	2	..	11	*Delete the words* "is formed."
" "	257		Table VIIIB.		*In heading, for* "$CaSO_4+10SiO_2$" *read* "$CaSO_4+10Al_2O_3$."
" "	299	1	17	..	*For* "3 m." *read* "30 m."
No. 6—Mar. 31	349	2	..	6	*For* "gassy" *read* "glassy."
" "	371	1	3	..	*Reverse* "caffeine" *and* "theobromine."
No. 7—Apr. 15	401		Table XI.		*In heading, for* "$SO_2nNa_2CO_3$" *read* "SiO_2 in Na_2CO_3."
" "	401		Table XI.		*Under* "Remarks," *for* "Tl." *read* "Total."
" "	401	2	18	..	*For* "NaO" *read* "Na_2O."
" "	411	1	16	..	*For* "$<\begin{matrix}C\\O\end{matrix}>$" *read* "$<\begin{matrix}CO\\O\end{matrix}>$"
" "	412	1	23	..	*For* "dimethylpyranthrose" *read* "dimethylpyranthrone."
" "	450	2	..	18	*For* "calcium chloride" *read* "calcium hypochlorite."
" "	450	2	..	33	*For* "10° C." *read* "100° C."
No. 8—Apr. 30	470	1	16 and 17	..	*For* "Fe_1O_3" *and* "Al_4O_5" *read* "Fe_2O_3" *and* "Al_2O_3."
" "	480	1	Title of 4th abstract		*For* "951,271" *read* "951,272."
No. 10—May 31	612	2	3	..	*Insert* "0·5" *before* "Al_2O_3" *and for* "$10SiO_2$" *read* "$5SiO_2$."
" "	627	1	17	..	*For* "General Electric Co." *read* "General Chemical Co."
No. 11—June 15	678	2	24	..	*For* "Roak" *read* "Roake."
" "	679	1	..	5	*For* "Rodke" *read* "Rodhe."
No. 12—June 30	778	1	22	..	*For* "$x=Kt$" *read* "$x=Kt^n$."
No. 13—July 15	802	2	..	10	*For* "double" *read* "direct."
" "	802	2	..	9	*Delete the words* "and closed chains."
" "	834	2	20	..	*For* "957,237" *read* "959,237."
No. 14—July 30	886	1	..	41	*For* "ferons" *read* "ferrous."
" "	886	1	..	46	*For* "(process I.)" *read* "(process II.)."
" "	889	1	..	19	*For* "Gwicky" *read* "Zwicky."
" "	898	2	..	31	*For* "carbazide" *read* "carbazone."
No. 15—Aug. 15	926	1	4	..	*For* "Coleman" *read* "Colman."
" "	926		Table		*For* "350 %o C." *read* "350° C."
" "	958	2	Title of 3rd abstract		*Before* "Nov. 24" *insert* "Eng. Pat. 27,364."
" "	972	1	Title of 2nd abstract		*For* "Woeller" *read* "Moeller."
No. 16—Aug. 31	1002	1	..	49	*For* "Mitobedzka" *read* "Milobedzka."
No. 17—Sept. 15	1057	2	Table		*In last column, for* "8·50" *read* "0·50."
No. 18—Sept. 30	1102	1	..	15	*Insert* "From E. Welchert."
" "	1123	1	..	4	*For* "9881" *read* "9551."
" "	1132	2	8	..	*For* "2,057,475" *read* "2,077,475."
No. 20—Oct. 31	1231	2	..	29	*For* "£490,000" *read* "£3,427,000."
No. 22—Nov. 30	1283	1	..	3	*For* "revenue" *read* "rubber."
No. 23—Dec. 15	1367	1	35	..	*For* "1909" *read* "1910."
No. 24—Dec. 31	1428	1	4 and 18	..	*For* "washing" *read* "roasting."
" "	1428	1	12	..	*For* "washed" *read* "roasted."
" "	1472	1	7, 9, and 12	..	*For* "methylhydrastine" *read* "methylhydrasteine."

Journal of the Society of Chemical Industry.

No. 1, Vol. XXIX. JANUARY 15, 1910. No. 1, Vol. XXIX.

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Official Notices.

NEW HON. FOREIGN SECRETARY AND VICE-PRESIDENT.

Dr. Rudolph Messel has been appointed Hon. Foreign Secretary of the Society in the place of the late Dr. Ludwig Mond, F.R.S.

Prof. A. Liversidge, F.R.S., has been appointed a Vice-President of the Society in the place of Dr. R. Messel, appointed Hon. Foreign Secretary.

NEW HON. SECRETARY OF THE LONDON SECTION.

Mr. J. H. Coste, of "Utopia," Gloucester Road, Teddington, has been appointed Hon. Secretary of the London Section in the place of Mr. Julian L. Baker, who has resigned office.

Canadian Section.

Meeting held at Toronto on April 8th, 1909.

DR. W. LASH MILLER IN THE CHAIR.

THE CRYSTALLISATION OF CANE SUGAR.

BY C. F. BARDORF.

New England Section.

Meeting held at Boston, U.S.A., on Friday, December 3rd, 1909.

DR. W. H. WALKER IN THE CHAIR.

THE HEAT OF CHEMICAL REACTIONS AS A BASIS FOR A NEW ANALYTICAL METHOD.

BY HENRY HOWARD.

Test of fuming sulphuric acid.—The old-fashioned method of analysing fuming sulphuric acid by titrating with a normal alkali solution is not at all satisfactory for regular technical use, particularly by the foreman of an acid works, for the reason that a very slight error in the strength of the solution or in the quantities of the materials used causes a serious error in the percentage of free sulphuric anhydride. We found in our plant that it was extremely difficult to get concordant results unless these titrations were made by the chemist. As it is not practicable to have the chemist on hand day and night, and as control analyses have to be made once an hour on several kinds of acid, it is most important to have a reliable and simple method. I began the work on my new method in the winter of 1908, and have had it in regular operation ever since the early spring of that year. The principle involved is the measurement of the heat developed by combining the free sulphuric anhydride with water. As this heat value is very great, very small variations in the percentage of free anhydride make large variations in the heat produced. In order to eliminate as far as possible the heat of dilution of sulphuric acid, I prefer to take as my source of water for hydrating the anhydride, a sulphuric acid of such concentration, that when a given quantity of this acid is mixed with an equal weight of fuming acid, the resulting mixture will only contain slightly more water than is necessary to produce the monohydrate. In practise where a fuming acid of 20 per cent. to 25 per cent. of free anhydride is to be tested, I use for mixing with it a sulphuric acid containing 92 per cent of H_2SO_4. It is, of course, important to carry out the analysis in a vessel so arranged as to prevent the loss of heat by radiation. For this purpose I have found a Dewar vacuum tube to be most satisfactory. The drop in temperature through radiation when using one of these tubes does not materially affect the result within the time required for analysis. In detail my method of procedure is as follows:—

100 grms. of the fuming acid to be tested are weighed in a Dewar vacuum tube. The temperature (a) is noted, and then the temperature (b) of the reagent acid, after which 100 grms. of the 92 per cent. acid are poured into the Dewar tube and thoroughly mixed by stirring with the fuming acid already in the tube. The temperature (c) of the mixture is recorded. The heat of reaction equals $c - \frac{a+b}{2}$, making no allowance for the heat capacity of the Dewar tube. In order to avoid corrections for the heat capacity, or any other small errors which might creep in, tests are made in this manner of fuming acids, the composition of which is exactly known, and from these initial determinations a table is prepared. *Note*: Vacuum tube No. 7145, 100 mm. × 45 mm. diameter, sold by Eimer & Amend, is a convenient size and shape to use

Heat of reaction. ° F.	Free sulphuric anhydride. Per cent.
72°	21·0
73·2	21·2
74·4	21·4
75·6	21·6
76·8	21·8
78·0	22·0
79·2	22·2
80·4	22·4
81·6	22·6
82·8	22·8
84·0	23·0
85·2	23·2
86·4	23·4
87·6	23·6
88·8	23·8
90·0	24·0
91·2	24·2
92·4	24·4
93·6	24·6
94·8	24·8
96·0	25·0
97·2	25·2
98·4	25·4
99·6	25·6
100·8	25·8
102·0	26·0

It will be noted from the above table that there is a difference of 6° F. for each per cent. increase of free anhydride, and as readings may be depended upon, even with the simple apparatus used, to within ½° F., it will be seen that the results obtained should be extremely accurate. They are, moreover, carried out very easily by an ordinary intelligent workman; the time required for the determination should not exceed 3 or 4 minutes from the start to the finish.

Test of monohydrate.—The same principle may be used to give a most accurate determination of the strength of sulphuric acid running from 95 per cent. to 100 per cent. H_2SO_4, but, of course, in making this test the fuming acid must be used in excess, and the heat developed is the measure of the amount of uncombined water contained in the sulphuric acid which has been tested.

For the reagent acid is used ordinary fuming acid of 24 per cent. to 25 per cent. anhydride, and with this fuming acid a sulphuric acid may be tested provided it contains from 94 per cent. to 100 per cent. H_2SO_4. If weaker acids are to be used, a fuming acid containing more anhydride would be preferable. The analysis is carried out as follows:—100 grms. of the sample of acid to be tested are weighed into a Dewar vacuum tube and the temperature (a) noted. 100 grms. of the fuming reagent acid, the temperature (b) of which has been noted, are added to the monohydrate in the Dewar tube and thoroughly mixed with it by stirring. The temperature of the mixture (e) is recorded. The heat of the reaction equals $e-\frac{a+b}{2}$, (making no allowances for the heat capacity of the tube). The necessity for these allowances is obviated by making tests of acids of known composition as in the case of the fuming acid, and from these tests the following table has been prepared :—

Heat of reaction	%H_2SO_4	Heat of reaction.	%H_2SO_4
72·2	94·0	40·5	96·6
71·0	94·1	39·3	96·7
69·7	94·2	38·1	96·8
68·5	94·3	36·9	96·9
67·2	94·4	35·7	97·0
66·0	94·5	34·5	97·1
64·8	94·6	33·2	97·2
63·6	94·7	32·0	97·3
62·4	94·8	30·8	97·4
61·2	94·9	29·5	97·5
60·0	95·0	28·5	97·6
58·8	95·1	27·4	97·7
57·5	95·2	26·4	97·8
56·3	95·3	25·3	97·9
55·1	95·1	24·3	98·0
53·9	95·5	23·2	98·1
52·7	95·6	22·1	98·2
51·5	95·7	21·0	98·3
50·2	95·8	19·9	98·4
49·0	95·9	18·8	98·5
47·8	96·0	17·7	98·6
46·6	96·1	16·6	98·7
45·4	96·2	15·5	98·8
44·1	96·3	14·5	98·9
42·9	96·4	13·5	99·0
41·7	96·5		

From the above table it will be noted that for every 0·1 per cent. variation in the acid between 94 per cent. and 99 per cent. H_2SO_4 there is more than a degree difference in the temperature resulting from the reaction. In practise I find that this is a much more satisfactory method than titration for exactly controlling the strength of acids within the limits covered by the tables, and is. moreover, a method which can more easily and accurately be carried out by the workman.

It is obvious that this method of analysis by heat of reaction has a very wide application, and can be extended to cover a great variety of compounds: for instance, alkali can be determined by measuring the heat of reaction developed when it is mixed with an acid. Salts of the weaker bases may be determined by decomposing them with a stronger base, and measuring the heat of the reaction, etc., and the method is subject to great refinement by using a variety of well-known apparatus, which has been brought to a high state of development for measuring the heats of reaction for purely scientific purposes.

Nottingham Section.

Meeting held at Nottingham on Monday, December 7th, 1908.

MR. O. QUIBELL IN THE CHAIR.

THE SODA BOIL.

BY S. R. TROTMAN AND S. J. PENTECOST.

Abstract.

The object of the soda boil is to remove the natural fats, albuminoids, pectins, and tannins present in the cotton. At the same time adventitious dirt, dressing materials, and grease are also removed. Unsaponifiable oils, if present, are chiefly removed by emulsification, while the saponification of the grease liberates much mechanically entangled dirt, which is then removed by the action of gravity or pedesis. Dressing materials are in general readily soluble in boiling alkaline solutions. The first rule of successful bleaching is undoubtedly a complete soda boil. If grease be left it protects the fibres from action, and makes it necessary to employ stronger bleaching solutions, with the accompanying danger of over bleaching and tendering. The incomplete removal of nitrogenous compounds not only causes the same trouble, but is directly objectionable, owing to the power which proteids have of absorbing chlorine, giving rise to chloramines (Cross and Bevan, J.S.C.I., 1908, 260).

The soda boil is sometimes preceded by a lime boil, followed by an acid bath. When cotton is boiled with lime, lime soaps are produced, while the pectins are converted into soluble compounds. After the lime treatment, the goods are treated with hydrochloric acid, to decompose the lime soaps and other calcium compounds. They are then boiled with soda lye, to reconvert the liberated fatty acids into soluble soaps, capable of being removed by washing. An advantage claimed for the use of lime is that if goods be impregnated with it, they are protected from mercerisation, and thus stronger solutions of soda can be used without danger. The advantages of the lime process are not, however, great in comparison with the increased cost of the extra processes necessary, and, as a general rule, in this district at any rate, only weak solutions of caustic soda are used with or without the addition of sodium carbonate. The latter body, although possessing little power of saponifying, aids in the formation of emulsions, and assists in the removal of unsaponifiable oils.

When cotton has been thoroughly bottomed in the boil it should not contain more than traces of oil or nitrogen, and the completeness of the process can easily be measured by a determination of the residual grease and nitrogen. When cotton has not been thoroughly bottomed, patchy bleaching frequently results, and ultimately the impurities left in the fibre work their way to the surface, causing loss of colour. Bleached cottons, which contain from 0·25 to 0·5 per cent. of oil and nitrogen, indicate a faulty soda boil, and are frequently the cause of complaint and claims for damage. The difficulties of lye boiling are often increased by the necessities of quick delivery of the finished goods. In such cases the use of potash instead of soda is desirable where the cost will allow of its substitution. The results of a number of experiments made by us show that in any length of time less than that necessary for the complete action of soda, potash will always remove about 20 per cent. more than soda when used in equimolecular solutions. The conditions necessary to ensure a complete soda boil are :—

1. The use of suitable water.
2. Good packing and circulation in the kier.
3. Absence of air and oxygen.
4. The presence of sufficient soda.
5. The complete removal of soda immediately after boiling.
6. The absence of direct contact of the goods with steam pipes.
7. Purity of the reagents used.

Water used in soda boil.—This should be as soft as possible. If hard water be used, it will, in presence of sodium hydrate, form lime and magnesia. These will in turn fix their equivalent of fatty acids as insoluble soaps in the fabrics, and the latter can only be removed by decomposition with acid. The damage caused by lime and magnesia soaps has already been pointed out by one of us (this Journal, 1905, 267).

The following experiment gives a concrete example. Two equal quantities of cotton were boiled with caustic soda solution, the solution being in one case made with distilled water, and the other with water containing 40 parts of hardness per 100,000. At the end of four hours the fat removed was estimated. The results showed that in the first case twenty-three per cent. more of the total fat had been removed. Goods bleached with hard water can always be detected by estimating the fat and then soaking the goods in acid, washing, drying, and extracting the fatty acids. It is by no means uncommon to find as much as 0·3 to 0·5 per cent. of fatty acids as soaps. There is no doubt that soft water is far better than merely softened water, since many neutral salts, such as chlorido and sulphates of sodium, if present in any quantity, have a retarding effect on saponification.

Freedom from iron should be ensured both in the original water and condensed steam, where this is used. Very small quantities of iron are sufficient to cause loss of pure colour. In one case it has been proved to be caused by so little as 0·05 grains per gallon.

Packing of goods in the kier.—The careful packing of the goods in the kier is also of great importance. They should be so arranged that spaces in which steam or air could collect cannot be formed between the layers, since this is a frequent cause of overheating, and causes mechanical stress sufficient to break fine goods. The closer the goods are packed the less likely this is to happen, but close packing emphasises the importance of good circulation. A good plan is to saturate the goods with caustic soda solution before placing them in the kier, and to pack them as regularly as possible. If the packing be uneven, the liquor will tend to circulate freely through the loosely packed portions, leaving the tightly packed, which offer greater resistance. The saturation of the goods can be conveniently carried out by running them through a bath and out between two rollers, to remove the superfluous liquor. They are then run straight into the kier and arranged. Care must be taken to see that the goods are completely immersed in the soda solution, and that no steam pipes come in contact with them. Neglect of these precautions causes incomplete scouring or local damage from burning.

Good circulation.—The rate of saponification varies with the cube of the rate of circulation. The lye tends to become weakened in contact with the goods, and if the circulation is not good it is not replaced. The rate of saponification is thus diminished, and imperfect scouring results. Most kiers are provided with some automatic apparatus for ensuring circulation. The commonest of these is a spreader beneath a false bottom, which combines the heating and circulation of the liquor in one operation. In this method it must be remembered that the introduction of the steam must be intermittent, since, as soon as the liquor has the same temperature as the steam, the latter will simply escape without causing circulation. Many other methods of inducing circulation have been described in the Journal of this Society, amongst which are the use of a vacuum (1909, 979), and a horizontally perforated spreader (1902, 612), the use of perforated concentric cylinders (1902, 342), and an aspirator (1908, 1016). In Barlow's kier, circulation is induced by gravity, while in Farmer and Spendé's kier an automatic spring, affected by the pressure in the kier, controls a valve, which in turn regulates the circulation. Perhaps the most effective method of producing circulation is the centrifugal pump, which continuously withdraws liquor from the bottom of the kier, and sprays it on to the goods at the top.

Absence of oxygen and air.—This is perhaps the condition most essential to good soda boiling. Although dilute boiling soda has no action on cellulose in the absence of air, it readily attacks it in the presence of oxygen, forming oxycellulose. The production of oxycellulose means destruction of tissue, and consequently tendering. Moreover a fabric containing oxycellulose often develops a brownish tinge on keeping. Air is sometimes present owing to bad packing or imperfect soaking of the goods. Not only does it cause oxidation, but expanding on heating, produces air bubbles, which protect the cotton from the action of the lye. The tendency to oxidation is increased by the power which cotton has of absorbing gases.

The presence of sufficient soda.—Not only must the quantity of lye be sufficient to cover the goods, but it must contain a sufficient quantity of alkali to saponify and render soluble the impurities. In this respect the use of old lyes without previous analysis is to be deprecated, and it is too often forgotten that a hydrometer cannot give reliable information in the presence of a mixture of soluble compounds. No old lye should be used without the determination of the caustic soda and sodium carbonate by titration. Great care should be taken to strain off or otherwise remove any impurities present in the caustic soda, since many of them have a directly inhibiting effect upon saponification. This point will be returned to later.

Rapid removal of soda after boiling.—After boiling, the goods should be washed so far as possible in the kier, and not exposed to the action of the air until only traces of the soda are present. The incomplete removal of soda before the goods are exposed to the air favours the production of oxycellulose as mentioned above, but it is also objectionable for another reason. If cotton be left exposed to the air in contact with a weak solution of caustic soda, the latter will gradually become concentrated by evaporation, especially if the solution be hot to start with. In this way the lye will gradually reach the strength necessary to exercise a mercerising effect. Mercerisation is accompanied by shrinkage. In the case of goods like lace curtains, containing a tightly made pattern, these patterns, being unyielding, offer considerable resistance to the shrinkage, and thus considerable tension results The bobbin threads being much finer than the remainder, are often unable to withstand this tension, and consequently break in the subsequent stretching process. Even if they do not break, considerable distortion of pattern often results. This is mostly caused by lifting the lid of the kier, exposing the goods at the top, which get partially dry instead of washing at once.

Absence of direct contact of the goods with steam pipes.—In all well-constructed kiers, this is provided against. The goods frequently become burned through direct contact with pipes.

Purity of reagents used.—It is easy to obtain caustic soda of a high degree of purity, but some samples contain notable quantities of sodium chloride and sulphate, and occasionally alumina as aluminate. Experiments made by us have shown that these impurities exercise a greater effect upon the removal of the impurities than is usually recognised. The results of these experiments will be brought before the Society shortly.

Completeness of boil.—The following are typical analyses, showing the difference between a well-boiled cotton and one from a faulty process.

	Good material	Bad Material.
Mineral matter	0·05—0·75	1·00
Free fat	0·10—0·15	0·35—0·70
Fat as soap	traces	0·25—0·50
Nitrogen	0·05—0·10	0·25—0·35

Other bodies used in lye boiling.—Other alkaline compounds are also used, with or without caustic alkalis, the chief of which are sodium carbonate, sodium silicate, sodium borate, or borax. Sodium carbonate has already been referred to, its chief use is as an emulsifyer, and the same may be said of borax. Neither have any detrimental effect on cotton. Sodium silicate has considerable scouring properties, but its use is not advisable with fine goods, owing to the possibility of the silica being deposited and mechanically damaging the goods. As is to be expected, none of these bodies remove so much from cotton as caustic alkali, as is seen by the following table of experiments, made upon the same cotton:—

	Percentage loss.
Caustic potash	5·00
Caustic soda	4·40
Sodium carbonate	3·70
Sodium borate	2·80
Sodium silicate	2·40

Changes due to scouring and lye boiling.—The physical changes due to scouring and lye boiling are:—

1. Loss in weight.
2. Loss in length.
3. Alteration in count.
4. Increase of tensile strength.
5. Alteration in twist.

Loss in weight.—Very few attempts have been made to quantatively measure the loss that may be expected when ordinary cotton yarn or goods are subjected to the soda boil. This is to be wondered at, considering how often disputes arise as to the allowance to be made. Although both parties to a dispute have their own ideas on the subject, these rarely rest upon quantitative experiments, since neither, as a rule, knows the condition of the goods before or after bleaching with respect to moisture. Thus a bleacher receives 100 pounds of cotton yarn, containing X per cent. of water, and delivers say 90 pounds of bleached yarn containing Y per cent. of water. The apparent loss is 10 lbs., or 10 per cent., but the real loss can only be ascertained when X and Y are known and allowed for. Thus, if when received the yarn contained 92 per cent. of dry yarn and 8 per cent. of water, it must, after bleaching, be calculated to the same percentage composition before the loss can be found. The best way of doing this is, of course, to determine the "condition weight" of the yarn before and after treatment.

The following table is a summary of a number of tests made with common counts in this way, and since they have been made under strictly scientific conditions, should prove of some value.

Reputed count.	Percentage loss.	No. of tests.
24/2 Am	5·30	7
32/2 Am	4·01	36
40/2 Am	4·35	15
70/2 Am	3·90	29
70/2 Eg	6·54	8
80/2 Eg	4·59	12
100/2 Eg	4·35	18
120/2 Eg	4·60	12
150/2 Eg	4·55	6

Loss in length.—The shrinkage due to boiling varies very much with the conditions. In the foregoing experiments the length of the yarn tested was measured before and after boiling, the average loss being 2·6 per cent. In commercial bleaching operations, it is usual to allow 5 per cent., but this should not be reached.

Alteration in Count.—Since count depends jointly upon weight and length, it is obvious that it will be affected by both of the above losses. In speaking of an alteration in count, one must be careful to distinguish between the apparent count and the true count at correct condition with respect to moisture. The apparent alteration in count may be quite as misleading as the apparent loss in weight for exactly the same reasons. The following table shows the results of a large number of tests of cotton yarns before and after lye boiling, in each case the "true" count being given.

Count before lye boil.	Count after lye boil.
24	25·70
32	33·72
40	42·0
70	72·58
80	83·90
100	104·60
120	125·60
150	167·50

It will be noted, as might be expected, the alteration gradually increases with the count.

Increase in tensile strength.—After a properly conducted lye boil, yarn will always show a greater breaking strength than before. Any weakening which might result from the removal of waxy matters is probably more than made up for by the thickening and felting of the fibres. Piece goods, such as lace curtains, are sometimes weaker after the boil, because the finer threads have been unable to stand the strain caused by the shrinkage due to careless boiling. As a general rule, any difference of breaking strength between unbleached and bleached yarn is due to the bleaching process, and not the soda boil.

Alteration in twist.—In addition to the alteration produced in the natural twist of the cotton fibre, the soda boil causes an increase in the number of turns per inch in a yarn. This is due to the combined effect of shrinkage and tightening of the cotton. We have made a number of experiments upon this point, and find that the increase in turns is on the average 15 per cent.

Meeting held at Derby, on Wednesday, December 8th, 1909.

MR. S. J. PENTECOST IN THE CHAIR.

THE RONCHÈSE METHOD OF DETERMINING AMMONIA AND ITS EXTENSION TO THE DETERMINATION OF THE TOTAL ACID CONTENT OF ORGANIC AMMONIUM SALTS AND AMMONIACAL SOLUTIONS.

BY JOHN M. WILKIE, B.SC., A.I.C.

In the paper by Wood and Trotman on "The Amount of Skin Substance dissolved in Fellmongers' Collecting Limes" (this J., 1909, Dec. 31st, p. 1304), the authors incidentally referred to some work of Bennett (this J., 1909, 291), who suggested the employment of the Ronchèse method in Kjeldahl work. This method depends on the fact that in the presence of a large excess of formaldehyde ammonium salts form hexamethylenetetramine, liberating the acid quantitatively: the liberated acid is then directly titrated with standard alkali and thus a measure of the ammonia obtained. Considering the potentialities of the method its scanty treatment in literature is remarkable. Ronchèse treats two cases. Neutral salts are treated as just described. Acid solutions require preliminary neutralisation, which is effected in another portion of the solution than that actually used for the ammonia determination, because of the inapplicability of phenolphthalein for the neutralisation of ammonium salts. Water free from carbon dioxide is directed to be used, and 20 per cent. formaldehyde is the strength employed, at least 2 c.c. being added for each 1 c.c. of $N/10$ ammonia present. The method is available only when the neutrality of the salt to a suitable indicator can be ensured, otherwise there is no certainty that the acid liberated is derived wholly from an ammonium salt. Now since the usual indicator for this purpose, methyl orange, is not available for the weak inorganic acids or for organic acids generally, the method as published is limited to quite a small number of salts, sulphate, nitrate, the halogen salts, &c. Ronchèse does not seem to have made this differentiation clear. He assumed the normal composition of the so-called neutral ammonium salts, and returned in terms of ammonia all acid liberated by the formaldehyde. Of course such an assumption is untenable.

As a result of a somewhat considerable experience of the method in the case of the salts above cited, I find it advantageous to slightly modify the directions of Ronchèse. A solution of the ammonium salt is prepared in water free from carbon dioxide, one-tenth molecular for the sulphate and one-fifth for the other salts cited. 10 c.c. of this solution is transferred to a small flask. A drop of methyl red (*cf. infra*) is added and exact neutrality effected by addition of alkali or acid as the case may be. 20 c.c. of 10 per cent. formaldehyde solution (neutralised immediately before use) is added, and the liberated acid is titrated with $3N/20$ barium hydroxide solution, using phenolphthalein as indicator, until the solution just turns pink; the end point is quite sharp and the results are excellent. It will be noticed that I differ from Ronchèse in ensuring preliminary neutrality in every case by using a more dilute formaldehyde solution in less amount, and by substituting baryta for soda. Since phenolphthalein i the indicator, the advantages accruing from the use o baryta are self-evident. The more dilute formaldehyd solution enables neutrality to phenolphthalein to be effecte more sharply, and I find the presence of methyl red o methyl orange in no wise vitiates the end point with th phenolphthalein. I would again insist that in no sens can the process be accurate unless exact neutralisatio is effected. Obviously the solutions to be tested mus be free from carbon dioxide; if present, the solution mus be boiled under a reflux condensor, acid being added necessary.

So far as I am aware, Ronchèse did not examin the second class of ammonium salts, those i which initial neutralisation with a reliable indicato is impossible. In the case of any monobasic organic acid the salt may be neutral (normal), acid, or alkaline. In the first case the amount of acid liberated on treatment with neutral formaldehyde is an accurate measurement of the ammonia. If the salt is acid the result obtained will be too high, for both the free and combined acid will be returned as ammonia. If the salt is alkaline the result will be too low, for the free ammonia will escape measurement. But in all three cases an approximately correct measurement of the total acid, both free and combined, will be obtained. The ammonium salts of salicylic, benzoic, sulphuric, citric, tartaric, oxalic, acetic, and valerianic acids have been examined by this method, and in all cases fair results have been obtained. In the case of succinic and oxalic acids, pure specimens were available, and $N/5$ solutions were prepared in water free from carbon dioxide. Four portions of 10 c.c. of each solution were transferred to small flasks to which were added respectively 0·0, 1·0, 2·0, 3·0 c.c. of $N/1$ ammonia; 20 c.c. of 10 per cent. neutralised formaldehyde were then added and the acid titrated in the usual manner. (To the experiment containing excess of ammonia (3·0 c.c. of $N/1$) 30 c.c. of formaldehyde was added instead of 20 c.c.). In all cases the maximum error was about 1 per cent., but I shall not at present deal further with the subject until I have looked more fully into it. As far as my evidence goes there is a distinct residual alkalinity in the case of organic acids which is much more marked in some cases than others. The maximum error observed as already mentioned is about 1 per cent., this residual alkalinity to a certain extent being proportional to the amount of ammonia originally present, and apparently being independent of the actual amount of formaldehyde present, provided a certain minimum is exceeded.

Hexamethylenetetramine, the condensation product of formaldehyde and ammonia, is a perfectly stable substance; it is a monacid base and may be determined with fair accuracy by direct titration with $N/1$ acid in presence of methyl orange. 1·4 grm. is transferred to a small beaker or other cylindrical vessel of small diameter and 10·5 c.c. of $N/1$ sulphuric acid is added and the amine dissolved by stirring; a few drops of methyl orange solution are added and the excess of acid titrated with $N/1$ sodium hydroxide solution. Hexamethylenetetramine may also be determined very conveniently by the Ronchèse method after destruction with a limited amount of sulphuric acid. About 0.07 grm. is gently heated in a 100 c.c. Kjeldahl flask with 2 c.c. of concentrated sulphuric acid until a colourless solution is obtained—an operation which takes some two or three hours. When cool, 25 c.c. of water, two drops of methyl red and caustic soda freed from carbonate by treatment with barium hydroxide is added drop by drop until the solution is nearly neutral. After cooling, neutrality is effected by addition of $3N/20$ barium hydroxide solution, formaldehyde and phenolphthalein are added, and the liberated acid is titrated in the usual manner. Since the final product is again hexamethylenetetramine, the determination involves a curious cycle.

With reference to the use of the Ronchèse method in Kjeldahl determinations, it will be seen from the above that Bennett (this J., 1909, 291) has failed to draw attention to certain necessary precautions. Thus the use of phenolphthalein in the preliminary neutralisation of the ammonium salt is to be deprecated, and so also the employment of barium carbonate to neutralise the formaldehyde; attention should also have been drawn to the necessity of freeing the strong caustic soda used from carbonate. The method was tested by adding 20 c.c. of $N/10$ ammonium chloride solution to 5 c.c. sulphuric acid somewhat diluted and determining the ammonia in the manner described for hexamethylenetetramine. Though the results obtained were quite near theory, it seems to me that distillation is to be preferred if as much as 5 c.c. of concentrated sulphuric acid requires preliminary neutralisation. Of course if solutions of soda absolutely free from carbon dioxide and barium are available, the end point will be much clearer because of the absence of precipitated barium sulphate.

Methyl red, *p*-dimethylaminoazobenzene-o-carboxylic acid, is a recent discovery of Rupp and Loose (this J. 1908, 1223). Its colour changes are very similar to those of methylorange but much sharper. It may be used with $N/100$ solutions and is designed for use with weak bases. I have to express my indebtedness to Messrs. Boots, Ltd., in whose laboratory the work was carried out,

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DISCUSSION ON THE DETERMINATION OF LEAD IN THE PRESENCE OF IRON (this J., 1909, 636).

BY J. M. WILKIE.

Mr. WILKIE, in opening the discussion, briefly reviewed the objects of his investigation.

The estimation of small quantities of lead by comparison of the tint developed by hydrogen sulphide in acid solution with that developed by known amounts of lead under similar conditions has been in use a long time. This simple process suffers, however, from the serious drawback that the tints developed are of a greyish colour which does not lend itself readily to purposes of comparison. In alkaline solution especially in the presence of an organic acid—hydrocyanic acid answers admirably—a chocolate brown tint is obtained which is immensely better for comparative purposes, but in presence of traces of iron, yellow or greenish black colourations are produced which render the test useless. In view of the universal occurrence of iron it was of the first importance that the test should be so modified as to enable it to be carried out in the presence of small amounts of that widespread impurity. Dr. Teed suggested the addition of potassium cyanide after having previously made the solution alkaline with ammonia, it being supposed that under these conditions ferrous and ferric compounds were quantitatively converted to alkali ferrocyanide or ferricyanide as the case might be. To prevent precipitation of iron hydroxides by the ammonia Teed added tartaric acid, which acts as is well known by forming stable complexes from which no iron is precipitated by ammonia. Shortly afterwards Warington, in an important investigation on the determination of lead in citric and tartaric acids, showed that the method was capable of considerable accuracy if properly carried out—insisting that the standard lead tint must in all cases be developed under precisely similar conditions to that occurring in the test itself. Thus if lead was to be determined in say tartaric acid the comparisons must be made between solutions containing the same quantities of the acid and not between the tartaric acid solution and a plain aqueous solution of the lead salt. Warington's material was apparently free from iron, and so he contented himself with the statement that in its presence "the solution made alkaline with ammonia should be treated with potassium cyanide and heated to near boiling." It will be noticed in both of these investigations either citric or tartaric acid was present in all the tests made.

Last year I had occasion to determine lead in the presence of a small amount of ferric iron and was surprised to find that none of these methods worked. On addition of ammonia ferric hydroxide was precipitated which obstinately refused to dissolve on boiling with potassium cyanide, and more surprising still on filtering no lead was left in solution. First of all I tried the effect of reducing the iron to the ferrous condition but things were no better. The next thing was to try the addition of tartaric acid as suggested by Teed, but now though no ferric hydroxide was precipitated on adding ammonia the bright yellow colour of the ferric complex refused to discharge on boiling with cyanide and things were in an impasse. This then was the origin of my paper. After a good deal of work I found the question solved itself very simply if two essential conditions were observed:

(1) The iron must be in the ferrous condition.

(2) The ferrous hydroxide must be precipitated under conditions that ensured its intimate contact with the potassium cyanide.

If these conditions were observed there was no necessity to add citric or tartaric acid to prevent precipitation of iron, in fact the addition of either of these two acids provided an unlooked for difficulty. I had found sodium sulphite the most satisfactory reducing agent, as it was so readily obtained lead free and its presence did not involve any complications. But when citric or tartaric acid was present sodium sulphite was utterly useless as a reducing agent and great difficulty was experienced in finding a reducer which would act in the presence of these two acids. For instance, as cited in the paper, it was found that in the presence of citric acid 0·1 Mg ferric iron produced so highly coloured a solution that the test was rendered useless. Quite early it was noticed that the presence of ammonium salts accentuated the difficulty due in all probability to stable ammonia ferric organic acid complexes, but ultimately it was found that sodium thiosulphate effected the reduction in a thoroughly satisfactory manner. Thus a method was developed of general applicability. As has already been suggested the solution to be tested must be colourless before the alkali sulphide is added, for otherwise the initial colour may entirely obscure that due to the lead sulphide. This is a point of the first importance, and since in practically every case iron is the sole colouring agent one has to consider, you will see the necessity of the routine method being proof to that element. Perhaps on this account the title of my paper is somewhat misleading in suggesting that the method need only be used in the known presence of iron—it is dangerous to over assume its absence since no extra complication is involved in guarding against it.

The method of testing I recommend is as follows :—

A given amount of the substance is dissolved in water and if not already acid a few drops of acetic or other acid is added to give a distinctly acid reaction. 1 c.c. of 10 per cent. potassium cyanide is then added and finally a considerable excess of ammonia. If the solution is colourless at this stage it only remains to add a few drops of sodium sulphide. Should a colourless solution not be obtained it shows that a certain amount of iron is present. If orginally present in the ferrous condition the colour disappears on heating to boiling, but if orginally in the ferric condition it is necessary to put on a fresh experiment. To the acid solution as previously made a few drops of $N/10$ sodium thiosulphate are added. The exact amount depends to a certain extent on the amount of iron present. The solution is heated slowly to incipient boiling, allowed to stand until the colour suddenly bleaches, and then potassium cyanide and ammonia are added as usual.

An exceedingly interesting point arising out of the investigation is the discovery of the great adsorbing power of ferric hydroxide for lead. It was found that with many inorganic salts if the ferric iron exceeded twice the lead present, precipitation was complete and no lead was left in solution. Subsequent boiling with potassium cyanide did nothing to extract the lead or dissolve the iron. This has important applications in the preparation of lead free reagents..

Mr. **John White** said he could not understand the statement by Mr. Wilkie that there was any difficulty in matching the colours produced by minute quantities of lead with sulphuretted hydrogen in acid solution. He had to estimate lead in a large number of waters, and using that method had never found the slightest difficulty, while the presence of iron in great quantities had no effect. He did not know why one wanted to part from the ordinary method, but it was of the utmost importance in matching the colours that a definite routine should be adhered to. His own practice was to take 100 c.c. of water in a Nessler cylinder standing on white opal glass, add six drops of acetic acid, mix thoroughly, then add 5 c.c. saturated sulphuretted hydrogen water, again mix, and compare with standards prepared in an exactly similar manner. He had had difficulty in estimating minute quantities of lead in mineral waters, such as ginger beer, lemonade, or ginger ale. It had been pointed out by Bevan that the presence of sugar multiplied the apparent colour produced in some metals about ten times. If Mr. Wilkie could suggest any method of estimating minute quantities of metals in such liquids, he would feel obliged. He also desired to know whether Mr. Wilkie could confirm the statements of Messrs. Budden and Hardy regarding estimating tin, lead, and copper in the same liquid ? He had satisfied himself that speaking generally, if good excess of potassium cyanide were added before adding the sulphuretted hydrogen, the copper was practically kept up, and further that small quantities of tin were kept up by hydrogen peroxide.

Mr. T. F. **Harvey** briefly traced the recent evolution of the test and remarked that it was not dealt with from the point of view of drinking waters, but of chemicals. He referred to Dr. MacFadden's report to the Local Government Board in 1907, on the occurrence of lead in citric and tartaric acids and in cream of tartar, and went on to say that in 1904, at a meeting of manufacturers of and traders in cream of tartar, at which several public analysts were present, it was agreed to adopt as a practicable standard of purity for commercial purposes, a maximum lead content of 0·002 per cent. (20 parts per million). Later MacFadden, in his report, considered this a satisfactory limit for lead in tartaric and citric acid, as well as in cream of tartar. On the other hand, the Committee of Reference in Pharmacy, in their Report made to the Pharmacopœia Committee of the General Medical Council in 1908, suggested therein certain fallacious methods of testing lead in some 44 different chemical substances, at the same time suggesting limits for many of these twice and four times as severe as MacFadden's limits for lead in tartaric and citric acid and cream of tartar, which substances are ingested in much larger quantity. For instance, it was suggested that hydrochloric acid and calcium carbonate should contain not more than ten parts per million. These tests, based on insufficient data and erroneous assumptions, overlooked in some cases the presence of insoluble lead, occurring as sulphate, basic carbonate, etc., and even included a casual direction to filter it out. Yellow or brown colorations were corrected for by adding burnt sugar, a suggestion which was quite indefensible, especially when it was considered that any coloration was nearly always caused by the presence of ferric hydroxide. Inorganic salts containing ferric iron in quantity only twice as great as the lead present, appeared to be entirely free from lead, and so on. The method devised by Mr. Wilkie overcame these difficulties, and furnished water-white solutions for testing.

Mr. **Wilkie**, in replying to the discussion, stated that his method was not specifically intended for drinking waters, but, as already stated by Mr. Harvey, for chemicals generally. There was no good reason why it should not be used for that purpose. Warington had shown clearly the advantages of working in alkaline solution, the colouration so produced lent itself much better for purposes of comparison. In view of its universal adoption he did not think that any defence of the alkaline method was needed. In the majority of the experiments cited in his paper, the salt concentration was enormously higher than in any conceivable drinking water. He had not suggested that in acid solution iron in amount not much exceeding the lead present would interfere. Mr. White had drawn attention to an important limitation of the acid method of testing—that after addition of the hydrogen sulphide no further addition of lead could be made. In this respect, the alkaline method of testing offered a decided advantage, for in spite of a widespread impression to the contrary, additional lead could be added if the correct amount had not been arrived at initially. Although a constant error of 10-20 per cent. was thereby involved matching was facilitated very considerably indeed. With regard to the intensifying action of sugar, his impression was that this had been over-estimated. Since the potassium cyanide uniformly present in all the tests had a distinct intensifying action, the effect was to flatten out such difference very considerably indeed. He was aware of the work of Budden and Hardy to which Mr. White had referred, but at the present stage he was not in a position to give the results of his work on the determination of tin. He would refer Mr. White to Dr. Schryver's report to the Local Government Board on the determination of tin in canned foods. The alkaline method was applicable in the presence of relatively enormous amounts of copper. In the case of highly coloured organic matter, the method of wet ashing was available. Mr. Harvey's remarks were of importance in drawing attention to the endorsement by MacFadden of the trade limit of 20 parts per million in the case of tartaric and citric acid and cream of tartar. Certainly, such a standard was severe enough for all practical purposes. In the Laboratories of Messrs. Boot's Pure Drug Co., where some thousands of lead determinations were carried out each year, they had excellent opportunities of judging of the extent to which lead occurred in the chemicals of commerce, and so could speak with some authority on the subject. In conclusion he might state that to him the most surprising feature of the research has been the number of points awaiting investigation.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Combustion in furnaces; Apparatus for indicating the conditions of ——. A. Lomschakow, St. Petersburg. Eng. Pat. 27,134, Dec. 14, 1908.

In order to ascertain the conditions existing in furnaces, the amount of excess air passing into the furnace is automatically determined and recorded. The waste gas is passed first through a meter which revolves at a rate corresponding to the amount of gas passing, then through a solution which absorbs carbon dioxide, then through a second similar meter, then through a solution which absorbs the residual oxygen, and finally through a third meter. The gas is maintained at the same temperature as it passes through the successive meters. The amount of nitrogen determined by the last meter, divided by the amount of nitrogen corresponding to the oxygen consumed in the furnace, gives the ratio of the air required for combustion to the total air passed into the furnace. Since the amount of nitrogen in air is 3·772 times the amount of oxygen, if the quantity of oxygen as determined by the second meter be multiplied by 3·772, and the product subtracted from the total residual nitrogen, the amount of nitrogen corresponding to the oxygen consumed in the furnace is obtained. By means of a somewhat complex arrangement of differential gearing, this ratio is continuously recorded on a drum. —W. H. C.

Mixing devices [mixing gases and liquids]. Felten und Guilleaume-Lahmeyerwerke, Act.-Ges., Frankfort-on-Maine, Germany. Eng. Pat. 6012, March 12, 1909. Under Int. Conv., July, 13, 1908.

The device consists of a nozzle connected with a supply of liquid, and having a side connection for gas, *e.g.*, ozonised air. The liquid issues from the nozzle into a conical chamber, the diameter of which increases in the direction of flow of the liquid, and the gas is drawn in through the side tube. The liquid and gas then pass through a mixing chamber having a series of perforated plates, the apertures of one plate being over the non-perforated portions of the next plate. The perforated plates are cup-shaped, and their edges have projections which engage with the apertures of the following plates, for the purpose of holding the whole in the correct position. —J. W. H.

Cooling water or air, or treating gases with liquids; Apparatus for ——. H. Heenan, Manchester. Eng. Pat. 6452, Mar. 18, 1909.

The invention relates to apparatus for cooling air or water, or for treating gases with liquids, in which one or more drums or rotors, revolving on a horizontal shaft and partially immersed in a liquid, continuously bring fresh layers of the liquid into contact with the current of air or gas in the upper part of the apparatus. According to this invention such rotors are made by rolling spirally upon the shaft or upon a drum, a strip of sheet metal corrugated transversely, the inner end of the strip being secured to the shaft or to a drum upon it, and the whole held in position by rivets or otherwise. To prevent the corrugations of contiguous layers from closing into each other, a plain strip of metal is rolled up with the corrugated strip. —J. W. H.

Measuring flowing fluids; Device for ——. A. G. Bloxam, London. From Siemens-Schuckertwerke Ges.m. b. H., Berlin. Eng. Pat. 11,027, May 10, 1909.

The current flowing in a pipe is measured by placing an obstacle in the form of a segmental tongue in the pipe and determining the difference of pressure before and behind it. The tongue may be mounted to swing, so that its inclination from the vertical may become a measure of the current flowing, or ducts may be led from before and behind the obstacle to a suitable pressure-indicating apparatus. Guiding surfaces are provided to prevent the flowing liquid from influencing the stationary liquid before and behind the obstacle.—J. W. H.

Filter presses; Hydraulic opening gear for ——. G. Irwin and E. and S. H. Johnson and Co., Ltd., London. Eng. Pat. 16,615, July 16, 1909.

The retraction of the hydraulic closing ram of a filter-press is effected by means of chains actuated by a second ram, arranged at right angles to the closing ram. The chains, secured at one end to the frame, are carried round pulleys on the cross-head of the retracting ram and then round guide-pulleys on the frame, and to the follower of the press, to which they are secured. The final adjustment of the closing cylinder is made by means of a hydraulic hand pump.—J. W. H.

Evaporators for liquids which deposit crystals; Continuous ——. T. Suzuki, Sunamura, Japan. Eng. Pat. 26,537, Dec. 8, 1908.

See Fr. Pat. 397,186 of 1908; this J., 1909, 691.—T. F. B.

Distilling, evaporating, heating, or cooling liquids; Method of and apparatus for ——. O. Brücke, Hochspeyer, Germany. Eng. Pat. 779, Jan. 12, 1909.

See Fr. Pat. 392,986 of 1908; this J., 1909, 79.—T. F. B.

Furnaces; Regenerative, reverberatory ——. O. Friedrich, Bobrek, Upper Silesia. Eng. Pat. 6561, March 18, 1909.

See Fr. Pat. 400,924 of 1909; this J., 1909, 1077.—T. F. B.

Gas-kiln. E. Schmatolla, London. U.S. Pat. 942,013, Nov. 30, 1909.

See Fr. Pat. 386,991 of 1908; this J., 1908, 740.—T. F. B.

Refrigerating apparatus and process. W. W. Seay, San Francisco. U.S. Pats. 941,733 and 941,734, Nov. 30, 1909.

SEE Eng. Pat. 25,806 of 1907; this J., 1908, 740.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Effect of oxygen in ——. D. White. U.S. Geol. Survey; through J. Gas Lighting, 1909, **108**, 618.

FROM a comparative study of ultimate analyses of coal, the author concludes that oxygen has approximately the same effect as ash on the calorific value. If the calorific value be taken as ordinate and the ratio of carbon to oxygen plus ash as abscissa, a smooth curve can be drawn, the variations from the curve not exceeding 1 per cent. of the calorific value. The greatest variations occur with weathered coals, with anthracitic coals, and with boghead cannel coals. The weathering of lignites, bituminous coals, and peat, is accompanied by an increase in the percentage of oxygen, and a decrease in the calorific value. The coking quality of the coal can be referred to the ratio of hydrogen to oxygen in the dry coal. This ratio is 59 per cent. or over in coking coals.—A. T. L.

Gas-producer tests. R. H. Fernald and C. D. Smith. U.S. Geol. Surv. Bull. No. 393. Mining World, 1909, 1025–1027.

IN order to determine the fuel consumption during a test run, the fuel bed should be in the same condition at the end as at the commencement of the run, and should have the same depth. The depth may be measured by providing four sets of sight-holes 90° apart, the holes in each set being one above the other, and 6 inches apart. In this way the position of the top and of the bottom of the fuel column can be determined at four points, and the mean is taken in each case. An error of 4 to 6 inches may occur, and the test must be prolonged sufficiently to render this unimportant. Any correction for a difference in the depth of the fuel bed before and after the test, introduces a large error, since the weight involved may be that of a certain volume of raw coal, or of coke, weighing only one-half as much, or of some intermediate substance. With a producer 7 feet in diameter, rated at 250 h.p., a suitable duration of test is 100 hours.—A. T. L.

Petroleum; Formation of naphthenes in ——. I. C. Engler. Ber., 1909, **42**, 4610—4612.

THE author has previously expressed the view that the naphthenes present in petroleum may have been formed from olefines, and Aschan (Annalen, 1902, **324**, 1) has shown that methylcyclobutane is produced by the action of aluminium chloride on amylene in the cold. Experiments carried out by the author and Eberle gave results agreeing generally with those of Aschan. *sym.*-Methylpropylethylene (sp. gr. 0·6870, b. pt. 67°—68° C.) was heated for 14 days in a sealed tube at 360°—365° C. liberation of gas was observed, and the product had the sp. gr. 0·7282 and boiled between 67° and 240° C. (35 per cent. between 67° and 85°, and 58 per cent. between 86° and 240° C.). The bromine-absorption, which, before heating, corresponded to 32 c.c. of $N/10$ bromide-bromate solution, fell to 23·1 c.c. (13 c.c. for the fraction distilling between 86° and 240° C.). The experiments of Aschan (*loc. cit.*) and Heusler (see this J., 1896, 584) were also extended, in that the heavy viscous oil (lubricating oil) separated from the product of the action of aluminium chloride on amylene, was heated under pressure. In this way low-boiling oils could be obtained, in which, especially in the higher-boiling fractions, naphthenes were present. Thus naphthenes can be produced from olefines either directly or after the intermediate formation of viscous oils (lubricating oils), and this second mode of formation is especially interesting, since olefines have been shown (see this J., 1897, 1008) to possess a tendency to polymerise, with formation of heavy (lubricating) oils.—A. S.

Naphthenes; Formation of ——. II. Action of aluminium chloride on amylene in the cold and with gentle heating. III. Products obtained by heating amylene and hexylene under pressure. C. Engler and O. Routala. Ber., 1909, **42**, 4613—4631.

THE action of aluminium chloride on amylene in the cold, according to the method employed by Aschan (Annalen, 1902, **324**, 1), and also at temperatures up to 100° C., was studied. The lower-boiling fractions (up to about 200° C.) of the products consisted chiefly of paraffin hydrocarbons. Only small quantities of naphthenes were produced, these being found in the higher-boiling fractions, but considerable quantities of viscous oil (lubricating oil) were formed.

The products obtained by heating amylene (and hexylene) under pressure, contained in their lower-boiling fractions chiefly paraffin hydrocarbons, but with rising boiling point the content of saturated hydrocarbons of the formula, C_2H_{2n}, increased, and the higher-boiling portions (up to about 250° C.) consisted exclusively of them. These latter hydrocarbons agreed in their general properties with the naphthenes isolated from petroleum. The highest-boiling portions of the reaction-products were similar in character to petroleum lubricating oils.—A. S.

Petroleum; Import duty on—in Canada. See IX.

PATENTS.

Coal washing; Method and apparatus for recovering the fine coal from the slurry deposited by the effluent water in —. C. Burnett, Durham. Eng. Pat. 25,246, Nov. 24, 1908.

THE deposit from the slurry tank is delivered by a conveyor into an agitator and thence on to a fixed inclined trough, or a travelling band, down which the fine coal is washed. The sand, &c., is removed from time to time by band, or when a travelling band is used, the sand is removed continuously by the upward movement of the band. The agitator comprises a horizontal or inclined cylindrical casing with a series of stirring arms mounted on a rotating spindle within it. The slurry from the agitator may be delivered on to a long endless band with upturned edges, forming a slowly moving trough, or it may be delivered on to a short band and thence to a fixed trough. When a fixed trough is used, alone, or in conjunction with a short moving band, the trough may be divided into two by a longitudinal partition, the upper end of which is hinged and serves to direct the material to one side of the double trough, whilst the other side is being cleared of sand, &c., thus permitting of continuous working.—A. T. L.

Carbon; Process for purifying most forms of ——. W. Clacher, Greenock. Eng. Pat. 2071, Jan. 28, 1909.

SILICIOUS and other mineral impurities are removed from anthracite, graphite, retort carbon, gas-coke, etc., by heating the powdered material with caustic alkali, filtering, washing, and then heating with dilute acid. The powdered carbon is finally washed and dried. The used caustic alkali solution is freed from silica by digesting it with milk of lime.—A. T. L.

Pulverous material [coal-dust]; Method of and apparatus for the treatment of —— preparatory to the moulding of same into briquettes, balls, or the like. H. Woodruff and H. B. Budgett, London. Eng. Pat. 6519, Mar. 18, 1909.

COAL-dust and a binder composed mainly of pitch which can be pulverised when cold but becomes semiliquid when heated, are first mixed in the dry condition, than heated in a steam-jacketed chamber, and finally moistened by the injection of live steam whilst the hot mass is agitated. The material is then moulded into briquettes in the ordinary manner. The apparatus comprises a mixer, a heating chamber, and a moistening chamber. The mixer is a cylindrical chamber with stirring arms on two shafts rotating in opposite directions. The outlet from the mixer communicates by a shoot with one end of the heating chamber. This chamber is a steam-jacketed, horizontal, cylindrical vessel, having a worm-conveyor mounted axially within it. The conveyor delivers the heated material by a vertical shoot into the moistening chamber, which consists of a cylindrical vessel provided with stirring arms on an axial spindle, and with a number of steam-jets arranged at suitable points. A vertical shoot leading from the bottom of the moistening chamber may contain a worm conveyor and may deliver into a wider vertical shoot leading to the press or to the rolls, this shoot being open at its upper end to afford relief if the material is fed too quickly to the press.—A. T. L.

Coal; Process of briquetting ——. C. E. Hite, Burlington, N.J. U.S. Pat. 941,454, Nov. 30, 1909.

The process consists in the addition to the fine coal, before briquetting, of a binding material composed of oil, fatty acids, or crude petroleum, emulsified with ordinary flour paste or similar glutinous preparation, to which a suitable preservative has been added.—W. E. F. P.

Drying apparatus for peat and other materials. A. J. Boult, London. From W. H. Bradley, Chicago, Ill., U.S.A. Eng. Pat. 8541 of 1909, dated Nov. 24, 1908.

The peat is caused to pass through a series of jacketed boilers by means of screw conveyors. The first boiler of the series is heated by external means, and the steam given off from the peat therein is passed into the jacket of the second boiler, and that from the second into the jacket of the third and so on. The peat passes from boiler to boiler through a rotating steam-lock so that no steam can pass directly from boiler to boiler.—W. H. C.

Calorific value of solid fuel; Process and apparatus for measuring the ——. M. Mehler and G. Lohmann. Fr. Pat. 403,413, May 27, 1909. Under Int. Conv., June 1, 1908.

In calorimeters of the type in which the fuel is burned in a current of oxygen, and the heat is absorbed by a body of water in which the combustion chamber is immersed, the calorimeter is arranged so that a steady current of water can be passed through it, entering near the bottom and leaving at the top, and a large sample, say 500 grms. of the fuel is used for a determination. The temperature of the outlet water is read at intervals, or recorded automatically, from the commencement of combustion until, after completion of combustion, the temperature has fallen to that of the inlet water. The crucible for the fuel is of vertical, cylindrical form, the neck tapering inwardly so that it becmes strongly heated and ensures complete combustion of the gases leaving the crucible.—A. T. L.

Coke ovens. W. W. Peck, Wakefield, Yorks. Eng. Pat. 24,469, Nov. 14, 1908.

The patent relates to a horizontal or inclined coke-oven of the regenerative type, having combustion-chambers beneath the vertical heating flues which are formed in the dividing walls between adjacent retort-chambers. Each combustion-chamber and an air-distributing conduit beneath it are built as a single flue and are separated from one another by thin tiles which rest on ledges on the walls, and are suitably spaced apart to form apertures for the admission of air to the combustion-chamber. Alternatively, perforated tiles may be used. The gas-distributing conduit is formed of perforated pipes of D-section resting on the floor of the combustion-chamber. A flue beneath each retort-chamber is divided by partitions of thin tiles into heating flues for the hot products of combustion and regenerator flues for the incoming air. Air-heating flues are also formed in the crown of each oven, and these flues are connected by external pipes with the air-heating flues beneath the retort-chambers.—A. T. L.

Coke; Method and apparatus for the manufacture of —— *with compression.* A. G. Maul. Fr. Pat. 403,926, June, 11, 1909.

The patent relates to the manufacture of coke from coal or other combustible, in a closed retort, provided with a piston actuated by means of a screw, and so constructed as to allow of the free exit of the volatile products. The charge is heated to a temperature just below its ignition point, the piston being gradually screwed down as the distillation proceeds, so that the resulting coke is in a very compact condition.—W. E. F. P.

Gas; Manufacture of —— *from liquid hydrocarbons.* H. W. Lake, London. From Hydrocarbon Converter Co., New York. Eng. Pats. 24,109, Nov. 10, 1908, and 23,831 of 1909, dated Nov. 10, 1908.

(1) A fixed gas suitable for illuminating, heating, or power, is produced by passing heavy oils or their vapours through the pores of a heated mass of silicious material, such as earthenware, porcelain, fireclay, brick-dust, quartz-sand, &c., contained in a retort at a temperature between 800° F. and 1400°–1470° F. The retort may be an inclined tube heated by gas jets, and provided with a preliminary vaporising chamber for the crude oil at its lower end, or it may be a chamber formed in the cylinder-head of an internal-combustion engine. In another form the retort is a tube surrounded by a jacket for the circulation of heating gases, or a number of inclined retort-tubes may be arranged within a furnace-chamber. When the silicious material is in the form of a solid plate, this plate is held between two grooved metal plates provided with inlet and outlet connections respectively for the oil vapour and for the fixed gas, the whole being contained in a chamber through which heating gases are circulated. The gas made in this way from crude petroleum contains 55·8 per cent. of hydrogen and 7·25 per cent. of methane. (2) An "unfixed gas" suitable for heating and power is produced in a similar manner, the temperature of the retort being between 300° F and 800° F.—A. T. L.

Gas-producers. K. Koller, Barczika, Hungary. Eng. Pat. 26,475, Dec. 7, 1908.

The patent relates to the type of gas-producer in which removal of the slag is effected by lowering the hearth of the producer, inserting temporary grate bars so as to cut off the layer of slag and to support the fuel column, removing the hearth with the slag upon it, and replacing it by a clean hearth. According to this invention, a trolley is provided for the removal of the hearth, this trolley consisting of an open frame mounted on wheels, so that the central supporting pillar for the hearth can pass up through the open framework of the trolley, whilst the trolley can be removed with the hearth upon it after the central pillar has been lowered. Further improvements consist in the provision of a vertical cylindrical casing on the trolley, which forms a continuation of the producer below the false grate, and within which the removable hearth is lowered; in the construction of the hearth in four sector-shaped portions and a central hollow portion carrying the air-supply tuyère; and, finally, in the construction of the gas-outlet, which comprises an annular inverted channel surrounding the charging hopper, which extends downwards through the top plate.—A. T. L.

Producer gas plants; Suction or pressure ——. T. H. Oswald, and T. H. Oswald, jun., London. Eng. Pat. 11,639, May 17, 1909.

The patent relates to apparatus for purifying the waste water from the scrubber, of the type in which the sulphuretted hydrogen and other gases in the effluent are taken up by a current of air and returned to the producer. The apparatus consists of a box or casing having an air inlet near the bottom, and an air outlet in the removable top plate. Perforated horizontal plates rest on ledges in the casing, and the effluent to be purified is distributed over these from a perforated pipe or a series of such pipes arranged in the upper part of the casing.—A. T. L.

Gas-producer. R. B. Kernohan, Pittsburg, Pa. U.S. Pat. 940,696, Nov. 23, 1909.

The producer comprises a body portion supported over a water-sealed ash-pit, either of these parts being arranged to rotate about its axis. The ash-pit carries a vertical poker projecting up into the body of the producer to a higher level than the air-inlet tuyère. Gearing on the lower end of the poker is arranged so that the poker rotates about its own axis, and the upper part of the poker is not in line with this axis, so that it is moved in a circle not concentric with the body of the producer.—A. T. L.

Water-gas apparatus. S. J. Dickey. Assignor to United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 940,925, Nov. 23, 1909.

In order to permit of the use of a definite quantity of steam during each period of gas-making, the steam connection is provided with an automatic regulating valve. This valve is controlled by a diaphragm, the pressure on which is proportional to the amount of steam passing into the producer.—A. T. L.

Gas-producer for heating gas retorts or for other purposes. P. V. Parsy. Second Addition, dated May 6, 1909, to Fr. Pat. 393,810, Nov. 6, 1907 (this J., 1909, 131).

In order to render the producer described in the principal patent applicable for use with a gas-engine, means are provided for automatically controlling the supply of water for vaporisation, so that no water is supplied at light loads, but when the production of gas exceeds a certain amount, the supply of water will be controlled in proportion to the load. The water supply is taken from a closed vessel provided with a water-sealed tube connected to the engine exhaust, or to the delivery of the blower if the producer is worked at pressure, and no water can flow from the vessel unless the pressure of the exhaust or of the air supply, is sufficient to blow through the water-seal.—A. T. L.

[*Suction*] *gas-producer.* V. G. Montaland-Davray. First Addition, dated May 8, 1909, to Fr. Pat. 395,103, Oct. 9, 1908 (this J., 1909, 302).

The annular boiler or vaporiser described in the principal patent is dispensed with, and the steam is generated in a separate boiler, preferably heated by the exhaust gases of the engine. The steam is superheated before entering the producer fire by passing through a jacket surrounding a long gas-outlet pipe, and then through vertical passages formed in the refractory lining of the producer chamber. —A. T. L.

Gas producers. A Fichet and R. Heurtey. Fr. Pat. 403,397, Sept. 23, 1908.

The gas-producer, which is suitable for fuels containing a high proportion of incombustible matter, is provided with a rotating hearth of iron which may be water-cooled. Tuyères for the injection of steam and air are arranged in the producer walls well above the hearth. The steam is generated in an annular boiler formed in the upper part of the walls of the producer. The lower end of the producer casing is sealed in a water-trough, from which the ashes are removed by a screw conveyor.—A. T. L.

[*Producer*]*-gas for engines; Production of —— from bituminous fuels.* Dresdner Gasmotoren Fabrik, vorm. M. Hille. Fr. Pat. 403,837, June 9, 1909.

The producer comprises a tall cylindrical fuel chamber arranged above a producer chamber, and the lower part of this fuel chamber is heated by the circulation around it of gases from the producer. For this purpose these gases, mixed with the distillation gases from the fuel chamber, pass through superposed annular flues which increase in cross-section towards the gas-outlet flue, and are connected by a number of vertical flues so as to cause thorough mingling of the gases. From the gas-outlet the gases pass to a boiler for supplying steam to the producer. An air-inlet is provided beneath this boiler, so that at starting, the gas can be burned beneath the boiler. The gases are finally led to a wet scrubber, in which they pass down and up through a perforated plate below the water-level. —A. T. L.

Suction gas-producers; Automatic regulation of ——. C. G. Viatour. Fr. Pat. 403,963, June 12, 1909.

In order to decrease the proportion of steam or vapour drawn with the air into the producer when the load is reduced, the ash-pit is provided with an air-inlet, which is controlled automatically by the suction of the engine, so as to be closed at full load, and to open gradually or suddenly as the load falls. This may be effected by providing an automatic lift-valve arranged so as to close against the air-inlet when the suction is sufficient, the movement of the valve being opposed by a spring if desired. In another arrangement, the air-inlet to the ash-pit is from a vertical pipe, having its lower open end just above the normal water-level in a constant-level tank. The lower part of this pipe is surrounded by a casing sealed in the tank and having an air-inlet of suitable area, so that the water-level within the casing will vary with the load on the engine. When the load is heavy, the water-level is raised sufficiently to seal the end of the air-pipe leading to the producer.—A. T. L.

Separating particles of liquid from gases and vapours; Apparatus for ——. M. Steger, Bochum, Germany. U.S. Pat. 940,947, Nov. 23, 1909.

The apparatus, which is intended for separating tar, oil or other liquid particles from gases and vapours, comprises a cylindrical casing with a series of fixed perforated conical baffle-plates, alternating with similar rotating baffle-plates, mounted on a vertical spindle. The fixed baffle-plates are joined to the wall of the casing, so as to form annular troughs, and these troughs are provided with discharge orifices for the liquid separated.—A. T. L.

Peat; Process for the preparation and treatment of ——. Peat preparing and excavating apparatus. Eng. Pats. 25,299, Nov. 24, 1908, and 8540 of 1909, date of appl., Nov. 24, 1908.

See Fr. Pat. 397,022 of 1908; this J., 1909, 693. Reference is directed, under Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 29 of 1869; 2714 of 1873; 5036 of 1891; 7077 of 1900; 3215 of 1901; 6308 of 1904; 21,321 of 1906; and 16,978 of 1907.—T. F. B.

Gas producers. J. Fielding. Fr. Pat. 403,532, May 26, 1909.

See Eng. Pat. 14,292 of 1908; this J., 1909, 512.—T. F. B.

Gas producers; Rotary grate for ——. Gutehoffnungshütte Aktienverein f. Bergbau und Hüttenbetrieb. Fr. Pat. 403,763, June 7, 1909. Under Int. Conv., Oct. 1, 1908.

See Eng. Pat. 14,947 of 1909; this J., 1909, 1116.—T. F. B.

Mineral-oil emulsion; Process of producing a ——. S. Knopf, Vienna. U.S. Pat. 941,785, Nov. 30, 1909.

See Eng. Pat. 17,523 of 1907; this J., 1908, 693.—T. F. B.

Obtaining nitrogen and carbon dioxide from combustion-gases. Ger. Pat. 215,608. *See* VII.

Calorimeter; [Gas ——.]. Fr. Pat. 404, 131. *See* XXIII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Incandescence of platinum in mixtures of coal-gas and air; Conditions regulating the ——. J. Meunier. Comptes rend., 1909, **149**, 924–926.

In his experiments on the incandescence of platinum wires in the interior of a Bunsen flame (see this J., 1909, 195), the author has noticed that if the wire be perfectly clean it no longer glows in the mixture of coal-gas and air in the tube of the burner. When, however, the wire is passed between the fingers before being plunged into the gaseous mixture, incandescence is produced. Dipping the wire in ordinary drinking water also produces the same phenomenon, and the author comes to the conclusion that it is not the platinum itself but the saline substances upon it which causes the production of incandescence. In the case of drinking water, the solid residue on the wire consisted principally of calcium sulphate.—W. P. S.

Titanium arc. W. S. Weedon. Amer. Electrochem. Soc., New York, Oct. 1909. Electrochem and Met. Ind., 1909, **7**, 509.

Of a large number of substances examined as to their suitability for arc-lamp electrodes, none was found to give so high an efficiency in candle-power per watt as materials containing titanium. A suitable method of producing a titanium flame arc consists in using a titanium carbide cathode and a copper anode. In preparing the electrodes, finely-powdered titanium carbide is mixed to a plastic mass with oil or glycerin, and then extruded through a nozzle. The sticks thus obtained are cut into suitable lengths, dried first at the ordinary temperature and then in a gas oven, and fired at a high temperature in a carbon tube electric furnace. The temperature must not be too high, otherwise the finished electrodes may be brittle. The arc is usually produced with direct current, but under certain conditions, alternating current may also be employed. The efficiency of the arc increases with increase of current-density and of the length of the arc. With an arc-length of 1 inch, and a current of 3 ampères at 103 volts, 0·228 watt is consumed per horizontal candle-power. At 2·87 ampères and 95 volts, the power consumption is 0·51 watt per mean spherical candle-power and 0·37 watt per mean hemispherical candle-power. The arcs are operated most satisfactorily on a constant-current circuit rather than on a low-voltage multiple circuit. A titanium arc may also be produced with a cathode of titanium suboxide produced by the reduction of rutile in an electric furnace. The character of the arc is almost identical with that of the arc produced with titanium carbide, but the efficiency is higher and the light much steadier. There are, however, the disadvantages that large troublesome deposits are liable to be formed on the anode, and that the titanium suboxide cathode is consumed fairly rapidly. The titanium suboxide arc can only be operated with direct current.—A. S.

Boron. Weintraub and others. *See* VII.

Patents.

Distilling wood-alcohol and other products; Apparatus for ——. B. R. and M. J. Lyster, Whitefield, N.H. U.S. Pat. 941,641, Nov. 30, 1909.

The invention relates to a secondary still, of the multitubular type, fitted into the horizontal neck of a wood-distilling apparatus. The heated vapours passing through the neck, while serving as a source of heat to the still, are themselves sufficiently cooled by contact with the tubes of the latter to deposit their heavy oils, which collect in a depression below the still, and may be drawn off. W. E. F. P.

Incandescence mantle for gas or vapour burners. G. Bagrachow, Paris. Eng. Pat. 5598, Mar. 8, 1909.

Mantles consisting of filaments of quartz coated or incorporated with rare earths are prepared by repeatedly heating the quartz filaments, previously made into the desired form of the mantle, and dipping them while hot into a solution of salts of the rare earths in amyl alcohol, or ether. The mantles may consist of two or more spiral threads, or of a number of zig-zag threads, or of a latticework of threads, supported at the top from a perforated quartz plate or by a ring, and this plate or ring may rest upon the top of a glass or quartz chimney, or it may be supported on a fork in the usual manner.—A. T. L.

Incandescence mantles; Process for the manufacture of ——, *with conversion of the nitrates into oxides in one operation.* Bruno-Patente-Verwertungs Ges. m. b. H. Fr. Pat. 403,433, May 28, 1909.

The mantles, after impregnation with a mixed solution of thorium and cerium nitrates, are freed from the excess of liquid, and whilst still moist, treated with an aqueous solution containing an alkali or amine in admixture with a suitable acid or phenol. This treamtent causes the precipitation of the rare metals (as basic compounds) in and on the mantle tissue, the mixed oxides being produced, in dense form, by subsequent calcination.—W. E. F. P.

Incandescence mantles; Process for the manufacture of ——, *with conversion of nitrates into oxides in two stages.* Bruno-Patente-Vertwertungs Ges. m. b. H. Fr. Pat. 403,434, May 28, 1909.

The impregnation of the mantle tissue with the solutions of the rare earths is made in two stages, the first being with thorium nitrate and the second with cerium nitrate in slightly alkaline solution. In order to obtain a compact deposit of thorium oxide, and to avoid the formation of the spongy oxide which results from the direct calcination of the nitrate, the mantles, after being freed from the excess of the first solution, are treated with ammonia or other precipitant, whereby the thorium is converted into insoluble hydroxide or a basic compound which yields the oxide on calcination. After this operation, the mantles, whilst still moist, are impregnated with cerium nitrate, being then dried and calcined as usual.—W. E. F. P.

Metallic filaments [for electric incandescence lamps] prepared with organic binding agents; Process for the carbonisation of ——. Wolfram Lampen Akt-Ges. and O. Goll. Fr. Pat. 403,750, June 7, 1909. Under Int. Conv., Feb. 15, 1909.

The process consists in heating the filaments in a very rarefied atmosphere of inert gas.—W. E. F. P.

Electric conductors; Manufacture of refractory ——. C. T. Fuller, Schenectady, U.S.A. Eng. Pat. 17,619, Aug. 21, 1908. Under Int. Conv., Aug. 24, 1907.

See U.S. Pat. 929,578 of 1909; this J., 1909, 972.—T. F. B.

Process of making acetates. U.S. Pat. 939,980. *See* VII.

III.—TAR AND TAR PRODUCTS.

Patents.

[Coal] tar; Treatment of ——. S. G. Coulson, Rotherham. Eng. Pat. 7427. Mar. 27, 1909.

The treatment consists in an improvement of the sulphuric acid process, the tar being first distilled until the volatile matters passing over up to about 270°C. are removed. The residual "semi-pitch" is treated with about 1 to 2 per cent. by weight of sulphuric acid and well stirred. The product is then run off from the still into the cooling chamber or pitch bay and when cold will be quite hard.—J. C. C.

Sodium derivatives of α- and β-naphthol; Process for preparing solid ——. W. König. Ger. Pat. 216,596, April 26, 1908.

Hot solutions of α- or β- naphthol in slight excess of caustic soda solution are treated with a neutral sodium salt, (*e.g.*, sodium chloride) until crystallisation commences when they are cooled and the sodium-naphthol compound separated and dried, preferably by heating *in vacuo*. The products contain only a small percentage of sodium salt as impurity, which is of no disadvantage for their applications. They rapidly absorb water from moist air, becoming brown, but can be kept for a long time in stoppered vessels.—T. F. B.

Dianthraquinonyls and dibenzanthronyls; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 215,006, Dec. 11, 1908.

Dianthraquinonyls and dibenzanthronyls are obtained when the diazo derivatives of the anthraquinone or benzanthrone series are treated with cuprous chloride or bromide, in aqueous solution or suspension, and in absence of hydrohalogen acids or in presence of so small a quantity of them that no halogen-anthraquinones are formed.

—T. F. B.

2-Methylanthraquinone or its derivatives substituted in the nuclei; Process for preparing side-chain halogenated ——. Badische Anilin und Soda Fabrik. Ger. Pat. 216,715, April 9, 1905.

2-METHYLANTHRAQUINONE and its derivatives when treated with bromine under pressure or with chlorine, are halogenated in the side-chain (methyl group); the products may be used either for preparing dyestuffs or for conversion into anthraquinone-aldehydes.—T. F. B.

Dianthraquinone-imines; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 216,083, Nov. 8, 1907.

A GENERAL process for preparing dianthraquinone-imines consists in heating aminoanthraquinones with anthraquinonesulphonic acids. β-β-Dianthraquinone-imine, which cannot be obtained by the methods formerly in use, can be produced by heating β-aminoanthraquinone with anthraquinone-β-sulphonic acid.—T. F. B.

Carboxylic acids of arylsulphoxy-acetic acids; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 216,725, Sept. 20, 1907.

ARYLTHIOGLYCOL-o-CARBOXYLIC acids are converted, on treatment with hypochlorites, into carboxylic acids of arylsulphoxyacetic acids, $HO.CO.R.SO.CH_2.COOH$. For example, 21·2 kilos. of phenylthioglycol-o-carboxylic acid are dissolved in 80 kilos. of 10 per cent. caustic soda solution, the solution is kept cool, and 130 litres of a solution of sodium hypochlorite, containing 55 grms. of active chlorine per litre, are added; when the reaction is finished, the new acid is precipitated by addition of a mineral acid; it melts at 177° C., with decomposition. The new products are of value in the preparation of dyestuffs.—T. F. B.

Anthraquinone derivatives containing sulphur and nitrogen; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 216,306, Nov. 18, 1908.

ANTHRAQUINONE-α-MERCAPTANS when heated with sulphur (preferably in the form of alkali polysulphides) and ammonia, are converted into new derivatives, which contain the thiazole ring, and may be called anthrathiazoles. Anthraquinone-α-thiocyanate or α-xanthogenate, or other derivatives which are converted into the α-mercaptan by alkali, may be utilised, or such anthraquinone derivatives as the α-halogenide or α-sulphonic acids, which are converted into the mercaptans by alkali sulphides, may also replace the anthraquinone-mercaptans.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Indigo-bis-arylimides. E. Grandmougin and E. Dessoulavy. Ber., 1909, 42, 4401—4407.

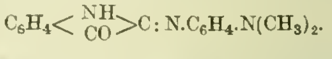
IN continuation of their former work (this J., 1909, 1189, 1244) the authors have prepared the hydrochloride and the sulphate of indigodianilide. When nitric acid is added to indigodianilide in the cold, the red nitrate, $C_{28}H_{18}N_4,3HNO_3$, of dehydroindigodianilide is obtained, which when treated with alcoholic potash and the resulting solution heated, furnishes indigodianilide. Dehydroindigodianilide may be obtained from indigodianilide by oxidation with lead peroxide suspended in pyridine. A hydrochloride and a tetranitrate of dehydroindigodi-p-toluidide were also prepared. 7:7′-Dimethylindigodi-p-toluidide is prepared by heating dimethylindigo with p-toluidine and boric acid. It forms dark blue, coppery needles. On oxidation with chromic acid it yields o-methylisatin, and with nitric acid, 7:7′-dimethyldehydroindigodi-p-toluidide tetranitrate is formed.
—J. C. C.

5:7:5′:7′-Tetrabromoindigo. E. Grandmougin. Ber., 1909, 42, 4408—4411.

THE author has prepared pure tetrabromoindigo by the patented process (this J., 1907, 819) and has proved that it has the above constitution by oxidising it to 5:7-dibromoisatin. He concludes that when indigo is brominated the halogen enters first the para-position (5 and 5′) to the NH-group and then the 7 (tribromoindigo=5:7:5′) and 7′-positions (ortho to the NH-group). Spectroscopic observations give for 5:5′-dibromoindigo: λ=601·6, for 5:7:5′-tribromoindigo: λ = 608·7, and for 5:7:5′:7′-tetrabromoindigo: λ = 611·7. The very bright shades of tetrabromoindigo (dyed from a hydrosulphite vat) are developed by soaping.—J. C. C.

Isatin-anils. I. Preparation of —— and hydrate- and salt-formation of isatin-p-dimethylamino-2-anil. R. Pummerer and M. Goettler. Ber., 1909, 42, 4269—4279.

THE authors find that when aromatic nitroso-compounds react with indoxylic acid in aqueous solution, the isatin-2-anils are formed, thus affording a convenient method for converting indoxyl into isatin. Nitrosobenzene and indoxylic acid interact in neutral aqueous solution to give isatin-2-anil, but in presence of 10 per cent. sodium hydroxide a violet vat dyestuff, "indigo-red"-anil, is formed together with some indigo. Under the latter conditions nitrosodimethylaniline and indoxylic acid give a similar blue-violet dyestuff and much indigo, but in neutral or faintly alkaline solution, a blue-red intermediate product is formed, which even on crystallisation passes into isatin-p-dimethylamino-2-anil,

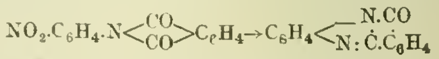


$$C_6H_4{<}{}^{NH}_{CO}{>}C:N.C_6H_4.N(CH_3)_2.$$

On treatment with hot mineral acid the above intermediate product furnishes isatin. Isatin-p-dimethylamino-2-anil crystallises from acetone in green prisms with a metallic lustre: it forms a blue and a yellow monohydrochloride, and its acid solution, on standing, gives rise to isatin.—J. C. C.

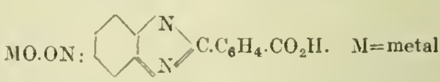
Benzoylenebenzimidazole. H. Rupe and K. G. Thies. Ber., 1909, 42, 4287—4304.

BENZOYLENEBENZIMIDAZOLE is obtained by reducing o-nitrophthalanil (prepared by condensing o-nitroaniline and phthalic anhydride in presence of fused sodium acetate), with either iron and glacial acetic acid or sodium hydrosulphite.



$$NO_2.C_6H_4.N{<}{}^{CO}_{CO}{>}C_6H_4 \rightarrow C_6H_4{<}{}^{N.CO}_{N:\dot{C}.\dot{C}_6H_4}$$

It forms yellow needles melting at 212°—213° C. The authors have prepared a large number of its derivatives. It gives two nitro-derivatives according to the process of nitration: when dissolved in acetic anhydride, and nitric acid added, a nitro-compound is obtained which melts and decomposes at 280° C., and dyes wool and silk in bright lemon-yellow shades from an acid bath. When the latter is dissolved in alkalis and the product boiled with acetic anhydride, the corresponding nitrophenylbenzimidazole-o-carboxylic acid is obtained: this dyes wool and silk in old gold shades from a neutral bath, and lemon-yellow from an acid bath. The authors are of the opinion that the constitution of the dyestuff is represented by the formula,

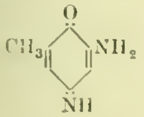


The second nitro-derivative, prepared by pouring nitric acid over benzoylenebenzimidazole and then adding acetic anhydride, drop by drop, on reduction with sodium hydrosulphite in acetone solution, yields the corresponding amino-compound, which dyes wool and silk in orange-yellow, and tannin-mordanted cotton in strong red-brown shades. When diazotised and combined with resorcinol, the azo dyestuff dyes cotton direct in orange shades, and when the diazo-compound is combined with

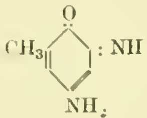
2:7-dihydroxynaphthalene, a red dyestuff is obtained. The dyeings are fairly fast to light and washing. *o*-Aminophthalanil, prepared by reducing *o*-nitrophthalanil with sodium hydrosulphite in acetone solution, gives, when diazotised and combined with resorcinol, an azo-dyestuff which, however, dyes cotton only very slightly.—J. C. C.

Amino- and aminophenyl-groups ; Auxochromic action of ——. J. Piccard. Ber., 1909, **42**, 4332—4341.

In opposition to Willstätter and Piccard's theory that the deep colour of many dyestuffs, and especially of triphenylmethane dyestuffs, is due to their *meri*-quinonoid condition, Kehrmann (this J., 1908, 800) referred to a series of red substances, oxidation products of diaminophenols, which he considered could not contain a hydro quinonoid benzene ring. The author now shows that when, for example, diaminocresol is oxidised with an excess of ferric chloride, a *holo*-quinonoid salt is in fact obtained. In connection with this and Kehrmann's opinions, however, he remarks that it is not certain that the latter's red compound is a *para*-quinone (I): it may be an *ortho*-quinone (II).

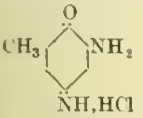


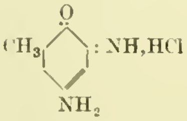
(I)



(II)

The fact that it is dark red is explained not only by the presence of the auxochromic amino-group, but also by the presence of an *ortho*-quinonoid nucleus: the compound cannot be regarded as a true dyestuff: this is shown not only by its physical properties, but also by a comparison of its absorption spectrum with the absorption spectra of Diamond Magenta and Würster's red salt. When, however, a quantity of ferric chloride is used insufficient for the formation of a *holo*-quinonoid salt, the nitrate is precipitated as a dark red mass: in these circumstances it is obvious that the formation of a *meri*-quinonoid salt is possible. The author draws the conclusion that compounds which contain, in addition to the quinonoid nucleus only the auxochromic amino-group are not dyestuffs. When diaminocresol is oxidised with excess of ferric chloride, the resulting nitrate can be converted into two isomeric hydrochlorides: the one, bright red, separates only on cooling, whilst the other, dark red, separates at the ordinary temperature. These salts probably have the constitutions:





the dark red salt having the *ortho*-quinonoid constitution. From spectroscopic observations the author finds that Würster's salt exists in both a red and a green modification.
—J. C. C.

Colouring matters of the flowers of Hibiscus sabdariffa and Thespasia lampas. A. G. Perkin. Chem. Soc. Trans., 1909, **95**, 1855—1860.

The flowers of *Hibiscus sabdariffa* (red sorrel of the West Indies) were digested with water and the aqueous extract treated with dilute sulphuric acid to hydrolyse the glucosides. After an elaborate system of purification there were isolated gossypetin, to which the formula, $C_{15}H_{10}O_8$, is now assigned, a new colouring matter, ***hibiscetin***, which is yellow and dyes mordanted cotton, and quercetin. The flowers of *Thespasia lampas* gave, on similar treatment, a small quantity of quercetin. The flowers dye mordanted wool in yellow shades which are, however, not superior to those produced by the better known Indian natural yellow dyestuffs.—J. C. C.

Colouring matter of cotton flowers. Gossypium herbaceum. II. A. G. Perkin. Chem. Soc. Proc., 1909, 25, 291—292.

The flowers of the Egyptian cotton plant, a variety of the *Gossypium herbaceum*, have been found to contain three hitherto unknown glucosides. *Quercimeritrin*, $C_{21}H_{20}O_{12}$, the main constituent, crystallises with three mols. of water in small, yellow plates, m. p. 247°—249° C., dyes mordanted fabrics very similarly to quercetin, and gives with lead acetate an orange-red precipitate. It forms an *octa-acetyl* compound, $C_{21}H_{12}O_{12}(C_2H_3O)_8$, colourless needles, m. p. 214°—216° C., and is hydrolysed with difficulty according to the equation:

$$C_{21}H_{20}O_{12}+H_2O=C_{15}H_{10}O_7+C_6H_{12}O_6$$

into quercetin and dextrose (osazone, m. p. 204°—205° C.). *iso-Quercitrin*, $C_{21}H_{20}O_{12}$ (dried at 160° C.), consists of pale yellow needles, m. p. 217°—219° C., and is readily hydrolysed by acid:

$$C_{21}H_{20}O_{12}+H_2O=C_{15}H_{10}O_7+C_6H_{12}O_6,$$

with formation of quercetin and dextrose, but differs from quercimeritrin in several important respects. With lead acetate it gives a bright yellow precipitate, dyes mordanted fabrics similarly to quercitrin (Chem. Soc. Trans., 1902, 81, 480), and is present in the flowers in small amount. The third glucoside, *gossypitrin*, $C_{21}H_{20}O_{13}$ (dried at 160° C.), pale orange-yellow needles, m. p. about 200°—202° C., when hydrolysed gives gossypetin and dextrose:

$$C_{21}H_{20}O_{13}+H_2O=C_{15}H_{10}O_8+C_6H_{12}O_6.$$

It yields a bright red precipitate with lead acetate, and dyes mordanted fabrics. The flowers yielded 1·86 per cent. of yellow colouring matter, consisting of quercetin mixed with about 10 per cent. of gossypetin.

Patents.

Disazo dyestuffs ; New substantive ——. Chemische Fabrik vorm. Sandoz, Basle, Switzerland. Eng. Pats. 20,649 and 20,650, Sept. 9, 1909. Under Int. Conv., Jan. 2, and July 16, 1909.

In the first patent claim is made for the manufacture of substantive orange disazo-dyestuffs (a), by combining the intermediate products obtained from one molecule of the tetrazo compound of a *p*-diamine and one molecule of salicylic acid or *o*-cresotinic acid with one molecule of 1-*p*-sulphophenyl-3-methyl-5-pyrazolone or 1-*p*-sulphophenyl-5-pyrazolone-3-carboxylic acid; or (b), by combining the tetrazo compounds of *p*-diamines with one molecule of 1-*p*-sulphophenyl-3-methyl-5-pyrazolone or 1-*p*-sulphophenyl-5-pyrazolone-3-carboxylic acid and one molecule of phenol, and alkylating the resulting disazo-dyestuffs. Example 1: the intermediate compound from one molecule of tetrazotised tolidine and one molecule of salicylic acid is combined with 1-*p*-sulphophenyl-3-methyl-5-pyrazolone in alkaline solution. Unmordanted cotton is dyed in brilliant orange shades, which are similar to, but much faster to light than, those produced by Toluylene Orange R. Example 2: The intermediate product obtained from one molecule of tetrazotised benzidine and one molecule of 1-*p*-sulphophenyl-5-pyrazolone-3-carboxylic acid (in neutral solution) is combined with an ammoniacal solution of phenol, and the resulting paste is ethylated by dissolving it in dilute sodium hydroxide solution and heating for two hours at 96° C., with ethyl *p*-toluenesulphonate. The product is a brick red powder which dyes unmordanted cotton in clear orange shades very fast to light. In the second patent is described the preparation of the dyestuff from the intermediate product of one molecule of tetrazotised benzidine and one molecule of salicylic acid and 1-phenyl-5-pyrazolone-3-carboxylic acid. The dyestuff produces red orange shades on unmordanted cotton, and also on half wool, which are fast to light.—J. C. C.

Nitro-o-oxyazo-dyestuffs ; Production of ——. Kalle und Co., Akt.-Ges., Biebrich-on-the-Rhine, Germany. Eng. Pat. 22,200, Sept. 29, 1909. Under Int. Conv., Jan. 2, 1909.

In nitrating the diazo-compounds obtained from the sulphonic acids of 1-amino-2-naphthol or 2-amino-1-

naphthol, the products hitherto isolated have always been associated with a by-product. It is now found that the pure nitro-*o*-hydroxyazo-dyestuffs can be prepared by first isolating the zinc salt of the nitrodiazo-oxysulphonic acids. The crude acid is dissolved in dilute alkali and precipitated with zinc sulphate or chloride. The zinc salt can then be combined with the appropriate component and furnishes a dyestuff which is pure. In an example is described the nitration of the zinc salt of diazotised 1-amino-2-naphthol-4-sulphonic acid, its purification by the above method, and its combination with α-naphthol.—J. C. C.

β-Naphthindoxyl; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 216,639, June 13, 1908.

If β-naphthylglycine or its salts or esters are heated with acid condensing agents, such as aluminium chloride or phosphoric anhydride, β-naphthindoxyl is obtained as an olive-yellow powder, changing to green in the air. It melts at 80°—85°C., and is readily soluble in alcohol, ether, acetone, etc., and also in caustic soda solutions; these last solutions can be oxidised by means of air, producing β-naphthindigo.—T. F. B.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,177, Nov. 23, 1908.

See Ger. Pat. 210,597 of 1908; this J., 1909, 698.—T. F. B.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,023, Dec. 2, 1908.

See Fr. Pat. 396,833 of 1908; this J., 1909, 596.—T. F. B.

Anthracene derivatives; Manufacture of new —— and their employment in dyeing and printing. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,098, Dec. 14, 1908.

See Ger. Pat. 210,019 of 1908 and Fr. Pat. 399,495 of 1909; this J., 1909, 650 and 933.—T. F. B.

Dyestuffs of the anthracene series; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 3276, Feb. 10, 1909.

See Fr. Pat. 400,186 of 1909; this J., 1909, 976.—T. F. B.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5383, March 5, 1909.

See Fr. Pat. 402,030 of 1909; this J., 1909, 1190.—T. F. B.

Indigo; Production of stable chlorine derivatives of ——. Ges. f. Chemische Industrie in Basel. First Addition, dated September 11, 1908, to Fr. Pat. 386,841, April 19, 1907.

See Eng. Pat. 19,793 of 1908; this J., 1909, 238.—T. F. B.

Triphenylmethane dyestuffs from carbazole; Process for producing ——. L. Cassella und Co. Fr. Pat. 403,543, Sept 26, 1908.

See Eng. Pat. 20,709 of 1908; this J., 1909, 697.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Megasse in papermaking. J. S. Remington, D. A. Bowack, and A. J. B. Carrington. World's Paper Trade Rev., 1909, Oct. 29, 1–3.

The authors have obtained a quantity of sugar cane "megasse" from Trinidad, the analysis of which gave the following results:—Moisture, 11·05; ash, 1·54; loss on α-hydrolysis, 30·01; loss on β-hydrolysis, 48·70; loss on mercerisation, 32·73; gain on nitration, 10·21; cellulose, 47·11 per cent.; length of ultimate fibre, 3·5 mm. The fibre is highly lignified and somewhat irregular in length and in its distribution in the stem. The authors find that the best and most profitable method for converting the material into pulp consists in digesting it with 7—10 per cent. of sodium hydroxide for 12 hours under a steam pressure of 1 atmosphere. This comparatively mild treatment yields 45—50 per cent. of pulp, as against 38—40 per cent. in the case of the more severe treatments, which destroy a portion of the less resistant cellulose. The method of digestion proposed by the authors involves particular care in the subsequent beating of the pulp. The authors state that a satisfactory bleached pulp is obtained with the consumption of about 15 per cent. of bleaching powder, and 1—2 per cent. of other chemicals. They contend that the excessive quantities of bleaching powder, which are required to bleach the pulps obtained under more severe conditions of digestion, are consumed by the products of the decomposition of the cellulose, which are absent from the pulps boiled under low pressures. Megasse pulp, when used alone, invariably yields a stiff hard paper, in whatever way it may be treated in the beater; further it is not easy to obtain papers free from coarse fibres. By a system of gradual beating it is possible to obtain papers of great strength, but if the beating be overdone, as very readily happens, the strength of the paper suffers considerably. Megasse pulp, when mixed with other fibres, *e.g.*, chemical wood pulp, lalang (*Andropogon caricosus*) grass, or Para grass, gives papers which are eminently suitable for printing purposes and which do not possess the harshness of the pure megasse products. The authors have made and tested several samples of paper of pure and mixed fibres and speak very favourably of the possibilities of the megasse fibre as a material for papermaking.—J. F. B.

Pulps: Testing bleaching qualities of ——. P. Klemm. Wochenbl. Papierfab., 1909, **40**, 3973—3976.

In testing the bleaching qualities of commercial pulps it is necessary to determine the quantity of bleaching powder required to produce a certain degree of whiteness; in some cases it is also necessary to take into account the time required to attain the desired result. In mills it is sufficient to use some of the current bleached half-stuff as a standard for the degree of whiteness required, the test pulp and the standard being compared with each other in the moist state in glass vessels of identical dimensions. But in analytical practice, such a standard is not available, and it is desirable to produce bleached products of different degrees of whiteness and to preserve them as records. For such tests, the author makes a series of four experiments with increasing proportions of bleaching powder, chosen so that the desired degree of whiteness shall fall within the limits of the series. For wood pulps he uses 15, 20, 25 and 30 per cent. of bleaching powder on the air-dry weight of pulp. These proportions are measured out in the form of clear bleach liquor into four cylinders of about 1 litre capacity with a mark at 400 c.c. Five grms. of the pulp are weighed out for each test, uniformly beaten up with water, and added to each of the cylinders, the volume being made up to 400 c.c. The cylinders are placed in a water-bath, maintained at a temperature of 40°—45° C., and their contents are kept in agitation, with free access of air, by means of mechanical stirrers. At the end of a given time (*e.g.*, five hours), the volume is again made up to 400 c.c. if necessary; quantities of clear liquid are drawn off from each test by means of a pipette covered with wire gauze, and the pulps are then thoroughly drained with the aid of the filter-pump. The titration of the clear liquids gives the actual amounts of the bleaching powder consumed, and the residual pulps show the corresponding degrees of whiteness. These pulps are washed by shaking twice with successive quantities of 1 litre of water, and drained by suction. In order to prepare sheets from them for record, each lot of bleached pulp is shaken with 500 c.c. of water and poured into a porcelain filter-pump funnel, the perforations being covered with a piece of fine wire gauze. The stem of the funnel is provided with a tap, so that the whole of the fluid pulp may be distributed evenly in the funnel before any liquid runs through. The sheets so formed, about 15 cm. in diameter, are placed between filter-paper, and passed through a wringing machine and dried in the

air. Strips from each are mounted together on a framo of black cardboard, so arranged that they may be compared by transmitted, as well as by reflected light.
—J. F. B.

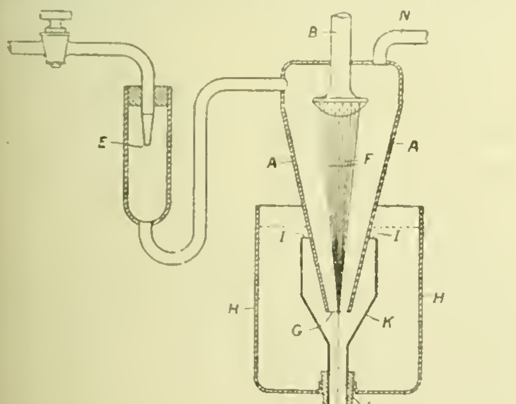
Paper industry of Westphalia and the Rhenish Provinces. Board of Trade J., Dec. 30, 1909. [T.R.]

Paper manufacturers in Westphalia and the Rhenish Provinces are suffering from a dearth of orders for paper. Cellulose has fallen in price, but for lack of sufficient orders manufacturers are unable to get the full benefit of the reduction. Other raw materials have risen in price owing to the formation of a syndicate of the manufacturers selling to the paper mills; waste-paper has risen from 25 to 30 per cent. The United States have lately been buying up a great deal of the raw materials needed in the manufacture of paper in Europe. Resin, however, the use of which can be restricted when it is too expensive, has fallen in price by 25 per cent. Paper exports, especially to the East, on which the manufacturers of the Westphahan district largely depend, almost ceased. The state of the paper industry has become critical in the district, owing to the fact that a large number of new paper mills have been erected of late years and existing ones enlarged. Owing to over-production, paper has repeatedly fallen in price, and some varieties are sold at unremunerative prices, in order to keep the works open and the hands employed. Another reason for the existing depression in the paper industry is that Sweden floods Germany with cellulose paper at exceedingly low prices. At present there are a number of large paper factories in course of erection and completion which, when finished, will be able to turn out daily 200,000 lb. of cheap cellulose paper.

Patents.

Fibres from solutions; Apparatus for obtaining ——. W. A. E. Crombie, London, and F. Schubert, Great Yarmouth. Eng. Pat. 24,922, Nov. 19, 1908.

The invention relates to apparatus of the kind wherein the solution from which the fibre is to be prepared is successively treated with two different coagulants, and the fibres produced are stretched or drawn to a finer size. The solution, supplied through the pipe, B, provided with a rose, comes into contact with the first coagulant in the vessel, A, and the fibres, F, are drawn or stretched during their passage through this vessel. The fibres issue at G into a second coagulant; the latter is supplied from an open trough, H, through an annular inlet, I, the rate of flow being adjusted by raising or lowering the tube, K, through the gland, L. The vessel, A, is filled with the first coagulant by exhausting the air through N. The rate of flow from E is adjusted, so as to keep the liquid in A at proper working strength, and at the same time prevent the second solution in H from rising into A.—B. N.



Cellulosic films; Treatment and application of ——. J. E. Brandenberger, Thaon-les-Vosges, France. Eng. Pat. 24,811, Nov. 18, 1908. (See also Eng. Pat. 24,809 of 1908; this J., 1909, 851.)

A cellulose film is prepared by regeneration from an aqueous solution, preferably viscose, which film may be transparent, opaque, coloured or variegated with metallic or mineral particles or powders, or otherwise decorated or painted. It is then attached, either in the moist or dry condition, to a support, such as paper, fabric, leather or foil, by means of suitable adhesives. The whole is then embossed or impressed either upon the front or back and employed for decorative or imitative purposes. Among the adhesives specified is included a solution of cellulose itself.—J. F. B.

Waste paper and the like; Apparatus for obtaining pulp from ——. L. Herz, Nürnberg, Germany. Eng. Pat. 24,343, Nov. 12, 1908.

The apparatus consists of a vertical cylindrical casing containing a perforated revolving drum. Inside the drum are situated two fixed shafts, with beater-arms on two sides of each shaft, and two revolving beater-shafts driven by toothed wheels from the central drum-shaft. The arms of all the beater-shafts are so arranged that they move between each other, as the drum revolves, without locking; the outer set of arms of each fixed shaft carries a scraper which removes the paper from the periphery of the revolving drum and returns it to the moving beater-arms. Water or chemical bleaching agents are charged into the drum with the paper, and the waste liquid passes through the perforations of the drum into the casing, whence it may be discharged when necessary, whilst fresh liquor or water enters the drum at the top, until the disintegrated pulp is sufficiently purified.—J. F. B.

Paper and the like [from peat]; Manufacture of ——. R. Pearson and H. S. Stoneham, London. Eng. Pat. 26,573, Dec. 8, 1908.

Fibrous peat is converted into paper pulp in the ordinary way, the present invention relating first to bleaching of the pulp by the use of "chlorine in a form free from lime," and secondly to the addition to the pulp of a mucilage prepared from seaweed, such as Irish moss. For strong mill-board about 2·5 per cent. of the seaweed gum is employed.
—J. F. B.

Paper having relief-like effect; Manufacture on the paper-machine of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 15,555, July 3, 1909. Under Int. Conv., July 20, 1908. Addition to Eng. Pat. 10,529 of 1908, dated June 7, 1907 (this J., 1908, 1130).

To produce regular or irregular relief effects on paper on the paper-machine itself, simple devices are substituted for rollers having relief patterns as described in the original specification. For instance, cloths, brushes, dandy rolls, or felts are caused to trail on or rotate in contact with the paper web, while on the wire cloth or wet felt. Or, compressed air is, by suitable means, blown into the web, or the surface is scratched with nails or the like. The paper web so prepared is dyed and finished as described in the original specification.—J. L. H.

Paper. P. Hinkel, Chicago, Ill. U. S. Pat. 940,969, Nov. 23, 1909.

Paper-board or felt-paper is made from a mixture of paper pulp and oily cotton fibres such as are removed from cotton seed hulls by treatment with oil. The cotton fibres contain as much oil as they will absorb and before they are added to the pulp, the latter is rendered neutral.—S. H. H.

Printers' ink from printed paper; Process for removing ——. Henkel und Co. Ger. Pat. 215,312, Dec. 15, 1908.

The claim is for the use of a mixture of peroxides of alkali or alkaline-earth metals with gelatinous silicic acid for the removal of printers' ink from printed paper.—A. S.

Indurated [fibrous] product and method of preparing same. L. H. Baekeland, Yonkers, N.Y. U.S. Pat. 942,852, Dec. 7, 1909.

See Fr. Pat. 386,628 of 1908; this J., 1908, 686.—T. F. B.

Acetyl- and nitro-cellulose; Treatment of —— for the manufacture of a plastic material. F. Meyer, Aachen, Germany. Eng. Pat. 19,735, Sept. 19, 1908.

See Fr. Pat. 393,963 of 1908; this J., 1909, 257.—T. F. B.

Cellulose acetate; Process for the manufacture of solutions of —— which are of industrial value. A. Schloss, Stettin, and Fürst Guido Donnersmarck'sche Kunstseiden und Acetatwerke, Sydowsane, Germany. Eng. Pat. 6554, March 18, 1909.

See U.S. Pat. 922,340 of 1909; this J., 1909, 671.—T. F. B.

Cellulose products in the form of threads, ribbons, films, or similar objects; Process for obtaining ——. P. Friedrich. Fr. Pat. 403,427, May 28, 1909.

See Eng. Pat. 11,700 of 1909; this J., 1909, 1246.—T. F. B.

Soda pulp mills; Process of treating waste liquors from ——. E. L. Rinman, Gothenburg, Sweden. Eng. Pat. 8175, April 5, 1909.

See Fr. Pat. 401,856 of 1909; this J., 1909, 1163.—T. F. B.

Producing a [stable] solution of ammoniacal cupric oxide [cuprammonium]. Eng. Pat. 1148. *See* VII.

Horny substance from cellulose. Ger. Pat. 216,629. *See* XV.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Logwood Black dyeing on cotton cloth; Continuous ——. E. Montavon. Rev. Gen. Mat. Col., 1909, 13, 348–353.

Most lustre blacks are still dyed with logwood, as Aniline Black and Diamine Blacks are dear and liable to affect the fibre, and the latter are wanting in depth. Sulphur Blacks are economical but uncertain. The author recommends the following process of logwood dyeing as economical on the large scale:—The pieces (after singeing and stitching) are first passed through the impregnating machine. This is a wooden vat divided in two, fitted with wood rollers, and having a pair of squeezing rollers fixed over the far end of each division (the upper roller is covered with ebonite and the lower with medium hard rubber). There is a feeding guide and at the end a folder. The bath consists of iron pyrolignite of 5° B., kept at about 50° C. by a steam coil. The rate of travel is about 30 to 35 metres a minute. 9 to 10 litres of pyrolignite are added for every 3 pieces (of about 100 metres each) passed through. The pieces are then piled on waggons till the next morning. The second operation consists of squeezing and drying. The squeezing cylinders must have a diameter of at least 220 mm. and be capable of withstanding strong pressure; the lower one is covered with medium hard and the upper with hard rubber. The speed is regulated by that of the drying apparatus, say 15 to 20 metres a minute, and so as to keep about 50 metres ready for drying. The dryer is a hot flue with two sets of horizontal rollers of wooden laths, the upper set being worked by pinions. Warm air is circulated by a fan and ventilator. The pieces are kept even by a series of openers. After drying, the pieces are again piled on waggons. The third portion of the plant consists of two machines placed in line, the first for liming and the second for washing and dyeing. The first is similar to the impregnating machine, but both vat and rollers are of galvanised iron. The lower wringing rollers are covered with brass and the upper ones with rubber. The second machine is of galvanised iron with brass rollers, has five divisions and five pairs of wringing cylinders similar to the liming machine. The first three divisions are for washing. Water is supplied by pipes of perforated copper. The last two divisions are for the dyeing; these have copper coils for heating by contact only. The lime bath is made by adding 20 litres of milk of lime (25 kilos. of quicklime made up to 500 litres), to the boiling water in the vat, and smaller quantities (4 to 5 litres) are added as required to ensure that the colour of the cloth readily changes to red. Excess of lime must, however, be avoided, and the subsequent washing must be well done to avoid loss of dye. For dyeing, water is introduced till the lower rollers in the dye-vat are covered; this is heated to boiling and 50 litres of dye-solution then added, and the whole kept boiling whilst the pieces are passing. The dye solution is made by dissolving 35 litres of logwood extract, 30° B., adding a solution of 1 kilo. of soda ash, and making up to 200 litre For each piece dyed, about 5 litres of the dye solution are used. After dyeing, the pieces remain overnight in the waggons, are then washed with sprays on a wringer of three rollers and dried on steam cylinders. It is stated that five men and four boys can dye 18,000 to 20,000 metres every 10 hours. For such a production however the plant for the second operation (squeezing and drying, after the impregnating) must be duplicated.
—A. Sbld.

Fuscamine Brown. H. Schmid. Bull. Soc. Ind. Mulhouse, 1909, 79, 286–289.

Although Paramine Brown, on account of its useful properties, has been used, its tone is rather too red. It has been found that *m*-hydroxyamino-compounds, oxidised upon the fibre, yield more yellowish brown shades, of good fastness and solidity. *m*-Aminophenol is now sold under the name Fuscamine G, and a medium brown is obtained as follows: Pad in a bath containing 20 grms. of Fuscamin. G (B. A. S. F.), 20 grms. of hydrochloric acid of 20° B. 25 grms. of sodium chlorate, and 5 grms. of potassium ferrocyanide per litre, an dry in the hot-flue. Discharges may be printed on at this stage, and the goods are then steamed for 5–10 minutes, passed through the ammonia box and then through a warm weak solution of alkali and washed. The treatment with alkali serves to destroy any Prussian blue which may have been formed, and to clear the shade. The fibre is not tendered and the fastness of the shade to both light and soaping is good.—F. M.

Steaming of pieces; Determination of the amount of air in the Mather and Platt steaming apparatus, during the —— at about 100° C. A. Scheurer. Bull. Soc. Ind. Mulhouse, 1909, 79, 283–286.

The presence of air in the steaming apparatus may interfere with the fixation of vat-dyestuffs, and the author has determined experimentally the amount of air contained in the atmosphere of steam. A blank trial showed that the percentage of air was 1·2 to 1·3. Upon steaming some pieces which had been printed with a dyestuff—hydrosulphite paste, the percentage of air during the passage of the blanket was 0·77–0·82; during the passage of the first pieces it was 1·12 and whilst the fifth piece was passing, it fell to 0·3 per cent. It is evident that the amount of air varies from one operation to another and the author concludes that this variation is hardly due to air dissolved in the water used for steam raising, to variations in pressure, or to air carried mechanically into the steamer by the pieces, but is caused by leakage through the vent-holes, crevices, etc. The amount of air thus entering the steamer is diminished by increasing the amount of steam admitted.—F. M.

Patents.

Soap: Substitute for —— for washing, cleaning and bleaching purposes. P. Mausoloff, Frankfort-on-Maine, Germany, Assignor to Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 941,158, Nov. 23, 1909.

A substitute for soap for washing, cleansing, and bleaching is obtained by mixing together sodium perborate, soda, and borax.—S. H. H.

Mercerising hanks; Rotating machine for ——. Kleinewefers Söhne. F. Pat. 403,724, June 5, 1909.

THE machine is fitted with six pairs of horizontal rollers, and arrangements are made for keeping entirely separate the various liquors with which the yarn is treated. Special features are that the hanks, after mercerisation, are thoroughly squeezed and simultaneously steamed or rinsed with water, so as to effect as complete a removal as possible of the caustic lye, and that souring is effected whilst the hanks are under tension in the machine. All operations are performed automatically during one revolution.—J. L. H.

Dyeing wound yarn; Apparatus for ——. F. G. Schumacher, Basle, Switzerland, and H. Resch, Lörrach, Germany. Eng. Pat. 24,404, Oct. 23, 1909. Under Int. Conv., Oct. 24, 1908.

IN circulatory machines for dyeing roving or yarn in the form of spools or cops, the spindle is made of such a size that the perforated core on which the material is wound fits very closely on to it. The spindle thus supports the core, which consequently can be made very thin and light. This is of advantage when the cores have eventually to be mounted on flyers for spinning. In order to ensure uniform distribution of the dye-liquor, the spindle, in addition to its perforations, is provided with external longitudinal and transverse grooves.—H. P. P.

Dyeing yarn; Apparatus for ——. F. Geissler, Kottbus, and B. Wagner, Görlitz, Germany. U.S. Pat. 940,868, Nov. 23, 1909.

THE dye-vats contain frames which carry the yarns to be dyed and are capable of being removed from the vats. The yarn is hung over iron bars, supported one above another, by the sides of the frames and extending across the dye-baths. The dye-liquor is caused to circulate through the dye-vats, entering near one set of bars and passing out of the vats near the other set. In this way the current of liquor passes along the yarns, disturbs them, and thus ensures even dyeing at the parts where the yarn is in contact with the suspending bars. —S. H. H.

Print effects on fabrics; Production of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 7734, Mar. 31, 1909.

THE process consists in printing or padding fabrics with a mixture of substantive and basic dyestuffs and then coverprinting with suitable agents which discharge the former. For instance, cotton piece goods are padded with Diamine Rose BD and printed with a combination of 1 part of print paste I. and 2 parts of print paste II. Print Paste I. 50 parts of New Methylene Blue NSS, 50 parts of glycerin, 100 parts of acetic acid (30 per cent.), 460 parts of water, 40 parts of starch, 180 parts of tragacanth solution (60 : 1000), 120 parts of tannin-glycerin (1 : 1). Print paste II. 40 parts of Diamine Dark Green N, 50 parts of glycerin, 670 parts of water, 40 parts of starch, 200 parts of tragacanth solution (60 : 1000). The goods are then steamed, dried, cover-printed with a discharge composed of 150 parts of Hyraldite C extra and 850 parts of British gum (2 : 3), and again steamed, lightly chromed if necessary, treated with antimony salt, rinsed, and dried. The direct print produces black on a pink ground and the discharge, pale blue and white. Coloured discharges may also be employed. The process is applicable to silk, half-silk, half-wool, and other fabrics.—J. L. H.

Brown shades, with white and coloured effects; Production of —— by oxidation on the fibre. Badische Anilin und Soda Fabrik. 1st Addition, dated May 1, 1909, to Fr. Pat. 357,472, Sept. 4, 1905. Under Int. Conv., March 1, 1909.

IN the principal patent (this J., 1906, 120) a brown colouring matter was produced in dyeing and in printing by the oxidation of *p*-phenylenediamine. This colouring matter was very fast to washing and light, but did not admit of variety of tint. According to the present patent this variety is provided by the addition of other organic amines, *e.g.*, hydroxylated mono-amines and their derivatives, to the *p*-phenylenediamine. These bases are used in the form of their neutral salts. For example *m*-aminophenol produces an olive shade, and other bodies cause a variation in shade from brown to black. The substances thus produced are claimed to be definite chemical compounds caused by substitution in the benzene ring, and not merely mixtures of Paramine Brown, as the dyestuff described in the orginal patent was called, and other dyestuffs. In printing, white effects can be produced by printing a reserve containing a strong reducing agent, as sulphites, hydrosulphites or formaldehydesulphoxylate, and then steaming for a short time. By using aniline colours or mineral colours fixed by albumin in the reserve, coloured effects are produced.—S. H. H.

Dyeing and printing pastes; Process for removing sand and other foreign substances from ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 214,945, June 26, 1908.

SAND and other foreign bodies may be almost entirely removed from pastes for use in dyeing and printing, by centrifugal action in suitable apparatus.—T. F. B.

Reserves under indigo on cotton goods; Process for producing white and coloured ——. Felmayer und Co. Ger. Pat. 215,128, Nov. 23, 1907.

COTTON goods prepared by means of alkalis or naphthol and alkalis, are printed with a thickened solution of a manganous salt, a small amount of an oxidising agent, and, if coloured reserves are desired, a diazo solution. After dyeing in the indigo vat, the reserves are removed by means of acid reducing solutions.—T. F. B.

Proofing starched linen; Process for ——. A. Douqué. Fr. Pat. 403,761, June 7, 1909.

BODIES are added to the starch, such as basic aluminium acetate, the double salts of zinc and ammonium, or caseinlime, which during drying, ironing or subsequent treatment of the linen, dissociate or decompose, leaving a water-resistant coating on the material. The latter is then treated with a solution of cellulose acetate either alone or mixed with a collodion, celluloid or resin varnish, or the cellulose acetate and varnish may be applied separately. Solutions or suspensions of soap, sebacic acid, or any suitable substance capable of rendering insoluble the aluminium or zinc salts, etc., employed, may advantageously be added to the varnish.—J. L. H.

Dyeing and washing machine; Circulating ——. T. Allsop and W. W. Sibson, Philadelphia, U.S.A. Eng. Pat. 8744, April 13, 1909.

SEE U.S. Pat. 918,485 of 1909; this J., 1909, 519.—T. F. B.

Dyeing wool; Process of ——. H. Winslow, Providence, R.I., Assignor to Cassella Color Co., New York. U.S. Pat. 941,399, Nov. 30, 1909.

SEE Eng. Pat. 22,097 of 1908; this J., 1909, 791.—T. F. B.

Dyeing, mordanting, or similarly treating textiles in slubbing, yarn, or other fibrous materials; Machines or apparatus for ——. J. Kershaw and J. T. Cole. Fr. Pat. 403,638, June 3, 1909.

SEE Eng. Pat. 16,329 of 1908; this J., 1909, 979.—T. F. B.

Textile fibres, threads, and fabrics; Method of improving ——. G. Kraemer, Cologne, Germany. U.S. Pat. 942,395, Dec. 7, 1909.

SEE Eng. Pat. 11,928 of 1907; this J., 1907, 1046.—T. F. B.

Obtaining solutions or pseudo-solutions of ferric oxide, etc., for dyeing. Eng. Pat. 24,842. *See* VII.

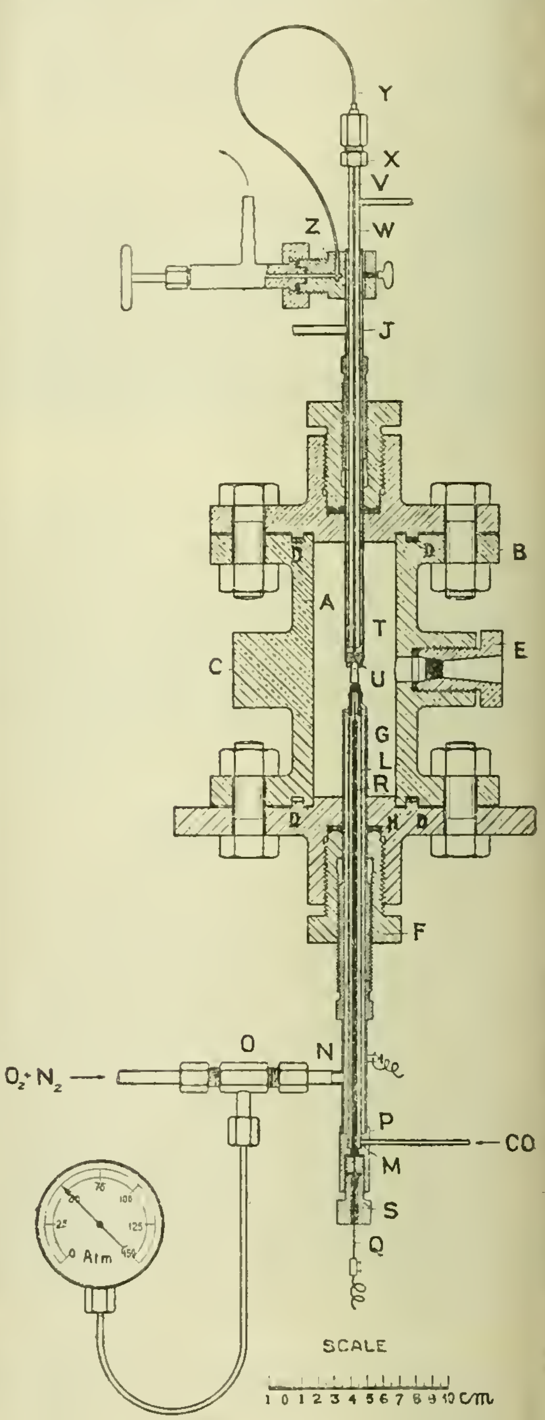
VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid from gypsum. H. Trey. Z. angew. Chem., 1909, 22, 2375—2377.

Gypsum is readily decomposed when intimately mixed with sand or silica and strongly heated, a mixture of sulphur dioxide, oxygen, and water being evolved; the small proportion of iron oxide contained in ordinary sand or sea-sand acts catalytically and hastens the decomposition. From the mixture of gases sulphuric acid may be obtained by the contact process, and, on account of the purity of the product and the fact that the residue may be utilised for making glass, it is considered that gypsum could possibly compete as a raw material for sulphuric acid manufacture, especially in countries possessing large deposits of gypsum but no pyrites.—F. Sodn.

Nitric oxide; Formation of —— by the combustion of carbon monoxide. F. Haber and J. E. Coates. Z. physik. Chem., 1909, **69**, 337–388.

In the authors' experiments, carbon monoxide was burnt in mixtures of oxygen and nitrogen under pressure, and the yield of nitric oxide observed under different conditions. The carbon monoxide and the different mixtures of nitrogen and oxygen were stored in steel cylinders at pressures of 150 to 200 atm. It may be remarked that under these conditions iron carbonyl is slowly formed in the carbon monoxide cylinder; after several months this became a source of inconvenience on account of the iron oxide deposited by the flame. The form and dimensions of the apparatus in which combustion was effected are given in the Fig. A is a flanged bronze cylinder, the middle portion of which is thickened into a projecting ring C. The ends are closed by bronze plates, the lower of which carries the burner and air-inlet tube, while the upper supports the tube through which the products of combustion escape. Into the thickened portion of the cylinder are screwed two glass windows, E, at an angle of 90° to each other; through these the flame could be observed. The apparatus screwed into the lower plate consists of two concentric steel tubes; L, G,; the annular space between them serves to admit the mixture of nitrogen and oxygen, while carbon monoxide is introduced through the inner tube, which is provided at the top with a soapstone burner having a single round hole of 1·5 mm. diameter. As a means of lighting the flame, a glowing platinum wire was adopted (the electric spark method is much more difficult under high gaseous pressure); the arrangement can be readily understood from the figure. The upper plate is similarly fitted; the products of combustion pass through a thin platinum tube, V, of about 1 mm. internal diameter, provided with a water-cooler, J, the outer tube of which is of steel. The lower end of the platinum tube carries a small slightly conical quartz tube, U (10–15 mm. long, greatest diameter 4–6 mm.), in which the flame burns as in a chimney, while the upper end terminates in a fine regulating needle-valve. Iron tubes may also be used instead of platinum, and prove equally serviceable, there being no perceptible corrosion. The flame was ignited at low pressures and then by regulating the supply of the gases, the conditions of pressure, gas outflow velocity, and size of flame, were brought to, and kept at, the desired values. The experimental results, which are given in tables, show that by using a mixture of equal volumes of oxygen and nitrogen at ordinary atmospheric pressure, only small quantities of nitric oxide are formed, even when the temperature of the flame is raised by heating the gases before combustion to 800° C. The yield of nitric oxide rapidly increases as soon as the pressure rises above 5 atmospheres. Without a preliminary heating of the gases, 100 mols. of carbon dioxide are accompanied by 4 to 5 mols. of nitric oxide in the products of combustion; with preliminary heating, 6 mols., and by use of air instead of equal volumes of oxygen and nitrogen, 3 mols. of nitric oxide are obtained. An increase of pressure is much more effective than an increase of temperature in increasing the yield of nitric oxide. That the combustion of carbon monoxide may be made to yield nitrogen tetroxide (N_2O_4) in a concentrated form, seems worthy of consideration from a technical point of view. Concentrated carbon monoxide is a cheap waste product in the carbide and zinc industries, and it is suggested that this carbon monoxide instead of being burned directly, might be compressed to about 9 atm., and delivered at this pressure into a kind of vertical locomotive steam boiler, and burned there (still under pressure) in the flame tubes, the air (or other oxygen-nitrogen mixture) being delivered under the same pressure to the apparatus. The combustion gases, still under pressure, could be cooled in order to separate the nitrogen tetroxide as liquid, and the remaining mixture of carbon dioxide, oxygen, and nitro-



gen allowed to expand to ordinary pressure in a suitable engine. The heat of combustion of the carbon monoxide would produce steam in the boiler, which would serve to drive the compressors, while the energy for the cooling apparatus could be derived from the expansion of the gas behind the cooling plant. Assuming that the carbon monoxide, as a waste product cost nothing, then the cost of the process would be determined only by the interest and depreciation of the plant, the wages, and the repairs, the necessary power being entirely derived from the combustion process itself. This calculation, however, would only hold in the case of air; when a nitrogen-oxygen mixture richer in oxygen (say a 50% mixture) was used, then the cost of the plant for the production of oxygen would have to be added. Taking the cost of production of oxygen on a large scale as ¼d. per cubic metre, even at this small price the cost of the nitrogen tetroxide would be considerably increased, so that from the technical standpoint the use of air demands first consideration. With air, good results can only be obtained if a regenerative burner arrangement is used, so that the gases are strongly heated before entering the flame. The actual quantities of nitric acid that could be produced by this process are dependent on the amount of carbon monoxide available. In a carbide plant a daily yield of 10,000 cubic metres of carbon monoxide may be taken as a fairly large one. Using air for combustion, this quantity of carbon monoxide would suffice for the production of 250 cubic metres of nitric oxide, corresponding to nearly 660 kilos. of nitric acid. Hence, where carbon monoxide in a fairly pure state is produced in large quantities, its utilisation for the production of pure nitric acid seems to be a matter well worthy of consideration.

Sodium nitrate statistics, shipments, consumption, stocks, and prices, from 1907—1909. W. Montgomery & Co., Ltd., London, Dec. 31, 1909. [T.R.]

					1907.	1908.	1909.
Shipments from South American Ports to all parts for the six months ending Dec. 31st.	Tons				887,000	1,052,000	1,318,000
Ditto do. for the twelve months ending Dec. 31st	,,				1,626,000	2,017,000	2,085,000
Afloat for Europe on 31st December	,,				493,000	526,000	662,000
Stocks in U.K. Ports :—		1907.	1908.	1909.			
Liverpool	Tons	7,200	24,500	13,100			
London	,,	1,700	3,400	1,400			
Out Ports	,,	5,100	20,100	9,500	14,000	48,000	24,000
Stocks in Continental Ports on 31st Dec.	Tons				188,000	354,000	313,000
Consumption in U.K. for the six months ending 31st Dec.	,,				37,000	41,000	41,000
Do. in Continent do. do.	,,				270,000	312,000	359,000
Do. in U.K. for the twelve months do.	,,				112,000	103,000	111,000
Do. in Continent do do.	,,				1,140,000	1,275,000	1,354,000
Do. in United States do. do.	,,				350,000	309,000	398,000
Do. in other Countries do. do.	,,				56,000	45,000	63,000
Do. in the World do. do.	,,				1,558,000	1,732,000	1,929,000
Visible supply on 31st Dec. (including the quantity afloat for Europe and stocks in U.K. and Continent)	,,				695,000	928,000	999,000

Ammonium carbonate; Electrolytic oxidation of ——. F. Fichter and H. Kappeler. Z. Elektrochem., 1909. **15**, 937-943.

The chief product at the anode, when an aqueous solution of ammonium carbonate is electrolysed by a continuous current, is ammonium nitrate, and there is a simultaneous evolution of oxygen. The best yield is given when the current density at the anode is 0·4 to 0·6 ampère per sq. cm., the temperature 50°-60° C., the composition of the solution corresponding to the ratio $\frac{1}{2}\text{CO}''_3 : \text{NH}_4 = 0{\cdot}55$, and a concentration not below 2 gram.-equivalents per litre. Under these circumstances the yield was from 82·5 to 96·7 per cent. of theory. The concentration of hydroxyl-ions most favourable to the formation of nitrate is obtained in a solution of the carbonate containing ammonia; ammonium hydrogen carbonate alone and ammonia to which sodium carbonate solution has been added diverge in opposite directions from this optimum, and give poorer yields. Ammonium tetraborate, however, gives results as good as those obtained from an ammoniacal solution of ammonium carbonate.—J. T. D.

Ammonium chloride; Free importation of —— *into Australia.* Board of Trade J., Dec. 16, 1909. [T.R.]

According to a Customs By-Law (No. 73) published in the "Commonwealth Gazette" of Oct. 30, 1909, ammonium chloride for use in galvanised manufactures may be imported free of duty, under Tariff item No. 434, provided security be given by the owner that it will be used for galvanised manufactures only, and that evidence of such use be given to the satisfaction of the collector within six months after delivery by the Customs.

The German potash industry. "Times," Dec. 18, 1909. [T.R.]

The Prussian Government is promoting in the Federal Council a Bill to regulate for the next twenty years the production and sale of potash. By the formation of a trading corporation which will supersede the existing syndicate and will completely control sales, it is sought to prevent "squandering of salts of potash abroad at unduly low prices," and by making the opening of new works depend strictly upon increase in sales it is sought to remove the main obstacles to effective syndication of the potash industry.

Hydrated salts; Calorimetrical analysis of ——. F. G. Donnan and G. D. Hope. Faraday Soc., Nov. 30, 1909. [Advance proof.]

It is shown that the heats of solution of partially dehydrated salt mixtures, obtained by slow dehydration over sulphuric acid at a relatively low temperature, may be utilised, provided they are measured in sufficiently dilute solution, to ascertain the existence of definite hydrates, though owing to the difficulty of accurately determining the heat of solution, the method is not considered so reliable or convenient as other known methods. Thomsen's conclusions from his calorimetric data are criticised, and, by plotting curves showing the variation of the heat of solution per "gram formula-weight" with the number of molecules of water per molecule of anhydrous salt, his results for sodium carbonate, which are confirmed by the authors, are shown to point to the existence of three hydrates only, the compounds, $Na_2CO_3.H_2O$; $Na_2CO_3,7\ H_2O$; $Na_2CO_3,10\ H_2O$.—F. Sodn.

Percarbonates; The existence of true ——, *and their distinction from carbonates with hydrogen peroxide of crystallisation.* E. H. Riesenfeld and B. Reinhold. Ber. 1909, **42**, 4377 to 4383.

By electrolysis at a temperature of −30° to −40° C. the authors have prepared a practically pure and anhydrous potassium percarbonate. They find that only by this process can percarbonates be prepared: all the substances, hitherto regarded as percarbonates, prepared by the action of hydrogen peroxide on solutions of alkali carbonates, are merely carbonates with hydrogen peroxide of crystallisation. These substances, when added to a concentrated neutral solution of potassium iodide, are decomposed with evolution of oxygen, and liberation of hardly any iodine, whilst the true percarbonate gives off no oxygen, and liberates iodine equivalent to the available oxygen which it contains. The electrolysis, under similar conditions, of lithium, sodium, rubidium, and cæsium carbonates, gave solutions which the above reaction showed to contain percarbonates; but the solubility of these salts was much greater than that of potassium percarbonate, and they could not be separated in the solid form.—J. T. D.

Sodium sulphate; Reduction of —— by carbon. A. Colson. Comptes rend., 1909, **149**, 1076—1078.

Experimental examination of the reduction of sodium sulphate by heating with lampblack shows that it is hardly sensible below 950° C., but is rapid and uniform at that temperature, whatever be the proportion of carbon. With excess of carbon (Na_2SO_4+4C), 70 per cent. of the sulphate is decomposed in twenty minutes, and the speed of reaction increases rapidly with the temperature.
—J. T. D.

Basic magnesium chlorides. W. O. Robinson and W. H. Waggaman. J. of Phys. Chem., 1909, **13**, 673—678.

The solubility of magnesium hydroxide at 25° C. in solutions of magnesium chloride of various concentrations has been determined, with a view to ascertaining the existence of basic salts of definite composition. The results indicate that, in contact with unsaturated solutions containing more than about 10 grms. of magnesium chloride per 100 c.c., the stable solid phase is the hitherto undescribed basic salt, $3Mg(OH)_2,MgCl_2,7H_2O$.—F. Sodn.

Lead silicates: thermal analysis of the system, $PbO : SiO_2$. H. C. Cooper, L. I. Shaw, and N. E. Loomis. Amer. Chem. J., 1909, **42**, 461—473.

The authors have applied the method of thermal analysis to an investigation of the lead silicates, the heating curves of a series of mixtures of lead oxide and silica being studied. These mixtures were made to crystallise by slowly cooling the melts, but no crystallisation could be effected when the molecular ratio of lead oxide to silica was less than 43:57, and marked supercooling was observed in all cases, even with pure lead oxide. The melting-point curve clearly shows the existence of the orthosilicate, Pb_2SiO_4, and metasilicate, $PbSiO_3$, both of which crystallise readily. The former compound melts at 746° C. and the latter at 717° C. The melting point of pure lead oxide (PbO) is 888° C., and the eutectic, Pb_2SiO_4, $PbSiO_3$, melts at 717° C. A thermo-couple of platinum and platinum-rhodium, immersed naked in the lead silicate melts, was found to be practically unaltered after a year's use.
—F. Sodn.

Iron dioxide; Compounds containing ——. L. Moeser and H. Borck. Ber., 1909, **42**, 4279—4283.

Ferric nitrate and strontium nitrate solutions are mixed and evaporated to dryness. The residue is heated in a stream of oxygen at a temperature not exceeding 600° C., till no more nitrogen oxides are evolved. A loose black residue is left, consisting of a compound of the formula, $2SrO,FeO_2$, together with variable quantities of strontia and ferric oxide. A similar barium compound can also be obtained, though less readily. These compounds contain no alkaline-earth dioxide, but are compounds of the alkaline-earth and iron dioxide, in which the iron dioxide plays the part of acid radical, as manganese peroxide does in manganites. They are amorphous, and stable up to 650° C.; at higher temperatures they lose oxygen, and leave strontia or baryta and ferric oxide. Cold water acts on them slowly, boiling water more rapidly, setting free oxygen. A small percentage of barium or strontium hydroxide in the water prevents this decomposition. Hydrogen peroxide decomposes them rapidly, with evolution of oxygen from both substances. Hydrochloric acid causes evolution of oxygen and chlorine, oxalic acid of oxygen and carbon dioxide. Vapour of alcohol or other combustible, mixed with air and led over the heated substances, burns completely; the combustion once started may be continued indefinitely without the aid of external heat.
—J. T. D.

Radioactivity of the crude, intermediate, and final products of the Imperial Uranium Colour Works at St. Joachimsthal. J. Step. Oesterr. Berg. u. Hüttenw., 1909, **57**, 155 and 173. Chem.-Zeit., 1909, **33**, Rep., 237.

The author has examined the whole of the crude, intermediate, and final products, and also the liquors and wash-waters, in order to ascertain whether there is any loss of radioactive material in the roasting of the pitchblende or in the manufacture of the uranium pigments. It was found that there is no loss of radioactive substances in either case: the ratio of the radioactivity of the raw ore to that of the roasted ore is the same as the ratio of their uranium contents; also the radioactivity of the roasted ore is equal to the sum of the radioactivities of the products obtained therefrom. Of the total radioactivity, the residue of the ore after lixiviation accounts for 73·90 per cent., the "soda-precipitate" for 7·32, the "uranium yellow I." for 7·35, and the "uranium yellow II." for 11·88 per cent. The "soda-precipitate" was further examined as to the nature of the radioactive substance contained in it. The ore is extracted with sulphuric acid, in which radium is insoluble: hence the "soda-precipitate" which is produced on neutralising the liquor should be free from radium. It was found, however, that the precipitate contained radium besides other active substances. The presence of radium in the precipitate was proved to be due to the fact that on siphoning off the sulphuric acid solution from the ore residue, some finely-divided suspended matter (containing radium) is carried over, and later carried down by the precipitate produced on neutralising the liquor.—A. S.

Reactions in ultra-violet light. H. Thiele. Z. angew. Chem., 1909, **22**. 2472—2484.

The author has studied the influence of ultra-violet light from a high-tension Heraeus mercury lamp on different chemical reactions. The quartz reaction vessel was placed opposite the middle of the lamp, only a short distance away, and was cooled by a water spray which formed a thin mantle around the vessel. The E.M.F. supplied to the mercury lamp was maintained at about 120 volts. Experiments with mixtures of hydrogen and oxygen were conducted with the moist gases, with gases dried by means of sulphuric acid, and with gases dried by contact for eighteen days with phosphorus pentoxide. Combination between the two gases was accelerated by ultra-violet light, and the presence of moisture was not essential, the reaction-velocity being indeed somewhat greater with the dry than with the moist gases (compare Baker, this J., 1902, 428). Carbon monoxide and oxygen also combine when exposed to ultra-violet light, but less readily than hydrogen and oxygen. In ultra-violet light interaction takes place in a mixture of hydrochloric acid and air, even when the gases are dried by means of sulphuric acid (compare Richardson, J. Chem. Soc., 1887, **51**, 802). Hydrobromic acid, also, is decomposed by air in ultra-violet light. The formation of hydrogen peroxide from water and oxygen in ultra-violet light could be observed only occasionally and appeared to depend largely upon the experimental conditions, possibly upon the presence of impurities; on the other hand, the decomposition of hydrogen peroxide, and of potassium percarbonate and ammonium persulphate was considerably accelerated. Formic acid, ammonium oxalate, peptone, and egg-albumin all suffered more or less decomposition on exposure to ultra-violet light. Potassium nitrate was reduced to nitrite, with liberation of oxygen: in a N/10 solution, 6·3 per cent. of the nitrate was reduced in 2½ hours. A small piece of filter-paper lost 0·8 mgrm. in weight when exposed for three hours to the ultra-violet light. Experiments were also made with portions of 20 c.c. of water containing about 1 per cent. of sulphur in suspension: in the dark there was no measurable change; after exposure to sunlight for three days, a current of air being passed through the water, a quantity of acid equivalent to 0·5 mgrm. of sulphuric anhydride was found: after three hours exposure to the ultra-violet light (at a distance of about 8 mm. from the lamp), quantities of acid equivalent to from 31·6 to 44·8 mgrms. of sulphuric anhydride were found.—A. S.

Boron. E. Weintraub, E. Kraus, and G. Weintraub. Amer. Electrochem. Soc., New York, Oct. 1909. Electrochem. and Met. Ind., 1909, 7, 509–512.

By the interaction of boric anhydride and magnesium under the conditions described by Moissan, the authors were unable to obtain homogeneous products: in all cases there were obtained a dark substance, rich in magnesium, and a brown substance, previously supposed to be boron. By working at a higher temperature, a product of a uniform brown colour, practically free from magnesium, was obtained, which however contained only from 82–85 per cent. of boron and 14–16 per cent. of oxygen. The composition of this product remained constant on oxidation with permanganate in stages, and the authors name it boron suboxide. Attempts to prepare pure boron from it by reduction and by fusing with a large excess of boric anhydride proved unsuccessful. The best method for the production of pure boron was found to consist in the reduction of boron chloride by means of an arc discharge through a mixture of the vapour of the chloride with hydrogen. One or more alternating current arcs, fed by a high-potential transformer, were produced between water-cooled or air-cooled copper electrodes in a mixture of boron chloride with a large excess of hydrogen in a glass or copper vessel. The boron was obtained partly in the form of fine powder, deposited on the walls of the vessel and on the electrodes, and partly in the form of fused lumps, produced by the falling of molten beads from the ends of the electrodes. The powder after being freed from a small quantity of boric anhydride, showed, on analysis, 99–99·5 per cent., and the fused lumps, 99·8 to 100·2 per cent. of boron. The yield was greater the larger the excess of hydrogen. By using a number of arcs in one vessel or in vessels connected in series, a yield of 30 per cent. of the theoretical could be obtained, and the amount of boron formed per unit of time was also satisfactory. For melting the boron powder, two methods, which are of wide applicability in the treatment of refractory materials, were employed. The first consists in the use of a mercury arc produced either in vacuum or in an inert gas: and the second is the use of a high-potential arc in an inert gas. Pure boron melts between 2000° and 2500° C.: *in vacuo* it begins to volatilise before melting, but subsequently begins to melt. When the surface is fused, the tendency to volatilise is greatly reduced. The vapour pressure is considerable even at 1600° C. The hardness of boron is inferior only to that of diamond; the fracture is conchoidal. Boron is a very poor electrical conductor at the ordinary temperature, but its conductivity rises very rapidly with increase of temperature, being about 2,000,000 times greater at a dull red heat than at 23° C.; at bright red heat boron is a relatively good conductor. Thus although at 23° C. boron has a specific resistance of about $1·7 \times 10^6$ ohms, it behaves as a relatively good conductor when moderate voltages are applied, the change in resistance taking place rapidly. On account of its remarkable electrical properties, boron can be used technically in the production of motor-starting devices, sensitive pyrometers and bolometers, wireless detectors, etc., whilst its hardness and conchoidal fracture make it suitable for jewels, dies, etc. Pure boron may also be prepared by the dissociation of magnesium boride and similar compounds, boron suboxide (see above), and boron nitride at high temperatures. By dissolving small amounts of carbon in boron, the conductivity at the ordinary temperature is greatly increased (twelve times by a few tenths per cent. of carbon) and the negative temperature-coefficient of resistance is reduced. A product with almost any desired negative temperature-coefficient of resistance can be selected from pure boron and mixtures of boron and carbon containing up to 8 per cent. of the latter. On the other hand by the introduction of a trace of boron into carbon, the latter is "metallised," *i.e.* converted into a variety having a low specific resistance and a positive temperature-coefficient of resistance. This catalytic effect of boron is characteristic; all other elements tried, including iron and silicon failed to produce a similar result.—A. S.

Silicon; So-called amorphous ——. E. Wilke-Dörfurt. Wallach-Festschrift, 1909, 671–684. Chem. Zentr., 1909, 2, 1965–1966.

According to Von Haasy (Z. anorg. Chem., 1900, 23, 32) a very reactive form of amorphous silicon can be obtained by passing gaseous silicon fluoride through metallic sodium heated to faint redness, and purifying the product by fusing with sodium and aluminium. Attempts to purify the crude product by extraction with water and treatment with acids, instead of by the fusion process, proved unsuccessful, owing to oxidation of the silicon. Sulphuric acid oxidises the silicon to silicic acid, becoming itself reduced to sulphur, which is difficult to remove. By boiling with water, the content of silicon was reduced, in one case, from 96·7 to 34·3 per cent.

By fusing together sodium silicofluoride, sodium, and aluminium, a regulus is obtained, which on treatment with acids, yields a less reactive form of silicon. The reactive brown variety can, however, be produced from this by heating with hydrofluoric acid. It is obtained as a brown impalpable powder which interacts with concentrated nitric acid, with production of flame and evolution of oxides of nitrogen; the white residue yields ammonia abundantly on treatment with caustic soda solution. The less reactive, bluish-grey variety of silicon obtained at first does not react with either sulphuric or nitric acid, and only slightly with water. In the author's opinion the differences in the degree of reactivity of different varieties of silicon is due merely to the varying degrees of fineness of the products, and there is no need to assume the existence of different kinds of silicon. The more reactive varieties are considered to consist of crystalline silicon in an extremely fine state of division, and it is pointed out that the less-reactive, bluish-grey variety described above, is intermediate between the more active variety and ordinary crystalline silicon, in regard to both colour and behaviour.—A. S.

Diamond; Change of colour of —— *by various physical agencies.* P. Sacerdote. Comptes rend., 1909, 149, 993–994.

The author has submitted diamonds of varying tint, to the following influences in succession. (1) *X-rays.* The stone was placed outside an X-ray tube. No appreciable change in colour was observed (compare Meyère, following abstract). (2) *Cathode rays.* The stone was placed inside a cathode ray tube. The initial colour (white or faint greenish-yellow) was gradually intensified to a beautiful "Madeira wine colour" which became a more or less deep brown on prolonging the action. This colour was apparently permanent at ordinary temperatures. (3) *Rise of temperature.* The coloured stone was heated to 300°–400°C. in an electric muffle furnace. The initial colour was restored.—W. H. P.

Precious stones; Influence of radium, X-rays, and cathode rays on different ——. A. Meyère, Comptes rend., 1909, 149, 994–995.

Working with diamond and with different varieties (white, pink, and blue) of corundum, the author found that radium rays, X-rays, and cathode rays all produced the same yellow colour (*jaune brûlé*) varying only in intensity and in permanence (compare Sacerdote, preceding abstract). Neither the position of the stone (inside or outside the vacuum tube), nor the presence of a previously applied film of metallic oxide (copper or nickel) on its surface, had any influence in the result. Variation in the nature of the electrodes was also without effect. In some cases a film of metal (from the cathode) was deposited on the stone, but when this was removed by a suitable acid, the yellow colour was found beneath it. The colour was not caused, therefore, by the transfer of particles of radium or of the cathode to the stone.—W. H. P.

Air; Desiccation of ——before liquefying. G. Claude. Comptes rend., 1909, **149**, 915–917.

The process described consists in adding to the compressed air, before the latter enters the counter-current apparatus, a quantity of alcohol approximately equal to the amount of moisture present, say from 0·5 to 1 grm. per cubic metre of air. The alcohol evaporates and then, during the cooling part of the process, condenses together with the water, the mixture remaining liquid and showing no signs of freezing. If the moist air be cooled directly, the water separates in the form of hoar-frost, which ultimately blocks the pipes of the apparatus. About 75 per cent. of the alcohol employed may be recovered for further use.—W. P. S.

Reaction of polybosic acids, and new reaction of titanium. Piccard. *See* XXIII.

Electrolytic determination of chlorine in hydrochloric acid. Gooch and Read. *See* XXIII.

Apparatus for determination of very small quantities of ammonia in large volumes of rapidly moving air. Liechti and Ritter. *See* XXIII.

Volumetric determination of sulphates. Mitchell and Smith. *See* XXIII

Detecting arsenites in presence of arsenates. Covelli. *See* XXIII.

Determining chromium gravimetrically. Quantitative hydrolysis of sesquioxides. Schoeller and Schrauth. *See* XXIII.

Patents.

Burner gases; Process and apparatus for purifying ——. J. B. F. Herreshoff, Assignor to General Chemical Co., New York. U. S. Pats. 940,595 and 940,596, Nov. 16, 1909.

Burner-gases are made to pass upwards through a series of scrubbing towers, and weak acid containing absorbed sulphur dioxide is sprayed in at the top of each tower. Solid impurities are thus eliminated, and the gases are then freed from liquid impurities by filtration. The acid leaving the bottom of each tower passes through a cooler to a settling chamber, from which it is pumped up into the tower for use again.—F. Sodn.

Causticising-tank. E. F. Parker, Fairfield, Me. U.S. Pat. 941,036, Nov. 23, 1909.

Inside the causticising tank is mounted an auxiliary reservoir, open at the top and bottom, but provided with a perforated false bottom, and containing solid lime. A number of spray-pipes enter the reservoir immediately below the false bottom, and a gas, *e.g.* air, is forced in through these pipes. The air rises through the perforated false bottom and through the lime in the reservoir and thus causes a circulation of the solution.—A. S.

Ammonia spent liquor; Purification of ——. J. Radcliffe, East Barnet. Eng. Pat. 16,924, Aug. 12, 1908.

The liquor is acidified by means of a stream of gases, such as combustion gases, whereby calcium carbonate is precipitated, and phenols and analogous compounds are liberated. The latter are removed by means of a current of hot air, steam, or other inert gas, and are recovered by passing the products through a series of scrubbers. A strong acid, such as sulphuric acid, may also be used in the place of combustion gases, whereby cyanides also are decomposed, and gaseous compounds of cyanogen are liberated and may be recovered.—O. R.

Salt; Apparatus for evaporating brine for the production of ——, or for evaporating liquid from other solutions. J. Hodgkinson, Manchester. Eng. Pat. 26,068, Dec. 3, 1908.

A primary closed evaporating tank is heated by a furnace fed by a Hodgkinson or similar automatic stoker which distributes the fuel over the fire-bars, so as to maintain a constant temperature. The furnace is arranged adjacent to the pan, but not directly beneath it; thus the flames do not come into direct contact with the base of the evaporator. The tank is provided with a rotary scraping device for removing the product and also with a paddle for breaking up surface films. The steam from the primary tank is conducted under the false bottom of a secondary closed evaporator (or evaporators), being superheated by the partially spent furnace-gases. The product may be similarly removed from this evaporator, and the steam from it, superheated by the furnace gases, is used to heat auxiliary open tanks, the gases then passing on to heat a further series of open tanks which may be heated also, if desired, by exhaust steam. Heated brine is fed into the evaporating pans, and there are means for inducing the flow of gases through the flues, which are provided below the evaporators, with baffles for the uniform distribution of the heat. Owing to the uniformity of temperature, the primary pan produces continuously the same quality of fine salt, and salt of uniform though coarser quality is obtained from the auxiliary pans, that from the last series of open tanks at the lowest temperature being the coarsest. Besides the even grade of the product, the advantages claimed are the automatic working of the process, an increased production of salt per ton of coal consumed, and greater economy of labour.—F. Sodn.

Solutions or pseudo-solutions of ferric oxide; A novel method of, and novel means for, obtaining —— and other substances commonly deemed insoluble, such solutions or pseudo-solutions being applicable to dyeing and other purposes. Z. Cartwright, Ilford. Eng. Pat. 24,842, Nov. 18, 1908.

The method is applicable to the partial separation or purification of commercial oxides, which consist of a mixture of compounds of various shades of colour, and of varying degrees of hydration. The finely-powdered oxide is mixed with a dilute aqueous solution of soap (or saponified fatty or resinous matter), or of an alkaline solution of fatty or resinous compounds. By employing a solution of suitable strength, the oxides of the shade required for the manufacture of paint may be "dissolved," and afterwards precipitated from the solution by the addition of acid or alkali.—B. N.

Ammoniacal cupric oxide [cuprammonium]; Process of producing a [stable] solution of ——. British Cellulose Syndicate, Ltd., and V. E. Mertz, Manchester. Eng. Pat. 1148, Jan. 16, 1909.

Stable cuprammonium solutions are obtained by maintaining an equilibrium of dissociation in such solutions. To that end, organic hydroxyl compounds may be used, such as glycerol, acetol, or an alkali tartrate. A salt of a per-acid, such as ammonium persulphate, which by its gradual liberation of oxygen serves to keep the copper in solution, is also added.—O. R.

Silicon nitride [fertiliser] and metals; Process of manufacturing —— from metallic silicides. A. Sinding-Larsen, Christiania, Norway. Eng. Pat. 3732, Feb. 15, 1909. Under Int. Conv., Feb. 17, 1908.

Complete interaction between silicon and nitrogen is brought about by dissolving the former in a metal, such as iron or aluminium, to form an alloy or compound which is thinly fluid at the reaction temperature. The silicon nitride is obtained in such a finely-divided state that it may be directly employed as a manure, or, by heating with readily reducible oxides, such as copper oxide, oxides of nitrogen may be produced. The process may also be employed for liberating a metal from its silicide. Thus, by reducing aluminium silicate to aluminium silicide and treating this with nitrogen, metallic aluminium is produced and may be distilled into a suitable receiver, and silicon nitride is obtained as a valuable by-product.—F. Sodn.

Aluminium and nitrogen; Process for producing compounds of ——. O. Serpek, Niedermorschweiler, Germany. Eng. Pat. 15,995, July, 8, 1909. Under Int. Conv., Sept. 22, 1908. Addition to Eng. Pat. 13,579, June 13, 1906.

Instead of heating alumina and carbon in the presence of nitrogen, as in the main patent (this J., 1907, 255), the raw materials are first heated together without access of nitrogen, with partial formation of aluminium carbide, and a powerful blast of nitrogen or of nitrogenous gases is then blown into the furnace.—O. R.

Salts of ammonia, especially sulphate of ammonia; [Electrical] process of making ——. O. P. Hurford, Chicago, Ill. U.S. Pat. 940,972, Nov. 23, 1909.

Nitrogen and hydrogen, approximately in the proportion of one volume of the former to three of the latter, are led by separate pipes into a closed receptacle, in which the mixture is subjected to electric discharges; the ammonia is absorbed as fast as it is produced by a spray of sulphuric acid which is made to pass through the vessel, so as to form ammonium sulphate, which is withdrawn.
—F. Sodn.

Clay, bauxite, kaolin, and analogous minerals; Process of treating ——. A. J. Boult, London. From E. Ladd, Cleveland, U.S.A. Eng. Pat. 18,923, Aug. 17, 1909.

The process consists in subjecting aluminous minerals to a red heat, and then treating them with a mixture of equal parts of concentrated hydrochloric acid and water, 3 per cent. of hydrofluoric acid being added to facilitate the reaction. The liquor obtained is evaporated to precipitate any dissolved silica, then diluted with water, filtered, evaporated to dryness, and the residue calcined. The calcined residue is washed with hot water, leaving the oxides of iron and aluminium, which may be separated by known methods.—J. W. H.

Acetates; Process of making ——. H. O. Chute, Cleveland, Ohio. U.S. Pat. 939,980, Nov. 16, 1909.

The process consists in removing concentrated wood spirit and accompanying volatile impurities from crude pyroligneous acid by fractional distillation, distilling the purified acid, and neutralising the acid vapours by contact with a base, such as lime, at a temperature of 100° C. The vapour and a stream of lime and water are made to pass in opposite directions, and the temperature is maintained by the addition of quicklime. Dilute acetic acid may be treated in a similar manner.—F. Sodn.

Thorium sulphide; Process of making ——. J. L. Huber, Assignor to the Firm of Kunheim und Co., Niederschöneweide, Germany. U.S. Pat. 941,071, Nov. 23, 1909.

The process consists in acting with sulphuretted hydrogen on solid thorium chloride or other halide thorium compound, at a temperature below that at which it sublimes. The chloride may be mixed with an indifferent substance, such as sodium chloride.—F. Sodn.

Alkaline-earth silicides; Process for the preparation of ——. E. Merck. Ger. Pat. 215,609. Feb. 25, 1909.

The method claimed is analogous to the thermite process, the charge consisting of a mixture of silicon with an alkaline-earth peroxide and oxide. On igniting the charge at one spot, the heat developed is sufficient to carry the reaction to completion. $MO_2+2MO+3Si=MSi_2+(MO)_2SiO_2$. With a mixture of silicon and an alkaline-earth peroxide, without oxide, the reaction proceeds too violently, and only small yields of silicides are obtained.—A. S.

Oxygen; Method of and means for the preparation of ——. G. F. Jaubert, Paris. Eng. Pat. 22,034, Sept. 27, 1909. Under Int. Conv., Nov. 26, 1908.

Oxygen or a gaseous mixture rich in oxygen is prepared by the auto-combustion of pulverulent mixtures containing chlorates or perchlorates and other substances to maintain combustion. The mixture is packed and transported in a cylindrical metal cartridge, having a perforated bottom and detachable covers for the ends. The combustion is effected directly inside the cartridge, for which purpose the covers are removed from the two ends, and the cartridge is introduced into an appropriate generating apparatus, the charge being kindled in the ordinary way. It is found that the liberated oxygen cools the wall of the cartridge and prevents the metal from being damaged, so that the interposition of any insulating body is unnecessary.
—F. Sodn.

Graphite; Manufacture of pure unctuous ——. E. G. Acheson, Niagara Falls, Ontario, Canada. U.S. Pat. 933,944, Sept. 14, 1909.

Anthracite, petroleum coke, or other suitable carbonaceous material is heated in an electric furnace, and surrounded by a protecting envelope, which consists of a mixture of carbon and silica, in the proportions requisite for the formation of silicon carbide. The protecting envelope has a thickness of at least one-half of the diameter of the charge of carbonaceous material, and the heating is continued until the latter has been converted into an unctuous graphite of high purity. A shell of silicon carbide is formed, which extends outwardly from the graphite core to at least one-fourth of its diameter, and the portion of the envelope adjacent to the graphite forms a firm, coherent, and non-friable mass, which is readily separable from the core of graphite obtained.—O. R.

Silicon carbide; Process of producing ——. F. J. Tone Niagara Falls, N.Y. U.S. Pat. 941,339, Nov. 23, 1909

Silicon carbide is made by passing an electric current through a resistance-conductor, embedded in a charge of silicious and carbonaceous materials, and consisting of a series of separate, shaped resistance pieces of predetermined cross-section and resistance, which are supported by the charge and are loosely and directly connected in a circuitous line between the terminals of the furnace, so as to maintain contact, notwithstanding lateral movement of the charge.—F. Sodn.

Nitrogen and carbon dioxide; Process for obtaining —— *from combustion gases.* Nitrogen Ges. m.b.H. Ger. Pat. 215,608, Sept. 10, 1908.

In the process of producing nitrogen and carbon dioxide from generator gases by burning them with air and leading the products over a mixture of copper and copper oxide, after a time the whole of the metal is converted into oxide by the excess of oxygen, and the combustion process has to be interrupted, and the air supply cut off, in order to reduce some of the oxide again to metal. In order to avoid this, it is proposed, according to the present patent, to add a quantity of reducing gases or vapours to the combustion gases before passing them over the mixture of copper and copper oxide. By this means the burning of the generator gases can be carried on continuously, which is of importance when the heat developed is utilised for generating steam, &c.—A. S.

Nitric oxide; Process for the preparation of —— *from a mixture of nitrogen and oxygen under pressure by means of explosive combustion.* F. Häusser. Ger. Pat. 216,518, Oct. 27, 1907.

The mixture of nitrogen and oxygen is forced by a compressor into an explosion bomb, wherein, after the desired pressure is attained, it is ignited. The products of explosion are forced by the pressure through an outlet valve, and rapidly cooled in order to avoid decomposition of the nitric oxide. During the explosion and emptying of the bomb, the supply of the combustible mixture is cut off. After the explosion, air is forced by the compressor through the bomb, in order to expel the remaining combustion gases. Or, between the compressor and the bomb, a reservoir may be interposed, in which the combustible mixture is stored during the combustion; by this arrangement, several bombs may be fed by a single compressor.—A. S.

Carbonic acid ; Process for separating —— from gas mixtures containing carbonic acid. S. G. Behrens, Bremen, Germany. Eng. Pat. 28,112, Dec. 24, 1908.

SEE Fr. Pat. 397,767 of 1908 ; this J., 1909, 938.—T. F. B.

Zinc compounds and ammonia ; Method of recovering ——. E. G. and M. M. Pearlman, Philadelphia, U.S.A. Eng. Pat. 6822, March 22, 1909.

SEE U.S. Pat., 919,375 of 1909 ; this J., 1909, 522.—T. F. B.

Alkaline earth sulphydrates ; Process of manufacturing ——. S. Coulier, St. Agathe, Belgium. Eng. Pat. 17,690, July 30, 1909.

SEE Fr. Pat. 392,671 of 1908 ; this J., 1909, 22.—T. F. B.

Salt ; Apparatus for producing —— by evaporation of brine, and for evaporating the liquid from other solutions. J. Hodgkinson. Fr. Pat. 403,578, June 1, 1909.

SEE Eng. Pat. 5011 of 1908 ; this J., 1909, 784.—T. F. B.

Calcium silicide ; Process for producing ——. T. L. Willson. Fr. Pat. 403,606, June 3, 1909. Under Int. Conv., April 2, 1909.

SEE U.S. Pat. 934,379 of 1909 ; this J., 1909, 1087.—T. F. B.

VIII.—GLASS ; CERAMICS.

Seger cones ; The testing of ——. Hoffmann and Rothe. Tonind.-Zeit. 1909, **33**, 1577—1580.

THE author describes an investigation on Seger cones carried out at the Physik.-Techn. Reichsanstalt, Germany. The softening temperatures of Seger cones Nos. 4—20 have been determined previously (this J., 1908, 75), and the investigation has now been extended to the range of cones from No. 20 to No. 35. In this range the differences between the estimated and the observed temperatures are much larger than in the lower range, and increase as the temperature rises. As in the previous series of tests, the cones were heated in an iridium tube furnace, but for measuring the temperatures only an iridium iridium-ruthenium couple could be used, with occasional recourse to an optical pyrometer. To ensure uniformity in the measurements, the thermo-couple was fixed in the furnace, and calibrated there by comparison with a second couple introduced at the opposite end of the furnace, so that the junction of the first couple projected into a magnesia tube in which was the second couple. The melting points of gold, palladium, and platinum were taken for the standardisation. To ensure uniformity with the former series of tests, the values for cones Nos. 14 and 20 were determined, and were found to be 1420° and 1540° C. respectively, against the previous values 1410° and 1530°. Two makes of cones were tested ; one, designated L-cones, were made specially at the Royal Porcelain Factory, the other, Z-cones, were made by Prof. Marquardt. The latter, which begin at No. 26, have higher softening temperatures from Nos. 26—31, and lower from Nos. 32—35, than the corresponding L-cones. The values for cones Nos. 21—26 lie very close to one another, and Nos. 21—25 have now been withdrawn from the list. From No. 26 there is a sharp rise, but from No. 27 the values increase very uniformly, especially with the Z-cones. In most cases observations on cones of a particular number only differed by 5°, and in a few by 15°. In this field of work there still remains the determination of the values of cones above No. 35, and of those below 1200° C., besides the effects produced by the rate of heating, by furnace gases, &c.

The following table gives the comparison of revised estimated temperatures with those observed.

Cone No.	Estimated temperatures.	Observed temperatures.	
		L-cones.	Z-cones.
26	1580°	1550°	1590°
27	1610°	1605°	1620°
28	1630°	1610°	1625°
29	1650°	1625°	1635°
30	1670°	1640°	1650°
31	1690°	1640°	1660°
32	1710°	1670°	1660°
33	1730°	1680°	1680°
34	1750°	1700°	1690°
35	1770°	1710°	1710°

—W. C. H.

Crystalline glazes on soft porcelain. Heinecke. Tonind.-Zeit. 1909, **33**, 1586—1588.

TITANIA, or willemite (anhydrous zinc silicate), or a mixture of both, is used for producing crystalline glazes on porcelain, china, or earthenware. The titania should amount to 10·8—11·5 per cent., and the zinc oxide to 2—5 per cent. The glazes used contained lead, but were low in alkalis. (For crystalline effects in leadless glazes, see Purdy and Krehbiel, this J., 1908, 564.) Crystals are best obtained by the contact of two glazes, one viscous, the other fluid, and both containing titania. The author made up three mixings of the following compositions respectively :—(A), 0·5 Al_2O_3, K_2O, CaO, ZnO, 2PbO, $13SiO_2$, $2B_2O_3$; (B), 0·5 Al_2O_3, K_2O, ZnO, 7PbO, $22SiO_2$, $5B_2O_3$; (C), 2PbO, SiO_2, B_2O_3. The titania was introduced as a frit, fired at cone 014, made up of 1 part of titania to 2 parts of mixture A. The frit was roughly ground to particles of 0·5 mm. size. The viscous glaze was made up of 3 parts of A, 1 part of B, and 1 part of titanium frit. The fluid glaze was made by mixing 1 part of A, 7·2 parts of B, 2·4 of C, and 5·4 of the titanium frit. The composition of the body used was $3Al_2O_3$, R_2O, $18SiO_2$. The ware was dipped in the viscous glaze, and fitted with a specially constructed cover divided into compartments by partitions. The bottoms of the compartments had a slight, downward slope to the outer wall, and were provided with small holes at their lowest parts. The fluid glaze was placed in these compartments, and on melting ran down through the holes and over the viscous glaze. The compartments were filled to various depths with the fluid glaze-material, in order to vary the patterns of the crystals produced on the vase. The ware was provided with a saucer to catch the fluid glaze as it ran off. After the firing, the cover and saucer were knocked off, and the ends of the vase ground and polished. The atmosphere of the muffle-kiln was kept oxidising. The firing was conducted gradually up to cone 015, and then quickly, in two hours, up to cone 7. To obtain proper crystallisation, the cooling must be protracted.—H. H. S.

Lead silicates. Cooper and others. *See* VII.

PATENTS.

Ceramic ware ; Manufacture of ——. S. Heller and C. Baumgartl, Teplitz, Bohemia. Eng. Pat. 11,633, May 17, 1909.

GOLD graphite is substituted for silver or gold as a conducting ground for the production of metallic coatings on ceramic ware. It is prepared by adding 500 grms. of water and 10 grms. of potassium cyanide to 3 grms. of gold chloride, and then mixing this solution with 1 kilo. of pure graphite and baking in a muffle at 600° C. It is mixed with an alcoholic solution of celluloid, tar, and unsaturated liquid hydrocarbons, and then applied to the ware, which is afterwards burnt in a muffle at 200° C.

—H. H. S.

Ceramic colours and fluxes; Preparation of —— by precipitation. H. Renoul. First Addition, dated Sept. 15, 1908, to Fr. Pat. 358,988, Jan. 7, 1905 (this J., 1906, 316).

For lithographic and typographic work, crystalline preparations must be avoided. The stains and fluxes are therefore prepared as amorphous precipitates of silicates and borates, and in the present addition claim is made for the precipitation of the flux apart from the stain.
—H. H. S.

IX.—BUILDING MATERIALS.

Lime-sandstones, and the preparation of coloured surfaces thereon. Glasenapp. Rigasche Ind.-Zeit., 1909, **35**, 215. Chem.-Zeit., 1909, **33**, Rep., 623.

In the manufacture of lime-sandstone a high lime content has comparatively little influence on the strength of the product, but the addition of a few parts per cent. of very fine sand, or an increased steam pressure, increases the formation of calcium hydrosilicate which acts as a binding agent between the grains of sand.—F. Sodn.

Cement and petroleum; Import duties on —— in Canada. Board of Trade J., Dec. 16, 1909. [T.R.]

The duties have been fixed as follows by decisions of the Canadian Board of Customs:—

Articles.	Tariff No.	Rates of Import Duty. Under British Preferential Tariff.	Under General Tariff
Keene's cement (so-called)	711	15 % *ad val.*	20 % *ad val.*
Caen cement (so-called)	711	15 % *ad val.*	20 % *ad val.*
Petroleum, refined, gravity over 0·8235, not entitled to entry under No. 267—but dutiable under...........	271	1¼ c. per gall.	2½ c. per gall.

Rotary kilns, revolving roasters and furnaces of metal, for roasting ores, clay, &c., cannot now be admitted free of duty under Tariff No. 462, as they are now made in Canada.

Patents.

Lithographic stones or metal plates; Substitutes for ——. H. G. C. Fairweather, London. From H. Christensen, Halle a/S., Germany. Eng. Pat. 15,417, July 1, 1909.

To produce a coating suitable for lithographic printing on stone or metal backings, the backing is heated to 90° C., and to it is applied, preferably by an atomiser, a liquid formed by adding sodium aluminate, or sodium and aluminium hydroxides, to water saturated with carbonic acid, the precipitate being allowed to settle. The operations of applying, drying and washing are repeated several times until the requisite thickness of coating is obtained.—H. H. S.

Paving stones; Process of manufacturing artificial ——. H. Flentje, Dresden-Strehlen, Germany. Eng. Pat. 18,102, Aug. 5, 1909.

Calcareous stone containing approximately 36 per cent. of silica, 35 of lime, 26 of carbonic acid, and 3 of alumina, and melting at about 1300° C., is exposed to the atmosphere for three or four months and then reduced to powder in a disintegrator. 84 parts of this material are thoroughly mixed with 16 of a clay melting at about 950° C., and water, so as to form a plastic mass. The material is then worked into the form of a "string," cut into pieces, and dried for about six days at a temperature rising from 5° C. at first to 60°–65° C. at the end of the operation. A weatherproof and durable paving stone is said to be produced by burning the dried pieces in an annular brick kiln at a temperature of about 1100° C. J. W. H.

Fireproof product; A new industrial ——. J. F. d'Araujo. Fr. Pat. 403,715, June 5, 1909.

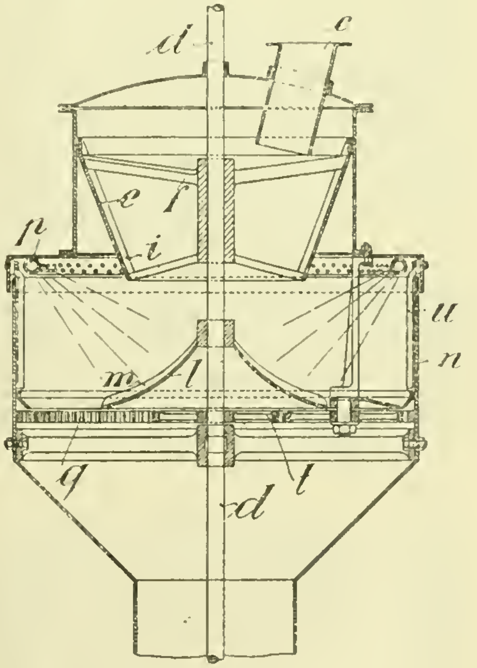
Solutions of magnesium chloride or aluminium chloride are added to clays or other natural or artificial silicates, and the mass is formed into briquettes and heated above 150° C. The bricks are then powdered, calcined magnesia is added, in the ratio of 7 : 3 or 6 : 4, and the mixture is made into a paste with hydrochloric acid. The product is suitable for the manufacture of artificial marbles and stones, and jointless floors, of a fireproof nature.—H. H. S.

Imitation rosewood from oakwood; Process for the preparation of ——. S. Freund and M. Hollfelder. Ger. Pat. 214,192, Dec. 9, 1908.

Green oakwood is immersed in a concentrated alcoholic solution of ammonia, to which has been added iron salts and suitable tar dyestuffs, until it is coloured throughout.
—A. S.

Centrifugal mixer of concrete and other mortar mixtures. G. Hiller, Dresden, Germany. Eng. Pat. 2947, Feb. 6, 1909.

The materials are fed into the machine through the opening, *c* (see Fig.), and fall into a revolving hopper, *e*. The arms, *f*, and the inclined ribs, *i*, on the walls of the hopper, are arranged to mix the materials, which then fall on to a bell-shaped deflector, *l*, having inclined ribs, *m*. The vertical spindle, *d*, carries the hopper, the deflector, and also a gear wheel, *t*, which, by means of an intermediate gear wheel and an annular gear wheel, *q*, rotates the casing, *n*, in the opposite direction. Fixed scrapers, *u*, remove the material which adheres to the walls of the casing, *n*, and suitable guards protect the gears. As the materials fall through the apparatus, they are moistened by means of sprays of water from the pipe, *p*.
—J. W. H.



Cementitious composition [basic calcium aluminate], and process of making the same. W. E. Carson, Riverton, Va. U. S. Pat. 939,977, Nov. 16, 1909.

A cementitious material is prepared by igniting a mixture of a basic oxide, such as lime, and a sesquioxide, such as alumina (bauxite), and then incompletely hydrating the product, so as to give a dry powder. The ratio of the lime to the alumina should be greater than 3 : 1.—F. Sodn.

Cement kiln. T. M. Morgan, Long Point, Canada. U.S. Pat. 942,509, Dec. 7, 1909.

See Eng. Pat. 8760 of 1907: this J., 1908, 23.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Magnetic testing of iron. M. G. Lloyd and J. V. S. Fisher. Bull. Bureau of Standards, U.S.A.; Electrician, 1909, 64, 319—321.

The method of Epstein for magnetically testing sheet iron and steel has been so modified that an accuracy of 1 per cent. can be attained. The sheets are cut into strips, 10 in. by 2 in., which are arranged in four bundles, in which each strip is separated from its neighbours by a piece of press-board of somewhat shorter length. The bundles are arranged in the form of a square with corner pieces and cramps. On each bundle a solenoid is mounted consisting of three coils, two of these having 45 turns of No. 20 copper wire and the third, the magnetising coil, having 250 turns of No. 14 wire. The four solenoids are connected in series, forming a magnetising coil of 1000 turns, and two secondary coils of 180 turns each. One of the secondary coils is used to determine the magnetic flux by connection with a mirror dynamometer, and the second is connected to the moving coil of a wattmeter in which the field coils are energised by the magnetising current used. The low magnetising current required at low flux densities makes silicon-steel particularly suitable for current transformers, which must have close regulation, such as those used for measuring instruments. The hysteresis loss is larger when the steel is magnetised at right angles than when magnetised parallel to the direction of rolling. The eddy current loss is practically the same under these circumstances. The authors have tested sheet iron and steel from a great variety of sources, and express surprise at the great range in the quality of the material generally used by electrical manufacturers; they found that there was no close relation between the quality and the price.—J. W. H.

Steels; Resistivity and thermo-electric power of ——. H. Pécheux. Comptes rend., 1909, **149**, 1062—1064.

From an examination of four steels, the author concludes that increase of carbon has but little effect on the electrical resistivity, but increase of silicon raises it; both carbon and silicon, however, tend to lower the rate of increase of resistance with temperature. In regard to their thermo-electric properties (for which, couples of the steel and pure copper were compared with a platinum-platinum-iridium couple), the results show that: *a*, the temperature of neutrality (*i.e.*, where the E.M.F. of the steel copper couple is nil) is lowered by increase of carbon; *b*, it is raised in low-carbon steels by silicon, which, however, has but little effect in high-carbon steels; *c*, the temperature (centigrade) of inversion is always more than double that of neutrality; *d*, before the temperature of inversion is reached, the curve of E.M.F. changes its form; the point at which this change occurs rises and falls with the temperature of inversion, and increase of silicon lessens the difference between the two temperatures.
—J. T. D.

Iron-copper alloys. C. F. Burgess and J. Aston. Amer. Electrochem. Soc., New York, Oct. 1909. Electrochem. and Met. Ind., 1909, 7, 527—529.

The alloys examined were prepared from electrolytic iron of 99·7 per cent. purity and pure electrolytic copper; they contained less than 0·1 per cent. of carbon. Up to 2 per cent. of copper, the alloys forge well at low heats, but with higher percentages, less readily; between 7 and 75 per cent. of copper, the alloys are non-forgeable, whilst between 80 and 100 per cent., they will forge only at a fair red heat. The hardness of the alloys increases with the copper content; with 5—7 per cent. of copper, the alloys can only be turned in the lathe with some difficulty. Tensile strength tests were made both on the unannealed alloys and after annealing for several hours at 900° C. In the unannealed alloys, the ultimate strength and elastic limit increase almost as linear functions of the percentage of copper. The ultimate strength rises from 61,180 lb. per sq. in. at 0·1 per cent. of copper to 132,400 lb. at 7 per cent.; the yield point rises from 52,580 lb. to 122,900 lb. The elongation falls from 28·5 per cent. at 0·1 per cent. of copper to 4 per cent. at 7 per cent. of copper. The reduction of area increases from 69·2 per cent. at 0·1 per cent. of copper to 72·1 at 0·8 per cent., and then falls to 7·3 at 7 per cent. of copper. The effect of annealing on the alloys is very marked. In the annealed alloys the elastic limit and ultimate strength are considerably increased by additions of copper up to 1 per cent., and the elongation and reduction of area are not reduced, the latter in fact rising to a maximum at 0·4 per cent. of copper. The elastic limit rises from 35,570 lb. at 0·1 per cent. of copper to 51,570 lb. at 1·5 per cent., and 56,950 lb. at 7 per cent. of copper; the ultimate strengths of the corresponding alloys are 54,050 lb., 65,720 lb., and 67,900 lb. respectively. Beyond about 1·5 per cent. of copper the elongation and reduction of area are lower than in the case of pure iron and decrease with increasing proportions of copper. Contrary to Breuil who considered the alloy containing about 4 per cent. of copper most deserving of attention, the authors consider that the most valuable alloys are those containing between 1 and 2 per cent. of copper. In the following table the mechanical properties of the alloys containing respectively 1·5 and 4 per cent. of copper are compared with those of an alloy of electrolytic iron with 4 per cent. of nickel, and of an alloy prepared by Hadfield (this J., 1900, 150) containing 3·82 per cent. of nickel and 0·19 per cent. of carbon.

Unannealed alloys.

	Elastic limit.	Ultimate strength.	Elongation.	Reduction of area.
	lb.	lb.	per cent.	per cent.
4·00 Ni...	67,000	76,000	28·5	68·6
1·50 Cu ...	73,920	77,300	23·5	66·9
4·00 Cu ...	105,560	108,640	13·5	45·6
3·82 Ni ...	62,720	82,800	30·0	54·0

Annealed alloys.

	Elastic limit.	Ultimate strength.	Elongation.	Reduction of area.
	lb.	lb.	per cent.	per cent.
4·00 Ni ...	57,000	69,000	26·5	04·8
1·50 Cu ...	51,570	65,720	29·2	63·1
4·00 Cu ...	53,570	66,540	24·8	54·2
3·82 Ni ...	56,000	73,920	35·0	55·0

Waddel (this J., 1909, 985) has recommended the use of nickel-steels in place of ordinary carbon-steels for constructional work, and the authors consider that the 1·5 per cent. copper alloy is also worthy of consideration in this respect, since even if it be not quite so strong as nickel-steel, the lower cost of the copper would result in a lessened cost of construction, although a somewhat greater weight of the alloy-steel had to be used.—A. S.

Metal filings; Briquetting of ——, and its value in iron and bronze foundries. O. Leyde. Stahl u. Eisen, 1909, **29**, 1881—1885.

The utilisation of metal filings, which in many machined articles may amount to 10 per cent. of the total weight of the cast metal, by re-melting with another charge of metal, has hitherto presented difficulties, owing to their fine state of division and the large surface presented for oxidation. The only practicable plan has been to charge them into the furnace in boxes made of wood or cast from some of the same metal. Recently, briquettes, formed from filings by simple pressure, have been used with very satisfactory results. The briquettes remain intact up to the melting-point, and melt much more readily than broken castings. The loss on melting, which with loose filings amounts often to 50 per cent., and with pig-iron to 2½ or 3 per cent., is with briquetted filings about 10 per cent., and with a mixture of 80 per cent. of briquettes and 20 per cent. of pig-iron, about 3½ per cent. In many instances, the addition of briquettes has enabled a metal to be obtained which otherwise required the addition of irons of special quality. Wood sawdust, similarly briquetted, yields a satisfactory fuel.—J. T. D.

"*Electro-cementizing.*" [*Galvanising iron wire*]. A. Sang. Amer. Electrochem. Soc., New York, Oct., 1909. Electrochem. and Met. Ind., 1907, **7**, 532—533.

The process consists essentially in coating iron wire with zinc by cementation, the wire being heated electrically. The furnace used is filled with a mixture of crushed coal and zinc oxide. The strands of wire from the supply reels pass over a series of brass contact-sheaves mounted in insulating bushings on a common rotating shaft. The end sheaves are connected to the poles of a transformer supplying alternating current at a low tension; the intermediate sheaves are connected in pairs by means of common hubs, so that the current may pass freely from one to the other in each pair. From the contact sheaves the wires pass into the lower part of the furnace through openings provided with hinged flaps, then through the furnace, over sheaves at the far end, back through the upper part of the furnace, and then to a second set of reels on which the galvanised wire is wound. The entire system forms a resistance-grid on a large scale. The coating is said to be of the colour of freshly electro-deposited silver. The heat efficiency is claimed to be better than in the usual sherardising process (see this J., 1909, 399).—A. S.

Zinc; Method for the recovery of —— from solution of sulphate. W. Cullen and G. F. Ayers. J. Chem., Met., and Min. Soc., S. Africa, 1909, **10**, 87–90.

Although a large amount of zinc is annually used in the precipitation of gold from cyanide solution, no method for recovering it is at present in use. In the treatment of zinc slimes, the zinc is usually dissolved out by sulphuric acid or sodium bisulphate and the zinc sulphate solution allowed to go to waste. This zinc may be readily precipitated from solution as insoluble zinc hydroxide by the addition of a fine emulsion of magnesium hydroxide, but as commercial calcined magnesia contains varying amounts of insoluble foreign matter, the purity of the precipitated zinc hydroxide would be correspondingly affected. It is also necessary that the calcination of the magnesia should be performed at about 800°—900° C., as "dead-burned" magnesia is useless as a precipitant, and if present, would lower the value of the zinc hydroxide precipitate. G. H. Stanley, in the discussion which followed, stated that a method which recovered the zinc in a metallic form, would have a better chance of success, and that it was quite easy to deposit the zinc electrolytically in the form of branching crystalline forms or spongy masses, which could be used direct in the cyanide precipitation boxes. If the electrolytic zinc proved too pure to act effectually, it could be dipped, to produce a superficial coating of lead.—F. R.

Zinc [ore] separation. F. S. McGregor. Mining World, Nov. 6, 1909, 917.

The hitherto unrecovered zinc which is contained in the pyritic lead ore of Bingham, Utah, and amounts to about 10 per cent. of the ore, is now recovered by means of the Huff electrostatic separator. The ore is first concentrated, as far as possible, on tables, and the middlings, which contain 28 per cent. of zinc, five to six of lead, 18 of iron, and 1·5 of copper, are dried, screened, and passed through the electrostatic separators. The middlings from the separators are automatically returned to the machine, so that only two products are delivered, a pyritic concentrate sufficiently free from zinc to be an excellent smelting product, and a high-grade zinc product, averaging 50 per cent. or more of zinc. Very little dust is said to be raised during the screening and separating of the dry ore, and though the plant has not been long in operation, it appears to be very successful.—F. R.

Copper refining; Power for electrolytic ——. W. L. Spalding. Amer. Electrochem. Soc., New York, Oct. 1909. Electrochem. and Met. Ind., 1909, **7**, 526—527.

In the electrolytic refining of copper, the cost of the power forms 40 per cent. of the total cost of converting anode into cathode copper, or 20 per cent. of the total cost including furnace treatment. Having regard to the present extensive use of labour-saving machinery, it would appear that further reduction of costs must be obtained most easily through lower power charges. The author discusses the various modes of generating electrical energy, including the utilisation of waste heat by means of boilers on the reverberatory and cupola furnaces. He points out that a copper refinery forms an ideal customer for an electric power company, since with proper regulation its ordinary load curve is quite flat, and in addition, it could take additional quantities of electrical energy at such times as the power company wished. In other words the copper refinery could, to a considerable extent, make the company's load factor uniform. The author suggests that some arrangement whereby copper refineries contracted with power companies for a steady 24-hour load and for additional quantities of energy at cheaper rates, at times prescribed by the power company, would be mutually advantageous.—A. S.

Arsenic and antimony [in metallurgical products]; Separation of —— by means of the Knorr distillation apparatus. W. C. Smith. Eng. and Min. J., 1909, **88**, 1062—1063.

The following method, which is said to be suitable for determining antimony and arsenic in ores, mattes, slags, metals and alloys, including lead and copper bullion (with the exception of any containing tin), is based on the difference of temperature at which arsenious and antimonous chlorides distil. The apparatus used consists of a condenser fitted by means of a ground-glass joint to a distilling flask having a ground-in dropping funnel. The ore is weighed into the flask, moistened with water, and boiled with 10 to 12 c.c. of concentrated sulphuric acid, with, if necessary, a few drops of nitric acid, until completely decomposed. The arsenic and antimony are reduced by the addition of 5 c.c. of hypophosphorous acid, and the solution boiled until the sulphur has disappeared. When cool, 15 c.c. of water are added, and the condensing apparatus connected. The end of the condenser is arranged to almost reach the bottom of a second distilling flask which contains a small quantity of water, and is cooled with water. The solution containing the arsenic and antimony is boiled briskly to expel air, after which strong hydrochloric acid is run in from the dropping funnel at the rate of about two to three drops per second. The distillation is continued until the condenser-flask is from two-thirds to three-fourths full; this distillate contains all the arsenic and most of the antimony. A beaker is now substituted for the flask, and the distillation continued until no antimony can be detected in the vapours by sulphuretted hydrogen. The arsenic in the mixed distillate is separately and completely redistilled by boiling down to 20 to 25 c.c. and then continuing the distillation for five to ten minutes while two to three drops of hydrochloric acid per second are run in. The solution containing the antimony remaining in the flask is added to the latter portions of the first distillate, and the arsenic and antimony estimated by volumetric or other methods. The residue from the original distillation is evaporated until fumes of sulphuric anhydride are evolved, after which any copper, bismuth, tellurium, iron, nickel, cobalt, zinc, &c., which may be present, can be readily determined. The separation is said to be very accurate, but the distillation requires care and constant attention. A rapid method for poor ores, &c., is to separate the arsenic and antimony as sulphides in the usual way, convert them into chlorides in the flask and separate by a single distillation.—F. R.

Carbon; Separation of — with metals in electrolysis of aqueous solutions, with special reference to nickel. G. Lambris. Z. Elektrochem., 1909, 15. 973–981.

The author has investigated the conditions under which carbon is deposited with the metal in electrolysis of nickel-ammonium oxalate. An attempt to isolate the non-metallic residue, by removing the nickel with cupric chloride and chlorine, led to the discovery that appreciable quantities (about 0·4 per cent.) of ammonium salts were also present in the metal. A study of the conditions of carbon separation brought to light the following facts: (1) The ammonium salts of glycollic, acetic and formic acids behave in precisely the same way as ammonium oxalate and allow the deposition of carbon even in strongly ammoniacal solutions. (2) Ammonium carbonate or bicarbonate will also cause the separation of carbon on electrolysing nickel sulphate, but if a small quantity of free ammonia is present, the separation is prevented. (3) Carbon may be deposited from oxalate solutions even when the ammonium carbonate (which is formed at the anode) is prevented from diffusing to the cathode. These facts seem to point to the formation of an intermediate reduction compound (carbon monoxide or a hydrocarbon), which is decomposed with the formation of carbon. It was found experimentally that carbon monoxide and acetylene (not methane, ethane or ethylene) deposited carbon with the nickel when passed into a nickel-ammonium sulphate electrolyte. Acetylene is a more probable intermediate product than carbon monoxide, because it will deposit carbon even in the presence of free ammonia, and because it is known to be formed immediately when ammonium oxalate is electrolysed with platinum or nickel (not with copper, iron, or zinc) electrodes. Moreover, the percentage of carbon in the nickel is higher, and nearer to that from ammonium oxalate, in the case of acetylene than in the case of carbon monoxide. The complete solubility of the nickel deposit in hydrochloric acid leads to the conclusion that the carbon is present as carbide. The hydrocarbons produced on solution give, when burnt, a quantity of carbon dioxide which corresponds (making allowance for the ammonium salts mentioned above) to the excess of weight of nickel over the theoretical quantity. In the case of iron, carbon is not deposited from an ammonium oxalate electrolyte till all the iron is removed, and then it appears in the free state. In the presence of acetylene, however, iron carbides are deposited from the beginning. The continuous separation of carbon at the cathode is therefore due to the formation of acetylene (in presence of nickel or platinum) and to the reaction of the cathode (nickel or iron but not platinum) with the acetylene to form carbides.
—W. H. P.

Gold hydrosols; Preparation of ——. C. Thomae. J. prakt. Chem., 1909, 80. 518–520.

Gold hydrosols of considerable stability may be prepared by Zsigmondy's method (this J., 1898, 767), but with ordinary distilled water, if proper precautions be taken. The process consists in adding to 120 c.c. of boiling water 2·5 c.c. of gold chloride solution (1 grm. of the crystallised salt to 167 of water) and then 3·2 c.c. of potassium carbonate solution (2·5 : 100), and, when the mixture is boiling briskly, introducing 5 c.c. of a solution of formaldehyde (3 grms. of commercial formalin : 100), drop by drop, the liquid being meanwhile rotated. No precipitate ought to be formed on adding the first drops of formaldehyde, and, if a separation of gold occur, the mixture should be boiled for a short time. The colour of the liquid becomes first blue and then suddenly a deep red, and the solution remains clear, unless the reducing agent is added too quickly or in large quantities, when considerable cloudiness or even turbidity results. Flasks of the ordinary shape and of Jena glass should be used for the preparation, and at the end of the process it is recommended that the solution be transferred to another vessel, also of Jena glass, to separate it from a trace of gold which is liable to be deposited as a mirror during the preparation. Solutions prepared in the above manner have been found to contain colloidal gold even after four months. Zsigmondy's statement that the gold sol may readily be prepared in ordinary distilled water by means of ethereal phosphorus solution is confirmed.—F. Sodn.

Lead silicates. Cooper and others. *See* VII.

Determining lead. Sacher. *See* XXIII.

Determination of manganese. Fischer. *See* XXIII.

PATENTS.

Copper and other ores; Treatment of ——. F. B. Dick, Sunbury, Surrey. Eng. Pat. 16,667, Aug. 7, 1908.

Copper carbonate or other ores that are not amenable to concentration by a flotation process, are crushed to pass a sieve having six holes per linear inch, and then heated to just below redness in a reducing atmosphere, such as coal-gas, for one or two hours. The ore is cooled in a non-oxidising atmosphere, and after crushing to 20-mesh size, may then be concentrated by a flotation process.
—F. R.

Copper-nickel matte; Method of separating copper, nickel and other metals from ——, and recovering hydrochloric acid from nickel chloride solution. H. L. Wells, New Haven, Conn. U.S. Pats. 940,292 and 940,293, Nov. 16, 1909.

Copper-nickel matte is pulverised and agitated with a hot, but not boiling, solution of hydrochloric acid, containing not more than 25 per cent. of hydrogen chloride, until all the nickel has been extracted, the copper remaining in the residue. Additional matte is then added to the solution containing the nickel, until all the hydrochloric acid is exhausted, the partially extracted matte being re-treated with fresh hydrochloric acid solution until the remaining nickel is leached out, and so on progressively. The hydrochloric acid is regenerated by adding to the nickel chloride solution the necessary amount of sulphuric acid and ammonium sulphate to form nickel-ammonium sulphate.—F. R.

Cleaning metal objects to be galvanised or nickelled; Chemical electrolytic process for ——. H. Vollert, Hagen in Westfalen, Germany. Eng. Pat. 27,034, Dec. 12, 1908.

The articles, after being roughly cleaned by rubbing with sawdust and rinsing with benzine or caustic lye, are placed in a cleaning bath consisting of a 10 per cent. solution of potassium hydroxide, with the addition, if copper articles are being treated, of some cupric-potassium cyanide. An electric current of 10 to 30 volts is passed through the bath for two or three minutes, using a carbon plate as anode, except when treating copper articles, when a copper plate is substituted. The objects are then cleaned and taken direct to the galvanising or nickelling bath. (Reference is directed to Eng. Pats. 2545 of 1868; 17,672 of 1906; and 4336 and 25,553 of 1907; this J., 1907, 972, 1055; 1908, 987).—F. R.

Tapping furnace; [Electric ——]. G. O. Seward, Holcombs Rock, Va., Assignor to Electro Metallurgical Co., W. Va. U.S. Pat. 940,561, Nov. 16, 1909.

THE tap-hole of an electric furnace is closed with a plug of refractory material having an electrically conducting rod passing through its entire length. When it is desired to empty the furnace, the tap-hole is opened by melting the central rod by means of an arc, established between it and an external electrode.—F. R.

Iron or steel; Method of treating ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., New York. U.S. Pat. 940,665, Nov. 23, 1909.

INSTEAD of adding titanium to the bath of molten iron, in the form of metal or of titanium carbide, a comparatively readily fusible alloy is used containing more than 5 per cent. each of titanium and silicon and less than 10 per cent. of carbon.—F. R.

Titanium alloys; Process of producing low-carbon low-silicon ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., W. Virginia. U.S. Pat. 941,553, Nov. 30, 1909.

LOW-CARBON, low-silicon, titanium alloys, such as ferro-titanium, are made by producing high-silicon ferro-titanium by smelting a mixture of oxides of titanium and silicon, carbon, and a source of iron, and then removing the contained silicon, by oxidising with iron oxide.—F. R.

Armour plate; Method of treating ——. S. S. Wales, Munhall, Pa., Assignor to Carnegie Steel Co., Pittsburg, Pa. U.S. Pat. 941,477, Nov. 30, 1909.

BALLISTIC steel plates, containing vanadium, are heated to above 875° C., cooled to between 350° C. and 100° C., and subsequently annealed. The heating and cooling may be repeated, or two or more annealings may be given. —F. R.

[Cyaniding] ores; Process of treating ——. J. R. Parks, Spokane, Wash. U.S. Pat. 940,821, Nov. 23, 1909.

THE pulverised ore is mixed with a solution of potassium cyanide and an electrolyte, with or without mercury, and the pulp caused to flow through each of a series of pans, in which it is subjected to the action of compressed air and of a current of electricity. Any one of the cyanide pans may be excluded from the series without interfering with the flow of pulp.—F. R.

Electroplating apparatus. L. Potthoff, Flushing, N.Y. U.S. Pat. 941,535, Nov. 30, 1909.

THE articles to be plated are placed in a rotatable tumbling drum, which is partly submerged in the plating solution. When finished, the articles are automatically discharged and conveyed to a washing tank.—F. R.

[Lead] ores; Process for treating certain ——. H. S. Auerbach, New York. U.S. Pat. 941,904, Nov. 30, 1909.

THE apparatus consists of a chamber, at the bottom of which a shallow bath of molten lead is maintained. The chamber is divided vertically by means of a partition reaching nearly to the bottom and terminating below the surface of the lead bath, which forms a seal between the two compartments. One side of the chamber is filled with an electrolyte consisting of a fused haloid salt, into which an electrode dips, the bath of lead serving as the other electrode. Galena is fed on to the surface of, and dissolves in, the molten lead in the other portion of the chamber, and an electric current is passed through the fused haloid salt and the molten lead.—F. R.

Tantalum; Process of producing ——. Siemens und Halske A.-G., Berlin. Eng. Pat. 22,873, Oct. 27, 1908. Under Int. Conv., Nov. 16, 1907.

SEE Fr. Pat. 395,730 of 1908; this J., 1909, 480.—T. F. B.

Silicon [tellurium] alloys. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 26,826, Dec. 10, 1908.

SEE U.S. Pat. 923,152 of 1909; this J., 1909, 715.—T. F. B.

Ore products; Means for separating —— or other comminuted solid matter from liquid. A. J. Arbuckle and A. Osborne, Johannesburg. Eng. Pat. 27,767, Dec. 21, 1908.

SEE Fr. Pat. 400,626 of 1909; this J., 1909, 1043.—T. F. B.

Agglomerating or hardening pulverulent, finely-divided, and friable substances [ores]; Method of ——. H. Delporte, Ougrée, Belgium. Eng. Pat. 1650, Jan. 23, 1909.

SEE Fr. Pat. 398,615 of 1909; this J., 1909, 889.—T. F. B.

Calcining, desulphurising, agglomerating, and sintering ores and like materials; Apparatus for ——. F. D. Weeks, Salida, Colo., U.S.A. Eng. Pat. 9158, April 17, 1909. Under Int. Conv., April 18, 1908.

SEE U.S. Pat. 916,903 of 1909; this J., 1909, 479.—T. F. B.

Metallizing non-metallic articles; Process of ——. A. J. Boult, London. From The Newell Manufacturing Co., Prescott, Canada. Eng. Pat. 5675, March 9, 1909.

SEE Fr. Pat. 401,137 of 1909; this J., 1909, 1093.—T. F. B.

Electroplating; Arrangement for uniform and rapid —— of articles of the flat sheet or rod type. Langbein-Pfanhauser-Werke A.-G., Leipzig-Sellerhausen, Germany Eng. Pat. 14,091, June 16, 1909. Under Int. Conv., June 22, 1908.

SEE U.S. Pat. 936,472 of 1909; this J., 1909, 1145.—B. N.

Metal; Process for depositing —— electrically direct on objects. J. J. N. Brachmann. Fr. Pat. 404,102, Oct. 10, 1908.

SEE Eng. Pat. 23,193 of 1908; this J., 1909, 990.—T. F. B.

Roasting and other furnaces; Means for charging ——. U. Wedge, Ardmore, Pa., U.S.A. Eng. Pat. 12,766, May 29, 1909.

SEE U.S. Pat. 939,881 of 1909; this J., 1909, 1256.—T. F. B.

Copper; Process for extracting —— from cupreous residues. D. Crispo. First Addition, dated May 24, 1909, to Fr. Pat. 375,899, March 20, 1907.

SEE U.S. Pat. 936,762 of 1909; this J., 1909, 1141.—T. F. B.

Bessemer converters. G. J. Stock. Fr. Pat. 403,667, June 4, 1909. Under Int. Conv., June 5, 1908.

SEE U.S. Pat. 935,615 of 1909; this J., 1909, 1140.—T. F. B.

Slags; Utilisation of the heat contained in ——. C. Vautin. Fr. Pat. 403,699, June 5, 1909. Under Int. Conv., Feb. 13, 1909.

SEE Eng. Pat. 3623 of 1909; this J., 1909, 987.—T. F. B.

Iron and steel; Process and apparatus for the electrical production or fusion of ——. Aktiebolaget Elektrometall. Fr. Pat. 403,748, June 7, 1909. Under Int. Conv., Aug. 1, 1908.

SEE Eng. Pat. 6088 of 1909; this J., 1909, 944.—T. F. B.

Electric induction furnaces; Melting-hearth for ——. K. Grunwald. Fr. Pat. 403,921, June 11, 1909. Under Int. Conv., Aug. 15, 1908.

SEE Eng. Pat. 7396 of 1909; this J., 1909, 800.—T. F. B.

Silicon nitride and metals from metallic silicides. Eng. Pat. 3732. *See* VII.

XI.—ELECTRO-CHEMISTRY.

Titanium arc. Weedon. *See* II*B*.

Electrolytic oxidation of ammonium carbonate. Fichter and Kappeler. *See* VII.

Boron. Weintraub and others. *See* VII.

Magnetic testing of iron. Lloyd and Fisher. *See* X.

Electrolytic production of dichloroethylene. Askenasy and Vogelsohn. *See* XX.

Use of aluminium dishes and other appliances in electro-analysis. Formanek and Pec. *See* XXIII.

Electrolytic determination of chlorine in hydrochloric acid. Gooch and Read. *See* XXIII.

Electro-analytical determination of lead as peroxide. Sand. *See* XXIII.

Patents.

Electrodes for electric furnaces. M. Ruthenburg, London. Eng. Pat. 4175, Feb. 20, 1909.

In electric furnaces where the electrodes are water-jacketed to prevent their being consumed at the sides by the action of the hot gases, &c., a lining of insulating and, preferably, refractory material is provided between the electrode and the water-jacket, to prevent, in case of accidental breakage of the electrode, an arc being formed between it and the water-jacket. F. R.

[*Electric*] *furnace; Induction* ——. M. Unger, Pittsfield, Mass., Assignor to General Electric Co., New York. U.S. Pat. 941,435, Nov. 30, 1909.

The furnace consists of a number of vertically arranged magnetic cores, having independent primary windings. Narrow annular furnace chambers surround each core and open into a central shallow bath.—F. R.

Electric furnace for gas reactions. O. Dieffenbach and W. Moldenhauer, Darmstadt, Germany. U.S. Pat. 941,768, Nov. 30, 1909.

The arc furnace consists of a chamber having the electrodes disposed vertically. The lower electrode is composed of a charge of fragments of carbon, resting on a conducting body through which passes a tubular connection to the source of electricity. The upper electrode consists of a carbon tube through which gases may be supplied to the arc. Gasses may also be passed into the furnace through the tubular connection of the lower electrode.—F. R.

Accumulators; Process for preventing the dropping of active material in alkaline ——. L. Marseille, Paris, and P. Gouin, Levallois-Perret, France. Eng. Pat. 15,373, July 1, 1909. Under Int. Conv., July 4, 1908.

See Fr. Pat. 392,024 of 1908; this J., 1908, 1211.—T F.B.

Electric cell or battery; Primary ——. A. Heil, Frankfort on Maine, Germany. U.S. Pat. 941,416, Nov. 30, 1909.

See Fr. Pat. 392,429 of 1908 and Addition thereto; this J., 1909, 28, 147.—T. F. B.

Electric batteries. G. Schauli. Fr. Pat. 404,012, June 14, 1909.

See Eng. Pats. 14,609 and 24,356 of 1908; this J., 1909, 988 and 1045.—T. F. B.

Electric furnace. C. A. Keller, Paris. U.S. Pat. 941,419, Nov. 30, 1909.

See Eng. Pat. 21,741 of 1908; this J., 1909, 97.—T. F. B.

Electric furnace with raised charging-pit. A. Helfenstein, Vienna. U.S. Pat. 942,068, Dec. 7, 1909.

See Fr. Pat. 402,652 of 1909; this J., 1909, 1206.—T. F. B.

Electric conductors; Method of making insulating coverings for ——. W. A. Phillips and F. Hutchins, London. U.S. Pat. 941,810, Nov. 30, 1909.

See Eng Pat. 13,943 of 1907; this J., 1907, 1242.—T.F.B.

Dynamo-brushes; Method of manufacturing ——. G. Egly, Berlin, Assignor to Gebr. Siemens und Co., Charlottenburg, Germany. U.S. Pat. 942,379, Dec. 7, 1909.

See Eng. Pat. 27,499 of 1906; this J., 1907, 621.—T. F. B.

Carbonisation of metallic filaments [*for electric incandescence lamps*]. Fr. Pat. 403,750. *See* II*B*.

Manufacture of pure unctuous graphite. U.S. Pat. 933,944. *See* VII.

[*Electrical*] *process of making salts of ammonia.* U.S. Pat. 940,972. *See* VII.

Producing silicon carbide. U.S. Pat. 941,339. *See* VII.

XII.—FATS; OILS; WAXES.

Beeswax; Use of the flash point method in the analysis of ——. E. Stoeber. Chem.-Zeit., 1909, 33, 1275—1276.

If the determination is made under constant conditions, the flash point of a sample of wax may afford proof of adulteration in doubtful cases. In the method recommended, 15 grms. of the wax are placed in a 25 c.c. porcelain crucible, which is imbedded to the depth of its contents in 100 grms. of sand contained in an iron dish with a diameter of 10 to 12 cm. This is heated until the temperature is within about 10° C. of the flash point as found by a preliminary experiment, after which the flame is regulated so that the temperature rises about 1° C. in eight to ten seconds. The thermometer is suspended with its bulb near the middle of the fluid mass, and a light applied from time to time to the vapours. The flash points observed with various samples of pure unbleached wax of different origin (including Russian, Italian, Smyrna, and Abyssinian waxes) varied from 242° to 250° C. Wax, which in the unbleached condition had a flash point of 245·5° C., had the value raised to 249° C. by sun-bleaching, and to 251° C. by bleaching with permanganate. The author therefore fixes the limits for yellow wax at 240° to 252° C., and for white wax at 245° to 258° C., under a pressure of 752-755 mm. Under the same conditions the following results were obtained with substances used to adulterate beeswax:—Ox tallow, 316° C.; carnaüba wax, 310° C.; ceresin, 198° C.; stearic acid, 192° C.; paraffin wax, 190° C.; Japan wax, 185° C.; and rosin, 181° C. A mixture of beeswax (flash point 246° C.) with 5 per cent. of ceresin flashed at 236° C.; with 10 per cent. at 227° C.; with 15 per cent. at 223·5° C.; and with 20 per cent. at 217° C. On the other hand, it was not impossible to detect in this way a small addition of beeswax to ceresin, the presence of 10 per cent. of the former only raising the flash point from 198° to 199° C. A mixture of 37·5 parts of Japan wax, 6·5 parts of stearic acid, and 56 parts of ceresin, gives, as has been pointed out by Lewkowitsch, analytical values which agree with those of pure beeswax. The adulteration is shown by the flash point, however, which in the case of an experimental mixture was 231·5° C. From 30 to 35 per cent. of carnaüba wax can be added to beeswax without changing the flash point beyond the limits for pure wax, and this test by itself will therefore not detect the addition of a mixture of carnaüba wax or tallow with ceresin. If, however, the flash point lies between 240° and 252° C., whilst the sp. gr. is between 0·960 and 0·970 and the m. pt., 63° to 64·5° C., it may be concluded that the Hübl figures are also normal, and that the wax is genuine.

But when the flash point is normal, whilst the sp. gr. and m. pt. are above the higher limits mentioned, the presence of carnaüba wax is probable. In this case the ratio between the acid and ester values will be greater than 3·8. On the other hand, if the flash point is normal, but the sp. gr. and m. pt. are below the lower limits mentioned, the presence of tallow is indicated. In this case the ratio number will be greater than 3·8. When the flash point is below 240° C. the wax has been adulterated with paraffin wax, rosin, Japan wax, or stearic acid.—C.A.M.

Hevea brasiliensis [Para rubber] seed as a source of oil. Carruthers. *See* XIV.

Margarine clause of Food and Drugs Act, 1899. *See* XIX*A*.

Patents.

Thickened oil; Process for the preparation of —— by heating vegetable oils in absence of air. J. Schmitz. Ger. Pat. 215,349, Nov. 21, 1908.

The vegetable oil is heated in a closed vessel, which is provided above the level of the oil, with a perforated partition, on which is placed a layer of absorbent material to retain any condensed distillation products, and prevent them running back into the oil. It is stated that by means of this device, a nearly colourless, neutral product is obtained.—A. S.

Wax-like product obtained from sugar-cane. A. Wynberg, Amsterdam. U.S. Pat. 941,401, Nov. 30, 1909.

See Fr. Pat. 397,843 of 1908; this J., 1909, 899. The untreated product melts at 50°—75° C., has an acid value of 8 to 12; saponification value, 40·7 to 81·2; iodine value, 12 to 15; and acetyl value, 75 to 80. The wax-like portion has a melting-point of 60° to 91° C., an acid value, 4 to 10; saponification value, 6 to 14; and acetyl value, 77 to 95. The fat-like portion melts at 35° to 55° C., has an acid value of 10 to 40; saponification value, 120 to 242; iodine value, 49 to 68; acetyl value, 15 to 47.
—T. F. B.

Soap substitute. U.S. Pat. 941,158. *See* VI.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

American colophony. P. Levy. Ber., 1909, 42, 4305—4308.

On oxidising purified sodium abietate, from American colophony, with dilute potassium permanganate solution, separating the unattacked abietic acid by means of carbon dioxide and acidifying the concentrated filtrate, there was obtained a yellowish-brown resinous precipitate. When this was extracted with ether, and the ethereal solution evaporated, the products of the oxidation were left as a brown resinous substance, which was freed from fatty acids (propionic and isobutyric acids) by passing through it a current of steam. The resinous residue was soluble in most solvents, but was insoluble in petroleum spirit. When boiled with water, part of it dissolved, and the solution on evaporation left a shining yellowish-red resinous mass, which was sparingly soluble in ether. When this substance was treated with acetone, it was partially dissolved, whilst a white pulverulent compound remained undissolved. This dissolved with difficulty in ether, benzene and ethyl acetate, was insoluble in petroleum spirit, but was fairly soluble in glacial acetic acid and absolute alcohol. It separated from its solutions in crystals, melting at 246°—247° C. It had the composition of a monobasic acid, $C_{20}H_{34}O_6$, and formed a crystalline silver salt readily soluble in water, and a crystalline barium salt. The formation of this acid containing four hydroxyl groups is an additional proof of the occurrence of two double linkages in the molecule of abietic acid, and its existence was predicted by Fahrion (this J., 1902, 127), who proposed the name of tetrahydroxysylvic acid for it. Apparently the oxidation of abietic acid does not end with the formation of this tetrahydroxyabietic acid, since the bulk of the products of oxidation are of a resinous nature. The acid substance also extracted from the oxidation product by means of boiling water, was, unlike tetrahydroxyabietic acid, readily soluble in cold acetone, and appeared to be a ketonic acid, since it reacted with phenylhydrazine acetate. Crystalline compounds were also obtained by the further oxidation of tetrahydroxyabietic acid with hot potassium permanganate solution and with nitric acid.—C. A. M.

Patents.

Pigment; Black magnetic iron hydrate utilizable as a ——. J. T. Carrick and B. S. Pattison, Johannesburg. Eng. Pat. 13,848, June 12, 1909.

The bluish-black pigment, ferro-ferric hydroxide, prepared from waste pickle liquors, is apt to become brownish in tinge during or after its preparation. According to the present patent, the original colour is restored by treating the pigment with oils or greases at a temperature between 150° C. and 300° C. The oil may be heated and the pigment dropped into it. A volatile solvent may be used to remove the oil from the pigment, but this operation is rendered unnecessary when making paint, by using linseed oil for the treatment.—J. W. H.

[Rust-inhibiting] paint; Manufacture of ——. R. S. Perry, Cave Spring, Ga. U.S. Pat. 938,505, Nov. 2, 1909.

The claim relates to the use in paints for iron and steel, of rust-inhibitors, consisting of organic salts of an inorganic base (*e.g.* chromium linoleate or resinate or other compounds having similar properties), which are soluble in the vehicle of the paint but insoluble in water. The use of chromium combined with an organic acid is especially claimed as a rust-inhibiting vehicle for paints.—J. W. H.

Paints; Preservative ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 403,103, May 17, 1909. Under Int. Conv., June 15, 1908.

The claim is for the use of certain organic mercury compounds, for example the salts or anhydrides of hydroxymercury derivatives of organic acids (see Ger. Pat. 208,634; this J., 1909, 543) in the preparation of preservative lacquers, varnishes, paints, etc.—A. S.

Paint; White ——. A. Monin. Fr. Pats. 403,881 and 403,882, Oct. 5, 1908.

(1) A white paint is prepared by intimately mixing the following finely powdered materials:—50 parts of zinc oxide, 35 of anhydrous calcium sulphate, and 15 of hydrated calcium sulphate, then grinding (preferably) with oil, spirit, or water. The addition of calcium sulphate as above is said to produce a tenacious mixture and to greatly increase the covering power of the zinc oxide. (2) The pigment used is composed of 60 parts of lithopone, 30 of anhydrous calcium sulphate, and 10 parts of hydrated calcium sulphate. The calcium sulphate covers any discoloration of the lithopone due to the action of light and air.—J. L. H.

Ultramarine; Apparatus for the manufacture of artificial ——. J. Luciani and V. Battesti, Paris. Eng. Pat. 8967, April 15, 1909. Under Int. Conv., April 15, 1908.

See Fr. Pat. 399,211 of 1908; this J., 1909, 992.—T. F. B.

White lead; Process of making ——. J. A. Erb and G. Condron, Los Angeles, Cal., U.S.A. Eng. 14,835, June 24, 1909.

See U.S. Pat. 930,057 of 1909; this J., 1909, 992.—T. F. B.

Lampblack; Process of making ——. Carbonium Ges. m.b.H. Fr. Pat. 403,995, June 12, 1909. Under Int. Conv., June 13, 1908.

See Ger. Pat. 212,345 of 1908; this J., 1909, 1050.—T. F. B.

Condensation product and method of making same. L. H. Baekeland, Yonkers, N.Y. U.S. Pat. 942,809, Dec. 7, 1909.

See Eng. Pat. 21,566 of 1908; this J., 1909, 374. T. F. B.

Obtaining solutions or pseudo-solutions of ferric oxide, etc. Eng. Pat. 24,842.—*See* VII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc molecule; Size of the —— in latex. F. W. Hinrichsen and E. Kindscher. Ber., 1909, 42, 4329—4331.

Kickxia latex was shaken with dry benzene, free from thiophene, and the mixture centrifugalised until an approximately clear benzene solution was obtained. This was further cleared by filtration and was found to contain a considerable amount of caoutchouc and rubber resins. Examination with the ultramicroscope showed the solution to be distinctly colloidal. A freezing-point determination with this solution in a Beckmann apparatus gave the following figures:—0·4118 grm. of caoutchouc plus resin in 35·1248 grms. of benzene lowered the freezing-point of the latter by 0·028° C. A benzene solution of the resin, separated by extraction with acetone of the residue, left on evaporating the original benzene solution, gave, when examined cryoscopically, the following figures:—0·2182 grm. in 23·9418 grms. of benzene: lowering of freezing-point 0·107° C. Molecular weight of resin, calculated from these figures $= 5000 \dfrac{0{\cdot}2182}{0{\cdot}107+23{\cdot}9418} = 426$.

The rubber contained 8 per cent. (0·0328 grm.) of resin, hence the lowering of freezing point of the rubber solution, due to resin $= \dfrac{5000 \times 0{\cdot}0328}{426 \times 35{\cdot}1248} = 0{\cdot}011^\circ$;

and the lowering due to caoutchouc $= 0{\cdot}017^\circ$, and molecular weight of rubber $= 5000 \dfrac{0{\cdot}3790}{0{\cdot}017+35{\cdot}1248} = 3173$.

This is probably only a lower limit, since there are possibly present substances, soluble in benzene, and insoluble in acetone, which have their effect upon the freezing-point. The figure obtained supports the contention of De Jong and Tromp de Haas, and others, that the caoutchouc is present in the latex as such, and is opposed to the opinion of Weber that it is formed, on coagulation, by polymerisation of a simpler molecule.—E. W. L.

Rubber-like mass from Calotropis procera (?) F. Jacobsohn. Verh. d. Kolonialwirts. Komitees, 1909, 56; Gummi-Zeit., 1909, 24, 277—278.

The sample was obtained from a wild cotton-tree growing in German East Africa. It formed a crumbly, whitish mass, containing much colourless serum. It had a strong odour of organic bases; this smell was intensified by heating with caustic alkali, but disappeared on drying. The dried substance formed a sticky, doughy, grey, non-elastic mass, somewhat similar in appearance to some of the low-grade resinous rubbers of Venezuela. The following results were obtained on analysis:—

	Per cent.	On dry substance, per cent.
Water	62·9	—
Resins	26·3	70·8
Insoluble impurities (organic and inorganic)	5·7	15·3
Mineral constituents ..	2·4	—
Rubber-like substance ..	5·1	13·9

The ash contained alumina, iron oxide, lime, and magnesia.—E. W. L.

Vulcanisation; Contribution to the study of ——. S. Axelrod. Gummi-Zeit., 1909, 24, 352—354.

The author adduces physical and chemical data in illustration of the well-known fact that the behaviour of rubber on vulcanisation is influenced by the nature and extent of the treatment which it has received prior to vulcanisation. A sample (B) of Para rubber which had been heated, in the form of washed and dried sheet at 120° C., for thirty minutes, was compared with a sample (A) which had not been subjected to this treatment. The viscosities of the unvulcanised samples (in 8 per cent. solution in benzene) were:—A, 223 secs.; B, 142 secs. Mixings of A and B with 10 per cent. of sulphur were vulcanised in the same mould, and the vulcanised samples gave the following values on analysis, and when tested on the Schopper machine:—

	A.	B.	Elongation.	Load.	
				A.	B
	%	%	mm.	kilos.	kilos.
Total sulphur	10·06	9·92	100	1·27	1·09
Extracted by acetone.	9·81	9·83	300	3·09	2·67
Combined sulphur .	2·91	3·07	500	8·91	6·83
Free sulphur	7.15	6·85	640	25·00 (broke)	—
Resins	2·66	2·98	665	—	23·58 (broke)

The effect of the preliminary heating is, therefore, to increase the elongation for a given load, to diminish the tensile strength, and to increase the sulphur-combining power of the rubber. Since the rubber is subject to the influence of heat during (hot) vulcanisation, changes in properties, similar to the above, must go on. It follows that one and the same mixing, vulcanised at two different temperatures, will yield two different products, even though the percentage of combined sulphur be the same in both cases. This fact is illustrated by the following figures:—

Combined sulphur.	Vulcanisation at 130° C		Vulcanisation at 105° C	
	Load at 600 mm. elongation.	Elongation at a load of 10 kilos.	Load at 600 mm. elongation.	Elongation at a load of 10 kilos.
	kilos.	mm.	kilos.	mm.
1 per cent.	4·4	710	—	—
2 ,, ,,	8·6	618	8·3	632
3 ,, ,,	14·8	455	11·5	575
4 ,, ,,	32·2	400	25·5	480

The changes in the rubber hydrocarbon, as well as its reactivity towards sulphur are dependent upon the duration of heating as well as upon the temperature. Weber's vulcanisation curves for various temperatures (Chem. of Ind. Rubber, 1902, 86)—percentage of combined sulphur as ordinates, and times of heating as abscissæ—exhibit kinks, representing points where the percentage of combined sulphur begins to increase more rapidly, subsequently falling off again. These kinks occur, roughly, at 120° C. after 6 hours; at 125° C. after 5 hours; at 130° C. after 3 hours; and at 135° C. after 1½ hours. The 135° C. curve exhibits two such breaks. These facts may be explained in the following way:—During the vulcanisation, two processes are going on side by side, a process of depolymerisation by the action of heat on the rubber, tending to bring the latter into a more reactive molecular condition, and a reverse process of polymerisation accompanying the chemical process of sulphur-addition. The first vulcanisation-products are less susceptible to further vulcanisation than the original rubber, but after a certain time (*e.g.*, 6 hours at 120° C.) these products also become depolymerised to a degree that renders them more open to attack, when sulphur combines more rapidly with them. The second-stage products again resist the action of sulphur until a further depolymerisation is brought about, when rapid addition of sulphur again takes place (second break in the the 135° C. curve). The first breaks in the curves occur at a sulphur-content of about 2·3 per cent. corresponding to $(C_{10}H_{16})_{10}S$, which the author has regarded as correctly-vulcanised soft rubber, [bromide = $(C_{10}H_{16})_{10}Br_{38}S$]. In the case of "cold" vulcanisation the depolymerisation process is brought about by the heat of combination of sulphur chloride with rubber.—E. W. L.

Hevea brasiliensis [*Para rubber*] *seed as a source of oil.* Carruthers. Gummi-Zeit., 1909, **24**, 282.

It is shown that 1 acre planted with *Hevea* trees, 15 feet apart, produces 3 cwt. 79 lb. of decorticated seed, in value, at present prices in the London market, £1 17s. The following costs are given: Freight (from British Malaya), £2 2s.; collecting, £2 4s.; decorticating, 6s.; packing, £1 15s.; total, £6 7s. per ton. The market value being £11 per ton, the net profit is £4 13s. per ton, or 16s. 4d. per acre. From the examination of a number of seeds, the following average values were found for the weight of shell and of kernel; shell, 1·656 grms., kernel, 2·25 grms. The kernel thus constitutes 59·7 per cent. by weight of the seed.—E. W. L.

Indiarubber market, 1909; *S. Figgis & Co.'s Annual Review.* Jan. 3, 1910. [T.R.]

Plantation rubber grown in Ceylon, British Malaya, Sumatra, India, &c.

Exported from	1909.	1908.	1907.	1906.
	tons.	tons.	tons.	tons.
Ceylon and India	600	350	250	160
Malaya, &c.	3000	1450	780	350
Total	3600	1800	1010	510

About 600,000 acres are estimated to be under rubber cultivation in the East (partly mixed with other products), and about 120,000 acres in Mexico, West Indies, Nicaragua, &c. The general improvement in quality is maintained, a large proportion of "clean *crêpe*" and very little "tacky" rubber being received.

The *world's supply* in 1909 was about 69,000 tons, against 65,000 tons in 1908 and 69,000 in 1907. Consumption amounted to about 68,000 tons. Brazil and Bolivia exported 42,000 tons in 1909, and 40,000 in 1908. Guayule rubber from Mexico amounted to about 3,500 tons. About 15,500 tons of rubber were exported from the West Coast of Africa last year, and about 14,000 tons in 1908. East Coast African generally increased.

Imports, &c., of all kinds of rubber into England were:—

	Imports.	Deliveries.	Stock, Dec. 31st.
	tons.	tons.	tons.
1909	24,563	24,225	1848
1908	21,611	23,369	1510
1907	22,964	21,317	3268
1906	21,269	21,162	1669

Imports of Para (Manaos) rubber into England in 1909 amounted to 10,179 tons, and of Peru (caucho) rubber to 4630 tons. Brazil exported in 1909 about 39,000 tons of rubber, compared with about 38,000 tons in 1908.

Rubber production in Angola. Board of Trade J., Dec. 16, 1909. [T.R.]

Wild rubber. Among the many native rubber-yielding plants in Angola, the most promising appears to be *Carpodinus gracilis*, which grows extensively over a large area. The bark is separated from the wood of the rhizome by beating between two pieces of wood; when the bark is separated, it is further beaten until it is reduced to a spongy mass, which is then worked in cold water and again beaten (these operations being repeated several times, according to the extent of purification desired), and then steeped in boiling water, moulded, and dried. Most of the rubber thus produced is classified as "second class." A British Company has recently commenced working an *asclepiaceæ* rubber, which grows on the Burro-burro plain of Benguela.

Cultivated rubber. In the forest belt of the Loanda district endeavours are being made, on the initiative of the Government, to cultivate Para, Panama, and Lagos silk rubber trees, and in 1907 and 1908 seeds and plants were imported for purposes of distribution. Experimental stations have been established at N'Dalla Tando and other places, and a research laboratory has been established at Loanda. The industry is still in an experimental stage of development. Mainly owing to the small yields of the present system of tapping the *Manihot glaziovii*, only poor results have been attained by planters on a small scale, who have not been able each to produce more than a few pounds of rubber for shipment to markets where many tons could be easily disposed of. The better yielding species, such as the Pará, Central American, and Lagos silk rubbers, have still to attain a sufficient age to permit of their being tapped.

Guayule rubber industry of Mexico. Board of Trade J., Dec. 16, 1909. [T.R.]

The "Mexican Herald" states that experiments which have been made in the cultivation of the guayule plant at Torreon during the last three years have proved successful, and that a large area will now be planted; the plants will require about four years before they become of commercial value. See this J., 1909, 483, 844.

Patents.

Spongy, elastic material: Process for the preparation of a —— from a solution of rubber, etc. F. Laarmann. Fr. Pat. 402,996, May 13, 1909. Under Int. Conv., June 22, 1908.

A solution of rubber in a volatile solvent is converted into a froth by beating or by forcing into it a gas, perferably nitrogen, under pressure, and the rubber is then vulcanised by means of sulphur chloride vapour. The mass of froth is next forced into moulds, *e.g.*, into tyres, and is finally dried by hot air, or steam. Hot vulcanisation may also be employed, in which case the rubber solution is mixed with sulphur before being converted into froth. The froth is filled into the tyres, then dried, and finally vulcanised by raising the temperature still higher. Where the froth has been produced by means of compressed gas, the drying (and hot vulcanisation) are carried out under a pressure equal to that used in producing the froth, in order to prevent the destruction of the spongy nature of the mass. A. S.

Rubber; Apparatus for cleaning and devulcanising ——. M. C. Clark. Fr. Pat. 403,446, May 28, 1909.

See Eng. Pat. 12,250 of 1909; this J., 1909, 1321.—T. F. B.

XV. LEATHER; BONE; HORN; GLUE.

Chroming of hide powder, acidity of hide powder, and the rapid cooling of tannin solutions; Report on ——. C. Eachus. J. Amer. Leather. Chem. Assoc., 1909, **4**, 310—322.

The general opinion of the various members of the Committee of the Amer. Leather Chem. Assoc., was that the official method of chroming hide powder should remain as at present, but ten times instead of twenty-five times the weight of water, calculated on the dry hide powder, should be used. The acidity of the powder for future work should be adjusted so that 10 grms. require 10 c.c. of *N*/10 sodium hydroxide for neutralisation, Hough's method (this J., 1909, 804) being used for the estimation. Various methods of cooling tannin solutions should be tried, as rapid cooling of such materials as ordinary quebracho and hemlock extract affects the amount of insoluble matter, whilst clear extracts such as chestnut and clarified quebracho are unaffected by either rapid or slow cooling.—H. Br.

Hide powder; Determination of acidity in ——. D. L. Tucker. J. Amer. Leather Chem. Assoc., 1909, **4**, 323—326.

A comparison of four methods for estimating the acidity in hide powder, *viz.*, those of Bennett (this J., 1907, 456), Small (J. Amer. Leather Chem. Assoc., 1907, **2**, 347; 1908, **3**, 75), and Hough (this J., 1909, 804), and a modifica-

tion of Bennett's method is given. The author finds difficulty in obtaining a satisfactory end point in the titration. Hough's method is an improvement on the others, but none of the methods is correct to 0·2 c.c. of N/10 alkali.
—H. Br.

PATENTS.

Plastic masses; Process for the preparation of —— by heating swollen glue with linseed oil. C. Heinrichsdorff and R. Zimpel. Ger. Pat. 216,605, March 1, 1908.

THE plastic mass is prepared by heating together glue (swollen in water), linseed oil, and a mixture of wood tar and alcohol.—A. S.

Horny substance; Process for the preparation of —— from cellulose. F. Ahrens. Ger. Pat. 216,629, Sept. 6, 1907.

CELLULOSE is treated with zinc chloride solution, until the individual fibres begin to swell; it is then removed from the liquor and allowed to stand in the air until, by the action of the adhering solution, it is converted into a gelatinous, transparent mass, which is washed with water and dried. The product is strong and tough, has a lustrous, conchoidal fracture, and can be worked in the same manner as horn.—A. S.

XVI.—SOILS; FERTILISERS.

Phosphoric acid: Determination of —— in basic slags and natural phosphates by the "citro-mechanical" method. E. Guerry and E. Toussaint. Bull. Soc. Chim. Belg., 1909, **23**, 454—457.

THE following method is given for the determination of the total phosphoric acid in basic slags and natural phosphates; the raw material is decomposed by heating with sulphuric acid alone, the authors having abandoned the subsequent treatment with nitro-hydrochloric acid (this J., 1906, 912) as being useless. A weighed portion (2·5 grms.) of the finely powdered sample is heated in a Jena flask for 10 minutes with from 20 to 25 c.c. of concentrated sulphuric acid. After cooling, the mixture is diluted, again cooled, made up to a definite volume, say 250 c.c., and filtered. Twenty-five c.c. of the clear filtrate are neutralised with ammonia, cooled, and 30 c.c. of ammonium citrate solution (containing 10 grms. of citric acid) and 15 c.c. of concentrated ammonia solution are added. The solution is agitated mechanically whilst 35 c.c. of magnesia mixture are added drop by drop, and, after the lapse of 25 minutes the precipitate is collected on a filter, washed with ammonia solution and ignited. The volume of the matter insoluble in the sulphuric acid need not be taken into account, as its influence on the result obtained is inappreciable. Whilst further experience has shown that accurate results may be obtained by a method described previously by the authors (*loc. cit.*), in which a ferric salt is added to retard the precipitation of silica, the method is somewhat tedious and the process given above is to be preferred.
—W. P. S.

Bacteria which decompose cyanamide; Cultivation of ——. H. Kappen. Zentralbl. Bakter. u. Parasitenk., 1909, II. Abt., **24**, 382—404. Chem. Zentr., 1909, **2**, 1884.

BY cultivation first in media containing calcium cyanamide and then in media containing cyanamide, the author succeeded in isolating bacteria capable of decomposing the latter compound under certain conditions. Under the experimental conditions, cyanamide was not decomposed by carbon dioxide nor by organic acids, such as acetic, butyric, and lactic acids. The favourable effect of dextrose on the bacterial decomposition of cyanamide thus cannot be attributed to the action of decomposition products of the dextrose, but must be due to a physiological action of the carbohydrate on the bacteria. The power of decomposing cyanamide is possessed in a marked degree by certain fungi, and in future experiments on the decomposition of calcium cyanamide in the soil, more attention should be paid to the action of fungi than has been done hitherto.
—A. S.

Urease in soy beans. T. Takeuchi. J. Coll. Agric., Imp. Univ., Tokyo., 1909, **1**, 1—14.

THE seeds of *Glycine hispida*, soy beans, contain a very active urease, which liberates ammonia from urea at ordinary temperatures, but does not act on other nitrogenous compounds. It is readily soluble in water, so that an infusion of soy beans may be employed to detect traces of urea in a mixture of organic matter, the ammonia liberated by the action of the urease being indicated by means of phenolphthalein. The author suggests the use of the seeds for the conversion of the nitrogen of urine into ammonium sulphate for manurial purposes.—J. O. B.

PATENTS.

Superphosphate; Apparatus for the further treatment of moist ——. Z. Littman. Ger. Pat. 215,376, July 12, 1908.

THE apparatus consists of a tower in which are disposed horizontal gratings formed of thin rods, and, near the bottom of the tower, a movable inclined sieve. The distance between the sieve and the lowest grating and between the several gratings is about five or six feet. The warm and moist superphosphate from the reaction-chamber is allowed to fall from a considerable height on to the top grating, and then falls by its own weight from grating to grating, gradually becoming more and more finely divided. The finest material passes through the sieve and is collected, whilst the coarser portion is returned to the top of the tower. A flue is provided by which a current of air is drawn through the tower.—A. S.

Silicon nitride [fertiliser] from metallic silicides. Eng. Pat. 3732. See VII.

XVII.—SUGARS; STARCHES; GUMS.

Sugar in fresh cossettes; Determination of —— by Pellet's method of instantaneous, cold aqueous digestion, and the use of the Sans-Pareille press. H. Pellett. Bull. Assoc. Chim. Sucr. et Dist., 1909, **27**, 465—467.

IN some experiments on the determination of sugar in fresh cossettes, Le Docte found that the hot and cold methods of analysis did not give identical results, and ascribed the differences to the use of the Sans-Pareille press. According to the author however, if the press is in proper working order, the pulp obtained may be treated by the cold digestion method with perfectly satisfactory results. The press is tested periodically with a special paper disc, in order to make sure that the teeth are in good contact with the bottom of the groove with which they engage. Apart from accidents, the toothed rings of the press are changed two or three times at most during the campaign, and other parts of the press, e.g., the groove, sometimes require attention. To control the results obtained by the cold digestion method, it is sufficient to make a determination by hot digestion once in 24 hours, unless in cleaning out the press, a defect is observed; this should be remedied at once. A small stone may sometimes be introduced with the cossettes into the press and injure the latter; such injury is easily repaired and if the toothed ring is sufficiently tempered, the injury will not be serious enough to affect the working of the press. If however, many stones pass with the beetroots into the slicing machine, and it is necessary to keep the Sans-Pareille press in constant use, the hot digestion method should be used.—L. E.

Diffusion juice; Saturation of —— in general and with 1 per cent of lime in particular. J. Hudec. Z. Zuckerind. Böhm., 1909, **34**, 164—169.

IN the campaign 1908/9, addition of 1 per cent. of lime was found to be quite sufficient for the first saturation. The organic colouring matters precipitated on treating diffusion juice with lime, unlike the organic non-sugar which is coagulated or fixed by the lime, show a great tendency to re-dissolve, the solution darkens in contact with air and re-precipitation is then difficult to effect. If carbon dioxide is used as precipitant, successive saturations must be employed. The amount of lime necessary for ordinary clarification depends on (1), the quantity requisite to precipitate coagulable non-sugar; (2), the quantity by means of which the organic colouring matters are precipitated; (3), the quantity which imparts the requisite alkalinity to the juice. Since excess of lime is not harmful, the same quantity of lime may be used for clarification in a given sugar factory from year to year, though the quantity will of course be different in different factories. The author shows that the precipitation of the non-sugar from diffusion juice by lime, only occurs in an alkaline medium, and that complete precipitation is only possible with a certain degree of alkalinity; an increase of the alkalinity beyond this point is useless.—L. E.

Sugar in saturation mud; Use of zinc nitrate in the determination of ——. V. Stanek. Z. Zuckerind. Böhm., 1909, **34**, 161—164.

If saturation mud be treated with zinc nitrate solution, both the free lime and that combined with the sugar are converted into calcium nitrate. The zinc does not form an insoluble sucrate, and the zinc hydroxide precipitated does not possess an alkaline reaction, so that the requisite amount of zinc nitrate may be easily found by addition of phenolphthalein, though excess of the salt is harmless, since it does not hydrolyse sucrose at the ordinary temperature. The author describes the following method for determining sugar in saturation mud:—Twice the normal weight of mud is weighed into a tared thick-walled, wide-necked flask of 200—250 c.c. capacity, and treated with 100 c.c. of water. A few pieces of lead (3—5 grms. in weight) are added, the flask is closed with a rubber stopper, and shaken for 1—2 minutes. The contents are now treated with phenolphthalein, and then with a solution of zinc nitrate until the rose colour disappears (since commercial zinc nitrate has an acid reaction, its solution must be neutralised with sodium hydroxide prior to use). The turbid liquid is transferred to a 210 c.c. flask through a funnel which is fitted with a piece of wire gauze; the latter retains the pieces of lead and also serves to show whether the admixture of the sample with the liquid has been complete. The contents of the flask are made up to volume, mixed, and filtered. With normal muds also, Le Docte's principle may be adopted, *i.e.*, the weighed quantity of mud (30 or 60 grms.) is treated with so much zinc nitrate solution (100 or 200 c.c.) as to give the desired quantity of total solution. The filtrates obtained by the author with his method were always clear and nearly colourless, and he shows that the results obtained agree well with those obtained by Scheibler's method of decomposition with carbon dioxide and clarification with basic lead acetate.—L. E.

"*Megasse*" *in paper-making.* Remington and others. *See* V.

PATENTS.

Gases from lime kilns used in the manufacture of sugar; Process for cooling and purifying ——. S. von Grabski. Fr. Pat. 404,157. June 18, 1909.

See U.S. Pat. 934,965 of 1909; this J., 1909, 1156.—T.F.B.

Wax-like product from sugar-cane. U.S. Pat. 941,401. *See* XII.

XVIII.—FERMENTATION INDUSTRIES.

Infected yeast; Ammonium persulphate solution as a wash for ——. F. Schönfeld and M. Hardeck. Woch. f. Brau., 1909, **26**, 621—622.

The use of ammonium persulphate solution has recently been recommended by Thevenot (this J., 1909, 1157) for the purification of yeast infected with bacteria. The authors have tested the method on cultures of top and bottom fermentation yeasts infected with various organisms present in "Weissbier." The persulphate was used in concentrations of 1·0, 0·5, 0·3 and 0·25 per cent., and allowed to act on the yeast for 18—24 hours. It was found that the yeast did not settle well from the wash liquor even in its most dilute form, while in the case of the strongest solution tried, practically all the yeast could be poured away in suspension. The toxicity of the solution to bacteria and cocci was found to be negligible. The authors conclude that the method is useless for the purpose recommended.—R. L. S.

Zymase fermentation; Formation of an organic phosphorus compound and its rôle in ——. L. Iwanow. Zentralbl. Bakter. u. Parasitenk, 1909, II. Abt., **24**, 1—12. Chem. Zentr., 1909, **2**, 1363.

The organic phosphorus compound produced in the fermentation of sugar by zymase preparations ("zymin" and "hefanol") corresponds in its properties with a triose-phosphoric acid compound. According to the author, it is produced by the agency of a synthesising enzyme, named by him *synthease*. It is fermented by zymase with production of carbon dioxide, alcohol, and inorganic phosphoric acid compounds. The insoluble residue of the zymase preparation is capable of fermenting the triose-phosphoric acid, but not dextrose. The fermentation of dextrose thus proceeds, in at least three stages:—(1) depolymerisation of the dextrose; (2) formation of the triose-phosphoric acid, by the agency of the easily soluble enzyme, synthease; (3) decomposition of the triose-phosphoric acid by the slightly soluble enzyme, alcoholase, with production of carbon dioxide and alcohol. (See also Young, this J., 1909, 1322.)—A. S.

Cider; Preparation of sweet —— *from early apples.* L. Meunier. Bull. Assoc. Chim. Sucr. et Dist., 1909, **27**, 492—494.

The author gives some account of the manufacture of a very sweet, almost unfermented cider, prepared from early apples in the neighbourhood of Rheims. To obtain a cider which retains a sweet flavour, the fermentation must be delayed until the pectic substances, etc., have separated from the juice. This is effected by adding 1 litre of potassium metabisulphite solution (containing 1 kilo. of the salt per 10 litres of water) to every 1000 kilos. of the freshly-milled apples. The must is allowed to stand at as low a temperature as possible. Fermentation is continued until a compact mucilaginous head of a reddish colour rises through the bung-hole of the cask in which fermentation is effected. The fermentation is known locally as "fermentation en rouge." A sample of the cider is then drawn off. If this is clear, the whole of the clear liquid is transferred to a sterilised cask; if the sample is not clear, fermentation is allowed to continue for some hours, another sample then being examined. The coagulation of pectin substances which precedes the "fermentation en rouge" does not occur in all apple juices, and this fermentation only succeeds well with a few mixtures of a few varieties of apples. Selected Normandy apples which are fully ripe but not decayed, give satisfactory results. A mixture of the Petit-Girard, Blanc Mollet, and a smaller quantity of the Doux Evêque, varieties, gives a sweet must of pleasant flavour, but of rather low acidity; the acid-content is increased by addition of 20 per cent. of Ardennes apples from the neighbourhood of Tourteron.—L. E.

Citric acid fermentation fungi. C. Wehmer, Chem.-Zeit., 1909, **33**, 1281.

As with bacteria, certain of the *Citromyces*, whilst morphologically identical, differ specifically in physiological characteristics, such as the production of special pigments or enzymes, acid-producing power, rapidity of growth, etc. Out of 13 cultures, the author has isolated 5 to 6 definite species, that are interesting apart from their acid-producing capacity. One of them, *Citromyces Tollensianus*, remains snow white for weeks; the calcium citrate separates from the colourless fermentation liquid as peculiar brilliant white concretions. Another species is able to develop in saturated solutions of oxalic acid, whereas *Aspergillus niger* cannot withstand a higher concentration than 1 per cent. Still another species produces oxalic acid instead of citric acid; and this product is also found when the fermentation experiments are prolonged, in consequence of the further decomposition of the citrate in solution. A fifteen-year old culture of *Citromyces Pfefferianus* was found still to contain living portions, from which new cultures were obtained.—C. S.

Patent.

Fermentable sugar from lignocellulose; Process of producing ——. M. F. Ewen and G. H. Tomlinson, Chicago, Ill. U.S. Pat. 938,308, Oct. 26, 1909.

The lignocellulose, *e.g.*, sawdust, is charged into a revolving digester together with not more than 2·5 times its dry weight of water, containing a hydrolysing acid, *e.g.*, sulphuric or hydrochloric acid, and the temperature of the mass is raised as rapidly as possible to what is termed the "critical point" by the admission of steam. When the reaction is complete, as determined by the maximum production of fermentable sugar, the temperature is rapidly reduced to that of boiling water, by opening the digester and allowing the vapours to escape. The "critical temperature" is defined as that above which the production of unfermentable substances and the destruction of sugar become excessive. It lies between 275° and 325° F. The time during which the mass is subjected to this temperature is generally 30-45 minutes. The concentration of the acid generally ranges between 1 and 5 per cent.; the restriction of the quantity of liquid permits the rapid raising and lowering of the temperature, and ensures a concentrated product.—J. F. B.

XIXa.—FOODS.

Milk; Nature of the cellular elements present in ——. R. T. Hewlett, S. Villar, and C. Revis. J. of Hygiene, 1909, **9**, 271—278.

On account of the importance now being attached to the presence of multi-nucleated cells in milk, the authors have collated the views and results of various workers on the subject. Improved methods in staining the cells have enabled the authors to demonstrate clearly that in general structure, etc., these cells, for the most part, are not leucocytes.—W. P. S.

Milk; An anaeroxydase and a catalase in ——. F. Bordas and Touplain. Comptes rend., 1909, **149**, 1011—1012.

A reply to Sarthou (this J., 1909, 1160). The authors adhere to their original conclusion that calcium caseinate is the catalyst which decomposes the hydrogen peroxide in the reactions which are supposed to point to the presence of catalases and peroxydases in milk. Sarthou attempted to remove the caseinate from curdled milk by filtration with paper, and to prove the presence of the enzyme in the filtrate. The authors state that the milk serum contains the caseinate in fine suspension which will pass through the paper. They have filtered milk coagulated under varying conditions, through a Chamberland filter-candle, and have never found any trace of a soluble anaeroxydase in the clear liquid.—W. H. P.

Margarine clause of the Food and Drugs Act, 1899. Interim report of Sir E. Thorpe and a Committee representing the Society of Public Analysts and other Analytical Chemists. Analyst, 1909, **34**, 514.

The members of the Committee in question, namely, Messrs. R. R. Tatlock, E. J. Bevan, W. W. Fisher, and O. Hehner, desire, in conjunction with the Principal of the Government Laboratory, to make an addendum to their previous report on the methods, etc., to be employed in determining whether the quantity of butter-fat in margarine exceeds the legal limit. The method there described was based upon experiments carried out with margarine-fat and butter-fat, into the composition of which cocoanut oil did not enter. As, however, the presence of cocoanut oil and similar oils, containing larger quantities of volatile acids than the fats formerly used in the manufacture of margarine, may increase the Reichert-Wollny number beyond 4, even when used without any butter-fat, the presence or absence of such fats must be ascertained before deciding that a Reichert-Wollny number exceeding 4 is evidence of the presence of butter-fat in excess of 10 per cent. An indication of the quantity of cocoanut oil or palm-nut oil present may be gathered, within limits, by the determination of the insoluble volatile acid number, and the Committee propose to conduct further experiments with a view of recommending a method for use in the case of samples of margarine containing cocoanut oil. In the meantime it is desirable that the following words should be added to the Report of the Committee dated Nov. 7, 1900: "The limiting figure of 4, obtained by the Reichert-Wollny method described, and the table of figures connected therewith, are not applicable to those cases of margarine in which the insoluble volatile acids number exceeds 1."—W. P. S.

Indian rice; The composition of ——. D. Hooper. Agric. Ledger, 1908—09. No. 5, 63—109.

Results of analyses of 159 samples of rice are given in tabular form, together with a full description of the various methods of cultivating the grain adopted in different districts. The following table gives a summary of the results obtained :—

District.	Number of samples.	Water.	Proteins.	Fat.	Carbohydrates.	Crude fibre.	Ash.
		per cent	per cent.	per cent.	per cent.	per cent.	per cent.
Bengal	14	11·10	7·51	0·40	79·82	0·44	0·73
Bengal	12	12·37	7·09	0·40	78·86	3·48	0·80
Eastern Bengal and Assam	16	11·19	7·67	0·53	79·21	0·58	0·82
Barma	10	11·54	7·54	0·98	78·59	0·58	0·77
Central Provinces	7	9·05	6·68	0·88	82·05	0·42	0·92
Cuttack	11	10·92	6·58	0·31	80·81	0·35	1·03
United Provinces	10	10·03	7·44	2·83	77·14	1·00	1·56
Nepal	13	11·28	7·50	0·85	79·13	0·32	0·92
Punjab	14	12·89	6·98	0·36	78·63	0·39	0·75
Bombay, Sind, Surat aad Dhalia	16	12·61	7·69	2·65	74·63	0·89	1·53
Bombay, Karnatic	14	13·15	7·29	2·56	74·90	0·74	1·38
Madras	11	8·94	7·10	0·74	81·54	0·43	1·25
Madras	11	11·69	6,81	1·03	79·00	0·49	0·98

—W. P. S.

Feeding stuffs; Some new ——, and their relative value as cattle foods. A. Smetham. J. Royal Lancashire Agric. Soc., 1909.

The results of analyses of a large number of feeding stuffs imported into England in recent years are shown in the following table:—

Name.	Water.	Oil.	Albuminoids.	Digestible carbohydrates.	Woody fibre.	Mineral matters.	Sand and silica.	"Food units."
Wheat, whole grain	12·77	1·65	13·07	68·04	2·76	1·71	—	105
,, Garton's	12·90	2·85	12·19	69·06	1·30	1·70	—	106
,, Hardcastle White	13·90	2·35	12·19	68·01	1·75	1·80	—	104
,, Burma	10·40	1·77	15·75	68·60	1·88	1·60	—	112
,, Danubian	9·35	2·03	15·75	69·22	2·10	1·55	—	113
,, Meal	16·75	1·33	12·37	64·37	2·73	2·45	·20	99
Flour, Bakers'	11·90	1·30	13·62	72·63	·10	·45	—	110
Seconds	11·40	4·56	17·94	58·12	4·03	3·65	·10	115
Thirds	11·20	3·56	18·37	61·66	2·46	2·75	·05	116
Sharps	11·80	3·30	13·12	58·95	8·73	4·10	·30	100
,,	11·05	5·13	18·01	54·36	6·60	4·85	·20	112
Wheat Pollard	9·95	3·37	11·62	55·74	14·17	5·15	1·45	93
,, ,,	10·70	3·60	14·25	56·73	8·57	6·15	1·55	101
,, ,,	11·65	5·13	17·69	55·59	5·43	4·51	·15	113
,, Germ	12·01	7·70	21·41	51·18	3·90	3·80	—	124
Bran	11·45	4·33	16·46	57·01	6·50	4·25	—	109
,, flattened	12·25	4·30	15·37	58·86	5·37	3·85	·20	107
Cockle	11·45	3·16	12·62	55·94	10·83	4·00	2·25	95
Wheat Screenings	11·35	4·67	12·37	61·14	5·77	4·70	1·60	104
Ground Winnowings	8·20	1·90	9·31	33·85	9·63	37·01	29·30	61
Barley Grain, average of English, 42 analyses	14.95	1·46	8·59	67·96	4·46	2·58	·39	93
,, Azof	12·95	2·50	13·25	64·13	4·37	2·80	1·05	103
,, Smyrna	12·30	2·27	11·88	63·92	5·73	3·90	1·60	99
,, Canadian	13·30	2·07	12·12	65·13	4·48	2·90	·85	100
,, Danubian	12·40	1·93	11·00	68·00	4·22	2·45	·50	100
Offal, from Pearl Barley Meal	10·10	3·90	14·37	58·81	7·67	5·15	2·40	104
Oats (crushed)	13·45	6·77	11·12	56·92	9·14	2·60	·85	102
Oat meal	8·14	7·03	13·17	66·97	2·75	1·94	—	117
,, ,, Irish	7·85	9·53	14·38	64·77	1·57	1·90	—	—
Oat Shudes	9·30	·83	1·31	52·74	31·87	3·95	3·10	58
Feeding Oat meal	8·40	5·10	10·12	60·13	12·60	3·65	1·65	98
Dari, Indian	10·70	3·03	7·75	74·36	2·21	1·95	·25	101
,, Seed Meal	11·50	4·93	10·25	67·75	2·02	3·55	·85	105
White Towaree Meal (Guinea Corn) Karachi	10·65	3·43	9·75	71·53	1·79	2·85	·75	104
Millet	12·85	4·76	11·08	59·46	7·45	4·60	2·15	98
,, Rangoon	12·40	3·13	10·62	70·34	1·41	2·10	·25	104
Maize, new crop	17·45	4·06	9·25	66·14	1·50	1·60	·05	99
,, old, average	11·25	4·80	10·20	70·17	1·85	1·73	—	108
,, Danubian	12·85	4·23	9·75	70·90	1·17	1·10	—	106
,, Turkish	15·95	4·63	9·12	67·30	1·65	1·35	—	101
,, River Plate	13·55	5·07	10·12	68·88	1·13	1·25	—	107
,, N. American mixed	12·55	4·37	10·62	69·71	1·50	1·25	—	107
Corn Meal	12·45	4·20	10·01	70·13	1·96	1·25	—	105
Maize Germ	14·65	25·47	14·88	31·00	7·45	6·55	·25	132
,, ,,	12·05	8·66	15·13	55·07	5·99	3·10	·10	114
,, ,, Meal	10·35	14·66	26·16	40·60	6·93	1·30	·20	143
,, ,, ,,	10·55	8·87	20·12	55·90	3·81	·75	·05	128
,, ,, Cake	9·50	6·86	15·07	57·91	5·26	5·40	·15	113
,, Residue (chemically treated)	11·75	18·66	29·31	20·75	6·33	13·20	8·60	141
,, Tailings	12·25	10·36	10·87	57·01	6·26	3·25	·20	110
Maizone Flake	12·01	·85	8·50	77·69	·60	·35	—	101
Flaked Maize	6·30	·87	10·62	81·56	·30	·35	—	110
Gluten Meal (by-product)	8·50	19·47	36·01	31·82	2·15	2·05	·10	170
,, ,,	8·60	10·60	30·12	44·16	4·62	1·90	·10	146
,, ,,	9·65	4·53	32·25	51·57	1·25	·75	·10	143
Hominy Meal	9·80	9·46	10·88	62·76	4·05	3·05	·10	114
Hominy Feed	10·25	8·07	10·87	64·86	3·10	2·85	·15	112
,, ,,	7·15	10·73	12·75	60·40	5·72	3·25	·10	119
Maize Bran	11·05	13·37	12·75	52·22	6·81	3·80	—	117
Corn Flour	11·25	4·10	6·00	76·77	·23	·75	—	104
,, ,,	11·35	·27	·50	87·50	·03	·35	—	89
,, Cob Meal	11·05	·80	2·00	56·18	28·52	1·45	·30	63
Rice (cleaned)	11·80	2·40	8·01	75·88	·76	1·15	—	102
Rice Flour (from hand-picked cleaned rice)	12·65	2·20	7·75	75·34	·66	1·40	—	100
,, Husks (hand picked)	9·70	1·16	3·25	32·44	39·90	13·55	13·20	43
,, Floor from Burma Rice	11·30	·57	7·00	80·65	·13	·35	—	99
,, Flour, Canadian	12·25	·93	7·00	78·45	·17	·70	—	98
,, Meal or Bran, English	9·95	10·43	13·94	48·95	8·03	8·70	4·05	110
,, ,, Rangoon	9·10	15·46	13·31	47·00	0·23	8·90	1·25	119
,, ,, Chittagong	8·99	15·86	13·00	41·98	7·53	12·64	5·69	114
,, ,, Saigon	8·70	11·40	11·62	59·46	3·27	5·55	1·50	107
,, ,, Madras	8·20	15·07	11·50	45·60	8·33	11·30	6·20	112
,, ,, Italian	7·70	8·21	8·86	41·13	22·20	11·90	8·15	84
,, ,, Canadian	10·15	9·73	10·62	46·00	14·80	8·70	4·10	97
,, Meal (chiefly ground shudes)	9·55	1·93	2·87	36·15	30·20	19·30	17·90	48
,, Polish	9·50	10·07	11·62	63·90	·61	4·30	·25	118
Beans, English	14·14	1·86	28·12	46·70	6·14	3·04	—	121
Burma Pai-Yin Beans (*Vigna Catiang*)	10·35	1·07	23·00	56·83	5·05	3·70	·05	117
Rangoon Red Beans	11·75	1·37	20·00	59·16	4·02	3·70	·10	112
Peas, English	14·20	1·71	22·50	52·59	5·99	3·01	—	113
,, Canadian	13·95	1·93	24·31	52·01	4·20	2·70	—	110
,, Ground Green Indian	12·15	2·23	27·06	48·05	7·60	2·85	—	121
Horse Gram (Kulthi, Kooltee, or Kult Peas, *Dolichos Ciflorus*)	11·05	1·10	23·37	54·27	5·11	5·10	1·50	115
Pea Meal	13·70	1·86	24·87	52·97	3·90	2·70	·05	120
,, (refuse from split peas)	9·25	3·13	20·37	47·59	15·91	3·75	·45	106
Indian "Peas"—Mutter, *Lathyrus Sativus* (poisonous)	13·10	1·46	31·62	42·54	8·13	3·15	—	—
"Winter Tares" from Smyrna (probably *Lathyrus Sativus*)	10·55	1·46	22·12	58·49	4·08	3·30	·50	—
Bengal Horse Gram (*Cicer arietinum*) whole seed	9·30	4·67	21·25	53·66	8·11	3·01	·05	118
Bengal Horse Gram (split)	12·95	5·43	21·88	55·71	1·13	2·90	·15	124
Soya Beans	10·85	18·07	38·75	21·11	5·87	5·35	·60	163
Soya Bean Cake, English	12·70	11·07	38·82	26·51	5·85	5·05	·35	151
,, Meal ,,	3·85	11·33	43·25	30·77	5·45	5·35	·25	167
,, Cake, imported	17·00	9·00	40·50	23·78	4·47	5·25	·40	147
Lentils, average	9·80	2·01	25·50	59·03	1·01	2·65	·05	127
,, Syrian	10·55	1·90	24·25	56·53	3·87	2·90	·20	122
Locust Beans	13·40	1·01	4·87	72·24	5·68	2·80	·05	87
,, ,, Algerian	11·85	1·03	5·94	71·43	7·10	2·65	—	89
,, Bean Meal	12·05	3·01	5·04	71·12	5·73	3·05	·10	91
Rain Beans (*Calliandra Saman*)	14·25	·50	11·50	60·33	10·87	2·55	·05	90
Pods from Peru (*Huaranga 'Prosopis Juliflora*)	11·15	1·47	10·12	59·80	14·01	3·45	·05	88
Linseed	8·10	35·56	25·69	18·92	8·13	3·60	·20	172
,, Calcutta	7·30	37·86	19·31	20·09	10·89	4·55	·75	163
,, Turkish	7·55	39·20	20·94	18·63	8·73	4·95	1·35	169
,, La Plata	8·20	33·00	23·00	24·58	7·37	3·85	·20	164
,, Cake, English (average)	11·16	9·50	29·50	35·54	9·10	5·20	·60	133
,, ,, American	9·30	10·06	33·37	31·84	10·37	5·06	—	140
,, ,, ,,	10·25	9·10	34·63	30·63	9·84	5·55	·45	140

Name.	Water.	Oil.	Albuminoids.	Digestible carbohydrates.	Woody fibre.	Mineral matters	Sand and silica.	" Food units."
Linseed Cake, Bombay	7·35	15·63	31·37	25·55	9·60	10·50	2·90	143
,, ,, Calcutta	9·25	9·83	33·25	34·82	5·70	7·15	2·20	142
,, ,, Japanese	10·65	8·60	35·88	29·37	8·10	7·40	1·65	140
,, ,, Galatz	10·75	9·53	37·25	29·51	8·16	4·80	·15	146
,, ,, River Plate	10·15	12·60	30·42	26·60	14·43	5·80	·70	134
,, ,, Russian	11·70	9·70	35·25	30·35	7·70	5·30	·60	143
,, ,, Italian	11·90	11·83	32·62	28·78	9·27	5·60	1·10	140
,, ,, Chilian	10·90	13·20	30·37	34·38	5·75	5·40	·25	143
,, Meal, Japanese	10·95	11·47	33·12	30·91	7·20	6·35	1·10	142
,, ,, ,,	10·45	5·77	34·25	34·70	6·93	7·90	2·10	135
,, ,, (extracted)	13·15	3·03	34·75	34·67	8·75	5·65	·65	129
Cotton Seed, Egyptian	8·80	23·93	19·56	21·54	21·16	5·01	·80	130
,, ,, Brazilian	10·70	23·63	19·62	25·64	15·96	4·45	·05	134
,, ,, Maceio	8·01	22·70	22·56	24·27	18·15	4·25	·10	137
,, ,, Bombay	8·05	21·53	18·62	28·49	19·46	3·85	·15	129
,, ,, Burma	8·90	14·63	17·37	31·42	24·13	3·55	·15	101
,, ,, (decorticated)	7·55	37·23	30·87	17·15	1·85	5·35	·10	187
Decorticated Cotton Cake (average), oil very variable	9·00	11·38	43·78	23·56	5·18	7·10	—	161
Decorticated Cotton Cake, N. American (exceptionally rich)	6·65	15·47	51·50	18·43	2·65	5·30	·05	186
Decorticated Cotton Cake Meal, N. American	7·40	10·16	42·37	25·86	7·06	7·15	·05	157
Decorticated Cotton Cake Meal, Egyptian	11·45	7·46	32·19	30·34	12·06	6·50	·20	129
Decorticated Cotton Cake Meal, Brazilian	9·70	11·06	44·25	22·83	5·76	6·40	·20	160
Decorticated Cotton Cake Meal (another sample)	9·40	12·40	35·62	26·67	10·36	5·55	·35	147
Decorticated Cotton Cake Meal, Peruvian	9·05	13·01	40·96	22·60	5·83	8·55	·80	158
Decorticated Cotton Cake, Chinese	12·80	9·47	39·88	24·87	6·53	6·45	·25	152
,, ,, ,, ,,	12·60	5·20	37·88	25·94	12·23	6·15	·20	133
Decorticated Cotton Cake Meal, Shanghai	9·60	13·03	41·12	23·32	6·38	6·55	·05	158
Decorticated Cotton Cake, Burma	12·30	10·27	40·84	23·57	6·47	6·55	1·05	151
,, ,, ,, Russian	7·10	14·50	43·94	22·61	5·20	6·65	·20	168
,, ,, ,, Mexican	6·35	10·23	43·12	26·54	7·57	6·19	·19	160
Undecorticated Cotton Cake (English make)	13·75	6·56	24·62	29·28	21·19	4·60	·15	107
Undecorticated Cotton Cake (another brand)	13·05	6·46	26·31	31·80	17·48	4·90	·25	114
Undecorticated Cotton Cake, Egyptian	12·15	5·53	23·01	32·37	21·19	5·75	·35	104
Undecorticated Cotton Cake, Chinese	10·15	5·97	29·63	28·88	19·47	5·90	·40	118
,, ,, ,, Burma	9·80	5·03	23·38	32·04	23·30	6·45	1·75	103
,, ,, ,, ,,	10·50	4·57	18·62	33·33	27·33	5·65	1·30	91
Undecorticated Cotton Cake, W. African	10·30	6·47	23·25	27·45	28·68	3·85	·30	102
Whole Seed Cotton Meal (from cleaned seed)	10·60	23·57	21·62	23·75	16·06	4·40	·35	137
Cotton Seed Meal (extracted)	9·15	1·26	26·94	28·40	28·45	5·80	·35	99
Cotton Seed Husks (38·7 % Husk in Seed)	11·90	·63	3·50	41·89	39·73	2·35	—	52
Cotton Bran	12·25	·90	2·88	47·74	33·78	2·45	·10	57
Kapok Seed (Bastard Cotton)	10·85	22·01	22·87	18·65	20·02	5·60	·10	131
Kapok Seed Cake	13·80	7·47	26·25	23·19	23·19	6·10	·38	107
Yellow Rape Seed	6·50	43·17	24·75	18·30	2·63	4·65	·75	188
Rape Seed Cake	0·90	10·27	32·87	29·70	10·86	6·40	·75	137
,, ,,	8·75	12·06	34·69	23·52	9·63	11·35	5·50	139
,, ,, Punjaub	7·75	13·27	37·25	28·46	5·90	7·37	2·15	155
Rape Seed Cake, Chinese	7·05	10·77	33·13	25·78	9·87	12·80	5·80	135
,, ,, ,,	7·45	10·57	27·63	22·75	11·10	20·50	12·95	118
,, ,, Benarabian Peasant made	8·10	12·27	33·13	27·32	9·83	9·35	4·15	141
,, ,, French	8·10	9·27	36·38	29·28	7·97	9·00	2·05	143
,, Meal (extracted)	9·90	3·30	35·42	31·60	11·03	8·75	3·10	128
,, ,, Jamba (extracted)	10·20	2·87	40·25	33·55	8·43	4·70	·99	141
,, ,, Jamba Cake	7·75	8·40	35·50	30·95	9·00	8·40	2·55	141
,, ,, Brown E. Indian (extracted)	12·01	3·10	35·12	33·00	8·47	8·30	1·80	128
Ravison Cake	7·30	7·10	33·12	29·16	12·27	11·05	4·90	130
,, Dneiper	8·70	12·13	36·75	30·29	6·78	5·35	·90	152
Turnip Seed Cake, River Plate	12·35	9·60	27·63	33·70	9·97	6·75	·60	127
Navette Cake	11·80	8·47	31·62	28·03	10·53	9·55	2·99	128
Radish Cake	7·55	12·90	26·63	32·27	15·45	5·20	·70	131
Mustard Seed Meal (extracted)	11·60	2·18	22·50	40·89	16·23	6·60	·80	—
Cocoanut (Copra)	16·13	58·23	5·44	14·26	4·36	1·58	—	159
,, ,, Bombay	5·50	67·03	—	—	—	—	—	—
,, ,, South Sea	4·95	62·50	7·75	19·27	3·53	2·00	—	195
,, Cake, English	9·01	9·20	21·19	43·04	11·91	5·65	·30	119
,, ,, English (another make)	8·70	14·96	21·19	40·29	9·51	5·35	·25	130
Copra Cake, Foreign	11·65	23·03	19·38	33·72	6·72	5·50	·70	140
,, ,, Bombay	11·90	11·83	23·12	35·70	7·90	9·55	4·10	123
Palm Kernel Meal	9·99	12·91	16·18	35·57	21·80	3·55	—	108
,, ,, Cake	9·73	9·14	15·89	41·66	19·74	3·84	—	105
Palm Kernel Meal (extracted)	10·69	1·80	19·13	49·06	15·38	3·94	—	101
,, ,, Buenos Ayres	7·65	25·67	27·25	25·51	8·72	5·20	·90	158
,, ,, Shells	6·65	7·45	2·25	48·15	32·20	3·30	1·15	56
" Coco Meal " (Vegetable Ivory)	12·25	·93	4·13	69·92	7·77	5·00	1·05	82
Candle Nuts	4·55	63·43	22·13	3·81	2·08	4·00	·05	218
Candle Nut Cake	7·10	16·01	42·87	19·92	5·95	8·15	·10	167
Euphorbia Elastica Nuts	8·10	39·07	18·25	14·51	16·97	3·10	·05	—
Calabash Seeds, Lagos	5·50	52·17	31·37	6·46	·90	3·60	·05	215
Acoomoo Beans, Lagos	4·90	63·03	8·62	12·97	8·53	1·95	—	—
Cuajo Nuts (*Myristica Surinamensis*)	3·75	65·23	8·75	10·64	9·68	1·95	·10	—
" Folla Panza " Seed (*Pentaclethra macrophylla*)	8·15	37·01	23·75	25·16	3·48	2·45	·05	—
Tallow Nuts (*Pago Aleosa*)	4·90	73·40	4·38	11·04	4·53	1·75	—	—
,, ,,	7·90	50·33	7·37	18·80	13·30	2·30	—	—
,, ,,	8·45	55·47	7·87	13·24	13·47	1·50	—	—
Para Rubber Nuts (*Hevea Brasiliensis*)	11·00	24·87	9·63	22·55	30·40	1·55	—	—
" Chakore " Seed (*Cassia Tara*)	12·10	6·60	17·25	49·77	9·23	5·05	·75	102
Niger Seed Cake	8·90	14·03	34·06	21·80	9·26	11·95	3·15	142
Niger and Kurdee (Safflower) Cake	8·15	8·73	29·01	24·96	19·40	9·75	3·45	119
Sesame Cake (Burma)	7·20	17·80	35·88	22·44	4·43	12·25	1·95	156
Benniseed (Sesame) Cake	8·45	11·07	40·29	24·02	5·17	11·00	—	152
Til Seed (Sesame) Cake	7·30	15·03	32·25	24·27	4·90	6·25	6·80	142
Ground Nut Cake (Earth Nut) (decorticated)	10·60	7·73	49·31	21·71	4·70	5·95	1·60	164
Ground Nut Cake (undecorticated)	11·60	7·17	28·50	28·06	18·97	5·70	2·20	117
Earth Nut Husks (hand picked)	15·00	1·30	6·01	20·04	54·55	3·10	·45	38
,, and Kurdee Cake	11·80	8·46	38·62	23·14	11·63	6·35	2·20	140
,, ,, ,, (another sample)	8·15	8·63	30·87	23·21	21·13	8·01	2·10	122
Ground Nut and Niger Cake	7·70	9·03	37·37	24·83	12·27	8·80	2·30	141
Gingelly and Niger Seed Cake	7·25	12·53	34·63	19·42	12·97	13·20	5·25	137
Gingelly and Kurdee Cake	8·35	10·60	26·12	23·76	21·27	9·90	3·10	115
Earth Nut Meal (chiefly husks)	7·85	4·60	9·75	28·54	45·61	3·65	45	64

Pea Nut Cake, American	6·10	16·90	40·00	27·90	4·70	4·40	·80	170
Earth Nuts, Rangoon	7·90	39·03	20·50	12·84	17·58	2·15	·10	161
Kurdee Cake (Safflower)	8·55	9·73	20·25	25·12	32·95	3·40	·70	100
,, (decorticated)	11·60	7·70	47·88	19·72	6·20	6·90	1·65	158
Sunflower Seed Cake	7·10	7·43	19·01	28·93	30·03	7·50	2·65	95
,, ,, (Husked)	7·75	10·03	37·00	21·14	16·53	7·55	2·20	139
,, ,, Egyptian	9·95	7·23	16·06	30·71	24·70	11·35	5·75	89
Gold of Pleasure Cake	10·25	11·20	35·37	25·64	11·53	6·01	·80	142
Canary Seed Cake	9·54	19·80	17·35	38·50	8·67	6·14	2·19	131
Mahwa (Bassia) Cake (unfit for feeding)	8·45	10·53	15·25	48·21	5·16	6·40	1·45	—
Mahwa Flowers	12·75	1·57	6·00	65·85	3·13	10·70	7·75	—
Illipé Meal	7·60	30·16	8·03	42·94	5·77	4·90	1·10	—
,, (extracted)	17·90	10·27	10·25	45·76	9·97	5·85	1·10	—
Shea Nut Meal	7·85	20·30	11·13	48·54	6·68	5·50	·90	—
"Olive Kernel Meal"	8·40	2·23	1·12	43·08	43·41	1·76	·65	—
Olive Nut Refuse	10·65	17·33	7·75	20·91	34·51	2·85	—	—
,, ,,	12·80	4·33	6·94	38·57	30·46	6·90	4·50	—
Coffee Bran	9·45	·77	2·37	24·70	61·75	·90	·10	32
Cocoa Shells	9·30	3·83	18·81	46·01	13·85	8·20	·85	102
Hop Seeds	11·35	18·63	30·37	15·90	16·60	7·15	2·30	138
Sago Flour	16·75	·23	·25	82·34	·13	·30	·29	84
Sago Flour (Seconds)	10·30	·17	1·12	76·91	3·30	2·20	1·60	80
Tapioca Root	12·49	·80	1·50	81·69	1·31	2·30	·05	87
,, Flour	12·15	·63	1·12	82·49	1·41	2·20	·05	87
Buckwheat	10·80	2·45	10·13	67·29	7·73	1·60	·05	99
Poppy Seed Cake	10·15	11·43	35·38	20·04	7·90	15·10	3·15	—
,, Meal	9·95	12·13	39·50	16·24	9·43	12·75	1·40	—
Hemp Seed Cake	12·55	8·30	32·38	16·02	22·90	7·85	2·10	118
Hemp Seed Meal, Russian	11·75	1·73	34·75	10·82	25·70	9·25	3·15	108
"Kandy" Cake (*Pongamia Glabra*)	10·45	13·67	27·62	42·18	2·98	3·10	·10	—
Treacle	22·92	—	—	71·28	—	5·80	—	71
Dried Brewers' Grains	10·01	6·93	19·50	42·31	17·00	3·65	1·75	108
,, Distillery Grains	6·05	10·73	32·75	37·15	10·67	2·65	·60	146
Distillery Grains Sediment	9·40	13·37	34·12	30·19	10·67	2·25	1·19	149
Malt Refuse	51·42	1·50	7·37	37·80	1·26	·65	·15	60
,, ,, Cake	42·55	3·80	11·50	34·92	5·03	2·20	1·01	73
,, Culms	9·80	1·03	26·28	45·96	11·08	5·85	1·55	114
Combings, No. 2	10·10	1·55	21·25	45·28	15·17	6·65	2·90	112
,, No. 3	10·75	1·72	22·12	45·56	13·90	5·95	2·01	115
Megass Meal	11·10	1·47	2·00	51·88	30·19	3·45	2·25	60
Peat Dust	26·15	2·90	6·50	43·65	22·80	3·00	1·99	—
Carui Chaff	13·50	4·03	8·88	37·60	24·59	11·49	·55	—
Canadian Stock Feed	12·50	11·40	12·25	34·02	16·63	13·20	8·30	—
Meadow Grass	70·48	·83	2·95	14·14	9·54	2·00	—	23
Ensilage from same, salted	68·74	2·35	3·04	11·10	9·90	4·87	—	24
Meadow Hay (Plot 7 Saltney)	14·30	1·48	9·32	41·28	26·84	6·79	1·42	68
Clover Hay (Plot 15 Saltney)	16·68	·86	11·75	37·39	25·33	7·99	1·99	68
Swedes (average of 14 analyses)	90·42	·20	·91	6·61	1·29	·57	—	9
Straw, Wheat	13·81	1·47	2·96	30·29	47·07	4·40	—	41
,, Barley	14·65	1·45	3·25	35·35	41·00	4·30	—	47
,, Oat	15·15	1·52	4·04	38·47	35·64	5·18	—	52
Turnips	91·85	·20	1·05	5·25	·95	·70	—	8
Mangels	87·89	·17	1·32	8·63	1·06	·93	—	12
Potatoes	75·80	·20	2·08	19·90	1·10	·92	—	26
Carrots	87·25	·20	1·25	8·80	1·60	·90	—	12
Dried Beet Pulp	11·80	·83	8·75	58·92	16·45	3·25	·05	83
Beet Fodder, Spanish	12·00	·60	8·87	61·52	10·21	6·80	·05	85

"Albuminoids" represent total nitrogen multiplied by 6·25.

"Digestible carbohydrates" include all non-nitrogenous organic matter, except woody fibre and fat.

The "food units" are calculated on the assumption that oil and albuminoids are of equal value and 2·5 times as valuable as carbohydrates.

Saccharin in foods and beverages; Confirmatory test for ——. F. A. Genth, jun. Amer. J. Pharm., 1909, **81**, 536—537.

Salicylic acid having proved to be absent, a portion of the ether extract of the material is evaporated almost to dryness in a porcelain crucible. The residue is treated with a drop or two of water, and a particle of solid sodium hydroxide, then evaporated to dryness and cautiously fused. The cold melt is dissolved in 1 c.c. of water, neutralised with dilute acid, and tested with 1 per cent. ferric alum reagent. In the presence of saccharin, a violet colour is produced in the neutral liquid. When the amount of saccharin present is small, the test may be made more sensitive by first adding a slight excess of acid to the alkaline solution of the melt, then adding the reagent, and, finally, titrating back with very dilute ammonia until the solution is neutral. Four mgrms. of saccharin in 50 c.c. of solution can be readily detected by this test.—J. O. B.

Betaines and choline in drugs containing caffeine and theobromine, and choline in some edible fungi. Porlstorff. *See* XX.

Determining essential oil and moisture in spices and aromatic drugs. Cripps and Brown. *See* XX.

Patents.

Milk; Fibrous, desiccated ——. A. L. Just and B. Stolz, Exors. of J. A. Just, Syracuse, N.Y. U.S. Pat. 939,139, Nov. 2, 1909.

The claims relate to a new and readily soluble form of desiccated milk, consisting of tubular, flaky and filamentous particles of milk solids with extremely thin walls. Owing to the characteristic shape of the particles, they form a very bulky mass of a pure yellowish-white colour which dissolves in water without forming a sticky cake, as is the case with the denser forms of desiccated milk. In order to produce this product, the milk, suitably concentrated, is fed into the trough produced by the contact of two parellel wire-gauze drums. The drums as they revolve, carry round a layer of concentrated milk on their surfaces, and a current of hot dry air is constantly discharged from the inside through the meshes of the gauze. This air, whilst continuing the evaporation of the milk, blows out the thickened fluid in the form of tubes and bubbles, which burst and solidify in the form described. The dried milk, which adheres to the drums like a honeycomb, is continuously removed by fixed scrapers, and subsequently broken up by gentle crushing. —J. F. B.

Milk; Process of desiccating ——. F. X. Govers, Owego, N.Y. U.S. Pat. 939,495. Nov. 9, 1909.

Milk is partially concentrated under reduced pressure by bringing it, in small quantities, into contact with surfaces heated to a temperature below 212° F., but sufficiently high to produce almost immediate ebullition of the whole volume of the milk. The partially condensed material is then withdrawn from the bottom of the mass in the form of thin layers or films upon moving rollers heated to a temperature below 212° F., under reduced pressure.—W. P. S.

Baking-powder. J. H. Hooker, Buckingham. U.S. Pat. 942,072, Dec. 7, 1909.

See Eng. Pat. 53 of 1907; this J., 1908, 416.—T. F. B.

Flour; Process for ageing, conditioning, and bleaching ——. F. H. Loring. Fr. Pat. 403,935, June 11, 1909. Under Int. Conv., June 15, 1908.

See Eng. Pats. 12,780 and 12,781 of 1908; this J., 1909, 740.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Disinfectants; Semi-specific ——. H. Bechhold. Z. Hyg. u. Infekt-Krankh., 1909, **64**, 113—142. Chem. Zentr., 1909, **2**, 1937—1938.

In continuation of his work on the disinfecting action of the halogen-substituted naphthols and phenols (see this J., 1909, 1162), the author finds that from the point of view of "molecular disinfection," only 14 molecules of tribromonaphthol are required to prevent the growth of a definite culture as compared with 1500 molecules of β-naphthol and 1000 molecules of cresol. Among bodies of this class, the maximum efficiency against *Staphylococci*, *Streptococci*, and *B. diphtheriae* was attained by tribromo-β-naphthol, and against *B. coli* by dibromo-β-naphthol, whilst against *B. paratyphosus N*, the introduction of more than two atoms of halogen into the naphthol molecule decreased the bactericidal efficiency. Although more strongly disinfectant against *Staphylococci* the tri- and tetra-halogen compounds were inferior to lysol against *B. coli*, and although effective against anthrax spores, they were without effect on *B. tuberculosis*. The naphtholsulphonic acids and their bromine derivatives were also examined, but on the whole were not very effective.—J. H. J.

Patents.

Ether from m-cresol and oxalic acid; Process for making the compound ——, which is a solid disinfectant. Rütgerswerke Akt.-Ges. Fr. Pat. 403,863, June 10, 1909. Under Int. Conv., June 24, 1908.

Oxalic acid and *m*-cresol interact slowly, at low temperatures, to form an ester, which is solid at ordinary temperatures. When the reacting mixture has become solid, the excess of *m*-cresol is pressed out; the product is decomposed at 51° C. into *m*-cresol and oxalic acid, but it is readily soluble in water, and is a powerful disinfectant, for which purpose it may be used alone or in conjunction with other substances.—T. F. B.

Antiseptic. A. Liebrecht, Frankfort, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 911,888, Nov. 30, 1909.

See Eng. Pat. 15,931 of 1908; this J., 1909, 742.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES: ESSENTIAL OILS.

Cinchona alkaloids; Varying fluorescence of ——. G. Denigès. Bull. Soc. Pharm. Bord.; through Rép. Pharm., 1909, 21, 4864—4887.

If 0·02 grm. of quinine, cupreine, cinchonine, and cinchonidine be dissolved separately in 2 c.c. of glacial acetic acid, and 2 c.c. of strong sulphuric acid added to each, a slight fluorescence is observable in each case. On adding 0·2 c.c. of formaldehyde solution, the cupreine and quinine solutions show a strong bluish-green fluorescence; with cinchonine, the shade is decidedly bluer; and with cinchonidine, it is bluish-violet. On adding 3 or 4 c.c. of water to each mixture, the fluorescence of the quinine, cinchonidine, and cinchonine solutions persists, but it disappears in the cupreine solution; and in the quinine solution, the green shade tends to be accentuated. On further dilution with water, the fluorescence of the cinchonidine solution rapidly diminishes and is barely visible in 10 to 15 c.c.; while it is quite evident in 40 or 50 c.c. of the quinine solution, and is stronger still in that of cinchonine. This difference of behaviour, serves, therefore to distinguish these closely-related alkaloids.—J. O. B.

Drugs: Restriction of the importation of certain —— into India. Board of Trade J., Dec. 16, 1909. [T.R.]

According to a decision of the Governor-General in Council, published in the "Indian Trade Journal" of Nov. 25, 1909, the bringing into British India by means of the post, by sea or by land, of eucaine, beta-eucaine eucaine lactate, and holocaine is prohibited; and the importation of these articles by any other means is restricted to cases in which they are imported by persons, or by their authorised agents, who have been granted special permission.

Glucosides [primeverin and primulaverin]; Two new —— from Primula officinalis. A. Goris and M. Mascré. Comptes rend., 1909, **149**, 947—950.

The following method was employed for the separation of the two glucosides from the roots of *Primula officinalis*. The roots were first sterilised by heating in alcohol vapour at a temperature of 105° C., this treatment being necessary to destroy the enzyme, *primeverase*, which is also present. The roots are then boiled with 90 per cent. alcohol in the presence of calcium carbonate, the alcoholic solution is distilled under reduced pressure, and the residue dried over sulphuric acid. This dry residue is extracted with absolute alcohol, the solution is filtered, evaporated, and the residue taken up with ethyl acetate. After evaporating off the ethyl acetate, the residue obtained is extracted with anhydrous ethyl acetate and the solution is set aside. A mass of white crystals separates, which by fractional crystallisation from absolute alcohol or anhydrous ethyl acetate, may be separated into the two glucosides. Both glucosides are equally soluble in water and in dilute alcohol. *Primeverin* melts at 172°—173° C., and has $[\alpha]_D = -60{\cdot}24^\circ$; *primulaverin* melts at 160°—161° C., and has $[\alpha]_D = -66{\cdot}86^\circ$. Aqueous solutions of the glucosides slightly reduce Fehling's solution. The glucosides are decomposed by primeverase and by boiling with dilute sulphuric acid, an odour of aniseed being produced; they are not, however, acted on by emulsin. If the acid solution be extracted with ether and the ether evaporated, an aqueous solution of the residue gives a coloration with ferric chloride, blue in the case of primeverin and violet with primulaverin.—W. P. S.

Vanillin; Syntheses of ——. A. Guyot and A. Gry. Comptes rend., 1909, **149**, 928—931.

The following processes were found to yield pure vanillin, the amounts obtained being from 70 to 80 per cent. of the theoretical yields. One grm.-mol. of a methyl or ethyl ester of mesoxalic acid or of any *αβ*-diketonic acid is added to a solution of 250 grms. of zinc chloride in 500 grms. of glacial acetic acid; condensation commences at once and is allowed to proceed at the ordinary temperature for 15 hours. At the end of this time, the mixture is heated to a temperature of 50° C. for some hours, then diluted with water and shaken with ether. The ethereal solution, after being washed with water containing sodium carbonate, and distilled with steam to remove guaiacol if this substance be present, contains one or other of the following substances according to the ester employed. For instance, methyl mesoxalate yields methyl-*p*-hydroxy-*m*-methylhydroxyphenyl tartronate; ethyl mesoxalate gives the corresponding ethyl compound. Ethyl diketobutyrate gives *p*-hydroxymethylhydroxyphenyl acetylglycollate, and ethyl benzoylglyoxalate yields *p*-hydroxy-*m*-methylhydroxyphenyl benzoylglycollate. All these condensation products are oxidised, the first two by boiling with copper chloride after saponification, and the two glycollates by heating with an aqueous solution of copper acetate, with the formation of vanilloylcarbonic acid. This substance when heated to a temperature of 170° C. with an equal weight of dimethyl-*p*-toluidine yields vanillin, which may be extracted by means of ether from the acidified mixture. The esters used in the above-mentioned process may be replaced by the corresponding acids, and it is shown that vanillin may be prepared by the condensation of guaiacol with dihydroxysuccinic acid. Fifty grms. of sodium dihydroxytartrate are added slowly to 300 grms. of sulphuric acid of sp. gr. 1·82, so as to avoid a rise of temperature in the mixture. Twenty grms. of powdered guaiacol are then added, the mixture is shaken until complete solution has been attained, then poured on ice, and extracted with ether. The ethereal solution yields

a non-crystallisable acid which, when boiled with copper acetate, gives copper vanilloylcarbonate. The latter is then converted into vanillin as described previously.
—W. P. S.

Betaines and choline; Occurrence of —— *in drugs containing caffeine and theobromine, and of choline in some edible fungi.* K. Polstorff. Wallach-Festschrift, 1909, 569—583. Chem. Zentr., 1909, 2, 2014—2016.

Betaïne in kola-nuts (*Kola acuminata*). The powdered nuts were treated for a long time with very dilute sulphuric acid, the solution concentrated, extracted with chloroform to remove caffeine, and then treated at 26°—28° C. with a solution of potassium-bismuth iodide. From the precipitate produced, after decomposition with barium carbonate, betaïne was isolated; 10 grms. of betaïne were obtained from 4 kilos. of nuts. It was observed that the caffeine was only partially extracted from the kola nuts by dilute sulphuric acid, and further quantities could be obtained from the dried residue by treating with slaked lime and boiling with 80 per cent. alcohol.

Trigonelline in coffee-beans (*Coffea arabica*). The raw coffee-beans were extracted with ether, coarsely powdered, and treated as described above; 4·5 kilos. yielded 10·5 grms. of trigonelline, the methylbetaine of nicotinic acid.

Choline in tea-leaves (*Thea chinensis*), *Pasta guarana, and cacao-beans* (*Theobroma cacao*). From ten kilos. of Indian tea, 3 grms. of choline chloride were separated by the method described, the crude base being purified by means of the mercuric chloride compound. 2·5 kilos. of *Pasta guarana* yielded 0·5 grm., and 4·4 kilos. of cacao-beans yielded 2 grms. of choline chloride.

Choline in edible fungi. Chantarelle (*Cantharellus cibarius*), mushroom (*Agaricus campestris*), and boletus (*Boletus edulis*) yielded 0·01, 0·015, and 0·0056 per cent. of choline respectively.—A. S.

Bombay mace; Detection of ——. J. W. Gladhill. Amer. J. Pharm., 1909, **81**, 537.

One grm. of the mace is macerated in 10 c.c. of alcohol for two hours. Two or three c.c. of the filtered alcoholic extract are floated on 5 c.c. of solution of "chlorinated soda." In the presence of Bombay mace, a bright red colour appears at the contact-zone. The tint is fugitive when not more than 1 per cent. of Bombay mace is mixed with genuine [Banda] mace; but it is claimed that the presence of as little as 0·02 per cent. may be thus detected.—J. O. B.

Spices and aromatic drugs; Determination of essential oil and moisture in ——. R. A. Cripps and J. A. Brown. Analyst, 1909, **34**, 519—522.

The moisture is determined by the method proposed by Dupré for the determination of water in cordite, &c. (this J., 1906, 780). A weighed quantity of about 0·5 grm. of the finely divided spice or drug is placed in a tube about five inches long and $\frac{5}{8}$ inch internal diameter; dry sand is added to a depth of about $\frac{3}{4}$ inch, and then calcium carbide, in moderately large pieces, to within $1\frac{5}{8}$ inches of the mouth of the tube, which is connected with a calcium chloride tube and this with a nitrometer filled with saturated sodium chloride solution. The tube containing the spice is immersed in a brine-bath to the upper level of the carbide, and after the apparatus has been adjusted at atmospheric pressure, the brine-bath is gradually brought to boiling. When the volume of gas in the nitrometer ceases to increase, the brine-bath is removed, the tube is allowed to cool to the ordinary temperature, and the volume of gas noted. The number of c.c. of gas at 0° C. and 760 mm., multiplied by 0·001725, gives the weight of water in the quantity of spice taken. The total volatile matter (water plus volatile oil) is determined by heating about 2 grms. of the sample in a tube in an air-bath at a temperature of 135° C., while a current of air is aspirated through the bath. The total volatile matter is removed from the sample within one hour, and the difference between the amount of water found previously and the volatile matter gives the quantity of volatile oil present.—W. P. S.

Aurantiaceæ; Some essential oils from Algerian ——. A. Chapus. J. Pharm. Chim., 1909, **30**, 481—487.

In view of the presence on the market of neroli and petitgrain oils produced in Algeria, the author has examined their physical constants, and compared them with those of oils of French and Spanish origin.

Essential oil.	Sp. gr. at 15° C.	Optical rotation in 100 mm. tube at 15° C.	Esters.	Source.
Neroli bigarade.	0·8768	+ 5° 57′	31·99	Blida
,, ,,	0·8739	+ 6° 6′	25·26	Bouffarik.
,, ,,	0·8723	+ 5° 42′	28·38	Blida. Bouquet de Nice.
Neroli portugal ...	0·8731	+ 26° 15′	34·18	Blida
Petitgrain bigarade.	0·8755	− 5° 5′	42·39	Blida.
Petitgrain portugal	0·8705	+ 21° 33′	21·62	Blida

Compared with French oils, the *Neroli bigarade* oils have a higher content of esters, but about the same sp. gr. and optical rotation. The Algerian *Neroli portugal* oil has a higher sp. gr. and greater optical rotation than Spanish oils of this variety.—F. Shdn.

Cryptomeria oil. H. Kimura. Ber. deutsch. Pharm. Ges., 1909, **19**, 369—387.

After a brief historical summary, the author gives the results of an examination of the oil obtained from the wood of *Cryptomeria japonica* Don., in which the oil is present to the extent of about 1·5 per cent. The oil, after being purified by steam distillation, has the sp. gr. 0·9590, and $[\alpha]_D = -22° 32'$. It has a saponification value of 3·88 and contains from 30—40 per cent. of alcohols. On fractionation and distillation over sodium, a fraction was obtained boiling at 140°—147° C. at 9 mm., and having the composition of a sesquiterpene. By the action of hydrogen chloride upon an ethereal solution of the sesquiterpene, a solid hydrochloride was obtained. This was identified as cadinene hydrochloride. The liquid sesquiterpene hydrochloride was decomposed with glacial acetic acid and sodium acetate, when a sesquiterpene named *suginene* was obtained. This substance has the sp. gr. 0·921, and $[\alpha]_D = +14° 43'$. The alcoholic constituents of *Cryptomeria* oil were converted into potassium xanthogenates, from which a solid substance, *isocryptomeriol*, $C_{15}H_{26}O$, was produced, which melted at 135°—136° C. The oil accompanying this alcohol had the same composition and $[\alpha]_D = -3° 25'$. When the alcoholic constituents of the oil were treated with potassium, and the solid potassium compound freed from oil and decomposed with water, a sesquiterpene alcohol was produced, which was present to the extent of about 10 per cent. in the oil. This alcohol, *cryptomeriol* boils at 162°—163° C. at 10 mm., and has the sp. gr. 0·964, and $[\alpha]_D = -37° 5'$. When cryptomeriol was treated with anhydrous formic acid, a sesquiterpene was produced, which boils at 143°—144° C. at 13 mm., and has the sp. gr. 0·918, and $[\alpha]_D = -1° 5'$. If phosphorus pentoxide be used instead of formic acid, the sesquiterpene obtained has the sp. gr. 0·917, and $[\alpha]_D = +56° 26'$.—F. Shdn.

Monodora grandiflora seeds; Essential oil of ——. R. Leimbach. Wallach-Festschrift, 1909, 502—512. Chem. Zentr., 1909, 2, 1870.

The light yellow oil of cymene-like odour has the sp. gr. 0·8574 at 15° C., $\alpha_D = -46° 15'$ in a 100 mm. tube at 15° C.; acid value, 3·9; saponification value, 7—12; it is soluble in 3·5 parts of 90 per cent. alcohol. On distilling at a pressure of 20 mm., 90 per cent. pass over below 85° C.

The chief constituent is *l*-phellandrene, boiling at 64°—66°C. at 17 mm., sp. gr. 0·8488 at 15° C., α_D = up to − 58° 36′ in a 100 mm. tube, n_D^{17} = 1·48014. The oil also contains camphene (b. pt. 158° C. at 750 mm., sp. gr. 0·855 at 15° C., α_D = − 15° 30′, n_D^{15} = 1·46608), *p*-cymene, a compound, $C_{10}H_{16}O$ (light yellow liquid boiling at 130°—154° at 35 mm., sp. gr. 0·9351 at 15° C., α_D = 4° 32′ in a 50 mm. tube), a hydrocarbon, $C_{15}H_{24}$ (b. pt. 260°—270° C., sp. gr. 0·9138 at 15° C., α_D = + 24°, n_D^{16} = 1·50513), and a compound melting at 160°—163° C., probably a sesquiterpene alcohol. Palmitic acid and carvacrol are also probably present.—A. S.

Terpene series: Hydrogenations in the — —. G. Vavon. Comptes rend., 1909, **149**, 997—999.

Pinene, camphene, and limonene absorb gaseous hydrogen when agitated with platinum black. To maintain the velocity of reaction it is necessary that the catalyst should be present in considerable quantity (7 grms. of platinum to 70 grms. of terpene). Pure *α*-pinene (m.p., − 50° C., $[\alpha]_D$ = + 48°) gives a quantitative yield of a hydrocarbon, $C_{10}H_{18}$ (b.p. 166° C., α_D = + 22·7°, sp. gr. at 15°/15° = 0·861), which seems to be identical with that obtained by Sabatier and Senderens (Compt. rend. 1901, 1254) with nickel as catalyst. The darkening in colour observed by these authors is not confirmed. French turpentine (mainly *β*-pinene) gives a body of almost equal lævo-rotation, $[\alpha]_D$ = — 21·3. Hence the *α*- and *β*-pinenes probably give the same dihydro-derivative. From camphene (m.p. 55° C., $[\alpha]_D$ = − 80°) in ethereal solution the reduction product ($C_{10}H_{18}$) is a solid, similar to camphene in appearance, but melting at 87° C. This appears to differ from the liquid hydride of Sabatier and Senderens (*loc. cit.*), and also from the body melting at 156°, which is obtained by the action of water on magnesium-camphene hydrochloride. Limonene, $[\alpha]_D$ = + 121·3°, in ethereal solution absorbs four atoms of hydrogen, giving a hydrocarbon, $C_{10}H_{20}$ (sp. gr. at 15°/15°, 0·803, b.p. 169° C.), which is optically inactive. Various other substances with ethylenic and acetylenic linkages can be reduced in the same way, but the velocity of reaction is never so great as in the terpene series.—W. H. P.

Camphor; Condensation products of — —. M. Guerbet. Comptes rend., 1909, **149**, 931—933.

When camphor is heated to a temperature of 280° C. with sodium hydroxide, it is mainly converted into campholic acid (see this J., 1909, 440), but certain oily products are also formed and, by fractional distillation and crystallisation from alcohol of the portions distilling between 326° and 335° C., the author has obtained two definite compounds. The first of these has the formula, $C_{20}H_{30}O$, and its reactions are similar to those of the diphenylcamphomethylene obtained by Haller and Bauer (this J., 1906, 558); it may be considered as bornylene camphor and results from the condensation of the sodium-camphor with camphor, sodium hydroxide being liberated. The second compound isolated had the formula, $C_{20}H_{32}O$, and it was found that it could also be prepared by the action of nascent hydrogen on bornylenecamphor; it may be termed bornylcamphor. Bornylenecamphor melts at 93° C., and has $[\alpha]_D$ = + 69·2° in alcoholic solution; bornylcamphor melts at 77·5° C.—W. P. S.

Methylhydrastimide hydrochloride [amenyl]. Freund. Therap. Monatsh., 1909, 586. Apoth.-Zeit., 1909, **24**, 871.

Methylhydrastimide hydrochloride is prepared by treating hydrastine iodomethylate with ammonia, and then heating the resulting methylhydrastamide with hydrochloric acid. When crystallised from absolute alcohol, it forms yellow needles, m.pt. 227° C. The free base, liberated by alkalis or alkali carbonates, and crystallised from alcohol, occurs in yellow needles, m.pt. 192° C. —J. O. B.

Organic sulphur preparations [ichthyol, etc.]. F. W. Passmore. Chem. and Drugg., 1909, **75**, 935.

Ichthyol has been frequently stated to be a definite chemical compound of the composition, $C_{28}H_{36}S_3O_6(NH_4)_2$, but its behaviour towards solvents shows that this is not the case. The author has analysed samples of ichthyol and of various substitutes for the same, making determinations of the dry residue at 100° C., the total ammonia, total sulphur, and sulphates and chlorides. After deducting from the total ammonia (and other bases, if present) that present as mineral salts, the remainder is considered to be present in combination with sulphonic acids. The difference between the total sulphur and that present as sulphates and sulphonates is designated as "sulphidic" sulphur, and represents the sulphur present in the original hydrocarbon oil before sulphonation. The following results were obtained.

	Dry residue at 100° C.	Organic dry residue.	Total ammonia.	Total sulphur.	Ammonium sulphate.	Ammonium chloride.	Total org. sulphur in org. dry residue.	"Sulphidic" sulphur in org. dry residue.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Ichthyol	55·7	49·73	3·16	10·72	5·94	0·03	18·66	12·51
Ichthynat	53·5	46·86	3·53	8·25	6·6	0·04	14·19	6·85
Ichtosan	53·9	51·91	2·74	8·24	1·69	0·30	15·08	6·70
Isarol	54·3	51·47	2·82	8·67	2·76	0·07	15·54	7·82
Lithyol	50·8	39·22	4·5	7·57	10·35	1·23	12·90	4·07
Petrosulfol	60·7	60·43	2·54	10·07	trace	0·27	16·66	9·11
Piscarol	50·7	41·42	3·75	7·82	9·28	trace	13·44	7·27
Fossilol	51·9	46·16	3·15	8·57	5·65	0·09	15·60	8·67
Subitol	47·9	40·11	3·33	8·05	7·63	0·16	15·46	9·08

—A. S.

Anhydrides; Preparation of — — by the action of thionyl chloride on salts of organic acids. (Preliminary note.) W. S. Denham. Chem. Soc. Proc., 1909, **25**, 294—295.

The author has shown (this J., 1909, 813) that sulphur monochloride acts readily on the sodium or silver salts of organic acids in presence of indifferent solvents, forming unstable suphur compounds of the type, $(R{\cdot}CO_2)_2S_2$, which, on spontaneous decomposition, give anhydrides of the acids, together with sulphur dioxide and sulphur. Attempts have now been made to obtain compounds of the type, $(R{\cdot}CO_2)_2SO$, by the substitution of thionyl chloride in the above reaction. Intermediate compounds of this type were not obtained, but it was found that reaction takes place smoothly and readily between typical silver salts and thionyl chloride, with evolution of sulphur dioxide and formation of the acid anhydride, propably according to the equation: $2R{\cdot}CO_2Ag + SOCl_2 = (R{\cdot}CO)_2O + SO_2 + AgCl$. This modification of the reaction possesses obvious advantages as a method of preparing anhydrides over that in which sulphur chloride is used. The reaction is carried out as described in the case of sulphur chloride, that is, by adding thionyl chloride dissolved in dry ether to a slight excess of the silver salt suspended in the same solvent, the containing vessel being cooled if necessary. After filtration from silver chloride and distillation of the ether, the anhydride is left in good yield, and generally nearly pure. In this way, acetic, benzoic, and succinic anhydrides have already been obtained. The method promises to be useful for the preparation of anhydrides of hydroxy-acids and of optically active acids, and to the preparation of mixed anhydrides.

Aliphatic acids; Catalysis of ——. J. B. Senderens. Comptes rend., 1909, **149**, 213—215.

The author has previously shown (see this J., 1909, 489) that good yields of ketones can be obtained by passing the vapours of fatty acids over heated thoria or alumina, the best results being obtained with the former. Experiments have now been made with oxides of chromium, iron, calcium, zinc, copper, cadmium, and uranium, but none gives results so good as those obtained with thoria. With the oxides of calcium, zinc, copper, and cadmium, the intermediate formation of salts of the acids could be easily detected, these salts being again decomposed, as the temperature was increased, but giving in general only small yields of ketones, especially in the case of the higher acids.—A. S.

Ketones; Catalytic preparation of mixed aliphatic ——. J. B. Senderens. Comptes rend., 1909, **149**, 995—997.

In continuation of previous work (see this J., 1909, 489, and preceding abstract), the author finds that a binary mixture of fatty acids in equimolecular proportions, is completely converted into the three possible ketones, with elimination of water and carbon dioxide when the vapours are passed over thoria heated to about 400° C. The mixed ketone preponderates, but the two simple ones are also formed. The yield of mixed ketone is increased by using an excess of one of the acids, preferably the lower member of the series. The process can also be used to prepare unsymmetrical ketones of the aromatic series.
—W. H. P.

Dichloroethylene; Electrolytic production of ——. P. Askenasy and C. Vogelsohn. Z. Elektrochem., 1909, **15**, 773—779.

Dichloroethylene is used extensively as a solvent and as the starting point of a number of important syntheses. Symmetrical tetrachloroethane, which is the source of all the chlorine derivatives of acetylene, is readily obtained by the successive action of dry chlorine and dry acetylene on a chlorinating agent, such as antimony pentachloride (see Eng. Pat. 18,602 of 1904; this J., 1905, 150). Dichloroethylene has hitherto been obtained by the action of zinc dust on tetrachloroethane suspended in water (see Eng. Pat. 19,576, of 1907; this J., 1908, 37). On the large scale the heat of reaction is so great as not only to render the use of external heat unnecessary, but furthermore to cause the continuous and regular distillation of pure dichloroethylene, which boils at 55° C. The authors have now devised a process for recovering zinc electrolytically from the zinc chloride obtained as a by-product. The apparatus used consisted of a wide-mouthed glass flask fitted with a cork stopper, through which were inserted a thermometer, a tube leading to the anode, and a delivery tube. The anode consisted of a roll of platinum gauze, enclosed in a cork-stoppered cylinder of porous earthenware, and suspended from a connecting wire, which passed through the above-mentioned anode tube. The latter fitted into the cork of the porous cylinder, holding the latter in position, and was provided with a side tube connected with an upright condenser and a chlorine-absorbing apparatus. The cathode consisted of a coil of copper wire wound round the diaphragm, and the delivery tube was fitted with a reflux condenser surmounted by a fractionating apparatus. Tetrachloroethane was introduced into the flask, with its surface some distance below the level of the bottom of the diaphragm and of the cathode. The flask was almost filled with an aqueous solution of zinc chloride, which was maintained very nearly, but not quite, at boiling temperature, and a suitable electric current was passed through the apparatus. The delivery tube condenser was filled with hot water and kept at 65° C., so that steam and tetrachloroethane vapour were condensed and flowed back into the flask, and the more volatile dichloroethylene passed through the fractionating apparatus into an ice-cooled receiver. The chlorine liberated at the anode passed through the side of the anode tube, by way of the reflux condenser, into a vessel containing lime, to form bleaching powder. The authors conclude, that using a 10 per cent. solution of zinc chloride, a cathode current density of 20 amps. per sq. dcm., a diaphragm surface of 3 to 4 sq. dcm. per kilo. of dichloroethylene produced in 24 hours, and a temperature of 97° C., an almost theoretical yield can be obtained, with a current efficiency of 80 per cent., and an energy consumption of 3·7 to 4 kilowatt-hours per kilo. of dichloroethylene. Taking the average prices of electrical power and of chlorine in Germany, the authors claim that the value of the chlorine recovered more than pays for the cost of the power used.—O. R.

Mercuric iodide; Determination of —— *in ointments.* P. Adam. J. Pharm. Chim., 1909, **30**, 300–301.

Mercuric iodide cannot be easily separated from fatty preparations, such as the pharmaceutical ointments, on account of its solubility in most fat-solvents. Petroleum spirit is the best solvent for the purpose. From 2 to 3 grms. of the ointment are treated, in the cold, with the smallest possible volume of petroleum spirit. The solution of fat is decanted and the residue is washed, on a tared filter, with several small portions of the solvent. It is then dried over sulphuric acid, in the cold, and weighed. The petroleum solution is then shaken with potassium iodide solution; after separating the aqueous liquid, the mercury is precipitated from this, in the usual manner, with hydrogen sulphide. The mercury found, weighed as sulphide, is added to that of the previous determination. If fraudulent admixture with chloride, or ammoniochloride is suspected, the amount of iodine present must be determined.—J. O. B.

Reaction of polybasic acids, and new reaction of titanium. Piccard. *See* XXIII.

Patents.

Benzoic acid from toluene; Process for preparing —— *by means of nitric acid.* H. Sachsse. Ger. Pat. 216,091, Nov. 2, 1907.

Toluene is mixed with five times its weight of nitric acid (17°B.) in a stone or other acid-proof pot, contained in an autoclave made of, or lined with, aluminium or iron; the autoclave is heated to 130°—150° C. until the pressure ceases to increase. When cool, the nitrogen oxides are removed, and the product purified by reducing the small quantity of nitro-compound formed, and separating the benzoic acid from the amino-compound. In this process the walls of the autoclave are said to be protected from the nitric acid vapours by the intermediate product which is formed at the beginning of the reaction.—T. F. B.

Monohalogen-acetic acids; Process for producing ——. G. Imbert, and Consortium f. Elektrochem. Industrie. Ger. Pat. 216,716, March 21, 1907. Addition to Ger. Pat. 209,268, Nov. 4, 1906.

When monohalogen-acetic esters or dihalogen-vinyl ethers are heated with excess of water, the alkyloxy group is hydrolysed before the halogen is attacked, and if the reaction is interrupted as soon as the mixture becomes homogeneous, monohalogen-acetic acids only are obtained. For example, 100 kilos. of dichlorovinyl ether or 87 kilos. of ethyl chloroacetate are boiled with 100 kilos. of water for twelve hours under a reflux condenser: the chloro-acetic acid can be recovered from the solution by evaporation on a water bath. (See also Eng. Pat. 5013 of 1907; this J., 1907, 637, and Ger. Pat. 210,502; this J., 1909, 815).—T. F. B.

Lymph: Process of making preventive and curative ——. S. Krafft, Munich, Germany. U.S. Pat. 941,423. Nov. 30, 1909.

See Eng. Pat. 13,210 of 1908; this J., 1908, 1222.—T.F.B.

Sodium salt of lactalbumin; Process of making a neutral ——. E. Fischer, Gronau, and P. Bergell, Berlin. U.S. Pat. 941,773, Nov. 30, 1909.

See Eng. Pat. 6179 of 1908: this J., 1908, 1079.—T. F. B.

Diphenyl-ortho-oxalic esters; Method of making ——. H. Schneider, Hamburg, Germany. U.S. Pat. 942,674. Dec. 7, 1909.

See Addition of Feb. 3, 1909, to Fr. Pat. 377,141 of 1907: this J., 1909, 1000.—T. F. B.

1-Aryl-2.4-dialkyl-3-halogenmethyl-5-pyrazolones or 1-aryl-2.4-dialkyl-5-halogenmethyl-3-pyrazolones; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 403,919, Oct. 6, 1908.

See Ger. Pats. 206,637 and 208,593: this J., 1909, 328 and 491.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Brilliant light [flash-light] for photography; Powder for producing ——. A. Lesmüller. Fr. Pat. 403,722, June 5, 1909.

Powders suitable for use in producing flash-lights for photography are obtained by adding suitable oxidising agents to mixtures or compounds of rare earth metals with boron, silicon, uranium, or titanium; the oxidising agents should be such as do not leave a non-volatile residue at the temperature of combustion of the powder. These powders give a light which contains a large number of indigo rays: the colour of the flash can be controlled by varying the proportions of the constituents, and also by the addition of a sulphide of a heavy metal, *e.g.*, of iron, manganese, or copper.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Safety explosives prepared with ammonium nitrate; Action of —— *in the presence of carbon, paper, and paraffin.* H. Dautriche. Comptes rend., 1909, **149**, 926—928.

Safety explosives used in coal mines, containing ammonium nitrate as their chief constituent, liberate free oxygen when exploded, and the author has investigated the question whether this oxygen would not combine with the coal dust around the cartridge and thus augment the temperature and action of the explosive. Experiments carried out under conditions practically identical with those of actual mining, but in which the cartridge was packed around with powdered wood charcoal and with coal dust, showed that the oxygen combines with the carbon and yields carbon monoxide. The combustion of the paper and paraffined-paper surrounding the cartridges appears to vary in its completeness with the diameter of the cartridges; in the case of the smaller cartridges the combustion is feeble.—W. P. S.

Nitroglycerin explosives; Analyses of gases from burning —. W. Cullen and D. W. Greig. J. Chem., Met., and Min. Soc., S. Africa, 1909, **10**, 90—92.

Investigation was made as to the large amounts of nitric oxide produced during the burning of nitroglycerin explosives under atmospheric pressure. During a previous research (see this J., 1909, 162), the gases formed by detonation were examined, and it was found that less carbon monoxide was produced by the detonation of the explosive "Antifume" than by the other nitroglycerin explosives tested. When burnt, however, under normal pressure, the gases from "Antifume" appeared to be no less dangerous to health than those from other explosives, the amount of nitric oxide produced being about proportional to the percentage of nitroglycerin present. The results of the comparative tests are as follows:—Ordinary blasting gelatin, burnt under atmospheric pressure, produced an amount of nitric oxide equal to 33·46 per cent. of its original weight; "Antifume" blasting gelatin, 29·23; blasting gelatin containing chlorate, 33·27; gelignite, 21·0; modified gelignite, 19·58; and gelatin-dynamite, 25·0.—F. R.

Patent.

Blasting cartridges; Process and apparatus for the manufacture of ——. St. Laszczynski. Ger. Pat. 215,202, March 30, 1909.

In using the so-called Sprengel explosives, cartridges charged with an alkali chlorate are impregnated with a liquid combustible, such as an oil, petroleum, nitrobenzene, etc., just before use. Owing, however, to the impossibility of preparing cartridges packed uniformly tight throughout, the impregnation is not uniform, and the explosive action of the prepared cartridges is uncertain. According to the present patent, the liquid combustible is contained in a vessel divided into separate compartments, so that separate portions of the cartridge are impregnated with separate portions of the liquid. It is claimed that in this way the cartridges become uniformly impregnated, even if the porosity of the filling is different in different parts. —A. S.

XXIII.—ANALYTICAL PROCESSES.

Polybasic acids; A reaction of ——, *and a new reaction of titanium.* J. Piccard. Ber., 1909, **42**, 4341—4345.

It is known that the reduction of many organic substances by titanium trichloride is greatly hastened by the presence of tartaric acid. The author finds that this is not a specific character of tartaric acid, but that many polybasic acids (and some other substances) exhibit the property, whilst monobasic acids, with very few and doubtful exceptions, do not. The most suitable substance on which to make the test is the orthoquinonoid aminoquinonimonium salt of di-aminocresol, prepared by the action of ferric chloride on di-aminocresol *bis*-hydrochloride (see page 15). This red salt is very slowly reduced and decolorised by titanium trichloride, but the addition of polybasic acids makes the reaction much more rapid. The author divides the substances he has examined in respect of their efficiency in accelerating the reduction as follows:—*Very strongly active*—Hydrofluoric acid (hence probably H_2F_2, not HF), oxalic, glycollic, lactic, pyruvic, tartaric, malic, and citric acids, catechol (pyrocatechin), pyrogallol. *Strongly active*—Orthophosphoric, hydrocyanic, hydrothiocyanic, hydroferrocyanic, and malonic acids, quinol (hydroquinone), salicylic, *p*-hydroxybenzoic, and phthalic acids, dihydroxyaminodiphenylamine. *Weakly active*—Tetrathionic, *m*-hydroxybenzoic, isophthalic, and *a*-hydroxynaphthoic acids, R-salt, G-salt, pyrotartaric acid, glutaric acid, glycocoll. *Very weakly active*—Boric acid, glycerol, succinic acid, resorcinol, ethyl alcohol, sucrose, phenol, *p*-aminophenol, diaminophenol, diaminocresol, phenylenediamine. *Inactive*—hydrochloric, hydrobromic, hydriodic, formic, acetic, propionic, butyric, benzoic, *β*-naphthoic, and monochloracetic acids.

It is known that salts of trivalent titanium give with oxalic acid in aqueous solution a yellow coloration. The author finds that they give with catechol (pyrocatechin) a very much stronger orange-yellow coloration. This is the most delicate reaction known for titanium, being fifteen times as sensitive as the hydrogen peroxide reaction. The catechol must be present in excess. Acids hinder the reaction, and alkalis, alkali carbonates or ammonia also weaken it.—J. T. D.

Sodium, cæsium, and rubidium; New method for the detection of ——. W. C. Ball. Chem. Soc. Proc., 1909, **25**, 284.

A solution of potassium bismuth nitrite, to which about 1 per cent. of cæsium nitrite has been added, produces a yellow, crystalline precipitate of the composition, $9CsNO_2,6NaNO_2,5Bi(NO_2)_3$, with traces of a sodium salt. One part of sodium in presence of several thousands of potassium may thus be detected. Conversely, a solution of sodium bismuth nitrite is an excellent test for cæsium, and also for rubidium, if in not too great dilution.

Chlorine in hydrochloric acid ; Electrolytic determination of —— with the use of the silver anode. F. A. Gooch and H. L. Read. Amer. J. Sci., 1909, **28**, 514—552.

The determination of the chlorine of hydrochloric acid by the electrolytic process, with the use of a silver anode, is found to give results which are very irregular and always low. Sources of error are the fixation of oxygen by the anode, the production of oxygen compounds of chlorine (hypochlorous acid), and the solution of silver from the anode, with its incomplete transference to the cathode.—F. Sodn.

Ammonia ; Apparatus for the determination of very small quantities of —— in large volumes of rapidly moving air. P. Liechti and E. Ritter. Chem.-Zeit., 1909, **33**. 1265—1266.

The apparatus described is of large size, and designed to deal with several hundred litres of air per minute. Its essential feature is the alternation of narrow and wide tubes, in which the air is brought into very intimate contact with a small volume of standard acid, the excess of which is subsequently titrated. The air first passes through a U-tube of comparatively small diameter, containing the acid, and then into a long vertical tube which gradually widens and then tapers again towards the top ; much acid is carried into this tube by the rapid air current, and by reason of the whirling motion which is produced and the downward counter-current of liquid particles separating in the upper part of the tube, the last portion of the ammonia is washed out. The complete separation of suspended acid particles from the air is effected in sloping tubes, alternately of large and small diameter, which constantly alter the rate of flow of the air and secure the deposition of the last traces of acid, which drains back towards the U-tube.—F. Sodn.

Sulphates ; Volumetric determination of ——. A. D. Mitchell and C. Smith. Chem. Soc. Proc., 1909, **25**, 291.

The method consists essentially of adding a small excess of *N*/5-barium chloride solution, destroying mineral acid by sodium acetate, adding excess of *N*/10-ammonium bichromate solution, and making up to 100 c.c. ; when the precipitate has settled, 25 c.c. of the clear supernatant liquid are titrated with *N*/20-ferrous ammonium sulphate solution, using potassium ferricyanide as an external indicator. This has been applied to ammonium sulphate, potassium sulphate, zinc sulphate, magnesium sulphate and copper ammonium sulphate, and gives results accurate to about 0·2 per cent., although in the case of potassium sulphate special precautions have to be adopted to minimise absorption. Excluding weighings, five determinations may easily be made in an hour.

Arsenites ; Detection of —— in presence of arsenates. E. Covelli. Boll. Chim. Farm., 1909, 623 Rép. Pharm., 1909, **21**, 505.

Contrary to the statements of Fresenius and of Dragendorff, it is impossible to reduce arsenate to arsenite in the presence of free alkali, with any reducing agent. In fact, the following (modified Gutzeit) method may be employed to detect arsenite in arsenate :—Five c.c. of the solution are treated with two pieces of solid caustic potash ; a fragment of granulated zinc and a small piece of fine iron wire are immersed in the alkaline liquid, the metals being in contact. If there be no arsenite present, the evolution of hydrogen will be slow, and the surface of the zinc will remain bright : no black stain will appear on ammoniacal silver nitrate test-paper brought into contact with the gas evolved. In presence of traces of arsenite, hydrogen is rapidly evolved, the metals are darkened, and the test-paper gives a positive reaction for arsenic.—J. O. B.

Lead ; Very rapid method of determining —— in the wet way. J. F. Sacher. Chem.-Zeit., 1909, **33**. 1257—1258.

For the rapid estimation of lead in its oxides and other compounds, in lead residues, solder, etc., the molybdate method, carried out in the following manner, is recommended. An excess of ammonia is added to the solution, which is then acidified with acetic acid, and the hot solution titrated with ammonium molybdate, using tannin as indicator in the known manner. The ammonium molybdate solution is prepared by dissolving 8·580 grms. of the commercially pure salt and making up to 1 litre ; the solution is standardised with pure lead nitrate. In all titrations a correction must be made for the volume of molybdate required to produce the yellow colour with tannin, when the given volume of liquid is used but no lead is present, this volume being subtracted from that of the molybdate previously found ; the amount of lead present does not affect this correction, but the lead concentration should lie between 0·15 and 1·5 per cent. An alcoholic solution of tannin may be used as indicator, or a freshly prepared aqueous solution, containing 0·3 per cent. of tannin. The precipitate of lead molybdate may, if desired, be weighed, after moderate ignition, as $PbMoO_4$.—F. Sodn.

Lead ; Electroanalytical determination of —— as peroxide. H. J. S. Sand. Faraday Soc., Nov. 30, 1909. [Advance proof.]

The author has carried out experiments to elucidate the behaviour of a lead peroxide anode deposit on drying and to study the effect of varying conditions on its nature generally. It is found, as with metal deposits, that the higher the temperature and the smaller the current-density, the more coherent is the deposit, but too much nitric acid must be avoided, and it is specially important to remove any oxides of nitrogen, which may be present, by evaporating the electrolyte to dryness before a determination ; the temperature should be kept below 97° C. Large quantities of ammonium nitrate appear to render the precipitate of peroxide loose, and when colloids (such as colloidal metallic oxides produced by the hydrolysis of salts) are present, small amounts of the colloid are precipitated with the peroxide. At about 200° C. the deposit is capable of absorbing moisture in a damp atmosphere and only parts with it very slowly by continued heating in a dry atmosphere. Special precautions must therefore be taken to remove moisture from the atmosphere of the drying oven, but a simple method of obtaining satisfactory results is to adopt the procedure made use of for metals, *viz.*, to dip the electrode first into alcohol and then into ether, and to dry it rapidly over a Bunsen burner. The electric current itself is made use of to keep the deposit free from water by electric endosmose, a high temperature of the electrolyte and high current density being the conditions for securing a satisfactory result. The absorption of water is not rapid enough to cause an increase of weight during the operations of disconnecting, and no error need be feared if the ether should burn for an instant after accidental ignition during the process of drying. The electrodes employed in the experiments were those previously described (this J., 1908, 963), the outer electrode being the anode, and with such, for a temperature of about 90° C. and a current strength of 5 ampères, the factor 0·863 may be taken ; for a temperature of 95°—97° C. the factor is 0·865.—F. Sodn.

Manganese ; Determination of —— by the method of Volhard and Wolff. W. M. Fischer. Z. anal. Chem., 1909, **48**. 751-760.

The method is a modification of that devised by Volhard and Wolff, and is claimed to give accurate results in the presence of chlorides and when titrating with a solution of permanganate standardised by oxalic acid, without the use of a correcting factor. A solution of a manganous salt, containing hydrochloric or sulphuric acid, is treated as follows : Sodium hydroxide is added until a slight precipitate appears ; this is redissolved with a few drops of sulphuric acid, 1 grm. of freshly ignited zinc oxide and 10 grms. of zinc sulphate are added, and the solution is titrated with permanganate, with frequent boiling and shaking. Then 1 c.c. of pure glacial acetic acid is added and the liquid is boiled : this discharges the pink colour, apparently owing to the liberation of adsorbed manganous salt from the precipitate, which becomes flocculent and settles, and the liquid is again titrated until the pink colour is restored, the total volume of permanganate used being taken as that required to react with the manganese. If sulphates only be present, about 10 grms. of zinc sulphate are added for every 10 c.c. of $N/10$ permanganate used. Iron when present, as in the analysis of ferromanganese, is, as usual, precipitated with zinc oxide, and manganese is determined in the filtrate.—F. Sodn.

Chromium; Determination of —— gravimetrically. The quantitative hydrolysis of sesquioxides. W. Schoeller and W. Schrauth. Chem.-Zeit., 1909, **33**, 1237.

Although incapable of directly decomposing a chromium salt in solution, aniline, by combining with the acid liberated by the hydrolysis of the salt, leads to the quantitative precipitation of the metal as hydroxide, thus furnishing a method which is claimed to be the most accurate of existing processes for the gravimetric estimation of chromium. The boiling neutral solution, containing 0·1—0·2 grm. of chromium in about 300 c.c., is mixed with 1 c.c. of aniline, in three portions, and the well-stirred solution is boiled for 5 minutes; the precipitate is allowed to settle for 5 minutes on the water-bath, and is then washed and ignited in the usual way. Good results are obtained by this method in the presence of alkali salts, and it may be utilised for determining chromium in the presence of manganese.—F. Sodn.

Electro-analysis; Use of aluminium dishes and other appliances in ——. J. Formanek and F. Pec. Chem.-Zeit., 1909, **33**, 1282–1283.

The authors consider that aluminium dishes, made of sheet metal, 0·6 mm. thick, and plated inside with very thin sheet copper, are suitable for replacing platinum vessels in the quantitative determination of certain metals: copper, cadmium, silver, antimony, tin, iron and nickel. In the case of cadmium it was observed that the silvery coating deposited on the dish, vanished as soon as the whole of the cadmium was separated, leaving the copper again visible. For tin and antimony the dish was tinned by means of tin-ammonium oxalate, to prevent the ammonium- or sodium sulphide reagent from blackening the copper; and the same treatment can also be adopted in the case of iron. For zinc the copper may be silver-plated. The further determination of the deposited metals may be either performed in the dish, or by removing the deposit with fine emery paper, or dissolving it off carefully with dilute acid (iron). A strengthening coating of silver or copper may be deposited inside the dish by passing a current of 0·15 ampère through a suitable electrolyte for 8-10 hours. Holes burned in the dish may be filled with tin solder and re-plated with copper. For rapid analyses the inside of the dish may be provided with four small lugs (also used in platinum dishes), 12 mm. long and 4 mm. thick, which prevent the electrolyte from overflowing under the centrifugal force exerted by the electrode, and divert the liquid back toward the anode. The dish is covered with a watch glass in which a radial slit has been cut as far as the central bore, to facilitate handling.

For maintaining a constant current, variation resistances are preferred to ordinary rheostats, and are screwed into a glow-lamp resistance, no tentative adjustment being then required.

The rotation of the electrode is effected by inserting the latter in a 2-mm. metal tube, where it is clamped by a screw, the tube being connected at the top with the motor by means of a flexible steel shaft, or a small pulley and cord.—C. S.

Separation of arsenic and antimony. Smith. *See* X.

Use of flash point method in the analysis of beeswax. Stoeber. *See* XII.

Chroming of hide powder, acidity of hide powder, and rapid cooling of tannin solutions. Eachus. *See* XV.

Determining acidity in hide-powder. Tucker. *See* XV.

Determining phosphoric acid in basic slags and natural phosphates. Guerry and Toussaint. *See* XVI.

Determination of sugar in fresh cossettes. Pellet. *See* XVII

Use of zinc nitrate in the determination of sugar in saturation mud. Stanek. *See* XVII.

Margarine clause of Food and Drugs Act, 1899. *See* XIX*A*.

Test for saccharin in foods and beverages. Genth, jun. *See* XIX.*A*.

Detecting Bombay mace. Gladhill. *See* XX.

Determining essential oil and moisture in spices and aromatic drugs. Cripps and Brown. *See* XX.

Determining mercuric iodide in ointments. Adam. *See* XX.

Patents.

Calorimeter [; Gas—]. C. Féry. Fr. Pat. 404,131 June 17, 1909.

The calorimeter consists of a chamber in which a jet of gas is burned at a rate controlled automatically, so that the temperature difference between the products leaving the calorimeter and the air entering it is constant and equal to some predetermined value. The calorific power of the gas is then inversely proportional to the consumption of gas per unit of time. Several thermostatic devices are described. In one form the gas-cock is actuated through worm gearing by an electro-motor. This motor replaces the galvanometer of a Wheatstone bridge, and runs in one direction or the other to open or close the cock, according as the temperature difference between two resistance coils forming adjacent arms of the bridge, and arranged in the calorimeter inlet and outlet, is less or greater than the desired value. In another arrangement, a motor is run continuously by the current from thermo-couples placed in the calorimeter inlet and outlet. This motor drives one member of a differential gear at a speed varying with the temperature difference between the couples; the other member of the differential gear is driven at a constant speed by clockwork, and when the speeds of these two members differ, the resulting movement of the planet wheel which gears with both is used to move the gas-cock. In a further arrangement, the E.M.F. due to the thermo-couples is opposed by a constant E. M. F. due to a potentiometer or to a thermopile in which the hot and cold junctions are kept in steam and in melting ice. Any difference in the opposed electro-motive forces drives a motor in one or other direction and actuates the gas-cock. Finally, if it is desired to avoid the use of coils or couples in the outlet for the products of combustion, an anemometer wheel may be suspended in the air inlet by a torsion thread forming part of the circuit of the motor, so that a pointer carried by the lower end of the thread hangs freely between two terminals when the desired temperature difference is established, but closes one or other of two circuits to drive the motor in one or other direction when the temperature difference, and consequently the speed of the air current, increases or decreases.—A. T. L.

Measuring the calorific value of solid fuel. Fr. Pat. 403,413. *See* II. *A*.

Trade Report.

Tariff changes in Canada. Board of Trade J., Dec. 30, 1909.

According to a Memorandum, dated Nov. 1, 1909, issued by the Department of Customs, Ottawa, metallic elements and tungstic acid, when imported by manufacturers for use only in the manufacture of metal filaments for electric lamps, antimony salts for dyeing, and hyposulphite of soda when imported by tanners for use in the tanning of leather, may enter free of duty. The duty on preparations made from pyroxylin and wood naphtha, when imported by manufacturers for use in the coating of imitation leather, has been fixed at 5 per cent. *ad val.* under the British preferential tariff, and 10 per cent. *ad val.* under the General tariff.

Netherlands; Import duties. Board of Trade J., Dec. 23, 1909.

The following rates of duty have been fixed by a Decree of the Dutch Ministry of Finance, dated Nov. 1, 1909:—

Articles.	Rate of Duty.
Leather polish, consisting of a solution of shellac in water, to which borax and ammonia have been added, besides a dyewood extract and an albuminous substance, dutiable as—	
"Paints ground in oil"............	5% *ad val*
Chlorine water in any packing	Free.
Laevulose in powder form, dutiable as "loaf and lump sugar," &c. .	27 Florins per 100 kilos.

Books Received.

Chemisch-technische Untersuchungsmethoden: Herausgegeben von Dr. G. Lunge, emer. Prof. der techn. Chemie am Eidgenöss Polytechnikum in Zürich, und Dr. E. Berl, Privatdozent für allgem. und techn. Chemie am Eidgenöss. Polytechn. in Zürich. Erster Band. Sechste, vollständig umgearb. und vermehrte Auflage. Verlag von J. Springer, Berlin, 1909. Price M. 18, bound, M. 20.

8vo volume containing 651 pages of subject matter, with 163 illustrations, alphabetical indexes of authors' names and of subjects, and an appendix consisting of tables. The text is classified as follows, the names of the colleagues who assisted the editors being given in brackets. General part (Dr. G. Lunge and Dr. E. Berl). I. Sampling. II. General laboratory operations. III. Volumetric analysis. IV. Gas analysis. V. Areometry (specific gravity determinations). VI. Measurement of draught and pressure. VII. Measurement of heat. VIII. Calculation of analyses. Special part. Technical gas analysis (Dr. G. Lunge and Dr. E. Berl). Examination of solid fuels (Dr. F. Fischer and Dr. G. Lunge). Manufacture of sulphurous, nitric, and sulphuric acids (Dr. G. Lunge and Dr. E. Berl). Manufacture of sodium sulphate and hydrochloric acid (Dr. G. Lunge and Dr. E. Berl). Manufacture of soda (Dr. G. Lunge and Dr. E. Berl). Chlorine industry (Dr. G. Lunge and Dr. E. Berl). Potassium salts (Dr. L. Tietjens). Liquefied and compressed gases (Dr. E. Berl).

Beet-Sugar Making and its Chemical Control. By Y. Nikaido, B.Sc., M.A. Chemical Publishing Co., Easton, Pa., U.S.A. Williams and Norgate, 14, Henrietta Street, Covent Garden, London. 1909. Price, 3 dols.

8vo volume containing 341 pages of subject-matter, with 65 illustrations, and an alphabetical index. The chapter-headings are as follows:—I. Definitions of chemical terms. II. Non-metallic elements. III. Metallic elements. IV. Organic chemistry. V. Cane-sugar. VI. Polariscope and its accessories. VII. Chemical apparatus and general methods for sugar analysis. VIII. Practical operation of beet-sugar house. IX. Special analysis. An appendix contains tables for: corrections of Brix degrees for variations of temperature; comparison of degrees Brix and Baumé, and of specific gravity of sugar solutions at 17·5° C.; per cent. of sucrose calculated for the 110 c.c. volume method; per cent. of sucrose calculated for the 110 c.c. volume method and purity of dilute juices (7·1° to 27·0° Brix) and Brix of undiluted thick syrups; per cent. of sucrose calculated for the 110 c.c. volume method and purity of osmose waste water; amount of calcium oxide in milk of lime of various densities.

Sprechsaal-Kalender für die Keramischen, Glas- und verwandten Industrien. Herausgegeben von Dr. J. Koerner. Verlag von Müller und Schmidt, Coburg, 1910. Price M. 2.50.

Small volume, of pocket-book size and form, bound in linen. It contains a calendar with blank pages subdivided for each day of the year, and 126 pages of subject matter, containing miscellaneous information likely to be of service to those engaged in the ceramic, glass, and allied industries.

Kolloidchemische Beihefte (Ergänzungshefte zur Kolloid-Zeitschrift). Monographien zur reinen und angewandten Kolloidchemie, herausgegeben von Dr. W. Ostwald. Band I. Heft 1 u. 2. Verlag von T. Steinkopf, Dresden, Germany. 1909. Price M. 2.40.

This 8vo volume contains a monograph on the tanning process by J. von Schroeder (see this J., 1909, 1278), and one on an electrical method for the measurement of changes produced in chromated gelatin films by the action of light, by H. Mayer (see this J., 1909, 412).

Tanners' and Chemists' Handbook. By L. E. Levi, A.M., Ph.D., and E. V. Manuel, S.B. S. E. Tate Printing Co., Broadway, Milwaukee, U.S.A. 1909. Price, 5 dols. post paid.

8vo volume containing 351 pages of subject-matter, including an English-German and German-English dictionary of tanning terms, occupying 83 pages, and an alphabetical index. The book contains tables useful for analytical purposes; methods for the analysis of tanning materials, leather, and substances used in the tanning industry; short descriptions of tanning materials; notes on the dyeing of leather; a number of miscellaneous recipes, etc. etc.

Introduction to Experimental Inorganic Chemistry. Authorised translation from the German of H. Biltz, by W. T. Hall and J. W. Phelan. J. Wiley and Sons, New York. Chapman and Hall, London. 1909. Price 1.2 dols. or 5s. 6d. net.

12mo volume containing 185 pages of subject-matter with 15 illustrations. The text is classified as follows:—Filters and filtration. Manipulation of glass. Use of the blowpipe. Cork boring. First group of acids and negative elements (anions). Bases. Second group of acids.

Royal Commission on Canals and Waterways. Vol. VII. Fourth and Final Report (England and Wales, and Scotland) of the Royal Commission appointed to enquire into and to report on the Canals and Inland Navigations of the United Kingdom. [Cd. 4979.] Wyman & Sons, Fetter Lane, London, E.C. Price 2s. 11d.

New Books.*

Austin, L. S.: The metallurgy of common metals, gold, silver, iron, copper, lead, and zinc. 2nd ed., rev. and enl. San Francisco, Mining and Scientific Press. 1909. 494 p. il. O. cl., $4.

Bornemann, Dr. K.: Die binären Metallegierungen. (In 3 Tln.) I. Tl. (56 S. m. 8 Taf. u. Ableselineal.) Lex. 8°. Halle, W. Knapp. 1909. M. 7.

Dolezel, Prof. F.: Grundzüge der Tonwaren-Industrie. Zum Gebrauche an fachl. Fortbildungsschulen f. Oefner u. Töpfer. (Lehrtexte f. Fachschulen.) IV..47 S. m. 18 Abbildgn. 8°. Wien, A. Hölder. 1909. Boards. 85 Pf.

Ewell, A. W.: A text-book of physical chemistry; theory and pracitice; with 102 il. and 63 tables. Philadelphia. P. Blakiston's Sons & Co. 1909. c. 9+370 p. O. cl., $2.25 net.

Feit, W.: Ueber die Darstellung des Chlorkaliums aus Hartsalz. [Aus: "Kali."] (83 S.) 8°. Halle, W. Knapp. 1909. M. 2.40.

Fischer, Emil: Introduction to the Preparation of Organic Compounds. Translated with the Author's sanction from the new (eighth) German ed. by R. V. Stanford. With 19 Figures in the Text. Cr. 8vo, pp. xix.—175. London, Williams and Norgate. 1909. Net 4s.

Fowler, A.: The Spectrum of Magnesium Hydride. 4to, sd. London. Dulau. 1909. Net 2s. 6d.

Gerlach, Dr. V.: Physiologische Wirkungen der Benzoesäure u. des benzoesauren Natron. (V, 95 S. m. 15 Taf.) gr. 8°. Wiesbaden, H. Staadt. 1909. M. 5.

Gille, P.: Physique, Electricité, Chimie. In-8. Paris, Challamel. 1909. Boards. 7 fr. 50.

Gooch, F. A., and *Browning*, P. E.: Outlines of qualitative chemical analysis. 2nd ed., rev. New York, John Wiley & Sons, 1909. 6+145 p. 8°. cl. $1.25 net.

Haenig, A.: Der Schmirgel u. seine Industrie. Eine techn. Studie über moderne Schleifmittel u. die Entwicklg. der Schleifmaschinenindustrie. VIII., 112 S. m. 45 Abbildgn. 8°. Wien A. Hartleben. 1910. M. 3, cloth M. 3.80.

Hale, W. J.: The calculations of general chemistry; with definitions, explanations, and problems. New York, D. Van Nostrand Co., 1909. c. 7-9+174 p. 12. cl., $1.

König, Prof. J.: Chemie der menschlichen Nahrungs- u. Genussmittel. III. Bd. Untersuchung v. Nahrungs-, Genussmitteln u. Gebrauchsgegenständen. 4., vollständig umgearb. Aufl. In Gemeinschaft m. Dr. A. Bömer, Prof. Fr. Goppelsroeder, Dr. J. Hasenbäumer u. a. bearb. 1. Tl. Allgemeine Untersuchungsverfahren. (XIV, 772 S. m. 405 Abbildgn.) gr. 8. Berlin, J. Springer. 1910. Half mor., M. 26.

Lampa, A.: Ueber Absorption u. Brechung des Lichtes in kolloidalen Metallösungen, speziell in kolloidalen Goldlösungen. [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (17 S.) gr. 8°. Wien. A. Hölder. 1909. 55 Pf.

Leavens, G. D.: A discussion of methods for determining the availability of phosphoric acid in Thomas phosphate powder (basic slag phosphate); with a complete transcript of Wagner's method. [New York, Coe-Mortimer Co., 24 Stone Street.] [1909.] 1908.39 p. il. tabs., O. pap. (Add. publishers for price.)

Lockemann, Dr. G.: Die Beziehungen der Chemie zur Biologie u. Medizin. (30 S.) gr. 8°. Heidelberg, C. Winter, Verl. 1909. 80 Pf.

Mindes, J.: Die Selbstbereitung pharmazeutischer Spezialitäten. 2., verm. Aufl. (IV. 52 S.) kl. 8°. Wien, F. Deuticke. 1909. M. 1.50.

Moser, Dr. L. Die Bestimmungsmethoden des Wismuts u. seine Trennung v. den anderen Elementen. (126 S.) Sammlung v. Einzeldarstellgn. auf dem Gebiete der chem., technisch-chem. u. physikalisch-chem. Analyse. X. Bd. Hrsg. v. Dr. B. M. Margosches. Lex. 8°. 1909. Stuttgart, F. Enke. M. 4, cloth M. 4.60.

Nahrungsmittelbuch, Deutsches. Hrsg. vom Bunde deutscher Nahrungsmittel-Fabrikanten u. -Händler E. V. 2. vielfach geänd. u. verm. Aufl. (VII., 408 S.) gr. 8°. Heidelberg, C. Winter, Verl. 1909. M. 10.40, cloth 11.50.

Passon, M.: Handwörterbuch der Agrikulturchemie. 2 Bde. Leipzig, W. Engelmann. 1909. About M. 24.

Perkin, W. H., and *Lean*, B.: An Introduction to Chemistry and Physics. 12mo., pp. 236. London, Macmillan. 1909. 3s. 6d.

Prag, E.: A course in dyeing for garment dyers. Philadelphia. Modern Dyer and Cleaner Publishing Co. [1909.] 4+90 p. il. 8°, $5.

Richards, R. H.: Text book of ore dressing. New York, McGraw-Hill Book Co. 1909. 700 p. il. 8°. cl., $5 net.

Schmatolla, E.: Die Brennöfen f. Tonwaren, Kalk, Magnesit, Zement u. dergl. m. besond. Berücksicht. der Gas-Brennöfen. 2., verm. u. umgearb. Aufl. (VI., 151 S. m. 150 Abbildgn.) 8°. Hannover, Dr. M. Jänecke. 1909. M. 5, cloth M. 5.80.

Tangl, Prof. F.: Arbeiten aus dem Gebiete der chemischen Physiologie. [Aus: "Archiv f. d. ges. Physiol."] 5. Heft. (III., 192 S.) gr. 8°. Bonn, M. Hager. 1909. M. 9.

Tröger, J., and *Bauer*, E.: Jahresbericht üb. die Fortschritte der Chemie u. verwandter Teile anderer Wissenschaften. Begründet v. J. Liebig u. H. Kopp. Für 1905—1908. 1. Heft. (S. 1—240.) gr. 8°. Braunschweig, F. Vieweg & Sohn. 1909. M. 12.

Weber, F.: Untersuchungen üb. die Wandlungen des Stärke- u. Fettgehaltes der Pflanzen, insbesondere der Bäume. Ausgeführt im pflanzenphysiolog. Institut der k. k. Wiener Universität. [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (65 S.) gr. 8°. Wien, A. Hölder. 1909. M. 1.75.

Zerr, G., u. *Rübencamp*, Dr. R.: Handbuch der Farbenfabrikation. Lehrbuch der Fabrikation, Untersuchg. u. Verwendg. aller in der Praxis vorkomm. Körperfarben. Mit zahlreichen Abbildgn. u. Tabellen. 2. neubearb. u. verm. Aufl. (XVI., 878 S.) gr. 8°. Berlin, Union, Zweigniederlassg. M. 28, cloth M. 30.

Zipser, Prof. J.: Die textilen Rohmaterialien u. ihre Verarbeitung zu Gespinsten. (Die Materiallehre u. die Technologie der Spinnerei.) Ein Lehr- u. Lernbuch f. textile, gewerbl. u. höhere techn. Schulen sowie zum Selbstunterrichte. Auf Grund des Normallehrplanes u. der Instruktion f. den technolog. Unterricht an k. k. Webschulen. I. Tl.: Die textilen Rohmaterialien. Mit 40 Orig.-Zeichngn. im Texte. 4. Aufl. (IX., 101 S.) gr. 8°. Wien. F. Deuticke. 1909. M. 1.50.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London W.C., from whom all the works in foregoing list can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

APPLICATIONS.

29,755. Caldecott. *See under* X.

29,764. Wilton. Furnaces. Dec. 20.

29,780. Krüger. Production of crystals.* Dec. 20.

29,879. Collard. Recovery of by-products contained in the state of gas or vapour in the atmosphere of works.* Dec. 21.

30,069 and 30,070. Haddan (Aktiebolaget Separator). Centrifugal separators with filtering apparatus.* Dec. 23.

30,080. Tiemann. Purification of solutions. [Addition to No. 25,644 of 1908.]* Dec. 23.

30,247. Hartley. Vacuum filters. Dec. 28.

30,363. Rusdell. Apparatus for transmitting heat between fluids. Dec. 29.

30,540. Brownlow. Separating liquids from solids by centrifugal force. Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

27,939 (1908). Jones. Centrifugal machines for separating liquids from solids. Dec. 30.

8493 (1909). Wedge. Furnaces having superposed working chambers. Dec. 31.

13,034 (1909). Schmidt. Liquefying and separating mixtures of gas. Dec. 30.

16,198 (1909). Kyll. Rectifying columns. Dec. 30.

18,742 (1909). Makin. *See under* XVIII.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

APPLICATIONS.

29,752. Evans. Purification of coal gas and like gases. Dec. 20.

29,930. Fabry. Removing tar from coke-oven gas, retort gas, &c.* Dec. 22.

30,148. Von Unruh. Manufacture of incandescing bodies for use in gas lighting.* Dec. 24.

30,198. Johnson (Maschinen u. Armaturenfabr. vorm. H. Breuer und Co.). Controlling the flow of gases, especially from coal-distilling retorts.* Dec. 24.

30,229. Boult (Groeling). Utilisation of natural gases or petroleum distillation gases.* Dec. 24.

30,396. Parker. Destructive distillation of coal. Dec. 29.

Complete Specifications Accepted.

23,013 (1908). Wilton. Purification of gas obtained by distillation of carbonaceous materials and recovery of by-products. Dec. 31.

28,135 (1908). Laigle. Incandescent gas filaments. Dec. 31.

71 (1909). Robin. Incandescent gas mantles. Dec. 31.

282 (1909). Coolidge. Manufacture of refractory electric conductors. Dec. 31.

1629 (1909). Lewes. Incandescent gas mantles. Dec. 31.

6411 (1909). Jones. Purifying and revivifying spent or waste lime. Dec. 30.

11,442 (1909). Gewerkschaft der Steinkohlenzeche Mont Cenis. *See under* VII.

12,467 (1909). Haddan (Bruno-Patente-Verwerthungsges.). Manufacture of incandescence bodies. Dec. 30.

16,961 (1909). Köhn. Firing furnaces with tar and other heavy hydrocarbon liquids. Dec. 31.

IV.—COLOURING MATTERS AND DYES.

Applications.

29,794. Johnson (Badische Anilin und Soda Fabrik). Manufacture of halogenated indigo colouring matters and derivatives thereof. Dec. 30.

30,197. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable indigo-white preparations. Dec. 24.

30,297. Newton (Bayer und Co.). Manufacture of azo dyestuffs. [Addition to No. 1397 of 1909.] Dec. 28.

30,480. Ullmann. Manufacture of anthraquinone derivatives. [Ger. Appl., March 15, 1909.]* Dec. 30.

30,504. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. Dec. 30.

Complete Specifications Accepted.

1600 (1909). Newton (Bayer und Co.). Manufacture of dyestuffs of the gallocyanine series. Dec. 30.

6727 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a monoazo dyestuff for chrome-mordanted wool. Dec. 31.

6992 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of halogenated indigo colouring matters. Dec. 30.

7820 (1909). Newton (Bayer und Co.). Manufacture of acid wool dyestuffs. Dec. 30.

9908 (1909). Newton (Bayer und Co.). Manufacture of a new dyestuff. Dec. 30.

V.—FIBRES: TEXTILES: CELLULOSE; PAPER.

Applications.

29,991. Schwalbe. Refining all kinds of celluloses or ligneous fibres.* Dec. 22.

30,337. Müller. Rendering cardboard or pasteboard impervious to light liquids and grease. Dec. 28.

30,510. Gebauer. Manufacture of artificial silk and fabrics thereof.* Dec. 30.

Complete Specifications Accepted.

27,676 (1908). Pfiel and Siebert. Process for obtaining textile fibres. Dec. 30.

28,163 (1908). Malcolmson (De Lamarre). Treatment of megasse and other vegetable fibre. Dec. 30.

12,976 (1909). Reeser. Manufacture of sheets or objects from acetylcellulose. Dec. 31.

15,107 (1909). Hentschel. Drying paper webs coated on both sides. Dec. 31.

15,190 (1909). Brandenberger. Manufacture of cellulosic films. Dec. 30.

VI.—BLEACHING: DYEING: PRINTING: FINISHING.

Applications.

29,723. Warburton. Appliances for bleaching or dyeing yarn in the cop, cheese, or other dense form. Dec. 20.

29,925. Denman. Colour printing on fabrics and the like. Dec. 22.

30,243. Warburton, and Cass. Dyeing machines for cops, cheeses, and similar dense bodies of yarn. Dec. 28.

30,273. Brickhill and Barnes. Cotton fabrics dyed with aniline black. Dec. 28.

30,505. Johnson (Badische Anilin und Soda Fabrik). Discharging dyed material and pastes therefor. Dec. 30.

Complete Specifications Accepted.

6031 and 13,483 (1909). Robertson. Calico printing machines. Dec. 30.

22,986 (1909). Platt, and Times Coloured Spinning Co. Apparatus for dyeing and similarly treating textile material on bobbins, &c. Dec. 30.

VII. ACIDS, ALKALIS, SALTS: NON-METALLIC ELEMENTS.

Applications.

29,795. Johnson (Chem. Fabr. Griesheim-Elektion). Manufacture of alkali metals. Dec. 20.

29,962. Falk. *See under* XIII.

30,151. Blake and Smart. Kilns for revivifying animal charcoal, &c.* Dec. 24.

30,196. Raschen, Imison, and United Alkali, Co. Purification of arsenical sulphuric acid and obtaining arsenic therefrom. Dec. 24.

30,323. Rollin, and Hedworth Barium Co. Manufacture of barium oxide. Dec. 28.

30,324. Peniakoff. Manufacture of alkali aluminates.* Dec. 28.

30,339. Soc. Anon. pour l'Utilisation de l'Air et ses Dérivés. Purification of barium carbonate. [Fr. Appl., Jan. 21, 1909.]* Dec. 28.

30,359. Burns. Manufacture of sulphuric acid and plasters or cements from anhydrites. Dec. 29.

30,379. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable anhydrous hydrosulphites. Dec. 29.

30,380. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. [Comprised in No. 15,641 of 1909.] Dec. 29.

30,386. Herve. Manufacture of soda crystals.* Dec. 29.

30,502. Johnson (Badische Anilin und Soda Fabrik). Manufacture of nitrate. Dec. 30.

30,503. Johnson (Badische Anilin und Soda Fabrik). Removal of nitrous acid from solutions. Dec. 30.

Complete Specifications Accepted.

25,208 (1908). Greenwood. Electrolytic decomposition of alkaline salts. Dec. 30.

27,587 (1908). Rollin, and Hedworth Barium Co. Manufacture of anhydrous barium hydrate. Dec. 30.

27,592 (1908). Hazard-Flamand. Dividing air into its elements by fractional distillation. Dec. 30.

27,774 (1908). Riiber. Production of phosphate precipitates. Dec. 30.

28,674 (1908). Dewrance and Williams. Manufacture of alkaline cyanides. Dec. 30.

5799 (1909). Comp. Gén. d'Electro-Chimie de Bozel. Manufacture of metallic silicides. Dec. 30.

6411 (1909). Jones. *See under* II.

11,275 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of calcium nitrite. Dec. 31.

11,442 (1909). Gewerkschaft der Steinkohlenzeche Mont Cenis. Manufacture of ammonium sulphate from distillation gases. Dec. 30.

23,645 (1909). Meyer, and Soc. Chim. des Usines du Rhône. Manufacture of zinc sulphide. Dec. 31.

VIII.—GLASS; CERAMICS.

Applications.

30,220. Thompson. Manufacture of glass from cheap material. Dec. 24.

30,233. Helliwell and Helliwell. Manufacture of abrading or polishing powders. Dec. 24.

Complete Specification Accepted.

5722 (1909). West and Lewis. Potters' kilns or ovens. Dec. 31.

IX.—BUILDING MATERIALS.

Applications.

29,753. Poths. Rotary kilns for burning cement. [Addition to No. 13,440 of 1908.]* Dec. 20.

29,990. Elliott. Drying or seasoning timber. Dec. 22,

30,259. Stephenson and Duerden. Kilns for burning bricks and tiles. Dec. 28.

30,330. Matcham and Gale. Lithographic stone. Dec. 28.

30,359. Burns. *See under* VII.

X.—METALS; METALLURGY INCLUDING ELECTRO-METALLURGY.

APPLICATIONS.

29,755. Caldecott. Separating liquid from crushed ore products or other granular material.* Dec. 20.

29,779. Von Schlippenbach. Apparatus for continuous oxidation, reduction, or other treatment of ores, &c. [Ger. Appl., Jan. 23. 1909.]* Dec. 20.

29,916. Portheim. Alloying lead and aluminium. Dec. 22.

30,182. Sulman and Picard. Recovery of oxidised mineral substances. Dec. 24.

30,341. Johnson. Extraction of gold and other metals from their ores. Dec. 28.

30,377. Cito. Smelting silver-nickel-cobalt and arsenic ore.* Dec. 29.

30,425. Marks (Colorado Iron Works Co.). Treatment of ores.* Dec. 29.

COMPLETE SPECIFICATIONS ACCEPTED.

28,508 (1908). Stewart. Treatment of alloys of tin and copper to separate the metals. Dec. 31.

28,509 (1908). Stewart. Treatment of tin alloys containing silver to separate the metals. Dec. 31.

28,551 (1908). Jensen (Spitz). Separating tin or other metals from waste metal, old metal ware, alloys, &c. Dec. 31.

6138 (1909). Steinweg. Soldering aluminium and metals rich in aluminium. Dec. 30.

13,553 (1909). Gayley. Drying air particularly for use in metallurgy. Dec. 31.

XI.—ELECTRO-CHEMISTRY.

APPLICATIONS.

29,706. Luckow. Method of regenerating storage batteries.* Dec. 20.

30,463. Schulte. Apparatus for electrolytically removing the grease from objects to be galvanised.* Dec. 30.

30,603. Wassmer. Thermally treating substances of inferior conductivity. Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

25,208 (1908). Greenwood. *See under* VII.

2128 (1909). British Thomson-Houston Co. (General Electric Co.). Electric insulating material. Dec. 31.

XII.—FATS; OILS; WAXES.

COMPLETE SPECIFICATION ACCEPTED.

17,271 (1909). Filbert. Cottonseed oil and food compounds of which cottonseed oil is an ingredient. Dec. 30.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

29,886. Marks (Southern Manufacturing Co.). Extraction of turpentine, oils, and other products from wood.* Dec. 21.

29,962. Falk. Manufacture of white lead.* Dec. 22.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

APPLICATIONS.

29,864. Dreyfus, Friedl, Bentley, and Clayton Aniline Co. Recovery of rubber from old or waste vulcanised rubber. Dec. 21.

30,447. Cockerill. Production of india-rubber. Dec. 30.

XV.—LEATHER; BONE; HORN; GLUE.

APPLICATION.

30,272. Winterbottom and Barnes. Manufacture of imitation leather. Dec. 28.

COMPLETE SPECIFICATION ACCEPTED.

12,211 (1909). Prutz. Leather and process of manufacturing same. Dec. 31.

XVI.—SOILS; FERTILISERS.†

COMPLETE SPECIFICATION ACCEPTED.

26,867 (1909). Mines de Manganese de Las Cabesses. Stimulant manure having a base of oxide of manganese. Dec. 30.

XVII.—SUGARS; STARCHES; GUMS.

APPLICATION.

30,390. Holste. Bleaching-starch.* Dec. 29.

COMPLETE SPECIFICATION ACCEPTED.

17,637 (1909). Steel. Manufacture of invert sugar and glucose in transportable form. Dec. 30.

XVIII.—FERMENTATION INDUSTRIES.

APPLICATIONS.

29,757. Black and Levin. *See under* XIX.

30,181. Boult (Wahl). Manufacture of fermented hopped beverages.* Dec. 24.

30,223. Buxton. Using hops in brewing beer. Dec. 24.

30,224. Buxton. Conditioning beer for bottling. Dec. 24.

30,476. Whitaker. Brewing process. Dec. 30.

30,594. Selton-Jones (Elmassian). Quick malting process. Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

18,742 (1909). Makin. Apparatus for drying brewers' refuse, hops, grains, &c. Dec. 30.

19,257 (1909). Kluge. Production of a denaturing agent for spirits. Dec. 30.

XIX.—FOODS. WATER PURIFICATION; SANITATION.

APPLICATIONS.

29,737. Normandy. Apparatus for water distilling and filtering. Dec. 30.

29,757. Black and Levin. Manufacture of vinegar. Dec. 20.

30,303. Gobbi. Apparatus for purifying water or other liquids. [Fr. Appl., April 19, 1909.]* Dec. 28.

30,397. Henri, Helbronner, and von Recklinghausen. Sterilisation of liquids. Dec. 29.

30,512. Nogier. Sterilising liquids. [Fr. Appl., Feb. 17, 1909.]* Dec. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

28,507 (1908). Bloxam (Thomas). Bleaching or conditioning flour. Dec. 31.

17,271 (1909). Filbert. *See under* XII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

APPLICATIONS.

29,751. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. [Addition to No. 27,030 of 1909.] Dec. 20.

29,787. Busch, and Wulfing und Co. Preparation of salts of guaiacol-sulpho acid.* Dec. 20.

30,592. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. [Addition to No. 28,166 of 1909.] Dec. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

4561 (1909). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of albumose-silver compounds. Dec. 30.

11,108 (1909). Wellcome and Pyman. Manufacture of therapeutic compounds. Dec. 31.

XXI. PHOTOGRAPHIC MATERIALS AND PROCESSES.

COMPLETE SPECIFICATIONS ACCEPTED.

27,687 (1908). Soc. Anon. La Photographie des Couleurs, Sury, and Bastyns. Printing on paper of photographs in colour. Dec. 30.

50 (1909). Duncan. Preparation of plates and films for producing coloured pictures by photography. Dec. 31.

XXII.—EXPLOSIVES; MATCHES.

APPLICATION.

29,882. Claessen. Manufacture of smokeless gunpowder.* Dec. 21.

COMPLETE SPECIFICATION ACCEPTED.

28,544 (1908). Andersen. Explosives. Dec. 31.

XXIII.—ANALYTICAL PROCESSES.

APPLICATION.

30,478. Foster. Pyrometers. [U.S. Appl., Feb. 10, 1909.]* Dec. 30.

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No. 2, Vol. XXIX. JANUARY 31, 1910. No. 2, Vol. XXIX.

Official Notice.

CLASSIFICATION OF JOURNAL AND PATENT LITERATURE.

Since January 1st, 1910, the Journal and Patent Literature has been classified and entitled as follows :—

1. General Plant ; Machinery.
2. A. Fuel ; Gas ; Mineral Oils and Waxes ;
   B. Destructive Distillation ; Heating ; Lighting.
3. Tar and Tar Products.
4. Colouring Matters and Dyes.
5. Fibres ; Textiles ; Cellulose ; Paper.
6. Bleaching ; Dyeing ; Printing ; Finishing.
7. Acids ; Alkalis ; Salts ; Non-metallic Elements.
8. Glass ; Ceramics.
9. Building Materials.
10. Metals ; Metallurgy, including Electro-Metallurgy.
11. Electro-Chemistry.
12. Fats ; Oils ; Waxes.
13. Paints ; Pigments ; Varnishes ; Resins.
14. India-Rubber ; Gutta-Percha.
15. Leather ; Bone ; Horn ; Glue.
16. Soils ; Fertilisers.
17. Sugars ; Starches ; Gums.
18. Fermentation Industries.
19. A. Foods ;
    B. Water Purification ; Sanitation.
20. Organic Products ; Medicinal Substances ; Essential Oils.
21. Photographic Materials and Processes.
22. Explosives ; Matches.
23. Analytical Processes.
24. Miscellaneous Abstracts.

Charles G. Cresswell, *Secretary.*

London Section.

Meeting held at Burlington House, on Monday, January 3rd, 1910.

DR. J. LEWKOWITSCH IN THE CHAIR.

The Chairman referred in feeling terms to the great loss the Society and the Section had suffered through the death of Dr. Ludwig Mond, F.R.S.

THE RELATION BETWEEN THE MINERAL AND THE CHEMICAL INDUSTRIES.

BY GEORGE T. HOLLOWAY.

To adequately deal with this subject would occupy the time of many meetings and necessitate dealing at length with branches which are much better left to individual specialists. So simple a mineral as salt might, for instance, form the basis of a series of papers on the alkali industry, the " mineral " known as clay could be dealt with by those versed in the ceramic, pottery and allied industries and by the furnace builders, &c., and many others among the minerals and mineral substances referred to later, could be similarly treated.

It is my intention, therefore, to consider the subject generally, although—so far as possible—always from the point of view most important to those engaged in chemical industry, and to draw especial attention to the manner in which minerals and mineral aggregates are produced in nature, and the way in which they are originally associated or become associated together.

In their highest state of purity, minerals are definite chemical compounds—chemicals as truly as the manufactured products—but made by natural processes. It is, in fact, now possible to manufacture a large number of " minerals " by artificial means, such products being often so true to nature as to almost defy detection, and many being of considerable commercial importance.

It is true that, in nature, replacements are numerous. the composition of certain minerals being frequently varied and complicated by the partial substitution of one element for another without interfering with their crystalline habit, but the same applies to manufactured chemicals, as is well instanced in the case of the alums. Minerals also so commonly occur in admixture that, although the component minerals may be, and frequently are, chemically pure substances, they require to be separated in order that their respective commercial values may be realized. In the case of the majority of metalliferous minerals, mechanical " dressing " or a preliminary metallurgical or chemical treatment is a necessity.

In the hope of being able to avoid the mere stringing together of a series of isolated facts, and to correlate such details as can be given in the time at my disposal, it is my intention to trace the formation of certain typical minerals from their primary igneous source, the molten magna or its solidified representatives, whose molecules, through natural agencies, have ultimately become rearranged into the forms familiar to the mineralogist. Much matter must be omitted and many important sources of minerals and causes of mineralization ignored, while what may appear to be undue attention must be given to certain factors, in order to emphasize the connection between the mineral and the chemical industries. Many highly important mineral substances such as coal, petroleum, asphalt, bitumen, &c., and many metallic minerals, have for instance been dismissed in a few lines or left out entirely.

In the production of mineral substances, the action of nature differs in no way from that of the chemist or metallurgist, but she has the advantage that her supply of raw material is unlimited, that her resources as to fuel, fluxes and labour are unbounded, and that such details as time and balance sheets are matters of indifference. Heat, water, air and time are the principal factors through which her work is accomplished.

Our knowledge as to the composition of the earth is mainly confined to the examination of a thickness of the crust extending for less than fifteen miles from the top of the highest mountain to the lowest depths of the sea (but practically only of definite value for quite a small proportion even of this thin layer), out of the 4000 miles separating us from the centre of the earth. It is true that volcanic disturbances afford some clue to the conditions existing at greater depths, but the composition of the ejected material differs in no way, except in physical condition, from the deposits with which the mining man has to deal.

The fact that the density of the earth is about 5·5 (a little higher than that of magnetite) while the average density of the crust works out at rather over 2·6 (about the same as that of quartz, which is a distinctly light mineral), shows that the composition of the interior must be largely different, either generally or locally, from that of the crust.

Many attempts to estimate the relative proportions of the principal elementary constituents of the earth's crust have been made, the latest being that of F. W. Clarke, who in 1900, published figures based on analyses of 830 samples of the older crystalline rocks throughout the world, and ignoring water and air. In 1898 and 1899, Professor Vogt, of Christiania, published an estimate, in which the rocks, air and sea are included together.

The figures of Clarke and Vogt are as follows :—

	Clarke. per cent.		Vogt. per cent.
Oxygen	47·02	..	50·00
Silicon	28·06	..	26·00
Hydrogen	0·17	..	0·90
Carbon	0·12	..	0·20
Phosphorus	0·09	..	0·08
Sulphur	0·07	..	0·06
Chlorine	0·01	..	0·17
Fluorine	0·01	..	0·03
Nitrogen	—	..	0·02
Aluminium	8·16	..	7·45
Iron	4·64	..	4·20
Calcium	3·50	..	3·25
Magnesium	2·62	..	2·35
Potassium	2·35	..	2·35
Sodium	2·63	..	2·40
Titanium	0·41	..	0·30
Manganese	0·07	..	0·07
Other elements	0·07	..	0·17
	100·00		100·00

It will be noticed that the number of elements included in these estimates is small when compared with the 80 or more known to exist in the earth's crust. Of those included, only eight are of special interest as regards quantity, while of those omitted, the proportions are so small that probably few exceed $\frac{1}{100}$ of one per cent.

It is interesting to note the great preponderance of non-metals over metals, the former constituting about 75 per cent. of the total, while aluminium, which by the mineralogist may almost be considered a non-metal, accounts for at least one-third of the remaining 25 per cent.

The principal elements occur as oxides and the proportions in which such oxides exist have been calculated by Clarke as follows :—

	Per cent.
Silica (SiO_2)	59·71
Alumina (Al_2O_3)	15·41
Ferric oxide (Fe_2O_3)	2·63
Ferrous oxide (FeO)	3·52
Lime (CaO)	4·90
Magnesia (MgO)	4·36
Potash (K_2O)	2·80
Soda (Na_2O)	3·55
Water (H_2O)	1·52
Titanic acid (TiO_2)	0·60
Phosphoric acid (P_2O_5)	0·22
	99·22

It is interesting to note that titanium, which we are accustomed to regard as one of the rarer elements, occurs in greater proportion than most of the commercial metals, but one must remember that most rocks and most aluminous minerals contain titanium either as an accessory mineral or as an impurity, although true titanium minerals such as rutile, ilmenite, &c., are comparatively rare. The proportion existing in the earth's crust is, however, no criterion as to the amount of an element commercially available. Iron, for example, is present in the crust to the extent of over 4½ per cent., but the great bulk exists, as in the case of titanium and aluminium, only in the rock matter or in other forms not available for use.

It will be observed that, with few exceptions, none of the ordinary metals of commerce are included in the above estimates, the proportions being far too small for individual mention. Even lead, with its annual production of about 1,000,000 tons per annum, copper, with its production of about 762,000 tons, zinc and tin, with their respective annual productions of over 724,000 tons and over 108,000 tons, are all included among "other elements." as also are the precious metals. It may be mentioned here that all figures throughout this paper are in tons of 2240 lbs. Notwithstanding the fact that gold is almost as widely distributed as water and is the most sought after of all the metals, the 21 million or 22 million troy ounces of "fine" gold extracted annually and valued at from 89 million pounds to 93 million pounds, is in fact, one of the least important of nature's products, when quantity is considered. It is probably produced at a loss, allowing for the expenditure on the unproductive enterprises of the gold-seeker. The ore from which this gold is obtained averages throughout the world under one-third of an ounce of precious metal, or, say, one part in 98,000, and amounts to well over 60,000,000 tons.

Apart from metalliferous veins which have filled fissures in the earth's crust from below, the primary source of most minerals is the fused or igneous matter which, by rapid cooling at the earth's surface, has yielded lava or the natural glasses, the latter being known as obsidian in the case of highly silicious matter, and by other names when more basic in composition. This fluid or semi-fluid igneous matter has often been acted upon by steam and other gases or vapours, and has thus given rise to vesicular and hair-like forms of lava, the former of which is known as pumice. When such igneous matters have been slowly cooled under pressure, as is the case with the deeper-seated masses, such highly crystalline rocks as granite, syenite, diorite, &c., or such semi-crystalline rocks as rhyolite, trachyte, andesite, and basalt have resulted, according to the rate of cooling. As with furnace slags, so in nature, rapid cooling tends to produce glassy products, and slower cooling the more stony or crystalline varieties.

Taken in mass, the natural glasses, having been produced from the same molten mass or magma, have the same composition as the corresponding semi or highly crystalline rock. During the slow cooling to which the latter have been subjected, however, aided often by the action of volcanic gases, steam, and other agencies, whose powers under the conditions existent are scarcely comparable with any of which we have actual experience, the minerals to which they owe their crystalline structure have separated out. The more basic minerals usually crystallize out first, the order of separation being one of decreasing basicity, the quartz, which may be regarded as the excess of the acid constituent, silica, or that unused by the bases, crystallizing last of all, and commonly enclosing many of those minerals which were first formed. The partial solidification of a rock magma therefore usually results in the increased acidity of the remaining fluid portion, so that the compositon of rock magmas may vary between highly acid and highly basic, and in classifying the igneous rocks, we must recognise a transition from the vitreous to the crystalline state, and a variation in chemical composition from highly acid to highly basic.

A concise classification of the igneous rocks is difficult, but for general purposes a tabulated statement such as the following is convenient :—

Igneous Rocks.

Silica.	Acid. 80–65 %	Intermediate.		Basic. 55–45 %.	Ultra-Basic. Less than 45 %.
		65–60 %	60–55 %.		
Vitreous.	Pumice. Obsidian. Pitchstone.	Trachytic-pitchstone.	Andesitic-glass.	Tachylyte.	—
Hemi-crystalline.	Rhyolite. Quartz-felsite.	Trachyte.	Andesite.	Basalt. Dolerite.	—
Holo-crystalline.	Granite. (Pegmatite).	Syenite.	Diorite.	Gabbro.	Picrite. Peridotite.
Essential Minerals.	Quartz. Felspar. Mica.	Felspar. Hornblende.	Felspar. Hornblende.	Felspar. Augite.	Basic ferro-magnesian minerals (olivine, &c.).

In the foregoing table, it will be seen that the essential mineral constituents of the crystalline rocks are given, but it must not be supposed that these are the only minerals present. On the contrary, a complete list of the subsidiary or accessory minerals would be both lengthy and important. Only a few of the most important could, however, be included in the table.

For our present purpose, it will be convenient to consider the crystalline igneous rocks as a whole, and the following table is intended to indicate the more important of the numerous products to which these rocks eventually give rise.

Igneous Rocks.

Quartz.	Felspars.			Mica, Hornblende, Augite and Olivine.	Accessory Minerals. viz.:—
Sandstone.	Clay.	Dissolved Silica.	Carbonates, sulphates, fluorides, borates, &c.	Asbestos, serpentine, chlorite, talc and other magnesian minerals, calcite, dolomite, iron oxides, chromite, &c.	Tourmaline, apatite, Fluorspar, garnets, zircons, topaz, &c., magnetite, chromite, &c., pyrites, cassiterite, titaniferous and "rare-metal" minerals.
Quartzite.	Shale.	Chalcedony, opal, vein-quartz, &c.			
	Slate.				

Taking as a type, the most acid of the igneous rocks, ordinary granite, it is possible to trace the formation of a large number of the minerals of commercial importance and the preceding table roughly indicates how, by the action of atmospheric agents, of volcanic steam and gases, and of alkaline and other liquids, such rocks are "broken down."

With regard to granite, consisting essentially of quartz, felspar and mica (but also containing many accessory minerals which will be considered later), we have, in quartz, a mineral which is but little affected by the weathering or other "breaking down" action, while the felspar may be, and commonly is, completely decomposed. The remaining constituents are also more or less altered, with production of a large variety of new mineral substances.

In the rock known as pegmatite, which may be regarded as a giant variety of granite, the essential minerals occur in very large crystals. Pegmatites have probably been produced by igneous intrusions around granite masses, and it would seem that heated vapours and solutions, forming part of the intrusions, are in a large measure responsible for their formation. This view is supported by the frequent occurance in pegmatites of a variety of rare minerals, few—if any—of which occur in the surrounding rock.

The pegmatites supply the felspar, mica and some of the quartz of commerce, these minerals being present in such form as to afford easy separation.

The most potent factors which result in the decomposition of rocks are air and moisture, aided by frost and the action of plants. Total submersion of a rock or mineral in water may, and commonly does, serve as a preventive to atmospheric action, but moist air has a power which few silicates and still fewer of the non-oxidised metalliferous minerals can resist.

The disruptive power of frost is merely a physical one. Its shattering force is comparable with the grinding of ore in a works prior to its chemical treatment, although its effect is limited to a very large extent, by the physical condition of the mineral itself. One mass of rock or mineral may be comparatively unacted upon, while an adjacent deposit, of practically the same mineralogical composition, may be completely disintegrated and decomposed, merely on account of the physical condition of the latter being favourable to the entry of films of water between the crystals or interspaces or into fissures or cracks.

The action of the organic acids produced from decaying vegetation and even the mechanical power of the roots of living plants, are also powerful disruptive and decomposing forces. These acids act as direct solvents and they, and other agents produced by the decomposition of plants, are commonly powerful reducing agents, so that the insoluble peroxides in rocks and minerals become reduced to protoxides which pass into solution in combination with the organic acids or with carbonic acid. By this abstraction, red rocks are bleached, and the coherence of even compact stones is weakened until they crumble down to soil. The ferruginous solutions thus produced, may, by oxidation, deposit their iron elsewhere, with production of beds or deposits of bog-iron ore, limonite, or haematite.

The "weathering" action of the air is partly due to its ordinary oxidising power, but even more to the carbonic acid which it contains. Although amounting by weight to only about 0·034 per cent. as against 21 per cent. of oxygen, the carbonic acid in the atmosphere shows surprisingly powerful chemical properties.

Under conditions controlled by the chemist, carbonic acid may be regarded as the weakest of inorganic acids, but when dissolved in surface or other waters, and particularly when absorbed merely by moisture where it has the maximum surface action, it possesses the power of gradually decomposing most of the rock-forming silicates. Under such conditions, silica itself is only a weak acid and is readily expelled from many of its compounds and carried away in solution as free silicic acid in colloidal or other form or as an alkaline silicate, to re-appear in one or other of the many forms of which vein quartz, chalcedony, agate, jasper, opal, &c., are familiar examples.

At the depths and temperatures at which the rocks themselves were formed, silica is, however, the most powerful of all acids. Practically non-volatile at temperatures at which most other acids evaporate or are decomposed, silica destroys or prevents formation of compounds other than silicates until the affinities of the bases in the magma have become satisfied by it, any excess of silica separating out as quartz.

A homely illustration is afforded by one of the most common of analytical processes—the fusion of silica or silicious matters with sodium carbonate. If quartz, the densest and most inert form of silica, be thus treated, carbonic acid is expelled with the formation of sodium silicate or "water-glass." If the latter be dissolved in water and treated with carbonic acid, carbonate of soda is re-formed, while the bulk of the silica is precipitated as gelatinous silicic acid (H_4SiO_4).

The action of carbonic acid in the natural decomposition of felspars and of many other silicates of which the rocks are composed, is exactly similar but the action is so slow that other factors intervene and the direct and complete decomposition explainable by formulæ is thus often replaced by most complicated reactions resulting in the production of an immense variety of products, including clays, zeolites, and other minerals. But for the diluted condition of the attacking acid, the extremely dense nature of the crystalline silicates and the smallness of surface exposed to chemical action, decomposition would be effected far more rapidly than is actually the case.

Taking, as typical, the action of carbonic acid and water upon orthoclase—the potash felspar which predominates in granites—the net result, if the felspar were absolutely pure, would be a hydrated aluminium silicate, forming the basis of clay, together with potassium carbonate and silicate in solution, and free silicic acid (partly gelatinous and partly in the colloidal state).

In the case of the decomposed granites, which yield the china-clay of Cornwall, although atmospheric action is sufficient to account for the changes which have occurred near the surface, the physical condition of the decomposed material and the nature of many of its subsidiary constituents cannot be satisfactorily explained without attributing at least a portion of the change to the action of volcanic gases and vapours, such as hydrofluoric acid and volatile fluorides, boric, sulphuric, and hydrochloric acids, and superheated steam.

Hot springs and the exhalations from dying volcanic energy are known to have changed great sheets of volcanic rock into brilliantly variegated masses of clay and kaolin. A striking example exists at the Falls of the Yellowstone river in the United States, where rhyolite to a depth of more than a thousand feet has been thus decomposed.

The occurrence, too, of fluorspar in the best Cornish "China stone" (the partly decomposed granitic rock which is ground for use as a fritting material in the manufacture of china) indicates that fluoric gases have been active in this manner, while the presence of tin ore in conjunction with fluorspar in many of the Cornish tin mines has been attributed to the action of gaseous fluoride of tin passing up through the mass from below, and being decomposed near the surface into oxide of tin or "Cassiterite," the only commercially important ore of tin. There is no doubt that gases or gaseous mineralisers have been of vast practical importance in the formation of ores, and reference will be made later to the minerals of the rare metals which have probably been produced by such means.

The admission of such potent agents into our calculations affords ample scope for chemical change. Salts of hydrofluoric, sulphuric, hydrochloric, boric, phosphoric and other acids occur as minerals—often in large quantities—and their mode of occurrence and their mineral associations fully justify the belief that they are largely the result of direct or semi-direct chemical action upon the igneous rocks, notwithstanding the fact that similar minerals are known to be also derived from other sources.

So far as our typical rock, granite, and many other igneous rocks are concerned, the chief decomposable constituent is the felspar. There are many varieties of felspar, the term being applied to a group of double, triple, or even more complicated silicates of aluminium and bases such as potash, soda, lime, or magnesia. These compounds occur in varying degrees of purity, and commonly merge one into the other, the potash variety, orthoclase, typical of granite, generally having a portion of the potash replaced by soda, lime, or magnesia, while the soda felspar, albite, and the lime felspar, anorthite, generally contain more or less of bases other than the soda or lime which are their essential bases.

We have already seen that the primary solid decomposition product of felspars consists of clay in a higher or lower state of purity, depending on the nature of the original rock, and also that, during the decomposition, the alkalies or other bases are mainly carried away in solution.

Should such clay be sufficiently free from iron to be originally white, and to yield a white product on burning; sufficiently free from alkali, lime, &c., to offer the necessary resistance to fritting when burned, and sufficiently plastic to admit of free working by the potter, we have "china clay" as in the Cornwall deposits, which are the most important in the world.

Other varieties are fireclays, pipeclays, brickclays, &c., each of which owes its value to the presence or absence of constituents other than aluminium silicate, and to peculiar properties which fit it for some special purpose for which others—although perhaps of very similar composition,—are unsuitable.

Naturally, the purer varieties of clay are derived from rocks comparatively free from ferro-magnesian constituents. Of these, the granites form an excellent example, the commoner clays more often owing their origin to the disintegration of the more basic minerals and their associated felspars.

It is impossible to more than mention the many varieties of clay which are of commercial application, but it may be of interest to state as regards china clay, that the pottery and allied industries are by no means the only ones in which it is employed. Considerable amounts of the whitest material are used in other industries; for example, most white papers contain it as a filling material, a single paper-making firm being stated to use no less than 30,000 tons of china clay annually. Many of the crucibles, scorifiers, and roasting dishes used by the assayer are largely composed of the micaceous clay obtained in the settling pits through which clay passes to separate suspended impurities before collecting the refined china clay for the market.

The total quantity of china clay produced in Cornwall alone in 1908, amounted to 654,814 tons, valued at £432,677.

Although yielding the finest china clay, Cornwall is by no means the only source of supply. Large deposits are known in many parts of the world, some resembling those of Cornwall, where the clay has remained in situ, while others have evidently been deposited like ordinary clay, after having been carried away by water.

As an ingredient in the manufacture of Portland cement, suitable clays are of great economic importance. The actual production of real Portland cement in England amounted to about three million tons, the total possible output of Germany being somewhat more. In 1908, over 8½ million tons (over 51 million barrels of 380 lbs., or six to the ton) was produced in the United States, including ¾ million tons made by the United States Steel Corporation from blast furnace slag.

Clay beds, when subjected to sufficient pressure, either from the weight of superimposed deposits or through other agencies, become indurated, converted into shales, and finally into the harder laminated form known as slate. Further alteration is effected by the intrusion of igneous masses, or by purely dynamic action, the clay, shale or slate being altered, and often transformed into mica schist. The physical changes are accompanied by molecular rearrangement, so that we find in the shales and slates, and particularly in the mica schists, a new series of accessory minerals. The latter often occur in such abundance as to be of great commercial importance and, owing to the homogeneous nature of their surroundings, are often so perfect in form as to be of particular interest to the mineralogist.

Double ended quartz crystals, magnetite and many other minerals in their highest state of mineralogical perfection both as to form and purity, and garnets and other precious stones, frequently occur as secondary or accessory minerals. It is interesting to note that certain well-known brands of hones or sharpening stones consist of slates or shales full of microscopic garnets or other hard minerals. Garnets are so common in these and other rocks, and in the gravels, &c. produced by their natural disintegration, as to scarcely deserve the title of precious stone, although the beauty of those of good colour almost equals that of the ruby. Owing to their hardness, garnets are largely used as abrasives, and probably nearly 10,000 tons of true garnets whose only fault is that they are "off colour" are ground up for that purpose annually.

During the degradation of our type rock—granite—another of the principal constituents, the quartz, is also commonly transported (although to a less distance, on account of its coarseness) and ultimately reappears in such well-known deposits as pebbles, gravel and sand, containing also a large variety of other weather-resisting minerals which formed part of the original rock.

Such pebbly deposits, whether formed originally from granites or other rocks may, by the addition of clayey material or by the deposition of iron oxide, silica, carbonate of lime, &c., by percolating solutions, become eventually consolidated into conglomerate or pudding stone.

Should the percolating solutions be mineralised to any extent, or should the deposits become mineralised by any other means, commercially valuable products may be formed.

The well-known "Banket" gold ore of the Transvaal affords an excellent example of this kind, immense beds of rounded quartz pebbles of varying dimensions having become compacted into hard rock. In this case the cementing material is mainly silica of a somewhat ferruginous character, the iron being oxidised above water level but pyritic at depth. The origin of this material has been, and still is, the subject of much discussion many interesting theories having been propounded to account for its formation and mineralisation. It has been found that no gold exists in the pebbles themselves, all the values being contained in the matrix or cementing material. The whole value of this, the most important of our gold-producing deposits, depends therefore, on the secondary minerals through whose agency the gold was concentrated. Although, throughout the Transvaal, the ore now treated averages under a third of an ounce per ton, the amount of "fine" gold produced there in 1908 was 7,054,621 ounces worth nearly £29,000,000, over one-third of the World's output.

It may be here noted that, at one of the Rand mines, over a ton and a half of ore is stamped per minute day and night for 365 days per year and that the whole has to be mined, crushed, stamped, ground in tube mills, amalgamated, classified and leached with cyanide solution before finally appearing on the dump heaps, where it perhaps awaits re-treatment in a future generation by a process capable of treating waste which is so poor as to be of no further interest to the chemist of to-day.

By processes similar to those producing conglomerates, beds of sand become consolidated into sandstones, partly through the agency of percolating solutions containing silica, &c., and partly through pressure.

It is well known that many sandstones are fairly soft and may be easily cut and shaped when freshly quarried, but that a few days exposure to the air renders them hard and suitable for use for building. This quality is attributed to the presence of the above silicious solutions known as "quarry water," whose action resembles that of silicate of soda which is so valuable a cementing material or preservative for stone.

In many cases, more or less pure sandstones have been changed by the action of intense pressure into quartzite, a hard, compact, granular material composed of adherent quartz grains which have been recrystallized, so that the rock breaks with a characteristic lustrous fracture. The production of most quartzites has, however, been aided by the infiltration of silica in solution into quartz sand, and its deposition upon the quartz grains so as to bind the rock into a mass almost as compact as vein quartz.

As regards the soluble products from the decomposition of the igneous rocks, it is scarcely necessary to point out that many substances which are commonly considered "insoluble," dissolve to a sufficient extent under conditions existent in nature, to produce most important commercial results.

Silica, in the form in which it is produced by the decomposition of silicates, dissolves in alkaline or practically neutral solutions. The deposition of silica from such solutions has resulted in the formation of flints, agates, jaspers, opals and all varieties of chalcedony; of the petrified forests of Arizona and elsewhere, in which it has replaced the woody fibre of trees; and of the silicious terraces of New Zealand in the formation of which the silica has deposited from hot solutions almost as quickly, and in much the same manner, as carbonate of lime deposits from a "petrifying spring."

Vegetable and animal organisms also collect their tithe from dissolved silica and the enormous beds of Kieselguhr or diatomaceous earth which are mined to the extent of thousands of tons annually for use as an abrasive, as a non-conductor and as an absorbent in chemical industries, particularly in the manufacture of dynamite, consist of the outer shells or skeletons of fossilized minute infusoria, vegetable organisms which are remarkable for collecting silica to protect their tissue instead of the carbonate of lime which foraminifera and shellfish absorb or the phosphate of lime which animals secrete.

The enormous use of quartz and other forms of silica in glass making and for many other purposes, scarcely requires mention here. Quartz is one of the few minerals obtainable in quantity in a state of almost absolute purity and reference may be made to its increasing use as the only source of silica glass, for the production of such important electric-furnace products as elementary silicon and alloys of silicon with iron, copper, &c., and of carborundum, alundum and silundum, three carbides of silicon used as abrasives and for other purposes.

The solution of lime in carbonic acid during the decomposition of rocks and its reappearance as beds of limestone, marble, Mexican onyx, and other ornamental varieties, or as stalactitic deposits, or, after serving to build up the skeletons of foraminifera, corals, shellfish, &c., as chalk and the like, is too well known to require more than passing mention, but it is worth while to point out that carbonate of lime, which has been collected from solution by such organisms, is thereby purified with formation of deposits of great purity.

Many chemical processes and an enormous number of metallurgical ones, depending upon the use of carbonate of lime or of quick or slaked lime, thus have unlimited supplies of extremely pure material, in the form of chalk or limestone occurring in most districts where metalliferous minerals are found, and obtainable at low prices.

Without this material, the alkali industry would be practically non-existent, and many of the smelting operations upon which our metal supplies depend, would be impossible except on entirely different and far more expensive lines, while many of our water companies would be compelled to supply harder water than at present, although the lime is primarily responsible for the very hardness which the chemist now makes it remove.

The value of limestones for building and other purposes need not be more than mentioned, but the well-known Bath stone and especially the Portland stone with the working of which so many Englishmen have had practical experience, may be instanced.

Local or complete change of deposits of carbonate of lime has commonly occurred, through infiltration of solutions containing sulphates, phosphates, &c. This has resulted in the production of gypsum and other varieties of sulphate of lime, and of "rock phosphate," the former minerals being used for ornamental purposes and in the production of plaster of Paris, and the latter in the manufacture of chemical fertilizers. Some idea of the importance of these secondary mineral deposits, which are not of course all derived in this direct manner from carbonate of lime, may be gained from the fact that nearly 4,000,000 tons of gypsum is annually mined and that apatite and phosphate rock for manufacturing fertilizers, is mined to the extent of about 4,500,000 tons, of which the United States produces over half. The Atoll islands of the Southern Pacific, originally coral formations, are extraordinarily rich in phosphates, and deposits on two islands in the Gilbert group are stated to contain 50,000,000 tons suitable for export.

Although of lesser extent, and only found in mass in a few localities, magnesite—carbonate of magnesia—is of extreme importance, especially as a highly refractory basic material. Dolomitisation of limestone through the action of carbonate of magnesia, is common and some of our most important building stones and materials used in the manufacture of refractory bricks and furnace linings are dolomite or dolomitised limestones.

One of the first uses to which magnesia was applied (excluding its employment in medicine) was in the manufacture of receptacles for the fusion of platinum, but its uses in metallurgy have grown, gradually at first, but latterly by leaps and bounds until now, at least a quarter of a million tons of high quality magnesite is mined annually. Bone ash cupels are now almost a thing of the past, having been replaced by those made by magnesia. Bricks and linings for furnaces producing basic slags are largely composed of it and through its use, the formation of such extremely basic slags as would dissolve ordinary firebrick as water dissolves sugar, is an every-day occurrence in metallurgical practice.

In the case of rocks less acid than granite, the weathering action, although essentially similar to that already described, results in the formation of larger quantities of the more basic products. In the basic rocks, the dark ferro-magnesian and aluminous silicates are in excess, and in decomposition, their peculiar products predominate, the distinctly magnesian ones yielding serpentine, while those more aluminous alter to chlorite, in either case with separation of such important minerals as iron oxide and carbonate, calcite, dolomite, magnesite, talc, asbestos, &c., together with valuable accessory minerals such as chrome iron ore, magnetite and possibly the oxidised nickel and cobalt ores which occur as double silicates with magnesia, in New Caledonia.

Although granite has been selected as a typical rock for description, it must be remembered that digression from that type to the less acid or to the highly basic rocks has frequently been necessary. The only difference to be borne in mind is that the basic rocks are more easily decomposed than are granites, syenites, diorites, &c., and that more of the non-silicious products result.

The important mineral, bauxite, a hydrated oxide of aluminium containing more or less oxide of iron and other impurities, is a decomposition product of highly aluminous silicates. Opinions differ as to its exact mode of formation in many instances, but there is no doubt that processes similar to those already enumerated have played an important part in its production. The consumption of bauxite in the United States in 1907 was 122,841 tons valued at £171,770, and France, in the same year exported over 100,000 tons. About 60,000 tons of bauxite was consumed in 1907 for the production of about 32,000 tons of aluminium but bauxite has many other uses.

To dismiss briefly the immense iron ore deposits which largely owe their origin to carbonate of iron dissolved in carbonated or other waters and deposited either as carbonate (chalybite) or more commonly—after oxidation—as ordinary brown and red iron ores, may be excused, as a paper on iron and steel has recently been read before the Society by F. W. Harbord.

Over 130,000,000 tons of iron ore varying in iron contents from under 30 per cent. to nearly 70 per cent., and averaging slightly under 40 per cent., is mined annually, the United States contributing considerably over a third of this total and also supplying ore of higher average iron values than any other large producing country. The world's annual production of pig iron amounts to about 60,000,000 tons, Great Britain contributing about a fifth and the United States nearly two and a half times as much. About four-fifths of the pig iron is converted into steel, and from first to last, it is probable that well over 130,000,000 tons of fuel is consumed in mining and converting the iron ore into finished metal. By far the larger proportion of this fuel consists of coke made from bituminous coal. In the production of this coke, immense quantities of by-products such as ammonia and ammonium sulphate are produced, together with tar whose amount is now about equal in quantity to that produced in gas works and similar to it although somewhat inferior in value. Waste gases, rich in combustible gas and intensely hot, as they leave the blast furnace in which the pig iron is produced, are now no longer run to waste but are employed for motive power to drive the whole plant and the writer has seen at Middlesbrough, the overplus employed for evaporating brine which has itself been raised from the strata below the works by pumps operated by engines driven by combustion of the waste gases. Notwithstanding all efforts to utilize this immense store of energy, there is still so much (at present unavoidably) lost as would supply all the electric power required for lighting Middlesbrough and the district within a radius of several miles.

It will be interesting to see how far the consumption of fuel in such and other metallurgical operations will be affected in the future by electric smelting with the aid of current obtained by water power.

The manufacture of cement from iron slag has been already mentioned, but the production of fertilizer by grinding the slag obtained in the treatment of phosphatic pig iron is of still greater importance, and furnishes an interesting example of a metallurgical concentration forced on the manufacturer by the necessity for removing an impurity which is present in the ore and which becomes accentuated in the pig produced from it. The only method by which this has been found feasible is the only one which would be likely to yield a slag suitable for agricultural purposes, a by-product so valuable as to permit the smelting of many iron ores otherwise worthless.

The manner in which one industry affects others, and in which each may depend upon the other for its success, could not indeed be better shown than in the case of the iron and steel industry. The direct effect on mining and on the chemical industries through the quantities of ore and fuel required and the immense amount of waste power and bye-products resulting, is by no means the end of the tale.

The requirements of the steel maker have resulted in an enormous use of ores containing manganese, chromium and nickel, and the producers of such ores depend now more on this use than any other and are able to dispose of ores which, when the chemist was practically the only purchaser, were unsaleable, an ore which is utterly unsuitable for one purpose being often the best for another. In the case of manganese ores, pyrolusite or peroxide of manganese, is practically the only one employed on the large scale by the chemist, while braunite, which may be described roughly as the sesqui-oxide, and others of the less highly oxidized ores, are preferred by the steel maker and the producer of ferro-manganese and spiegel, who prefer as little "available oxygen" as possible. Lime is objectionable, but phosphorus harmless to the former, while to the metallurgist, the position is exactly reversed.

The miner or mineralogist has, in fact, to study more and more the varying conditions of the market and many mines now flourish whose produce was unsaleable a few years ago, or whose owners may find their market disappear within the next decade.

Some idea of the importance of these side issues of the iron and steel trade to the mining man, and incidentally to the chemist, may be gained from the fact that nearly 3,000,000 tons of manganese ores are treated annually for steel making, in addition to enormous quantities of manganiferous iron ores. India, whose first export took place in 1893, now leads as regards *quality* of ore and actual amount of "manganese" exported, although Russia produces a slightly larger *quantity* of ore. The United States only produces about 6,000 tons of true manganese ores but imports large quantities. Much of the manganese ore has been deposited from carbonic acid solution exactly as in the case of lime and iron deposits.

It is worthy of note that over 100,000 tons of waste manganiferous residues from the roasting of franklinite and other zinc ore from New Jersey, were smelted for making spiegel and ferro-manganese in 1908, and that much of the true manganese ore which is smelted also contains zinc. So much zinc oxide is produced from blast furnaces as to almost justify the installation of zinc retorts by the iron-masters.

Chrome iron ore averaging 45 per cent. of chromium oxide, is mined annually to the extent of about 60,000 tons, while nickel ore is mined to an enormously larger extent, although no reliable statistics are available on account of the great variation in the nature, value and uses of the ore the larger proportion of which, however, is undoubtedly employed in steel making.

Reference will be made later to the use of the rare metals in steel making and the consequent impetus given to the search for minerals containing them.

To the chemist, the most interesting of the carbonates are those of the alkalies. Produced in enormous quantities (owing to the presence of the alkali metals in all felspars and a large number of other natural silicates) their existence might have solved the alkali problem, could they have remained in their original form, but the very solubility on which their commercial value would depend, has led to their destruction. So soon as the alkaline carbonates meet the chlorides, sulphates and other more or less soluble salts of the alkaline earths and earthy metals, or of iron, they are converted into the chlorides, sulphates, &c., with which we are familiar in natural waters.

In a few cases, the alkaline carbonates are found as large superficial deposits in arid districts such as the alkali wastes of California, and would be of great value but for the difficulties of transport and commonly the impossibility of purification owing to the absence of water.

The nitrates of Chili and Peru, and the borates of California, have already formed the subject of valuable communications to this Society, so that their occurrence and origin, although well within the scope of this paper, may be passed over.

A study of the manner in which certain minerals are usually found associated together in nature, commonly those which are isomorphous or which contain the same group of elements, but very often of entirely different mineralized and chemical character, is of particular importance to the commercial man, and should be of great assistance to such chemists and physicists as study the genesis of minerals and "elements" and the so-called degradation of the latter. Just as the Periodic Law of Newlands and Mendeléeff was evolved from the tabular marshalling of chemical and physical data, and was found capable of prophetic use, so one may learn and predict much from a study of the known associations of minerals, and particularly those of the rare metals. One has the advantage of knowing that minerals have been produced under natural conditions where no mistakes or errors of manipulation can have occurred and where no difficulties due to want of time, material, or facilities for experimenting existed; in other words, where the personal factor was absolutely non-existent.

Incidental reference has frequently been made throughout this paper, although detailed consideration was impossible, to the commercial importance of the secondary or accessory minerals, and to such ore bodies as have come up from beneath what has been roughly described as the earth's crust, and the great density of the earth as a whole, as compared with that of the crust, has been mentioned.

Probably the most promising field for research exists in the oldest plutonic rocks and particularly in such pegmatites and other extremely old granitic and other rocks as have been subjected at great depth and pressure and at high temperatures, to the action of intruded flows of fused mineral matter from still deeper-seated sources, or of vaporised mineral matter of similar origin. Such rocks exist in many parts of the world, but the pegmatites of Norway, the old granites of Greenland, and many of the old but less highly crystalline tin bearing deposits of Cornwall may be instanced as likely to throw light on the origin of many metals, and especially of those at the "heavy" and "light" ends of the periodic table.

It is extremely probable that some of the many missing heavy elements near the uranium end of the table will be found in such rocks and that certain light elements for which room may have to be made in the table, may also be unearthed.

My experience of the rare minerals found in the older rocks induces me to particularly refer to the vast field which they furnish for research for those who regard the rare metals from the commercial point of view, for those who wish to improve our present defective methods of both qualitative and quantitative analysis, and for those who are searching for new elements. I would specially draw attention to the "black tin" concentrates obtained from the tailings and slimes run to waste from the "dressing floors" of the Cornish tin mines. This waste passes down what is known as the "Red River" from Camborne to the sea at Gwithian, and is collected and re-treated over a length of about eight miles, by sixteen independent firms or individuals known as "streamers," each of whom extracts as much as possible from what passes by his holding. Finally, on Gwithian beach, where the waste passes into the sea, the waves perform the last dressing operation, and, at low tide, little patches of the heavy tin ore which have thus been collected, are scraped up by the last of the tin dressers, to complete the tally. It is an interesting proof of the necessity for efficient dressing appliances for minerals, to note that the Red River produce amounts to over 800 tons annually of "black-tin"—which by the way is red—containing an average of about 50 per cent. of metal, notwithstanding that the ore, before its waste is rejected by the mines, has passed through more "dressing" processes than any other mineral with which I am acquainted.

My excuse for this digression, is that the black tin from the Red River contains not only the tin, the only substance which is extracted from it, but there have become concentrated in it minerals of tungsten (representing according to my analyses, an annual loss of over 100 tons of wolfram), uranium, vanadium, tantalum, niobium, molybdenum and other known heavy rare metals as well as strong indications of rare elements, which have somewhat similar properties, but which have not yet been isolated. Those who have had experience of tin and wolfram ores from certain Cornish mines and elsewhere, have encountered difficulties in their analysis due to the presence of unidentifiable metals and, as the waste from most of the mines passes into the Red River, the natural concentration originally made by nature in the rocks and followed up by the ore dressers on the mine, has been completed by the streamers. The minerals of the rare elements, owing to their greater friability, became more finely ground than the tin during the dressing of the ore and therefore pass into the slimes so that the produce from the Red River, consisting, as it does, mainly of slimes, forms an ideal material for research, being always available in large quantity, easily procurable and probably containing in the most accessible form, many of the missing links which, since the discovery of radium, have become of so much interest and probable potential value.

The fact that radium is a product of the breaking-down of uranium and that uranium and all the allied heavy elements, as well as many of the light elements which may also be products of similar degradation of elements, occur, so far as we know, only in deposits which are distinctly of the most deep-seated and ultra-plutonic origin, may perhaps be coupled with the peculiar force or "emanation" which frequently accompanies *sudden* volcanic outbursts, and which kills so instantaneously as not to be attributable to any gas or to any cause with which we are acquainted.

The occurrence together of practically all the heavy rare elements and the almost invariable occurrence with them or at any rate in the same or similar rocks, of many of the rare alkali, alkaline-earth and allied elements such as lithium, caesium, rubidium, cerium, thorium, didymium, beryllium, zirconium, &c., is of extreme interest. All occur in pegmatites or others of the oldest and particularly, the acid rocks, and practically none are found elsewhere except under conditions directly traceable to such an origin. Where uranium abounds, the other heavy metals are usually present in comparatively small quantity and the other groups of rare elements are practically non-existent while, under conditions where uranium is absent or only found in comparatively small quantity, the others may be found associated together either as components of minerals of complicated constitution or each in its own characteristic mineral form.

It is extremely probable that there is a definite connection between these occurrences and the birth or decomposition of the elements, and that a study of them may elucidate many doubtful points more simply and conclusively than attempts, however well directed, to artificially produce results which Nature has already achieved. The occurrence of fluorides with these rare metals or in the rocks where the same occur, is also of importance. Both fluorspar and cryolite are commonly, although by no means always, associates of them, and it is considered by many that these fluorides, which often occur in fissure veins in granites, diorites, gneisses, &c., of great age, have been produced, in many cases, by the action of metallic fluorides whose decomposition has resulted in the production of metalliferous deposits and of such fluorides as fluor-spar, cryolite, &c., and minerals containing fluorine such as topaz, tourmaline, &c. The important and growing use of fluor-spar and cryolite as fluxes in metallurgical operations, has resulted in a great increase in their production during recent years. The colour of topaz, zircon and many others of the more or less precious stones which occur in the old rocks, is probably often attributable to the action of uranium or other radio-active substances and the effect of uranium and radium in colouring these stones and such minerals as fluor-spar, quartz, &c., with which uranium minerals occur, is now fairly well known. Certain peculiarities in the colour of these two minerals, as found in situ, are even taken as an indication of the presence of uranium by the miners The first reference to this property was made by Mr. Richard

Pearce, who published a note on the subject in the Journal of the Royal Institution of Cornwall in 1861, long before radio-activity was dreamed of and experiments have recently been made by him and the author in this direction with radium itself.

The peculiar action which the heavy rare metals have when added to steel shows how curiously they stand as a class distinct from others. Uranium, tungsten, molybdenum, tantalum, niobium, vanadium and even titanium, have extraordinary powers in producing special effects when added to steel, even in small quantity. These powers might be considered only as of passing interest from the point of view of the chemist, were they not practically confined to one group of metals and possessed more or less by each member of that group. It is true that valuable properties are imparted by other metals such as aluminium, manganese, nickel and chromium, but their effects are less marked and are produced by the addition of a comparativey large quantity of the metal, excepting in the case of aluminium, whose action is, however, of an entirely different nature.

The recent demand for these rare metals has resulted in a large increase in the production of the minerals containing them. They were commonly passed over by the prospector or ignored by the analyst, and the present increased supply is mainly due to increased education, and is much on a par with the production of monazite and other thorium-containing minerals used for incandescent lamp mantles, and now obtainable from alluvial and other deposits in many parts of the world, in addition to its early and only source in Brazil. Over 200 million of such gas mantles are now produced annually. The best concentrated monazite sand averages only about 5 per cent. of thoria and other earths actually required by the mantle industry, so that a large field is open for research to utilize the ceria, zirconia, didymia, &c., which are obtained as by-products.

Tantalite, at one time almost unobtainable, is now found in larger quantities than are required, and is even produced as a by-product in washing cryolite, with which it occurs, as might have been expected from a study of the natural associations of the rare elements mentioned above.

Reliable statistics as to the output of minerals of the rare metals are not obtainable, but it may be mentioned that the world's output of tungsten ores was over 5,500 tons in 1908, as against about half as much in 1905, although the price obtainable per ton had nearly doubled by 1907–8.

A lengthly list of important associations together of certain of the ordinary commercial minerals might be added with a commentary as to the reasons for such association but want of space forbids more than a passing reference to them.

Such associations may perhaps, be in many cases attributed to a cause similar to that suggested above for the rare elements although in a very large proportion of the cases, it is due merely to the ordinary chemical decomposition of a primary rock or mineral. Indications of a simultaneous primary origin exist in the case of a large number of minerals and mineral aggregates. No lead mineral has, I believe, ever been found free from silver or from gold nor has any metallic lead or salt of lead free from silver or gold been prepared except by the most costly processes and in extremely small quantity. Practically all commercially treated copper minerals also contain gold and silver and modern methods of treatment now permit the buyer to pay for both, even when present in little more than traces which, twenty years ago, would have been totally lost. The attempts at obtaining the gold and silver from antimony ores in which both metals also invariably occur, have been largely responsible for the highly successful volatilization methods of extracting antimony which have resulted in so great a fall in the price of that metal.

The invariable association of selenium and tellurium with sulphur, of cadmium with zinc and of nickel with cobalt, and the common association of potassium and sodium, of calcium, barium and strontium and of the halogens excluding fluorine, is too well known to need comment. They may be explained by the similarity of their properties but there are many other mineral associations of elements which, like that of the precious metals as compared with lead, are not in any way similar and a knowledge of them is of great assistance to the mining man and mineralogist in searching for minerals and in his anticipation of what may be expected to follow such indications as are found in prospecting, as well as to the metallurgist and chemist as a guide in searching for valuable or objectionable constituents in such minerals as he has to treat.

One of the most common associations is that of zinc blende with galena, copper and iron pyrites being also usually present. Such an association is objectionable in every way commercially and although these minerals may be separated mechanically, hydraulically, or magnetically, when the minerals are not so fine-grained or so intimately interlocked that a preliminary crushing will not break them apart, millions of tons of ore of high "assay value" exist which have not yet been treated at a profit and which are known as "refractory zinc-lead ores." When it is remembered that ores containing metal values of zinc, lead, silver and gold to the amount of perhaps ten pounds or more can be obtained for little more than the cost of mining, of almost uniform composition and in unlimited quantity, one cannot wonder at the numberless attempts which have been made to solve the problem and which have raised more hopes and emptied more pockets than any other metallurgical problem during the last century.

Many papers have been read on this subject before our technical societies, but it must be remembered that the problem is both a physical and metallurgical one and that, like so many attempts at separating valuable minerals or eliminating objectionable constituents, the work which has been done, although often a failure as regards its primary object, has resulted in most valuable improvements in side-issues affecting other metallurgical problems.

A knowledge of the common associations of minerals and especially of the metalliferous minerals, may often save the miner and the metallurgist from serious error and loss, and experience as to the condition in which they are required for the market is of equal importance. In the earlier days of mining, zinc blende, the most important ore of zinc, was regarded as a worthless mineral and was picked out from the galena with which it occurred and thrown away. The German called it "blende" because it was put into the mine by the demons to delude them and the Britisher called it "black jack" for the same reason. Similarly, nickel and cobalt were named after German demons and their ores, when occurring with copper ores, were thrown away. Nickel ores are still commonly mistaken for copper ores and the writer, in one of the outports of Newfoundland, has seen molybdenite picked out from granitic rocks where it occurs under conditions which, to the mineralogist would at once identify it, and used as black-lead for blacking grates.

Even within the last few years, amblygonite, the hydrated phosphate of lithium and aluminium,—now the most important source of lithia—was sold from a tin mine abroad as inferior phosphate for making fertilizers. The purchaser sold it to the lithia manufacturers at a large profit until the mine owners had their eyes opened by a friendly chemist.

Although the sulphides and similar minerals and the oxidized ores produced by their alteration are of greater metallurgical and commercial importance, there is perhaps more justification for dealing briefly with these minerals than with those already discussed, the latter lending themselves better to collective and general treatment.

In many cases, the sulphides and other non-oxidized metalliferous minerals may be clearly traced to definite sources, but they are commonly intrusions from below or occur as veins and lodes whose origin is of a doubtful or controversial character, and may perhaps be best regarded by the chemist as resembling that of Topsy, who was not born, but "merely growed." Concerning metalliferous minerals generally, the Cornishman's adage "Where they are, there they are" is a safe one for a non-geological paper.

As the most important group, and as typical of others, the sulphides are deserving of especial consideration by the chemist. In conjunction with the selenides, tellurides, arsenides, &c., with small quantities of which they are so commonly associated and which they so strongly resemble mineralogically, the sulphides directly or indirectly furnish a large proportion ot the ores from which the world's metal supplies are derived.

It is true that pyrites as such, does not constitute a commercial ore of iron, but the oxide left by the roasting of pyrites is regularly smelted for the production of pig iron and it must not be forgotten that a considerable proportion of our iron ore deposits are themselves the result of the decomposition of sulphide of iron in one or other of its various mineralogical forms.

Where exposed to atmospheric action, or roughly speaking, above "water-level" (that is, above the line below which pumping is necessary in the working of a mine) most of these sulphides oxidize more or less, often completely, so that metallic sulphates, carbonates, and oxides commonly occur at and near the surface, the proportion decreasing as depth increases and finally giving place entirely to the sulphides from which they were derived.

The "gossans" or oxidized outcrops which, in so many instances, have been the surface indications leading to the discovery of important mining fields, are of this class and have furnished more of the rare mineral specimens which grace our museums, than all other sources combined.

Since iron pyrites is of such commercial importance, being the chief source of the world's supply of sulphuric acid upon which so many of the chemical industries depend, it may be well to discuss the changes which occur during the weathering of this mineral, and their important and far-reaching results.

This subject has received considerable attention since before the time of Henckel, whose "Pyritologia, or a history of the Pyrites, the Principal Body in the Mineral Kingdom," published in Germany over 150 years ago, states that hot baths, volcanoes and whirlpools "derive their matter from pyrites and sulphur."

The most interesting work in connection with the oxidation of pyrites, has been accomplished during the last twenty years, the introduction of the "cyanide process" for gold extraction having made such investigations an absolute necessity. So thoroughly has this been done that, at the present time, the number of minerals which are either directly or indirectly credited by both practical man and theorist, with a pyritic parentage, is legion.

Briefly stated, the result of the weathering of iron pyrites is the production of ferrous sulphate and free sulphuric acid, followed by the oxidation of the ferrous—to normal, and ultimately, to basic, ferric sulphate. With certain kinds of iron pyrites—notably marcasite—the decomposition proceeds with great rapidity, a clean specimen soon becoming coated with minute crystals of ferrous sulphate even when enclosed in a mineral cabinet.

The sulphates so produced are mainly carried away in solution or suspension, but a small quantity usually remains and, by final conversion into oxide, reddens the mineral mass from which the pyrites has been leached out.

Should gold be present in the solutions acting upon the pyrites, the reducing action of the ferrous sulphate precipitates it as metal, producing oxidized ferruginous gold ore. The presence of extremely minute traces of gold in many saline and other natural waters is well-known and, although this store of precious metal will most certainly never be profitably tapped by mankind, nature is continually drawing from it and depositing the gold in concentrated and therefore available forms. Such gold ores are often of great beauty and richness, and probably most of those in which the metal occurs in the crystalline state, have been produced by the above or some similar reducing action.

Enormous quantities of pyritic ores containing the precious metal exist under conditions which altogether preclude such an explanation of the deposition but the fact that the rich surface indications of a gold mine are by no means a sign of continuance in depth (as would be the case were the gold merely left behind by the weathering of the pyrites already containing it) is a significant proof of the frequent deposition of gold from surface and other waters.

As already indicated, the products from the weathering of pyrites have caused much trouble in the application of the cyanide process to gold ores. Being specially suited to ores containing the precious metal in a finely divided condition, the cyanide process is widely employed in the treatment of pyritic gold ores, and particularly of the "tailings" or residues from which the coarse free gold has already been extracted by amalgamation. The use of cyanide for treating silver ores is also large and rapidly increasing, although still almost in its infancy.

The history of the manufacture of potassium cyanide affords an interesting example of the direct effect of a purely metallurgical upon a purely chemical industry.

Prior to the introduction of the cyanide process potassium cyanide was a chemical of strictly limited application, of somewhat doubtful purity and of high price. The demand created by this process has, during the last 15 years, resulted in the production of almost pure potassium cyanide at about one-tenth of its former price and will probably result in its replacement by sodium cyanide. Not only is this the case but, whereas the cyanogen products from gas works were formerly regarded as useless, their recovery for cyanide manufacture is now a firmly established and profitable industry, and has been the main factor in the great reduction of price.

In addition to their far-reaching effects upon the igneous and other rocks already referred to, the soluble products from the weathering of pyrites also re-act upon such carbonates and other compounds of lime, magnesia, alumina, &c., as they come into contact with, producing the corresponding sulphates.

The carbonate of iron produced from such inter-action, may be directly deposited as chalybite or spathic iron ore, but is more commonly converted, by loss of carbonic acid and subsequent oxidation, into various forms of ferric hydrate or oxide such as limonite, haematite, &c.

The familiar rusty iron stain which settles from chalybeate waters, affords an indication of the manner in which such ores have been produced, and the thick brown mud so frequently found in disused mines and on the beds of streams, are further examples.

The natural or induced weathering of iron pyrites is taken advantage of in the case of low grade cupriferous iron pyrites at the Rio Tinto mine, both metals being dissolved out as sulphate and the copper finally precipitated as metal by treatment with pig or scrap iron.

It is interesting to note that the Rio Tinto ore is one of the very few which lend themselves to such weathering. Many large deposits exist, which, although very similar in appearance, are almost incapable of such weathering and, being too poor for smelting, have had to be abandoned.

Although Henckel's views as to the effect of pyrites were too advanced, there is probably no mineral on which so many industries depend or which yields so many direct or indirect by-products of commercial value.

Although not a tenth of the total sulphur mined yearly in the form of pyrites and practically none of that existing in other minerals, is utilized, the remainder passing into the atmosphere or being otherwise directly lost, nearly 2,000,000 tons of iron pyrites averaging about 45 per cent. of sulphur, is annually mined, as a source of sulphur, mainly for utilization in the manufacture of sulphuric acid. This huge supply is supplemented by a comparatively small return of sulphur recovered from alkali waste by the Claus-Chance process, and particularly by the large amounts of native sulphur mined in Italy and probably attributable to natural processes acting on sulphurous gases somewhat as in the Claus-Chance process, and by the rapidly increasing output of Louisiana. The two latter sources account between them, for about three quarters of a million tons of crude native sulphur annually.

The consideration of the pyrites and sulphur industry must be left for the writers of special papers, but a few words may be devoted to the many by-products which are obtained during roasting, smelting or other treatment of pyritic ores.

Selenium occurs, although only in minute quantities, in native sulphur and in all pyritic ores, and becomes concentrated throughout various stages of their treatment. Its production as a by-product of sulphuric acid manufacture is well-known but its latest and principal source is the anode mud or slime from the electrolytic purification of crude copper. Although its percentage in the cupriferous pyritic ores from which the bulk of the world's copper is obtained, is so small that it cannot usually be determined, it becomes to a large extent, concentrated with the copper through the various stages of treatment and when one remembers that the bulk of the world's copper is purified by that process and that most of the selenium becomes accumulated in the mud left by solution of the anodes, the possibilities as to supply of selenium, should the demand increase, will be readily realized. Not only do these anode residues contain selenium; they contain often as much as 50 per cent. of their weight of gold and silver, together with much bismuth, all similarly concentrated by the selective power of metallic copper from the otherwise non-recoverable traces which occur in the original ore and all obtained as true by-products by a treatment which would be necessary in most cases even were they not present. As regards bismuth, it may be noted that, in addition to the amount recoverable from the copper, over 800 lbs. is stated to escape daily from the smoke stack of a single copper smelter, the Washoe smelter of Montana, and that bismuth is now obtained from the anode mud from the electrolytic refining of lead bullion.

In the roasting of tin ores and of many others where pyrites is present, large quantities of arsenious oxide are produced from the arsenical pyrites which almost invariably accompanies even ordinary iron pyrites and which is still more common with mixed ores. Although in mining districts, unlimited amounts of sulphurous acid are often permitted to pass into the air, the escape of arsenic fumes is usually rigidly forbidden. A large proportion of the white arsenic of commerce and, through it, of practically all other arsenical compounds; is thus obtained as a by-product. The residues from the roasting of pyrites for sulphuric acid manufacture are by no means exhausted of their values. The extraction of their copper contents and the recovery of their silver and gold by the Claudet process are well-known, and the use of the burnt pyrites as pigment and polishing material and for smelting down for production of pig iron may be mentioned as the principal among its other applications. Want of time prevents any description of the many other ore bodies on which our mineral wealth depends or any reference to the mechanical, hydraulic, magnetic and other methods by which most minerals are dressed for the market.

Papers might well be presented to this Soicety by specialists on the Cornish tin industry and on the treatment of the gold ore of the Rand. Either would include a description of the most typical dressing appliances and methods, while one on general metallurgy would include the most important metallurgical methods of concentrating mineral values.

The impossibility of dealing adequately with the subject before us in a single paper was emphasized at its commencement, and the writer can plead that his difficulty has been mainly in deciding what must be left out, that the original manuscript extended to over twice its present size and that many matters which are now ignored, were previously included in it.

In conclusion, he has to express his indebtedness to Mr. W. E. F. Powney and Mr. F. Rowley, whose help has been invaluable both in the preparation of the notes and as critics and correctors of the manuscript.

DISCUSSION.

Mr. Howe (Museum of Practical Geology, Jermyn Street), said one thing which would help very much in the practical geological treatment of building stones would be to have a uniform expression of the analytical results. Although, in so many instances, one depended upon the chemist, he thought the practical man was largely independent as regards building stones. A microscopic examination of a section would usually give all the information one required. He understood Mr. Holloway to say that as a mineral titanium was not very prevalent; but really on the minute scale it was very widely distributed. A large field lay open for the further examination of the minerals which had been referred to. With regard to kaolin, he did not know that things were quite satisfactory.

In the literature it was continually mentioned as being present in all sorts of clays, slates, sandstones, and many other rocks; but it could not be isolated in most of these cases. In by far the greater majority of those rocks, it was reported on analysis as kaolin without sufficient evidence. There was much to be done in clearing up their knowledge of the formation of clays and also as to the way of treating clays so as to separate out those colloidal parts of clayey material which were supposed to be present in large proportion in certain deposits, and seeing how to treat them so as to be able to handle them for practical purposes. They would be glad to know more with regard to the colouring of precious stones by radio-active substances, as that was a matter about which they were constantly being questioned at the museum by practical jewellers.

Prof. H. Louis said that while he was in accord with the general tenor of the paper, there were one or two points which he thought were open to discussion. First, with regard to the formation of the mineral deposits which were found on the borderland of masses of igneous rocks. The Scandinavians called the aureole of igneous rocks by the word "skarn," meaning thereby the zone of more or less metamorphosed rock which surrounded the igneous mass within which such deposits occurred. The author appeared to agree with Vogt in attributing the origin of these deposits to what Vogt called "pneumatolytic" action, that is, that they were produced by mineral vapours. The classical example was that due in the first place, to a French chemist, Daubrée, who ascribed the formation of tin-stone to the action of aqueous vapour on fluoride of tin. For his own part, he did not thoroughly believe in this pneumatolytic theory: his own view was that there was but little true pneumatolysis in the form of true vapours of those haloid compounds interacting with water vapour, and that, in the great majority of cases, there was something between the state of vapour and the liquid state—that these igneous rocks would certainly have contained water vapour in enormous quantity and no doubt other vapours, perhaps even haloid compounds of certain metals. But he thought these had been condensed into some excessively superheated sludge, not a true vapour, under enormous pressure, something between a liquid and a gas and that the mineral deposits were formed more or less through a process of solution. As a fairly strong argument in favour of that view, he quoted the pseudomorphs of cassiterite after orthoclase of St. Austell. It was obviously quite certain that the granite or pegmatite, or whatever it was, must have solidified, and that the felspar crystal must have crystallised out and have had a completely solid matrix all round it. The crystal must have been thoroughly solidified to form a sufficiently rigid mould, and it was only afterwards that the particles of felspar were dissolved away, and were replaced particle by particle, by tin-stone: for there was no other conceivable way in which that pseudomorph could have been produced. That meant that tin-stone was deposited long after the solidification of the igneous rock; and it seemed a strong argument against accepting the pneumatolytic theory in its fullest sense. There were a number of cases which could be quoted which showed that pneumatolysis in the simple form in which Vogt put it forward might occasionally have occurred; but if so, it was only the exception, and not the rule. Taking again the case of fluorine, practically the whole of the fluorspar obtained in this country was derived from veins in the mountain limestone, where there was unquestionable evidence of the replacement of limestone by carbonate of iron acting in the form of a solution. In the Weardale district there was a vein fifteen feet in width, filled up with practically pure fluorspar, and it was quite certain that a vein fifteen feet wide, which required a heavy expense to keep it open by timber, did not stand open under much heavier superincumbent ground than was there now, while the fluoride slowly volatilised into it; it was gradually produced by replacement in solution. Very likely these solutions came in a highly heated form. Another point to which the author made only a passing reference, he should like to suggest, deserved more attention; and that was the changes that the limestone deposits had undergone. He was strongly of opinion that over 90 per cent. of the iron ores being mined in Great Britain to-day were produced by the replacement of limestone by iron, particle by particle. Probably the whole of the Cleveland deposits, the carbonate of iron mines in Weardale, and almost certainly the whole of the red hematite of Lancashire and Cumberland, were produced by the slow replacement of carbonate of lime by carbonate of iron. Years ago he proved on a small scale in the laboratory, that the iron could be directly precipitated in the form of brown hematite, *i.e.*, oxide more or less hydrated, by blowing carbon dioxide and air through finely divided ferriferous limestone suspended in water. Whether these deposits had been formed in that way, or whether they had been first formed as carbonate of iron and afterwards changed into the brown or red hematite, he was not prepared to say; but the latter method was almost certainly the one which had prevailed in the beds of iron ore which were deposited in Northamptonshire, Lincolnshire, and the Cleveland district—many of which ores, although brown hematite at the surface, were carbonates in the deeper lying portions. In connection with this change in the limestone, he would point out an important group which he might call for convenience, residual deposits, deposits produced by the dissolving away of the beds of limestone and leaving behind the minerals they contained in small quantities. One of the best examples was the region of Santander in the North of Spain, where there were masses of iron ore (brown hematite), and also deposits of zinc carbonate, in a soft clay, deposited in and about the eroded pinnacles of a dolomite which contained small traces of these minerals. The general geology of the district left no doubt that these were residual deposits produced by dissolving away the carbonate of lime and magnesia, leaving the iron or zinc, as the case might be, in the clayey matter that the original rock contained. These changes of limestone formed some of the most important of mineral deposits. The author seemed to think that gold deposits might be due to deposition by chemical or electro-chemical action from sea water. There were one or two cases where that might possibly be so. For instance certain sandstones in the Bristol coalfield had been shown to contain chemical traces of gold, and possibly that was a case in point; but in the vast majority of instances he was convinced that the gold had been deposited not from sea water lying above the deposits but that the gold solution had infiltrated from the sides or upwards; that it was a deep-lying solution, and not a sea-water solution which had been the origin of the gold. There were phenomena that Mr. Holloway barely touched upon, which geologists were speaking of of familiarly nowadays as the "secondary enrichments" of the higher lying portions of certain deposits that had played a very important part in determining the gold contents. He remembered in the early days of the Randt going into what was now the Jumpers Mine and breaking out with his own hands and panning for himself stuff which ran over 200 ounces to the ton; the bottom of the pan was simply covered with gold. The stuff from that same mine now went about one ounce to the ton in depth. The superficial enrichment in such cases was a partly chemical and partly mechanical concentration. As the surface of the ground was worn down the heavier gold-bearing portion would remain more or less *in situ* and would be attacked, possibly dissolved, and re-deposited. But that would be a purely local action. He gathered that the author thought the gold might have been dissolved by ferric sulphate and re-deposited by ferrous sulphate, and he had heard it so stated; but his own experience entirely negatived that. Absolutely pure ferric sulphate would not dissolve gold; but if it contained traces of chlorides, the gold would dissolve readily; and that was always the case in nature. No doubt there was always sufficient chloride present to enable that reaction to take place; so that a deposit of that kind would be subject to a chemical as well as a mechanical enrichment of the gold, which was, of course, one of the well-known phenomena of gold deposits all the world over. He believed that if gold had been derived from overlying sea water it was the exception; and that probably nearly always it came from hot saline water circulating within the earth's crust.

Mr. R. **Pearce** said Mr. Holloway had referred to some investigations of his in connection with the occurrence of pitchblende at Dolcoath mine in a matrix of purple fluorspar, and since it had been recently found that the emanations from radium compounds had the peculiar property of colouring glass a deep purple, he thought that perhaps the purple fluor-spar which was associated with pitchblende might have derived its colour from emanations of radium. In his paper he (the speaker) referred to the peculiar purple colour of the fluor-spar and also stated that it gave a strong indication of uranium when treated by a blowpipe test. Mr. Holloway had kindly made some experiments to discover if any marked change of colour was developed by allowing radium bromide to be in close contact with a piece of colourless fluor-spar for some weeks. They proved conclusively that there was a perceptible change of colour even in so short a time. It was, he thought, fair to suppose that strongly radio-active minerals like pitchblende might have played some part in the colouring of minerals. The chemical changes which occurred in rocks and their intimate connection with mineral deposits and the formation of lodes, had received an immense amount of attention during the last few years. In 1864 attention was called to the fact that many of the Cornish mineral veins had been formed by a process of slow replacement of one mineral by another, by the circulation of mineral solutions through the natural joints or channels of the granite; the felspar of the granite as well as the mica having been altered into "chlorite." The same agency which produced these changes in all probability impregnated the altered zone of rock with tin oxide, and the other common accompaniments of tin in lodes. Professor Louis had referred to this subject and to the solubility of gold in certain solutions. The speaker described an experiment made with the object of finding out if water containing very small quantities of sodium chloride and free sulphuric acid, such as is frequently found in mines, would dissolve gold under certain conditions. An ore from a Cripple Creek mine taken from near the surface containing gold in a fine spongy form (an oxidised telluride ore), and having a matrix mainly silicious, with small quantities of psilomelane (impure manganese dioxide) and limonite was selected. The fine ore was digested for some days with the saline solution referred to with the result that a portion of the gold passed into solution. The solution was allowed to act on crystals (cubes) of iron pyrites, and after some weeks the appearance of little rosette crystals of gold on the faces of the crystals of pyrites was noticed. This experiment might explain the change which was known to occur in veins, where the gold had been transferred by solution from the upper or oxidised portions of the vein to the pyritic ores which occurred at greater depth, forming what were now termed "secondary enrichments."

Mr. **Hutchin** said in some parts of Cornwall there were china clay deposits and a lode structure associated with them, but with this china clay deposit there was often associated a little tin other than cassiterite: and the point was, did that tin come up into the china clay or was it there originally? Points had been made as to the genesis of the tin ore deposits, the wolfram, and hydrofluoric acid. Was it the fact that the fluoride always accompanied the tin ores and the wolfram ores? In general, in the upper levels the fluorides and tin ores and the wolfram were associated; and it might be said therefore that they must come up from one centre; that the fluorides, the wolfram and the tin ores had all come up by pneumatolysis from below; but in that same district it was possible to strike across a bar of rock cutting right across and on one side of which was tin and wolfram and on the other side tin only. The deep-seated origin could not have come in at all; it must have come in from above. There he agreed with Professor Louis. The author also referred to the possibility of finding rare elements in the Cornish tin slimes, and possibly an investigation of Cornish tin ores might well repay study. The homologue of tungsten might be found in Cornish tin ores.

Mr. Dreydel wished to draw attention to the importance to be attached to the presence of the tungsten, &c., which might be found in tin ores and to the necessity of work being done on these metals, particularly in connection with their use alloyed with iron in steel manufacture, and alone or alloyed with one another, in the electric lamp industry.

Dr. O. J. Steinhart said he could not quite agree with the theory put forward by Mr. Hutchin with respect to china clay and tin. He (Dr. Steinhart) had for some time past been interested in the china clay and tin deposits in Cornwall and thus had many opportunities of studying these beds of clay. It could be clearly seen from the tin and quartz schorl veins or greisen (locally known as "stent") running generally in a N.E. direction through the clay and in many instances remaining standing after the clay had been removed, that these veins must have existed in the granite, before the decomposition of the latter took place. There was very little doubt that china clay was formed by the action of magmatic gases coming up from below. Why was it for instance that huge boulders of granite were often found right in the centre of clay pits? It was simply that these pieces of granite had escaped the action of gases and vapours owing probably to occurrence of fissures or lines of rifting existing at the period when the clay was being formed. Rosler's and also Fiebelkorn's, investigations show pretty conclusively that china clay has been formed by pneumatolytic action through the medium of aqueous vapours derived from the magma (often aided by fluorine and boron) as follows:
$K_2O.Al_2O_3.6SiO_2 + 2H_2O = Al_2O_3.2SiO_2.2H_2O + K_2O.4SiO_2$

With regard to uranium and radio-activity, it was an accepted theory that the radio-activity stood in direct proportion to the quantity of uranium present in the mineral.

Mr. W. F. Reid referred to the presence of zircon crystals in the Bagshot sand and said that under certain conditions large quantities of these rare minerals were obtainable, and they could be concentrated in a cheap way, while washing the sand for building purposes. With regard to the colouring of fluor-spar, he would remark that in some cases undoubtedly the purple colour, especially in Derbyshire, was due to organic substances—there was no question about that—for, by distilling fluor-spar he had obtained bituminous matter. He thought Mr. Howe had rather underrated the importance of chemistry in the matter of building-stone. A microscope could not tell how a stone was going to stand the weather; and he thought the best test was the practical effect of the atmosphere upon it. Many building-stones in London were now in the most pitiable state. The inexperienced architects who chose them could have got something better and cheaper by consulting a chemist. In Berlin, a most important series of experiments on the action of the atmosphere on building-stones was being carried out by Dr. Rathgen, of the Royal Museum in that town. The samples of stone were actually exposed to the air on the roof of the museum.

Mr. A. C. Claudet wrote:—With regard to by-products from metallurgical operations the presence of phosphorus in iron ores may be instanced; an iron ore to be of value should contain a very small percentage of phosphorus as is well known; ores containing a large percentage of phosphorus also are valuable on account of the phosphorus being high enough in the slag to make the slag valuable as an artificial manure; on the other hand a medium percentage does not produce slag of sufficient value and, as simple iron ores, are of little value unless they are previously treated by a magnetic process, should they be magnetite iron ores, as practised in Sweden and Norway. The above statement is subject of course to correction by those more experienced in iron smelting than I am. Chemical separation of small quantities of selenium and tellurium in the electrolytic treatment of impure copper indicates that there is a source of supply of a certain amount of these rare metals should the demand for them arise; these same metals occur in certain gold ores but in this case the difficulties in extracting them at a profit are much greater. In alkali manufacture, the hydrochloric acid condensers are generally built of "Yorkshire" flagstones which resist the action of acid more than any other kind of stone: this also is the case with the chlorine stills used in connection with the bleaching powder manufacture: thus a stone is utilised which has stood the test of geological time, and has survived the decomposing processes of nature. The refractory zinc lead ore problem has a great future before it, sulphuric acid can now be obtained by the careful roasting of these types of ores and the products from them, and can be utilised not only for the treatment of the wasted ores and products to extract the zinc from them, but can also be applied to the production of superphosphates, of course under favourable conditions. In connection with this problem may be mentioned the use of oil and sulphuric acid in enriching the zinc tailings, to a marketable product, resulting from the ordinary wet concentration processes used at Broken Hill and other localities. The Claudet process has been mentioned: this process is simply one of a cycle of operations in connection with the economical treatment of cuprous Spanish pyrites imported into Great Britain, for the manufacture of sulphuric acid. The economical treatment of this kind of pyrites has reached extraordinary excellence. The sulphur is utilised, the copper is extracted from the burnt residues, and the silver is extracted by means of a soluble iodide (at one time a payable proposition but now questionable owing to the low price of silver). The "purple ore" (the residues left after extracting the copper) is used for iron making. Sulphate of soda, carbonate of soda, caustic soda, and bleaching powder are manufactured with the aid of sulphuric acid obtained from the pyrites, and various important by-products are produced, hydrochloric acid being a principal one, and others too numerous to mention. Finally the alkali waste containing a very large proportion of the sulphur of the original pyrites is treated by the Chance-Claus kiln process to recover the sulphur contents.

Mr. W. L. S. Alton wrote:—The rarer elements occur in Cornwall and many other districts in quantities which are relatively considerable although, through want of knowledge as to their nature and value, or as to the best method of dealing with them, they have too often been regarded as useless. The typical case of pitchblende, may be instanced as one of the many cases of valuable material which has been regarded in the past as useless. Until recently, we in England were not acquainted with the best method of extracting either uranium or radium: so that what is practically a "corner" in radium has been established abroad, with the result that its price has risen enormously and our experience as to its uses has been correspondingly restricted. Excellent as are our various "Schools of Mines," there still exists the need for some institution in England where special problems such as those relating to the rare elements and out-of-the-way minerals could be fully investigated and processes devised for the treatment of the latter; in fact, an institution where chemical technology should be specialised in connection with this almost unworked branch of mineralogy.

Mr. G. T. Holloway replied that, with reference to the geological matters brought up in the discussion, he had endeavoured to confine his paper to such natural changes in minerals and rocks as were of interest to the chemist, and to avoid geological details so far as possible. As regards Mr. Howe's remarks, the statement that true titanium minerals were rare, referred to their availability for commercial purposes. Prof. Louis' opinion that the pneumatolytic theory could only account for a portion of the known changes in mineralisation was in accord with the written paper, which had necessarily been curtailed in reading. The changes due to the action of deep-seated forces had been emphasised as probably accounting for the production of many minerals not otherwise readily explained, but the earlier portion of the paper gave full and perhaps almost undue credit to the simple chemical changes produced by atmospheric, aqueous, and other surface action. He was glad to hear Prof. Louis' reference to the replacement of limestone by iron ore, to the many other replacements, and to the production of residual deposits. Want of space had prevented their proper consideration in the paper, but their importance should not be overlooked. He had not stated in the paper that auriferous deposits had been largely produced from sea-water, but that it was continuously being deposited from various solutions which contained it, including, of course, sea and other saline waters. He had not expressed the opinion that the gold had been dissolved by ferric sulphate. He had, in fact, ignored the means by which it had passed into solution and had only dealt with its deposition. Three of the speakers had referred to the action of radio-active bodies on minerals, including precious stones. That was a matter of great scientific and of some practical importance. The extraordinarily varied colours of many minerals including quartz, fluorspar, rock salt, zircon, topaz, and other precious stones had been the subject of much practical work and of far more theoretical consideration, and much had been published on the matter. The author considered it certain that, as a rule, such colours were not due to the presence of impurities, and that this was especially true as regards the minerals above named. A yellow, green, or colourless fluorspar, or a yellow or smoky quartz such as cairngorm, would, for instance, be quite as likely to contain manganese as would the amethyst-coloured varieties. Mr. Reid had pointed out that the dark purple (almost black) fluorspar of Derbyshire contained bituminous matter. It was interesting to note that, although such fluorspars became colourless when heated, the colour, or at any rate, a somewhat similar colour, would return on exposure to the emanations from radium and therefore, with longer exposure, from uranium. Fluorspar, zircon, topaz, and many other of these curiously coloured minerals became momentarily fluorescent when heated, and lost their colour at the same time, but could be recoloured by exposure to radium. This fluorescence was most significant. Those who had examined fluorspars and precious stones must have noticed the commonly patchy nature of the colouring. In some cases, the colouring was nebulous, but it was often defined by plane surfaces as though that portion of the mineral had a different composition, although that was not the case, and often two or more different and definitely limited colours would be seen on the same mineral. The whole colour might be instantly discharged by heat and gradually reproduced sometimes in the same but sometimes in other parts, by the action of radium. He thought that it was more reasonable to attribute the colours to the action of radio-active material than to the presence of an ordinary identifiable colouring matter. Even in the case of rock-salt, the colouring was possibly due to radio-active agency and it was interesting to note that radium was obtainable from the calcium sulphate residues from Galician brines. Mr. Reid's remarks regarding zircons in alluvial and other sands accorded with the author's experience. Zircons as well as garnets and other more or less precious stones occurred in large quantities in many of the concentrates from gold alluvial washings, and would form a valuable source of such minerals should demand arise. He was glad to see that Mr. Hutchin, Mr. Dreydel, and Mr. Alton agreed as to the importance of further work on the rare heavy minerals.

Manchester Section.

Meeting held at Manchester on Friday, December 3rd, 1909.

R. H. CLAYTON IN THE CHAIR.

ON THE PROPERTIES OF CERTAIN COLLAGENOUS BODIES AND THEIR BEHAVIOUR TOWARDS LIGHT WHEN ASSOCIATED WITH ALKALI BICHROMATES.

BY CHARLES W. GAMBLE.

Although the investigations which have been made on the changes which take place when mixtures of certain proteoid and proteid bodies (gelatine, albumen and similar substances) with alkali bichromates on exposure to light have been in some respects very complete, attention has hitherto been directed mainly to one phase, *viz.*, changes which occur in the chromium compounds. Little, if any, attention appears to have been given either to changes which take place in the organic substances, or to how the organic substance and its state affects the change in the metallic salt and the combination which results. Taking gelatine as the most important of the bodies used in conjunction with the chromium compounds, investigation has shown that when the alkali or other bichromate is reduced the gelatine unites with the chromium oxide to form a mass insoluble in water.(¹)

Gelatine is, however, not a simple entity, but a very complex substance, showing in different specimens considerable variations, and it appears reasonable to suppose that such variations will influence the changes which take place—the rate of alteration in the chromated mixture, and the amount of insoluble substance produced. This assumption is all the more justifiable when it is remembered that other substances related to gelatine behave in a similar manner, as for example the degradation product "gelatose," commonly known as meta or continuously soluble gelatine, a body which may be prepared from ordinary gelatine by continued heating in contact with water.

The behaviour of the substance "gelatose" with alkali bichromates forms the subject of this communication. Inasmuch, however, as gelatine, disregarding the parent body collagen, forms the original material from which gelatose is produced, and, moreover, as there is no line of demarcation shown in the differences exhibited by the two bodies in their behaviour with alkali bichromates, it will be useful to consider in the first place the gelatine itself.

The proteoid gelatine is one of the resultants of the action of hot water on certain animal tissues—collagens. It is well known if animal membrane such as the skin freed from hair and fatty matter be subjected to the continued influence of hot water there is produced a solution which (when a certain soluble content reaches a particular amount varying with the substance) forms on cooling a viscous liquid that eventually at a particular temperature sets to form a jelly, the so-called "gel." If such a mass be freed from water by drying the substance obtained is the body gelatine. If however the original digest be heated for too long a period or at too high a temperature there follows such changes in the composition of the dissolved substance that the liquid will no longer yield a jelly on cooling—there is produced another form of the gelatine which is termed "gelatose." The most obvious effect of the change is that if the substance be freed from water by evaporation the solid body which is obtained is, unlike the original gelatine, directly soluble in water at the ordinary temperature of the air, and that though it is capable of producing a solution of considerable viscosity it will not "gel." Instead of skin the hardening cartilage—bone—may be used, when a different type of gelatine results. For a long time these bodies have been designated by special terms as chondrinous and glutinous gelatines representing respectively, gelatines from the non-hardening and hardening cartilage, terms useful only so long as they are retained for the purpose of indicating origin and not to suggest entirely different bodies.

If the skins of fish be digested in water a solution is produced which on concentration forms a viscous liquid that comes into commerce under the name of "fish glue." This substance is a form of gelatose and behaves in a similar manner. It is very largely used in conjunction with an alkali bichromate to form the sensitive coating for the production of "resists" for the purposes of photo engraving, and it was with the object of ascertaining the cause of the well-known variation in "sensitiveness" in the films obtained with different samples of chromated fish glue that the present investigation was undertaken.

The jelly-forming property of ordinary gelatine may be destroyed by other means than continued heating in association with water. The period required for the loss of the jelly-forming capacity of ordinary gelatine when heated in contact with water is greatly influenced by the temperature. Below 90° C. it proceeds comparatively slowly but the rate is rapidly accelerated when high temperatures obtain, and at any temperature the hydrolytic cleavage proceeds more quickly in the presence of acid or alkali. Further the change may be brought about by proteolytic enzymes and also by the influence of putrefactive organisms, as for example by b. subtilis, b. mesentericus, b. liquifaciens, and many others. The changes effected by putrefaction result largely in the production of the same bodies as by the enzymes, at least in the early stages. In the presence of the proteolytic enzymes the jelly-forming capacity of gelatine even in concentrated solution is soon destroyed, particularly at a temperature of 40° C. In acid solution, pepsin, the enzyme of the gastric juice (pepsin-hydrochloric acid) acts, but it is far less energetic than the enzyme of the pancreas, trypsin, which either in neutral or alkaline solution rapidly produces the change. In this respect the difference in the behaviour of the two enzymes is most marked, for while a 40° per cent. solution of gelatine containing 0·1 per cent. trypsin loses its setting power after 40 minutes' digestion at 40° C. a similar solution of gelatine containing pepsin to the amount of 3 per cent. with the addition of 1 per cent. of hydrochloric acid retains sufficient setting property after 3 hours' digestion to form a firm jelly. The rapid action in the case of trypsin is well known.(2) The action of mineral acids and caustic alkalis upon solutions of gelatine when present in small quantity at temperatures comparable with those given for the enzymes, so far as these cause a loss of setting power, is relatively slow. On the other hand the cleavage which results in a loss of setting power takes place rapidly in the presence of a relatively small quantity of caustic potash when the gelatine solution is boiled. Under similar conditions and using hydrochloric acid in equivalent proportion the change is effected more slowly. The extent of the loss of that property of the gelatine in virtue of which it forms a gel, may be ascertained by determining the temperature at which the gel (formed on cooling a portion of the treated solution) passes again to the liquid state, and such temperature value, or melting point, compared with that given by the original gel (gel before treatment) serves to show the degree of change. Conclusions as to the extent of the loss of "gelling" on setting power if deduced from the mere examination of the solution after cooling, are liable to be erroneous. A solution of gelatine, containing originally 20 per cent. by weight of the substance, with a relatively low content of such gelatine, is viscous, and the viscosity increases to some extent as might be expected when the temperature falls. Eventually the mass "sets," and a relatively firm gel may be produced. The immobility of the "gel" is much greater than might have been anticipated from the examination of the solution just before the setting. On remelting, the mass passes quickly to a relatively mobile solution. The firmness of the gel is also influenced by the temperature, becoming greater on cooling the mass below the point at which it would melt. If the cleavage has been carried to the stage at which the proteoid has lost its power to "gel," say at 15° C. and there be then dissolved in the gelatine at a higher temperature a small quantity of unchanged gelatine the mass will "gel" again on cooling.

Similarly if after hydrolysis there remain only a comparatively small quantity of gelatine still unconverted the solution may set. Another condition which may lead to erroneous conclusions is *retarded* setting.(3) It frequently occurs that the "gel" is not formed until after the solution has been kept for some weeks even though the temperature may have been maintained for some portion of the period below the melting point. A solution of gelatine will decrease in mobility as its temperature falls, then there is a fairly sharp transition to the solid or gel state. The character of the solution of gelatose is quite different in that it forms (when the content of the solid in the solvent is sufficiently high) a solution of marked viscosity, but one which preserves mobility until its freezing point is reached. Attention is particularly drawn to this difference, for the property exhibited is of extreme value so far as concerns the use of gelatose in photo-mechanical processes.

For the purpose of showing the progress of the change it is necessary to make careful determinations of the melting point of the "gel," which will show a steady decline as the hydrolysis proceeds.(4)

The destruction of the setting power of gelatine and the consequent formation of gelatose can be more easily brought about by trypsin than by any other agent, and the continual change in the gelatose as the hydrolysis proceeds can be examined. Leaving therefore for the present the other agents given, and considering only the action of trypsin, there occurs a hydrolysis and the first stage of this cleavage is the production of gelatose which is ultimately converted to gelatine-peptone or gelatone. These changes correspond to those produced by the protolytic ferments on ordinary proteids when there is produced in the first instance proteose (albumose or proto-peptone) which is ultimately converted to peptone. Inasmuch as the change is a progressive one, in no case is the solution of gelatose free from peptone, which is produced from the gelatose as the action proceeds.

The two substances may be separated by the addition of ammonium sulphate or zinc sulphate both of which when a sufficient degree of concentration is reached act as precipitants for the gelatose, the substance being thrown out of solution as a white curdy mass which under certain conditions clots upon agitation. If a sufficiency be added only the gelatine peptone remains in solution and its presence may be shown by the biuret reaction, but more conclusively by the precipitate which is formed on the addition of bromine water after acidification with hydrochloric acid, the halogen throwing down the gelatine peptone as a flocculent yellow precipitate (A. H. Allen, "Analyst," 1897, 258). Both ammonium and zinc sulphate act as precipitants for gelatine. If therefore there be any unchanged gelatine present in the solution in which hydrolysis has taken place, the gelatine will be precipitated together with the gelatose.

Further, if to the gelatine solution there be added a solution of chromic acid, the gelatose is precipitated but not the gelatine peptone. Any unchanged gelatine is also precipitated by the reagent. This fact has already been noted by Crismer.

Many other differences towards reagents are exhibited which are fully detailed in the literature of the subject, but it has been considered sufficient to describe only those which enable the two groups to be identified and whose action is definite in character.

If a fresh portion of the original liquid be submitted to dialysis, the gelatine peptone passes through the septum together with a very small proportion of the gelatose. By fractional dialysis the two substances may be almost entirely separated. It is desirable to regard the terms gelatose and gelatine peptone as designating groups of bodies of complicated character which behave in a certain manner to reagents, and to such treatment as described, and not as simple entities.

It will thus be seen that the action of the enzyme has been to alter the proteid gelatine to such extent that it has lost the property of forming a jelly when associated with water, and to convert it, broadly speaking, in the first instance into two bodies, one of which still behaves as a colloid and the other as a crystalloid towards an animal membrane. The liquid so produced is termed gelatose, but it consists of a mixture of gelatose and gelatine peptone and the existence of these two substances may be shown in the manner described. If the hydrolysis be carried further eventually the gelatose is converted to peptone, and by prolongation of the process, further cleavage results as in the case of ordinary proteids. Insomuch as the process is continuous and does not proceed in separate stages, the final products are formed in part long before the digestion of the gelatose and gelatine peptone are complete, there are formed amino-acids, glycine, leucine, aspartic and glutamic acids. Tyrosine is not produced, and this has been held as one of the distinguishing characteristics between gelatine and ordinary proteid bodies.

If the solution at the stage when it has lost its setting power be evaporated to dryness there is left behind a solid residue resembling that which is obtained from ordinary gelatine. If the original gelatose solution be submitted to dialysis so as to separate the gelatose and the peptone, the two solutions when evaporated to dryness yield solids which only differ slightly in appearance, the residue from the peptone portion being slightly more opaque. If the solids be dissolved in water they yield—if the concentration be sufficient—viscous solutions which are practically identical in appearance and which do not gelatinise.

It remains now to describe the behaviour of the gelatose and gelatine peptone towards alkali bichromate. It is common knowledge that if a mixture of gelatose, as for example fish glue, be mixed with a solution of an alkali bichromate and the mass dried, that re-solution in cold water may be effected without difficulty, the bichromate producing no change. If, however, the mass after drying be exposed to light for a sufficient length of time, a darkening takes place, due to the reduction of the chromium salt, and on eventually treating the darkened substance with cold water it refuses to dissolve. Exposure to light under the condition given has rendered the organic substance insoluble in water. Further, provided that the exposure has been sufficient the insoluble body withstands the action of water at a temperature of 50° C., and in many instances is unaffected when subjected to the action of water at a higher temperature. If for the fish glue there be substituted gelatose from ordinary gelatine the same phenomena are observed. On the other hand, when a mixture of gelatine peptone and an alkali bichromate is exposed to light, although the mass darkens, no substance insoluble in water is produced, the mixture after exposure dissolves quite freely. Such effect obtains whatever the duration of the exposure to light may have been. Further, if the form of gelatine known as fish-glue be submitted to hydrolysis so that the gelatose is converted to gelatine peptone, such peptone is not rendered insoluble in water on exposure to light in conjunction with an alkali bichromate. Inasmuch as all ordinary forms of gelatose are mixtures of gelatose and gelatine peptone, it will be seen from the facts given that only a portion of the solid content of this substance is capable of yielding an insoluble product with chromium oxide.

It appears proper now to consider the technical bearing of the results of this investigation so far as concerns the use of gelatose in photo-mechanical photography. This class of substance has been used from the earliest days of photo-engraving in the production of relief blocks. In the so-called "wash out" process a gelatose was employed which was prepared from gelatine or ordinary glue, by prolonged heating in water, with or without the addition of alkali. In such a process the glue would be preferable, because owing to its state, the setting power would be more easily destroyed than would be the case were high grade gelatine submitted to similar treatment. In later times, and with the advent of a different method for the production of "resists" for the making of type-high printing plates in half-tone, gelatose has been used in those processes, for which the generic term "enameline" has been employed. The form of gelatose most generally used for this purpose is that known as "fish glue," which is employed in the arts for many purposes, and of which there are several kinds. Recently there has been introduced into commerce from different sources, other forms of gelatose for the specific use of the photo-engraver. The most obvious advantages obtained in the use of gelatose as against ordinary gelatine arise from the fact that the former body is soluble in cold water. There are, in addition, certain other improvements in the technical result which are well known to the user. Briefly, the making of a resist depends on the production of an image of insolubilized gelatose by exposing a film of the organic material in conjunction with an alkali bichromate to the action of light under a suitable negative, and the subsequent removal of the unchanged portion by the solvent action of cold water. Eventually the plate of zinc or copper upon which the image or print rests is strongly heated when the insolubilised substance becomes altered in character, forming what is technically known as "enamel," in which condition it is capable of resisting the action of the etching mordant, nitric acid or ferric chloride respectively, employed to remove the unprotected portions of the metal.

The differences exhibited by these forms of gelatose and the variations shown by a particular kind are matters of common knowledge, but not so, however, the cause of these differences which hitherto, so far as the author is aware, have not received attention. All these substances are cleavage products of collagenous bodies, and their behaviour with respect to alkali bichromates is similar to that of gelatose from "pure" gelatine. The differences shown in the various samples of gelatose issued from time to time, may be understood by following the differences exhibited with gelatine in its passage from the parent substance to that state in which it no longer yields an insoluble mass with chromium oxide.

Commencing with collagens we can produce by the action of hot water the substance gelatine, which yields the maximum amount of insoluble matter when exposed to light in conjunction with an alkali bichromate. If the gelatine be submitted to further hydrolysis until such a stage is reached that the body loses its power to gel at normal temperature, we have converted the gelatine, broadly speaking, to gelatose. This body will still yield a large amount of insoluble substance with a bichromate on exposure to light, and at this stage it may be said to be in its most useful state for the purposes of the photo-engraver. If the hydrolysis, however, be continued beyond this stage, the gelatose is converted into gelatine peptone, and when this condition is reached it ceases to form an insoluble substance with an alkali bichromate, and is therefore of no value as a material for the production of prints. The changes are not sharply defined, and there is a change in property of the gelatose according to the proportion of gelatose and gelatine peptone.

From experiments which have been extended over a considerable period I have been led to the conclusion that the usefulness of a gelatose for photo-engraving purposes is largely a question of the gelatine peptone content; and that if precautions are not taken in the manufacture to ensure this being kept low, the print or resist yielding capacity of the body when exposed to light in conjunction with a bichromate will be reduced. If the proportion of peptone to gelatose be above a particular amount although a certain quantity of insoluble substance be yielded, there is not sufficient to form a coherent mass, the image washes away in development with water, and this effect is shown, whatever be the exposure (amount of light energy) received. This phenomenon always appears with gelatose from over-digested gelatine, and it may be produced without difficulty with a sample of satisfactory ordinary gelatose if there be added to the same a certain quantity of gelatine peptone.

Inasmuch as the formation of a coherent insoluble mass is a necessity for the production of a satisfactory print, and as the property of yielding such is the criterion of value to the user of bichromated gelatose, it is worth while to consider how the presence of peptone acts as a detriment. The film of the bichromated gelatose before and after exposure to light may be regarded as similar to a thin layer of dry and compressed sponge. Dispersed through the film are particles of peptone. Both bodies re-act with the chromium salt, the gelatose only yielding a substance insoluble in water. When after exposure the film is treated with water for the purpose of removing the portions unacted on, those under the opaque parts of the negative dissolve away. The parts affected, however, swell, and the peptone portions dissolve out. There will be in consequence a tendency to lessen the coherence of the particles forming the sponge-like mass of unsolubilised gelatose. If such a process be carried far, the mass disintegrates and the print washes away.

It is not absolutely necessary that the gelatose through the whole of the thickness of the film be rendered insoluble, though for the production of a firm print there should be a very small amount of soluble matter remaining. The greatest light action takes place on the top portion of the film, the soluble portion, if any, will be close to the metal, and the adhesion of the film to the metal will be lessened when the mass is treated with water, by solution of the insufficiently altered gelatose, and in consequence the print may wash away from its support. This effect is a common sign of insufficient exposure—of "under printing." From this it will be seen that peptone which will not become insoluble, and a mass of gelatose not yet brought to the insoluble state, produce effects on the printed image which are similar in character.

To which cause the trouble is due may be ascertained by exposing fresh films to light for a more prolonged period. With gelatose containing peptone to any extent although prolonged exposure may produce an image which persists, it will always tend to disintegrate, and moreover, such images will have a porous character even when converted to the enamel stage. With prints showing this condition, the mordant may penetrate the film and attack the metal underneath. In the experimental tests which have been made it has been shown that with the increasing proportion of peptone, the peculiar sponge-like characteristic increases until when the quantity of peptone passes a certain proportion, the image does not persist, but washes away during development. When, therefore, gelatose containing gelatine peptone in excessive quantity be used, it is necessary to prolong the exposure of the bichromated film to an undue extent, more than would be necessary were the latter constituent absent. Assuming the light source to be constant, increased exposure means an increased amount of energy received by the film. If when using two samples of bichromated gelatose one requires more exposure to light to produce a desired effect than the other, it is said to be less "sensitive." Such is the common expression used to denote the difference. Without qualification serious objection might be taken to the use of the term It is employed here in the sense denoted, and with the explanation given merely because no other simple term appears to be open to less objection. It is necessary to observe that when tests of gelatose in different conditions for comparative purposes are made that the thickness of film employed and the proportion of the alkali bichromate should not be altered. An investigation with the differences that may be produced by variations in these respects is now being carried out by my colleague, Mr. R. B. Fishenden, and will be published in due course.

If the presence of a soluble substance like peptone acts as a disintegrant it might be inferred that other bodies might play the same part, and experiment shows that such is the case. The addition of glucose to the extent of 5 per cent. of the value of the solid content of glue in the sensitive solution produces marked difference, the film tending to wash away, even after unduly long exposure.

The production of a "gelatose" containing only those constituents which yield insoluble bodies with chromium oxide is much to be desired, and investigation has been proceeding for some time, having such object in view. It is not difficult to produce a gelatinous substance that is freely soluble in water, and which is "sensitive" in the meaning of the term previously given. But owing to the method of use the gelatose must possess *ab initio* considerable viscosity in order to allow of the proper viscosity being obtained in the bichromated solution. Such a property is not easy to obtain except when the content of gelatose in the liquid is high and this results in a relatively high cost. So far as concerns sensitiveness the most satisfactory condition is when the substance contains unconverted gelatine. If, for example, a 40 per cent. solution of gelatine be hydrolysed until there remain only sufficient unchanged substance to form a tremulous "gel" at normal temperature, a film can be prepared which is extremely "sensitive," but the viscosity is so slight that it is far from simple to produce the necessary thickness of film. The attempts to produce increase in viscosity by the addition of salts have so far not yielded results of any appreciable value. To increase viscosity by the addition of unconverted gelatine, or by leaving a residuum of such gelatine (although this method has been adopted in some instances) is not satisfactory; the gel state is produced, which is different to the viscosity of a concentrated solution of gelatose, the state to be aimed at. Some of the products commercially put forward have failed in use owing to inconstancy of composition due to putrefactive change, a change which is neither arrested, nor is its presence disguised by the addition of safrol or of synthetic perfumes, coumarin, vanillin, and the like. So far, the form of fish glue now in use has proved the most satisfactory. Its high solid content (amounting to about 70 per cent.) of non-gelling substance is the cause of its remarkable viscosity, though it is proper to observe that of two samples the more viscous is not necessarily the more "sensitive" for an aqueous solution of peptone alone will be with sufficient concentration equal in viscosity to one of gelatose, and moreover, cannot be distinguished from it. The attainment of constancy of composition and character is not a simple problem, and in many respects the necessities are met. It appears, however, that it may serve a useful purpose to indicate the conditions which should be fulfilled in order that the substance may have the greatest value in a photographic process of the kind considered.

The considerations offered may serve to suggest that possibly valuable results might accrue from a more extended study of the influence of the cleavage products of gelatine in photographic processes, where this substance is employed. It is conceivable that the maker of emulsions for photographic dry plates might find in this way a clue to some unsolved problems.

The author desires to express his thanks to his colleague, Mr. R. B. Fishenden, for the continual help which he has given in the systematic practical testing of a very large number of samples of gelatose preparations; further, to his assistant, Mr. J. Schofield, who has carried out, during a long period, many series of experiments.

Discussion.

Dr. G. J. Fowler said the subject matter of the paper was an extremely interesting instance of the very latest developments of chemistry in the direction of colloids and of colloidal change and enzyme fermentation in relation to their application in the production of beautiful photographic prints. He suggested that change of conductivity might be of use in studying the progressive change of gelatine to gelatose and final peptone bodies. It was possible to follow the breaking down of albuminoid compounds by the change in conductivity in a solution. He would like to know whether, in dealing with compounds, which were almost impossible to separate as definite entities, a certain set of conditions could not be recognised by the conductivity of the solution.

Mr. E. Ardern asked whether the treatment referred to by Mr. Gamble had been applied in hardening the surface of rollers used for printing wall papers.

Mr. R. E. Crowther asked whether Mr. Gamble had determined the amount of water in the samples of gelatine he used for the production of various films. There was a critical amount of water present in commercial gelatine which must not be exceeded in order that the action of light should render the gelatine insoluble. Was the sensitiveness of gelatose films in any way affected, as the sensitiveness of the gelatine film seemed to be, by the presence of acid or alkali in the film during exposure?

Mr. J. Huebner said it was well known that in the manufacture of hand-made papers the glue was prepared by the addition of alum to such an extent that the glue which had been gelatinous became a very thin, mobile solution. He would like to know whether one of the methods suggested by Mr. Gamble for converting the gelatinous substance into a more liquid form might be used.

Mr. Blumenthal enquired whether other agents besides bichromate could be used.

Mr. GAMBLE said he had no doubt Dr. Fowler's suggestion with regard to determination of the conductivity was helpful. Hitherto he had confined himself to melting-point observations, but he hoped later to take advantage of the suggestion given. A difficulty presented itself with regard to the treatment of the rollers used for the printing of wall papers to which Mr. Ardern had referred. The hardness of the exterior of a roller might be increased by treating it with a bichromate and afterwards exposing the roller to light, but, in practice, the mass could not be rendered insoluble throughout. If the exterior only were hardened then the inside would swell or contract with atmospheric changes, and this would cause the exterior film to crinkle. If the gelatine was made completely insoluble by means of a bichromate it became hard and brittle. This would make it quite useless for the purpose under consideration. The hardening of the roller mass could be better effected by addition of a certain quantity of chrome alum to the mixture before casting. Probably the wiser plan would be to pay more attention to the selection of a suitable gelatine. With regard to Mr. Crowther's enquiry, the amount of moisture used in the film was practically constant. The proportion of water to gelatine influenced sensitiveness, with bichromated gelatine. If the bichromated gelatine was absolutely dry, it would be practically insensitive to light. To keep such gelatine quite dry was one method of preventing spontaneous change which always occurred with bichromated gelatine, even on storage in the dark. If there was a large quantity of water present the mixture became insensitive, and change was only produced after considerable exposure to light. The addition of alkali or acid might be detrimental. Alkali would reduce the bichromate—wholly or in part—to a simple chromate, in which case the mixture would not be so sensitive. The addition of a mineral acid would set free chromic acid, which tended to produce insolubility in gelatine without the agency of light. Replying to Mr. Hübner, the effect depended upon the amount of gelatine and alum present in solution, and the proportion between the two. At first sight there appeared to be no reason why one of the converted gelatines should not be used. In many respects it should be more convenient than ordinary gelatine.

REFERENCES AND APPENDICES.

(1) Uber die Reactionen der Chromsäurer und der Chromate auf Gelatin u. s. w. J. M. Eder. Wiener Photographische Gesellschaft. 1878. A translation of this important paper appeared in "The Photographic News," Vol. 22, 23, 1878—79, p. 172 *et seq.*

Sur la composition de la Gelatine insolubilisée par les sels de Sesquioxide de chrome et la théorie de l'action de la lumière sur la gélatine additionnée de chromates metalliques.

MM. Lumière et Seyewetz (Bulletin de la Société Chimique de Paris T. 29, p. 1077 (1903).

Sur la composition de la gelatine insolubilisée par la lumière en présence de l'acide chromique et des principaux bichromates métalliques.

MM. Lumière et Seyewetz. Bulletin de la Société Française de Photographie x, 21, 461).

Sur la composition de la gelatine impregnée de bichromate de potassium insolubilisée par la gelatine et sur la théorie de cette insolubilisation.

MM. Lumière et Seyewetz. Bulletin de la Société Chimique de Paris iii. 33. 1332—1340 (1905).

(2) The rapidity of the action of trypsin is influenced within limits by the quantity of the enzyme present, and upon the temperature of the environment, attaining a maximum at about 40° C. At a temperature of 45° trypsin in neutral solution is destroyed. The presence of free hydrochloric acid prevents the digestive action (*see* Physiological Chemistry, Hammersten, trans. Mandel 3rd Ed. p. 267—289). According to A. H. Allen, (Commercial Organic Analysis, vol. iv. 3rd Ed. p. 287—289), the action increases up to 50°C and then diminishes up to 75°C when the enzyme is destroyed.

The action once started does not appear to be readily checked according to the present author's experience. If the temperature of the mass be quickly raised for the purpose of destroying the trypsin the digestion proceeds with great rapidity. It was necessary to quickly stop the action, and for this purpose the addition of hydrochloric acid until a distinct acid reaction to litmus was obtained followed by rapid chilling to 10° C., was found to be the most satisfactory course. Frequently large volumes were involved, amounting to several litres, and in such cases the arrestment was not easy. When, however, it was intended to study the influence of alkali bichromates, the salt was added at once after the digestive period was completed and the mass cooled. Under such treatment the action of the enzyme ceases. If when the digestion of the gelatine solution has been allowed to proceed only for a short time—less than that required to destroy the setting power of the gelatine—the liquid be suddenly cooled, the mass will gel in a short time. If the flask containing the jelly be now kept at normal temperature, the action proceeds slowly, and eventually the mass liquefies. This method is advantageous as it enables the investigator to arrest further change at the transition point by acidification with hydrochloric acid or by addition of alkali bichromate. The author is, however, not entirely satisfied that the addition of hydrochloric acid does prevent further change, for if the gelatose be kept for several days at normal temperature, there is a decline in viscosity. That this is not due to putrefactive changes is evidenced by the fact that it occurs in the presence of thymol and phenol.

As having a possible bearing on this question, it may be remarked that Chittenden and Cummins have shown (Studies from the Phys. Chem. Lab. Yale, vol. i. p. 100, 1885) that although free mineral acids, when present even in small quantities, do prevent tryptic digestion, yet when the acid is not actually free but is combined with albuminous bodies, the digestion may take place quickly when the acid combination is in not too great an excess. According to Gillespie (Pro. Roy. Soc. 1897, lxxii. 4) organic acids slowly destroy trypsin, but the enzyme is still capable of exerting considerable digestion in their presence.

(3) The phenomena connected with the changes which occur in solution of gelatine under hydrolysis, so far as they effect the setting and swelling properties of the body, have been most minutely investigated by Schroeder (Ueber Erstarrungs und Quellungserscheinungen von Gelatine. Zeits Physik. Chem.: P. von Schroeder, 45, 1903). In this investigation changes of viscosity value are used to show variations in the state of the gelatine.

(4) There does not appear to be any marked difference in the appearance of the gelatine solution as the digestion proceeds. Agitation of the containing vessel, however, shows that the mobility has increased. It is difficult to determine by means of melting point observations how far the change leading to loss of power to gel has proceeded, except in such cases when the amount of trypsin used is small, so that the change is spread over a relatively long period. When a portion of the solution is withdrawn in the capillary tube used in the m. p. determination and cooled so as to produce the gel, the change still proceeds though more slowly, so that the value obtained does not represent the change which has taken place in the digestion flask alone, but represents, in addition, the change which has taken place in the capillary after withdrawal of the portion. For similar reasons viscosity determinations contain an element of error. These considerations do not hold to anything like the same extent for hydrolyses produced by the action of hot water alone, or with dilute acids or alkalis.

After the loss of setting power the reduction in viscosity proceeds rapidly. If the tryptic digestion be carried on at 40° C. a solution of gelatine containing originally 20 per cent. by weight of gelatine becomes almost as mobile as water. The same change is noted with pepsin, though it takes place relatively slowly. The incompleteness of the conversion to peptone by pepsin has been shown by Chittenden, who has found that the maximum yield was 60 per cent. even under the best conditions. It should be noted that the tryptic digestion proceeds without delay in the presence of phenol and thymol, both of which are powerful antiseptics. There is, in consequence, no putrefactive change.

The products of the action of the gastric and pancreatic enzymes on gelatine have been very carefully investigated by Chittenden and Solley (Jour. Physiol. xii. 23. *See* also Jour. Chem. Soc., 1891, p. 949), who distinguish three distinct groups. Of these, two are classed as gelatoses, and the third as a peptone, which is similar in its character to the peptone from albumen. The two former bodies are distinguished from the latter, in that they are precipitated by ammonium sulphate. Eventually the gelatoses are converted by further action of the enzymes to peptone. *See* also A. H. Allen, Commercial Organic Analysis, vol. iv. 2nd. Ed., p. 469.

Yorkshire Section.

Meeting held at Leeds, on Monday, December 13th, 1909.

PROF. W. M. GARDNER IN THE CHAIR.

THE SYNTHESIS OF A GLAZE, GLASS, OR OTHER COMPLEX SILICATE: THE INTER-ACTION OF LIME AND SILICA.

BY JOHN W. COBB.

When a suitable mixture of metallic oxides with silica is heated, it fuses to a homogeneous mass. When such a substance is produced in the arts, it is known as a glaze, glass, or slag, according to its use or origin, and its chemical composition can be determined by well-known methods. If, however, an attempt is made to map out its molecular constitution, difficulties arise. The working of the law of multiple proportion is obscured, because the substance is usually not a single compound, and displays no such limitation of composition. Regarded as a solution, it is usually impossible to say what is dissolved, and in what it is dissolved. One essential property of a normal glass, or glaze, is that on cooling it does not crystallize, and so a recognised way of arriving at information is closed at the outset. The result of ordinary chemical analysis applied to a glass, may be reported as shewing it to contain in a homogeneous mass such-and-such oxides, in proportions, corresponding with a formula of the type $a RO\, bR_2O_3, cSiO_2$, where a, b, and c, have limits, but are not necessarily or usually simply related. The assumption made in the calculation of such a formula from chemical analysis, is that the combination or solution processes involved in the formation of the glass in question, take place without any loss or gain of oxygen by the constituent normal oxides. The fact that the more carefully analyses are made, the more nearly do the results, calculated as oxide percentages, sum to 100, seems to justify the assumption, and so to place one limitation on the complexity of silicates as compared with carbon compounds. This limitation is sometimes overlooked from a premature extension of the existing analogies between carbon and silicon; its application restricts the allowable manipulation of bonds materially. Also, regarding the analogies of carbon and silicon, glass formation involves the reactions of silicon only at high temperatures under oxidising conditions, and the chemistry of carbon under those conditions, is not the complicated organic chemistry of lower temperatures, but so far as is known, a simpler science of carbonates and oxides.

In his "Analysis of silicate and carbonate rocks" (Bull, 305 U.S. Geological Survey), Hillebrand says:—"Given the purest obtainable reagents, an ample supply of platinum, facilities for working, and a reasonably clean laboratory, there is usually little excuse for failure on the part of a competent chemist to reach a summation within the limits of 99·75 and 100·5." This dictum is the result of much experience, and reference to such works as the Chemical Society's Annual Report, under mineral chemistry, confirms it. The same statement might be made respecting the analysis of artificial silicates, such as glasses, and generally it may be said that the most complicated mixed silicates, formed by heating under oxidising conditions, when analysed and calculated to constituent normal oxides, give percentages totalling very nearly 100, and that the more carefully analyses are made, and the more analytical processes are improved, the closer is the approximation. In accordance with the foregoing considerations, the assumption that such a complex silicate "melt" as a glass can be regarded as resulting from combination and solution of its constituent oxides, has been made a working hypothesis. The same assumption has been made before in most ceramic and metallurgical studies. It appeared likely that some clearer understanding of the character of a glass, or at least some useful practical knowledge as to the steps in its formation, would result if a synthesis were made gradually from simple constituent oxides, and the process followed as far as possible through its chemical and thermal stages, noting the gradual appearance of such essential properties as fusibility and non-volatility when hot, and resistance to acids when cold.

The formula of the glass studied was:—

$$\left.\begin{matrix}0{\cdot}5Na_2O\\0{\cdot}5CaO\end{matrix}\right\} 0{\cdot}5Al_2O_3,5SiO_2, \text{ or } \left.\begin{matrix}Na_2O\\CaO\end{matrix}\right\} Al_2O_3.10SiO_2,$$

chosen because of its symmetry, and because it represented a possible working glaze of the porcelain type. It had the further advantage, from one standpoint, of resembling number 5 in Seger's well-known scale of standard silicate mixings for pyrometric cones, which is:—

$$\left.\begin{matrix}0{\cdot}3K_2O\\0{\cdot}7CaO\end{matrix}\right\} 0{\cdot}5Al_2O_3 5{\cdot}0SiO_2.$$

The simplest way of arriving at such a complex silicate was followed; the advance was made from the oxides, through the double, and triple, to the quadruple oxide mixture. There were plainly many ways of working up to the final mixing and formula, depending on what double oxide mixture was chosen as a starting point, and in what order the other oxides were added.

The only way to proceed, without assumptions possibly invalid, was to investigate in parallel fashion all the double oxide and triple oxide mixtures possible. These were in synthesising $Na_2O,CaO,Al_2O_3 10SiO_2$:—

$Na_2O,10SiO_2$	$Na_2O.Al_2O_3.10SiO_2$	$Na_2O.CaO.Al_2O_3.10SiO_2$
$Na_2O.Al_2O_3$	$Na_2O.CaO.Al_2O_3$	
$CaO.10SiO_2$	$CaO.Al_2O_3.10SiO_2$	
$CaO.Al_2O_3$	$Na_2O.CaO.10SiO_2$	
$Al_2O_3,10SiO_2$		
$Na_2O.CaO$		
i.e., 6 double-oxide mixtures	4 triple-oxide mixtures	1 final quadruple-oxide mixture.

There were six possible double oxide mixings, and each of these could be studied independently. With the next stage of the synthesis, the triple oxides, the case was different. $Na_2O.Al_2O_3.10SiO_2$, for example, could be regarded as formed by the introduction of Na_2O into $Al_2O_3.10SiO_2$, of Al_2O_3 into $Na_2O.10SiO_2$, or of SiO_2 into $Na_2O.Al_2O_3$, and the effect of each introduction could be deduced separately from experimental results. Thus, each of the four triple-oxide mixings could be regarded as formed in three ways, according to which double-oxide mixture was used as a basis, and the final product $Na_2O.CaO.Al_2O_3.10SiO_2$ could be formed in four ways from the triple-oxide mixture, according to which of these triple oxide mixtures was used as a basis. The total number of possible steps in reaching $Na_2O.CaO.Al_2O_3.10SiO_2$ from the constituent oxides was, therefore:

6 in making 6 double oxide mixtures, plus 4 × 3 in making 4 triple oxide mixtures from double-oxide mixtures, plus 4 in making the quadruple-oxide mixture from the triple-oxide mixtures, that is 22 possible steps altogether to be considered.

The general procedure was as follows, but was subject to some variation, as called for in the progress of the work. the soda was used as anhydrous sodium carbonate and the lime as calcium carbonate. The alumina, before using, was calcined for three days, at a temperature gradually increasing to 1200° C., which rendered it insoluble in normal hydrochloric acid. For safety, it was then extracted for 24 hours, with normal hydrochloric acid, but the extract contained only a trace of dissolved matter. The silica was a pure quartz (containing as impurity only 0·1 % Fe_2O_3), calcined, and entirely insoluble. All the constituents were passed separately through a sieve 100-inch linear mesh, mixed, re-sifted, and re-mixed. Unglazed porcelain crucibles, filled with the mixture, were placed in a muffle gas furnace, and a thermo-couple with its junction symmetrically disposed with reference to the crucibles. The temperature was raised to 500° C. and kept there for 1 hour. (The pyrometer was calibrated against the melting point of pure copper in air, taken as 1065° C.). One crucible was then taken out, and the temperature raised to 800° C. for an hour. A second crucible was removed, and the other two were transferred to an injector furnace, gas-fired, with a cyclone burner. They were set on a raised centre-piece, so as to be put out of the direct path of the flame. The two crucibles were raised to 1100° C. for one hour, one removed, and the other raised to 1400° C. for one hour. Thus the 1100° C. heat had the same thermal treatment as the 800° C. heat, plus the additional heating at 1100° C., and this thermal treatment was the same as that of the 1100° C. heat from any other mixing. The final period was found to be all-important. Cooling was quickened by an iron plate, to minimise chemical changes which might conceivably occur during cooling.

Extraction and analysis.—Material from inside each crucible, rejecting the borders if the crucible had been attacked, and the surface layer, was put through a sieve, 50 to the inch linear mesh. The first plan was to put it through a sieve 25 to the inch, and one 100 to the inch, and to make tests on the material which passed the one sieve and did not pass the other, but preliminary trials made on mixtures containing much lime, shewed that fine dust passing 100 to the inch was richer in lime than the rest, and so the simpler plan was followed; it fixed a maximum size of grain (about ½ mm.).

2·5 grms. of each powdered mixture was treated for an hour with normal hydrochloric acid in the cold, with occasional shaking, and the insoluble matter filtered off. The filtrate was taken to dryness, the silica rendered insoluble by heating for an hour at 120° C., and alumina, lime, and soda, were determined in the filtrate from the silica. The nature of the investigation was not held to justify the use of more tedious, if more exact methods of separating silica. The result of the analyses of the mixing $Na_2O+CaO+Al_2O_3+10SiO_2$, heated to 800° C., 1150°, and 1400°, and extracted as above, in one typical experiment was :—

Temp. °C.	SiO_2	Al_2O_3	CaO	Na_2O	Total soluble.	Remarks.
Blank	0·52	0·20	6·0	6·63	13·35	Appearance unchanged.
800	1·86	0·41	5·2	3·31	10·78	Hardened shrunken.
1150°	3·07	1·23	0·98	0·72	6·00	Honeycombed fusion.
1400°	0·56	0·13	0·11	0·15	0·95	Transparent glass.

When interpreting the results of such an analysis, what is it justifiable to assume ? The alumina is insoluble at the outset in normal hydrochloric acid, and if heated alone, or with silica, remains so at all the temperatures employed. Where alumina, soluble in the acid, is found present after heating, is it not evidence that the alumina has formed during the heating a soluble or non-resistant compound, or more remotely, has been taken into solution, not mere suspension, by such a non-resistant compound. This assumption was made, and the silica which after heating was extracted by normal hydrochloric acid, was held as coming from the decomposition of a non-resistant or soluble silicate. Similarly, the lime or soda not extracted by the acid, was taken as having gone into an insoluble compound. Deduction from single hour extraction with normal hydrochloric acid, on these lines, was sometimes impossible, chiefly from silica not appearing in the acid extract when a non-resistant silicate had been formed and decomposed. Silica is held by dilute acid in colloidal pseudo-solution, and the extent of separation of gelatinous silica depends on such factors as the salts present, and the nature of the decomposed silicate. Hence, at times, the extraction was divided into two or three stages :—

1st stage.—1 hour with cold normal hydrochloric acid to extract " quickly soluble matter."

2nd stage.—48 hours with normal hydrochloric acid to extract " slowly soluble matter."

3rd stage.—15 mintues with hot 5 per cent. sodium carbonate solution, to extract silica formed in the decomposition of a silicate by normal hydrochloric acid, but not obtained in the hydrochloric acid extract " silica soluble in sodium carbonate."

Trials shewed that the sodium carbonate treatment might leave a small proportion of the liberated silica undissolved, but did not dissolve any ignited quartz ; the results obtained by Lunge (see this J., 1897, p. 762), suggested the method.

" Silicate " reactions generally under heat are complex, but slow ; the final product may defy chemical methods of examination, but the intermediate products exist for very appreciable periods of time. Moreover, inter-action is conditioned by continued heating, so that it can be stopped at any stage, fixing hypothetically the constitution of the product. Hence the possibility of the above method of investigation. It is pertinent whether repetition of heating and extraction gives again the same result, and such was found to be the case within fairly narrow limits. Also, two portions mixed separately, gave similar results, on analysis, if the heating and extraction were done in the manner described. The limits of accuracy can be best gauged from the experimental results. It was therefore considered feasible to investigate the synthesis of a silicate by the method outlined above, and the results obtained by its application will be detailed.

The simpler double-oxide mixtures, such as lime and silica, soda and alumina were held likely to give the most definite chemical results, and were varied, with this in view.

LIME AND SILICA.

The inter-action of lime and silica was made the starting point. The first mixing corresponded with the formula, $CaCO_3+SiO_2$. It was made from precipitated carbonate of lime and ignited quartz sand, the weights used being calculated on the assumption of 100 per cent. purity. The carbonate contained a trace of alumina, and the quartz sand 0·15 per cent. ferric oxide, as impurity. Heatings, and extractions with approximately normal hydrochloric acid, were made, and the numerical results are shewn in Table I. and Curve I.

In explanation of headings in Table I. :—

Where heated.—A muffle, or injector furnace for short period heating, and a works furnace for long period heating, were used.

Temperature.—The maximum temperature at which the heating was conducted.

Time.—The time during which the maximum temperature was maintained ; in the case of the works furnace, the time is only approximate.

Quickly soluble.—The percentage of lime, silica, etc., extracted by normal hydrochloric acid in one hour.

Slowly soluble.—The further percentage of lime, silica, etc., extracted by normal hydrochloric acid acting for successive 24 hour periods, until only a trace of extract resulted.

Silica solublein sodium carbonate.—The percentage of silica extracted by hot 5 per cent. sodium carbonate solution in 15 minutes.

Total soluble.—The total of the preceding three.

Physical condition.—The physical condition of the mixing after the heating, *i.e.*, the degree of its progress towards fusion.

When no determination was made, the space is left blank, and a dash (—) indicates that none of the substance was found present.

Conclusions.—The first conclusion to be drawn from Table I. is that interaction between lime and silica, resulting in the formation of a non-resistant silicate, commenced about 800° C., but was at that temperature extremely slow. The formation of the silicate waa not delayed by the necessity for first decomposing the calcium carbonate, since such decomposition is known to begin at a lower temperature (*see footnote), and was found, actually to, be complete in the 800° C. heatings, where the quantity of soluble silica was very small. The inter-action at 1100° C. and 1250° C. was advanced, and at 1400° C. was nearly complete, the soluble silica being 43·7 per cent. out of a total of 51·7 per cent.

The velocity of the reaction increased rapidly with rising temperature. There was no sign of the formation of an insoluble silicate, the soluble lime repeatedly determined, always approximating to the total quantity of lime present. The insoluble residue from an 1100° C. heating, after extracting 24 hours, was found to contain 0·3 per cent. lime, and this result was typical.

The temperature of heating was the primary determinant of the extent of inter-action, and the time of secondary importance. Thus the average soluble silica formed at 1100° C. in one hour was 7 per cent, and in 22 to 28 hours was 13·5 per cent., but one hour at 1200° C. gave 14·4 per cent, and one hour at 1400° C. gave 44 per cent.

The chemical inter-action was independent of the formation of any liquid substance in the heated mass. Up to 1250° C. only a slight cohesion was observable, whereas the formation of soluble silicate had been gradually increasing in quantity from 800° C. and had reached the amount represented by 15 per cent. soluble silica. Since $CaO+SiO_2$ has been shown by Boudouard (Journ.

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* The vapour pressure of decomposition of calcium carbonate has been determined as 27 mm. Mercury at 547° C., and 753 mm. mercury at 812° C.

TABLE 1.

Calcium Carbonate and Silica ($CaCO_3 + SiO_2$).

$CaCO_3 + SiO_2$ mixings made from
Calcium carbonate 100 } parts
Quartz 60 } by weight.

Percentage composition :—
$CaCO_3 + SiO_2$ contains $\begin{cases} CaO = 35{\cdot}00\ \% \\ SiO_2 = 37{\cdot}50\ \% \end{cases}$
$CaO + SiO_2$ contains $\begin{cases} CaO = 48{\cdot}27\ \% \\ SiO_2\ 51{\cdot}73\ \% \end{cases}$

Where Heated.	Time (hours).	Temp. °C.	Quickly sol.		Slowly sol.		SiO_2 sol. in Na_2CO_3	Total sol.		Physical Condition.	Notes.
			CaO	SiO_2	CaO	SiO_2		CaO	SiO_2		
			34·30	0·20				34·30	0·20		
Blank			35·00	0·30				35·00	0·30		
Muffle	1	500		·14						unchanged	
Works furnace	18	,,		·12							Co_2 after 18 hrs. in works fnce. same as before heating.
Injector	1	800		1·22							
Works fnce.	20	,,		3·8						unchanged	No CO_2 present.
Works fnce.	28	,,		2·5							
Muffle	1	1100		5·3	—	—	—		5·3	unchanged	
,,	1	,,		5·8	—	—	—		5·8		
,,	1	,,		9·14	—	—	—		9·1	sltly. hardened	
Wks. fce.	28	1100		13·0	5·0	—	—		13·0	speckled through't	Analysis duplicated.
,,	23	,,		13·9		—			13·9	sltly. hardened	
,,	28	,,		13·9		—			13·9	,, ,,	
,,	24	,,		13·7	—				13·7	,, ,,	
Injector	1	1200		14·4	—	—	—		14·4	sltly. hardened	
,,	1	1250		14·9	—	—	—		14·9	unchanged	
				15·9					15·9		
,,	1	1400		43·8	—	—			43·8	hardened	1425° C. was reached for a time.
,,	1	1400		43·6	traces				43·6	sugary fusion	
,,	1	1400		39·4						waxy fusion	After 2½ years in the laboratory this heating was quite unchanged in appearance.
,,	1	1400		40·5							

Iron and Steel Trust, 1905, Vol. lxvii., p. 352), to be itself the eutectic mixture of lime and silica, melting at 1440° C., as defined by the bending of a Seger pyramid made of that mixture, it is clear that a calcium silicate was formed at a temperature far below the melting point of either of the constituent oxides, or of their eutectic mixture.

The decomposition of calcium sulphate.—From the study of calcium carbonate and silica, was deduced the temperature of formation of soluble silicate, and the increase in quantity with temperature, but not the composition of the compound (or compounds) formed, because, although the passage of silica from the insoluble to the soluble condition, determined the quantity of silica which had gone into combination, no corresponding change took place in the lime, and no chemical method was thought sufficiently trustworthy to distinguish free from combined lime. Hence, it was decided to heat a mixing, calcium sulphate and silica, to make the quantity of soluble sulphur trioxide, left in the mixing after heating, the measure of the quantity of soluble lime sulphate undecomposed, and to assume that the remainder of the soluble lime was combined with the soluble silica found. That assumption could only be valid up to the temperature at which calcium sulphate, heated alone, under the conditions of these experiments, remained undissociated, or undecomposed ; it became necessary to determine that temperature.

Although theoretically the dissociation pressure could not be said to come into being at any particular temperature, it was thought possible to find a point at which it became practically appreciable.

The calcium sulphate used was plaster of Paris powder of the following composition :—

$CaSO_4 = 93{\cdot}69$ per cent. Water combined. = 6·31 per cent. It was placed in a platinum boat (see Fig. 1.), surrounded by a loose sleeve of platinum foil, to prevent contact with any such siliceous matter as the porcelain glaze, and to secure even temperature. The sleeve and boat were pushed into the middle of a porcelain tube, which was again enveloped by another tube of asbestos carding, with a small air-space between the asbestos and porcelain, so as to steady the heating and cooling, and to further secure even temperature along the length of the platinum boat, and at the thermo-electric junction. The junction of the thermo couple was inserted quite near the boat. The porcelain tube was heated by a cyclone burner, being placed well above the gas and air entry ; the ends were kept hot by independent burners to prevent any condensation, and the entry tube of the small absorption vessel, used to detect acid fumes, was fitted into the porcelain tube.

Para-nitro-phenol was used as an indicator, preliminary tests having shown it to be very sensitive to sulphur dioxide or trioxide, when viewed against a white sheet.

Air was passed through a lead-acetate solution, and then through concentrated sulphuric acid, in a rapid stream (about 5 bubbles per second), and the temperature of the tube was raised to 1300° C. before putting in the calcium sulphate ; no decolorization of the para-nitro-phenol was a satisfactory blank result. After cooling the tube, the calcium sulphate was put into place, and the temperature again slowly raised until decolorization of the para-nitro-phenol indicated the presence of sulphur dioxide or trioxide, and thereby the dissociation of the calcium sulphate. The temperature was then lowered about 200° and again slowly raised, more slowly when approaching the decomposition temperature, until decolorization again occurred. This process of lowering the temperature, slowly raising it, and noticing the temperature of decolorizing, was repeated as often as necessary, until the temperature was nearly the same for each observation.

The para-nitro-phenol tube was replaced in some experiments by one containing barium chloride solution and a drop of bromine; the temperature at which perceptible turbidity occurred was noted. The following figures were obtained.

Temperature of dissociation of calcium sulphate.

Temperature of decolorization of para-nitro-phenol °C.	Temperature of turbidity of barium chloride.	Remarks.
1280	1290—1300	Heated quickly
1260	1260	,, ,,
1210—1220	1220	Heated slowly.
1220—1225	1225	,, ,,
1225—1230	1230	,, ,,
1230	1230	,, ,,

A set of figures obtained some time later was 1230°, 1225°, 1230°, which was confirmatory. The temperature of dissociation of calcium sulphate in dry air was therefore taken as 1225—1230°. On raising the temperature above 1230°, the rate of evolution of acid sulphur compounds increased very gradually through a considerable range, but about 1380—1390° a marked quickening was noticed and rapid evolution began. At that temperature a distinct settling precipitate began to form almost at once on replacing the barium chloride tube by another. 1380—1390° was noted as the temperature of rapid dissociation. It was evidently only a rough approximation. The effect of moisture in the air was tried, since moisture was invariably present during the heating of the silicate mixings, in the products of combustion. Air was bubbled through water at 40°, and over the calcium sulphate (air saturated at 40° with water vapour contains 7·2 per cent. water vapour by volume). The temperatures of dissociation obtained were:—1230°, 1225°, 1230°, and so 1225°—1230° was taken as the temperature of dissociation of calcium sulphate in moist air, and the conclusion was drawn that the presence of moisture in such quantities was without influence.

Another experiment tested the effect of a reducing atmosphere. Hydrogen was tried first: it was passed through lead acetate solution and concentrated sulphuric acid, over the calcium sulphate as before. Hydrogen sulphide was detected at 290°—300° by the discolouration of filter paper moistened with lead acetate solution.

The solid residue in the tube contained sulphide. The influence of moistening the hydrogen was tried by bubbling through water at 47°—50°. The temperatures obtained were 290°—310°. The temperature of decomposition of calcium sulphate in dry or moist hydrogen was therefore taken as below 290°—310°; it was clear that stability of calcium sulphate on heating in a reducing atmosphere was not to be assumed. The decomposition of the calcium sulphate, as indicated by the presence of hydrogen sulphide seemed to increase very slowly as the temperature rose, until about 1000° and then more quickly.

Calcium sulphate decomposition. Collected results.

Atmosphere.	Decomposition detected at	Remarks.
Dry air	1225°—1230°	Increasing gradually to 1380°, then more rapid.
Moist air	1225°—1230°	
Dry hydrogen	below 300°	Increasing gradually to 1000°, then more rapid.
Moist hydrogen ...	below 300°	
Dry carbon monoxide	920°	

The preceding experiments were useful, but it was thought advisable to reproduce the actual conditions of the silicate heatings, by heating calcium sulphate alone in the injector furnace. For successive periods of one hour the loss in weight was: at 1200° C., nil; at 1250° traces, at 1300° 1 to 3 per cent. The decomposition of the calcium sulphate was indicated by a slightly blistered surface, brownish in reducing gases. The blistered portion was nearly pure lime, and the portion below, unaltered in appearance was undecomposed calcium sulphate. In silicate heatings containing calcium sulphate, the blistered skin, if present, was always put aside, along with any portion apparently affected by the crucible wall, and the sample for analysis was prepared from the rest.

The experiments just described decided the limits of stability of calcium sulphate, and justified the assumption that the actual conditions in the silicate heatings were such that any decomposition of the calcium sulphate therein was to be attributed to the action of the other ingredients of the mixture, up to 1200° for all heatings, and up to 1300° for short period heatings.

The effect of silica. Calcium sulphate and silica.—A mixture $CaSO_4+SiO_2$ was heated next. Under reducing conditions the silica was of no effect, the action of the reducing gas being direct upon the calcium sulphate. The temperatures at which sulphur compounds were evolved with dry air were:—1000°, 1010°, 1000—1010°, 1005°, and with moist air exactly the same. 1005—1010° was therefore taken as the temperature at which silica decomposed calcium sulphate, presumably with the formation of calcium silicate. The lowering of the temperature of decomposition of calcium sulphate brought about by silica was therefore 220°. The temperature, 1005—1010°, was not so low as the temperature (about 800°) at which calcium silicate was proved by former experiments (see Table 1) to form where a mixture $CaCO_3+SiO_2$ was heated. 1005—1010° was a temperature at which the affinity of silica for lime was not only existent, but was sufficient to overcome the affinity of sulphur trioxide for lime, and direct experiment had shown that affinity to prevent dissociation up to 1225—1230°. 800° was a temperature at which the affinity between free lime and silica had induced their combination, a simple, as distinguished from a differential force. The temperature 1225—1230° was therefore significant as being necessarily *above* the combining temperature of free lime and silica.

The appearance of the mixture $CaSO_4+SiO_2$ after heating was unaltered; it was a loose white powder, very slightly cohering where it had been gently pressed with a spatula before heating.

Effect of ratio of $CaSO_4$ to SiO_2.—The question arose whether the ratio of lime to silica was of importance in determining the temperature of interaction. Three mixings were prepared:—$3CaSO_4+SiO_2$, $CaSO_4+SiO_2$, $CaSO_4+3SiO_2$. The first contained a preponderance of lime in the proportion accepted for Portland cement. The second contained lime and silica in the same proportion as does the naturally occurring silicate of lime, Wollastonite ($CaO.SiO_2$); the third contained a preponderance of silica in a molecular ratio commonly occurring between the decidedly basic and acidic constituents of pottery glazes and glass.

The mixings were heated in a current of dry air; the temperature at which sulphur gases came off was 1005—1010° in each case. A blank experiment was run between each two sets of readings.

It was concluded that the temperature of interaction between calcium sulphate and silica was 1005—1010°, and was independent of the ratio of silica to calcium sulphate. The result suggests that the compound first formed in the interaction was in each case the same, whatever the proportion of lime to silica.

The further question, how far the rate of interaction between calcium sulphate and silica depended on their relative quantities was obviously untouched by the preceding experiment, and since the interaction was of an unusual character, as occurring between solids, another experiment was made. The mixtures used were: $CaSO_4+2SiO_2$, $CaSiO_4+3SiO_2$, $CaSO_4+4SiO_2$. The mixings were heated together in porcelain crucibles, and the loss of sulphur gases, at 50° intervals was determined by weighing. Each mixture was in two crucibles, which were weighed and heated alternately, so that duplicate numbers were obtained throughout. The results indicated a greater rate of combination between lime and silica as occurring in the more siliceous mixture, but some uncertainty attaches to them from the possible presence of a reducing gas.

The data obtained justified proceeding with the silicate mixing, $CaSO_4+SiO_2$, which was therefore heated, extracted and analysed.

The results are collected, in Table II. and Curve I.

TABLE II.

Calcium Sulphate and Silica ($CaSO_4+SiO_2$).

Per cent. composition : $CaSO_4SiO_2$ contains $\begin{cases} CaO=28{\cdot}6\% \\ SiO_2=30{\cdot}6\% \\ SO_3=40{\cdot}8\% \end{cases}$

Per cent. composition : $CaO.SiO_2$ contains : $\begin{cases} CaO=48{\cdot}3\% \\ SiO_2=51{\cdot}7\% \end{cases}$

Where Htd.	Time (hrs.)	Tmp. ° C.	Quickly sol.			Slowly sol.			SiO_2 sol. in Na_2CO_3	Total sol.			Insol.	Notes $\frac{\text{soluble CaO}}{\text{sol. } SiO_2}$.	Apprnce.	Notes.
			CaO	SiO_2	SO_3	CaO	SiO_2	SO_3		CaO	SiO_2	SO_3				
Muffle	1	800	28·5	0·2	40·9	—	—	—	—	28·5	0·2	40·9	30·4	—	unchanged	
Works furnce.	24	800	29·0	trace	40·9	—	—	—	—	29·0	trace	40·9	30·1	—	unchanged	
Works furnce.	24	1000 –1050	29·5	0·8	39·4	trace	trace	trace	trace	29·5	0·8	39·4	30·3	—	somewhat shrunk.	
Injctr.	1	1100	29·7	1·5	37·3	0·8	—	—	—	30·5	1·5	37·3	0·7	—	slt. cohesion	
,,	1	1250	41·5	17·6	16·1	trace			1·2	41·5	17·6	16·1	24·8	1·8	hardened not fused	Duplicate extractions, traces Al_2O_3 (0·3 %.)
,,	—	—	39·9	15·5	15,3	—	—	—	1·9	39·9	17·5	15,3	27·3	2·0		
,,	1	1300	45·4	34·0	1·4	—	—	—	1·8	45·4	35·8	1·4	17·4	1·3	partially fused	Duplicate extractions, traces Al_2O_3
			45·5	32·7	1·4	—	—	—	(1·8)	—	—	—	—	—		
,,	1	1350	48·0	42·7	0·4	—	—	—	2·4	48·0	45·1	0·4	6·5	1·1		
			47·3	41·2	trace	—	—	—	2·4	—	—	—	—	—	fused to opaq. mass	Duplicate extraction traces Al_2O

Calcium sulphate and silica.

The possibility of calculating the molecular ratio $\frac{\text{soluble lime}}{\text{soluble silica}}$' which forms a heading in Table II. was the advantage obtained by using calcium sulphate instead of carbonate. To illustrate this: the sulphur trioxide obtained by extraction of the 1250° heating, was 16·1 per cent.; combined with that sulphur trioxide as unaltered calcium sulphate would be $\frac{56}{80}\times 16{\cdot}1=11{\cdot}3$ per cent. CaO. The remaining lime extracted, *i.e.*, 41·5—11·3=30·2 per cent., was taken as combined with the silica extracted, 7·6 per cent., which gave a molecular ratio

$$\frac{CaO}{SiO_2} \text{ of } \frac{30.2}{56} \div \frac{17{\cdot}6}{60} = 1{\cdot}8.$$

All the ratios $\frac{CaO}{SiO_2}$ in the column were calculated in the same manner, and were taken to indicate the molecular ratio of lime to silica in the soluble silicate formed. The ratio was not calculated unless the quantities extracted were sufficient to give some probability of accuracy.

It is noticeable from comparison of Tables I and II that the silicate was formed much more slowly with the calcium sulphate than with the carbonate. Thus at 1100° in one hour the soluble silica was always over 5 per cent., in the carbonate mixing, but only 1·5 per cent. in the sulphate mixing. The first temperature which gave results justifying the calculation of the $\frac{CaO}{SiO_2}$ ratio was 1250° when 17·6 per cent. silica went into combination as non-resistant silicate, and the $\frac{CaO}{SiO_2}$ ratio was 1·0. At 1300° the ratio was 1·3, and at 1350° 1·1, with the mass fusing. Any reduction or direct decomposition of calcium sulphate which occurred as the temperature rose would have the effect or raising the $\frac{CaO}{SiO_2}$ ratio. That this ratio fell steadily to 1·1 was therefore taken as indicating gradual transformation into a less basic silicate, approximating, as the temperature rose, to $CaO.SiO_2$. An additional conclusion was therefore made on the interaction between lime and silica, that when they were heated together in the proportions and form of $CaSO_4+SiO_2$, the lime silicate first formed was more basic than $CaO.SiO_2$ (probably $2CaO.SiO_2$), but, as the temperature rose, it became less basic until $CaO.SiO_2$ resulted.

Curve 1 displays the comparative rates of silicate formation, with the calcium carbonate and sulphate, percentages of soluble silica formed being plotted vertically and temperatures horizontally. The curves meet, it is interesting to note, at a point corresponding with 1225° C., the lowest temperature of appreciable dissociation of calcium sulphate heated alone. (The exact coincidence is accidental.) This concludes the work for the double-oxide mixture, $CaO+SiO_2$.

The thanks of the author are due to the Directors of the Farnley Iron Co., in whose laboratory the experiments have been made, and to Mr. C. A. King, for valuable assistance in experiment and analysis.

Obituary.

CHARLES B. DUDLEY.

Dr. Charles B. Dudley was born at Oxford, N.Y., in 1842. In 1862 he enlisted in the New York Volunteers, where he served for three years, and was severely wounded in the battle of Opequan Creek in the Shenandoah Valley. He entered Yale College in 1867, where he graduated in 1871. In 1872 he entered the Sheffield Scientific School of Yale College, graduating in 1874 with a thesis "On lithium and a glass made with lithium." In 1875 he became chemist to the Pennsylvania Railroad at Altoona, a post which he held for the rest of his life. When he was appointed there were few, if any, specifications for railway supplies on that line; there are now 43 in use, the chemical part of which were devised by him. The laboratory which he established now employs twelve qualified chemists, as well as a bacteriologist, who perform some 60,000 determinations in a year.

The work of Dr. Dudley which has attracted most attention was his study of steel rails, and though his conclusion, that mild steel is both safer and more lasting than hard steel, is by no means universally accepted, nevertheless the research gives the steelmaker a view of the product from the user's standpoint, and compels him to keep an eye on the demands which the service would make upon it.

But the work of which he was most proud, and which he often said that he felt was his greatest achievement for the public good, was his share in the establishment of the bureau for the safe transportation of explosives.

Dr. Dudley was twice President of the American Chemical Society and was President of both the International and American Societies for Testing Materials. He was a member of this Society.

He died of typhoid pneumonia after a short illness on December 22nd last.

Journal and Patent Literature.

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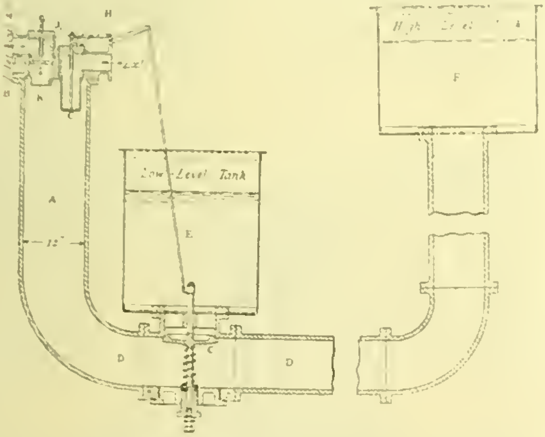
I.—GENERAL PLANT; MACHINERY.

Internal-combustion pump, and other applications of a new principle. H. A. Humphrey. Inst. Mech. Engineers, Nov. 19, 1909.

An internal-combustion pump is described, in which the explosive force is exerted directly on the water, and in which no rotating fly-wheel, solid connecting rod, piston crank, bearings, or glands are necessary: when explosion occurs, there is a full-bore passage from the combustion-chamber to the final outlet, whilst some of the water pumped to a high level returns again to compress a fresh combustible charge. The mass of liquid moved is sufficiently large to prevent excessive velocity, and the liquid forms a pendulum, which, by its movement alone, draws in fresh water, expels the burnt products, draws in a fresh combustible charge and compresses it. One of the simplest forms of the pump is shown in the accompanying diagram. It consists of a combustion chamber, A, with an inlet valve, B, for the combustible mixture, and an exhaust valve, C, for burnt products. The combustion chamber is connected by pipe, D, to the low-level tank, E, and high-level tank, F; between D and E is a water valve, G. B is normally closed by a spring, but C falls by its own weight when the pawl, H, is removed; this pawl is operated from the water-valve, G, so that when G opens, C is released. Starting with all valves closed, a compressed combustible charge in A, and the rest of the chamber and pipe full of water, explosion by the sparking-plug, K, forces the water into the high-level tank, F; the kinetic energy in the flowing water causes it to continue to flow, until the water-valve, G, is opened, and water flows from the low-level tank, partly following the water already passing into F, and partly flowing into the combustion chamber. Since the opening of the water-valve has released the exhaust, this latter flow of water expels some of the exhaust gases, and then, rising till it reaches the exhaust-valve, closes it by impact: the exhaust valve is then again automatically locked by the closing of water-valve, G, when the body of water in the right-hand limb has come to rest momentarily, its kinetic energy being spent. The small quantity of burnt products remaining in A is then compressed by the rising water, flowing back from F, until the pressures in the gases and water are equivalent. Since the compression pressure considerably exceeds the static head of the water-column, a reverse flow is set up, which reduces the pressure in A, and so draws in a fresh combustible charge, until the water column is again at rest; the head of water in the high-level tank produces a second compression of the charge in A, which is then fired, starting a fresh cycle.



A new ignition apparatus is described for firing at the maximum compression-pressure, and also four forms of two-cycle pumps working on the same principle, and a device to be fixed at the end of the discharge pipe when high lifts are required. The column of liquid which moves backwards and forwards can be made to enter an air-compressor chamber fitted with suitable valves; the energy of the moving liquid is utilised to compress the air, to store sufficient energy in an elastic cushion to produce a return flow towards the pump to give the compression-stroke, and also to draw a fresh supply of air into the compressor.—T. F. B.

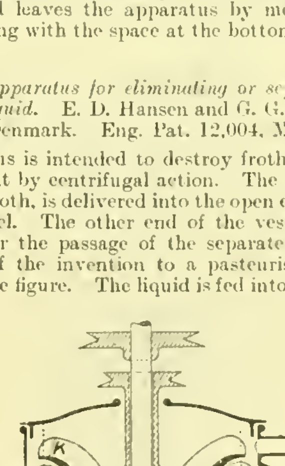
Patents.

Filters. J. L. Biddle, Kimberley, Notts. Eng. Pat. 26,661, Dec. 9, 1908.

A cylindrical casing is provided with a circular ledge and a central boss to support a plate consisting of outer and inner rings with connecting radial arms; rubber packing is placed between the ledge and boss respectively and the plate, in order to form water-tight joints. A metal disc with fine perforations, or a disc of metal gauze, rests on the plate. The central boss also carries the inlet pipe for the liquid. The filtering medium is packed upon the perforated disc round the inlet pipe and held in position by a similar perforated disc and plate pressed in place by projections on the cover of the casing. The liquid to be filtered enters the space next the cover of the apparatus by means of the central inlet pipe and after passing through the filter bed leaves the apparatus by means of a pipe communicating with the space at the bottom of the casing.
—J. W. H.

Centrifugal apparatus for eliminating or separating air or gas from liquid. E. D. Hansen and G. G. F. C. Winkler, Kolding, Denmark. Eng. Pat. 12,004, May 21, 1909.

The apparatus is intended to destroy froth by separating the air from it by centrifugal action. The froth, or liquid mixed with froth, is delivered into the open end of a rapidly rotating vessel. The other end of the vessel is provided with holes for the passage of the separated liquid. The application of the invention to a pasteurising apparatus is shown in the figure. The liquid is fed into the apparatus



by means of the pipe, o, and is distributed over the hot surface, M, by means of the stirrer, P. The froth-eliminating vessel, A, rotates on the spindle, Q, and receives the foam at its lower opening. The separated liquid passes through the holes, H, and is delivered over the lip, K, into the outer vessel.—J. W. H.

Linseed preparations; Manufacture of —— for use in connection with steam generation. [Anti-boiler incruster.] F. Brun, London. Eng. Pat. 20,245, Sept. 3, 1909. Under Int. Conv., Sept. 4, 1908. Addition to Eng. Pat. 25,987, Sept. 20, 1906.

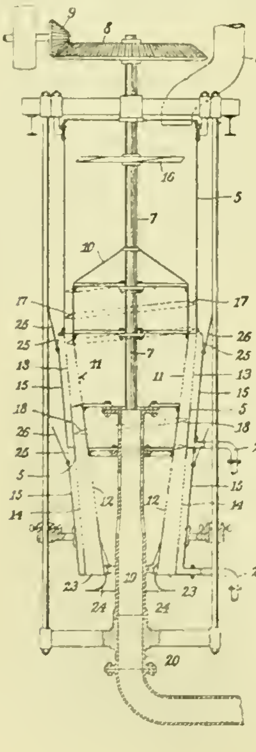
An apparatus is claimed for the preparation of a linseed extract which is fed into boilers for the purpose of preventing corrosion and incrustation. It consists of a vessel provided with a feeding hole for the linseed and a perforated diaphragm which divides it into unequal parts. The linseed is placed in the larger compartment, which is connected to the feed-water supply of the boiler. Steam is introduced into the apparatus through a suitable connection for the purpose of cooking the linseed. The decoction produced passes through the perforated diaphragm into the smaller compartment and thence to the boiler.—J. W. H.

Press for expressing fluids from solids. F. G. Wiselogel, Indianapolis, Ind., Assignor to United States Construction and Utilization Co., Rochester, N.Y. U. S. Pat. 942,301, Dec. 7, 1909.

A receiver for the material to be treated, having perforated walls, is provided with a piston actuated by a hydraulic piston. At one end of the receiver this piston passes across the inlet for the material. The opposite end of the receiver is provided with a head or piston by which the outlet may be opened or closed in a similar manner. Perforated tubes are arranged longitudinally in the receiver (the pistons being bored to pass over them) to carry away the expressed liquid.—J. W. H.

Separation of liquids from solids; Apparatus for the ——. S. v. Grabski. Fr. Pat. 404,159, June 18, 1909.

The apparatus (see Fig.) consists of a chamber, 5, into which the material to be treated is led by means of the pipe, 6. The lower part of this chamber is provided with belts of porous fabric or wire gauze, 13, 14, and an external jacket, 15. Inside the chamber a vessel, 10, on a vertical spindle, 7, is slowly rotated by means of the bevel gears, 8, 9, and is also provided with belts of porous fabric or wire gauze, 11, 12. The material is propelled through the apparatus by means of helices, 16, 17, and 18. Air under pressure is supplied by the pipe, 19, to the interior of the rotating vessel, 10, and, as the material passes between the belts of wire gauze, the particles of liquid associated with the solids in it, are blown by the air into the jacket, 15, from which it is removed by means of the pipe, 22. The air leaves the apparatus through openings, 25, baffle-plates, 26, returning any spray to the jacket. The rotating vessel may have a number of compartments each supplied with air at a different pressure.—J. W. H.

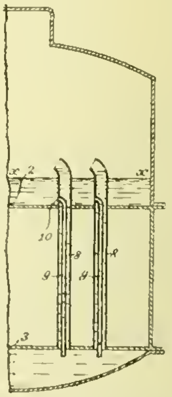


Evaporating apparatus. C. Ordway, New York. U.S. Pat. 942,407, Dec. 7, 1909.

A sheet metal cylindrical vessel is provided with two tube-plates connected by tubes, and forming three chambers, *viz.*, a feed chamber for the liquid to be evaporated, a steam space round the tubes, and a vapour space. A large door at the feed-chamber end gives access to the tubes and feed pipes, and a manhole in the wall of the vapour chamber gives access to baffle-plates fixed therein. Pipe bends are bolted across some of the tubes in pairs, forming a series of serpentine coils, through which the liquid passes while being evaporated. Constricted apertures for the entry of the liquid into the coils, and suitable pipe connections for the feed, steam, and vapour space are provided.—J. W. H.

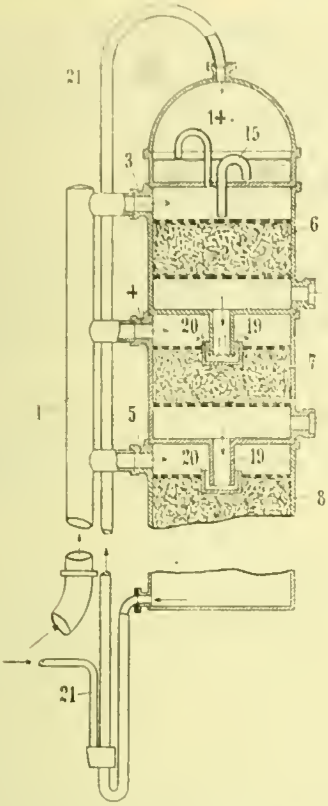
Evaporating or heating apparatus; Vertical —— with three chambers. S. Weglinski. Ger. Pat. 213,708, Nov. 22, 1907.

The apparatus is divided into three chambers by two horizontal partitions, 2, 3. The heating agent is introduced into the middle chamber, whilst the liquid to be heated fills the lower chamber completely and the upper one up to a relatively low level. The upper and lower chambers are connected by a series of double (concentric) tubes, 8, 9, the upper ends of both inner and outer tubes being bent over. At the lower end, the outer tube, 8, is flush with the partition, 3, forming the roof of the lower chamber, whilst the inner tube, 9, projects a short distance into the chamber. At the upper end, the outer tube opens above the level of liquid, *x,x*, in the upper chamber, whilst the inner tube penetrates the wall of the outer tube and opens below the level of the liquid as shown at 10. The liquid in the outer tube becomes more strongly heated than that in the inner tube. It rises, and overflows into the upper chamber, and at the same time, the cooler liquid in the lower portion of that chamber flows downwards through the inner tube. A continuous circulation is thus produced.—A. S.



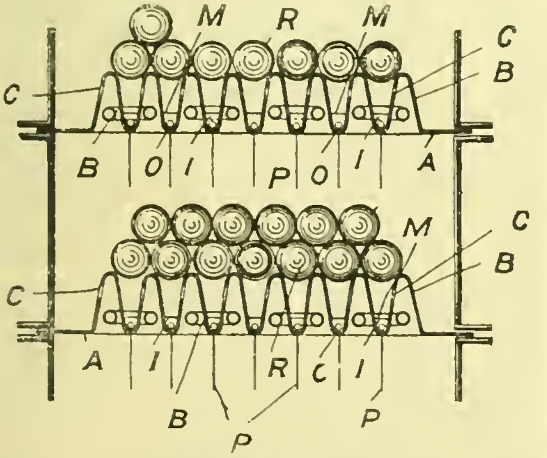
Treating gases or other vapours with liquids; Process and apparatus for ——. I. Moscicki. Fr. Pat. 403,401, May 27, 1909. Under Int. Conv., June 1, 1908.

The gas passes from the main, 1, by the pipes, 3, 4, 5, into the apparatus and through the layers of finely-divided material, 6, 7, 8, which offers a large surface and through which the absorbing liquid trickles, being finally discharged through the pipes, 16, 17. The absorbing liquid enters by the pipe, 21, overflows by the siphons, 14, 15, and passes through the perforated plates and finely-divided material. It flows from chamber to chamber by the seals, 19, 20, and is discharged from the lowest chamber. It may, if desired, be re-circulated by the air-lift, 21.—W. H. C.



Draining plates for the uniform distribution of the liquid and vapour in rectifying columns. Maschinenfabrik P. Kyll, Ges.m.b.H. Fr. Pat. 404,152, June 18, 1909.

The plate, A, is bent into a series of corrugations, B, having perforations, C, through which the vapours pass upwards.



The liquid flows over the weirs, M, at the ends of the gutters, I, and through the fine perforations, O, in each of which a pin, P, is placed to provide a fine point, from which the liquid drops in a finely-divided condition. The pins also serve to prevent the fine perforations, O, from being blocked. To assist in the rectification, balls, R, are piled upon the corrugations, B.—W. H. C.

Sawdust; Use of treated —— as a mechanical absorbent for viscous and other materials to facilitate storage, manipulation, and treatment. Cie. Indus. des Alcools de l'Ardèche, Paris. Eng. Pat. 9146, April 17, 1909. Under Int. Conv., June 18, 1908.

See Fr. Pat. 400,736 of 1908; this J., 1909, 1023.—T. F. B.

Furnace; Regenerative ——. E. Kirchberg, Dortmund, Germany. U.S. Pat. 944,444, Dec. 28, 1909.

See Fr. Pat. 388,154 of 1908; this J., 1908, 889.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal-dust; Propagation of explosions of ——, in the galleries of a mine. J. Taffanel. Comptes rend., 1909, **149**, 1127—1129.

In the experimental gallery at Liévin, 2·8 sq. metres in section and 230 metres long in a straight line, it has been shewn that the explosion of a shot first raises and then ignites the coal-dust previously spread in the gallery. The explosion is propagated in the usual way, a comparatively slow wave extending for 60 or 70 metres, with no pressure higher than 1 kilo. per sq. cm., being followed by an explosive wave of high speed causing pressures of 13 to 16 kilos. per sq. cm. at 220 metres, and bursting the sheet-steel covering of the gallery nearer the outlet. In cases where the gallery has angles or is partially obstructed, these destructive pressures are not caused, probably because of the breaking-up of the direct or reflected wave; and where the obstruction consists of movable and incombustible materials, these, raised into the air by the disturbance preceding the flame, present such a considerable cooling surface that the flame may be extinguished and the further propagation of the explosion prevented.—J. T. D.

Gas from gas-oil [petroleum] and water-gas tar, and its use for aeronautics. J. J. Neurdenburg. J. Gasbeleucht., 1910, **53**, 17—18.

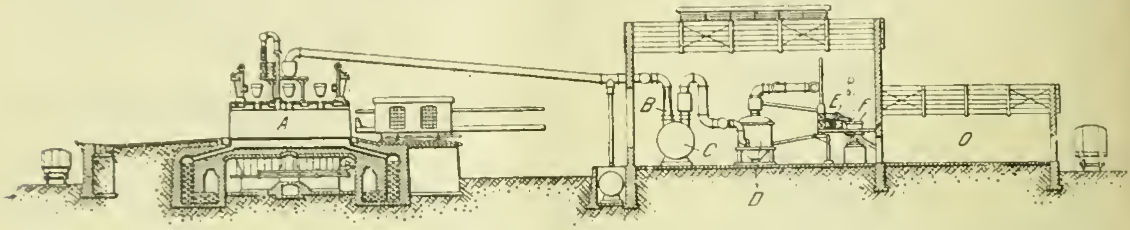
A gas of low specific gravity, suitable for filling balloons, has been obtained by a modification of Rincker and Wolter's process for the manufacture of lighting gas (J. Gasbeleucht., 1909, 789). This process consisted in blowing a bed of coke in a gas producer for 1½–2 minutes, spraying the hot fuel with a mixture of oil and water-gas tar for 2-3 minutes, then blowing with air or steam for ¼ minute to drive off the gases, and finally blowing with steam for 1 minute to clear the fuel-bed from any deposit of carbon. The oil used was Texas or Galician petroleum, of sp. gr. 0·88. The modification consists in working at a higher temperature, so as to obtain a higher percentage of hydrogen in the gas. The final blowing with steam is omitted. The composition, calorific value, and specific gravity of the gases obtained by the original and by the modified process, and the corresponding figures for carburetted water-gas and coal gas, are as follows:—

	Carburetted water-gas.	Coal-gas.	Oil-tar gas.	
			Original process.	Modified process.
	per cent.	per cent.	per cent.	per cent.
Carbon dioxide	5·3	2·0	0·2	0·2
Heavy hydrocarbons	9·2	5·0	11·6	5·2
Oxygen	—	—	0·6	0·8
Carbon monoxide	29·7	9·0	2·8	12·0
Hydrogen	36·2	47·0	46·5	73·2
Methane	13·9	34·0	31·3	8·2
Nitrogen	6·2	3·6	7·0	0·4
Calorific power (lower value) cals.	4470	5300	5490	Not stated
Specific gravity	0·70	0·44	0·45	0·33

A. T. L.

Ammonia ; Direct extraction of —— from the gases of coke-ovens. G. Hilgenstock. Stahl u. Eisen, 1909, 29, 1644—1648.

At the Julia mine of the Harpener Company, where sixty coke ovens are in operation, the ammonia is directly separated from the gases evolved, instead of by the usual method of washing with water and separation of the ammoniacal liquor from the tar by virtue of their different specific gravity. The principal portions of the plant are shown in the figure. The gas from the coke ovens (A) is first cooled in air, and then, by means of a tar injector (B), separated from the tar in the separator (C). It then passes to the saturator (D) containing sulphuric acid, where the heat produced by the formation of ammonium sulphate prevents any dilution. From the draining floor (E) the ammonium sulphate is transferred to the centrifugal (F) and thence to the salt house (O). A much purer product is obtained by this process, and the somewhat unsatisfactory distillation of the ammoniacal liquors with lime is avoided.—A. H. C.



Petroleum ; The acids of ——. K. Charitschkoff. Petroleum, 1909, 5, 316—317.

In addition to the monobasic naphthenic acids, the author has isolated from oxidised petroleum several complex polynaphthenic acids. They all contain four atoms of oxygen, and behave as dibasic acids on titration, though their ester values—corresponding to the presence of two alcohol hydroxyl groups—indicate a pseudo-acid character. The two groups of acids are not invariably associated in the oxidation products of petroleum, the fraction distilling at 184°—186° C. for instance, yielding products devoid of the monobasic acids. The oxidation products of a rectified fraction distilling at 183°—184° yielded, on extraction with petroleum spirit and expulsion of the solvent, an acid resembling oleic acid. The absence of the reaction with copper sulphate and petroleum spirit (see this J., 1907, 402) indicates that this is not a naphthenic acid.—C. S.

Cuprous compounds of ethylene and carbon monoxide. Manchot and Brandt. *See* VII.

Patents.

Coal- and other mines ; Preventing explosions of coal-dust and inflammable gas, and the extinction of underground fires in ——. T. W. D. Gregory, Stoke-on-Trent, Staffs. Eng. Pat. 25,329, Nov. 25, 1908.

The patent is for the use of potash alum or other alums, or soda crystals, or other suitable salts containing not less than 25 per cent. of combined water, in a granular, powdered, or finely crystalline condition. The salts may be mixed with or distributed over coal in the neighbourhood of shot-holes, or in cracks or joints of coal in mines, or they may be kept in buckets for use in scattering upon fires. Eng. Pat. 2200 of 1867 is referred to.—A. T. L.

Fuel ; Process for economizing ——. D. Allen and A. C. Pyper, Los Angeles, Cal. U.S. Pat. 942,530, Dec. 7, 1909.

Steam is passed into a preheating chamber, and thence into a second chamber where it is heated to a high temperature. The "lighter constituents of the steam" are separated at a high temperature and are mixed with a fuel and discharged into a flame in a combustion-chamber.—A. T. L.

Retort furnace heated by tar. P. P. A. S. A. F. de Lachomette and H. A. Villiers. Fr. Pat. 404,144, June 17, 1909.

In order to prevent damage to the retorts by the excessive temperature which occurs when tar is burned directly within the chamber in which the retorts are set, the tar is partially burned in a separate chamber, situated below the retort chamber, by a supply of preheated "primary" air. The vapours and flames pass through openings in the arch which supports the retorts and burn in the retort chamber with the aid of preheated "secondary" air introduced through openings formed in the arch.

W. H. C.

Coke ovens. A. O. Jones, Whitley Bay, Northumberland. Eng. Pat. 15,078, June 28, 1909.

During the working of an ordinary coke-oven, that portion of the exit pipe extending through the wall of the oven, is liable to obstruction from the deposition of carbon caused by contact of the volatile products with the hot walls of the pipe. According to the present invention, such obstruction is avoided by providing this part of the exit pipe with a water-jacket.—W. E. F. P.

Gas generators, producers, or refuse destructors. G. Wilton, London. Eng. Pat. 23,044, Oct. 29, 1908.

The fuel column, which rests upon a grate at the base of the producer or destructor, is also supported laterally by a number of superposed shelves or projections from the inner wall of the producer chamber. Annular recesses or pockets are thus formed beneath each shelf, and the gases pass into and out of these recesses on their way to the producer outlet, so that the formation of through blowholes in the fuel-column is prevented.—A. T. L.

Gas manufacture. S. Meunier, Stockport, Lancs. Eng. Pat. 23,263, Oct. 31, 1908.

The patent is for the provision of means in the hydraulic main for damping the fluctuations of the liquid level, so as to obtain a steady pressure in the retorts, with the object of obtaining an increased yield of gas of such quality that it does not deposit naphthalene in the mains. The apparatus comprises a perforated float or baffle-plate resting on the surface of the liquor in the hydraulic seal. The float or baffle-plate may be adjustable in position from outside the hydraulic main, and is so arranged that the upper surface is not immersed. An adjustable sleeve is provided on the end of the dip-pipe, in order to vary the depth of seal.—A. T. L.

Gas-producers. H. W. Williams, Abertillery, Monmouth. Eng. Pat. 9901, Apl. 26, 1909.

In a gas-producer of the water-jacketed type, the cylindrical metal outer casing is made in sections, each provided with a centreing flange and shoulder to facilitate erection or renewal. The combustion chamber is of slightly conical shape, being widest at its upper end ; while the water-jacket (which is also the steam generator) extends to the grate and is widest at that part adjoining the hottest zone of the fuel-chamber. For use in conjunction with a gas-engine, an annular chamber, through which the exhaust gases from the engine are made to circulate, is provided round the water-jacket ; and a series of pipes, connecting the upper with the lower end of the water-jacket, protrude into this annular chamber for the purpose of abstracting the waste heat from the exhaust gases.—W. E. F. P.

Gas producer. O. K. Zwingenberger, New York. U.S. Pat. 942,361, Dec. 7, 1909.

The producer is divided by a vertical partition into a combustion- and a coking-chamber, which communicate at the top, below the charging hopper. Beneath the producer a system of water pipes, connected to a supply tank, is arranged. The gas from the producer is circulated around the water pipes in order to cool it. Steam and air are admitted to the bottom of the coking chamber to convert the coke into gas.—W. H. C.

Retort for the manufacture of illuminating-gas. C. W. Isbell, New York. U.S. Pats. 942,501 and 942,858, Dec. 7, 1909.

Each retort consists of a vertical chamber enlarged by steps from the top to the bottom, so as to form gas spaces beneath the steps, from which the gas is led off through flues in the wall into a vertical main flue also formed in the wall of the retort. A group of such retorts is arranged to discharge the gas from the bottom of the retorts and the vertical flues into a common gas-chamber provided with a water seal and placed below the group of retorts. —W. H. C.

Gas washers. G. K. Davis, London. Eng. Pat. 2113, Jan. 28, 1909.

The washer comprises a horizontal cylindrical casing divided into a number of compartments by vertical partitions. These chambers communicate with one another in such a way that the gas in passing through the length of the washer follows a horizontal zigzag path. A quantity of washing liquor is maintained in the lower part of the washer, and orifices are provided in the partitions for the flow of liquor through the washer. One or more rotating shafts are arranged parallel with the axis of the washer, and these shafts carry blades which dip into the liquor in each compartment and throw it up in the form of spray.—A. T. L.

Cleaning gases; Apparatus for ——. W. Ahlen, Duquesne, and H. C. Siebert, Braddock, Pa. U.S. Pat. 941,841, Nov. 30, 1909.

The claim relates to the method of distributing the absorbing liquid in a gas-cleaning tower. At the top of the tower a cross of horizontal hollow arms is attached to and rotated by a hollow vertical shaft which passes through the top of the tower. Each arm is provided with a longitudinal slot, the width of which can be adjusted so that it varies at different points in its length from the centre. Each arm has an internal partition which causes the liquid supplied at the axis to flow to the extremity of the arm and return towards the axis.—W. H. C.

Gas producers. W. B. Chapman, Brooklyn, U.S.A. Eng. Pat. 2495, Feb. 2, 1909.

See Fr. Pat. 399,203 of 1909; this J., 1909, 930.—T. F. B.

Producer-gas; Apparatus for the manufacture of ——. W. J. Crossley and T. Rigby, Manchester. U.S. Pat. 943,182, Dec. 14, 1909.

See Eng. Pat. 28,181 of 1906; this J., 1908, 67.—T. F. B.

Gas for illuminating, heating, or power purposes; Manufacture of ——. H. S. Elworthy, St. Albans E. G. Elworthy, administratrix). U.S. Pat. 943,627. Dec. 14, 1909.

See Eng. Pat. 7713 of 1905; this J., 1906, 527.—T. F. B.

Gas producer. A. Jabs, Zurich, Switzerland. U.S. Pat. 944,332, Dec. 28, 1909.

See Eng. Pat. 13,753 of 1908; this J., 1909, 466.—T. F. B.

Measuring or analysing gaseous mixtures. Eng. Pat. 26,561. *See* XXIII.

Gas-analyser. U.S. Pat. 942,861. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Electric lamp filaments; Methods of, and apparatus for, the treatment of ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 2389, Feb. 1, 1909.

The patent relates to a method of treating unfinished lamp filaments (such as are prepared by the extrusion, through a die, of a plastic mixture containing tungsten or other similar metal), in which the filaments are mounted on a conveyor, or in clamps carried by an endless band. The conveyor or endless band passes through a chamber supplied with the treating gas, an electric current being passed through the filaments while they are in the chamber, and means being provided for the regulation of the current during the process.—W. E. F. P.

Arc-light electrodes; Manufacture of ——. Gebr. Siemens und Co., Berlin. Eng. Pat. 23,171, Oct. 11, 1909. Under Int. Conv. Nov. 19, 1908.

The incorporation of phosphoboric acid, BPO_4, obtained by the interaction of boric and phosphoric acids, in arc-light electrodes is claimed.—W. E. F. P.

Refractory product [for incandescence lighting or for the construction of furnaces]. F. Pascal. Fr. Pat. 403,903. April 15, 1909.

The refractory product consists mainly of thorium oxide, but small quantities of cerium oxide, alumina, beryllium oxide, magnesia, or of silicates are mixed with it according to the use for which it is intended. The oxides are mixed together and formed into a liquid paste with a small quantity of a solution of thorium sulphate containing sugar. The excess of water is removed, for example by means of a filter-press, and the mass is then formed into the required shape and calcined. The product may be used in place of lime for optical projection, and will withstand the temperature of the oxygen-acetylene blow-pipe.—A. T. L.

Incandescence bodies; Manufacture of ——. H. J. Haddan, London. From Bruno-Patente-Verwerthungsges., Berlin. Eng. Pat. 12,467, May 26, 1909.

See Fr. Pat. 403,434 of 1909; this J., 1910, 13.—T. F. B.

Incandescent mantle. T. Terrell, London. U.S. Pat. 943,488, Dec. 14, 1909.

See Eng. Pat. 6814 of 1906; this J., 1907, 398, 601.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Phenol; Determination of —— *by Lloyd's modification of Koppeschaar's method.* S. C. J. Olivier. Rec. Trav. Chim. Pays-Bas, 1909, 28, 354—367.

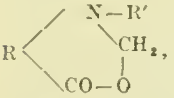
Lloyd (this J., 1905, 155) found that in determining phenol by Koppeschaar's method, tribromophenol bromide was produced in addition to tribromophenol, and that when once formed it could not be completely transformed into tribromophenol by the action of potassium iodide; hence the results were too high. The author has prepared pure tribromophenol bromide, and finds that its reaction with potassium iodide and hydrochloric acid in the presence of chloroform is practically quantitative, 99·6 per cent., at least, of the theoretical quantity of iodine being liberated. Under the conditions laid down by Koppeschaar, an excess of bromine does not decompose tribromophenol bromide; and the author's experiments also show that the liberation of a large amount of iodine owing to a large excess of bromine cannot produce errors in the results. In his opinion, the criticisms of Lloyd upon Koppeschaar's method are unfounded, and he doubts the correctness of Lloyd's figures. He considers that there is no advantage in using an alkaline solution of bromine in place of a solution of sodium bromide and bromate. Moreover, the large excess of acid is liable to cause liberation of iodine from the potassium iodide solution; and the high degree of concentration of the bromine in Lloyd's solution and its addition to an acid phenol solution, increase the probability of a loss of bromine. In determining phenol by Koppeschaar's method, the duration of the reaction between the phenol and bromine can be reduced to five minutes without affecting the accuracy of the results, provided that not more than about 0·09 grm. of phenol be taken, and that the strength of the solution of sodium bromide and bromate is about 0·8 *N*/10. The formation of tribromophenol bromide may be prevented by increasing the concentration of the sodium bromide. The addition of chloroform, as proposed by Thurnauer and Stockmeier for the determination of cresols, and applied by Lloyd to phenol is advantageous, since it enables the end point of the titration to be discerned more clearly.—C. A. M.

PATENTS.

Anthraquinone series; Process for preparing condensation products of the —— containing nitrogen. Badische Anilin und Soda Fabrik. Ger. Pat. 216,597, Aug. 28, 1908. Addition to Ger. Pat. 212,204, May 14, 1907. (See Fr. Pat. 386,606 of 1908; this J., 1908, 745.)

ANTHRAPYRIDONES are obtained by heating derivatives of 1-acetaminoanthraquinone which are not substituted in the 2-position, either with or without a suitable solvent or diluent. For example, an anthrapyridone is produced by heating *α*-acetaminoanthraquinone to 280°—290° C. for one or two hours, and recrystallising the product from glacial acetic acid.—T. F. B.

Phenylglycine-o-carboxylic acid; Process for preparing derivatives of —— substituted in the nitrogen. Badische Anilin und Soda Farbik. Ger. Pat. 216,748, Dec. 13. 1908.

By the action of formaldehyde on anthranilic acid derivatives of the formula, HO.CO.R.NHR′, when R is an aromatic radical and R′ an alkyl, aryl, or alkaryl group, simple or substituted compounds of the composition,  , are obtained. When these are treated with hydrocyanic acid, or when formaldehyde and hydrocyanic acid act on the anthranilic acid derivatives, nitriles of the composition, $HO.CO.R.NR'CH_2CN$, are formed, which, when saponified, are converted into the corresponding carboxylic acids. By starting with *ω*-cyanomethylanthranilic acid, anthranilo-diacetic acid is obtained. The intermediate compounds with formaldehyde may be first converted by bisulphites into the *ω*-sulphomethyl-derivatives, and these converted into the nitriles by treatment with cyanides. The new products are suitable for use in preparing indigo dyestuffs.—T. F. B.

Thiosalicylic compounds and process of making same. E. Münch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 943,560 and 943,561, Dec. 14, 1909.

SEE Fr. Pat. 385,044 of 1907; this J., 1908, 497.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Indican; Preparation of ——. H. Ter Meulen. Rec. Trav. Chim. Pays-Bas, 1909, 28, 339—341.

PERKIN and Bloxam (this J., 1907, 522, 1193) described a method of extracting indican from *Indigofera* leaves by means of acetone, and concluded from the high results obtained, that the method of Hoogewerff and the author (this J., 1900, 1100), in which the glucoside was extracted with boiling water, gave much too low results. The author now points out that the apparent discrepancies were due to the fact that in his experiments, fresh leaves of *Indigofera leptostachya* and of *Polygonum tinctorium* grown at Delft were used, whereas Perkin and Bloxam used dried leaves of *I. sumatrana* grown in India. A sample of the same leaves yielded by the author's method 2·7 per cent., as against 3·166 per cent. obtained by Perkin and Bloxam. The author finds that anhydrous indican melts at 180° C., whilst Perkin and Bloxam give the melting point as 178°—179° C.—C. A. M.

5. 7. 5.′ 7′-Tetrabromo- and tetrachloro-indigo; Synthesis of ——. Danaila. Comptes rend., 1909, **149**, 1383—1385.

THE tetrabromo-indigo is obtained by reducing in the cold a solution of the chloride of dibromo-isatin in benzene with an acetic acid solution of hydriodic acid. It is sparingly soluble in glacial acetic acid, and soluble in sulphuric acid, nitrobenzene and xylene. From a boiling solution in nitrobenzene or xylene, small violet crystals are obtained. Dissolved in xylene, it gives an absorption band in the red-yellow (the axis corresponds to $\lambda = 611 \cdot 5$); in nitrobenzene the band is a little nearer the red (the axis being $\lambda = 620$).

The tetrachloro-derivative is obtained in a similar manner by reducing the chloride of dichloro-isatin. In powder it is more violet than the tetrabromo-compound; it has about the same solubilities, and also crystallises from boiling solutions of nitrobenzene and xylene. The axis of the absorption band corresponds to $\lambda = 604 \cdot 5$, when dissolved in xylene, and to $\lambda = 615$ in nitrobenzene.

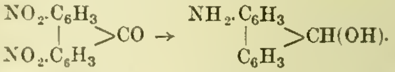
The halogen derivatives of indigo, especially the bromo-compounds, give faster and more brilliant shades than indigo (see also this J., 1907, 818, 819, 961, 1274; 1908, 116, 893, 1200; 1909, 17, 18, 238, 304, 517, 975, 976, 1245).—A. SBLD.

Indirubin; Constitution of ——. L. C. Maillard. Bull. Soc. Chim., 1909, 5, 1153-1158.

THE new synthesis of indirubin by condensing oxindole with isatin chloride, discovered by Wahl and Bagard (this J., 1909, 420), is not regarded by the author as having definitely settled its constitution. Reviewing his own researches, he still considers both indigotin and indirubin as polymers (with at least the formula, $C_{32}H_{20}N_4O_4$) of the blue and easily transformable body (hemi-indigotin) which is formed when oxindole is oxidised (this J., 1902, 398). Estimations of the molecular weight by the usual physico-chemical methods give contradictory results.—A. SBLD.

Fluorene series; Studies in the ——. J. Schmidt and H. Stützel. Annalen, 1909, **370**, 1—40.

WHEN fluorene-oxime is reduced with tin and hydrochloric acid, it yields fluorene ether, but with zinc and acetic acid, 9-aminofluorene is produced. When the acetyl derivative of this is nitrated, it gives 1:8-dinitrofluorenone, which on reduction with stannous chloride and hydrochloric acid, furnishes 1-amino-9-hydroxyfluorene, a red compound melting at 154° C.



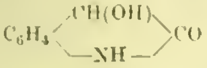
$$\begin{matrix} NO_2.C_6H_3 \\ | \\ NO_2.C_6H_3 \end{matrix} \!>\! CO \rightarrow \begin{matrix} NH_2.C_6H_3 \\ | \\ C_6H_3 \end{matrix} \!>\! CH(OH).$$

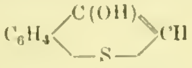
On diazotising this and combining with suitable components, azo-dyestuffs are obtained which dye wool from an acetic acid, and cotton from an alkaline bath. Using *β*-naphthol the dyestuff dyes wool brown and cotton a faint brown; with *α*-naphthol the dyestuff produced gives violet shades on wool and faint brown shades on cotton; whilst on using sodium naphthionate, the dyestuff produces reddish-brown shades on wool and faint brown shades on cotton. The reduction of 1:8-dinitrofluorene-oxime with zinc dust and acetic acid leads to the formation of 1:9-diaminofluorene, which when diazotised and combined with *α*-naphthol, dyes wool gray, and cotton dark cherry-red; with *β*-naphthol the dyestuff gives dark brown shades on wool and light raspberry-red shades on cotton, and when sodium naphthionate is used, the dyestuff yields orange-brown shades on wool and bright brown shades on cotton.—J. C. C.

PATENTS.

Leuco-compounds of dyestuffs containing sulphur ; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst-on-Maine, Germany. Eng. Pat. 5558, Mar. 8, 1909.

The leuco-compounds are obtained by condensing dioxindole (I.) or a substitution derivative with α-oxythionaphthene (II.) or a substitution derivative, or with the


I.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β-carboxylic acid of an α-oxythionaphthene. Example I.: A hot solution of 10 parts by weight of dioxindole (prepared by reducing isatin) in about 1000 parts of water is mixed with 10 parts of α-oxythionaphthene or 15 parts of α-oxythionaphthene-β-carboxylic acid, and sodium carbonate is added until the mixture is alkaline. The leuco-compound thus formed is separated from the accompanying zinc carbonate (produced in the reduction of the isatin with zinc and hydrochloric acid) by means of dilute acid. It dissolves in dilute sodium hydroxide with a yellowish colour, and the solution, when exposed to the air, yields a red dyestuff. A similar compound can also be prepared by condensing methoxydioxindole with methoxyisatin. On exposing its alkaline solution to the air, a dyestuff varying in colour from orange-yellow to brown is obtained.—J. C. C.

Vat dyestuffs ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 17,265, July 24, 1909. Under Int. Conv., July 27, 1908.

When nitroisatin or its acetyl derivative is condensed with m-amino-oxythionaphthene (S : OH : NH_2 = 1 : 3 : 6, prepared from m-acetaminophenylthioglycollic-o-carboxylic acid, as in U.S. Pat. 872,085 of 1907 ; this J. 1908, 116), dyestuffs are obtained which dye brownish-yellow shades from the hydrosulphite vat ; by reducing these dyestuffs and then halogenating the products, very fast brownish-yellow vat dyestuffs are obtained. Similar dyestuffs to the above may also be produced by condensing with m-amino-oxythionaphthene the aminodioxindole obtainable by reduction of nitroisatin, and then halogenating the product.—T. F. B.

Vat dyestuffs ; Production of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7819, April 1, 1909.

Halogen-substituted isatins or isatins containing other substituents in the ortho-position to the imino-group can be condensed with 1-naphthol or 1-anthrol or with substituted derivatives of these having a free ortho-position to the hydroxy-group. It is found also that 1-anthrol can condense with the α-isatins themselves. Example 1 : 100 parts of dibromoisatin are converted into the chloride by means of phosphorus pentachloride, and the mixture is stirred with a solution of 50 parts of α-naphthol in dry benzene. A blue crystalline powder separates on cooling, which dyes cotton from the vat in yellow shades, changing on exposure to the air into a pure fast reddish blue. If 4-ethoxy-α-naphthol is used instead of α-naphthol, a purer and bluer dyestuff is obtained. Example 2 : 25 parts of p-methylisatin-α-p-toluidide, 20 parts of 1-anthrol, and 100 parts of acetic anhydride are heated on the water-bath until the formation of the dyestuff is complete. The dyestuff furnishes deep greenish blue shades on cotton. Example 3 : 14·7 parts of isatin are converted into the chloride with phosphorus pentachloride (21 parts) and added to a warm solution of 20 parts of 1-anthrol in dry benzene. The dyestuff produced furnishes reddish blue shades on cotton when dyed from the vat.—J. C. C.

Anthracene dyestuffs ; Production of ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated May 21, 1909, to Fr. Pat. 400,653, Mar. 10, 1909. Unter Int. Conv., Nov. 16, 1908.

The benzoylated aminoanthraquinones described in the chief patent (this J., 1909, 1029) can be prepared by heating the halogen derivatives of anthraquinone with benzamide or its derivatives. Example : A mixture of 10 parts of 1-bromoanthraquinone, 20 parts of benzamide, 30 parts of nitrobenzene, 10 parts of anhydrous sodium acetate, and 0·5 part of cupric chloride is heated to boiling. When the reaction is complete, alcohol is added and the separated 1-benzoylamino-anthraquinone is collected.—J. C. C.

Azo dyestuffs ; Production of new —— *and their intermediate products.* Farbenfabr. vorm. F. Bayer und Co. First Addition, dated May 22, 1909, to Fr. Pat. 402,546, April 30, 1909. Under Int. Conv., Sept. 18, 1908.

Instead of the aminodiphenyl ethers mentioned in the chief patent (this J., 1909, 1191), their halogenated substitution products may be used. Thus the dyestuff obtained by combining one molecule of diazotised p-chloro-o-aminodiphenyl ether with one molecule of 1 : 8-aminonaphthol-4 : 6-disulphonic acid in acid solution and adding one molecule of diazotised m-nitro-aniline in alkaline solution, dyes wool in fast black shades. Similarly the dyestuff prepared by combining 1 : 8-aminonaphthol-3 : 6-disulphonic acid first with one molecule of diazotised 2 : 5-dichloro-aniline in acid solution and then with one molecule of diazotised p'-chloro-p-aminodiphenyl ether in alkaline solution, dyes wool in blue-black shades.—J. C. C.

Dyeing and printing ; Process of ——, *and production of a series of new derivatives of anthracene and new intermediate products.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 404,190, June 10, 1909. Under Int. Conv., July 28 and Aug. 25, 1908.

Acylaminoanthraquinones, when treated with sodium hydroxide and hydrosulphite, yield vats from which fibres are dyed in fast shades. Thus 1·5-diacetyldiamino- and cinnamyl-1-aminoanthraquinone furnish yellow shades. The dyestuffs may also be printed with the common reagents. A list of 16 similar dyestuffs is given in the patent, together with the shades they produce on cotton, wool and silk ; the tints vary from yellow to orange-red. —J. C. C.

Monoazo dyestuffs which dye cotton directly ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 216,667, July 12, 1908.

When diazo compounds of the benzene or naphthalene series are combined with 2-aminoarylamino-5-naphthol-7-sulphonic acids or their substitution products, direct cotton dyestuffs are obtained, which dye red, violet, and blue shades.—T. F. B.

Halogenated Indigos and indigoid substances ; Manufacture of ——. C. Dreyfus, H. K. Tompkins, and The Clayton Aniline Co., Manchester. Eng. Pat. 8138, April 7, 1909.

In preparing chloro and bromo-derivatives of dyestuffs of the indigo class by treating the dyestuff with the halogen in the presence of strong mineral acid or of indifferent diluents, difficulties are met with in producing the higher halogenated (especially the chlorine) compounds. More vigorous action can be brought about by the use of antimony halides, but in this case the action is liable to proceed too far, and the indigo separates in clots, the interior of which is not acted on. It is now found that if the salt of antimony be added to the dyestuff in the form of antimony chloro- or bromo-acetylide ($SbCl_5,C_2H_2$), these difficulties are overcome. The reagent, for example antimony chloroacetylide, is prepared by saturating a mixture of antimony tri- and penta-chlorides with acetylene. Example 1 : A mixture of 26·2 parts of indigo and 140 parts of acetylene tetrachloride is heated to expel moisture, cooled, and then 12 parts of antimony pentachloride, which has been saturated with acetylene, are added. Twenty-five parts of dry chlorine are then passed into the mass while it is cooled and stirred. After some time the mass is filtered and washed successively with alcohol, hydrochloric acid, dilute soda solution and water, and then dried. The product is chiefly trichloro-indigo and it dyes cotton in brilliant blue shades from an alkaline vat. If 33 parts of chlorine are used, the product consists of tetrachloroindigo. Further examples illustrate the production of tribromoindigo, of chlorobromoindigo (from monochloroindigo) and of tetrabromothioindigo (from thioindigo).—J. C. C.

Dyestuffs for cotton; Production of —— and of fast bluish-green shades (on cotton). L. Cassella und Co. Fr. Pat. 403,732, Oct. 1, 1908.

THE tetrazo-derivative of benzidine, tolidine, or dianisidine is combined with two molecular proportions of 1·8-amino-naphthol-4.6-disulphonic acid, the first molecule being combined in mineral acid and the second in acetic acid solution, so that combination takes place in the 2-position with reference to the amino-group in each case. The dyestuffs produced are violet, and sensitive to acids, but when dyed on cotton and treated with *p*-nitrodiazobenzene, bluish-green shades are produced which are very fast to washing, acids, and light.—J. C. C.

Dyestuffs of the gallocyanine series; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1600, Jan. 22, 1909.

SEE Fr. Pat. 399,636 of 1909; this J., 1909, 977.—T. F. B.

Acid wool [azo] dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7820, April 1, 1909.

SEE Fr. Pat. 402,546 of 1909; this J., 1909, 1191.—T. F. B.

Halogenated indigo colouring matters; Manufacture of —— and of intermediate products. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 6992, March 23, 1909.

SEE Fr. Pat. 401,506 of 1909; this J., 1909, 1120.—T. F. B.

Azo dyestuff for lakes; Red —— and process of making same. W. König, Ohrdruf, Germany. U.S. Pat. 942,916, Dec. 14, 1909.

SEE Fr. Pat. 382,191 of 1907; this J., 1908, 219.—T. F. B.

Disazo dyestuff; Red —— and process of making same A. Schedler, Assignor to Soc. Chem. Ind. in Basle, Basle. U.S. Pat. 943,470, Dec. 14, 1909.

SEE Eng. Pat. 10,936 of 1909; this J., 1909, 1190.—T. F. B.

Azo dyestuff; Mordant-dyeing ——. H. Geldermann, Gross-Lichterfelde-Ost, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 943,536, Dec. 14, 1909.

SEE Fr. Pat. 401,092 of 1909; this J., 1909, 1082.—T. F. B.

Leuco body containing sulphur and process of making same. B. Homolka, Frankfort, and R. Welde, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 943,678, Dec. 21, 1909.

SEE Eng. Pat. 5558 of 1909; preceding.—T. F. B.

Anthraquinone dyestuff; Brown —— and process of making same. R. Uhlenhuth, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 943,717, Dec. 21, 1909.

SEE Ger. Pat. 208,969 of 1908; this J., 1909, 650.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

The artificial silk industry. Chem. Trade J., Jan. 8, 1910. [T.R.].

THE production of artificial silk in Germany rose during 1908, the latest year for which figures are yet available, to about 1,200,000 kilos.; and the demand has exceeded this, 300,000 kilos. being imported from Switzerland and Belgium. The value of the silk consumed amounted to approximately £1,000,000. The total production of the world appears to be about 4,000,000 kilos. Of this quantity the nitrocellulose process, worked in Germany by the Vereinigte Kunstseidefabriken of Frankfort, continues to represent the greater part, with about 2,000,000 kilos. and during 1909 has increased this to an enormous extent; whilst the ammoniacal copper oxide process of the Vereinigte Glanzstoff-Fabriken of Elberfeld accounts for 1,450,000 kilos.

The viscose process, which for the first time produced on a large scale in 1907, rose rapidly into importance owing to the fineness and brilliancy of its thread, and represents about 600,000 kilos. The following table gives the results of the various companies working the nitrocellulose process in 1908:—

Nitrocellulose (Chardonnet) process.

Companies.	Production in kilos.	Gross Profit	Dividend per cent.	Capital.	Sinking Fund.	Reserve.	Total Reserves.
Soie de Chardonnet Besançon	700,000	1,151,504fr.	60	900,000fr.	50,000fr.	—	3,988,560fr.
Soie Artificielle de Tubize	500,000	2,294,575fr.	50	1,010,000fr.	516,774fr.	350,000fr.	920,000fr
Ver. Kunst. A.-G. Frankfort............	425,000	720,986M.	10	365,000M.	245,703M.	20,000M.	2,629,130M.
Soc. Hongroise Sarvar (Hungary)........	250,000	790,000Cr.	—	—	276,000fr.	—	—

The last company had a debt to liquidate from the previous year of 204,599 Cr. The Societa Italiana della Sete Artificiale of Paria, exploiting the same process, and a loss of 30,763 lire, and the Chardonnet Company of Paris entered into liquidation. The Tubize Company has announced an enlargement of business. The ammoniacal copper oxide process, judging from the profits of the companies working it, would seem to yield more uniform results, as the following table shows:—

Company.	Production in kilos.	Gross Profit.	Dividend per cent.	Capital.	Sinking Fund.	Reserve.	Total Reserves.
Ver. Glanzstoff-Fab. Elberfeld	800,000	2,876,889M.	40	1,000,000M.	1,059,437M.	550,000M.	3,962,323M.
E. Oester. Glstf. St. Polten..............	250,000	772,680M.	10	250,000M.	324,614M.	68,242M.	15,152M.
Soie Artif. Paris.........................	200,000	511,622fr.	17	806,802fr.	142,262fr.	20,297fr.	86,543fr.
Soie Artif. Izieux	150,000	380,389fr.	6	149,354fr.	137,953fr.	31,121fr.	31,121fr.

The German and Austrian companies have now considerably enlarged their works.

As a consequence of the British Patents Act the Vereinigte Glanzstoff-Fabriken have been obliged to form a company, the British Glanzstoff Manufacturing Co., Ltd., Liverpool, with a capital of £125,000, which expects to turn out from its factory at Flint 250,000 kilos. annually.

There are no figures of importance available regarding the viscose process, as the principal manufacturers exploiting this method, the Henkel Donnersmarck'schen Kunstseiden und Acetatwerke of Sydowsaue, being a private firm, do not publish a report. Their production, however, is estimated at about 120,000 kilos. In England Messrs. Courtauld and Co., of Coventry, are said to have produced 375,000 kilos. in 1908, making a profit of £46,968. Another firm, the Soc. Gén. de la Soie Viscose, of Alost, Belgium, has undergone reorganisation, and is making rapid headway.

Stoving of wool; The ——. A. Reychler. Bull. Soc. Chim. Belg., 1909, 23, 471—475.

THE method of experiment employed to investigate the action of sulphurous acid upon wool is described. The material was placed in a dry atmosphere of sulphurous acid, mixed in various proportions with air, and the results tend to show that the amount of gas fixed by the material depends upon two factors, (*a*) a "chemical adsorption"; and (*b*) the main one, an absorption (solution) of the gas by the fibre.—F. M.

Papers; Testing the absorbency of bibulous ——. Fromm. Wochenbl. Papierfab., 1909, **40**, 4172—4174.

THE usual test for the absorbent value of blotting papers and the like, by measuring the height to which water ascends in a vertically suspended strip in a given time (ten minutes), does not always afford a true measure of the relative value of the paper for practical purposes. Blotting papers are required to absorb moisture at the surface of the paper, and the author cites an instance of two blotting papers, practically equivalent by the ordinary test, one of which failed to fulfil the purpose for which it was required. The author, therefore, proposes a method for testing the absorbent qualities of the surface of the paper, by punching discs of suitable size (52 mm.) from five superposed sheets of the paper, and placing the pack of discs thus obtained on the surface of water at a temperature of 17·5°C. It is necessary that the discs should not peel away and separate from each other. The number of seconds required for the complete saturation of the discs is then noted, only those tests being accepted as valid in which the water penetrates uniformly all round from the circumference to the centre. When tested in this way, the two papers referred to above showed very different results, one requiring **11·2** secs. on the average, and the other 27·2 secs. for complete saturation.—J. F. B.

Cellase and the diastatic fission of cellose. Bertrand and Holderer. *See XVII.*

PATENTS.

Pulp strainers; Rotary ——. W. G. Fraser, London. Eng. Pat. 1684, Jan. 23, 1909.

THE specification describes the mechanical details of a rotary pulp strainer revolving in a vat with the crude pulp outside the drum, the filtered pulp being discharged from trunnions at the ends. The motion of the pulp is produced by a perforated corrugated sheet of metal following the contour of the drum, so far as this is immersed in the pulp, and situated either inside or outside the drum. Alternatively the stirring motion may be produced by paddles, which also may be situated inside or outside the drum. The corrugated sheet or system of paddles receives an oscillating motion from an external source, and oscillates on an axis situated above the axis of the drum. This oscillating motion may also be used for revolving the drum by the intervention of a ratchet wheel and pawl, or the drum may be rotated by a friction wheel. A spray pipe is placed inside the drum, near the top, for washing off the knots from the slits into an external channel. The slits are also kept clear by means of a flexible scraper.—J. F. B.

Pulp strainers for paper or cellulose manufacture. R. Lehmann, Schweinfurt on Maine, Germany. Eng. Pat. 19,366, Aug. 23, 1909. Under Int. Conv., Aug. 26, 1908.

IN this form of cylindrical pulp strainer, the trough casing serves as a whole to form an oscillating member, and having a cylindrical shape, it is capable of performing an oscillating movement of closed circular or elliptical form. The trough casing is supported on vertical shaking arms with bifurcated ends, connected at their lower ends to excentrics and pivoted at or near their middles, between the axial centre of the trough and that of the excentric, each to a one-armed lever, in such a manner that the joints of the shaking arms are free to oscillate in a rectilinear or nearly rectilinear and vertical path. J. F. B.

Coniferous woods; Treatment of ——. W. H. Rowley, Detroit, Mich. U.S. Pat. 942,106, Dec. 7, 1909.

CONIFEROUS wood is subjected to limited distillation with steam, in order to obtain a volatile solvent having a lower specific gravity and boiling point than commercial oil of turpentine. The soluble constituents are then extracted from the partially exhausted wood by means of this solvent, and the extracted wood is finally converted into pulp or fibre stock.—B. N.

Liquor of paper-mills; Process of treating the spent ——. I. Kitsee, Philadelphia, Pa. U.S. Pat. 942,207, Dec. 7, 1909.

THE liquor is placed in the positive (anode) compartment of an electrolytic apparatus and a solution of salt is introduced into the negative (cathode) compartment. A current of electricity is passed through the solutions, causing the solution in the cathode compartment to become alkaline in reaction, whilst the "intercellulose" and resinous matters are retained in the anode compartment. It is claimed that in this way the caustic and resinous matters of the spent liquor are recovered.—W. P. S.

Paper or millboard; Manufacture of a light, porous ——. Mme. S. Bernard, née Boulas. Fr. Pat. 403,886, June 10, 1909.

THE use of infusorial earth is claimed as a filling agent for light and porous papers or boards. A suitable mixture consisting of 10 parts of bleached chemical wood pulp, 40 parts of mechanical pulp, and 50 parts of infusorial earth, is cited as an example.—J. F. B.

Cellulosic films; Manufacture of ——. E. Brandenberger, Thaon-les-Vosges, France. Eng. Pat. 15,281, June 30, 1909. (See also this J., 1910, 17.)

THE machine described is designed to effect the drying of continuous films of cellulose regenerated from aqueous solutions of the xanthate. If such films are allowed to dry freely, the shrinkage and distortion are so great that the products are valueless. Means are therefore provided for applying a moderate pressure to the films in the process of drying, so that they are maintained throughout in intimate contact with the rigid drying cylinders. The machine, which may consist of two or more separate tiers to economise space, contains in each tier a horizontal range of heated drying cylinders which are driven by suitable gearing. Above each range of driven cylinders is a similar range of cylinders, which are not driven independently, but rest freely with their own weight, each one in contact with a pair of consecutive driven cylinders of the lower range, and rotated by these only as the result of such contact. The film passes alternately round a driven and a free cylinder, and on each cylinder it receives pressure at the two lines of contact, so that shrinkage takes place regularly and without distortion. The whole apparatus is enclosed in a casing through which heated air may be circulated. The same apparatus serves for the application and drying of the films on a flexible support, such as paper, passing through at the same time.—J. F. B.

Viscose; Manufacture of ——. C. C. Leclaire. First Addition, dated Apr. 20, 1909, to Fr. Pat. 402,804, Sept. 7, 1908 (this J., 1909, 1270).

IN the process for performing all the operations connected with the manufacture of viscose in a single revolving vessel, it is not necessary that the paper or pulp serving as the raw material should be completely disintegrated. The inventor also claims the use of paper-sawdust and of shreds, 1–2 mm. in width, obtained by passing a plane along the edges of a pack of sheets tightly clamped together; also of "confetti," either circular or polygonal, 4–7 mm.

in diameter, stamped out of the sheets of paper, as well as the residual perforated paper from the stamping of the "confetti." Another claim provides for the simultaneous introduction, under vacuum, of the sodium hydroxide and carbon bisulphide into the reaction-vessel containing the cellulose material.—J. F. B.

Cellulose ; Preparation of solutions of —— by means of ammoniacal copper oxychloride. R. Pawlikowski. Fr. Pat. 403,488, May 29, 1909.

Cellulose is steeped for several hours in a solution of copper oxychloride in aqueous ammonia, until it is practically all dissolved. Copper oxychloride is a substance of variable composition, but about 90 grms. of it and 850—900 c.c. of ammonia of sp. gr. 0·93 will generally suffice for dissolving 100 grms. of cotton-wool. The cupric oxychloride may be employed in admixture with other compounds of copper, such as cuprous oxychloride, cuprous chloride, cuprous oxide, cupric oxide, cupric carbonate, or cupric hydroxide. It is stated that the solution of the cellulose takes place more rapidly and completely than with the ordinary cuprammonium solutions, owing to the presence of the chlorides, and it is not necessary to subject the cellulose to a preliminary treatment with alkali hydroxides or powerful bleaching agents. The cellulose is precipitated from the solution by treatment with dilute acids.—J. F. B.

Cellulose from straw and other vegetable materials ; Manufacture of ——. A. Deiss and C. J. Fournier. Fr. Pat. 403,518, May 12, 1909.

The process described combines with the manufacture of cellulose, the recovery of oxalic acid as a by-product, and the regeneration of the alkali employed. The straw or other material is first steeped in acidulated water for about three hours, in order to remove chlorophyll, gums, and nitrogenous matters, the acid is then neutralised by an alkali and the steeping liquid is discharged. The material is next subjected to a retting process by means of organisms cultivated from African esparto, *amylobacter*, or other suitable ferments, in order to soften and disintegrate the plant tissues. The fermentation is assisted by the addition of an infusion of bran and the maintenance of a favourable temperature. The retted material is washed and then treated in closed vessels with concentrated caustic alkalis at a density of 20°—30° B., under a steam pressure of 3—5 atmospheres, for a period of 3—5 hours. The cellulose is separated from the lyes and purified in the usual manner. The lyes are collected in a tank and heated with superheated steam, with the subsequent addition of lime. The lime decolorises the lye, regenerates the caustic alkali and gives a precipitate containing calcium oxalate. The latter is pressed and utilised for the manufacture of oxalic acid.—J. F. B.

Celluloid sheets ; Production of ——. H. H. Simmons, Sevenoaks, Kent. From J. H. Field, Simla, India. Eng. Pats. 26,682, Dec. 9, 1908, and 16,010, July 8, 1909.

The use of sheets of celluloid of a thickness less than 0·002 inch is claimed for the construction of balloons or other articles the walls of which have to resist the passage of a gas. The sheets of celluloid are made by spreading liquid or pasty celluloid on a glass slab or other support by the motion of an accurately adjustable straight-edge, or of a flexible squeegee formed by the flexible bottom of a trough containing a liquid, such as mercury. The sheets of celluloid may be strengthened by incorporating threads of raw silk in their structure, *e.g.* by stretching the threads across the slab before spreading the liquid celluloid, or laying them on the surface of the film before it is dried.
—J. F. B.

Paper ; Apparatus for the manufacture of coloured —— having a smooth surface on one side only. L. E. Gossler, Neustadt-Schönthal, Germany. Eng. Pat. 26,299, Dec. 4, 1908.

See Fr. Pat. 396,572 of 1908 ; this J., 1909, 623.—T. F. B.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Dyestuff systems ; Action of light on ——. K. Gebhard. Z. angew. Chem., 1909, 22, 2484—2489. (See also this J., 1909, 1084.)

The opinion is expressed that the fading of dyestuffs is primarily due to the effects of oxidation and hydrolysis, and that these effects must be neutralised in the production of shades which are fast to light. Intermediate reactions often play a part and may be due to intramolecular changes ; thus Limmer has noticed that a solution of Malachite Green is decolorised by exposure to the rays of an arc-lamp, the colour returning by exposure to daylight. If the solution be next kept in the dark, the colour disappears again, and it has been proved, indirectly, that the change is due to the colour base existing in two forms, the true colour base, $:C:C_6H_4:N(CH_3)_2OH$, and a colourless pseudo base, $:C(OH).C_6H_4.N(CH_3)_2$. The existence of secondarily formed perhydroxyl compounds has been noticed by many investigators, and the author states that in the presence of "additions" which prevent the formation of perhydroxyl compounds, atmospheric oxygen exerts no bleaching action upon the shade. When hydrolysis is at the same time prevented, the dyed shade is quite fast to light.—F. M.

Patents.

Brown shades on the fibre ; Process for producing fast ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 216,297, Sept. 15, 1908.

Fast brown shades are obtained by treating textiles with ammoniacal or caustic alkaline solutions of nitroso derivatives of aromatic phenols and aromatic diamino- or aminohydroxy-compounds, and then drying and steaming. If reserve effects are desired, reducing agents can be applied before steaming.—T. F. B.

Paper, fabrics, etc. ; Apparatus for treating (waterproofing) and drying ——. G. H. May and W. M. Grosvenor. Fr. Pat. 403,520, May 17, 1909.

The apparatus is designed chiefly for coating paper and fabrics with substances dissolved in volatile solvents, with a view to rendering them impermeable, and for the recovery of the solvent by drying the coated material in a current of hot air in an enclosed space. It consists of a casing with elastic flaps at the entrance and exit ends, to prevent loss of vapours when the material is travelling through. A reeling arrangement, provided with brakes and tension drums, for keeping the material under a suitable tension, is placed at each end of the apparatus, and all the fittings are provided in duplicate, so that the material may pass through in either direction. At each end of the apparatus, inside the casing, is placed a spreading or coating device which is under observation through windows situated in the sides of the casing. The main body of the casing is occupied by the drying and condensing chambers. The drying chamber contains guide-rolls for supporting the coated material and a tubular air-heater below. The air ascends, is heated, and becomes charged with the vapours of the solvent ; it then passes from the top of the casing into the cooling and condensing chamber, in which are situated a series of cooling tubes and means for collecting the condensed solvent. The air, after depositing the condensed solvent, passes again into the drying chamber, where it is reheated. The walls of the drying chamber and the guide-rolls are connected to earth, in order to discharge any electricity which may be developed. One wall of the chamber is constructed of light but impervious material, which readily tears under the force of an explosion, whilst the rest of the apparatus is solidly constructed so as to resist such explosion if it should occur.
—J. F. B.

Cotton ; Process for the production of black shades on — [by means of azo dyestuffs]. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1227, Jan. 18, 1909.

See U.S. Pat. 936,456 of 1909 ; this J., 1909, 1120.—T. F. B.

Dyeing with gallocyanine dyestuffs ; Process of ——. J. Bierer and H. Lorétan. Assignors to Dye Works, formerly L. Durand, Huguenin, et Cie., Basle. U.S. Pat. 943,375, Dec. 14, 1909.

See Fr. Pat. 377,288 of 1907 ; this J., 1907, 1045.—T. F. B.

Fabrics ; Apparatus for treating —— with fluids. E. Gminder, Reutlingen, Germany. U.S. Pat. 943,632, Dec. 14, 1909.

See Eng. Pat. 21,829 of 1908 ; this J., 1909, 519.—T. F. B.

VII. ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Hydrofluoric acid in presence of fluorides; Detection of ——. W. Cronheim. Biochem. Zeits., 1909, 23, 143—145.

The solution under investigation is treated with a large excess of 95 per cent. alcohol, and then with a large excess of ether. Salts of hydrofluoric acid are thus precipitated quantitatively, whilst hydrofluoric acid itself (and most probably organic fluorine compounds also) remains in solution. The precipitate is allowed to settle for 24 hours in the cold, and then filtered off. The filtrate is made alkaline with lime- or baryta-water, the precipitate thus obtained being left to settle for several hours, and then collected, ignited, and submitted to the etching test. In this way, hydrofluoric acid can be detected in aqueous solutions and pure fruit juices containing 1 part of the acid in 800,000. The method does not, of course, permit of discrimination between free hydrofluoric acid and fluorine in organic combination.—L. E.

Selenious acid ; Volumetric determination of —— by means of alkaline permanganate. L. Marino. Z. anorg. Chem., 1909, 65, 32—37.

Volumetric determination of selenious acid in acid solution by permanganate is unsatisfactory, because a brown turbidity, either of manganese dioxide or of a manganese selenite, obscures the end of the reaction. This difficulty is avoided by working in alkaline solution as follows :—To the aqueous solution of selenious acid is added solution of sodium carbonate to alkaline reaction, and permanganate is dropped in from a burette till the liquid has a strong yellowish-red colour : the liquid is now boiled, and addition of permanganate continued till a strong violet colour remains permananent for 4—5 minutes. It is now allowed to cool a little, and acidified with 1 : 3 sulphuric acid ; $N/10$ oxalic acid is now run in from a burette till the liquid is clear, and the excess of oxalic acid is determined by permanganate. Soluble phosphates, borates, or silicates do not affect the determination, but chlorides cause volatilisation of selenium dichloride. If nitrates be present, the solution is made alkaline and evaporated to small bulk, excess of concentrated solution of zinc sulphate is added, and the evaporation continued to dryness. The residue is taken up with a little water and 1 : 3 sulphuric acid and evaporated to dryness, and this repeated three times. The nitric acid is thus driven off, whilst the zinc sulphate prevents the evaporation of selenious acid. Insoluble selenites, boiled with 15 per cent. sodium carbonate solution, can be titrated accurately by the method ; any insoluble sulphates or selenates present or formed will not interfere.—J. T. D.

Nitric oxide ; Decomposition of ——. Formation of nitrosyl chloride. Chemical reactions in gases under great pressure. E. Briner and A. Wroczynski. Comptes rend., 1909, 149, 1372—1374.

Nitric oxide subjected to a pressure of about 250 atmospheres by the authors' method (this J., 1909, 705) very gradually decomposes in accordance with the equation : $3NO = N_2O_3 + \frac{1}{2}N_2$. This is confirmed by the liberation of 43·4 cals. in the reaction. The decomposition explains the formation of nitrosyl chloride from nitric oxide and hydrochloric acid (*loc. cit.*), the nitrous anhydride first formed, reacting with the hydrochloric acid as follows : $N_2O_3 + 2HCl = 2NOCl + H_2O$.—A. Sbld.

Iodine ; Action of —— on dithionate and trithionate of sodium in solution. J. A. Muller. Bull. Soc. Chim., 1909, 5, 1119—1121.

The author finds that although a solution of iodine acts on warm solutions of dithionate and trithionate of sodium, only a very slight and slow reaction takes place in the cold, so slow as to be without any influence on the titration of sodium thiosulphate with iodine, in neutral liquids or in liquids acidified with acetic acid.—A. Sbld.

Calcium ferrites. S. Hilpert and E. Kohlmeyer. Ber., 1909, 42, 4581—4594.

Lime and ferric oxide in varying proportions were fused together in an electric furnace, and "cooling curves" plotted. Maxima were observed at compositions corresponding to the formulæ, $3CaO.2Fe_2O_3$, and $2CaO.3Fe_2O_3$. At the composition corresponding to the formula, $CaO.Fe_2O_3$, there was a minimum, as though no compound but a eutectic were present ; but other evidence for the existence of the compound, $CaO.Fe_2O_3$, was obtained, so that probably a maximum would be discovered here if the scale of the experiment could be enlarged. The colour of the fusions rich in ferric oxide is black and they have a metallic lustre ; the meta-ferrite ($CaO.Fe_2O_3$) is dark brown, the compound, $2CaO.Fe_2O_3$, red-brown, and the orthoferrite ($3CaO.Fe_2O_3$) black. The last substance, and the other fusions approaching it in composition, fall to powder on cooling, like calcium orthosilicate. The mixtures containing 20—50 per cent. of lime contract on solidifying ; those richer in lime expand. The specific volume decreases rapidly as the percentage of lime decreases, till the meta ferrite is reached ; here there is a sharp bend in the curve, and the decrease continues at a greatly reduced rate for the rest of the series. Up to 27 per cent. of lime the fusions are about as strongly magnetic as magnetite ; above that the permeability decreases, and reaches zero at about 67 per cent. of lime. The ferrites are but slightly soluble in water or dilute acids, and only those with more than 50 per cent. of lime take up any water of hydration or crystallisation. Of those which do this, only those with 60—70 per cent. of lime set like cement. When fused with silicates the ferrites form complex mixtures, in which the ferric oxide still seems to exist as acid radical. They are all much less easily reduced by hydrogen than is ferric oxide. —J. T. D.

Cuprous compounds of ethylene and carbon monoxide. W. Manchot and W. Brandt. Annalen, 1909, 370, 286—296.

In continuation of a previous investigation (this J., 1908, 403), the action of ethylene on cuprous chloride has been studied and is found to be analogous to that of carbon monoxide, a dissociable compound, in which one molecule of ethylene is combined with one molecule of cuprous chloride, being formed in the presence of water or certain other substances, such as ammonia and aniline. Under like conditions, however, the compound is much more strongly dissociated than the carbon monoxide compound, and in all cases (*i.e.*, in the presence of water, hydrochloric acid, or ammonia) the absorption of ethylene is found to decrease with an increase in the copper concentration. On adding hydrochloric acid to the aqueous solution of the compound, much of the ethylene is evolved. Experiments both with ethylene and with carbon monoxide show that a rise of temperature, at constant gas concentration, is accompanied by a shifting of the equilibrium in the sense of increased dissociation, as observed in similar cases. Applying the results of the investigation to the question of gas analysis, it is pointed out that ethylene must be removed from a gaseous mixture, before the absorption of carbon monoxide by cuprous chloride.—F. Sodn.

Euxenites; Rare earths in ——. O. Hauser and F. Wirth. Ber., 1909, **42**, 4443—4447.

SAMPLES of euxenite of different origin gave the following analytical results :—

	I. Eitland.	II. Arendal	III. Saetersdal	IV. S. Carolina
	per cent.	per cent.	per. cent.	per cent.
Niobium pentoxide ..	29·00	30·21	20·72	28·20
Tantalum pentoxide .	1·01			9·35
Titanium oxide, TiO_2	24·43	26·45	31·45	17·45
Zirconium oxide, ZrO_2	—	—	—	—
Tin oxide, SnO_2	0·11	—	0·13	0·07
Tungsten trioxide ...	trace	—	0·09	0·11
Uranium oxide, UO_2.	5·64	5·28	5·49	7·91
Thorium oxide, ThO_2	4·60	3·20	3·80	2·04
Yttrium oxide, Y_2O_3	27·32	28·47	25·42	22·01
$Ce(Sa,Di)_2O_3$	2·45	2·05	2·58	6·93
Alumina............	trace	—	—	—
Ferrous oxide	1·37	1·89	4·94	2·04
Calcium oxide.......	0·85	0·97	0·66	—
Magnesium oxide....	0·08	—	0·14	—
Lead oxide	0·43	—	0·46	0·96
Loss on ignition.....	2·87	2·01	3·88	2·21

The composition of I and II was that of typical euxenites, whilst III and IV belonged rather to the polycrases, the latter being characterised by its high proportion of tantalum oxide and relatively low proportion of titanium oxide. Terbium earths were present in traces, as in the case of all titanium niobates. On the other hand, ytterbium components and also scandium were present in relatively considerable quantities, the amount rising with that of the titanium. Samarium and praseodymium do not appear to occur in titanium niobates or other niobates, whereas cerium and neodymium are invariably present. About 100 grms. of 95 per cent. samarium oxide were prepared from 4½ kilos. of sample IV, so that the mineral must have contained at least 2 per cent. of that oxide. About 0·5 per cent. of gadolinium oxide was also obtained from this sample. It appears that the occurrence of samarium in euxenites is accompanied by a rise in the proportion of tantalum and a decrease in that of the titanic acid. This sample (IV) approximated to the yttrotantalites in composition. The occurrence and the amount of thorium in niobates is invariably dependent upon the relative amount of titanic acid. Should the latter be absent or be present in only a slight proportion, thorium is also absent. In the authors' experience zirconium is never present in appreciable quantities in typical euxenites; and they regard the question of the existence of *euxenite* earths as an open one.
—C. A. M.

Silicon; Nitrogen compounds of ——. [*Analysis of commercial silicon*]. L. Weiss and T. Engelhardt. Z. anorg. Chem., 1909, **65**, 38—104.

SILICON, prepared from potassium silicofluoride and aluminium, was heated in an electric furnace in a current of pure nitrogen. Practically no reaction occurred below 1420° C., and even at this temperature the speed of reaction was very low, but a considerable proportion of the silicon was ultimately converted into compounds containing nitrogen. From the residue, after removal of the free silicon as far as possible, were isolated the following compounds: — Silicon sesquinitride, Si_2N_3; silicon cyanogen, SiN; and "normal" silicon nitride, Si_3N_4. Which of these compounds is chiefly formed depends upon the temperature and the duration of the experiment. Their specific gravities, in the order just given, are 3·64, 3·17, and 3·44. They are all chemically stable and resistant, slowly decomposed by boiling concentrated sulphuric acid, more rapidly by hydrofluoric acid. A mixture of nitric and hydrofluoric acids hardly attacks the normal nitride, but destroys the sesquinitride, converting it into silicon cyanogen. Fusion with alkali hydroxide destroys them all, their nitrogen being evolved as ammonia.

The authors have repeated Deville and Wöhler's experiment of heating amorphous silicon in a carbon-lined crucible in a wind-furnace for some hours, and find that the product is not a pure nitride, but has the formula, Si_3C_3N.

The authors have also examined various methods for the analysis of commercial silicon. They find the best to be fusion with a mixture of (for 0·5 grm. of silicon) 10 grms. of potassium-sodium carbonate and 0·5 grm. of potassium nitrate. Half of this is used to line a platinum crucible, and the mixture of finely pounded silicon and most of the remainder put in, and covered with what is left. The crucible is gently heated till the evolution of gas ceases, and heated over a blast till a clear fusion is obtained. In this way complete decomposition of the substance is effected, and the crucible is not sensibly attacked.
—J. T. D.

Phosphorus; Dynamic allotropy of ——. E. Cohen and J. Olie, jun. Chem. Weekblad, 1909, **6**, 821—848. Chem. Zentr., 1909, **2**, 2124.

COMMERCIAL samples of phosphorus of different origin were purified in various ways, and the specific gravities of the purified products were determined, after heating to different temperatures. From the results of the experiments it is concluded that two allotropic modifications of phosphorus exist, namely white or yellow phosphorus and "metallic" phosphorus (violet phosphorus, Hittorf's phosphorus, sp. gr. 2·2 at 18°/4° C.). So-called red or amorphous phosphorus is a solid solution of white phosphorus in the "metallic" variety, and its composition depends upon the temperature and upon other factors. (See also Jolibois, this J., 1909, 883).—A. S.

Phosphorus; Red ——, *especially Hittorf's variety*. A. Stock and F. Gomolka. Ber., 1909, **42**, 4510—4527.

PHOSPHORUS was heated in closed tubes with lead to a higher temperature (800°C.) than was used by Hittorf, and the lead was dissolved by electrolytic action in a bath of lead acetate and acetic acid. Hittorf's phosphorus was obtained in larger yield than by Hittorf's own process. Bismuth acted similarly, but the solubility of phosphorus in bismuth, and the consequent yield, were lower than in the case of lead. The crystals were contaminated with lead (or bismuth), and after careful purification by nitric acid, the lead content could not be reduced below about 1·5 per cent. Attempts to obtain Hittorf's phosphorus by sublimation were not successful as to yield, but showed that a temperature of about 470°C. in the "retort" portion of the apparatus, and as small a difference as possible between that and the "condenser" portion are conditions promising success. Fusion and superheating of ordinary phosphorus in sealed tubes, with subsequent slow cooling, were also unsuccessful: the product was either amorphous phosphorus, or possibly a solid solution of Hittorf's phosphorus in it. The density of Hittorf's phosphorus was found to be 2·31—2·33, whilst the purified commercial red phosphorus used in its production had a density of 2.14—2·17. The chemical activity of Hittorf's phosphorus is much below that of ordinary red phosphorus; the difference in their behaviour with sulphur, or with solutions of sulphur or of iodine in carbon bisulphide, is so great as to suggest this as a possible means of separating them from one another. The usually accepted view that red phosphorus is unaffected by atmospheric oxygen is erroneous. The authors' experiments have shown that both commercial red phosphorus and Hittorf's variety oxidise in the air and ultimately disappear; they differ in this relation from white phosphorus only in the speed of the reaction. (See also this J., 1908, 626.)—J. T. D.

Ammonia production of Great Britain in 1909. Bradbury and Hirsch, Liverpool. [T.R.]

THE total production of ammonia from all sources in the United Kingdom (including that used in the ammonia-soda process and other chemical process), calculated into ammonium sulphate, for 1908 and 1909, was as follows :—

	1908	1909
	Tons.	Tons.
Gas works	165,000	171,000
Iron works	18,000	19,000
Shale works	53,500	57,000
Coke and carbonising works and producer-gas	85,000	101,000
	321,500	348,000

Of last years' production it is estimated that England contributed 233,300 tons, Scotland 112,000 tons, and Ireland 2,700 tons. The stock brought forward from 1908 amounted to 16,000 tons, making the supply for 1909 364,000 tons. Exports during 1909 were 264,000 tons, and the total home consumption 87,000 tons, leaving a stock of 13,000 tons to carry forward to 1910.

Patents.

Sulphuric acid; Process of manufacture of a mixture of nitrosylsulphuric acid and nitric acid, for replacing nitric acid in the manufacture of —— by the lead chamber method. Soc. Le Nitrogène, Soc. Anon. Fr. Pat. 404,071, June 15, 1909. Under Int. Conv., June 19, 1908.

The process consists in making a mixture of nitrosylsulphuric acid and nitric acid by bringing oxides of nitrogen, diluted with much air or other inert gas, into intimate contact with strong sulphuric acid (of a strength equivalent to at least 75 per cent. of sulphur trioxide), until this is saturated. The product, which may contain about 14 per cent. of nitrogen, is used, instead of nitric acid, in the manufacture of sulphuric acid; it may be transported in iron vessels. —F. Sodn.

Evaporating brine for the production of salt, or for evaporating liquid from other solutions; Apparatus for ——. J. Hodgkinson, Manchester. Eng. Pat. 22,163 of 1909, date of appl., Dec. 3, 1908.

The apparatus consists of a series of superposed shallow evaporating pans, the lowest one being heated by flue gases from a fire-grate provided with an automatic stoker. The steam given off from each pan heats the pan immediately above it. A scraper in each pan, mounted on a common central shaft, sweeps the deposited material to pockets, from which it is removed by elevators.—J. W. H.

Ammonium sulpho-phosphate [and other sulpho-phosphates] for the treatment of vintages and musts, and its process of manufacture. A. Hubert. First Addition, dated May 19, 1909, to Fr. Pat. 399,142, Feb. 5, 1909 (this J., 1909, 938).

Claim is made for sulpho-phosphates in general, especially the calcium salt and the double sulpho-phosphate of calcium and ammonium, for the treatment of vintages and musts. The compounds are prepared by saturating phosphates, or mixtures of phosphates, dissolved or suspended in water or other vehicle, with sulphur dioxide; the double salts are also obtained by mixing solutions of the corresponding sulpho-phosphates.—F. Sodn.

Monobasic metaphosphoric acid or its salts; Process for the preparation of ——. Mahlwerke Friedrichsthal (Proprietor, A. Hauck). Fr. Pat. 403,713, June 5, 1909. Under Int. Conv., Dec. 22, 1908.

The process, which is for the preparation of monobasic metaphosphoric acid or its salts, soluble in water and in most organic acids, consists in melting orthophosphates at a temperature of at least 2000° C., at the same time introducing oxygen or air into the fused mass, or adding an oxidising agent, such as manganese dioxide.—F. Sodn.

Manganese chloride; Process for treating and packing —— for use in batteries and for other purposes. Soc. Aubert Frères. Fr. Pat. 403,811, June 8, 1909.

The concentration of manganese chloride solutions is carried to the point at which only two molecular proportions of water remain, and the product, after addition of a little strong hydrochloric acid, to prevent the formation of oxychlorides, is moulded into blocks which are heated for about 24 hours at 60°—100° C., and are then turned out of the moulds, wrapped in paper, and coated with paraffin, or protected in any other manner. The blocks are well adapted for storage and transport, and, when required, dissolve readily in water without warming.—F. Sodn.

Hygroscopic inorganic salts; Process for obtaining the highest possible concentration of —— on evaporating their solutions. K. Hepke. Ger. Pat. 215,782, May 30, 1908.

It has been found impracticable on the large scale to carry the evaporation of solutions of hygroscopic salts, such as calcium nitrate, beyond a certain stage, owing to the production of strong frothing, or to the difficulty of removing the last portions of water. According to the present patent, such difficulties are overcome by the addition, towards the end of the evaporation, of a small quantity of a solid salt, capable of forming with the salt in the solution, a double compound of lower melting point than the latter. In the case of calcium nitrate, 5 per cent. of sodium nitrate is added.—A. S.

Alkaline-earth hydroxylaminedisulphonates; Process for the preparation of ——. F. Raschig. Ger. Pat. 216,747, May 22, 1908.

Solutions of the calculated quantities of alkaline-earth nitrite and bisulphite are mixed together and then the requisite quantity of mineral acid is added, or of sulphur dioxide gas is introduced, in order to obtain alkaline-earth hydroxylaminedisulphonate, according to one or other of the following equations :

$$(1)\ Ca(NO_2)_2+2Ca(HSO_3)_2+2HCl= 2HON(SO_3)_2Ca+CaCl_2+2H_2O.$$

$$(2)\ Ca(NO_2)_2+Ca(HSO_3)_2+2SO_2=2HON(SO_3)_2Ca.$$

On hydrolysis the alkaline-earth hydroxylaminedisulphonates yield hydroxylamine sulphate and alkaline-earth sulphate. (See also Divers, this J., 1900, 348.) —A. S.

Lead oxides; Manufacture of ——. G. V. Barton, Liverpool. Eng. Pat. 4465, Feb. 23, 1909.

The claim relates to an improvement on Eng. Pat. 21,830 of 1898 (this J., 1899, 1134), which comprises: (1) An automatic feeding arrangement, consisting of a trapped siphon let into the pot in such a manner, that molten lead may be introduced into the pot through the siphon, and the pot at the same time be closed by a seal of the molten lead in the bend of the siphon-tube. (2) A cooling device, consisting of pipes in the walls or body of the pot, so that the temperature of the latter may be maintained at about 400° C. (3) For the production of red lead, the combination of a muffle-chamber with a long uptake pipe having a filtering device at the top, which may conveniently take the form of a large, inverted, truncated cone, filled with cotton-wool, which prevents the escape of solid matter, but allows the passage of furnace-gases. Alongside the muffle-furnace is a chamber, into which the red lead is pushed and allowed to cool, while a fresh charge is being introduced into the muffle.—O. R.

Alumina; Manufacture of ——. G. McCulloch, East St. Louis, Ill., Assignor to Aluminium Co. of America, Niagara Falls, N.Y. U.S. Pat. 941,799, Nov. 30, 1909.

In the manufacture of alumina from bauxite by the alkaline process, the precipitation of alumina is arrested before it is complete, with the result that the solution, while still containing a small proportion of aluminate, at the same time retains a large proportion of the contained silica. The solution is then withdrawn and used for the treatment of further quantities of bauxite.—O. R.

Zinc oxide ; Process for the production of ——. Soc. di Monteponi. Fr. Pat. 403.681, June 4, 1909. Under Int. Conv., Jan. 27. 1909.

THE oxidised zinc ore is mixed with 40—60 per cent. of small coke or other form of carbon and introduced into a converter, with refractory lining, which is mounted on a carriage. The first stage of the process, that of driving off water and carbon dioxide, may take place under a special chimney hood, using a blast of air to aid combustion; the converter is then moved under a combustion chamber, and an air blast again used to renew the combustion of the charge and effect reduction of the ore; the zinc vapours thus liberated, together with carbon monoxide and particles of fuel, are burnt in the combustion chamber, and the fumes from this operation are led first under a boiler and then through air-cooled metal pipes; finally, the zinc oxide is separated from the combustion gases by filtration. As the charge sinks down, further dried charges are added, until the converter becomes filled with exhausted material, when its place is taken by another, no break being allowed in the process. The special feature of the invention is the utilisation, in various ways, of the heat produced, and a consequent saving in fuel, which is said to render possible the treatment of poor zinc ores.—F. SODN.

Air ; Process of separating —— into its elements by fractional distillation. M. Hazard-Flamand. First Addition, dated Sept. 18, 1908, to Fr. Pat. 394.881, Dec. 10, 1907 (this J., 1909, 310).

THE apparatus described in the principal patent is modified by the introduction of specially constructed side-tubes for indicating the height of the liquid at the various points of the system, and by an alteration in the dephlegmator, designed to produce a circulation of the liquid and effect its methodical concentration before passing into the evaporator. Also the base of the lower column is provided with a "decanter" for the separation of carbon dioxide, and, in order that this separation may take place, boiling of the liquid is here prevented by a surrounding jacket, in which the pressure is reduced and through which liquid from the decanter passes before travelling upwards to be delivered into the auxiliary column. Another modification concerns the nitrogen condensed in the dephlegmator; part of this, as before, is sent to the top of the auxiliary column, but instead of being used there as the reflux liquid, it is made to pass downwards through a spiral situated above the rectifying plates of the column; sufficient reduction of pressure is maintained in the spiral to gasify the nitrogen before it passes out to the heat interchangers, and a refrigerating surface is thus offered, on which part of the gas reaching the top of the column is condensed; this furnishes a reflux liquid.—F. SODN.

Atmospheric air ; Process and apparatus for liquefying and separating gaseous mixtures, especially ——. F. Schmidt. Fr. Pat. 403,630, June 3, 1909. Under Int. Conv., Dec. 12, 1908.

PARTIAL liquefaction of the compressed and cooled air is effected by utilising its energy in driving a motor, such as a turbine, provided with separate receivers for the uncondensed gas and the liquid produced. The special feature of the apparatus is that, instead of the usual paddles, the resistance surfaces of the turbine are constructed of gauze or of metallic filaments arranged like the bristles on a cylindrical brush. The entering air is thus divided into a number of fine jets which constantly mix with each other, as the motor rotates, and also come into contact with the liquid particles carried round. This brings about a continual washing of the expanded gas by the portion already liquefied, and a consequent more thorough separation of the more volatile nitrogen from the oxygen. This separation is rendered more perfect by heating the liquid collecting in the receiver by means of a coil, through which the entering compressed air is made to pass, so as to drive off retained nitrogen and leave a liquid very rich in oxygen. The current of gaseous nitrogen passing out at the upper part of the apparatus is checked by baffle-plates or the like, to separate any liquid particles from it.—F. SODN.

Rare gases [neon and helium] ; Process and apparatus for extracting —— from the air. Soc. L'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Procédés G. Claude). Fr. Pat. 403.777, Oct. 3, 1908.

THE apparatus is a modified form of that described in Fr. Pat. 398,580 of 1908 (this J., 1909, 884). The most volatile portion of the air, not condensed in the system of vertical tubes there described, is led through a special pipe to the top of the rectifying column, where it ascends a spiral tube which is cooled by the liquid nitrogen entering the column. Under the influence of the cold and pressure, the last traces of nitrogen are thus condensed and flow down the spiral, leaving gas very rich in neon and helium to pass on and be collected.—F. SODN.

Sulphur ; Process for preparing stable suspensions or colloidal solutions of ——. L. Sarason. Ger. Pat. 216,824, Nov. 20, 1907.

WHEN solutions of alkali thiosulphates in glycerin are decomposed by acids, white emulsions of sulphur are obtained, which will keep for one or more days. If the reaction is carried out in presence of gelatin or other thickening agent, stable solutions are obtained which are either transparent or fluorescent; aqueous gelatin solutions under the same conditions soon become turbid. —T. F. B.

Sulphur and selenium ; Process for preparing stable suspensions or colloidal solutions of ——. L. Sarason. Ger. Pat. 216,825, Sept. 12, 1908. Addition to Ger. Pat. 216,824, Nov. 20, 1907 (see preceding abstract).

ANY reaction which furnishes nascent sulphur may be carried out in glycerin solution to produce stable suspensions; suspensions of selenium may also be made in the same way. For example, a saturated solution of sulphuretted or seleniuretted hydrogen in glycerin is decomposed by sulphur dioxide or selenious acid, respectively.—T. F. B.

Nitric acid from mixtures of nitrogenous gases and water ; Process of manufacturing ——. Salpetersäure Industrie-Ges., Gelsenkirchen, Germany. Eng. Pat. 23,385, Nov. 2, 1908. Under Int. Conv., Nov. 2, 1907.

SEE Addition of Nov. 2, 1908, to Fr. Pat. 374.237 of 1906; this J., 1909, 473.—T. F. B.

Concentrating acids ; Continuous process of and apparatus for ——. Aktiebolaget Swedish Nitric Synd., Stockholm. Eng. Pat. 10,591, May 4, 1909. Under Int. Conv., May 6, 1908.

SEE Fr. Pat. 402,078 of 1909; this J., 1909, 1197.—T. F. B.

Lime ; Process of purifying and revivifying spent or waste ——. J. C. Jones, Carthage, N.Y., U.S.A. Eng. Pat. 6411, March 17, 1909.

SEE Fr. Pat. 401,803 of 1909; this J., 1909, 1126. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 91 of 1875, 3151 of 1877, 7446 of 1885, and 13,001 of 1901.—T. F. B.

Ammonia, etc. ; Process of making and recovering ——. W. J. Dunnachie, Coatbridge. U.S. Pat. 943,399, Dec. 14, 1909.

SEE Fr. Pat. 385,006 of 1907; this J., 1908, 496.—T. F. B.

Ammonium sulphate from distillation gases ; Process for the manufacture of ——. Gewerkschaft der Steinkohlenzeche "Mont-Cenis," Sodingen, Germany. Eng. Pat. 11,442, May 14, 1909. Under Int. Conv., May 15, 1908.

SEE Fr. Pat. 403,050 of 1909; this J., 1909, 1308. —T. F. B.

Alumino-silicate or artificial zeolite. R. Gans, Pankow, Assignor to J. D. Riedel A.-G., Berlin. U. S. Pat. 943,535, Dec. 14, 1909.

SEE Fr. Pat. 374,525 of 1907; this J., 1907, 872.—T. F. B.

Water-glass compound and process of making the same. R. Eberhard, Munich, Germany. U.S. Pat. 944,957, Dec. 28, 1909.

See Fr. Pat. 391,682 of 1908; this J., 1908, 1152.—T. F. B.

Silicides; Manufacture of metallic ——. Cie. Gén. d'Electro-Chimie de Bozel, France. Eng. Pat. 5799, March 10, 1909. Under Int. Conv., March 31, 1908.

See Fr. Pat. 388,730 of 1908; this J., 1908, 918.—T. F. B.

Storage receptacle [for peroxides]. E. Herrmann, Uster, Switzerland. U.S. Pat. 944,435, Dec. 28, 1909.

See Fr. Pat. 398,448 of 1909; this J., 1909, 880.—T. F. B.

Air; Method of dividing —— into its elements by fractional distillation. M. Hazard-Flamand, St. Vrain, France. Eng. Pat. 26,720, Dec. 9, 1908. Under Int. Conv., Dec. 10, 1907.

See Fr. Pat. 394,881 of 1907; this J., 1909, 310.—T. F. B.

Air; Method of dividing —— into its elements by fractional distillation. M. Hazard-Flamand, St. Vrain, France. Eng. Pat. 27,592, Dec. 18, 1908. Under Int. Conv., Sept. 18, 1908. Addition to Eng. Pat. 26,720 of 1908, dated Dec. 10, 1907.

See Addition of Sept. 18, 1908, to Fr. Pat. 394,881 of 1908; preceding.—T. F. B.

Gases [air]: Method of liquefying and separating mixtures of ——. F. Schmidt, Wilmersdorf, Germany. Eng. Pat. 13,034, June 3, 1909. Under Int. Conv., Dec. 12, 1908.

See Fr. Pat. 403,630 of 1909; preceding.—T. F. B.

Hydrogen-gas generator. G. F. Jaubert, Paris. U.S. Pat. 943,022, Dec. 14, 1909.

See Fr. Pat. 381,605 of 1906; this J., 1908, 152.—T. F. B.

Manufacture of cellulose from straw, etc. [with oxalic acid as by-product]. Fr. Pat. 403,518. *See* V.

VIII.—GLASS; CERAMICS.

Glass; Action of α-rays on ——. E. Rutherford. Phil. Mag., 1910, **19**, 192–194.

The coloured areas or pleochroic halos observed in brown mica, which are spherical in shape, invariably contain at their centre a minute crystal of zirconite, or more rarely of apatite, both of which minerals are relatively rich in radium. The average radius of the halos is about 0·04 mm., which is also about the range of the most penetrating α-rays from uranium-radium products in a material such as mica. Hence, Joly (Phil. Mag., March, 1907) concluded that the halos are due to the action of α-rays from radium. The author has observed a corresponding effect in glass exposed to α-rays. A large quantity of purified radium emanation was condensed in a capillary tube of soda glass (0·6 mm. external diameter), and then left for about one month, during which most of it was transformed. On then observing the tube under the microscope, a reddish-coloured area was seen to surround the whole length of the capillary, the distance between the edge of the capillary bore and the edge of the coloured area being 0·039 mm. throughout, notwithstanding wide variations in the bore of the capillary along its length. The line of demarcation between the coloured and uncoloured glass was quite sharp.—A. S.

Colloids in clays; Adsorptive power of ——. P. Rohland. Z. anorg. Chem., 1909, **65**, 108–109.

The colloidal hydroxides in clays (this J., 1909, 1250) have the power of absorbing oxygen-containing substances, such as water, alcohol, and acetone, but are impervious to those not containing oxygen, such as benzene, toluene, or carbon bisulphide; an exception to the latter statement, however, is found in the unsaturated hydrocarbons of the ethylene, acetylene, etc., series, which are absorbed. —J. T. D.

Patents.

Sheet or plate glass; Apparatus for making ——. J. L. Quertinmont, Point Marion, Pa., U.S.A. Eng. Pat. 18,322, Aug. 9, 1909.

A container, consisting of a trough provided with trunnions, has a cover which fits into it, and acts as a piston or follower. The cover is provided with a longitudinal slot, and means (*e.g.*, extensible bent rod clamps, with turnbuckles) are provided for exerting pressure on the cover. When the container has been filled with molten glass, it is inverted on its trunnions, so that a sheet of glass issues from the slot, the rate of flow being accelerated at will by pressure on the cover. By this means, plates and sheets of glass are obtained without contact of the surface with any tools or implements.—H. H. S.

Semi-liquid quartz and like material; Method of forming bodies from ——. A. Voelker, Beuel, Germany. Eng. Pat. 18,713, Aug. 14, 1909.

The method consists in inserting into a hot plastic mass of semi-liquid quartz some foreign body capable of being wholly or partially gasified by the heat, so that the pressure of the developed gases will blow the mass into the form of a mould or hollow body. The foreign body, such as paper, a potato, or a salt easily decomposed by heat, may be introduced into a cylinder of semi-liquid or plastic quartz, and by squeezing the ends of the cylinder with suitable tools, the mass may be blown into a hollow vessel by the pressure of the gases developed within it.—W. C. H.

Artificial teeth; Mixture for use in baking or burning ——. H. Wienand, Frankfort-on-Maine, Germany. Eng. Pat. 13,843, June 12, 1909.

See Ger. Pat. 214,282 of 1908; this J., 1909, 1209.—T. F. B.

Electric furnace for baking bricks, pottery, etc. Fr. Pat. 404,208. *See* XI.

IX.—BUILDING MATERIALS.

Calcium sulphate; New mode of preparing the second anhydrous modification of ——. P. Rohland. Z. anorg. Chem., 1909, **65**, 105–107.

Hemihydrated or dihydrated calcium sulphate is dissolved in hot concentrated sulphuric acid; the substance which separates on cooling is found to be anhydrous, and to have the same speed of hydration, the same hydraulic qualities and mechanical strength, as "flooring plaster" prepared by heating the dihydrate for a considerable time at 500°—600° C. There appear to be, besides natural anhydrite, four anhydrous modifications of calcium sulphate:—1. Kraut's anhydride, prepared by long-continued heating of the dihydrate on the water-bath; speed of hydration unknown. 2. Van't Hoff's anhydride, prepared by mixing plaster of Paris with 10—20 parts of water, pouring off excess water after an hour, drying, and heating to 100° C. for 24—48 hours: speed of hydration very high. 3. First anhydrous modification or dead-burnt gypsum, prepared by heating the dihydrate above 130° C.; does not hydrate or set. 4. Second anhydrous modification, prepared as above: speed of hydration very low. (See also this J., 1903, 906; 1908, 855, 858.)—J. T. D.

Portland cement; Determination of "flour" in ——. P. M. Petersen. Tonind.-Zeit., 1909, **33**, 1687—1688.

A narrow, elongated glass funnel, constricted at its mouth, is connected at its lower extremity with one end of an inverted **T**-tube, the other end of which communicates, by way of a regulating valve, with a rotary fan or

other device for producing an air current. The middle limb of the **T**-tube is connected with a vertical manometer containing turpentine. When the blast has been turned on and a constant wind pressure obtained, a weighed quantity of cement is rapidly introduced without loss through the mouth of the glass funnel, by means of the following device :—The cement is contained in a narrow metal cylinder, open at the top, and attached at the top and at the bottom to two long wires by means of pivots. When the wires are held parallel, the cylinder is vertical and can be introduced through the mouth of the funnel. By manipulating the ends of the wires outside the funnel, the contents of the cylinder may be rapidly shaken into the funnel and the empty cylinder withdrawn, before the rising cloud of cement " flour " can gain access to the cylinder. At the conclusion of the blast, the amount of residue left in the funnel gives the weight of cement not " flour," and by noting the duration and the pressure of the blast, weighing the residues in each case, comparisons can be made between different specimens of cement.
—O. R.

Titanium ; Determination of —— in argillaceous limestones. H. M. Ullmann and J. W. Boyer. Chem. Eng., Nov., 1909. Chem. News, 1909, **100**, 323—325.

The influence on cement of elements other than those ordinarily determined in cement rock is of interest. Titanium is sometimes present in quantity larger than can be neglected, and a direct method of determination is useful. 0·5 grm. of the finely ground rock is heated in a platinum crucible for five minutes over a Bunsen flame and then for five minutes over the blowpipe at a moderate temperature, to destroy organic matter and carbonates. The roasted rock is then ground in an agate mortar with potassium pyrosulphate, and fused carefully over a Bunsen flame for an hour. The fused mass is dissolved out of the crucible by heating in a beaker with 150 c.c. of dilute sulphuric acid (1 : 4), and then boiled for 20 minutes. After cooling, the mixture is diluted to 200 c.c. with more of the dilute acid, and shaken to separate calcium sulphate crystals, and 100 c.c. are filtered into a Nessler tube. The amount of titanium is then estimated by Weller's method (Bull. No. 305, U.S. Geol. Survey), by comparing the yellow colour produced by the addition of hydrogen peroxide with standards containing known amounts of titanium. The standard solution is prepared from the double fluoride of potassium and titanium in a similar manner to that of the test sample. If great accuracy is required, it will be necessary to allow for the slight colour due to ferric sulphate in the test solution, which may be done by adding sufficient of a solution of ferrous sulphate oxidised by hydrogen peroxide to the standard tubes. Vanadium will produce a colour under the conditions of the test ; therefore after the colour of the test solution has been matched, a drop of hydrofluoric acid should be added to the tube, when the colour should be at once discharged ; if any portion remains, this amount has been produced by vanadium.—J. H. J.

Patents.

Refractory bricks and the like : Manufacture of ——, and treatment of moulders' sand. A. Poulson, Farnworth. Eng. Pat. 1844, Jan. 8, 1909.

Gelatinous silica free from carbonates, which may be prepared by mixing dilute hydrochloric acid with a solution of sodium silicate, is used in the manufacture of refractory articles from sand, blast-furnace residue, or similar pulverised material, so that such articles when subjected to high temperatures do not give off carbon dioxide. Gelatinous silica free from carbonates may also be used to revivify spent moulding sand, or to render a sand suitable for moulding.—W. C. H.

Peat bricks, building blocks, and the like ; Method for making——. E. C. Körtling, C. C. R. Jaentsch, and E. Sauer, Kassel, Germany. Eng. Pat. 6958, Mar. 23, 1909.

Peat cut directly out of the soil without being pressed or moulded is saturated, after being dried, with a solution of water-glass. According to a second process, the unpressed peat is simply coated with a fireproof material such as water-glass. Blocks so made may be used for walls having to carry no weight.—H. H. S.

Mineral materials and the like for street and road construction ; Method of preparing ——. Composition for paving purposes. Paving composition. J. H. Amies, Assignor to The Amies Asphalt Co., Philadelphia, Pa. U.S. Pats. 942,235, 942,236, and 942,237, Dec. 7, 1909.

(1) Heated asphalt is mixed with hot water to induce foaming of the asphalt, and during the foaming, cold mineral or fibrous matters are added in successive small quantities to the foaming mass, so that they are coated " by a self-acting process." (2) Mineral matters are coated with a light oil, then mixed with hot asphaltic cement, and then again with cream of calcium hydroxide. (3) Calcium oxide or hydroxide is added to a mixture of coal tar and crushed stone.—H. H. S.

Blast furnace slag ; Machine for the treatment of —— in the manufacture of cement. G. F. Metzger, Manchester. Eng. Pat. 15,165, June 29, 1909.

The machine, which is for use in the granulation of molten blast-furnace slag preparatory to the manufacture of cement, consists of a series of rotating drums mounted on horizontal axes arranged around a central drum, all of them being driven at variable speeds, but in the same direction. The molten slag passes directly from the furnace through a shoot on to the top drum, and, overflowing therefrom falls on to other drums, at the same time being thoroughly granulated by means of fluid forced under pressure from the drums. The granulated material is thrown by the rotating drums on to water-cooled walls, whence it is continuously removed by a travelling conveyor.
—H. H. S.

Portland cement surfaces ; Process of treating —— and product. M. Toch, New York. U.S. Pat. 943,327, Dec. 14, 1909.

A mixture of a vegetable oil containing a dissolved free organic acid and a finely divided inert solid in suspension, is applied to Portland cement surfaces in order to convert the calcium compounds in the cement into a hard organic-acid salt, and simultaneously to provide the cement with a rough surface to which a finishing coating is afterwards applied. The claims also include Portland cement constructions which have a rough superficial layer containing an organic calcium salt, and a finishing coat superimposed upon and adhering to the rough layer.—W. C. H.

Portland cement ; Process and apparatus for seasoning [weathering] ——. T. A. Edison, Orange, N.J., Assignor to Edison Portland Cement Co., Stewartsville, N.J. U.S. Pat. 941,630, Nov. 30, 1909.

The process consists of passing hot air, aqueous vapour and products of combustion, at a temperature exceeding 100°F., over Portland cement contained in an apparatus which comprises a mixing chamber and a storehouse communicating with one another.—O. R.

Slag ; Process for producing granulated —— from refuse for artificial stone. H. Stein, Cologne, Germany. Eng. Pat. 118, Jan. 2, 1909. Under Int. Conv., Feb. 27, 1908.

See Fr. Pat. 391,059 of 1908 ; this J., 1908, 1128. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 21,954 of 1898 and 7521 of 1905.—T. F. B.

Refractory product. Fr. Pat. 403,903. *See* IIb.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Ferric oxide ; Reduction of —— by hydrogen and by carbon monoxide. S. Hilpert. Ber., 1909, 42, 4575—4581.

The temperature at which reduction of ferric oxide by hydrogen begins, depends upon the source and previous treatment of the oxide. Whether produced from the oxalate or from the precipitated hydroxide, if the oxide has not been heated beyond 800°—850° C., reaction begins at 280°—290° C.; but at a temperature above 1000° C. in the case of the oxide from oxalate, and about 900° C. in the case of that from hydroxide, a molecular change occurs, and the temperature of initial reduction rises to 330°—350 C. Specular iron ore begins to be reduced at the same temperature. It was found impossible to produce definite lower oxides of iron (Fe_3O_4 or FeO) by reducing ferric oxide in hydrogen: some metallic iron was always formed, even before the amount of reduction was enough to correspond with the conversion of the whole sample into magnetic oxide. When carbon monoxide was substituted for hydrogen the same was the case (the temperature of initial reduction was 240° C.), and the iron formed caused deposition of carbon in the manner already well known. This reduced iron appeared to contain chemically combined carbon, and is possibly cementite.—J. T. D.

[*Steel*] *Martin process with fluid pig iron.* W. Schdanow. Stahl u. Eisen, 1909, **29**, 1930—1935, 1987—1991.

A large number of tables are given showing the working details of an open-hearth furnace using molten pig iron from pans holding fifteen tons conveyed to the furnace by a locomotive. It was found inadvisable to use magnesite for repairing the furnace, as it nearly all appeared in the slag, and it was necessary to wait for it to adhere to the walls before running in the charge. Dolomite gave very much better results. When working with strongly heated ore, it was found that silica appeared early in the reaction, especially if the boiling was vigorous, being derived largely from the arch, while the bath suffered most between taking the first and second test. It was calculated that the arch would survive thirty charges. A number of analyses of the metal and slag are given, as well as calculations on the calorific economy.—A. H. C.

Electric [*iron*] *smelting with the Girod furnace.* W. Borchers. Eng. and Min. J., 1909, **88**, 1113—1117.

A description is given of two of the latest type of the Girod furnaces in use at Ugine, France, treating respectively 2½ and 12 tons of iron per charge. The furnaces, which are of the tilting variety, are a combination of the resistance and arc heating types. The metal to be smelted forms one electrode; the other, consisting of one or more carbon blocks, descends vertically through the cover of the furnace, and forms an arc with the refining slag. The distribution of the electric current evenly through the molten metal, and its consequent thorough agitation, is ensured by having a number of pure iron conductors, or contact pieces, of small cross-section, passing through the bottom of the furnace and arranged at equal distances from the centre. The current divides itself amongst the contact pieces, the conductivity of which is equalised by water-cooling their outer ends. The total duration of smelting, from charging in the scrap to casting the ingot, is about eight hours, and the power required about 800 to 900 kilowatt-hours in a large furnace, and 900 to 1000 in a small furnace, per ton of steel. The consumption of carbon electrodes is about 12 to 15 kilos. per ton of steel, including the short pieces remaining in the holders. The lining of the furnace, which consists of calcined dolomite, will stand 80 or more charges with only occasional repairs to the side walls, and if molten charges be exclusively employed, the linings may last two or three times as long. The furnace covers, however, require renewing after 20 to 30 charges, the covers of the larger furnaces having the shorter life. A two and a half ton furnace, including regulators for the electrodes, measuring instruments, tilting device mechanism, and the conductors from the furnace to a dynamo or transformer near the furnace room, costs about £600, and a twelve and a half ton furnace about £1200. The manufacturing cost of the electrodes is stated to be between 2s. 4d. and 3s 2d. per ton.—F. R.

Iron carbon alloys; Theory of the melting and solidifying changes in ——. N. Gutowsky. Metallurgie, 1909, **6**, 731—736, 737—743.

The author has re-investigated the diagram of Carpenter and Keeling (this J., 1904, 608), and gives a new diagram confirming their results. Alloys of from 0·577 to 4·94 per cent. of carbon content were examined. Specimens of about one gram in weight having been heated in a platinum boat, beneath fused alkali chlorides, in a kryptol furnace, were kept at the required temperature for seven minutes and then quenched at 6° C. After heating specimens of the same alloy to temperatures varying from 1120° C. to 1230° C., the changes in structure were traced out by microscopical examination. In order to determine the relationship of the solution of carbon in iron to the iron carbide or cementite, the author carried out a number of cementation experiments on Swedish nail iron, 0·041 per cent. of carbon, white cast iron, 3·746 per cent. of carbon, and grey cast iron, 2·263 per cent. of graphite and 0·311 per cent. of combined carbon. The cementation was carried out in graphite, animal charcoal, and a mixture of sugar charcoal and barium carbonate, at temperatures varying from 950° C. to 1120° C. The results are given in a diagram. The author also investigated the effect of the rate of thermal change on the structure and composition of white and grey cast iron. It was found that the melting point was lowered by slow heating (this effect is attributed to the decomposition of the cementite), and that white iron passes into grey iron before melting. The paper is illustrated by nine diagrams of cooling curves, and twenty-five microphotograms.—A. H. C.

Steel; The structure of —— at high temperatures. A. Baykoff. Metallurgie, 1909, **6**, 743—745.

The author corroborates the definition of austenite by Le Chatelier, *viz.*, that it is a solution of carbon in γ-iron, and can only be obtained, and even then rarely, by quenching quickly, and that there is no pure austenite at ordinary temperatures, but only a mixture of austenite and martensite. Maurer probably obtained the purest austenite in a steel containing 2 per cent. of manganese and 2 per cent. of carbon by quenching in ice from 1100 C. In order to control this view of Le Chatelier, and recognising that etching after quenching does not represent the condition at the high temperature, since the change of γ-iron is very rapid, it is necessary to observe the condition of the alloy at the temperature at which the austenite is stable, *i.e.* between 700° C. and 1200° C. The author obtained very good results by heating the steel in the porcelain tube of an electrical resistance furnace through which a stream of pure hydrogen had been passing for some hours; a current of hydrogen chloride for a few seconds etched the metal at the required temperature, and the hydrochloric acid was then removed by hydrogen passing for two or three hours. Steels varying in carbon content from 1·94 to 0·12 per cent., and containing from 0 to 0·73 per cent. of manganese, were investigated, being etched at 1120°C. They all showed the same polyhedral crystalline structure, similar to that of the special non-magnetic steel of Maurer. The results obtained are very different from the structures of chilled alloys, and the method promises interesting results. Ten microphotograms illustrate the paper.—A. H. C.

Carbon monoxide; Determination of —— in steel. E. Goutal. Comptes rend., 1909, **149**, 1129—1131.

The gas disengaged during the solution of steel in copper chloride (this J., 1909, 477) was passed through a series of tubes containing known quantities of diluted defibrinated blood, the number of these tubes in which the hæmoglobin had been converted into the carbon monoxide compound was determined by spectroscopic observation, and the amount of carbon monoxide calculated. The results agreed with those obtained by the iodic anhydride method. It was thus found that the proportion of carbon monoxide was independent of—1. The quantity of material taken. 2. The time taken in dissolving. 3. The acidity of the copper solution. 4. The substitution for cupric chloride of a solution of iodine in potassium iodide. 5. The nature of the gas (air or nitrogen) used to wash out the apparatus. Examination of a large number of samples showed that the percentage of carbon monoxide does not rise above 0·014, that it is nearly constant for all ordinary steels containing 0·3 per cent. or more of carbon; that nickel-steels contain less than ordinary steels of the same carbon content: and that chromium-steels resemble ordinary steels in their content of carbon monoxide.—J. T. D.

Special steels; Separation of vanadium, molybdenum, chromium, and nickel in ——. E. Pozzi-Escot. Comptes rend., 1909, **149**, 1131—1132.

The metal is dissolved in hydrochloric or nitric acid. The solution is heated to boiling, and a large excess of strongly alkaline solution of sodium hypobromite added: it is then boiled for some minutes and filtered through a plug of cotton. The precipitate of iron and nickel (with any cobalt and manganese) peroxides is dissolved in dilute hydrochloric acid and the filter well washed; the precipitation by hypobromite is repeated (to separate any traces of chromium, molybdenum, and vanadium retained by the original precipitate), the precipitate filtered off and thoroughly washed. The iron and nickel can then be separated from one another by means of ammonia. The chromium in the filtrate is reduced by alcohol and precipitated by ammonia, and the molybdenum and vanadium can then be separated by any of the usual methods, preferably that of Carnot (Comptes rend., June 27, 1887), as manganese vanadate.—J. T. D.

Amalgamation; Electro-chemical plate ——. F. E. Carey. Mining J., June 12, 1909. J. Chem., Met. and Min. Soc., S. Africa, 1909, **10**, 148.

The new method of amalgamation is designed to extract practically all the values from an ore, in one operation, and render subsequent cyaniding unnecessary. The apparatus consists of a sluice-box of suitable width and 40 feet or more in length, having a copper bottom which forms the cathode. Graphite anodes are arranged to conduct the current into the pulp flowing through the sluice-box, the current being about 0·5 ampère per sq. ft. of cathode surface at 5 to 10 volts. The ore is generally ground to about 80 mesh (linear) and mixed with solutions of mercury, sodium, and other salts before passing through the sluice-box. The most important part of the process is the constant uniform deposition of mercury on the copper bottom of the box. The increased activity of mercury when freshly deposited from solution enables "rusty," greasy, or pyritic gold to be readily amalgamated. "Fouling" or "sickening" of the plates is prevented by the liberation of nascent hydrogen.—F. R.

Cyanide solutions and slime residues carrying dissolved gold; Assay of ——. A. Whitby. J. Chem., Met. and Min. Soc., S. Africa, 1909, **10**, 134—136.

Twenty assay-tons (583·3 c.c.) of the cyanide liquor are shaken with 15 to 20 c.c. of a 15 per cent. solution of crystallised copper sulphate and acidified with about 7 or 8 c.c. of sulphuric acid (1—5). After again shaking, 20 to 30 c.c. of a 10 per cent. solution of crystallised sodium sulphite is added and the whole is occasionally agitated during 5 to 10 minutes. The precipitate is filtered off, transferred to a dry pot, and fluxed with two assay-tons of borax and one of litharge, with sufficient reducing material to give a 25-grm. button. Waters, slimes, solutions, etc., containing little or no cyanide or ferrocyanide are first rendered faintly alkaline, and sufficient cyanide, in solution, added to bring up their content to nearly 0·1 per cent. of potassium cyanide. 5 to 6 drops of a 10 per cent. solution of potassium ferrocyanide are then added, and the assay proceeded with as usual. The partial loss of dissolved gold during the drying of slimes pulp is prevented by treatment with the above reagents before drying. In discussion H. A. White stated that he obtained satisfactory results by adding a few drops of a 5 per cent. solution of potassium ferrocyanide to 80 assay-tons of solution, followed by sufficient of a saturated acid solution of cuprous chloride to bleach the first formed precipitate of cupric ferrocyanide. After vigorous stirring, additional cuprous chloride is added, which causes the precipitate to settle readily. The cuprous chloride is made by saturating hydrochloric acid with copper sulphate and reducing the solution with metallic copper.—F. R.

Assay of acid washes resulting from the cyanide "clean up" by the use of bisulphate; Experiments on the ——. L. J. Wilmoth. J. Chem. Met. and Min. Soc., S. Africa, 1909, **10**, 136—139.

The following method of assay was found by comparison to give the highest and most reliable results:—10 c.c. of a 10 per cent. solution of lead acetate was mixed with 10 assay-tons of the solution, and 15 c.c. of strong hydrochloric acid added. When boiling, 2 grms. of zinc shavings were added and the boiling continued until all the lead sulphate was decomposed. The precipitate was filtered off and fused under borax, and the lead cupelled. Precipitation by copper sulphate and zinc fume gave fairly good results, but the lead button obtained by fluxing the residue, contained too much copper for satisfactory cupellation. Both evaporation with litharge, and precipitation with alkali sulphides gave very low results. It was pointed out that owing to the high specific gravity of the liquors, it was important that the samples should be taken by weight and not by volume.—F. R.

Gold; Solvent effect of ferric and cupric salt solutions upon ——. W. J. McCaughey. J. Amer. Chem. Soc., 1909, **31**, 1261—1270.

Gold is soluble in hydrochloric acid solutions of iron alum and cupric chloride. If the concentration of the acid or salt be increased, the solubility of the gold is increased. The rate of solubility increases more with an increase in concentration of acid than with an increase in concentration of the salt. This is more noticeable in the case in which a copper salt is used. With a change of temperature from 38°—43° C. to 98°—100° C., the rate of solubility is increased seven times in the presence of an iron salt, and thirty-two times in a cupric chloride solution. Ferric salts act as a solvent in the presence of ferrous salts, but the solubility of gold is decreased if the concentration of the ferrous salt be increased. Hence in precipitating gold by ferrous sulphate, a rather large excess of the reagent should be used, and the mixture allowed to cool before filtering. Tables of solubilities are given. A solution containing 1 grm. of iron as iron alum, and 25 c.c. of hydrochloric acid in 125 c.c. of water dissolved 1 mgrm. of gold in 16 hours at 38°—43° C. and 2·90 mgrms. in 185 hours.—F. Shdn.

Zinc oxide; Investigations on the —— in calcined calamine and zinc blende. Lindt. Metallurgie, 1909, **6**, 745—747.

The author has investigated the reason why more zinc can be obtained from roasted calamine, although containing more or less silica and sulphur, than from roasted blende even when it contains very little sulphur as sulphate. Muspratt's solution of ammonia and ammonium carbonate was used to extract the zinc oxide, and it is found that although this is not a quantitative method for the zinc in the roasted material, yet by giving the amount of free zinc oxide, it agrees very well with the amount of zinc obtainable in practice. The results of the experiments show that some zinc oxide produced during roasting suffers a chemical change, and is not extracted by Muspratt's solution, and only reduced by a high temperature. Practice also shows that blendes containing iron are more difficult to reduce than those free from iron, yet the author shows that added metallic iron acts favourably, while by precipitating iron and zinc oxides, and roasting them together, it was found that a large portion of the zinc oxide reacted with the iron oxide, and was not extracted by Muspratt's solution, forming a chemical compound, Fe_2ZnO_4, analogous to Fe_3O_4. It is concluded that blendes containing iron oxide do not yield so much zinc, because of the above fixing of zinc oxide by the iron oxide during roasting, and not to any complications arising in the muffle, and that the iron as well as the lime and magnesia should be removed before roasting.—A. H. C.

Zinc ores containing lime and their economical treatment. Landt. Metallurgie, 1909, **6**, 747—749.

The lime in a zinc ore is converted into calcium sulphate during roasting, and is reduced in the muffle, giving up its sulphur to the iron present, as well as to the zinc, thus causing a loss of zinc. The author treated raw washed blende with a 6·5 per cent. solution of sulphur dioxide (sp. gr. 1·035), and found that the ore was concentrated to about 14 per cent., 94 per cent. of the lime and magnesia being removed. This is of value for transport reasons. The zinc content was only raised 3·4 per cent., owing to some calamine in the blende being washed away. It is recommended that in order to avoid additional apparatus, and any new departure, to combine the use of sulphur dioxide with the original ore-washing; this not only sets free the finer particles of blende which would otherwise be washed away, but ensures better results on roasting, and it is considered that it would be well worth the trouble and cost of practical proof.—A. H. C.

Bronze, brass, and similar alloys; Analysis of ——, and the electrolytic determination of tin in alloys. E. Schürmann and H. Arnold. Mitt. Kgl. Materialprüfungsamt, 1909, **27**, 470—473.

In the present paper the application of the method of analysis published previously (this J., 1908, 1042) to alloys containing 40—50 per cent. of copper, 45—55 of tin, and 5—10 of antimony is described. Attempts were also made to determine the tin electrolytically in the filtrate from the antimony sulphide, without a preliminary precipitation. It was found impossible to separate tin accurately from a stannous chloride solution or from an acid oxalate solution. Good results were however obtained in experiments with a solution of tin sulphide in oxalic acid, rendered alkaline with potassium hydroxide. The method finally adopted was as follows:—The filtrate from the antimony sulphide (*loc. cit.*) is concentrated to 150 c.c., neutralised with potassium hydroxide, and an excess of 2 c.c. of a 50 per cent. solution of potassium hydroxide added. The tin is then deposited by means of a current of 5 volts and 5 ampères, using Frary's apparatus (this J., 1907, 875); the evaporated water is replaced from time to time. When the deposition of the tin appears to be finished (3—4 hours for about 0·5 grm. of tin), the clear solution is faintly acidified with acetic acid and tested for tin with hydrogen sulphide.—A. S.

Phosphorus in bronze, brass, and simliar alloys in presence of arsenic; Determination of ——. E. Schürmann. Mitt. Kgl. Materialprüfungsamt, 1909, **27**, 474—476.

The method proposed is based on the fact that phosphoric acid is not reduced by nascent hydrogen. The solution of the alloy (100 c.c., corresponding to about 2 grms. of the sample), containing about 20 c.c. of concentrated hydrochloric acid, is cooled, and about 1·5 grms. of an alloy of zinc and magnesium added gradually, in small portions, with frequent agitation. The solution is allowed to stand for ½ hour on the water-bath, then filtered, and the filter washed with warm water containing hydrochloric acid. The solution is treated with 20 c.c. of aqueous sulphurous acid, boiled to expel excess of the latter, and any traces of arsenic still present removed by precipitation with hydrogen sulphide. The solution is then evaporated, the residue dissolved in a small quantity of water containing hydrochloric acid, and the phosphoric acid precipitated with molybdenum solution according to Finkener's directions. The precipitate is washed with ammonium nitrate solution and with dilute nitric acid (5 c.c. of acid of sp. gr. 1·2 in 100 c.c.), and then treated in the usual way.—A. S.

Alloys of nickel and copper. E. Vigouroux. Comptes rend., 1909, **149**, 1378—1380.

Nickel-copper alloys (made by fusing together the powdered pure metals in a current of dry hydrogen) when subjected to the action of various acids, left residues containing the elements in varying proportions dependent on the conditions of experiment. This excludes the existence of any definite compound. (See also this J. 1896, 598, 906; 1907, 153, 826.)—A. Sbld.

Vanadium [in metallurgical products]; Determination of ——. H. F. Watts. Trans. West. Assoc. Tech. Chem. and Met., Boulder, Colo. Mining World, 1909, **31**, 1114.

For products low in silicon, 0·25 to 1 grm. of the finely powdered sample is mixed with three grms. of sodium peroxide in a nickel crucible, the mixture is covered with about one grm. of the peroxide and heated for three or four minutes. After cooling, the crucible is very cautiously placed in 250 c.c. of cold water and the contents dissolved out. The crucible is removed and the solution boiled while a current of carbon dioxide is passed through. The solution is decanted through a filter and the precipitate and filter well washed with a hot dilute solution of sodium carbonate. A slight excess of nitric acid is added to the filtrate, which is then boiled, and neutralised with sodium acetate; the vanadium is next precipitated with lead acetate. The lead vanadate is filtered off, and dissolved in a small quantity of dilute nitric acid, and the lead precipitated by adding 10 c.c. of concentrated sulphuric acid, evaporating to fuming, diluting, aod filtering. The filtrate is boiled, reduced with sodium sulphite, and the excess of sulphur dioxide removed by boiling. When the steam no longer decolorises a dilute solution of potassium permanganate, the hot solution is titrated with standard potassium permanganate. The factor for vanadium is found by multiplying the iron factor of the permanganate by 0·196. The usual correction for a "blank" is 0·2 c.c. If arsenic is present it must be removed before titrating. Ores may be decomposed by *aqua regia*, the silica filtered off and the filtrate nearly neutralised with sodium hydroxide, and poured with constant stirring into a hot solution of the alkali. The solution is boiled, carbon dioxide passed through, and the above method proceeded with. A very complete separation of vanadium and iron is obtained even with 0·3 grm. of iron vanadate.
—F. R.

Columbites and tantalites; Analysis of ——. G. Chesneau. Comptes rend., 1909, **149**, 1132—1135.

The mineral is fused in a platinum dish with 4 parts of potassium bisulphate and 2 parts of sulphuric acid, heating slowly up to dull redness. Before all sulphuric acid fumes are expelled, the mass is cooled, and after addition of 2 parts of sulphuric acid is re-heated; it now gives a clear liquid, which, poured into a cold platinum basin, cracks on solidifying, and is easily disintegrated on boiling with water. It is boiled several times with water, the solution being each time decanted through a filter. The filtrate is nearly neutralised with ammonia, boiled to precipitate niobic and tantalic oxides, filtered, and the precipitate thoroughly washed, digested for 24 hours with warm ammonium sulphide, and washed with water and 5 per cent. hydrochloric acid. The precipitate now consists of niobic and tantalic oxides, with silica and titanic acid. All other metals are in the filtrate, and are determined by the usual methods. The moist precipitate is treated in platinum with hydrofluoric acid, and most of the excess of acid evaporated off. The solution is filtered, the residue (oxides of niobium and tantalum with a little iron) washed and burnt off, and, with the ashes of the filters used, is evaporated to dryness with hydrofluoric acid. Potassium fluoride, in quantity 25 per cent. of the expected total amount of oxides of niobium and tantalum, is added, and the mixture fused. The mass is taken up with very dilute hydrofluoric acid and added to the main solution of the oxides; the liquid is then concentrated to 7 c.c. per grm. of oxides, cooled, and the fluotantalate allowed to crystallise out. The crystals are washed three times with a few c.c. of cold water, the decanted liquors are united, 0·1 grm. of potassium fluoride is added, and the concentration and crystallisation are repeated, until no further deposition of crystals occurs. The crystals are united, dried, and weighed, and examined microscopically to see that they contain no tables of fluoxyniobate. The solution of fluoxyniobate is decomposed by sulphuric acid, and the niobic acid obtained is freed from potassium sulphate by fusion with 5 parts of ammonium sulphate and 5 parts of sulphuric acid; the fusion is boiled with water, filtered, and the precipitate washed, dried, ignited, and weighed. Another portion of the mineral is taken for silica, the precipitate of niobic and tantalic oxides with silica and titanic acid being dried, ignited, and weighed, and then evaporated with hydrofluoric and sulphuric acids. For titanic acid, the solution of the oxides of niobium, tantalum, and titanium obtained as above is used to determine titanic acid colorimetrically by means of hydrogen peroxide, the author having found that 1 grm. of pure niobic or tantalic oxide will give under these circumstances a colour equivalent to 5 mgrms. of titanic acid, and will not interfere with the development of the titanium colour.—J. T. D.

Metals; Meta-stability of the common ——. E. Cohen and K. Inouye. Chem. Weekblad, 1909, **6**, 881—892. Chem. Zentr., 1909, **2**, 2127.

The phenomena attendant on the "tin disease" recently described (this J., 1909, 1139) have also been observed with other metals. Pieces of the metals were rolled to thin sheets, and the latter freed from grease by means of alcohol and ether, and cut into small pieces. On some of the pieces figures were etched by means of a suitable agent: the pieces were then washed, covered with unetched pieces, placed between two iron plates, and heated for a long time at a constant temperature. Just as in the case of tin, it was observed in certain other instances that the portion of the unetched plate, coming in contact with the etched portion of the other plate, was infected; the infected spot appeared distinctly crystalline under the microscope. (Control experiments at the ordinary temperature showed that similar effects could not be produced by simply pressing together etched and unetched plates). Under different conditions of temperature, the effect described was observed with lead, zinc, brass, and bismuth; less distinctly with copper; but not with nickel. In all cases, the etched metal represented the stable form, and the strained, unetched metal, the unstable form. It is apparent, therefore, that the metals, tin, lead, zinc, brass, and copper, as they are used in practice, are in a metastable condition, and that all metals that have been subjected to mechanical treatment suffer from the forcing or strain-disease (*loc. cit.*).—A. S.

[Metal] films; Preparation of thin ——, *by volatilisation in vacuo.* L. Houllevigue. Comptes rend., 1909, **149**, 1368—1369.

Films are obtained by volatilising metallic threads by means of an electric current under a high vacuum. The thread, preferably a fine platinum wire, 0·3 mm. diam., electrically plated with the required metal, is fixed zigzag horizontally. The glass plate to be coated is clamped to a brass plate (placed below and parallel to the thread), having a vertical axis and fitted with an iron plate. It is rapidly rotated, by a magnet outside the receiver, during volatilisation of the metal. The glass is coated in a few seconds. The method has been successful with platinum, gold, silver, iron, copper, cadmium, and tin (on iron wire). Mercury (using copper amalgam) was, however, deposited in little globules. The films are usually specular and transparent when thin enough. The silver film by transmitted light is violet, becoming purple with increased thickness. Gold appears almost colourless by reflection, and varies from rose to violet, by transmitted light, according to the thickness. The method is also applicable to volatile non-metals deposited on a wire.

—A. Sbld.

Mercury statistics, 1909. A. S. Pickering, London. [T.R.]

	Imports.	Exports.	Price.	
	Bottles.	Bottles.	Highest.	Lowest.
			£ s. d.	£ s. d.
1909	43,163	22,050	9 17 6	7 19 0
1908	43,605	22,348	8 10 0	7 12 6
1907	39,448	29,465	8 5 0	6 15 0
1906	38,823	27,712	7 7 6	6 17 0
1905	34,034	21,330	7 15 0	7 1 0
1904	33,218	27,277	8 5 0	7 14 0
1902	33,192	19,519	8 17 6	8 14 6
1900	32,725	25,869	9 12 6	9 2 6

The estimated consumption in the United Kingdom is 13,000 bottles per annum.

Nickel and cobalt in United States. U.S. Geol. Survey, 1909. [T.R.]

Nickel and cobalt are not produced in large quantities in the United States, the output of nickel in 1908 coming from only two or three places and that of cobalt from only one. Both metals are produced by a lead company at Fredericktown, Mo., and some nickel ore was shipped from Bunkerville, Nev. Other nickel deposits are known in various parts of the country, but no work of importance was done on them during 1908. Some nickel salts were made at a New Jersey refinery from electrolyte solutions obtained in the refining of copper. In copper refining by electrolysis, nickel contained in the raw copper anodes goes into solution in the electrolyte, and unless the solutions are changed before the amount of nickel reaches 1 per cent. of the solution, nickel is deposited with the copper. It is said that this causes the copper to lose some of its toughness. Before this factor in electrolytic refining was found to be serious, it was impossible to make electrolytic copper equal to the best Lake Superior brands, but the refiners say that since this discovery they can make electrolytic copper equal to any other, and even superior to some in conductivity.

Separations with "cupferron." Baudisch. *See* XXIII.

Volumetric determination of manganese. Heike. *See* XXIII.

Direct extraction of ammonia from coke-oven gases. Hilgenstock. *See* IIa.

Patents.

Alloys of copper such as brass; Production of ——. W. R. Hodgkinson, Blackheath, and S. C. Peck, Woolwich. Eng. Pat. 18,175, Aug. 29, 1908.

Small quantities of metals, such as chromium, manganese, and cerium are introduced into brass or other copper alloys in the form of phosphide, in order to improve the mechanical properties of the alloys. A phosphate of the metal to be added is reduced to phosphide by heating with charcoal in the presence of a portion of the alloy, which is afterwards melted with the remainder. Or, a rich phosphide alloy may be made by reducing the phosphate of the metal to phosphide in the presence of copper or brass, this rich alloy being afterwards added in the required proportion to the molten copper alloy.—O. F. H.

Ores, residues, and the like; Furnaces for the smelting of ——, *for the obtainment of copper, or other metals, therefrom.* B. de Saint Seine, Paris, and Thwaites Bros. Ltd., Bradford. Eng. Pat. 23,179, Oct. 30, 1908.

The blast-furnace described is closed at the top by a double hopper, through which the charge is introduced, and has a single row of tuyères situated in the upper part of the melting zone. The blast passes downwards through the charge, and the gases pass out of the furnace at the lower end with the molten products.—O. F. H.

Copper matte; Method of, and converter vessel for, bessemerising ——. W. H. Peirce and E. A. C. Smith, Baltimore, Md. U.S. Pat. 942,346, Dec. 7, 1909.

The converter consists of an outer shell with an inner refractory lining, which is arched over at the top so that it is free to expand, the tuyères being imbedded in this lining and communicating flexibly through the outer shell with the wind-box.—O. F. H.

[Copper] Converter; Metallurgical ——. W. H. Peirce, Baltimore, Md. U.S. Pat. 942,661, Dec. 7, 1909.

The converter consists of an outer shell with an inner lining of refractory basic material free to expand in opposite directions from the tuyère zone, where the lining is fixed.—O. F. H.

Copper matte converter. E. A. C. Smith, Baltimore, Md. U.S. Pat. 942,675, Dec. 7, 1909.

The converter has a series of tuyères placed longitudinally on either side of the outlet, below which there are no tuyères.—O. F. H.

[Refractory] ores; Treatment of oils and oily liquids for use in the treatment of ——. A. A. Lockwood and M. R. A. Samuel, London. Eng. Pats. 26,264, Dec. 4, 1908, and 8287, April 6, 1909.

In the separation of ores from their gangues by means of oil or the like, small quantities of such metallic compounds, as are insoluble in water and alkaline solutions, are added to the oil, with or without the addition of a soluble soap, to render it less miscible or emulsifiable, and more adherent to the metalliferous or carboniferous particles. For example, oil-gas tar or the like is mixed with a 1 to 5 per cent. solution of aluminium sulphate in the presence of 1 to 5 parts of a soluble soap per 100 parts of tar. If desired, 2 parts of magnetic iron oxide to 1 of oil (tar) may be substituted for the soluble soap. (See Fr. Pat. 398,660, this J., 1909, 889.)—F. R.

[Refractory] ores; Treatment of ——. A. A. Lockwood and M. R. A. Samuel, London. Eng. Pat. 16,229, July 12, 1909. Under Int. Conv., Jan. 7, 1909. Addition to Eng. Pat. 12,962 of 1908 (see Fr. Pat. 398,660, this J., 1909, 889).

Powdered ore, tailings or concentrates are agitated with oil or the like, so that the metalliferous particles become oiled or coated. The non-magnetic particles adhere to the magnetic, or magnetisable, portion and may be separated from the gangue by means of a magnetic separator.—F. R.

[Desiccated] air; Supplying —— *at constant temperature and humidity in the smelting, melting, or heating of metals, ores, or similar substances.* W. H. Webb, W. G. Brettell and A. J. Adamson, Liverpool. Eng. Pat. 1659, Jan. 23, 1909.

The air is first cooled to a few degrees above freezing point, by passing it through a chamber cooled by water or brine, the liquid being maintained at a uniform temperature by modifying the working of the refrigerating plant, and when necessary by the addition of warm water, to counteract the natural variation in atmospheric temperature. The air from this chamber, at constant temperature, is then passed into a freezing chamber and cooled to the low temperature finally required.—F. R.

Drying air [for blast-furnaces, etc.] by cooling; Method of ——. J. Gayley. Fr. Pats. 404,058, 404,059, and 404,060, June 15, 1909.

In drying air by refrigeration the deposited snow and ice render the cooling coils inactive. The apparatus consists of a series of chambers which contain cooling coils and through which the air to be dried is circulated. According to the present patents: (1) the deposit on the cooling coils is thawed by withdrawing the relatively warm liquid from an active coil, and, with or without further warming, passing it through the inactive coil until its deposit is thawed; (2) very large cooling surfaces are used in conjunction with a cooling liquid at a temperature only slightly lower than 0° C.; and (3) the walls of the chambers are provided with projecting baffle-plates, which besides directing the air current into close contact with the coils, leads the water, which condenses on the surfaces of the walls, on to the coils, thus thawing any deposit of snow or ice formed on them.—J. W. H.

Furnace; Regenerative gas heated cementation —— *and the like.* W. Kirkham, Sheffield. Eng. Pat. 7549, Mar. 30, 1909.

The gas from the gas flues and the heated air from one of the regenerators pass transversely under the bottom of the single heating chamber, then up through vertical flues at the side, over the top of the pot, and down vertical flues on the other side and under the chamber again to the second regenerator. Flues are also arranged at the ends of the chamber, so that the chamber may be heated uniformly, or less or more at the ends.—F. R.

Furnace for the production of iron and steel. F. Resinelli. Fr. Pat. 404,020, June 14, 1909.

A blast-furnace, the waste gases from which are taken off below the charging doors and passed into a air-heating chamber above, where they are burned. The metal is tapped into a receiver or fore-hearth where it may be refined. The receiver is connected with a subsidiary shaft-furnace in which materials to be added in the receiver are preheated. The pressure of blast in the fusion zone of the blast-furnace is reduced by taking off some of the gases from that region, passing them through the receiver and preheating furnace, and thence through the air-heating apparatus above the blast-furnace.—O. F. H.

[Metallurgical] furnaces; Electric ——. Aktiebolaget Elektrometall. Eng. Pat. 17,342, July 26, 1909. Under Int. Conv., Aug. 1, 1908.

The furnace is of the type described in Fr. Pat. 400,244 of 1909 (this J., 1909, 1047), in which free spaces exist between the inclined upper surfaces of the material and the masonry of the furnace, the electrodes penetrating the material in these free spaces. The lower portion of the shaft, through which the material is fed, is made of a conical form, the narrow part of the shaft entering the smelting chamber. Part of the pressure of the material in the shaft is taken up by the conical walls, thus preventing the material in the chamber from being forced up into the free spaces. The gases may also be taken off from the top of the shaft, and driven by suitable means into the free spaces, for the purpose of cooling the cupola and the charge.—B. N.

Furnace; Electric ——. F. T. Snyder, Oak Park, Ill., Assignor to Electric Metals Co., Chicago, Ill. U.S. Pat. 942,110, Dec. 7, 1909.

The electric smelting furnace comprises a crucible base, surmounted by a water-jacket forming the wall, and the furnace is heated by the passage of a current through a bath of molten slag contained in the crucible. Near to the top of the latter is a tap opening for removing the molten product from the furnace, and above the level of the tap opening, and extending through the wall of the furnace, is a tube filled with heat-resisting material. The bore of this tube is relatively small, and an additional water-jacket is arranged around the tube, which is also provided with an outlet.—B. N.

[Metallurgical] furnace; Electric ——. C. E. Wilson, Hood River, Oreg. U.S. Pat. 943,290, Dec. 14, 1909.

The furnace is designed for the reduction of ore containing ferro-tungsten, or a like refractory material, and consists of a base-plate carrying a lower electrode, with removable sides and means for securing them together. A counter-weighted suspending arrangement is provided for raising and lowering the furnace. An upper stationary electrode extends downwards into the furnace, and is surrounded by a heat-resisting cover, the latter being provided with a counter-weighted suspending means for raising and lowering it.—B. N.

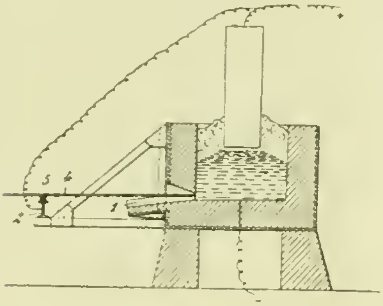
Furnace; Electric fusion —— *[for metals].* P. Girod. Fr. Pat. 403,501, Sept. 24, 1908.

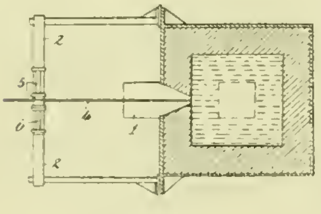
The furnace is provided with upper electrodes connected in parallel, and the bottom of the furnace, which forms the lower electrode, consists of two layers, the lower one conducting the current, whilst the upper one is refractory. The latter is of fine material, which rapidly becomes impregnated with molten metal and thus rendered conducting. The action of the furnace is started by metallic leads, which pass through the bottom of the furnace, acting as the lower electrode, and these are covered with refractory material, after the preliminary heating of the mass. The lower conducting layer may be replaced by a metallic mass, which may be the outer covering of the furnace. Metallic contact with the bath of metal is thus avoided.—B. N.

Furnace; Electric —— for reheating metals and other bodies. P. Girod. Fr. Pats. 403,538, Sept. 25, 1908, and 403,647, Sept. 29, 1908.

(1). THE furnace is heated by one or more arcs radiating into an appropriate enclosed space, the arc being produced preferably at the principal focus of the roof, which is circular or parabolic in cross-section, between one or more electrodes passing through the bottom of the furnace, and one or more electrodes passing through the roof. The heat is thus reflected on to the material placed on the base of the furnace. In order that the heating may be uniform, the roof or the base of the furnace may be capable of a rotary movement when the furnace is circular in form, or the base may have a longitudinal movement if the furnace is rectangular in form. (2). The arc is produced between electrodes, both of which pass through the roof of the furnace.—B. N.

Furnaces; Electric piercing of tap-holes of electric ——. C. A. Keller. Fr. Pat. 404,062, Oct. 8, 1908.





A CROSS-BAR, 2, suitably supported in front of and a little below the tap-hole, 1, of the furnace, is connected to one pole of the electrical circuit, the cross-bar supporting two pieces, 5 and 6, one of which, 5, is permanently in electrical connection with the cross-bar, the other piece, 6, being insulated. A poker or fire-iron, 4, for piercing the tap-hole, rests on one or other of these pieces, 5 or 6, so that the fire-iron may be readily put in or out of the circuit. —B. N.

Aluminium or aluminium alloys; Welding objects of ——. M. U. Schoop, Garenne-Colombes, France. Eng. Pat. 8778, April 13, 1909. Addition to Eng. Pat. 24,283 of 1907 (this J., 1909, 26).

A WELDING flux for aluminium consists of a mixture of alkali bromides and fluorides in place of a mixture of alkali chlorides and fluorides as in the original patent.—F. R.

Ferro-alloys; [Electrical] process of producing ——. E. F. Price, Niagara Falls, N.Y., Assignor to Central Trust Co., New York. U.S. Pat. 942,349, Dec. 7, 1909.

FERRO-ALLOYS, such as ferro-silicon, are obtained by electrically smelting a finely-divided charge of a metallic compound, or a silicon compound, with a reducing agent and a source of iron. The zone of reduction is surrounded by a considerable body of the charge, the electrodes being thus protected from the oxidising and cooling effect of the atmosphere. The waste gases are withdrawn laterally in different directions beneath the surface of the charge. —B. N.

Iron and steel; Manufacture of —— in the electric furnace. Soc. Anon. Electrométallurgique (Procédés P. Girod). First Addition, dated May 6, 1909, to Fr. Pat. 388,614, June 4, 1907.

A SECOND basic-lined furnace is used to complete the refining and remove intermingled basic slag before the steel is transferred to the acid-lined finishing furnace. —O. F. H.

Iron ores; Process for treating ——. B. F. Halvorsen and H. Johansen. Fr. Pat. 403,623, June 3, 1909.

SULPHIDE ores, especially nickel-bearing magnetic pyrites, are concentrated magnetically and then heated in a basic-lined electric furnace with powdered magnetite or roasted pyrites. Sulphur dioxide is given off in a sufficiently concentrated form to be utilised as a by-product, and the elimination of sulphur is completed by the highly basic slag. The method can also be used for the production of ferro-boron, using boric acid or a borate and a sulphide of iron.—O. F. H.

Iron intended to replace Swedish iron; Process for the manufacture of —— and of iron alloys. N. A. Héloui̇s. Fr. Pat. 404,187, June 4, 1909.

THE iron is produced by the reduction of its oxide by finely divided aluminium, using small quantities of fluorspar and lime as fluxes. The great heat evolved by this reaction allows a considerable quantity of scrap iron, preferably oxidised and heated to redness, to be added to the charge. A cylindrical furnace or cupola of special form, lined with magnesite bricks, is used, and the metal is tapped into a receiver from which it is poured into moulds. —O. F. H.

Ores; Method of securing the chloridisation of ——. W. Koehler, Cleveland, Ohio. U.S. Pat. 942,569, Dec. 7, 1909.

REFRACTORY ores are treated with hydrochloric acid or other halogen acid, either gaseous or in solution, in the presence of hydrogen, or of hydrogen and a carbon compound.—O. F. H.

Electrolyte and method of electro-depositing nickel. E. F. Kern, Knoxville, Tenn., Assignor to P. S. Brown, New York. U.S. Pat. 942,729, Dec. 7, 1909.

A SOLUTION, containing nickel fluosilicate, an alkali fluoride, such as ammonium fluoride, and a soluble fluosilicate of a metal "more basic than nickel," is electrolysed, using a nickel anode.—B. N.

Plated metal and process of making the same. J. Wilder, Assignor to the Wilder Metal Coating and Manufacturing Co., Connelsville, Pa. U.S. Pat. 942,803, Dec. 7, 1909.

IRON or steel is coated with an alloy of copper and aluminium with zinc or tin, or both, by immersing the cleaned and dried iron or steel in a bath of the molten alloy.—O. F. H.

Metals; Apparatus for use in the electric deposition of ——. Les Etablissements S. Grauer et Cie. Fr. Pat. 403,534, May 27, 1909. Under Int. Conv., Oct. 14, and Dec. 19, 1908.

THE electrolytic bath is provided with anodes, and with an inclined rotating vessel containing the articles to be treated, the upper end of the vessel being open, or closed by means of a movable cover, and the lower end closed, or sufficiently closed to retain the articles. The cathode may enter either at the upper end of the vessel or at the lower, but the connections are entirely independent of the motive power producing the rotation. The vessel may be detached from its support, and from the gearing producing the rotation, without dismantling the latter which is at the lower end of the vessel.—B. N.

Alloy for electrical resistance. W. B. Driver, East Orange, N.J. U.S. Pat. 943,066, Dec. 14, 1909.

THE alloy is composed essentially of nickel and manganese, and contains from 5 to 40 per cent. of manganese, and 50 per cent. or more of nickel.—B. N.

Cobalt ; Process for the extraction of —— from ores which contain it, especially manganiferous cobalt ores. M. B. Pécourt. Fr. Pat. 403,830, June 9, 1909.

The ores are ground up into a paste with sulphuric acid and pyrites, and then heated to a cherry-red heat in a reverberatory furnace. The sulphates so formed are extracted by lixiviation, the solution boiled, and powdered chalk added to precipitate iron. Calcium chloride is then added and the solution filtered. Freshly prepared calcium sulphide is added to the filtrate, which now contains only chlorides of manganese, nickel, and cobalt, until the nickel and cobalt are precipitated as sulphides ; the manganese remains in solution as chloride and is recovered. The sulphides of nickel and cobalt are reconverted into sulphates by roasting, dissolved in water, and the cobalt precipitated by means of sodium hypochlorite, the solution being kept nearly neutral by the addition of sodium carbonate.—O. F. H.

[Nickel and cobalt] Metals which can be extracted by converting their sulphides into soluble sulphates by roasting ; method of concentrating those minerals containing ——. M. B. Pécourt. Fr. Pat. 403,831, June 9, 1909.

The minerals are first roasted with sulphur or pyrites in order to convert the metals into sulphides, and these by further roasting at a low red heat are converted into sulphates. The soluble sulphates are extracted with water, and the ferrous sulphate removed by oxidation with air and precipitation with calcium carbonate. The nickel and cobalt in the solution are then precipitated as sulphides by means of calcium sulphide, which is added until the manganese just begins to be precipitated. The mixture of sulphides of nickel and cobalt, which contains a little manganese and some calcium sulphate, is then roasted and the sulphates of nickel and cobalt so formed are extracted with water. The solution is evaporated to dryness, and the bulk of the residue further reduced if necessary by reconverting the sulphates to sulphides by roasting with powdered charcoal.—O. F. H.

Metals ; Process for blackening ——. Fabrik. Chem. Gravüren Luppe und Heilbronner. Fr. Pat. 403,969, June 12, 1909.

Cuprous oxide is first formed on the surface of the article which has been coppered, and the cuprous oxide is then converted into cupric oxide by making the article the anode of an alkaline electrolytic bath, which may be a dilute solution of sodium or potassium hydroxide. The deposit of cuprous oxide may be formed by making the article the cathode in an alkaline bath, the cuprous oxide being converted into cupric oxide in the same bath by reversing the current.—O. F. H.

Slags or other residues or products of the melting or refining of different materials ; Apparatus for the recovery in the form of steam of the heat given out in the cooling of ——. Soc. de Saintignon et Cie. and C. Gallez. Fr Pat. 404,184, May 22, 1909.

The apparatus consists of a cylindrical iron drum which is divided into a number, *e.g.* eight, compartments by radial partitions, and which revolves beneath a closely fitting receiver or boiler. Molten slag from blast-furnace smelting or other continuous process is allowed to run into the drum. Water is admitted with the slag and a further quantity is injected into each compartment of the drum as it passes beneath the receiver, which serves to collect the steam generated.—O. F. H.

Minerals ; Process for the treatment of —— for the extraction of the metal which they contain. B. Junquera, Santa Susana, Spain. Eng. Pat. 21,837, Oct. 15, 1908. Under Int. Conv., Feb. 8, 1908.

See Fr. Pat. 394,719 of 1908 ; this J., 1909, 370. The ore charge is first pulverised to pass through a sieve of 4900 meshes per sq. cm.—T. F. B.

Metallic alloys ; Manufacture of ——. D. Landenberger, Berlin. Eng. Pat. 26,380, Dec. 5, 1908.

See Fr. Pat. 397,151 of 1908 ; this J., 1909, 799.—T. F B.

Alloys of copper, such as brass ; Production of ——. S. C. Peck and W. R. Hodgkinson, London. U.S. Pat. 943,159, Dec. 14, 1909.

See Eng. Pat. 18,175 of 1908 ; preceding.—T. F. B.

Fumes or smoke [from ore roasting, &c.] ; Method of treating corrosive gaseous ——. C. B. Sprague, Salt Lake City, U.S.A. Eng. Pat. 26,684, Dec. 9, 1908. Under Int. Conv., April 7, 1908.

See Fr. Pat. 397,268 of 1908 ; this J., 1909, 799.—T. F. B.

Electroplating barrel apparatus. T. A. Smith and T. Deakin, Walsall, Staffs. Eng. Pat. 27,624, Dec. 19, 1908.

See Fr. Pat. 403,534 ; preceding.—B. N.

Manganese ; Manufacture of commercially pure carburetted ——. Soc. Anon. " La Néo-Métallurgie," Paris. Eng. Pat. 28,003, Dec. 23, 1908. Under Int. Conv., Jan. 22, 1908.

See Fr. Pat. 386,442 of 1908 ; this J., 1908, 692.—T. F. B.

Welding compound. M. U. Schoop, Bois-Colombes, France. U.S. Pat. 943,164, Dec. 14, 1909.

See Eng. Pat. 24,283 of 1907 ; this J., 1909, 26.—T. F. B.

Furnace ; Electric ——. E. A. A. Grönwall, A. R. Lindblad, and O. Stalhane, Ludvika, Sweden. U.S. Pat. 943,224, Dec. 14, 1909.

See Eng. Pat. 17,342 of 1909 ; preceding.—B. N.

Electric induction-furnaces ; Melting-hearth for ——. C. Grunwald, Bredeney, Germany. U.S. Pat. 943,403, Dec. 14, 1909.

See Eng. Pat. 7936 of 1909 ; this J., 1909, 800.—T. F. B.

Electric furnace for the continuous extraction of zinc from its ores. E. F. Côte and P. R. Pierron, Lyon, France. U.S. Pat. 944,774, Dec. 28, 1909.

See Eng. Pat. 5100 of 1907 ; this J., 1908, 342.—T. F. B.

Briquetting metallic iron ; Process of ——. L. Weisz, Budapest. U.S. Pat. 943,724, Dec. 21, 1909.

See Eng. Pat. 17,844a of 1905 ; this J., 1906, 184.—T. F. B.

Treatment of blast-furnace slag in manufacture of cement. Eng. Pat. 15,165. *See* IX.

XI.—ELECTRO-CHEMISTRY.

Control of rubber materials for insulating purposes. Martens. *See* XIV.

Patents.

Wood ; Treating —— to render it suitable for use in secondary or storage batteries. P. Marino, London. Eng. Pat. 2641, Feb. 3, 1909.

Wood separators, for use as insulators between the electrodes of secondary batteries, are first treated with steam under pressure to remove pyroligneous acid (acetic acid), and afterwards with " oxygenated water," or with ozone, in order to oxidise the " vasculose," the latter being converted into resinous acids soluble in alkalis or alcohol. For further increasing the porosity or permeability, the separators are perforated with a large number of " almost imperceptibly fine holes." Glass wool is interposed in the battery between each wood separator and the lead peroxide surface of the positive plate, thus preventing formation of oxide and sulphate by contact with the wood, and also avoiding deterioration of the separator.—B. N.

Batteries ; Secondary or storage ——. P. Marino, London. Eng. Pat. 2683, Feb. 4, 1909.

An agglutinant, which is a conductor of electricity, is prepared from pure glycerin, a solution of an alkali silicate, a small quantity of starch, and " impalpable lead powder," the whole being stirred until all lumps are removed, and the mass converted into a homogeneous paste. This is thoroughly mixed with finely powdered litharge, and the agglomerate is spread on grids of metal for use as electrodes in secondary batteries. The active material is subsequently treated with acids, in order to precipitate silica from the alkali silicate, and the silica and starch are removed by washing, thus rendering the material thoroughly porous. By electrolytic treatment, employing the electrodes as cathodes, the active material of the elements is completely converted into porous lead.—B. N.

Active mass for the negative electrodes of primary and secondary electric elements with alkaline electrolyte. Nya Ackumulator Aktiebolaget Jungner, A. T. K. Estelle, and K. W. H. Evers, Fliseryd, Sweden. Eng. Pat. 7338, March 26, 1909.

The active mass consists of finely-divided iron and cadmium, mixed together "in such proportions (about equal parts by weight of each) that the discharge of the iron takes place according to a single curve of potential, namely, the high-potential curve, in order to avoid the formation of ferric compounds occurring at the discharge of the low-potential of the iron." (Reference is directed to Eng. Pat. 7768 of 1900; this J., 1901, 482).—B.N.

Storage-battery tank. T. A. Willard, Cleveland, Ohio. U.S. Pat. 942,990, Dec. 14, 1909.

The tank comprises an exterior wooden casing having an internal adherent protective coating of material of high melting point, such as "petrolyte," and an internal lead lining provided with a similar external protective coating. A layer of material of low melting point such as paraffin, is interposed between the protective coatings of the lead and wooden parts, so that by softening the paraffin, the parts may be readily separated, each retaining its coating of high melting point.—B. N.

Plastic [insulating] material from milk curds; Manufacture of a solid ——. V. Schütze, Riga, Russia. Eng. Pat. 13,601, June 10, 1909. Under Int. Conv., Sept. 23, 1908.

The milk curds are made into a paste with cold water, with the addition of colouring matter if desired, and heated at 100° C. for five or ten minutes, being meanwhile continuously stirred until the material reaches a pulpy state. The hot pulp is then subjected to a pressure of at least five kilos. per sq. cm., in previously heated moulds, for some three hours, and immediately immersed in formalin for a period of three to four days or longer. The material is strongly resistant to acids, and is also suitable for insulating purposes.—B. N.

Electric arcs; Production of —— intended for the formation of compounds of oxygen and nitrogen. P. Bunet and A. Badin. Eng. Pat. 16,225, July 12, 1909. Under Int. Conv., Nov. 30, 1908.

The apparatus is of the form known as the "diverging electrode or horn type," for the production of compounds of nitrogen and oxygen. One electrode is central, and the other is formed either of two or more lateral diverging arms, arranged symmetrically with regard to the central electrode, or of a truncated conical surface generated by the rotation of the lateral electrodes around the axis of the central electrode, the object of this arrangement being to multiply the formation of ascending arcs. In order to increase the speed of travel of the arcs, a magnetic blow-out may be obtained by passing an auxiliary current of high intensity along the pipes conveying cooling liquid to the electrodes, or by passing a current, derived preferably from a single transformer, along the central electrode only. A turbine may be arranged to throw a sheet of liquid into the "rupture-zone" of the arcs, with the object of cooling them, and rapidly absorbing the nitrous compounds, but in this case the electrodes are preferably inverted, so that the arcs are made to descend, thus avoiding the projection of absorbing liquid between the electrodes.—B. N.

Ozone; Process of [electrically] generating and storing ——. F. M. Ashley, New York. U.S. Pat. 942,046, Dec. 7, 1909.

Oxygen, or a gas containing a considerable quantity of free oxygen, is compressed, and the heat generated during the compression is withdrawn from the gas. The latter is then passed under pressure into an ozoniser, and the pressure quickly decreased to a predetermined amount, whilst the gas is being subjected to the action of an electric current in order to generate ozone. After treatment, the gas is passed into a receptacle, in which water, or a similar fluid, is stored, the liquid being allowed to escape from the vessel at the same rate as the gas is admitted, in order to prevent the gas from expanding to any considerable degree during the process of storing.—B. N.

Furnace; Electric ——. E. F. Price, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., Chicago, Ill. U.S. Pat. 942,350, Dec. 7, 1909.

The furnace comprises an open vessel, "with opposite series of vertically disposed, spaced electrodes depending into the same." Above the bath, and between the electrodes, is arranged a stack, so that the air current flowing into it has to pass around and between the electrodes.—B. N.

Furnace; [Electric] transformer ——. E. A. A. Grönwall, A. R. Lindblad, and O. Stalhane, Ludvika, Sweden. U.S. Pat. 942,961, Dec. 14, 1909.

Around different parts of the core of the furnace are arranged primary and supplemental coils, the latter being surrounded by the smelting bath which forms the secondary. The supplemental coil is supplied with current taken from a suitable number of windings of the primary, "whereby the magnetomotive force generated by the system of coils fully or partly overcomes the magnetic force which tends to force the leaking lines of force out of the iron core of the transformer furnace."—B. N.

Furnace; Electric —— with rotating arc, specially applicable to the nitrification of atmospheric nitrogen. C. Limb. Fr. Pat. 403,536, Sept. 25, 1908.

The arc is caused to rotate by means of a rotating magnetic field, the latter being obtained by the use of polyphase currents or equivalent means.—B. N.

Furnace; Electric —— for the baking of bricks, pottery, and other uses. J. L. Harper. Fr. Pat. 404,208, June 19, 1909.

The furnace comprises a tunnel divided into a longitudinal series of chambers, the middle chamber being heated by electric resistances, supported in the arch forming the roof of the chamber, and removable by longitudinal movement. Two trains of trucks move at intervals in opposite directions through the tunnel, the trucks being each of the same length as the chambers, so that each chamber receives two trucks. This permits of a free passage of heat between the contents of the trucks, those approaching the central chamber receiving heat from the set moving in the opposite direction. The bottoms of the trucks form the floors of the chambers, and the extreme ends of the trucks practically close the openings in the transverse walls dividing the chambers. The floors and ends of the trucks are provided with air spaces, for preventing the escape of heat.—B. N.

Planté negative plates; Process of treating or impregnating ——. H. Rodman, Pittsburg, Assignor to Westinghouse Storage Battery Co., New York. U.S. Pat. 944,822, Dec. 28, 1909.

See Eng. Pat. 5957 of 1907; this J., 1907, 1204.—T. F. B.

Electric lamp filaments. Eng. Pat. 2389. *See* IIb.

Arc-light electrodes. Eng. Pat. 23,171. *See* IIb.

Treating spent liquor of paper mills. U.S. Pat. 942,207. *See* V.

Alloy for electrical resistance. U.S. Pat. 943,066. *See* X.

Electric process of making pictures. U.S. Pat. 940,495. *See* XXI.

XII.—FATS ; OILS ; WAXES.

Soap ; Observations on the detergent action of solutions of ——. W. Spring. Rec. Trav. Chim. Pays-Bas, 1909, 28, 424—438.

Experiments upon the same lines as those previously described with lampblack (this J., 1909, 430) have shown that red earth ($7Fe_2O_3 + 3H_2O$) and colloidal iron hydroxide also readily form adsorption compounds with soap, which are not decomposed, or only decomposed with difficulty, by water. These compounds no longer possess the power of adhering under water to solid bodies such as glass, porcelain, cellulose, skin, etc. Hence in washing such solid bodies stained with red earth, etc., the cleansing is due to the formation of colloidal ferric soaps, which are not adsorbed by the solid bodies.—C. A. M.

Patents.

Antiseptic soap. W. A. Beatty, Assignor to R. W. McCulloch, New York. U.S. Pat. 942,538, Dec. 7, 1909.

The soap is prepared by adding tetrabromocresol to ordinary soap.—W. P. S.

Cottonseed oil and food compounds in which cottonseed oil is an ingredient. J. H. Filbert, Baltimore, U.S.A. Eng. Pat. 17,271, July 24, 1909.

See U.S. Pats. 929,845 and 930,280 of 1909 ; this J., 1909, 999.—T. F. B.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Zinc sulphide ; Manufacture and utilisation of ——. M. Pipereaut and A. Vila. Bull. Soc. d'Encouragement, 1909, 111, 517—557.

Zinc sulphide, intended particularly for use as a pigment to replace white lead and zinc white, is prepared by a special process as follows : Crude zinc oxide, obtained by roasting zinc ores, is dissolved by solution of caustic alkali, and powdered sulphur is added to the boiling solution, the first addition serving to precipitate impurities (metals forming coloured sulphides) which are separated by filtration. A further quantity of powdered sulphur, equivalent to the zinc content of the solution, is now added, and the solution is kept boiling until the whole of the zinc is precipitated as sulphide, and assumes a particular physical condition, only acquired by prolonged boiling. The precipitate is washed, filter-pressed, the press-cake dried, and finally calcined at a red heat in muffle-furnaces, air being excluded. The product, which is anhydrous, forms a soft white talc-like powder of sp. gr. 4 to 4·2. The properties of this product are exhaustively described. Its value as a pigment has been tested in a series of exact comparative experiments, side by side with white lead and zinc white. The tests included observations of the behaviour of the new product, when exposed to moist air, sunlight and water (pure and saline), and it was found that the zinc sulphide is practically unaltered in each case, water only causing the formation of a very small quantity of zinc sulphate, after an exposure of six months. The results of the comparative experiments, as regards miscibility with oil, covering power, plasticity, drying properties and various effects obtained by painting surfaces of woodwork, ironwork and plaster, show that the zinc sulphide, prepared by the process above described, is equal to, and in many respects superior to both white lead and zinc white, particularly as concerns its stability, plasticity and covering power.—E. C. V.-E.

Amber ; Solubility of ——. C. Coffignier. Bull. Soc. Chim., 1909, 5, 1101—1103.

The specimen of amber used in the experiments had a sp. gr. of 1·052 and m. p. over 300° C. The acid value was 97 and the saponification value 115. The solubility of this amber in various solvents was as follows :—Ethyl alcohol, 14·3 ; methyl alcohol, 11·3 ; amyl alcohol, 24·2 ; ether, 18·8 ; chloroform, 17·3 ; benzene, 21·2 ; acetone, 23·3 ; oil of turpentine, 16·9 ; benzaldehyde, 32·4 ; aniline, 30·7 ; amyl acetate, 30·0 ; carbon tetrachloride, 11·5 per cent. —W. P. S.

Patents.

Phenol and formaldehyde ; Method of making insoluble products of ——. L. H. Baekeland, Yonkers, N.Y. U.S. Pat. 942,699, Dec. 7, 1909.

Phenol is acted on by an aqueous solution of formaldehyde and the product of the reaction is separated from the solution by the addition of a soluble metallic salt. This product may then be moulded and rendered insoluble, infusible, and hard by the application of heat and pressure. —W. P. S.

Phenol and formaldehyde ; Condensation product of —— *and method of making the same.* L. H. Baekeland, Yonkers, N.Y. U.S. Pat. 942,700, Dec. 7, 1909.

The process consists in acting on a phenolic substance with formaldehyde, separating water from the mixture, and arresting the reaction when the initial condensation product has been transformed into a mass which is hard when cold, and soft and elastic, but infusible, when heated. This product is insoluble in alcohol, glycerin, and formaldehyde, or mixtures of these ; it swells in phenol and acetone without complete solution therein. It may be moulded into desired shapes and the moulded articles may be hardened by the application of heat.—W. P. S.

Abrasive composition and method of making the same. L. H. Baekeland, Yonkers, N.Y. U.S. Pat. 942,808, Dec. 7, 1909.

An abrasive or polishing composition is prepared by incorporating an abrasive material with a phenolic substance and formaldehyde (see preceding abstracts) and transforming the mixture into an insoluble product by the application of heat and pressure.—W. P. S.

Gum-resin solutions and balsams ; Process for the preparation of dark-coloured and strongly aromatic ——. Chem. Fabr. Reisholz Ges. m. b. H. Ger. Pat. 216,721, March 28, 1908.

Gum-resins or viscous balsams, such as Tolu-balsam, gum-benzoin, and storax, which contain cinnamic or benzoic acids, are heated, either alone, or with the addition of benzoic or cinnamic esters of cinnamyl or benzyl alcohols, to a temperature of 180°—270° C., the volatile matters evolved being condensed. The products are then mixed with the condensed volatile substances, or with benzoic or cinnamic esters of cinnamyl or benzyl alcohols.—A. S.

Treatment of coniferous woods. U.S. Pat. 942,106. *See* V.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber materials for insulating purposes ; Control of ——. A. Martens. Mitt. Kgl. Materialprüfungsamt, 1909, 27, 465-470.

An agreement has been entered into by the German electric cable works and the Königliches Materialprüfungsamt, Gross-Lichterfelde, W., whereby the products of the cable factories may be examined for purchasers at a reduced cost. In the agreement it is prescribed that compositions for the insulation of normal conducting wires should contain 33·3 per cent. of rubber, with a resin content of not more than 4 per cent., and 66·7 per cent. of filling materials, including sulphur. Of organic filling materials, only ceresin (paraffin hydrocarbons) is allowed, up to a maximum of 3 per cent. The specific gravity of the composition must be at least 1·5. The method of examination is as follows: (1) The material must sink in a zinc chloride solution of sp. gr. 1·49. (2) When the material is treated with solvents such as xylene, carbon tetrachloride, pyridine, or nitrobenzene, the solution should exhibit neither fluorescence nor a dark coloration—absence of mineral oils, asphaltum, and similar substances. (3) Two portions, 5 grms. each, of the sample are extracted for 10 hours with acetone on the water-bath in a Soxhlet apparatus protected from light, and the acetone is then distilled off. The residues are dried at 100° C. and weighed. One sample is now warmed with 50 c.c. of absolute alcohol, filtered, and the residue washed with 25 c.c. of boiling alcohol; the solution is cooled to −4° to −5° C. for one hour, filtered, and the insoluble matter washed with 100 c.c. of 90 per cent. alcohol cooled to the same temperature; the solution is again cooled to insure that the paraffin hydrocarbons have been completely separated. The residue is washed with alcohol and with warm carbon bisulphide, dried at 100° C., and weighed: the weight represents the quantity of paraffin hydrocarbons plus a portion of the sulphur. The sulphur is determined as barium sulphate after oxidation with nitric acid and evaporation with hydrochloric acid. In the residue from the second sample, the total sulphur soluble in acetone is determined in a similar manner. The difference between the total acetone extract and the sum of the paraffin hydrocarbons and sulphur, is taken to represent rubber-resin. (4) 1 grm. of the sample is extracted with acetone, dried at 50°—60° C., and dissolved in 25 c.c. of petroleum (b. pt. 230°—260° C.) in a tared flask fitted with a reflux condenser. (Other solvents such as camphor oil, etc., may be used, if necessary, to effect complete solution.) About 75 c.c. of benzene are added to the solution, and after 24 hours, the supernatant liquid is decanted through a tared Gooch crucible containing a double filter disc, the filtrate being repeatedly returned until it runs through quite clear. The precipitate in the flask and the filter are well washed with hot benzene, and then with light petroleum spirit, alcohol, and ether, and then the flask and the Gooch crucible are dried at 100 ° C., and weighed. (The solution may also be separated from the precipitate in a centrifugal apparatus.) The sum of the weights of the filling materials thus determined, of the paraffin hydrocarbons, and of the sulphur extracted by acetone, should not be more than 65·7 per cent. of the total; the difference between this sum and 100 is reported as vulcanised rubber. The percentage of pure rubber is calculated by subtracting 1 (representing combined sulphur) from the value obtained for vulcanised rubber. (5) A portion of the sample is extracted with acetone, dried at 50°—60° C., and heated for 4 hours with 50 c.c. of N/2 alcoholic sodium hydroxide solution under a reflux condenser on the water-bath. The solution is filtered, and the residue washed with 100 c.c. of hot absolute alcohol and with 50 c.c. of hot water. The solution is concentrated to about 15 c.c., diluted with water to about 100 c.c., acidified with dilute sulphuric acid, extracted with aqueous ether, and the extract evaporated in a small tared beaker; the residue is dried and weighed: it should not amount to more than 0·5 per cent.—A. S.

Lupeol. N. H. Cohen. Rec. Trav. Chim. Pays-Bas, 1909, **28**, 368—390.

The gutta-percha-like material, *bresk* or "*dead Borneo*," which is derived from the tree, *Alstonia eximia*, contains lupeol and α- and β-amyrin (partly in the form of their acetic esters), whilst the *alstol* described by Sack is a mixture of these substances. The lupeol from bresk melted at 211° C. (215° C. corr.) and had an optical rotation in chloroform solution, of $[\alpha]_D = +27°2$. It formed a benzoate (m. pt. 265°—266° C.; 273°—274° C. corr.), which crystallised in flat needles, an acetate (m. pt. 214° C.; 218° C. corr.) and a cinnamate (m. pt., 243°·5—244°; 249°—250° C. corr.). On treatment with bromine it yielded a monobromide, $C_{31}H_{49}OBr$, which melted at 184° C., and had a rotation of $[\alpha]_D = +3·8$. The benzoate also yielded a monobromide, which crystallised in small plates melting at 222°—223° C. On oxidation with Kiliani's chromic acid reagent (Ber., 1909, **34**, 3564), the lupeol was converted into a compound, *lupeone*, $C_{31}H_{48}O$, which melted at 169° C. (170° C. corr.), and had $[\alpha]_D = +63°·1$. The iodine values of the various derivatives, determined by Hübl's method, indicated the presence of a double linkage in the molecule, and from a consideration of all the analytical results, the formula, $C_{31}H_{50}O$, appears better suited to lupeol than the formula, $C_{30}H_{50}O$. (See also this J., 1908, 1123, 1124.) —C. A. M.

α-Amyrol and β-amyrol. N. H. Cohen. Rec. Trav. Chim. Pays-Bas, 1909, **28**, 391-394.

In addition to lupeol (see preceding abstract), *bresk* contains α- and β-amyrol, $C_{30}H_{50}O$, the former crystallising in fine needles (m. pt. 185° C.; 186° C. corr.), and the latter in long hard needles (m. pt. 1950; 197°—197·5° C. corr.). The acetate of α-amyrol formed flat needles melting at 224°—225° C. (corr); the benzoate, long needles (m. pt. 194° C corr.); and the cinnamate, needles melting at 178° C. (corr.). The acetate of β-amyrol crystallised in long hard needles (m. pt. 240°—241° C. corr.); the benzoate in rectangular plates (m. pt. 234°—235° C. corr.); and the cinnamate in small needles (m. pt., 241° C. corr.).—C. A. M.

Patents.

Indiarubber and cellulose; Manufacture of products containing ——. P. Defaucamberge, Assignor to Soc. Franç. de la Viscose, Paris. U.S. Pat. 943,658, Dec. 21, 1909.

See Eng. Pat. 7302 of 1909; this J., 1909, 844.—T. F. B.

Elastic or plastic products similar to caoutchouc, gutta-percha, or mastic; Process for the manufacture of ——. R. W. Wallace, London, and G. Reynaud, Paris. Eng. Pat. 27,688, Dec. 19, 1908. Under Int. Conv., Dec. 20, 1907.

See Fr. Pat. 395,215 of 1907; this J., 1909, 319.—T. F. B.

Plastic and elastic substance; Production of a ——. Commercial Products Co., Ltd., London. From L. Berend, Crefeld, Germany. Eng. Pat. 4154, Feb. 19, 1909.

See Fr. Pat. 402,028 of 1909; this J., 1909, 1212.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tanbark and tanning extracts in 1908; *Production of* —— *in the United States.* U.S. Census Bureau, Dec., 1909. [T.R.]

The total reported cost of tanbark and tanning extract consumed in 1908 by the tanneries in the United States was $21,361,719. Practically the same amount was expended for tanning material of this character in 1907 and also in 1906.

Business conditions in 1908 were almost universally unfavourable, but the canvass of the tanning industry was much closer than before and resulted in returns from 622 plants in 1908, as compared with 583 plants in 1907.

The following table shows the production of tanbark and tanning extract by varieties for the year 1908, as compared with 1907:—

Extract.

	1907.		1907.	
	Quantity (pounds).	Cost.	Quantity (pounds).	Cost.
Hemlock .	40,133,524	$968,041	40,808,723	$1,043,311
Oak......	30,830,291	639,938	21,705,775	460,124
Quebracho	145,324,677	4,995,807	143,174,614	4,934,475
Chestnut .	134,819,100	2,560,007	146,818,963	2,853,045
Palmetto .	486,980	12,502	163,049	3,980
All other .	13,304,963	473,378	39,429,963	1,263,347
Totals..	364,899,535	$9,649,673	392,101,087	$10,558,282

Tanbark.

	1907.		1908.	
	Quantity (cords).	Cost.	Quantity (cords).	Cost.
Hemlock .	815,840	$7,016,915	810,231	$7,203,206
Oak......	374,052	3,933,038	307,817	3,325,908
All other .	24,509	605,921	9,352	274,323
Totals..	1,214,401	$11,555,874	1,127,400	$10,803,437

These figures strongly indicate the tendency toward a diminished use of barks largely on account of their increasing cost. The number of plants that used extract exclusively in 1908 was greater by 42 than the number in 1907, and the number that used bark exclusively was greater by 4, while the number using both bark and extract decreased from 340 in 1907 to 333 in 1908.

The increase in the case of "all other" kinds, amounting in quantity to 26,125,000 pounds, or 196·4 per cent., and in value to $789,969, or 166·9 per cent., was due largely to the greatly increased use of myrobalan and mangrove extracts.

Among the "all other" extracts are also included gambier, quernos, palmetto, sumac, cutch, and other kinds. These extracts, however, were not differentiated in the schedule, and in the case of none of them was a sufficient quantity reported to warrant a separate tabulation.

The following table presents a comparison of the quantities and values of tanning materials imported for consumption during the fiscal years ending June 3[illegible] 1907 and 1908:—

	1907.		1908.	
	Quantity.	Value.	Quantity.	Value.
Bark and wood—				
Hemlock bark, cords	6,193	$27,786	8,877	$43,789
Mangrove bark, tons	20,699	426,439	15,190	310,745
Quebracho, tons	67,310	840,799	48,871	612,971
All other	....	82,024	....	126,193
Extract—				
Quebracho, pounds	76,479,846	2,243,386	62,593,671	2,037,648
Sumac, pounds	1,537,420	55,701	1,060,694	42,022
Myrobalan, pounds	*....	198,688	20,988,206	229,441
Totals	.....	$3,874,803	.....	$3,402,809

*Quantity not shown.

Although the total value of the imports of tanning materials was less by $71,994, or 12·2 per cent., in 1908 than in 1907, the imports of hemlock bark, "all other" bark and wood and myrobalan have in the same period increased in value. As myrobalan is employed also for making dyes, it is probable that a portion of the importation of them was thus used.

Patents.

Skins; Process for preparing [*bateing*]. O. Röhm. First Addition, dated May 22, 1909 (Under Int. Conv., May 22, 1908), to Fr. Pat. 387,950, Mar. 9, 1908 (this J., 1908, 581).

An aqueous solution of pancreas with the addition of a solution of a weak acid, such as lactic acid, or an acid salt, and ammonia has been found to give particularly good results when used for bateing skins.—H. Br.

Leather; Process for the mineral or vegetable-mineral tannage of heavy ——. J. B. F. E. Roy. Fr. Pat. 403,779, Oct. 3, 1908.

The use of various soluble mineral salts, such as those of aluminium, which can be rendered insoluble by some physical action (heat, etc.), is suggested as a means of producing a firm leather suitable for the soles of boots. Larger quantities of the mineral salt are used than are necessary to produce a supple leather, the excess quantity being rendered insoluble in the hide and thus adding to the solidity of the product.—H. Br.

XVI.—SOILS; FERTILISERS.

Root bacteria of the Leguminosæ; Resistance of the ——, *and their significance for soil inoculation.* J. Simon. Jahresber. d. Verein. f. angew. Botanik, 1907, 132. Biedermann's Zentr., 1909, 38, 822—828.

Attempts were made to infect a number of species of leguminous plants with pure cultures of the nodule bacteria derived from each one of them. With one exception each species could only be infected by its own particular bacteria and not by those from any other species of plant; for example *Phaseolus vulgaris* and *Soja hispida* could not both be infected by the same bacteria. The exception was afforded by species of *Pisum* and *Vicia*, which could both be inoculated by the bacteria peculiar to either one of them. Gelatin cultures of nodule bacteria show a visible growth only for a short time—growth is checked by the accumulation of the excretory products of the bacteria and the decomposition products of the nutrient medium. Soils should therefore be inoculated with the bacterial slime and not with the culture medium in addition. The addition of nutritive substances to a soil culture must be made with great care, since it may result in the increased development of injurious bacteria. Well cultivated soil is an excellent medium for the culture of nodule bacteria, and may be used for the regeneration of races weakened by culture on gelatin. Carbon bisulphide has no harmful influence on nodule bacteria, whether added before or after the inoculation of the soil. Copper sulphate is equally without influence, though other soil bacteria are very readily destroyed by this reagent. The resistance of the nodule bacteria to drying has been studied in detail. Gelatin cultures of varying ages showed but little difference in activity. Complete drying on gelatin or on nutrient free materials destroys the bacteria. When soil extract is added to the bacterial slime, and the solution slowly dried on wool, the bacteria remain alive. The bacteria are destroyed when quickly dried under these conditions and are in time destroyed by exposure to air with varying moisture content. For the isolation of nodule bacteria, gelatin cultures are indispensable, but for their propagation, soil extracts containing mannitol and glucose afford a better medium.—E. F. A.

Phosphoric acid; Manurial experiments with insoluble ——. J. Sebelien. Tidsskrift for det norske Landbruk, 1909, 16, 339—352. Biedermann's Zentr., 1909, 38, 801—804.

The experiments were carried out in cylindrical zinc vessels containing about eight kilos. of sand. In each experiment the same quantities of potassium chloride, nitrogen in the form of nitrate or of ammonium sulphate, and phosphate in varying forms were added. Experiments with buckwheat indicated that the utilisation of insoluble phosphates is better when nitrogen is supplied as ammonium sulphate than when nitrate is used. Every phosphatic manure increased the yield, even apatite being utilised: in combination with nitrate, superphosphate was the most effective agent, but in combination with ammonium sulphate, both French and Algerian crude phosphates gave better yields and even apatite was almost as valuable as superphosphate. By far the most effective combination, however, was superphosphate and nitrate.

In 1908 the ammonium sulphate was added in the form of a dilute solution and no crop of buckwheat was obtained. Experiments with oats indicated that, together with nitrate, apatite and French phosphate were of little value, whilst Algerian phosphate had only about one-quarter the effect of superphosphate. In conjunction with ammonium sulphate, all three forms of phosphate were more efficient, the effect being chiefly in the amount of grain produced and less marked in the amount of straw. —E. F. A.

Copper compound; A new ——, and its use as an insecticide on vines, etc. P. Malvezin. Bull. Soc. Chim., 1909, **5**, 1096—1098.

The compound described, cupric dimethanaldisulphite, $Cu[CH_2(OH).SO_3]_2$, is prepared by passing a current of sulphur dioxide into a mixture of 40 per cent. formaldehyde solution and cupric hydroxide. The latter dissolves as the gas is introduced, and a bright blue, clear solution of a syrupy consistence is obtained. This solution contains 150 grms. of metallic copper per litre and has a sp. gr. of 1·677. When diluted with water it forms a very efficient dressing for vines, etc., and does not leave a deposit on the leaves.—W. P. S.

Determining nitric nitrogen. Pozzi-Escot. *See* XXIII.

Patent.

Calcium cyanamide; Preparation of a dustless, non-caustic product from ——. O. F. Carlson. Fr. Pats. 404,155 and 404,156, June 18, 1909. Under Int. Conv., June 19, 1908, and Feb. 22, 1909.

(1) Calcium cyanamide is treated with water and carbon dioxide to convert any free lime or calcium carbide, which it may contain, into calcium carbonate. (2) The calcium cyanamide, after being treated as described, may be mixed with a suitable quantity of a non-drying oil or other fatty matter.—O. R.

XVII.—SUGARS; STARCHES; GUMS.

Beet slices; Method for the rapid determination of dry substance in exhausted ——. P. R. Voigt. Deutsche Zuckerind., 1909, **34**, 1012—1013.

Herzfeld's method for the determination of dry substance in exhausted slices requires 10—12 hours for execution, and is therefore often useless as a means of controlling the work of drying the slices. The author describes the following method which is much more expeditious:—Twenty-five grms. of the slices are introduced into a very wide- and short-necked flask of about 300 c.c. capacity, 125—150 c.c. of absolute alcohol are added, and the whole is heated to boiling for 20—30 minutes under a reflux condenser. The contents of the flask are then transferred to an ordinary filter, and, when the alcohol has drained off, the slices are washed once with ether. The funnel and contents should now be placed in the drying chamber for about five minutes in order to facilitate the separation of the slices from the filter. The slices are removed from the filter by means of a small brush to a wide, tared weighing dish, and dried for half an hour *in vacuo* at 100° C., or for one hour in an ordinary drying oven at 100° C.; the dish and contents are then allowed to cool in a desiccator and weighed. If a vacuum drying oven is used, the whole determination may be effected in 1½ hours. The results agree well with those obtained by Herzfeld's method.—L. E.

Sugar-decompositions. VII. Reversion of sugar-synthesis. W. Löb and G. Pulvermacher. Biochem. Zeits., 1909, **23**, 10—26. (See this J., 1909, 1264.)

It has previously been stated that amongst the products obtained by the action of lead hydroxide or sodium hydroxide on dextrose, pentose and formaldehyde occur (this J., 1909, 1068). Descriptions of experiments are now given, and it is shown that pentose and formaldehyde are formed in every case under the various experimental conditions employed. Thus, by the action of lead hydroxide on dextrose, pentose and formaldehyde are formed independently of the concentrations of the reacting substances (within the limits investigated) and independently of the temperature; a special experiment showed that even in presence of air at the boiling temperature, the oxidation processes involved in the action of lead hydroxide on dextrose depend on intramolecular re-arrangements. From the present and the earlier investigations of this series, it is concluded that, under the influence of hydroxyl-ions (lead hydroxide, sodium hydroxide), as well as under the influence of oxidising (this J., 1909, 535, 617) and reducing agents (*loc. cit.*, 1264), dextrose is decomposed into formaldehyde and pentose, with simultaneous intramolecular re-arrangements and oxidations. Since other workers have shown also that pentose is formed in the synthesis of sugar from formaldehyde, the following conclusions are fully justified:—1. The synthesis of sugar from formaldehyde is a reversible process. 2. Formaldehyde and pentose are phases of sugar-decomposition and sugar-synthesis. 3. Perceptible decomposition of dextrose into formaldehyde and pentose occurs in aqueous solutions the alkalinity of which is about equivalent to that of the blood. 4. It also occurs in acid solutions when the original state of equilibrium is destroyed by oxidising or reducing agents. 5. As the electrolysis of glycol and glycerol shows, a synthesis of sugar also occurs in acid solutions from the aldehydes formed by the decomposition of the sugar.—L. E.

Arsenious acid in quantitative analysis [Determination of dextrose]; Applications of ——. I. F. M. Litterscheid and J. Bornemann. Z. angew. Chem., 1909, **22**, 2423—2427.

The dextrose solution under examination is heated with an alkaline solution of copper sulphate. The reaction-product, which contains cuprous oxide and the excess of cupric salt, is treated with a solution of arsenious oxide equivalent to the copper solution originally used, and then acidified with acetic acid. The whole is treated with potassium iodide. Part of the arsenious oxide is converted into arsenic pentoxide by the iodine liberated in the action between the cupric copper and the potassium iodide. The residual arsenious oxide, which is subsequently determined with standardised iodine solution, corresponds to the cuprous oxide and thus constitutes a measure of the dextrose in the solution under examination. For details of the preparation of the solutions employed and of the method of effecting the determination, the original paper must be consulted.—L. E.

Cellase and the diastatic fission of cellose. G. Bertrand and M. Holderer. Comptes rend., 1909, **149**, 1385—1387.

Cellose (this J., 1901, 740; 1902, 144), a biose produced by the partial hydrolysis of cellulose, is not hydrolysed by maltase and sucrase. After contact, however, with an aqueous maceration of *Aspergillus niger* for about three days at 37° C., pure cellose is entirely transformed into dextrose. Emulsin and trehalase also hydrolyse it, but these diastases are not obtainable in sufficient purity to form definite conclusions from their action. The authors conclude in favour of the existence of a diastase, cellase, distinct from maltase, etc., but their researches are not completed.—A. Sʟᴅ.

Honey; Analysis of ——. Witte. *See* XIXa.

XVIII.—FERMENTATION INDUSTRIES.

Malt; Amount of extract obtained from —— by various processes. W. Windisch and R. Mellmann. Woch. f. Brau., 1910, **27**, 1—3.

The maximum yield is obtained by a combination of pre-mashing and proteolytic digestion, completing the operation according to the "Congress" directions. Pressure digestion alone gave values lower (this J., 1909,

1265) than this combined method, but equal to those yielded by either pre-mashing or proteolytic digestion separately. Increase of pressure above two atmospheres tends to reduce the yield. The authors regard any small increase in extract obtained by digestion under pressure to be outweighed by the colour and flavour which are simultaneously produced. It is recorded that the worts obtained by methods involving a proteolytic digestion are always very readily obtained bright.—R. L. S.

Amylase of malted and unmalted grain. T. Chrzakzez, Z. Spiritusind., 1909, **32**, 520, 535—536, 539, 544, 556—557, 569, 571, 578—579.

The statements of the various authors who have investigated the enzymes present in starchy seeds are contradictory. The majority of observers appear to incline to the existence of three enzymes: (1) the liquefying enzyme of malt which is non-existent in raw grain, (2) the secretion diastase of malt, a saccharifying enzyme with an optimum temperature of action at 50°—55° C., and (3) the translocation diastase of raw grain, a similar enzyme but with an optimum temperature of 45°–50° C. The present research was directed to determine whether the amylases of raw and malted grain are the same, and if the liquefaction and the saccharification of the starch are brought about by one or by two or more distinct enzymes. The experiments show that the optimum temperature for the liquefaction of potato and rice starch (gelatinised in presence of the enzyme) by extracts of green malted barley, oats, maize and millet lies between 60° and 65° C. Extracts were prepared from raw barley, rye, wheat, oats, maize and millet, and from horse-radish, beet and potato; all were found to have starch liquefying and saccharifying powers in varying degree. In every case the optimum temperature lay between 60° and 65° C. The starch liquefaction was always associated with saccharification, and all efforts to inhibit either alone proved fruitless. Except in intensity the action of the raw grain extracts was in all respects similar to that of the extracts from malted grain. The saccharifying enzymes of similar extracts from raw and malted grain showed absolute agreement in behaviour under various conditions of time and temperature, the optimum lying, in every case, between 50° and 55° C., higher temperatures producing very considerable restriction. The saccharified starch pastes were only examined for cupric-reducing power and coloration with iodine. The author concludes that starch liquefaction and saccharification are functions of one and the same enzyme and that there is no ground for distinguishing between translocation and secretion diastase.—R. L. S.

Diastases; Influence of the reaction of the medium on the filtration of ——. M. Holderer. Comptes rend., 1909, **149**, 1153—1157.

Sucrase (and no doubt other diastases act similarly) in a medium neutral to phenolphthaleïn, passes completely through a porcelain candle-filter, whilst in a medium neutral to methyl orange it is almost entirely retained. Between these two states of the medium, the filtration is partial. The extraction of sucrase by maceration is facilitated by making the macerating water faintly alkaline.—J. T. D.

Yeast; Yeast-poison in ——. F. Hayduck. Woch. f. Brau., 1909, **26**, 677.

Further investigations on this subject (see this J., 1909, 486) give results differing from those of Fernbach (this J., 1909, 996). Thus, the author has been unable to separate a volatile, poisonous constituent from beer-yeast or pressed yeast, by distillation either in a vacuum or in a current of steam at temperatures varying from 20° to 85°C.—the vapours emitted having the temperature 18°–50°C. The toxicity of the distillate was tested by means of yeast identical with that employed for the distillation. Further, the non-volatile residue was found in all cases to have retained its toxic properties apparently undiminished in intensity, this being the case even when the yeast was evaporated to dryness in a vacuum. Similar results were obtained when the yeast was triturated with quartz-sand in a mortar previous to distillation.—T. H. P.

Yeast; The preservative action of phosphoric acid on ——. E. Moufang. Woch. f. Brau., 1909, **26**, 642—643.

It is well known that soft and hard waters act differently upon yeast cells suspended in them for purposes of washing, and that yeast allowed to remain for a week or two under water may afterwards show no fermentative power. The author regards this as being due to the solvent power of the water upon certain necessary constituents of the cell plasma, particularly the substances containing phosphoric acid which as co-enzyme are necessary for the activity of the zymase. He has found that certain yeasts, which at first gave perfectly satisfactory results in the brewery but degenerated after 8–10 times round, could for a short time be restored to their original state by washing in dilute phosphoric acid, and that this restoration could be repeatedly brought about by repetition of the treatment. A yeast preserved for two weeks under water had at the end of that time practically no fermentative power, whilst some of the same culture left under dilute phosphoric acid had preserved its power undiminished.—R. L. S.

Cider-making; Use of sulphurous acid in ——. G. Warcollier. Bull. Assoc. franc. promologique, 1909; through Ann. Falsific., 1909, **2**, 513.

The addition of from 50 to 80 grms. of sulphurous acid per hectolitre of must allows the latter to be kept from one year to the next; by thus preserving excess of must from any one year and adding it to the must obtained during the next year, the quality of the cider is rendered more uniform. The sulphited must must be fermented by the aid of yeasts which have been acclimatised to sulphurous acid. The cider produced contains large quantities of sulphurous acid, which must be removed by aeration or the application of heat before the cider is placed on the market. Potassium metabisulphite should not be added to apple musts on account of the large amount of potash introduced.—W. P. S.

Lactic acid; Industrial manufacture of fermentation ——. H. Gouthière. Bull. Assoc. Chim. Sucr. et Dist., 1909, **27**, 576–581.

In its main outlines, the process resembles that described by McLauchlan (this J., 1909, 734). The lactic ferment used, however, is one isolated from "Sauerkraut." The sugar solution is prepared by saccharifying maize- or potato-starch with sulphuric acid and is neutralised with sterilised calcium carbonate suspended in water, and the nitrogenous (peptone) solution is obtained by extracting germs, culms, or screenings from maltings, with warm water. The two sterilised solutions are mixed in suitable proportions and run into sterilised vats (of 3000 litres capacity) containing ground chalk. By addition of cold water, the solution is suitably diluted (in a number of cases quoted by the author, the average dextrose-content of the solution was 10·9 per cent. prior to fermentation), and cooled to 35°–40°C., between which limits the temperature is kept during fermentation. About 50 litres of vigorously fermenting juice from another vat are used for inoculation, the whole is mixed for some minutes by means of filtered, compressed air, and left to ferment. The yield is very high; sometimes, owing to conversion of peptones into lactic acid, more than 100 parts of lactic acid per 100 parts of dextrose are obtained. The solution of free lactic acid finally obtained is decolorised and evaporated under reduced pressure to 50 per cent. concentration.—L. E.

Alcoholic liquors; Action of hydrogen peroxide upon ——. A. C. Chauvin. Monit. Scient., 1910, **24**. 12–21.

Following his observations on the influence of hydrogen peroxide on the constituents of rum (this J., 1909, 997) the author has studied its action in various strengths, on rectified spirit alone and with additions of aldehyde, furfural, ethyl acetate, and isobutyl alcohol, and also upon two samples of brandy. The figures obtained are given in four tables. In rectified spirit the acidity is practically unchanged; the amounts of aldehydes and ethers increase; while the quantities of higher alcohols and furfural diminish. In the case of the brandies the action is irregular and it can only be said that in each case the amounts of aldehydes and ethers are increased. The hydrogen peroxide was always present in excess at the end of the experiments. R. L. S.

Alcohol; New process for the rapid determination of ——. D. Sidersky. Bull. Assoc. Chim. Sucr. et Dist., 1909, **27**, 562–563.

This method, which has been proposed and patented by H. Rapeller, depends on the miscibility of ether with strong alcohol. Twenty c.c. of the alcoholic liquid under examination and 10 c.c. of ether of sp. gr. 0·724, are shaken in a closed vessel; on standing, the liquids separate into two layers. Successive quantities of alcohol of 98° are now added from a special burette, the mixture being shaken between each addition. The ethereal-alcoholic layer diminishes progressively and addition of alcohol is continued until the last drop of alcohol added causes the complete disappearance of this layer. The burette employed in adding the alcohol is so graduated as to give the percentage of alcohol in the sample directly. The vessel in which the admixture is made, has a very narrow neck, so that the separation of the two layers may be easily distinguished.—L. E.

Patents.

Hops; Process for making extract of ——. G. G. Smith, St. Albans, Vermont, U.S.A. Eng. Pat. 24,300, Oct. 22, 1909.

The hops, suitably shredded, are macerated with water at a temperature below that favourable to fermentation (below 16° C.), for a period ranging from 14 to 100 hours or longer, until the lupulin cells are fully saturated. The water, preferably the condensed water derived from the evaporation of the hop extract, is used in the proportion of about eight parts to one of hops. The steeped hops are then heated in a closed vessel with the liquid in which they have been steeped, and this liquid is continuously circulated through the mass at the boiling temperature. Finally the extract is separated from the spent hops by pressure and concentrated in a vacuum evaporator to the consistence of thick syrup, at a temperature not exceeding 60° C.—J. F. B.

Fruit juices; Apparatus for the continuous or intermittent desulphitation of —— *with or without concentration of the treated juice.* E. A. Barbet. Fr. Pat. 403,771, Oct. 2, 1908.

The apparatus used is similar to that described in Eng. Pat. 13,217 of 1905 (this J., 1906, 1229), but the air current employed is saturated with moisture before it comes into contact with the juice. For this purpose the air is passed through hot water contained in a tank at the bottom of the tower. The treated juice may be run off directly to the cooler, or it may be allowed to collect at the bottom of the tower and there concentrated as desired. The temperature of the water may be regulated to the required degree for heating the air and concentrating the juice. A simple form of the apparatus is also described, in which air saturated with moisture is drawn through the juice which is contained in a vessel surrounded by a hot-water jacket.—W. P. S.

Yeast; Process for the production of dry —— *from wort.* H. Braasch. Fr. Pat. 404,183, April 30, 1909. Under Int. Conv., May 5, 1908.

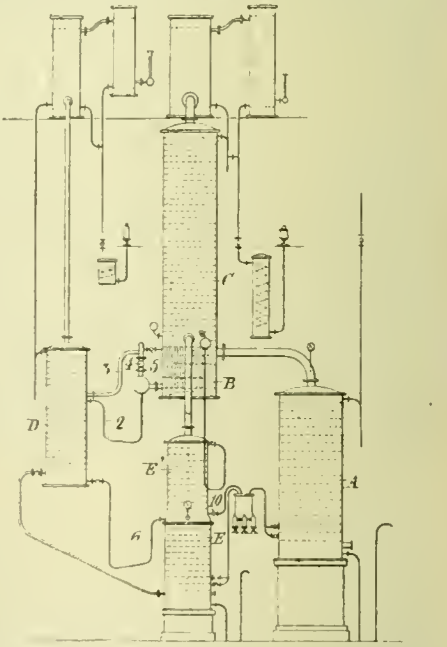
A wort, prepared from cereals, is cooled to a temperature of from 13° to 15° C., and to it is added a quantity of yeast amounting to about 8 per cent. of the dry solids of the wort. The wort is aerated thoroughly while fermentation proceeds, and the temperature is maintained at 13° to 15° C. The yeast is then separated and pressed. A portion of it may be used for fermenting a fresh quantity of wort, but after a third fermentation at a low temperature, it is necessary to commence afresh with yeast grown in wort at a temperature of 25° to 30° C.—W. P. S.

Wines and other beverages; Manufacture of ——. [*Process of ageing.*] V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 403,674, June 4, 1909.

The taste, colour and quality of new wine is improved by subjecting it, in the form of a thin layer, to the action of the ultra-violet rays emitted by a mercury lamp. The apparatus employed consists of an inclined rotating funnel, the walls of which are corrugated. The wine is allowed to flow down the sides of the funnel and the lamp is placed in the interior of the funnel as near as possible to the side. —W. P. S.

Rectifying column of combined distilling and rectifying stills or of separate rectifiers; Heating arrangement for ——. E. Guillaume. Fr. Pat. 403,385, May 26, 1909.

An arrangement having the form of a combined tubular condenser and heater is described for the purpose of utilising the latent heat of the vapours derived from the distillation of the crude wash. This heater is placed at the bottom of the rectifying column, and when distillation and rectification are effected in two distinct operations, it replaces the condenser of the first still, the vapours entering the top of the inter-tubular chamber of the heater, giving up their latent heat to the liquid which is undergoing rectification in the tubes, and returning in the liquid form through a cooler to the distilling department. The illustration represents the application of the condenser-heater to a combined, continuous distilling and rectifying plant. A is the still for crude wash, the vapours from which pass into the new condenser-heater, B, and are there utilised for boiling the richer alcoholic liquid in the tubes, which is undergoing rectification in the column, C. The condensed crude phlegms go by way of the tube, 2, and the uncondensed vapours by way of tube, 3, into the purifier, D, the tap, 4, serving to regulate the pressure in the condenser-heater; tap, 5, opens a short-circuiting pipe cutting out the condenser-heater. The purified phlegms from D, enter the exhausting column, E, by the pipe 6, and the space above this is occupied by a concentrating column, E′. This has the effect of raising the alcoholic degree of the liquid at the base of the rectifying column, C, and consequently of that in the tubes of the heater, B, so that the extraction of the fusel oils may be effected outside the rectifying column, at the point, 10, for instance, whilst the lower boiling point of the liquid, thus obtained, increases the efficiency of the tubular heater. The quantity of steam required to exhaust the waste



liquid from E is not increased, whilst the steam usually required to heat the rectifying column is dispensed with; the economy is calculated to amount to about 100 kilos. of steam per hectolitre of absolute alcohol. J. F. B.

Ferments: Production of ——. A. D. Barr, Jersey City, U.S.A. Eng. Pat. 24,592, Nov. 16, 1908.

See U.S. Pat. 911,803 of 1909; this J., 1909, 255. T. F. B.

Draining plates for rectifying columns. Fr. Pat. 404,152. *See* I.

Ammonium [and other] sulpho-phosphates for the treatment of vintages and musts. Addition to Fr. Pat. 399,142. *See* VII.

XIXa.—FOODS.

Lard: Variations in the composition of ——. E. Durier. Ann. Falsific., 1909, 2, 489—493.

The variation in the composition of lard is shown by the following results of the examination of the fat taken from various parts of the bodies of two pigs. The fats were rendered over a free flame and then filtered before being analysed.

	Pig No. 1.				Pig No. 2.			
Fat from:	Oleo-refractometer reading at 45° C.	Refractive index at 45° C.	Iodine value.	Free acids (as oleic acid) per cent.	Oleo-refractometer reading at 45° C.	Refractive index at 45° C.	Iodine value.	Free acids (as oleic acid) per cent.
Mesentery	−13·5	1·4560	49·65	0·541	−15·5	1·4555	46·19	0·462
Flare	−13·0	1·4561	50·54	0·217	−14·0	1·4559	47·60	0·257
Ham	−12·0	1·4564	53·59	0·352	−12·0	1·4563	52·53	0·307
Breast	− 9·0	1·4751	58·67	0·217	− 8·5	1·4573	58·64	0·282
Back	−11·0	1·4566	56·64	0·149	− 9·5	1·4570	57·37	0·231
Head	− 8·0	1·4574	61·46	0·217	− 5·0	1·4581	67·53	0·257

The temperature at which the lard is rendered has a considerable influence on the composition of the fat obtained. For instance, when the temperature did not exceed 50° C., the fat had an iodine value of 62·23, but when the substance was heated over a free flame the resulting fat had an iodine value of 47·75. The chemical and physical constants of the fats were not altered by treating (refining) the molten fats with fuller's earth and subjecting them to the action of a current of air.—W. P. S.

Lactic acid in cheese; Quantitative determination of ——. S. Suzukii and E. B. Hart. J. Amer. Chem. Soc., 1909, **31**, 1364—1367.

The basic lead salt of inactive lactic acid has the composition, $3PbO.2C_3H_6O_3$. The Palm method (Z. anal. Chem. 1887, **26**, 33) for the estimation of lactic acid, based on the formation of the above salt, could not be applied to cheese. In order to get satisfactory results with the Partheil method (Z. Untersuch. Nahr. Genussm., 1902, **5**, 1056; also this J., 1903, 1106, 1154), when applied to inactive lactic acid, the distillation must be done with superheated steam at a temperature of 130° C., and 750 c.c. of distillate must be collected. This method will not separate lactic acid from mixtures containing malic, tartaric, oxalic, or succinic acids. Fairly satisfactory results were obtained by acidifying the cheese, extracting with ether, and separating the zinc salt from the solution thus obtained. The lactic acid in solution was converted into the barium salt, which was treated with the requisite amount of zinc sulphate. The solution was filtered, and evaporated and the crystalline residue collected. F. Shdn.

Honey: Analysis of ——. Witte. Z. Unters. Nahr. Genussm., 1909, **18**, 625—649.

For the purpose of ascertaining the purity or otherwise of a sample of honey, it is recommended that the following determinations and tests should be made, a solution containing one part by weight of the honey to two parts by weight of water being used for the purpose:—total nitrogen (Kjeldahl); tannin precipitate; polarisation before and after inversion; Ley's reaction (see Schwarz, Z. Unters. Nahr. Genussm., 1908, **15**, 408); and Fiehe's reaction (see this J., 1908, 1127). Determinations of the quantity of water, invert sugar, non-sugars, acidity, and ash in the sample afford little, if any, evidence of the presence of adulterants. The tannin precipitation is carried out by treating 10 c.c. of a 20 per cent. filtered solution of the honey with 25 c.c. of water and 5 c.c. of a 0·5 per cent. solution of tannin in a graduated tube. The mixture is allowed to settle for 24 hours and the volume of the precipitate is then read off. Fiehe's test for starch syrup (see following abstract) is also useful.

The following minimum, maximum, and average results were obtained by the analysis of samples of pure and artificial honeys:—

	Pure honey. 24 samples.			Artificial honey. 6 samples.		
	Min. per cent.	Max. per cent.	Average. per cent.	Min. per cent.	Max. per cent.	Average. per cent.
Water	13·86	20·80	17·18	15·60	20·42	18·90
Invert sugar	68·10	76·97	72·33	56·88	71·74	68·83
Sucrose	0·16	7·55	2·89	3·25	15·73	8·82
Non-sugars	3·38	15·31	7·56	3·08	16·26	8·45
Polarisation before inversion	+ 1·25	— 9·54	— 5·50	+ 9·45	— 3·71	+ 4·25
Polarisation after inversion	— 1·19	—10·32	— 6·57	+ 7·73	— 8·18	— 2·76
Acidity (as formic acid)	0·043	0·153	0·087	0·018	0·095	0·052
Ash	0·063	0·624	0·190	0·076	0·250	0·167
Nitrogenous substances	0·254	0·636	0·398	0·114	0·173	0·147
Volume of tannin ppt. per 10 c.c. of 20 per cent. honey solution	0·90 c.c.	3·95 c.c.	1·49 c.c.	0	0	0

The polarisation is the reading given by a 25 per cent. solution in a 200 mm. tube. Analyses are also given of 22 samples of honey of suspicious or doubtful quality.
—W. P. S.

Honey and fruit juices ; Detection of starch glucose in ——. J. Fiehe. Pharm. Zentralh., 1909, **50**, 900.

Ten grms. of the honey are warmed on the water-bath with 20 grms. of water, and treated with 1 c.c. of 5 per cent. tannin solution. After standing for some hours the precipitated albuminous matter is filtered off. To 2 c.c. of the filtrate, two drops of hydrochloric acid of sp. gr. 1·19 and 20 c.c. of 94 per cent. alcohol are added. With pure honey, the mixture will remain perfectly clear: in the presence of starch glucose a milky turbidity will be seen. For fruit juices the method is thus modified:—Ten grms. of the juice with an equal quantity of water are boiled with eight drops of ammonium oxalate solution. The turbid mixture is then treated with a small quantity of animal charcoal, thoroughly shaken, and filtered. Two c.c. of the filtrate are tested as described above.—J. O. B.

Saccharin ; Determination of —— *in foods.* G. Testoni. Z. Untersuch. Nahr. u. Genussm., 1909, **18**, 577—587.

(1) *In presence of benzoic acid.* The ether extract of the substance, which contains the benzoic acid in addition to the saccharin, is heated in an air-oven to 110°–115° C. in order to remove the former. In the case of a large volume of solution, the benzoic acid is removed by steam distillation. If there be no substances present, other than saccharin, capable of yielding a precipitate with silver nitrate, the saccharin may be determined directly by mixing the ether extract with equal volumes of water and 96 per cent. alcohol, precipitating with silver nitrate, avoiding excess, and after 12 hours in the dark, filtering off the precipitated silver saccharinate with the aid of a water pump, transferring it to a Gooch crucible, washing with alcohol, drying at 100° C., and weighing.

(2) *In wine, beer, &c., and in presence of small amounts of citric and tartaric acids.* A litre of the liquid is oxidised with potassium permanganate, evaporated and extracted with ether. If relatively large proportions of citric and tartaric acids be present, as in fruit syrups, they may be precipitated in the usual way, the other substances then oxidised as before and the saccharin extracted in the usual manner.

(3) *In presence of salicylic acid.* This acid may be oxidised to tetrabromphenol according to the equation, $C_6H_4(OH)COOH + 4Br_2 = C_6H_2Br_3OBr + 4HBr + CO_2$, and its quantity determined by titrating the iodine liberated from potassium iodide by the tetrabromophenol thus produced. The saccharin may be estimated by difference, or directly by first ridding the ether extract of salicylic acid.

(4) *In presence of volatile oils and fats.* In the absence of sulphur compounds, the author oxidises the saccharin by fusing with equal parts of sodium carbonate and potassium nitrate, and estimates the resulting sulphuric acid in the usual way or by the Müller-Raschig method with benzidine hydrochloride (this J., 1903, 883, 1066). In the absence of other nitrogenous matter, the saccharin may be estimated by heating the original substance to 120°—130° C., cooling, extracting with ether, hydrolysing with hydrochloric acid, and estimating the nitrogen in the usual way.—J. W. G.

Lime juice ; Detection and determination of sulphurous acid in ——. E. Dowzard. Amer. J. Pharm., 1909, **81**, 561—564.

It is shown that pure lime juice will give a positive reaction in both the qualitative and quantitative official U.S. tests for the presence of sulphurous acid. With 25 c.c. of the pure juice, tested with zinc and hydrochloric acid, and lead test paper, a dark brown sulphur reaction is obtained, derived from some constituents present in the normal juice. Pure lemon juice gives a similar, but less marked reaction. When the distillate from the juice is titrated with $N/10$ iodine solution, as directed in the official test, another error is perpetrated, due to the absorption of iodine by the essential oil present. The amount thus combined by the distillate from pure lime juice was found to be equivalent to 0·008 per cent. if expressed as sulphurous acid. The following methods will give accurate results. *Qualitative test.* 100 c.c. of the juice are acidified with 5 c.c. of phosphoric acid (1 : 5) and 50 c.c. are distilled with the usual precautions into 25 c.c. of 1 per cent. solution of sodium bicarbonate. This distillate is then tested in the usual manner, with zinc and hydrochloric acid, and lead test-paper. The latter should show no brown discoloration after 30 minutes exposure. The presence of less than one part of sulphur dioxide in 100,000 parts of lime juice may be detected thus.

Quantitative test. 100 c.c. of the juice treated with 5 c.c. of phosphoric acid (1 : 20), are distilled with the usual precautions, until 75 c.c. have passed over, the distillate being received in 25 c.c. of 1 per cent. solution of sodium bicarbonate. The distillate is then shaken twice with 10 c.c. of chloroform. After separating the chloroform, the aqueous portion is treated with 25 c.c. of $N/10$ iodine solution; the uncombined iodine is then titrated back with $N/10$ thiosulphate. Each c.c. of $N/10$ iodine solution consumed is equivalent to 0·0032 grm. of sulphur dioxide.
J. O. B.

Patents.

Extracts of meat ; Use of "Tasajo" for the manufacture of solid, liquid, and powdered ——. L. Mongrell. Fr. Pat. 403,507, April 14, 1909.

Claim is made for the use of a substance known commercially as "Tasajo" as a basis for the preparation of liquid, solid, and powdered extracts of meat. "Tasajo" is a substance of animal origin and the extracts made from it contain more nitrogenous matter than do ordinary extracts of meat.—W. P. S.

Flour from wheat ; Process of obtaining a large yield of ——. Steinmetz Patent-Müllerei Ges.m.b.H. Fr. Pat. 403,967, June 12, 1909.

The wheat is decorticated while in a moist condition, then ground, and sifted. The bran and the coarse portions separated are then ground separately and mixed with the flour.—W. P. S.

Subdivision or grinding of globules or particles in suspension or in admixture with liquids, such as globules of milk or blood, cells of yeast, particles of casein and other substances ; Process and apparatus for effecting the ——. R. G. Lezé. Fr. Pat. 404,127, June 17, 1909.

The disintegration of the suspended particles is effected within the body of the liquid by taking advantage of the difference in specific gravity between the particles and the liquid. The milk or other fluid is treated in a centrifugal separator, and the particles are disintegrated against the wall of the bowl or drum, which is for this purpose provided with fine metallic gauze, or angular fragments of glass or other appropriate hard substances.—W. H. C.

Tobacco ; Process of ageing and curing ——. S. G. Martin, Chicago, Ill., W. O. Bartholomew, St. Louis, and E. Schaaf, St. Marys, Mo. U.S. Pat. 942,838, Dec. 7, 1909.

The tobacco is suspended in a closed chamber which is heated to a temperature of about 100° F., and through which a mixture of air and nitrogen peroxide, prepared by the action of an electric arc on air, is circulated.
—W. P. S.

Coffee ; Process of roasting ——. E. de Mattia, Recoaro, Italy, and G. de Mattia, San Paolo, Brazil. U.S. Pat. 943,238, Dec. 14, 1909.

See Eng. Pat. 27,036 of 1907 ; this J., 1908, 465.—T. F. B.

XIXb. WATER PURIFICATION ; SANITATION.

Water supplies; Purification of —— by the use of hypochlorites. W. P. Mason. Proc. Amer. Phil. Soc., **48**, No. 191. Chem. News., 1909, **100**, 321.

The water supply of Jersey City was treated during December, 1908, with bleaching powder in amount sufficient to yield 0·03 grain of available chlorine per gallon of water, and since that date with a less amount. Daily tests made during the month mentioned showed that the number of bacteria was reduced from an average of 559 per c.c. in the raw water to an average of 2·7 per c.c. in the water after treatment, and that no excess of hypochlorite remained. It was found experimentally that the amount used was also sufficient to kill all members of the *B. coli* group present. Filtration was necessary to remove any natural opalescence in the water, but the bleaching powder treatment rendered the supply bacterially safe at a moderate cost. Instead of bleaching powder, sodium hypochlorite obtained by electrolysing a solution of common salt may be used, the disinfecting effect being the same.—J. H. J.

Nitrates in water; Modification of Grandval and Lajoux's method for the determination of ——, and the influence of chlorides and nitrites on the determination. L. Farcy. Bull. Soc. Chim., 1909, **5**, 1088—1092.

The presence of chlorides causes the results obtained by this method to be too low (see this J., 1909, 740), but if the composition of the reagent be modified as follows, the error is eliminated. To 1 volume of phenolsulphonic acid (sulphuric acid, 37 parts; phenol, 3 parts) are added 1·5 volumes of hydrochloric acid and 1·5 volumes of water, and the mixture is then heated for 30 minutes on a water-bath. The residue obtained on evaporating a definite quantity of the water under examination is moistened with 1 c.c. of the reagent thus prepared, and heated for 15 minutes on a water-bath. The mixture is then rendered ammoniacal and the nitrate determined colorimetrically as in the original process. The loss of nitrate in the presence of chlorides is shown to be due to the formation of *aqua regia* and to mechanical loss of nitric acid in the vapours evolved. Whilst mixtures of nitrites and chlorides do not yield a coloration when treated by the above process, the addition of nitrate to such a mixture produces a coloration which is more intense than that due to the quantity of added nitrate. The presence of the chloride tends to decrease the coloration, but the *aqua regia* formed oxidises the nitrite, thus increasing the coloration. These two reactions are not compensatory, the effect of the second preponderating. It is therefore necessary, in the case of such mixtures, to either remove the nitrite by the action of urea or to oxidise it to nitrate before carrying out the determination of the nitrate. If the nitrite be oxidised to nitrate, the actual quantity of nitrite present must be determined separately and a correction made on the total amount of nitrate found. —W. P. S.

Grandval and Lajoux's reaction [for nitrates in water]; Nature of the coloured substance produced in ——. M. Lombard. Bull. Soc. Chim., 1909, **5**, 1092—1096.

The coloration produced in this process by the action of phenolsulphonic acid on nitrates is not due to the formation of picric acid, or rather, ammonium picrate. Experiments carried out by the author show that two substances, namely, o-nitrophenol and o-nitro-*p*-phenolsulphonic acid, are formed. A mixture of these substances, in the proportion of two parts of the former to three parts of the latter, when rendered ammoniacal, gives exactly the same tint of colour as that obtained in Grandval and Lajoux's process.—W. P. S.

Phenol; Disinfectant action of ——. Theory of disinfection. I. H. Reichel. Biochem. Zeits., 1909, **22** 149—176; 177—199; 201—231.

A saturated solution of crystallised phenol in pure olive oil was found to contain 31·1 grms. per 100 c.c. at 17·5° C., whilst an aqueous solution at the same temperature contained 7·83 grms. per 100 c.c. (ratio = 3·97). When the oil was saturated with phenol in the presence of water, the solubility was increased to 44·34 grms. per 100 c.c. (ratio = 5·66). Experiments with phenol hydrate showed an average ratio between the two solvents of 5·58, but the solubility of the hydrate in oil would be greater than 44·34 per cent. if it only, and not also the water were added in excess. Other experiments described in detail show that not only oil, but also coagulated albumin, cholesterol, and the whole cellular substance of bacteria enter into simple solution relationships with phenol, and that it is not necessary to assume the existence of deep-seated chemical reactions. The equilibrium of the different phases with aqueous solutions of phenol hydrate $(2C_6H_5OH + 1H_2O)$ is controlled by the simplest law of distribution. An increase in temperature effects a slight alteration in the distribution ratio in favour of the aqueous phase. The effect of addition of sodium chloride was also studied. With increase in the amount of sodium chloride added, the ratio is altered in favour of the non-aqueous phase in accordance with a simple relationship applicable in all cases. The amount of solution absorbed by capillary attraction by albumin gel varies with the composition of the aqueous phase. Thus whilst sodium chloride alone has little action, phenol, even in slight concentration, causes pronounced liquefaction (*Entquellung*), which is still further increased by the presence of sodium chloride. The fact that osmotic absorption processes (*Quellungsvorgänge*) play a great part in the case of living plasma, whilst they are apparently absent in the case of albumin gel, may be explained by the assumption of a cellular structure in the former. The results of disinfection experiments also indicated that the activity of solutions over longer periods was also dependent upon the conditions of distribution brought about in physico-chemical ways. The death of the cell must therefore be regarded as being due to the attainment of a definite concentration of the phenol solution in the phase consisting of the bacterial cellular substance. The deviations shown by the activity in a short time in solutions relatively poor in salts, may be attributed to an acceleration of the diffusion caused by the salt; and the influence of temperature upon the disinfectant activity of phenol may also be accounted for by an acceleration of diffusion. It is also possible that an abstraction of water necessary to life may be one of the factors in the disinfectant action of phenolic substance. It is recommended that in practice the ratios of distribution between these substances and phases of compounds in living bodies should be determined, and the results compared with the expected values. In this way it will be possible to obtain data upon which may be based the most suitable composition of solutions for disinfecting purposes.—C. A. M.

Patents.

Water from its contained iron; Process and apparatus for freeing ——. E. C. R. Marks, London. From Deseniss und Jacobi, Akt.-Ges., Hamburg. Eng. Pat. 12,246, May, 24, 1909.

The water is passed, together with air, through a filter, the latter removing the precipitated oxide of iron. The water and air are conducted from the bottom of the filter to a closed chamber, from the upper part of which the air is pumped back again to the top of the filter, whilst the water is drawn off from the bottom of the chamber. —W. P. S.

Sterilisation of liquids —— [by ultra-violet rays.] V. Henri, A. Helbronner, and M. von Recklinghausen. Fr. Pat. 403,945, June 11, 1909.

Various forms of apparatus are described for subjecting a liquid in the form of a thin layer to the action of ultra-violet rays. The liquid may be passed over a number of rotating drums or rollers, each one of which delivers the liquid to the next one of the series, and so on, the lamp emiting the rays being placed conveniently above the drums. The liquid may also be supplied to the interior surface of a rotating drum containing a mercury lamp, means being provided for removing the layer before the drum has made a complete revolution. A conical rotating drum may also be used, the liquid being introduced at the bottom. The centrifugal force caused by the rapid rotation of the drum forces the liquid up the sides and over the upper edge of the drum, where means are provided for collecting it; a mercury lamp is suspended inside the drum.—W. P. S.

Gas generators or refuse destructors. Eng. Pat. 23,044. See IIa.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Strychnine; New characteristic reaction for ——. P. Malaquin. J. Pharm. Chim., 1909, **30**, 546—549.

ONE c.c. of a solution containing a thousandth of its weight of strychnine is mixed with an equal volume of pure hydrochloric acid and 1 grm. of zinc added. The mixture is boiled from 2 to 4 minutes, cooled, and the clear portion carefully placed on the surface of 2 c.c. of pure concentrated sulphuric acid. A bright rose-coloured ring is formed at the junction of the two liquids, and when they are mixed, the colour permeates the whole liquid. The colour remains after the liquid has been boiled. Veratrine gives a rose coloration which turns yellow on boiling. The strychnine coloration is destroyed by the addition of a few drops of a solution of potassium thiocyanate, or by the addition of excess of ammonia. Excess of sodium bisulphite also destroys the colour. A distinct rose colour is obtained when only one part of strychnine is present in 50,000 or 100,000 parts of water. In place of zinc the reduction can be carried out by the use of sodium amalgam in a strongly alkaline liquid.—F. SHDN.

Strychnine, brucine, and other alkaloids; Bromination of ——. *II.* J. Buraczewski and M. Dziurzynski. Anz. Akad. Wiss. Krakau, 1909, 333—343. Chem. Zentr., 1909, **2**, 2083—2084. (See this J., 1909, 1102.)

Bromination of cinchonine. On adding a solution of bromine in carbon bisulphide to a cold saturated alcoholic solution of cinchonine, a yellow precipitate is produced, which disappears on adding a slight excess of bromine: this precipitate is a tetra-bromo-derivative, $C_{19}H_{22}Br_2N_2OBr_2$, in which two of the bromine atoms are combined much more firmly than the other two. On adding excess of bromine to the filtrate from the tetra-bromo-compound, a precipitate is produced, which when dissolved in water, and treated with ammonia, yields a precipitate composed of a dibromo-compound, $C_{19}H_{22}Br_2N_2O + H_2O$, which melts at 203° C. after slight decomposition, and is tolerably soluble in water and alcohol.

Bromination of quinine. If a solution of bromine in carbon bisulphide be added to an ethereal solution of quinine, so long as the precipitate produced is not coloured yellow, a white mono-bromo-compound, $C_{20}H_{24}N_2O_2Br$, is obtained. If an excess of bromine is used, a penta-bromo-compound, $C_{20}H_{24}Br_2N_2O_2Br.Br_2$, is obtained, probably contaminated by tribromo- and mono-bromo-compounds. A small quantity of this product, if warmed for a short time with water, not above 40° C., filtered, and the filtrate treated with ammonia, gives a white flocculent precipitate which almost immediately becomes coloured emerald-green: the green substance is easily soluble in alcohol, less soluble in ether; it contains bromine, and is probably identical with the substance giving rise to the green colour in the thalleioquin reaction.

Brucine-nitric acid reaction. The red coloration produced on adding mineral acids to monobromobrucine (*loc. cit.*) appears to be due to the production of coloured salts of the bromo-derivative, and is analogous to the well-known coloration produced by the action of nitric acid on brucine. The authors have isolated the substance which is the cause of this latter coloration; it is easily soluble in water and has a composition corresponding with the formula, $C_{23}H_{26}(NO_2)N_2O_4.HNO_3$.—A. S.

Codeine; Determination of —— *in syrup of codeine.* [*Suggested official test of the Syndical Chamber of Pharmacists of the Seine*]. J. Pharm. Chim., 1909, **30**, 492—493.

TWENTY-FIVE grms. of the syrup are diluted with an equal weight of water, and the solution is made distinctly alkaline by the addition of anhydrous potassium carbonate. The liquid is then shaken with three successive portions (40 c.c.) of chloroform: the mixed chloroform extracts are filtered, and the solvent is distilled off on a water-bath. The residue is dissolved in a small quantity of alcohol, the solution transferred to a tared capsule, the alcohol evaporated off, and the residue of anhydrous codeine dried at 100° C. and weighed. This weight multiplied by 1·060 gives the equivalent of the crystalline alkaloid.—J. O. B.

Calycanthus glaucus; Crystalline alkaloid of ——. *Isocalycanthine.* H. M. Gordin. J. Amer. Chem. Soc., 1909, **31**, 1305—1312.

HAVING occasion to prepare a further quantity of calycanthine (this J., 1905, 1252), the author extracted seeds of *Calycanthus glaucus* for the alkaloid in the usual way. The substance so produced differed in its properties from calycanthine, and is therefore styled *iso*calycanthine. It has the composition, $C_{11}H_{14}N_2$, crystallises with half a molecule of water, and then melts at 212°—214° C. It can only be obtained in the anhydrous condition by dissolving in chloroform, drying the liquid, and evaporating, when it melts at 235°—236° C. It is soluble in 8 parts of acetone, 6000 parts of water, 20 volumes of chloroform, 80 parts of cold alcohol, and 25 parts of hot alcohol. Several salts, including the hydrochloride, m.pt. 208° C., the hydrobromide, m.pt. 210°—211° C., and the neutral sulphate, M_2,H_2SO_4, m.pt. 218°—219° C., were prepared and are described. In acetone solution the base has $[\alpha]_D = +697·97°$.—F. SHDN.

Hordenine, the alkaloid from barley; Synthesis of ——. G. Barger. Chem. Soc. Trans., 1909, **95**, 2193—2197.

THE author has succeeded in synthesising hordenine (*p*-hydroxyphenylethyldimethylamine), the alkaloid present in barley (see Léger, this J., 1906, 133, 1115; 1907, 66, 341), starting from phenylethyl alcohol. *a*-Chloro-*β*-phenylethane was prepared by treating the alcohol with phosphorus pentachloride in presence of chloroform, and after purification by distillation under 20 mm. pressure, was converted into *a*-dimethylamino-*β*-phenylethane by heating it with excess of a 33 per cent. alcoholic solution of dimethylamine in a sealed tube for several hours at 100° C. The amino-compound was nitrated with nitric acid of sp. gr. 1·5 at —10° C., the nitro-compound being isolated by means of its crystalline oxalate (m.pt. 153°—154° C.). The same *a*-dimethylamino-*β*-*p*-nitrophenylethane was obtained by nitrating *a*-chloro-*β*-phenylethane and combining the nitro-compound with dimethylamine. The *a*-dimethylamino-*β*-*p*-nitrophenylethane was reduced with tin and hydrochloric acid, and as the resulting amino-compound could not readily be separated from the unchanged nitro-compound, the crude reaction-product was treated with sulphuric acid and sodium nitrite; a considerable quantity of resin was formed, but finally a small quantity of hordenine, identical with the natural product, was isolated.—A. S.

p-Hydroxyphenylethylamine. K. W. Rosenmund. Ber., 1909, **42**, 4778—4783.

ANISALDEHYDE is condensed with nitromethane, and the resulting *p*-methoxynitrostyrol is either reduced directly to *p*-methoxyphenylethylamine, or is first converted into the oxime of *p*-methoxyphenylacetaldehyde, and the latter reduced. The methoxy-compound is demethylated by means of hydriodic acid. A solution of 45 grms. of anisaldehyde and 21 grms. of nitromethane in 70 c.c. of absolute alcohol is cooled to 0° C., and 45 grms. of 50 per cent. potassium hydroxide solution mixed with 60 c.c. of alcohol, are added in small portions, the temperature not being allowed to rise above 5° C. After diluting with ice and water, the solution is poured into cooled 10 per cent. hydrochloric acid, and the *p*-methoxy-*ω*-nitrostyrol which separates is filtered off and purified by crystallisation from alcohol. It is reduced to the oxime of *p*-methoxyphenylacetaldehyde by means of zinc dust and glacial acetic acid in presence of alcohol, the mixture being cooled. The oxime is separated by extraction with ether, and is reduced to *p*-methoxyphenylethylamine by means of sodium amalgam in alcoholic glacial acetic acid solution. The methyl group is split off from the methoxy-compound by boiling with decolorised hydriodic acid in an atmosphere of carbon dioxide, the *p*-hydroxyphenylethylamine being thus obtained pure, whereas if hydrochloric or hydrobromic acid be used, strongly coloured reaction-products are obtained. It is stated that the yield of *p*-hydroxyphenylethylamine by the above method is 2½–3 times greater than that obtained by Barger and Walpole's process (this J., 1909, 1324), starting from *p*-methoxyphenylacrylic acid.—A. S.

Cannabinol [*active principle of Indian hemp*]; *Characters and reactions of* ——. Czerkis. Apoth. Zeit., 1909, **24**, 742—743.

Cannabinol is obtained by distilling the light petroleum spirit extract of Indian hemp in a vacuum of 0·1 mm., under which conditions it passes over at 230° C. It is very easily altered by exposure to air and light; and loses its physiological activity owing to oxidation. This alteration occurs readily in alcoholic and ethereal solutions, such as constitute most of the galenical preparations of the drug. Cannabinol, $C_{21}H_{30}O_2$, contains one hydroxyl group; when nitrated, a trinitroderivative is obtained, pointing to the probable presence of three benzene nuclei. By the further action of nitric acid, a substance of the composition, $C_{23}H_{29}N_3O_{12}$, is obtained, and ultimately, butyric and oxalic acids. When permanganate is the oxidising agent, besides butyric acid a solid, having the probable formula, $C_{18}H_{24}O_3$, results. None of the derivatives possesses the physiological activity of the original cannabinol. Solutions of cannabinol in glacial acetic acid have a characteristic marked dichroism, being green by transmitted and red by reflected light. The addition of caustic alkali to an alcoholic solution of cannabinol produces a deep red colour, which is discharged by the addition of acid. (See also this J., 1896, 372; 1898, 372.)—J. O. B.

Anisyl alcohol and anisaldehyde in Tahiti vanilla beans. H. Walbaum. Wallach-Festschrift. 1909, 649—653. Chem. Zentr., 1909, 2, 2181.

From an ethereal extract of Tahiti vanilla, after removal of the vanillin by means of caustic soda, a pale brown oil with a pleasant characteristic odour was obtained by distillation with steam. This oil was found to consist mainly of anisyl alcohol, together with some anisaldehyde. —A. S.

Lemon oil; Constituents of ——. E. Gildemeister and W. Müller. Wallach-Festschrift, 1909, 439—451. Chem. Zentr., 1909, 2, 2159—2160.

The lowest-boiling fractions of lemon oil which had been freed from oxygenated constituents by treatment with dilute alcohol, were found to contain small quantities of pinene and camphene. The presence of *l*-camphene was confirmed. Pinene was present in both the active and inactive forms, but was for the most part present as *l*-*a*-pinene, yielding optically active pinonic acid ($[a]_D$ = about —65° in chloroform) on oxidation. The presence of *β*-phellandrene and *β*-pinene was also detected. In all fractions boiling at 173° C. or higher temperatures, γ-terpinene was detected, yielding on oxidation with alkaline permanganate, a characteristic erythritol (m. pt. 237° C.), which agreed in its properties with 1.2.4.5-tetrahydroxyhexahydrocymene. The sesquiterpene fraction of lemon oil was found to contain the bisabolene discovered by Tucholka (this J., 1897, 938) in the essential oil of Bisabol myrrh, and probably also cadinene.—A. S.

Basil oil. Van Romburgh. Koninklijke Akad. van Wetenschappen te Amsterdam, 1909, 15. Schimmel's Report, Oct. 1909, 26—27.

The author prepared a considerable quantity of essential oil from *Ocimum Basilicum* L. (*Labiatæ*), of the variety known as "*selasih hidjau.*" The oil was found to possess the following constants: sp. gr. at 14° C. 0962, opt. rot. in a 2 decim. tube = + 1° 20′. From 1500 c.c. of oil, 210 c.c. were separated by steam-distillation, and this portion was distilled *in vacuo*. From the lowest-boiling fraction cineol was isolated. There were also indications of the presence of an olefinic terpene. The methylchavicol separated from the oil had the optical rotation, 1° 30′, in a 2 decim. tube. Various attempts to remove its active constituent by means of acetic anhydride, sodium bisulphite, permanganate, &c., were fruitless: only by treatment with magnesium ethyl iodide could it be obtained in an inactive state; it boiled at 214° to 215° C. (corr.).

Coriander oil. H. Walbaum and W. Müller, Wallach-Festschrift, 1909, 654-667. Chem. Zentr., 1909, 2, 2160.

A specimen of oil distilled from ripe coriander seeds had the sp. gr. 0·8735 at 15° C., a_D = + 10° 24′ (100 mm.), n^{20}_D = 1·46387, ester value, 20·22. It contained about 20 per cent. of hydrocarbons, of which *d*-*a*-pinene (together with some *i*-*a*-pinene), *p*-cymene, and terpinene (a mixture of the *a*- and *β*- modifications) were present in almost equal amounts; traces of *β*-pinene (nopinene), dipentene, and probably phellandrene and terpinolene, were also present. Besides the chief constituent, *d*-linalool, which forms about 70 per cent. of the oil, coriander oil also contains higher fatty aldehydes, especially *n*-decyl-aldehyde, and about 5 per cent. of a mixture of geraniol with small quantities of *l*-borneol and acetic esters of these two alcohols. —A. S.

Cumin oil. Schimmel's Report, Oct. 1909, 49—53.

The oil examined had the following characters: b. pt., 165°—280° C. at 754 mm.; sp. gr. at 15° C., 0·921; a_D in 100 mm. tube, + 4° 20′; n^{20}_D = 1·50784. It was fractionated *in vacuo* and the portion distilling above 80° C. (at 10 mm.) was shaken with bisulphite, only a small portion being left unaffected by this reagent. This latter portion contained cuminic alcohol and a small quantity of a substance melting at 90°—107° C. (at 3 mm.). The product obtained by decomposing the bisulphite-compound consisted mainly of cuminic aldehyde (cuminol), but appeared to contain also a small quantity of a hydrogenised derivative of cuminic aldehyde. The low-boiling hydrocarbon fraction of the distillate consisted mainly of *p*-cymene, but also contained small quantities of *d*- and *i*-*a*-pinene, *β*-pinene, *β*-phellandrene, and dipentene. —A. S.

Juniper oil. Schimmel's Report, Oct. 1909, 71—73.

An examination of the oxygenated constituents of juniper oil, separated by extraction with 70 per cent. alcohol, revealed the presence of terpineol-4 (b. pt. 93°—95° C. at 8 mm., 215°—220° C. at 750 mm., sp. gr. 0·940 at 15° C., a_D = + 13° 6′ in a 100 mm. tube), and small quantities of other unidentified compounds.—A. S.

Lebanon cedar oil. Schimmel's Report, Oct. 1909, 132.

Lebanon cedar wood (*Cedrus Libani* Barr.; *Pinus Cedrus* L.; *Abies Cedrus* Poir.; *Larix Cedrus* Mill.) yielded about 3·5 per cent. of a lemon-yellow oil of a pleasant balsamic odour, resembling that of methylheptenone and of thujone. This oil possessed the following constants: sp. gr. at 15° C. 0·9427; a_D = + 80° 20′ in a 100 mm. tube; n^{20}_D = 1·51254; acid value, 0·5; ester value, 3·0; ester value after acetylation, 19·8; soluble in 5 to 6 vols. of 95 per cent. alcohol. It boils chiefly between 270° and 290° C., the fractions passing over in an ordinary fractionating flask at 754 mm. being as follows:—between 270° and 275°, 30 per cent.; 275°—280°, 40 per cent.; 280°—285°, 14 per cent.; 285°—290° C., 6 per cent.; residue 10 per cent.

Limette oil. Schimmel's Report, Oct. 1909, 77.

West Indian limette oil, obtained by hand-pressing, had the following characters:—sp. gr. at 15° C., 0·878 to 0·901, mostly between 0·880 and 0·884; $a_D = +32° 30'$ to $+37° 30'$ in a 100 mm. tube; a_D of the first 10 per cent. of the distillate rather higher, or at most 4° lower, than a_D of the original oil; $n^{20}_D = 1{\cdot}482$ to 1·486; acid value, up to 3·0; ester value, 18 to 30; residue on evaporation, 10 to 14 per cent., in one instance 17·8 per cent. The oil gave a cloudy solution in 4 to 10 vols. of 90 per cent. alcohol, with separation of wax- or paraffin-like constituents.

Oil of Morinda citrifolia. P. van Romburgh. Koninklijke Akad. van Wetenschappen te Amsterdam, 1909, 17. Schimmel's Report, Oct. 1909, 80—81.

The oil was of a yellowish colour, and had a sp. gr. of 0·927 at 13° C. It was cloudy, owing to the separation from it of small crystals, which, recrystallised from alcohol, melted at 60° C., and, upon analysis, were shown to consist of paraffins. When freed from the crystals the oil was almost entirely soluble in dilute caustic soda. In the solution capronic and caprylic acids, as well a trace of higher aliphatic acids, could be detected. In the neutral part of the oil, which only amounted to a few per cent., ethyl alcohol could be detected after saponification; methyl alcohol and alcohols of a fusel-like odour were also probably present. The percentage of acids was over 90, a rare occurrence with essential oils.

Orange oils. Schimmel's Report, Oct. 1909, 65—66.

The following table indicates the points in which Jamaica orange oils agree with and differ from the Italian varieties:

	Orange oil, sweet.		Orange oil, bitter.	
	Jamaica.	Italy.	Jamaica.	Italy.
Sp. gr. at 15°C.	0·8481 0·8488	0·848 to 0·853	0·8517 0·8521	0·853 to 0·857
$[a]^{20}_D$ (100 mm.)	+97°47′ +98°2′	+95° to +98°	+96°20′ +96°58′	+90° to +93°
$[a]_D$ of the first 10 %	+97°4′ +96°54′	not, or only slightly, lower	+96°40′ +95°53′	slightly higher.
Residue of evaporation	1·4%; 1·4%	2 to 4%	2·6%; 3·2%	3 to 5%

Patchouli oil. De Jong. Teysmannia, 1909. Schimmel's Report, Oct. 1909, 92—94.

The author has studied the effect of the preliminary treatment of patchouli leaves on the yield of oil therefrom. The leaves were used in the green state, after drying in the shade until they were brittle, and after fermentation. Fermentation was effected by forming a heap of the half-dried leaves and allowing this to remain until the temperature, which rose to from 35° to 52° C., did not exceed that of the atmosphere; the leaves were mixed together every day in order to render the fermentation as uniform as possible. The oil was separated by distillation with steam at a pressure of 3—4 atm., the residue from the first distillation being pressed, dried, and then again distilled. With Java leaves the following results were obtained:—

Condition of leaves.	Weight, calculated for green leaves.	Volume of distillate.		
		1st.	2nd.	Total.
	kilos.	c.c.	c.c.	c.c.
Fresh	70	38	114	152
Fermented	70	375	30	405
Dried	70	360	49	409
Dried	70	315	69	384
Fermented	70	350	29	379
Fermented	70	259	28	287

Similar results were obtained with Singapore leaves. The author gives evidence to show that the increased yield of oil from dried and fermented leaves is not due to enzyme action or to the production of oil during drying or fermentation, but to the fact that the membranes enclosing the oil cells, which are partly on the surface and partly inside the leaf, are rendered more porous by the fading of the leaves. With green leaves the yield of oil is increased by using steam of greater pressure for distillation and by cutting up the leaves.—A. S.

Spanish turpentine oil. O. Fernandez. Chem.-Zeit., 1909, 33, 1341.

Spanish turpentine oil, from *Pinus halepensis*, after being distilled by means of a current of steam, in presence of potassium carbonate, has the sp. gr. 0·859 at 20° C., rotatory power, −8·73° in a 100 mm. tube; refractive index $[n]_D = 1{\cdot}4654$. On treatment with dry gaseous hydrogen chloride, a mixture of 35—40 per cent. of a solid and 60—65 per cent. of a liquid hydrochloride is obtained. For conversion into borneol, the ethereal solution of the hydrochlorides is treated with magnesium, heated gradually to boiling, and kept boiling for 25 hours, after which the ether is distilled off by means of steam, and the residual pinyl-magnesium chloride decomposed with 20 per cent. sulphuric acid. The borneol is contaminated with dihydrodicamphene; it is purified by repeated sublimation, and then crystallised from ether: yield, 88—90 per cent.—A. S.

Essential oils; Constituents of ——. Terpinolene and terpinene. F. W. Semmler and E. Schossberger. Ber., 1909, 42, 4644—4647.

In order to determine the constants of terpinolene afresh, it was prepared from terpinolene tetrabromide, m. pt. 115°—116° C., by the action of zinc dust and alcohol. The hydrocarbon was then converted into the tetrabromide and again reduced with zinc dust. Prepared in this way, the hydrocarbon boils at 67°—68° C. at 10 mm. For several specimens made in the same way, the average value of the sp. gr. at 20° C. was 0·854, and of n_D, 1·484. The molecular refraction is 45·5, whilst that calculated for $C_{10}H_{16}$ with two double linkages, is 45·2. The increment is undoubtedly due to the presence of a double bond between the nucleus and the side-chain. The author notices some observations of Auwers (Ber., 1909, 42, 4427) relating to terpinene.—F. Shdn.

β-Pinene and l-pinocamphone; Occurrence of —— in hyssop oil, and some observations on isomerism in the pinene series. E. Gildemeister and H. Köhler. Wallach-Festschrift, 1909, 414—438. Chem. Zentr., 1909, 2, 2158—2159.

The *l*-pinonic acid obtained by oxidising *l*-pinocamphone from hyssop oil (see this J., 1908, 710) differs in its properties from the *l*-pinonic acid prepared by Tiemann from *a*-dihydroxydihydrocampholenic acid. When it was mixed with an equal quantity of *d*-pinonic acid (m. pt. 68°—69° C., $[a]^{24}_D = +88{\cdot}27°$ in chloroform), prepared by the oxidation of strongly active *d*-pinene ($[a]_D = +46{\cdot}47°$) from Greek turpentine oil, racemic pinonic acid (*a*-pinonic acid), m. pt. 103°—104° C., was obtained.

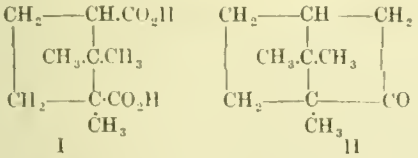
The authors point out the importance of the optical activity of the raw materials used in investigations in the pinene series. It is best to use either completely inactive pinene or else compounds showing the highest possible optical rotation. For example, active pinol hydrate can be easily obtained from strongly active pinene, whereas in the literature it is stated that active turpentine oils yield racemic pinol hydrate. On the other hand, the authors confirm the statement that the lower the activity of the pinene, the higher is the yield of nitrosochloride therefrom: hence in certain circumstances it is better to use the oxidation to pinonic acid, rather than the formation of the nitrosochloride, as a test for pinene, since with a pinene of high rotatory power, the latter test may fail. Even the strongly active pinene mentioned above was not pure *d*-pinene, but contained some of the racemic modification. —A. S.

Citral in essential oils; Determination of ——. Schimmel's Report, Oct. 1909, 153—154.

Bennett's modification (this J., 1909, 159) of Walther's method was tested with pure citral, acetaldehyde, and benzaldehyde, and with mixtures of known quantities of citral with lemon oil and lemon oil terpenes. In all cases it was found that the results were about 10 per cent. too low. Whilst in the case of lemon oil, with its comparatively low content of citral, the error is not very considerable, and the method may be useful on account of its simplicity, it is not sufficiently accurate for oils, such as lemongrass oil, richer in citral.—A. S.

Camphor and terpene series; Synthetical researches in the ——. G. Komppa. Annalen, 1909, **370**, 209—233.

The author has synthesised camphoric acid by the following series of reactions. Methyldiketoapocamphorate is methylated by means of sodium and methyl iodide to methyldiketocamphorate, which on reduction with sodium amalgam yields the corresponding dihydroxycamphoric acid. On further reducing this compound, *r*-dehydrocamphoric acid is obtained. On heating this with acetic and hydrobromic acids, *β*-bromocamphoric acid is formed. This was not isolated but immediately reduced with zinc dust and acetic acid to *meso*camphoric acid, which on treatment with acetyl chloride and sodium carbonate is resolved into the anhydride of a *cis*-acid and a *trans*-acid (which cannot be converted into an anhydride). The *cis*-anhydride was identical with the anhydride of *r*-camphoric acid and the acid from the *cis*-anhydride was identical with the *r*-camphoric acid prepared from natural camphor. Further the *trans*-acid was identical with *r*-*iso*camphoric acid. The syntheses prove that camphoric acid is an *α*-methylated apocamphoric acid (I) and as the relation between camphoric acid and camphor has long been known, Bredt's formula (II) for the latter is definitely proved to be correct.



I II

The complete synthesis of *r*-camphoric acid carries with it the attainment of the complete synthesis of *d*-camphor itself, for Beckmann and Saron (Ber., 1909, **42**, 485) have shown that *r*-camphoric acid can be resolved by means of its cinchonidine salt into *d*- and *l*-camphoric acids, and *d*-camphoric acid has been converted into *d*-camphor by Haller (Bull. Soc. Chim., 1886, **15**, 324) and by Bredt and Rosenberg (Annalen, 1896, **289**, 5).

Furthermore, the synthesis of other organic compounds derived from *d*-camphor is thus established, as, for example, *d*-borneol, *d*- and *r*-isoborneol, *d*- and *r*-camphene, *l*-bornylene, &c.—J. C. C.

Camphor; New occurrence of ——. T. Whittelsey. Wallach-Festschrift, 1909, 668—670. Chem. Zentr., 1909, **2**, 2160.

From the fresh twigs and leaves of *Artemisia nana*, Porsh., one of the plants known as "sage-brush," the author obtained 1·2 per cent. of a pale yellow oil by distillation with steam. The oil had the sp. gr. 0·9405 at 15° C.; $a_D = -19{\cdot}09°$; $n_D^{20{\cdot}5} = 1{\cdot}4702$; acid value, 4·2; ester value, 18·5; saponification value after acetylation, 111·8. On cooling the oil in a mixture of ice and salt, crystals of m. pt. 170°—173° C. separated. On distillation, about one-half of the oil passed over up to 203° C.: the residue solidified, and, after recrystallisation from alcohol, was identified as *l*-camphor. The content of camphor in the oil, as determined by means of semicarbazide, was 44·5 per cent. The presence of camphor in the essential oil of *Artemisia tridentata*, a plant also known as "sage-brush," could not be detected.—A. S.

Camphor; Determination of —— in camphor ointment. [Suggested official test of the Syndical Chamber of Pharmacists of the Seine.] J. Pharm. Chim., 1909, **30**, 491—492.

Ten grms. of the ointment, in a graduated 100 c.c. flask, are gently heated with absolute alcohol; when the fats have melted, the mixture is well agitated. The temperature of the liquid is then allowed to fall to 15° C. and the volume is adjusted to 100 c.c. by the addition of more absolute alcohol. A portion of the liquid is then filtered and its optical rotation determined in a 200 mm. tube. The amount of camphor is calculated from the formula: $[a]_D = \frac{100 \times a}{l \times c}$, the specific rotation of camphor being $[a]_D = +43°$.—J. O B.

Lecithin; Purity of ——. M. Morigi. Boll. Chim. Farm., 1909, **48**, 753—756. Chem. Zentr., 1909, **2**, 2135.

The purity of lecithin can be easily ascertained by forming it into an emulsion with water. If the emulsion is coloured yellow, this indicates the presence of fat, which considerably increases the liability of the lecithin to deteriorate on keeping. Lecithin should not be transparent; considerable quantities of solvent are sometimes left in the product in order to improve its appearance and stability. Lecithin is also frequently adulterated with phosphates and glycerophosphates. Pure lecithin contains from 3·8 to 3·9 per cent. of phosphorus and about 1·7 of nitrogen, and according to Vitali, products in which the ratio of phosphorus to nitrogen differs much from 2·21, must be regarded as impure or adulterated.—A. S.

Cholesterol. I. Application of the xanthic acid reaction. L. Tschugaeff and A. Gasteff. Ber., 1909, **42**, 4631—4634.

The authors have prepared a hydrocarbon, cholesterylene, $C_{27}H_{44}$, from cholesterol. Amylene hydroxide was distilled over sodium, dissolved in toluene, and boiled with potassium for some hours. Anhydrous cholesterol was then added, and the mass treated with carbon bisulphide. The mixture was warmed with methyl iodide or sulphate. In this way the methyl ester of cholesteryl xanthate, $C_{27}H_{45}.O.CS.SCH_3$, was produced. This melts at 126° C., and has $[a]_D = -39°$ in 9 per cent. toluene solution. When heated to above 200° C. it is decomposed into methyl mercaptan, carbon oxysulphide, and cholesterylene. The hydrocarbon crystallises from ether and alcohol in colourless needles, which melt at 77° C. In 11 per cent. toluene solution it has $[a]_D = -107°$. Dissolved in carbon bisulphide it decolorises bromine. It gives a blood-red coloration with sulphuric acid in chloroform. With sulphuric acid and acetic anhydride in chloroform, it gives a red colour, changing to violet and blue. When warmed with acetyl chloride and zinc chloride it gives a rose-red coloration, with a green fluorescence.—F. Shdn.

Airol; Determination of the iodine in ——. M. Wagenaar. Z. d. Allgem. österr. Apoth.-Ver., 1909, **47**, 583.

About 0·5 grm. of airol is accurately weighed and dissolved in 10 c.c. of 4*N*- potassium hydroxide solution. When cold the mixture is treated with 20 c.c. of a cold mixture of equal volumes of sulphuric acid and water, followed by the addition of 2 grms. of iron ammonium alum. The whole is distilled, the distillate being collected in potassium iodide. The free iodine in the distillate is titrated with sodium thiosulphate. Care must be taken not to carry the distillation so far that the sulphuric acid begins to act on the organic matter present, with the formation of sulphur dioxide.—F. Shdn.

Allo- and isocinnamic acids. C. Liebermann and H. Trucksäss. Ber., 1909, **42**, 4659—4674.

The anomalous behaviour of allo- and isocinnamic acids has led the authors to make further observations. The observations of Biilmann are confirmed on the whole (this J., 1909, 625). Three acids have been examined: allocinnamic acid melting at 68° C., Erlenmeyer sen.'s isocinnamic acid melting at 42° C., and Liebermann's isocinnamic acid melting at 58° C. Special precautions were taken to prevent accidental impregnations when the acids were being crystallised, such as exclusion of dust, cleansing of apparatus with alcohol and ether, use of sterilised corks, etc. The acid melting at 42° C. can be obtained by heating 0·5 grm. of allocinnamic acid to 105° C. in an oven for half-an-hour, and allowing to cool. The solid can be crystallised from light petroleum boiling between 30°—50° C. The acid so obtained melts at 42° C. The crystals are large transparent rhombs, 1·2—1·4 cm. long and 1—1·5 mm. thick. Measurements and a description of the crystals are given. The crystals have a characteristic complete cleavage and feel somewhat soft when crushed. Frequently on keeping, the crystals become opaque and then melt at 58° C. The acid melting at 58° C. can be readily obtained from the acid melting at 42° C., or from melted allocinnamic acid, by dissolving in light petroleum, b. pt. 60°—70° C., and sowing the solution with a crystal of the acid melting at 58° C. There seems to be no certain method for the preparation of this acid melting at 58° C. without sowing the liquid with a crystal of the same. It crystallises from light petroleum in fine, transparent, star-like clusters of needles. The crystals have been measured. In order to convert allocinnamic acid into the acid melting at 42° C., not more than 1 grm. should be kept melted for 20—25 minutes. With microscopic amounts the transformation can be made to take place after heating above the melting point for about one minute. The calcium salts of the three acids were prepared. The solutions of the salts were acidified and shaken out with ether. Each salt yielded an acid of the same melting point as that from which it had been prepared. The crystals of the calcium salts of the acids melting at 42°C. and 58°C. were measured. The three aniline salts when crystallised from light petroleum resemble each other in crystalline form, and all melt at 83°—84° C. On attempting to regenerate the original acids from these salts, sometimes one acid, sometimes another, would be obtained. Although allocinnamic acid can be crystallised from water without change when the operation is carried through rapidly, in the presence of dilute hydrochloric acid it is converted into the acid melting at 42° C. When 0·14 grm. of any one of the three acids is dissolved in 3 c.c. of N/1 sodium hydroxide solution, and acidified, an oil separates, which, on standing, solidifies and then melts at 42° C.—F. Shdn.

Benzoic and cinnamic acids; Determination of —— in the presence of each other. A. W. K. De Jong. Rec. Trav. Chim. Pays-Bas, 1909. 28, 342—348.

Volumetric methods of determining benzoic and cinnamic acids are not applicable in the presence of other acids. Methods based upon the difference in solubility of mercuric and other salts of the respective acids are also not sufficiently accurate. Thus the solubility of mercuric cinnamate (0·028 grm. per 100 c.c.) is greatly increased in the presence of a soluble benzoate. The following method is based upon the conversion of the cinnamic acid into phenyldibromopropionic acid, and the fact that that compound does not volatilise at 100° C. The solution of the mixed acids (about 2 grms.) in carbon bisulphide is treated with bromine, and, after standing for 24 hours, the solvent and excess of bromine are distilled off, and the residue taken up with ether. The ethereal solution is evaporated at the ordinary temperature, and the residue dried over sulphuric acid *in vacuo.* It is then powdered and heated at 100° C. in Riiber's apparatus (Anal. u. Konst. org. Verb. von H. Meyer, 1903, p. 14) and the residue of phenyldibromopropionic acid weighed. Experimental results quoted show that the separation is quantitative. By determining the amount of bromine in the residual substance and the quantity of sublimed benzoic acid, it is possible to calculate whether the mixture contained other compounds besides benzoic and cinnamic acids.—C. A. M.

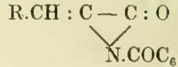
Sodium cacodylate; Varying degree of hydration of commercial ——. P. Lemaire. Rep. Pharm., 1909, 21, 250—253.

Although only the anhydrous form of sodium cacodylate, containing 46·87 per cent. of arsenic is official in the French Codex, 1908, the commercial salt contains two or more molecules of water of crystallisation. Specimens recently examined have yielded only from 34·2 to 37·95 per cent. of arsenic. The anhydrous salt has not been met with as a commercial article.—J. O. B.

Oxidation of unsaturated compounds by means of organic superoxides. N. Prileschajew. Ber. 1909, 42, 4811—4815.

An organic peroxide is dissolved in some indifferent solvent, such as ether or chloroform, and the available oxygen is determined by the use of potassium iodide and sodium thiosulphate. The solution is cooled to the room temperature or to 0° C. and the calculated amount of the substance to be oxidised is then added. After the reaction the acid is neutralised, the solvent distilled off and the residue fractionated. At first the author used benzoyl superoxide, but as the yields were poor, he made use of benzoyl hydroperoxide. The general result of the reaction was that an oxide of the unsaturated compound was produced. Oxides of octylene, di-iso-butylene, decylene, allyl alcohol, geraniol, linalool, citral, citronellal, limonene, and pinene were prepared, and descriptions of them are given, as well as of the products obtained on hydrating them. Aniline treated with benzoyl hydroperoxide yields azobenzene or nitrosobenzene, according to the relative amounts used. o-Toluidine gives o-nitrotoluene.—F. Shdn.

Phenyl-fatty acids; General synthesis of the ——. F. Mauthner. Annalen. 1909, 370, 368—375.

The phenyl-fatty acids may be synthesised from the corresponding aromatic aldehydes by a series of steps, the first of which consists in converting the aldehyde into an azlactone,  $\mathrm{R.CH:C-C:O}$ with $\mathrm{N.COC_6H_5}$ below, by condensation with hippuric acid, in the presence of acetic anhydride and sodium acetate (Erlenmeyer, Annalen, 1892, 271, 164). The azlactone is boiled with dilute sodium hydroxide, which gives benzoic acid and the corresponding phenylpyruvic acid, $\mathrm{R.CH_2.CO.COOH}$, and the alkaline solution is then cooled with ice-water and allowed to stand overnight at the ordinary temperature with rather more than the calculated quantity of hydrogen peroxide (Holleman's method); this gives the phenyl-fatty acid, according to the equation: $\mathrm{R.CH_2.CO.COOH + H_2O_2 = H_2O + CO_2 + R.CH_2.COOH}$. The mixture of benzoic and phenyl-fatty acids is acidified and distilled with steam, and the latter acid is extracted from the residue by means of ether. With hydroxy-compounds the decomposition of the azlactone by sodium hydroxide must be carried out in a current of hydrogen, and, before oxidation, the solution is acidified with acetic acid. The method, which gives good yields, is said to be readily carried out, and the preparation of phenylacetic, *p*-hydroxyphenylacetic, homovanillic, *o*- and *p*-methoxyphenylacetic, homopiperonylic, and trimethylhomogallic acids is described.—F. Sodn.

Patents.

Anhydrides of fatty acids, especially acetic anhydride, from fatty acid salts; Process of manufacturing ——. C. A. Jensen, London. From T. Goldschmidt, Essen-Ruhr, Germany. Eng. Pat. 25,433, Nov. 25, 1908.

In the preparation of fatty acid anhydrides by the action of sulphur chloride on fatty acid salts, the sulphur chloride is produced during the reaction, by the action of dry chlorine on a mixture of the fatty acid salt and sulphur. The reaction is preferably carried out at a low temperature. For example, a mixture of 8 or 9 mols. of sodium acetate with one atomic proportion of sulphur is treated in a closed vessel with 6 atoms of chlorine, the mixture being cooled to about 20°C.; the product is then heated to about 80°C. for two hours, to convert the acetyl chloride into anhydride, after which the latter is distilled *in vacuo.* —T. F. B.

Creosote ; Process to obtain strong aqueous solutions of ——. D. Lodigiani, Mexico. Eng. Pat. 26,296, Dec. 4, 1908.

Creosote (100 grms.) is mixed with glycerol (100 grms.) and absolute alcohol (20 grms.), and the mixture is gradually stirred with finely powdered magnesium carbonate (20 grms.): a sugar solution of 20° B. (700 grms.) is now added to the emulsion, with constant stirring, when complete solution of the creosote results, the product containing from 10 to 12 per cent. of creosote. A solution of sodium hypophosphite (10 grms.) and sodium iodide (10 grms.) in water (40 grms.) may be added to the creosote solution obtained as above. All the preparations thus made are applicable in pharmacy.—T. F. B.

Physiologically active base [*p-hydroxyphenylethylamine*] *and intermediate products in its production ; Synthesis of a* ——. H. S. Wellcome, London, and G. Barger, Herne Hill. Eng. Pat. 1561, Jan. 22, 1909.

A suitable derivative of phenylethylamine, *e.g.*, the acetyl, benzylidine, or benzoyl derivative, is nitrated, reduced, diazotised, and the product hydrolysed, whereupon *p*-hydroxyphenylethylamine is obtained. The following intermediate products are also claimed: Benzylidinephenylethylamine; acetyl- and benzoyl-*p*-nitrophenylethylamine; acetyl- and benzoyl-*p*-aminophenylethylamine; and benzoyl-*p*-hydroxyphenylethylamine. (See also this J., 1909, 913, 1324.)—T. F. B.

Aperients from phenolphthalein ; Process for preparing mild ——. Knoll und Co. Ger. Pat. 216,799, May 8, 1908. Addition to Ger. Pat. 212,892, Dec. 22, 1907 (see Eng. Pat. 27,095 of 1908 ; this J., 1909, 674).

The phenolphthalein esters described in the principal patent may also be prepared by interaction of phenolphthalein with the free acid, in presence of a condensing agent such as phosphorus oxychloride or phosgene, with or without a substance which will remove the hydrochloric acid. The preparation of phenolphthalein dicinnamate is described.—T. F. B.

Glycerol mono- and di-lactates ; Process for preparing ——. Kalle und Co. Ger. Pat. 216,917, Sept. 17, 1908.

Esters of glycerol with lactic acid are readily obtained by melting glycerol with one or two molecular proportions of lactic acid ; the di-lactate can also be prepared by heating dichlorohydrin with a salt of lactic acid. The esters are miscible with water and alcoholic liquids, and are very sparingly soluble in ether, and insoluble in carbon bisulphide and petroleum spirit. They are slowly resolved into their components by cold water and dilute acids and alkalis, and rapidly when heated. They can be applied as substitutes for lactic acid in pharmacy.—T. F. B.

Oxalyl chloride from oxalic acid and phosphorus pentachloride ; Process for preparing ——. H. Staudinger. Ger. Pats. 216,918 and 216,919, July 10 and Nov. 10, 1908.

(1) Oxalic acid is heated with more than three times (preferably five times) its weight of phosphorus pentachloride, with or without addition of inactive substances, such as phosphorus oxychloride, sand, salt, etc. For example, 1 part of oxalic acid, 5 parts of phosphorus pentachloride, and 10 parts of sand are heated at 50° C. for 12 hours. The temperature is then raised, the fraction distilling between 60° and 95° C. collected, and the oxalyl chloride obtained from it by fractionation. (2) Oxalyl chloride is also obtained in good yield by the action of three or less than three parts of phosphorus pentachloride on one part of oxalic acid at a temperature not exceeding 110° C.—T. F. B.

Camphor ; Manufacture of ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 26,708, Dec. 9, 1908.

See Fr. Pat. 398,361 of 1908 ; this J., 1909, 854.—T. F. B

Tobacco ; Process for removing nicotine from ——. W. E. Lake, London. From Soc. Anon. des Tabacs Désintoxiqués, Geneva. Eng. Pat. 26,939, Dec. 11, 1908.

See Fr. Pat. 397,021 of 1908 ; this J., 1909, 814.—T. F. B.

Albumose silver compounds ; Manufacture of ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 4564, Feb. 24, 1909.

See Fr. Pat. 400,627 of 1909 ; this J., 1909, 1062.—T. F. B.

Guaiacol-sulphonic acid and its salts ; Process for the manufacture of ——. J. Wetter, London. From F. Hoffmann-La Roche und Co., Basle, Switzerland. Eng. Pat. 12,745, May 29, 1909.

See Ger. Pat. 212,389 of 1908 ; this J., 1909, 1005.—T. F. B.

Tuberculosis ; Process for producing a preventative of ——. F. J. Rosenbach, Gottingen, Germany. Eng. Pat. 17,186, July 23, 1909.

See Ger. Pat. 216,310 of 1908 ; this J., 1909, 1327.—T. F. B.

Digitalis extract. R. Tambach, Assignor to Knoll und Co., Ludwigshafen on Rhine, Germany. U.S. Pat. 943,578, Dec. 14, 1909.

See Eng. Pat. 6019 of 1908 ; this J., 1908, 832.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic plate ; Action of organic peroxides on the ——. B. T. Brooks. Phillippine J. Sci, 1909, **4**, 451—453.

Benzoperacid, acetyl peroxide, and benzoylacetyl peroxide, in presence of moisture, act on photographic plates in the dark ; these peroxides are hydrolysed by water, with formation of hydrogen peroxide. It is probable that the action of resins and certain other organic compounds on photographic plates, may be due to their autoxidation to peroxides : this is supported by the fact that Manila copal rapidly absorbs oxygen from the air. The resin acids of Manila copal, in absence of terpenes, affect photographic plates in the same way as abietic acid. Recently collected resins appear to be more active than older resins, and kauri copal is more active than Manila, whilst Zanzibar copal is weaker than either of the two, and resin from Philippine coal least active of all.—T. F. B.

Toning and fixing solutions ; The best method of utilising combined ——. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1909, **25**, 440-442.

In toning and fixing silver chlorocitrate papers by means of combined baths, if the papers are fixed before toning, about 20 per cent. more of the gold in the baths can be utilised. Under the most favourable conditions only about 70 per cent. of the gold can be utilised. About two thousand prints, 13 by 18 cm., can be toned with one gram of gold.—T. F. B.

Patents.

Photographic powdering process. J. Rieder, Steglitz, Germany. Eng. Pat. 7932, April 2, 1909. Under Int. Conv., May 23, 1908.

Asphaltum is extracted by means of petroleum spirit and the extract mixed with a solution of indiarubber in petroleum spirit ; the solution is applied to some non-porous support, and dried, and the plate thus prepared is exposed to light under a suitable picture, and powdered with a suitable colour. The mixture of rubber and asphaltum loses its adhesiveness rapidly when exposed to light, so that a picture is obtained.—T. F. B.

Three-colour photography ; Sensitised plates for use in ——. F. E. Ives, Woodcliffe-on-Hudson, N.J., U.S.A. Eng. Pat. 14,243, June 17, 1909.

The invention relates to a composite plate for the three-colour process, which consists of a glass plate coated with an emulsion sensitive chiefly to blue-violet and ultra-violet rays, a layer of yellow dyestuff, a thin sheet of celluloid, a film sensitive to green rays, a layer of red or orange dyestuff to supplement the absorption of the first two films, a film sensitive to red rays, a second glass plate, and a backing of opaque material such as black paper. These films are clamped or otherwise fastened together during exposure, after which they are separated and developed as usual.—T. F. B.

Pictures; Electric process of making ——. B. D. Avis, Wallace, West Va. U.S. Pat. 940,495, Nov. 16, 1909.

A polished metal plate, *e.g.*, of copper coated with nickel, or of brass, is coated with gelatin, albumin, or other suitable substance sensitised by means of bichromate or otherwise; this is then covered by a positive or negative, exposed to light, and a metal deposited on it electrolytically. The other electrode may be of copper or brass, and is parallel to the plate, whilst the electrolyte is preferably a solution of sodium or potassium plumbate or lead acetate. It is stated that the metal passes through the covering film, and is deposited on the various parts of the metal plate in proportion to the extent of the action of the light.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Fires in gunpowder (black powder) factories. K. Schuppert. Chem. Ind., 1910, 33, 1—4.

Owing to a fire having taken place in a packing room constructed on the "blowing-out" system, it was decided to rebuild it on the ferro-concrete system advocated by Guttmann (this J., 1908, 669). An account is given of some tests carried out in this particular building. The back and sides of the building were of thick masonry. It was further divided by solid partition walls into three compartments. The central compartment was used for carrying out tests and it had a double-walled roof of ferro-concrete with sand between the walls. There was a skylight 500 mm. square, in the roof, glazed with wire-netting glass, 7 mm. thick. The front wall of this compartment consisted of a wooden framework boarded over. The front wall of the side compartments consisted of windows and a wooden door. The following tests were carried out:—(1) 25 kilos. of compressed black powder were placed on two drying frames and ignited electrically. The pressure developed threw down the front wall, which consisted of two parts, and was not fixed in any way. It was only very slightly scorched. (2). When 50 kilos. of powder were experimented on in the same way, the wooden wall was thrown to a distance of 7 metres. (3). In another experiment where 50 kilos. were placed on a drying frame and 25 kilos. in a packing case, the front wall was thrown to a distance of 8 metres. In the interior a stool and table were upset and some so-called fireproof impregnated clothing was entirely consumed. (4). When 100 kilos. of powder, the maximum allowed in the building, were employed, the front wall was, in this instance, securely fastened to the top and bottom with strong nails. On both sides of the testing room, in front of the adjoining rooms, powder kegs were placed at some distance from each other on the ground. After ignition of the powder the front wall was found to have been thrown a distance of 8·5 metres, and had fallen to pieces. Stools and table in the interior were inverted. The skylight was loosened in its frame, and had bent about 3 cm. in the middle. Although the wire-netting glass was broken in several parts, all the glass particles were held together by the wire insertion. Some of the kegs which had been placed upon the ground were set on fire. The walls and the concrete ceiling of the testing chamber were blackened by the action of the fire, but were otherwise quite unchanged. The stools and table which had not been specially impregnated were badly burnt, whilst those which had been impregnated with so-called fireproof paint were only attacked in parts. Impregnation for the purpose of rendering woodwork non-inflammable was thus successful, but in no case was it found that so called non-inflammable clothing was a success, as regards fire resistance. Impregnated clothes, according to their quality, were shown by other experiments to be safe against ignition by sparks. Wire-netting glass was shown, in these experiments, to be a very useful material.—G. W. McD.

Propagation of explosions in the galleries of a mine. Taffanel. *See* II.

XXIII.—ANALYTICAL PROCESSES.

Nitrogen; Determination of nitric —— by reduction with an aluminium-mercury couple. E. Pozzi-Escot. Comptes rend., 1909, 149, 1380—1381.

About 0·5 grm. of the nitrate is placed in the flask of a Schlœsing apparatus, and 4 to 5 grms. of aluminium clippings are added, with a few drops of a saturated solution of mercuric chloride to wet the aluminium: then after adding a small quantity of water, the whole is allowed to stand for a few minutes, whereupon an energetic action takes place. A small quantity of alkali is next added, and the ammonia distilled off, a small quantity of sodium hypophosphite being added towards the end, to destroy any mercury-ammonium derivatives which may be formed. The method is stated to be rapid and to have given very good results in the analysis of soils and manures.

—A. Sbld.

Manganese; Volumetric determination of ——. W. Heike. Stahl u. Eisen, 1909, 29, 1921—1930.

The author discusses in detail the permanganate and persulphate methods for the volumetric estimation of manganese and finds no appreciable difference in their accuracy. In the preliminary oxidation with potassium chlorate, in order to get rid of the last traces of chlorine after boiling the solution, he adds one or two drops of stannous chloride, till the smell of chlorine has disappeared; as excess of stannous chloride will form some ferrous salt, hydrogen peroxide is therefore added, the excess of which latter is destroyed by boiling. The author adopts the figure 0·2952 for the ratio of manganese to iron according to the equation: $3MnO + K_2Mn_2O_8 = 5MnO_2 + K_2O$. Since the personal element enters largely into the process, it is considered necessary to standardise the permanganate by means of recrystallised manganese ammonium sulphate, $Mn(NH_4)_2(SO_4)_2 6H_2O$. The accuracy of the process depends on the addition of the zinc oxide; the more zinc oxide is in excess, the lower is the manganese found. The zinc oxide should be sifted, and previously shown not to affect the permanganate. The solution should be as nearly neutral as possible, tending towards acidity rather than being alkaline. A definite volume of the solution is made, and such a quantity is taken that 1 grm. is used for 3 to 4 per cent. ores, or 0·2 grm. for manganese ores, and corresponding quantities for poorer alloys. It is diluted in an Erlenmeyer flask to 400 c.c. in the presence of much iron, or to 250 c.c. for small amounts of iron. Enough zinc oxide is added in the case of pig iron to cause large flocks of dark brown ferric hydroxide to form and to settle to the bottom, leaving a colourless solution which should be now tested by litmus, when it may be boiled and titrated with frequent shaking, boiling alone being sufficient to remove the first indications of the red colour.—A. H. C.

Lead; Determination of —— volumetrically by potassium permanganate in alkaline solution. J. F. Sacher. Chem.-Zeit., 1909, 33, 1321—1322.

Bollenbach's method of determining lead (this J., 1909, 1276) is criticised, in that the results obtained are found to depend on the quantity of free alkali present in the solution to be examined; errors amounting to 1 per cent. are liable to be introduced. The presence of carbonate in the alkali used also affects the determination.

—F. Sodn.

Antimony; Quantitative determination of ——, by the Gutzeit method. C. R. Sanger and E. R. Riegel. Z. anorg. Chem., 1909, **65**. 16–24.

The apparatus and general procedure are similar to those described in the case of arsenic by Sanger and Black (this J., 1907. 1115), save that the gas issues from the generating flask into a little cylindrical funnel of 17–20 mm. diameter, the neck of which passes through the cork of the flask, and which is closed by a cork carrying the 4 mm. tube, bent at right angles, which holds the paper. Into this funnel is brought, before the operation, a disc of lead acetate paper which just fits into it, and which is wetted by one drop of water dropped upon its centre. After the apparatus has worked for 10 minutes with 10 c.c. of acid as described (*loc. cit.*), the acid is poured off, 15 c.c. of fresh acid are added, and after 5 minutes the addition of the liquid to be tested is begun, and the operation continued for 30–40 minutes. No coloration of the strip occurs with less than 70 micromilligrams of antimony: but the strip is taken out and covered in a test-tube with $N/1$ ammonia solution which is allowed to act for 5 minutes, and the black band so developed is compared with previously prepared standards. These standards, flattened between two glass plates, with cement or gummed paper round the edges, will keep unaltered in the dark for considerable periods. The limit of workable delicacy of the process as described is about 5 micromilligrams of antimony; but by using a strip of paper of only 2 mm. width in a tube of 2 mm. diameter, as little as 1 micromilligram can be detected.—J. T. D.

"*Cupferron*" [*ammonium nitrosophenylhydroxylamine*]; *Quantitative separations with ——.* O. Baudisch. Chem.-Zeit., 1909, **33**. 1298—1300.

"Cupferron" (ammonium nitrosophenylhydroxylamine) when added to solutions containing ferric and cupric salts in the presence of excess of (hydrochloric) acid, completely precipitates these metals as complex salts. This reaction serves to separate iron and copper quantitatively from all other metals except lead and silver, which, unless they have been previously removed, are partly precipitated by cupferron. The reagent is a white crystalline substance, freely soluble in water, undergoing slight decomposition at ordinary temperature in the light, with formation of nitrosobenzene. If an old sample is used, its solution is therefore filtered from insoluble nitrosobenzene before use. The iron and copper complex salts are only slowly attacked by 2 N-hydrochloric acid in the cold, but warming readily causes decomposition. Alkali hydroxides decompose them immediately, while cold dilute sodium carbonate is without action. They are soluble in ether. The iron compound is unaffected by ammonia, but the copper compound dissolves readily to form a complex cuprammonium salt. From this solution the original copper salt can be completely recovered by driving off the ammonia or by acidifying in the presence of a little more cupferron. Thus it is possible to effect a complete separation of copper from iron by digesting on the filter with cold ammonia. Precipitation by cupferron is always carried out in fairly strong hydrochloric (sulphuric or acetic) acid solution, and in order to protect the precipitate from the action of the acid, it is necessary (1), to work at the ordinary temperature; (2), to add excess of cupferron; and (3), to filter and wash free from acid as quickly as possible. If the reagent is added slowly, with stirring, the point of complete separation is shown by a sharp change from a flocculent red-brown (iron) or grey-white (copper) to a snow-white crystalline precipitate. Beyond this point a decided excess must be added. After quickly washing with water on the suction filter, this excess must be thoroughly removed by dilute sodium carbonate (in case of copper) or by ammonia, since it interferes with the proper ignition of the precipitate. If both metals are present, they are then separated by ammonia solution and converted by ignition into the oxides. The author gives examples of the estimation of iron in an iron ore, and of iron and copper in a nickel ore, with suggestions for the wider application of the reagent in analysis of ores and of alloys.—W. H. P.

Determination of phenol. Olivier. *See* III.

Detecting hydrofluoric acid in presence of fluorides. Cronheim. *See* VII.

Determination of selenious acid. Marino. *See* VII

Cuprous compounds of ethylene and carbon monoxide. Manchot and Brandt. *See* VII.

Nitrogen compounds of silicon. [*Analysis of commercial silicon.*] Weiss and Engelhardt. *See* VII.

Determining "flour" in Portland cement. Petersen. *See* IX.

Determining titanium in argillaceous limestones. Ullmann and Boyer. *See* IX.

Determining carbon monoxide in steel. Goutal. *See* X.

Separating vanadium, molybdenum, chromium, and nickel in special steels. Pozzi-Escot. *See* X.

Assay of cyanide solutions and slime residues containing dissolved gold. Whitby. *See* X.

Assay of acid washes from the cyanide "clean-up." Wilmoth. *See* X.

Analysis of bronze, brass, and similar alloys, and electrolytic determination of tin in alloys. E. Schürmann and H. Arnold. *See* X.

Determining phosphorus in bronze, brass, and similar alloys. Schürmann. *See* X.

Determination of vanadium. Watts. *See* X.

Analysis of columbites and tantalites. Chesneau. *See* X.

Control of rubber materials for insulating purposes. Martens. *See* XIV.

Determination of dry substance in exhausted beet slices. Voigt. *See* XVII.

Arsenious acid in quantitative analysis. [*Determination of dextrose.*] Litterscheid and Bornemann. *See* XVII.

Rapid determination of alcohol. Sidersky. *See* XVIII.

Determining lactic acid in cheese. Suzukii and Hart. *See* XIXa.

Analysis of honey. Witte. *See* XIXa.

Detecting starch glucose in honey and fruit syrups. Fiehe. *See* XIXa.

Determining saccharin in foods. Testoni. *See* XIXa.

Detection and determination of sulphurous acid in lime juice. Dowzard. *See* XIXa.

Determination of nitrates in water. Farcy. *See* XIXb.

New reaction for strychnine. Malaquin. *See* XX.

Bromination of strychnine, brucine, and other alkaloids. [*Brucine-nitric acid reaction.*] Buraczewski and Dziurzynski. *See* XX.

Determining codeine in syrup of codeine. *See* XX.

Determining citral in essential oils. *See* XX.

Determining camphor in camphor ointment. *See* XX.

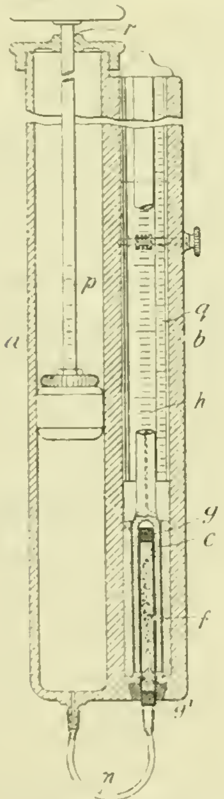
Determining benzoic and cinnamic acids in presence of each other. De Jong. *See* XX.

Determination of iodine in airol. Wagenaar. *See* XX.

Patents.

Measuring or analysing gaseous mixtures. B. C. Hinman, London. Eng. Pat. 26,561, Dec. 8, 1908.

The volume or percentage of a constituent of a gaseous mixture is determined from the change in temperature which occurs when a measured volume (corresponding to a definite weight) of the gas reacts with a definite weight of a suitable substance, preferably in the solid form. A suitable form of apparatus for determining carbon dioxide in flue-gases is shown in the figure. The apparatus comprises a pump, *a*, and thermometer chamber, *b*. The thermometer bulb, *c*, is of annular form and is arranged to surround a cartridge, *f*, filled with caustic alkali and sealed with wax at the ends, *g*, *g'*. In carrying out an analysis, the cartridge, *f*, is inserted, its ends, *g*, *g'*, having been pierced, and the temperature is noted on the scale, *q*. An adjustable scale, h, is next moved so that its zero coincides with the top of the thread of mercury. The gas is then drawn into the pump until a graduation, *p*, on the pump-rod, corresponding to the observed temperature, coincides with the point *r*, the volume of gas drawn into the pump being thus automatically corrected for temperature. The tube, *n*, is now attached, and the gas is forced through the cartridge, *f*. The percentage of carbon dioxide is read off directly on the scale, *h*, which is graduated empirically for each instrument; a correction for barometric pressure is necessary. Carbon monoxide may be determined by its heat of reaction with sodium peroxide, after the removal of carbon dioxide from the gas.—A. T. L.



Gas-analyser for furnaces. C. O. Mailloux and H. J. Westover, New York. U.S. Pat. 942,861, Dec. 7, 1909.

The gas-analysing apparatus is connected by a centre-valve with a number of pipes which serve to convey the gas from several separate furnaces. By means of an automatic electrical device, operated by the analyser and controlling the centre-valve, the pipe leading from the latter to the analyser is successively put into communication with the gas-pipes from the various furnaces. —W. H. C.

Calorific power and composition of gaseous combustibles; Apparatus for determining the ——. P. Lemoult, Lille, and Soc. Anon. les Etabl. Poulenc frères, Paris. Eng. Pat. 26,146, Dec. 3, 1908.

See Fr. Pat. 385,726 of 1907; this J., 1908, 646.—T. F. B.

Trade Report.

Tyneside chemical trade in 1909. Chem. Trade J., Jan. 15, 1910.

The chemical trade on Tyneside during the past year was well sustained, and the exports advanced from 40,235 tons in 1908 to 46,058 tons for the twelve months just ended. The workmen engaged in the industry have been kept in regular employment, and a steady demand for the products continued at the close of the year. Prices of fuel were favourable for the consumer, but there are indications of higher prices in the coming year. Bleaching powder and caustic soda were in good demand, but prices were low, and quotations may be further reduced during 1910. The officials of the Bauxite Company are hopeful that early in the new year their works at Hebburn, established for the purpose of treating the clay from which aluminium is obtained, may be started. The chemical manure trade on Tyneside did not experience the prosperity during the past year that could have been desired. Although the exports increased from 14,368 tons in 1908 to 19,998 tons last year, orders from abroad could only be secured at low competitive prices.

Tariff valuations of British India for 1910; *Revised* ——.

The tariff valuations of various goods imported into India have been modified in many cases as from Jan. 1st last. The full text of the customs notification embodying these changes will be found in the Board of Trade Journal for Jan. 13th, 20th, and 27th.

Census of the German chemical industries. Brit. and Col. Drugg., Jan., 1910.

Comparing the statistics just published of the census taken in June, 1907, with those of 1895, in the interval of 12 years there has been an increase of 55,853 in the number of persons engaged in the German chemical industries, the figures being 102,923 in 1895 and 158,776 in 1907, or 0·54 and 0·65 per cent. of all industries. Adding to these the persons dependent upon the actual wage-earners, the numbers become 289,526 in 1895 and 421,122 in 1907. Of every 1,000 persons engaged in chemical industries the number of owners and heads of businesses fell in the above period from 10·20 to 7·93, whereas managers, clerks, &c., rose from 101·9 to 151·6. The proportion of workmen has changed but little, namely, from 769·1 to 796·1 per 1,000. In chemical, pharmaceutical, and photographic manufactories there were 77,042 persons employed, in dyes and colours, coal and coal tar and lead pencil works 30,936, in explosives 21,911, in match works 6,441, and in waste products, manures, bone mills, etc., 4,374. These figures do not include women, who numbered —in the whole of the chemical trades—25,691.

Ten years of Russian chemical industry. N. Pantyuchoff. Chem. Trade J., Jan. 15, 1910

Books Received.

Technologie der Holzverkohlung, unter besonderer Berücksichtigung der Herstellung von saemtlichen Halb- und Ganzfabrikaten aus den Erstlingsdestillaten. Von M. Klar. Second enlarged and revised edition. Verlag von J. Springer, Berlin. 1910. Price M. 10. Bound M. 11.

8vo volume containing 103 pages of subject-matter, with 49 illustrations, a list of German, Austrian, English, United States, and French patents on the subject, and an alphabetical index. The text is classified as follows:—I. Historical. II. Raw materials for wood distillation. III. Chemical changes of wood during destructive distillation. IV. Products of the destructive distillation of wood. V. The condensable gases, their composition, properties, and utilisation. VI. Pyroligneous acid and its composition. VII. The tar and its constituents. VIII. Wood charcoal and its composition. IX. Preparation of the wood before distillation. X. Distillation apparatus. XI. Apparatus for wood in the form of billets, faggots, branches, etc. XII. Apparatus for wood waste, sawdust, and other finely-divided materials containing cellulose. XIII. Plant for cooling the distillation products. XIV. Treatment of the uncondensable gases and transport of the same. XV. Working up the crude pyroligneous acid into crude wood spirit and calcium acetate. XVI. Working up the calcium acetate into acetic acid and acetone. XVII. Working up the tar or tar-oils from non-resinous and resinous wood respectively. XVIII. Formaldehyde. XIX. Further working up of the wood charcoal into briquettes. XX. Analytical part.

The Transportation of Gases, Liquids and Solids by means of Steam, Compressed Air and Pressure Water. A complete description of the theory, construction, operation, and application of jet machines, montejus, spray nozzles, etc. By O. Nagel, Ph.D. Vacher & Sons, Great Smith Street, London, S.W.; or from the Author, New York, P.O. Box 385. 1909. Price 2 dols. (8s. 6d.) net.

8vo volume containing 194 pages of subject matter, with 193 illustrations, and an alphabetical index. The matter is divided as follows:—I. Transportation of gases. II. Transportation of liquids. III. Transportation of solids. IV. Atomising liquids. V. Condensers. VI. Theory. Appendix: Remarks on the nature of machines. Tables.

Producer Gas Fired Furnaces. Detailed descriptions and illustrations of practical producer gas-fired furnaces of the chemical, metal, metallurgical, iron, steel, lime, cement, glass, brick, and ceramic industries. By O. Nagel. Vacher & Sons, Great Smith Street, London, S.W.; or from the Author. New York P.O. Box 385. 1909. Price 2 dols. (8s. 8d.) net.

8vo volume containing 184 pages of subject matter, with 237 illustrations, and an alphabetical index. The text is arranged under the following headings:—I. The generation of producer gas. II. The construction of gas producers. III. The combustion of producer gas. IV. Producer gas-fired furnaces in the chemical industries: V. in the metal industries; VI. in the iron and steel industries; VII. in the lime and cement industries; VIII. in the glass industry; IX. in the brick and ceramic industries. X. The selection of refractories for gas-fired furnaces. Appendix: Purification of gases; gas power; tables.

Traite Complet d'Analyse Chimique appliquee aux Essais Industriels. Par J. Post et B. Neumann, avec la collaboration de nombreux chimistes et spécialistes. Deuxième Edition française enterièment refondue. Traduite d'après la troisième édition allemande et augmentée de nombreuses additions, par M. Pellet et G. Chenu. Tome Second. Deuxième Fascicule. Librairie Scientifique A. Hermann et Fils, Rue de la Sorbonne, Paris, 1910. Price 8 frs.

8vo volume containing 300 pages of subject matter, with 120 illustrations, and a detailed table of contents. The present volume deals with the analysis of the following substances:—Beetroot sugar, cane sugar, starch, dextrin, glucose. In an appendix are given the French official methods for the examination of sugar products, etc.

Year-Book of Pharmacy. Comprising abstracts of papers relating to Pharmacy, Materia Medica, and Chemistry contributed to British and Foreign Journals from July 1, 1908, to June 30, 1909, with the Transactions of the British Pharmaceutical Conference at the Forty-Sixth Annual Meeting held in Newsastle, July, 1909. By J. O. Braithwaite (Editor of the, Year-Book) and E. S. Peck, M.A., and H. Finnemore, B.Sc., F.I.C. (Editor of the Transactions). J. and A. Churchill, 7, Great Marlborough Street, London. 1909. Price 10s.

Tonindustrie-Kalender, 1910. Erster Teil, Zweiter Teil, Dritter Teil. Verlag der Tondindustrie-Zeitung, Ges.m.b.H., Berlin. Price M. 1.50. Single parts, M. 1. each.

Part I. is bound in linen, contains a calender with blank pages, and a table of the formulæ and molecular weights of substances used in the ceramic industry. Part II. contains 225 pages and an alphabetical index, and gives data and constants useful in the ceramic industry. Part III. is a guide to books relating to the ceramic industry, and contains also lists of the names of firms where materials, etc., can be purchased.

Statistical Abstract for the several British Colonies, Possessions and Protectorates in each year from 1894 to 1908. Forty-sixth number. [Cd. 4981). Wyman & Sons, Fetter Fane, London, E.C. Price 2s.

This publication contains in a succinct form the principal official data regarding the trade, shipping, agriculture, production, revenue, expenditure, &c., &c., of the various British Colonies, Possessions and Protectorates, as well as an abstract of the rates of import duty levied in the various Colonies on the principal articles of trade.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT: MACHINERY.

Applications.

216. Pearce. Collection of fume, flue dust, and other matter suspended in gas. Jan. 4.

366. Youlten's Onyx Process, Ltd., and Youlten. Machines for separating materials. Jan. 6.

433. Wilson. Apparatus for filtering liquids.* Jan. 7.

479. Davis. Column stills for distilling and treating thick, gritty liquids. Jan. 7.

581. Chambers, and H. B. Watson, Ltd. Vacuum plant for continuous discharge of solids from liquid. Jan. 10.

744. Shaw. Apparatus for evaporating liquids. Jan. 11.
826. Benninghoff and Klönne. Gas-fired retort or chamber furnaces.* Jan. 12.
1033. Averine. Filtering apparatus.* Jan. 14.

Complete Specifications Accepted.

20,765 (1908). Shaw. Apparatus for evaporating or concentrating liquids. Jan. 12.
26,301 (1908). Perks. Continuous distillation of liquids. Jan. 12.
317 (1909). Moore and Pearce. Separation of dust from gases. Jan. 12.
13,558 (1909). Gayley. Drying air. Jan. 19.
21,906 (1909). Turns. Apparatus for storing and compressing air, gases, and liquids under pressure. Jan. 19.

II.—FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

124. Marks (Internat. Marine Signalling Co.). Preserving calcium carbide.* Jan. 3.
207. Seaton-Snowdon and Young. Solidifying petroleum spirit and raising the flash point of the product. Jan. 4.
316. Tully. Retort furnaces for the destructive distillation of coal and other substances. Jan. 5.
342. Merrick. Gas purifiers.* Jan. 6.
343. Reichel. Regenerators for coke ovens.* Jan. 6.
442. Sauvageot. *See under* III.
826. Benninghoff and Klönne. *See under* I.
859. Roesch (Burchard). Treatment of oil and petrol for heating, lighting, &c. Jan. 12.
1045. Schuster. Removing heavy hydrocarbons from the hot gases from coke ovens, gas retorts, producers, &c. Jan. 15.

Complete Specifications Accepted.

26,199 (1908) and 11,675 (1909). Farnham. Gas producers. Jan. 12.
8150 and 8151 (1909). Senftner. Electrodes for arc lamps. Jan. 12.
21,554 (1909). Woodall and Duckham. Settings of vertical retorts for carbonising coal, &c. Jan. 19.

III.—TAR AND TAR PRODUCTS.

Applications.

442. Sauvageot. Obtaining mineral grease and retort carbon from coal tar residues. [Fr. Appl., Jan. 20, 1909.]* Jan. 7.
531. Newton (Bayer und Co.). Manufacture of formyl derivatives of natural alcohol bases. Jan. 8.
544. Ullmann. Manufacture of chlorinated anthraquinonesulphonic acids. [Ger. Appl., May 10, 1909.]* Jan. 8.

IV.—COLOURING MATTERS AND DYES.

Applications.

133. Soc. pour l'Industrie Chim. a Bâle. Manufacture of vat dyestuffs of the anthracene series. [Fr. Appl., Jan. 4, 1909.]* Jan. 3.
368. Newton (Bayer und Co.). Manufacture of dyestuffs of the triphenylmethane series. Jan. 6.
369 and 370. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Jan. 6.
532. Newton (Bayer und Co.). Manufacture of *o*-oxyazo dyestuffs. Jan. 8.
932. Newton (Bayer und Co.). *See under* XIII.
933. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Jan. 13.

Complete Specifications Accepted.

2702 (1909). Newton (Bayer und Co.). Manufacture of anthracene derivatives. Jan. 19.
4768 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Jan. 19.
5998 (1909). Newton (Bayer und Co.). Manufacture of derivatives of the anthracene series. Jan. 12.
8144 (1909). Newton (Bayer und Co.). Manufacture of trisazo dyestuffs. Jan. 12.
16,996 (1909). Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. Jan. 19.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

132. Arledter. Electrically sizing, filling, and colouring paper. Jan. 3.
476. Mijnssen. Preparation of non-brittle sheets from acetylcellulose. [Ger. Appl., Jan. 9, 1909.]* Jan. 7.
867. Shimizu. Heating cotton yarns and the products obtained thereby. [Japanese Appl., Feb. 20, 1909.]* Jan. 12.
870. Peters. Production of waterproof linen. Jan. 12.
951. Weeber. Production of adherent layers of varnish and cellulose on an underlay of fabric, paper, &c. [Austrian Appl., Jan. 16, 1909.]* Jan. 13.

Complete Specification Accepted.

3200 (1909). Dassonville. Apparatus for electrolytically cleaning and bleaching animal or vegetable fibres and fabrics, tissues, &c. Jan. 12.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Application.

900. Dean. Apparatus for treating cloth or yarn with liquors or vapours in bleaching, dyeing, &c. Jan. 13.

Complete Specifications Accepted.

625 (1909). Garscadden and Ingram. Automatic skein and hank dyeing machine. Jan. 19.
3055 (1909). Newton (Bayer und Co.). Process of dyeing and printing. Jan. 19.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

86. Freeth and Cocksedge. Manufacture of ammonium chloride from ammonium sulphate and common salt. Jan. 1.
228. Boult (Ashcroft). Manufacture of cyanides, cyanamides, amides, and other like derivatives of metals. Jan. 1.
262. Blake and Smart. Kilns for decarbonising and revivifying animal charcoal.* Jan. 5.
408. Luckow. Electrolytic manufacture of salts of heavy metals. Jan. 7.
475. Chem. Werke vorm. Dr. H. Byk. Treating borates containing active oxygen. [Ger. Appl., March 1, 1909].* Jan. 7.
779. Gathy. Treatment of dolomite. [Belg. Appl., Jan. 12, 1909.]* Jan. 11.
899. Ely and Rollason. Treatment of waste chemical liquors containing sulphur compounds and cyanides. Jan. 13.

Complete Specifications Accepted.

3395 (1909). Bartelt. Production of chlorine. Jan. 12.
5618 (1909). Gill. Manufacture of ferric oxide. Jan. 19.
9918 (1909). Walker. *See under* X.
18,203 (1909). Bender. Production of oxides of nitrogen. Jan. 19.
22,037 (1909). Pauling. Production of nitrous gases. Jan. 12.

VIII.—GLASS; CERAMICS.

Application.

289. Libeski and Offord. *See under* XIII.

IX.—BUILDING MATERIALS.

Applications.

47. Coventry (Doherty). Burning cement.* Jan. 1.

55. Lynde. Consolidating concrete compo, plaster, &c. Jan. 1.

528. McCormack and McCormack. Fire-brick. Jan. 8.

930. Sabbioni. Marble cement for imparting an insoluble weather-resisting coating to walls, &c. [Ital. Appl., Feb. 13, 1909.]* Jan. 13.

Complete Specification Accepted.

12,114 (1909). Bohn. Apparatus for cleaning and separating clay. Jan. 12.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

232. Parsons and Silberrad. Alloys. Jan. 4.

287. Soc. Electro-Métallurgique Franç. Manufacture of pure nickel. [Addition to No. 14,946 of 1909. Fr. Appl., Jan. 6, 1909.]* Jan. 5.

313. Rodman. Materials for case-hardening or cementation purposes.* Jan. 5.

452. Howard and Hadley. Treating the fumes from zinc retorts. [Addition to No. 4563 of 1909.]* Jan. 7.

461. Hardingham (Troeller). Treatment of ores and metallurgical products.* Jan. 7.

484. Rodman. Compound for case-hardening purposes.* Jan. 7.

672. Mulacek and Hatlanek. Electric induction smelting furnaces. [Ger. Appl., March 2, 1909.]* Jan. 10.

676. Boureoud. Manufacture of iron. Jan. 10.

684. Goldberg. Phosphorous metal composed of manganese and antimony.* Jan. 10.

707. Martin and Down. Zinc-distilling furnace. Jan. 11.

727. Cowper-Coles. Electrodeposition of metals. Jan. 11.

728. Cowper-Coles. Rendering iron surfaces non-corrosive. Jan. 11.

845. Lacroix. Electrolysis of metallic solutions. Jan. 12.

994. Reynolds. Manufacture of steel. Jan. 14.

1102. Cowper-Coles. Extraction of iron from its ores. Jan. 15.

1124. Stewart. Smelting tin ores. Jan. 15.

Complete Specifications Accepted.

14,434 (1908). Williams. Treatment of copper ores. Jan. 12.

20,838 (1908). Gibbs. Producing metallic articles and combined metallic and non-metallic articles by electrodeposition. Jan. 12.

21,164 (1908). Carrick and Pattison. Wet treatment of mattes. Jan. 19.

1677 (1909). Goodland, Ferro, and Thornton. Apparatus for recovering the metallic contents of ores, &c. Jan. 19.

9918 (1909). Walker. Reverberatory furnaces for producing blister copper and sulphuric acid. Jan. 19.

12,019 (1909). Stoker. Soldering aluminium and its alloys. Jan. 19.

16,931. (1909). Mills (Van Winkle). Electroplating baths. Jan. 12.

XI.—ELECTRO-CHEMISTRY.

Applications.

132. Arledter. *See under* V.

383. Marino. Manufacture of electrodes for batteries and electrolytic apparatus. Jan. 6.

408. Luckow. *See under* VII.

673 and 674. Mulacek and Hatlanek. Electric induction furnaces. [Ger. Appls., March 2, 1909.]* Jan. 10.

845. Lacroix. *See under* X.

1021. Ingle. *See under* XIII.

1110. Néméeek and Hofmann. Insulating covering or composition.* Jan. 15.

Complete Specifications Accepted.

3200 (1909). Dassonville. *See under* V.

6872 (1909). British Thomson-Houston Co. (General Electric Co.). Electrolytic cells. Jan. 19.

14,288 (1909). Schott und Gen. Electrolytic apparatus with a liquid anode. Jan. 12.

16,931 (1909). Mills (Van Winkle). *See under* X.

XII.—FATS; OILS; WAXES.

Applications.

632. Crosfield and Sons, Ltd., and Markel. Conversion of unsaturated fatty acids or their glycerides into saturated compounds. [Addition to No. 1515 of 1903.] Jan. 10.

636. Lilienfeld. Manufacture of substitutes for oils, caoutchouc, or resins. Jan. 10.

Complete Specification Accepted.

23,111 (1909). Weyner. Cosmetic soap and its manufacture. Jan. 19.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

289. Libeski and Offord. Compositions for pigments and for the production of ceramics and glass. Jan. 5.

636. Lilienfeld. *See under* XII.

932. Newton (Bayer und Co.). Manufacture of colouring matter lakes. Jan. 13.

1021. Ingle. Preparations for making floor coverings, insulating materials, &c. Jan. 14.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

341. Cockerill. Drying and otherwise treating indiarubber. Jan. 6.

537. Weller. Rubber substitute. Jan. 8.

636. Lilienfeld. *See under* XII.

659. Perkin, Matthews, and Strange. Synthetic manufacture of caoutchouc or its homologues. Jan. 10.

718, 719, and 720. Banchieri. Devulcanising indiarubber and treating reclaimed or regenerated indiarubber.* Jan. 11.

833. Hyatt. Manufacture of rubber and rubber articles. Jan. 12.

Complete Specifications Accepted.

9284 (1909). Markus. Utilisation of waste rubber. Jan. 12.

24,438 (1908). British Murac Synd., and Dessau. Removing foreign matter from india-rubber, gutta-percha, &c. Jan. 19.

7433 (1909). Smith. Manufacture of india-rubber. Jan. 19.

16,540 (1909). Poizot. Manufacture of spongy rubber. Jan. 19.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

225. Reidel. Leather substitute. [Ger. Appl., Jan. 8, 1909.]* Jan. 4.

513. Horsfield. Treatment of leather in the prepared or partly tanned state. Jan. 8.

Complete Specification Accepted.

21,202 (1909). Eberle. Process of bating hides. Jan. 19.

XVIII.—FERMENTATION INDUSTRIES.

394. Epstein. Treatments or utilisation of ferments or cultivations or the like. Jan. 6.

771. Kuhn. Manufacture of temperance beer. Jan. 11.

772. Kuhn. Manufacture of beer. Jan. 11.

Complete Specification Accepted.

15,331 (1909). Smart. Carbonating beer, cider, and other beverages. Jan. 19.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

6. Baldwin and Lester. Processes of sterilising. [U.S. Appl., Feb. 16, 1909.]* Jan. 1.

481. Neumann. Manufacture of cocoa powder. [Ger. Appl., Jan. 12, 1909.]* Jan. 7.

579. Chambers and Watson. Treatment of trade effluent. Jan. 10.

754. Neumann. Manufacture of cocoa powder. [Ger. Appl., March 15, 1909.]* Jan. 11.

825. Loring. Treatment of flour. Jan. 12.

834. Henri and others. Sterilising liquid foods and other liquids. [Ger. Appl., March 2, 1909.]* Jan. 12.

850. Schmidt. Water purifying apparatus. [Ger. Appl., Jan. 13, 1909.]* Jan. 12.

899. Ely and Rollason. *See under* VII.

Complete Specification Accepted.

412 (1909). Goldsmith. Process of making casein and like compounds. Jan. 19.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

418. Weiss. Cod-liver oil and preparations thereof containing a high percentage of natural phosphorus compounds. Jan. 7.

815. Gelhaar and Carlson. Production of compounds of guanidine.* Jan. 12.

816. Gelhaar. Production of salts of urea. Jan 12.

1088. Kaufmann. Process of making arylstibine iodides Jan. 15.

Complete Specifications Accepted.

13,828 (1909). Wellcome and Pyman. Manufacture of therapeutic compounds. Jan. 12.

14,663 (1909). Wellcome and Pyman. Manufacture of therapeutic compounds. Jan. 19.

17,171 (1909). Wellcome and Barger. Preparation of a physiologically active base. Jan. 19.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

7800 (1909). Hans. Producing chromate glue pictures on metal, porcelain, glass, &c. Jan. 12.

XXII.—EXPLOSIVES; MATCHES.

Applications.

460. Hale. Manufacture or treatment of explosives. Jan. 7.

555. Van Pittius. Explosives. Jan. 8.

Complete Specification Accepted.

25,553 (1909). Gray. Explosive compound. Jan. 19.

XXIII.—ANALYTICAL PROCESSES.

Application.

462. Arndt. Testing air or other gases for particular kinds of gases. [Ger. Appl., Jan. 7, 1909.]* Jan. 7.

Complete Specifications Accepted.

9368 (1909). Barron (Moir). Colour screens for detecting potassium. Jan. 12

9518 (1909). Brenot. Apparatus for analysing gaseous mixtures and recording the result. Jan. 12.

Journal of the Society of Chemical Industry.

No. 3, Vol. XXIX. FEBRUARY 15, 1910. No. 3, Vol. XXIX.

Birmingham Section.

Meeting held at Birmingham University on Thursday, December 9th, 1909.

DR. T. SLATER PRICE IN THE CHAIR.

THE PRINCIPLES OF VITREOUS ENAMELLING OF CAST-IRON FOR INDUSTRIAL PURPOSES.

BY HAROLD HOLCROFT, M.A., F.R.P.S.

Up to the present time enamelling has been treated as a secret process, but seeing that much of the practice of enamelling is now common knowledge, the time has arrived when the subject can be discussed by those interested with advantage to all. One difficulty in the way of research which involves any considerable expense, is the fact that the trade is but a minor industry, and perhaps likely to remain so.

Until recently the literature of enamelling for industrial purposes only existed in the Specifications of Patent Offices, or in scraps of no great importance in general literature. Silicates are now receiving attention, not only in their application to ceramics and glass, but also to some extent in their application to enamels on metals, and reports thereon are to be found in the transactions of the American Ceramic Society. A summary of recent work in Germany in the field of silicates has been published by Dr. Koerner in the "Sprechsaal Kalender für die Keramischen, Glas-, und verwandten Industrien (Müller und Schmidt, Coburg).

The application of vitreous enamels to cast iron is probably of French or German origin and dates from a time earlier than the beginning of the last century. Tradition asserts that cast iron vessels were enamelled in Alsace and Lorraine about this time, and probably also in the Rhine provinces of Germany.

In this country a patent was taken out by Hickling in 1799, and enamelled cast iron pots were made under this patent at the Eagle Foundry in Birmingham. This enamel appears to have been applied in one coat and to have contained a considerable percentage of lead compounds. The manufacture was abandoned after a short existence.

In 1839, T. and C. Clark, of Wolverhampton, took out a patent for a process in which the use of lead was avoided. This enamel consisted of two coats; the lower coat being a boro-silicate of relatively high fusing point; and the upper a more fusible glaze. The idea of using two coats, with the upper the more fusible of the two, appears to have originated on the Continent, but Clark's process was a marked advance, in that the quality of the goods was much superior, and the use of lead in the enamelling of cooking vessels dispensed with. In the manufacturing process, Messrs. Clark received great assistance from C. Machin, the manager in the enamelling department.

Two or three years later, Messrs. Archibald Kenrick & Sons, of West Bromwich, brought out a process upon the same principles, but differing in some important details. As a result of a long lawsuit between these two firms, a compromise was arranged upon equal terms, and to-day both these firms manufacture enamelled goods upon the original principle, but of course, with many improvements in detail. Of late years other processes of enamelling, differing in principle and composition, are in considerable use in the enamelling of baths and various miscellaneous and ornamental articles.

The trade is being specialized and developed for different purposes, but it still continues to be an adjunct or finishing process in several distinct trades. This will in part explain why it is that trained scientific specialists do not appear to be generally employed in the works. The position is unfortunate but not uncommon. If any great scientific development is to take place, it is imperative that the expert should be in close touch with manufacture in bulk, for in no industry is there a wider gulf between successful laboratory experiments on a small scale, and manufacture on a large scale which brings to light many important matters which are otherwise overlooked.

The objects of industrial enamelling on metals are: 1. To provide a protective coat for the metal against corrosion, either by the atmosphere or anything which may be brought into contact with the enamelled article. 2. To provide a smooth surface which may be easily kept clean. 3. To provide a coat which will withstand a wider range of temperature than is possible with any varnish or Japan. 4. For ornamental purposes. 5. To provide an insulating covering for parts of electrical apparatus. 6. To provide a hard surface for parts of textile machinery which will not only resist wear from the passage of the material but prevent discolouration from contact with the metal.

The principal articles of commerce in enamelled cast iron at the present time are: (1.) Culinary and household vessels, which are required to resist the solvent or destructive action of water, saline solutions, weak vegetable acids, weak alkaline solutions, or fatty substances, and may or may not be required to withstand moderate ranges of temperature. (2.) Baths, lavatory basins, &c., which more especially should resist the action of soap. (3.) Sanitary ware, soil pipes, &c., which are used at normal atmospheric temperatures. (4.) Chemical vessels or apparatus which are specially designed to resist different agents. (5.) Ornamental articles, some of which, such as the outside shells of gas fires, or other heating apparatus, have to resist a considerable range of temperature, (6.) Miscellaneous articles, such as reflectors, insulated electric fittings, &c.

A vitreous enamel is usually a species of glass which is applied to the metal and fused thereon at a temperature ranging from a low red to a bright red heat, but in very exceptional cases the enamel may not contain any silicate at all. In general, enamel consists of a mixture of several silicates or boro-silicates, with the addition of other substances for special purposes. It is necessary for the enamel to have a comparatively low fusing point, since with cast iron the highest permissible limit of temperature at which the enamel shall fuse, must be low enough to obviate the collapse or deformation of the article by its own weight: which temperature will obviously vary somewhat with the shape and weight of the article. It is, however, desirable to have the enamel with the highest permissible fusing point, as the requisite qualities in the enamel are more easily attained than in the case of an enamel of lower fusing point.

In the fabrication and application of an enamel for any required purpose, the manufacturer is confronted with very many difficult problems, one of which arises from the fact that a combination is attempted of two materials of very different physical properties. On the one hand, the metal is a good conductor of heat, has a comparatively high co-efficient of expansion for heat, and is comparatively soft and resistant to shocks; whilst, on the other hand, enamel is a bad conductor of heat; is hard and brittle, and unless care is taken, has a lower co-efficient of expansion.

In view of the many conditions which have to be satisfied it must be recognised that as no enamel can fulfil every condition perfectly, the best enamel for any particular purpose must be the most judicious compromise of conflicting conditions.

If a chemist is required to report upon the merits of an enamelled article, he should especially examine and test it to see if it fulfils the conditions for which it was designed.

For instance, in the case of an ordinary enamelled saucepan, which is manufactured for the purposes of cooking, the testing to which it should be subjected should be somewhat as follows :—Continuous boiling with water for say, 14 days. If it passes this test it should be subjected to continuous boiling successively for similar periods with weak vinegar, dilute citric acid, dilute solutions of sodium carbonate, and sodium chloride. If the enamel is attacked by these agents, or by boiling water, the polish or gloss of the surface will be replaced by a roughness more or less pronounced and easily seen when any deposits which may have been formed, have been carefully cleaned off. Milk should be allowed to stand in the cold in the vessel for a month, since milk and especially sour milk will attack some enamels which resist the previous tests. The enamel should be tested for hardness, which should be sufficient to resist abrasion in ordinary cleansing operations. The manufacturer's rough testing for hardness is usually performed by scratching with pieces of steel of varying degrees of hardness, which are adopted as standards. The saucepan should then be broken into pieces with a hammer, and it should be noted whether the enamel adheres firmly everywhere to the fragments. In passing, it may be said that by variations in the way of hammering, considerable differences in the result can be obtained. The broken pieces should be examined to see if the coat of enamel is uniform and of reasonable thickness. A good enamel for a saucepan should be somewhat thin. Since enamel is a bad conductor of heat, with a thick coat of enamel the temperature of metal when heated rises much more rapidly than that of the enamel. This sets up strains, which sooner or later do mischief. A thick layer of enamel also considerably impedes the passage of heat to the contents of the vessel, so that by the time the fluids reach the boiling point, the metal bottom of the vessel is at a considerably higher temperature. If therefore the vessel be removed from the source of heat, the moment the contents begin to boil, the heat accumulated in the metal bottom of the vessel, will cause the contents to continue boiling for some few seconds. The tendency to boil over is a frequent cause of complaint when the enamel is too thick. The other advantages of a thin enamel follow from a reduction of weight, and do not specially concern the chemist.

Another saucepan should be tested under reasonably rapid changes of temperature, such as are likely to be met with in ordinary use. Water should be raised to the boiling point in the vessel, which should be then rapidly emptied and cold water substituted ; repeating this a few times. There should be no chipping or cracking. A more severe test than this is scarcely reasonable for these articles.

Enamel for cooking vessels should be tested by analysis for the absence of lead or other objectionable substances ; but with cast iron cooking vessels of British manufacture, it is hardly necessary, as no British maker appears to use any objectionable ingredients in enamels for cooking purposes.

If the enamel appears to be composed of two distinct layers when the broken section is examined, the red ink test should be applied to ascertain if the lower layer of enamel is porous or not. If it is, the red ink will penetrate and will be visible from the upper surface. When the lower layer is porous, any liquid readily penetrates through any slight defect in the upper layer, and causes formation of rust, which sooner or later detaches the enamel from the iron.

The enamel for cooking vessels should be pure white in colour, the surface glossy, perfectly smooth and free from defects. Crazing or spider-like cracks, due generally to an error in the expansion co-efficient in the enamel, may be practically invisible at first, but will reveal themselves if the enamel is rubbed with any dark finely divided powder. Any test of a saucepan or cooking vessel with a strong acid or alkali is futile.

In the same way with all other enamelled articles, the chemist's tests should have regard to the especial use for which the particular article is designed.

It is found that comparatively small differences in composition produce marked differences in the physical properties of enamels, and in their capacity to resist various agents.

The results of the action of sulphuric acid upon enamel are sometimes curious. In some experiments made to produce enamels to resist this acid, one or two were found which would resist concentrated and also dilute (2½ per cent.) acid, for some weeks at least, but at 50 per cent. strength, the acid quickly destroyed the vessel. The greatest problem in producing large enamelled vessels to resist such agents, is not so much with the enamel itself, as in the difficulty of getting a perfect coat of enamel all over the surface of the metal ; the most microscopic fault is fatal.

It is a fact which should be more generally known that enamels have become highly specialised and different in their composition, physical properties and methods of application. In the enamelling of cooking vessels in this country, the industry is a perfectly healthy occupation for the operatives, from the absence of any deleterious materials in the composition, or dust in the working operations. On the other hand, in some of the other uses of enamels, there is need for proper precautions, and Home Office rules, which may be advisable in some cases, are quite uncalled for in others. The same manufacturers do not often produce more than one type of enamel.

Cast iron as a base for enamels, posesses one great advantage, in that it forms a rigid support, and the enamel has not to withstand the strains of bending. In this respect it is much superior to sheet iron ; but cast iron presents peculiar difficulties to the manufacturer in the application of the enamels. The chemical constitution of cast iron is not a matter of very great importance, except that a high percentage of graphitic carbon is not desirable, as the adhesion of the enamel is lessened. It is also desirable that the plumbago or other facing used in moulding the castings should be as small a quantity as possible for the same reason. The most important question in the enamelling of cast iron is whether the enamel is to be placed directly upon the natural skin of the casting, or upon a machined surface. Upon the machined surface many varieties of enamel can be applied easily, which would fail entirely if placed upon the natural skin. Enamelling upon the natural skin presents special difficulties, and requires special treatment. If the skin of the casting is to be removed, it is most efficiently done either by a lathe or planing machine or an emery grinder, as neither acid pickle nor sand blast is found to be so effective for the purpose. This necessity in practice tends to limit the application of many enamels to castings of round, elliptical or flat surfaces such as can be dealt with in lathes or planing machines.

When the skin of the casting is not removed efficiently and an unsuitable process of enamelling is used, it will be found that before the enamel has become hot enough to fuse completely, it will, in the language of the enameller, commence to " bleb." That is to say, some action takes place which results in the evolution of a considerable volume of gas, which causes the enamel to blister ; and when this happens, it is then impossible to obtain a perfect coat by further heating. The blebbing appears to be due to a reaction between the metal and the enamel, but may be due in part also to the liberation of the gases dissolved in the metal. Even when the skin of a casting has been removed efficiently, and a suitable enamel has fused to a perfectly level coat, a further unnecessary rise in the temperature will cause " blebbing " to occur, and in general it may be said of any enamel upon cast iron, that between the temperature at which the enamel will fuse quietly and the temperature at which " blebbing " will commence, there is a somewhat narrow range, and other things being equal, the best enamel is that which has the widest range between these points, because in practice the temperature owing to working conditions cannot be kept within very narrow limits, and blebbing means waste and commerical loss.

From their experience in the enamelling and tinning of castings on the natural skin, manufacturers are of opinion that metallurgists have much to learn as to the constitution of the skin of castings.

In an attempt to throw some light upon the subject in its bearing on enamelling and tinning, I made some preliminary experiments, to test the possibility of producing some considerable alteration in the constitution of the skin of castings. Various facing materials, including steatite, lime and magnesia dust, were tried, and castings were run in red hot loam moulds faced with these various materials in an atmosphere of coal-gas so as to exclude free and combined oxygen, but so far the results have been entirely negative. There has been no observable difference in the appearance of the castings, or in their behaviour in enamelling and tinning.

Preparation of an enamel.—In compounding an enamel for any particular purpose, the enameller usually makes no attempt to produce silicates of any definite chemical constitution, but follows such empirical rules as his experience may have taught him to accomplish his objects, and probably he is right. The preparation of an enamel must not only have regard to the physical properties required in the finished enamelled article, but must also conform to the qualities necessary in the enamel in the act of fusing upon the article; some of which are:—Temperature at which the enamel fuses; range between the fusing point and the temperature at which "blebbing" will take place; viscosity; surface tension.

The fusing point of an enamel is usually controlled by the proportion between the alkaline bases and the silica; by the use of borax, boric acid, or in some cases by lead compounds, but an undue proportion of alkaline bases or borax tends to produce softness and solubility of the enamel in aqueous solutions.

The difficulty as to "blebbing" has been alluded to and must be lessened by experience and skill in producing the enamel.

As regards viscosity in the enamel in the fused state; a high degree of viscosity is especially desirable when it is necessary to prevent the fused enamel running down any vertical surfaces of the castings; on horizontal surfaces it is of course not so important. Silicate of alumina is one of the components which is frequently employed for this purpose, but it has also a tendency to raise the melting point, which must be re-adjusted. Barium silicate is sometimes used when it is desired to reduce viscosity, but this has a tendency to lower the melting point of the enamel.

A high degree of surface tension is generally desirable in the enamel in the fused state, as it is the play of this force at the moment of fusing which stretches the enamel to a level smooth surface. It is possible however to have the surface tension too high. At the moment of fusing, the force of adhesion between the enamel and the metallic surface, or between the enamel and the under coat, as the case may be, should be considerable; that is, the fused enamel should "wet" the surface. There must be a proper balance between the forces of adhesion and surface tension. If the adhesion is not sufficient, the surface tension will cause the melted enamel to run up into isolated globules.

In the making of an enamel, the materials, in a fine state of division and well mixed, are fritted or melted in crucibles or reverberatory furnaces. The temperature of the furnace and the length of time in the furnace are important. Possibly the silica and the various bases arrange themselves differently at different temperatures: at all events the furnacing of the enamel materials may produce considerable differences in the physical properties of the enamel. The adjustment of the co-efficient of expansion for heat does not usually cause much trouble, as the enameller has his well-known formula and method which generally turns out right. But when something goes wrong, or when an enamel is required to comply with certain new conditions which may have been successfully met, except that the expansion co-efficient is too high or too low, it becomes necessary to correct the expansion co-efficient. There are several ways known to enamellers of doing this, but it is the case with most of us, that we cannot express even in approximate figures what will be the result of any given correction we may make. We do not even try to measure in figures the co-efficient of expansion; all we know is that we must adjust it to that of cast iron, viz., to 0·0000112 per degree Centigrade, as measured between 0° and 100° C.; and we do the adjusting by trial and error. Perhaps in the case of a saucepan, it would be better practice to make the expansion co-efficient of the enamel rather higher than that of cast iron, since the enamel in contact with a fluid, would rarely rise quite so high in temperature as the outside of the vessel whilst in contact with the source of heat. The subsequent cooling is a more gradual and equable process, and not likely to set up sudden local strains.

Grinding the enamel.—Enamels are applied to the metals in various ways, wet or dry; but in all cases it is necessary to reduce the enamel to a ground or powdered state, to permit of distribution in an even layer. The degree of fineness to which an enamel is ground or powdered is important. In the wet process, the enamel must be fine enough to remain in suspension in water for some time, but grinding too finely appears to affect the expansion co-efficient for reasons which are not easy to see, and the result is what is known as "crazing," *i.e.*, very fine cracks in the enamelled surface. Ideal grinding generally consists in obtaining all the particles of enamel of the same size; but in some ways of applying the enamel, it is an advantage to have a mixture of fine and relatively coarse particles. Grinding in the wet way is accomplished in mills lined with French burrs, with runners of the same material, or in horizontally rotating cylinders lined with hard porcelain and partially filled with glass balls or flint stones. With the mills, the large surface of the runners moving uniformly over a large number of particles of enamel tends to reduce them all uniformly in size, and is the best system where the enamel is required to be of any given degree of fineness, except the extremely fine; although this can be attained by prolonging the time of grinding. The cylinders, on the other hand, are best when the enamel is to be ground extremely fine. The actual surface contact between the glass balls or flints is so small that the pressure per unit of area is great and some of the enamel is at once reduced to extreme fineness, whilst the remainder is comparatively coarse. For fine grinding the cylinders are not only better but rather quicker, and the materials are not exposed to contamination from dirt.

For reducing enamel to powder in the dry way, edge runners of granite on a granite base are used, sometimes an ordinary French Burr mill.

In all the foregoing methods every care is taken to prevent contamination by metallic particles or organic matter, which give rise to defects in the enamels. In some of the coarser forms of enamelling where the specks and stains due to metallic particles do not matter, edge runners of cast iron or ordinary stamps are used.

Application and fusing.—When the enamel is used in suspension in water as a cream, it is ground finely with a small percentage of china clay, magnesium sulphate, or other agents to increase the specific gravity and viscosity of the cream, so as to keep the enamel in suspension longer, and to facilitate the operation of flowing the cream over the surface of the article to be enamelled in a uniform layer of the desired thickness. After drying the enamel is ready for firing.

When the enamel is applied in the dry state it is not so finely powdered, and is distributed with the aid of a sieve, or in other ways, over a surface coated with gum, or direct upon the red hot surface of the cast iron, either the bare metal or coated with a first coat. In the latter case the metal carries enough heat to fuse the enamel immediately it falls upon the surface, if the operations are carried out quickly, and the enamel has a low enough fusing point. It may or may not be necessary to return the article to the muffle to produce a perfectly fused surface. In some cases a combination of the wet and dry methods is used; and two or three coatings may be given of the same or different enamels by successive firings. When several coats are used, it is nearly always an advantage for the lower coats to be less fusible than the upper. When different enamels are superimposed, it is of course necessary that their co-efficients of expansion agree; and that they are otherwise a suitable combination.

In the firing of an enamelled article in a muffle, the enamels are partly protected against the furnace gases, but not altogether. Some enamels will not stand the action of the gases for long without deteriorating, and must be removed soon after complete fusing. With castings of uniform thickness, which rise in temperature equally all over the surface, this presents no difficulty, but in the case of a casting, especially a large casting which has thin parts and thick heavy parts, the heating is irregular, and the enamel upon the thin places is liable to be fused and spoilt before the enamel on the thick parts is melted. Such work is difficult and requires great experience.

When an enamelled surface is produced by two coats, the lower of which is a boro-silicate or other mass of comparatively high fusing point, and the upper a more fusible glaze, some considerable advantages are gained, one of which is that an enamel which could not be used direct upon the metal surface, can be used as the upper coat. Another advantage is that when necessary the enamel may remain longer in the muffle without damage; this is important with irregular or heavy castings. This method, however, requires accurate adjustment of the enamels, and special care in the operations, otherwise the lower layer may remain porous, so that liquids will rapidly penetrate by capillary action, as soon as there is the slightest flaw in the upper surface. The lower layer must at least soften sufficiently to form a solid mass, or the upper layer must penetrate the lower and fill up all porosity.

White enamels. Coloured enamels are produced much in the same ways that are adopted with glass or pottery, and scarcely require comment, except where the enamel is a more or less opaque or translucent white. There are several ways in use for producing the effect of a white surface. (1) By mixing with a transparent enamel some opaque white substance which does not enter into combination with the enamel, but remains as a mechanical mixture. Oxide of tin is an example. A specially pure and finely divided oxide is prepared for enamelling, and is introduced at the latest possible stage, so that the mixture of enamel and tin is heated as little as possible, otherwise the oxide of tin will enter into combination with the silica with a partial or total loss of opacity. In the application by the wet method the oxide of tin is often added to the enamel frit in the mill, and the two are merely ground together. Bone ash is probably another example. (2) Cryolite, or other fluorine compounds, with some enamels will produce a translucent white. Apparently the effect in these cases is due to the production of minute crystals having a different refractive index to the rest of the enamel. Overheating causes a loss of opacity which partially returns on cooling. (3) A white colour may be produced by coating a transparent or opalescent enamel upon a white ground layer of a boro-silicate, or other mass of a comparatively high fusing point. The lower layer does not fuse completely, but softens sufficiently to adhere to the surface of the metal, and supplies an opaque white ground, whilst the upper layer of enamel furnishes the smooth and glossy surface. (4) The effect of a white colour can also be given by the production of excessively fine air-bells in a transparent enamel. In this case considerable viscosity in the enamel is necessary, otherwise the air-bells coalesce with a loss of opacity.

Pinholes, a common trouble of enamellers, are "solutions of continuity" of the surface of the enamels in the shape of small round holes. They are due to several causes (1) Presence of fine particles of organic matter which are allowed to get into the enamel for the upper coat. Splinters of wood ground up with the enamel are a common source of trouble. These minute particles of organic matter become decomposed with the heat of the muffle and form small bells of gas, which either remain as such, or burst and form holes in the enamel which frequently will not close up. (2) Microscopic fissures or holes in the casting, the air from which expands by heat and forms air bells in the enamel. (3) "Blacks" that is, slag or scum in the skin of the castings which produce bells of gas by re-action with the enamel. (4) Imperfections in the first coat of enamel which expose the metal to the attack of the upper coat of enamel. (5) Particles of foreign matter or spots due to imperfect preparation is the first coat of enamel where the force of adhesion is less than the rest of the surface; these result in spots which the upper layer of enamel will not cover.

Principles in application of enamels. There are at least four well defined different principles in the application of enamels to cast iron.

1. That embodied in Clark's patent, *viz.*, an under coat of considerable thickness, with a relatively high fusing point: this is applied in the wet way, dried and fired, and an upper coat of enamel of a lower fusing point added.
2. A very thin special under coat is applied in the wet way, dried and burnt right into the surface of the iron. There is then scarcely any visible coat, but the surface of the iron is affected so that the propensity to "blch" is retarded, and an ordinary fusible upper coat can be added.
3. A moderately fusible enamel is applied in the wet way direct upon the surface of the iron, dried and fused.
4. One or more coats of very fusible enamel are applied as a dry powder direct upon the red hot surface of the metal.

Methods 1, 2, and 4, can be used either upon the natural skin of the casting or the machined surface. Method 3 as a rule can only be applied upon a machined surface, although with a few enamels it is possible to coat upon the natural skin. It is not a matter of indifference which way any given enamel may be applied.

It has been recommended to submit the casting to the Bower-Barff process as a preliminary to enamelling. In my own experience I have not found any special advantage in this, whilst the extra cost has been a serious commercial handicap.

To satisfy many of the conditions laid down in this paper, either singly or together, is not so difficult, but to satisfy all of them at the same time is difficult, and sometimes impossible. It is to be hoped that enamellers will abandon their habit of attacking problems single-handed, and will combine amongst themselves, and with trained chemists, seek to place upon a different footing an industry which if it is destined to remain a minor one, is at least of absorbing interest.

In conclusion, I have to express my acknowledgments to Sir William Kenrick, Sir George Kenrick, and Mr. C. F. Clark, for some of the information incorporated in this paper.

Discussion.

Dr. T. Slater Price asked what was the composition of the enamel which had the peculiar property of withstanding concentrated sulphuric acid and $2\frac{1}{2}$ per cent. sulphuric acid but would not withstand 50 per cent. acid. It was abundantly clear that, if this was not a very important industry in point of size, it was a highly specialised one. It might be well if the manufacturers could combine in some way with the chemical experts at the universities and technical schools and colleges, who were generally engaged in research, but that research did not, in the main, have a direct bearing on industry. Eventually it probably would have. It would pay manufacturers who could not afford to keep scientific experts to enter into conjunction with some of the younger chemists at those institutions to see if some of the problems which they wanted working out could not be undertaken by them. That principle was observed in Germany and in America, with the result that much of the research work from the universities and technical colleges had a direct bearing on industry. It seemed to him that the enamelling industry was one which might be tackled in that way.

Mr. H. L. Heathcote said he had enamelled steel at low temperatures, and had been confronted with the question of surface tension. The great difficulty was to get the crevices, which were microscopic, filled with the liquid. High surface tension encouraged that, just as it made a liquid tend to rise high in a tube of narrow bore. In reference to the experiment with coal gas, he did not know if Mr. Holcroft took the precaution to remove the carbon dioxide and oxygen from the gas. He had tried using coal gas to get rid of the oxygen and found that it was useless. Both coal gas and commercial hydrogen contain oxygen. A delicate test was to pass the gas over sticks of yellow phosphorus and if there was a trace of oxygen present it would be shown in the white fumes which appeared. Was there an enamel or the like which would not flow off cast iron articles at a high temperature, the object being to find some material which would prevent oxidation of iron at a high temperature? Such information would be a great boon in many industries. As to the testing of enamels he had had to test a number of metal advertisement signs; and one test which he applied would also apply to the enamel of cast iron articles—that was to immerse the articles in a solution of potassium ferricyanide, hydrochloric acid, and sulphuric acid. Wherever there was a speck of steel the blue precipitate showed it up; possibly on account of an electrolytic action a kind of halo formed, making the smallest cracks and crevices quite distinct.

Professor T. **Turner** referred to the fact that iron, rich in graphite, presented a difficulty in enamelling. They had had samples of metal sent to them which did not take enamel well, and they found that it was high in silica and graphite. He thought the direction in which scientific men wanted to work was in standardisation of work on enamels and by expressing the properties in figures. There appeared to have been no attempt to measure the viscosity. Experiments of the kind which had been recently made by Dr. Fawsitt in Glasgow seemed to indicate that some of the metals must have a very low viscosity. A standard method for measuring viscosity might be devised, if those who worked for the manufacturers and in the scientific laboratory could co-operate and give the results in figures, in the same way as in the tile industry.

Mr. F. H. **Alcock** referred to the inverted gas mantle, observing that there was a kind of enamel covering for the metal which was intended to protect it from rust or oxidation: on the metallic surface it showed a beautiful iridescence and there was a fine transparent film which was said to resist fairly high temperatures. It was claimed that it would resist a temperature such as was required to melt tin. He would like to know the nature of the thin transparent iridescent film which was apparently to prevent metals like brass and copper suffering from oxidation at high temperatures. Referring to the immediate subject of the paper, he said some time ago an analysis was required of an enamel, and it was asserted that in the composition was a large quantity of arsenic. But during the anlaysis the arsenic was not discovered; and the analyst was put down as incompetent. He was sure that there was not a particle of arsenic except in the composition which had been used. What was the special merit of arsenic in the components of the enamel if it should be used in large quantities, to begin with: and then not to be found in the product?

Mr. E. P. **Page** asked if Mr. Holcroft were familiar with the use of titanic acid. It had been extracted and used, but no one would own up to it.

Mr. H. J. **Pinnock** said he would welcome an opinion with respect to the efficacy of enamelling in the naked flame.

Mr. **Holcroft**, in reply, said that at the moment he could not state the exact composition of the enamel used in the experiments with sulphuric acid, but he would look up his records and reply to Dr. Price. In using coal gas for experiments with castings, he said that he did not attempt to purify it. All that he wanted to get was an indication whether it was possible to produce some alteration in the constitution of the skin of the casting in this way. A pipe was inserted into the mould and the gas was allowed to displace all the air in the pores of the sand for an hour or two before the metal was run in. He did not suppose he prevented oxidation entirely, but sufficiently for the purpose of the experiment. With regard to an enamel for high temperatures, he thought the first coat of boro-silicate similar to Clark's might be used, but it would probably be porous to some extent without an upper coat.

With respect to testing for defects of continuity, he should think the potassium ferricyanide, hydrochloric and sulphuric acids effective, but with cast iron the usual simple test of a solution of copper sulphate was sufficient: where the iron below the enamel could be attacked, the spots of metallic copper soon indicated the defects. He did not know how the viscosity of a red hot fluid was measured.

He thought manufacturers were of opinion that the viscosity in melted iron was very low. In the making of small castings, hand ladles holding, say, 28 lb. of metal were used, and it was a rule in most works that the boots which the workmen wore should be either covered with a leather shield, or at all events not be laced in front. If the melted metal fell on to a boot laced in front, even if laced tightly, the effect was curious. The metal was so fluid that it ran in at the laced opening and burnt the sole of the foot more than the upper surface. In reply to Mr. Alcock he said that enamelling on brass or copper was outside the range of his experience. He had not given any formulæ for enamelling but would be quite ready to do so upon a reciprocity basis. He had no experience in the use of arsenic in enamels and did not think it was much used now except perhaps in enamels for clock dials, &c.

In an enamel it would produce an opaque white colour, but by continuous heating the arsenic would volatilise, or at all events, the opacity of the enamel grew less. He did not know anything about the use of titanic acid in enamels. Enamelling with an open flame might be used for very small articles, but with a large article it would not be practical as all the difficulties of irregular heating would be encountered.

London Section.

Meeting held at Burlington House on Monday, 17th January, 1910.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE DIRECT SEPARATION OF EMULSIONS BY FILTRATION AND ULTRA-FILTRATION.

BY EMIL HATSCHEK.

The experiments of which the following is a record were in the first instance begun with a view to finding a convenient method of separating an emulsion which is, perhaps, of greater interest to the engineer than to the chemist, but is certainly produced in greater quantities than any other, *viz.*, the condense water from reciprocating engines which contains the oil used in the lubrication of the cylinders. This emulsion is extraordinary stable and the author has seen a sample taken at an electric generating station which had then been kept for three years and showed no signs whatever of separating. Although with moderate lubrication the oil amounts to only about five grains per gallon, it is well known that the repeated use of the oily water leads to very serious trouble in the boilers, especially in water-tube boilers. Various methods are accordingly in use for removing the oil, which depend in principle on producing in the water under treatment an hydroxide, which appears to collect, or to form round, the oil globules, and is subsequently filtered off. One hydroxide very generally used is aluminium hydroxide, which is produced by adding to the oily water definite proportions of aluminium sulphate and caustic soda solutions. This method involves the use of two separate reagents and the problem of feeding them into the water at a fixed ratio. Another method, which avoids these two features and has been introduced in a number of generating stations, consists in passing the water through a cell containing a large number of pairs of iron electrodes, between which the water is electrolyzed, an iron hydroxide being formed by the oxidation of the anodes. This is gradually washed away with the water and filtered off together with the entrapped oil. It is to be noted that this method makes no provision for maintaining a constant ratio of hydroxide and water, as the rate of production of the former depends only on the current, and would continue even if the flow of water were stopped. It has also been suggested that the passage of the current through the emulsion may cause cataphoresis of the oil particles and thus facilitate their collection by the hydroxide.

Partly with the object of testing this point, and partly with the larger object of finding a way of removing the oil by simple filtration, *i.e.*, by passing the emulsion through a ready formed layer without previous treatment, the author began experiments with ferric hydroxide in the following manner. A tube about one inch diameter by about four feet long was tightly packed with wood wool, and then filled with a concentrated solution of ferric chloride, which was allowed to remain in the tube until the wood wool was thoroughly impregnated. The remainder of the solution was then removed, the tube filled with caustic soda solution, and subsequently washed through with water, until the same showed no reaction. If condense water containing the usual amount of oil was now slowly passed through the tube, the oil was completely retained and a bright filtrate resulted. This appears to show conclusively that it is not essential to have an electric field, nor to employ the hydroxide in the nascent state, and the conclusion is unavoidable that its effect is exclusively due to its structure, which provides an immense number of very minute baffles. Additional evidence in favour of this view is afforded by the following: The tube, filled with water, was allowed to stand for 48 hours: when an attempt was made to start the filtration of oily water afresh, it was found that the hydroxide no longer retained the oil, and that the water left the tube as turbid as it entered. The obvious explanation seems to be that the filamentous or membranous structure of the precipitate gradually collapses or becomes consolidated on standing—a change which is of course well known, and is made use of to render difficult precipitates easier to filter. Still further corroboration was found in the fact, that a layer of hydroxide produced on a vacuum filter, with about 10 lb. pressure, had very little effect.

Since it thus turned out impossible to use ready formed hydroxide for any length of time, it became necessary to produce it continuously. At the same time it appeared desirable to avoid both the use of current and the addition of reagents. The most convenient way seemed to be its production by the slow electrolysis set up by a mixture of iron and copper, or preferably iron and carbon. The four foot tube previously used was accordingly filled to a length of about four inches with this mixture, the rest, as before, being packed with wood wool. The water to be purified was then slowly led through the tube, being, as in all other experiments, actual condense water, but treated for convenience at ordinary temperature, and not at about 95° C., as would be the case in practice. The result was inevitably a turbid and distinctly yellow effluent, which retained its tinge even after filtration through the closest filter paper. If, however, the water was heated above about 70° C. before or after passing through the iron-carbon mixture, but before passing the wood wool, the result was a perfectly bright filtrate. The hydroxide formed by the corrosion of the iron poles is therefore evidently in colloidal solution and flocculates on heating.

This method, while it gave a satisfactory filtrate, showed two defects. One is, that even with carefully graded and sifted mixtures in definite proportions the output of hydroxide varied greatly owing to the variation in the number of contacts between iron and carbon particles. The other is, of course, the polarisation of the carbon poles. These can be depolarised by exposing the mixture to the air, or passing air and steam through it, but this treatment leads to the formation of a different iron oxide, which is not washed off by the current of water and thus forms a nonconducting layer on the iron poles.

This method of providing a small constant supply of hydroxide accordingly appeared impracticable, and as the use of ready prepared hydroxide had also turned out to be impossible for any length of time, it was decided to look for a material which should not only possess, but also retain, an extraordinarily subdivided structure. Such a structure of a very remarkable character is possessed by the basic magnesium carbonate used for nonconducting compositions, and is extremely persistent, as it is not destroyed in the process of filtration and washing, but only by careful and prolonged grinding of the dry material. A layer of magnesium carbonate was accordingly deposited on a filter, and condense water filtered through it, the result being a clear filtrate and the retention of the oil on the surface of the carbonate layer.

The experiments were then continued—and all subsequent experiments were made—with vertical filtering surfaces in the following manner: a hollow porous cylinder was submerged in a sludge made up of carbonate and water and filtration started with a syphon three to four feet long. The filtered water was constantly replaced by clean water, until the whole of the suspended carbonate had been deposited on the cylinder, where it formed a layer of uniform thickness. Then the clean water was followed up by condensed water, the oil from which was retained on the surface of the carbonate layer. The passage of three to four litres of water left a distinctly visible film of oil, which happened to be a rather dark cylinder oil.

In view of the comparatively high price of the magnesium carbonate it seemed desirable to make further trials with a view to finding a cheaper substitute, and calcium carbonate was chosen. The commercial "precipitated chalk" was first tried, and gave encouraging but by no means perfect results. Various samples of causticizing mud were next tested, all giving perfectly satisfactory results, and a total quantity of about five gallons was filtered through a small cylinder already mentioned without any appreciable diminution of the flow. The experiments were then continued with a porous cylinder of large size, having a total filtering surface of about 4½ sq. ft., placed in a square wooden tank fed directly from the air pump discharge. This surface, covered with a layer of calcium carbonate one eighth inch thick proved capable of filtering 30 gals. per hour, *i.e.*, about 7 galls. per sq. ft. per hour with a pressure of about 10 lb. per sq. in. The retained film of oil for a time adheres to the filtering surfaces, but finally floats off and rises to the top. After a six hours' run the latter was covered with oil, while the permeability of the filter had only decreased very slightly.

The practical application of this method of removing oil from condense water (which forms the subject of a patent) is only a question of the design of an apparatus in which the various necessary operations, *i.e.*, the formation and the periodical removal of the carbonate layer, can be carried out with the greatest convenience, and it is not proposed to enter into details here.

The experiments so far described, which eventually led to the use of calcium carbonate as oil-retaining agent, were of a more or less empirical character, and even with the result attained it is not easy to give a convincing explanation why the particular material chosen should not permit the oil globules to pass. One obvious suggestion is the small size of the orifices in the carbonate layer—the other some specific behaviour of the carbonate surface towards oil.

Neither of these explanations is unassailable. The orifices are certainly small, owing to the extremely minute size of the carbonate particles in causticizing mud, few of which reach 2 micromillimeters diameter. Barium sulphate, however, may be preciptiated with even smaller—but crystalline—particles, but such a precipitate has very little effect on oily water. On the other hand, calcium carbonate may be precipitated in various forms, which, if the effect were one specific to the substance, should also retain the oil. Crystalline calcium carbonates, however, have no effect, and this applies practically to all other crystalline materials. If a substance can retain oil when in amorphous condition, but not in crystalline form, the only possible conclusion appears to be that crystal faces—as they do in so many other respects—behave differently from arbitrary surfaces of the same substance in regard to surface tension.

In addition to condense water various emulsions were filtered through the calcium carbonate layer. The results were fairly consistent. For any given emulsion there appeared to be a critical pressure, at which both the constituents passed through. If the pressure was kept lower, it was always possible to remove a varying—and sometimes considerable—portion of the water. Emulsions of ordinary lamp petroleum, various mineral lubricating oils, cottonseed oil, linseed oil, &c., emulsified by the aid of soap or quillaya saponin, were tested. From an emulsion containing 5 per cent. of petroleum it was possible to separate the water entirely, the maximum pressure used being 10 lb. per sq. in. In this case the oil appeared to rise to the top, but with most other emulsions it seemed to stay on the filtering surface and to coalesce into a more or less continuous film, which greatly retarded further filtration and eventually cracked the layer of carbonate in exactly the same way in which this would have formed cracks, if exposed to the air on a vacuum filter.

The performance of the carbonate filter is very considerably improved by the use of vertical filtering surfaces and by constant rocking or vibration, both of which factors obviously tend to remove the oil globules from the filtering surface. The influence of temperature is also marked, but as changes of the viscosities of both constituents and of surface tension are involved, the matter is excessively complicated, and has not been studied exhaustively.

The method described—filtration through a layer of finely divided calcium carbonate—therefore has very obvious and definite limitations. If any general method of separating emulsions by a form of septum was possible, it had to be looked for elsewhere and based on some general consideration of the nature of emulsions. The obvious starting point seemed to be the similarity between emulsions and colloidal solutions. In consequence of the enormous attention which systems of dispersed particles have lately received a considerable amount of data on this point is available, most of which may be found summarised in Freundlich's "Kapillarchemie." The most recent investigation bearing directly on the subject of this paper, of which the author has any knowledge, is contained in two papers by C. W. McC. Lewis, published in the Kolloidzeitung IV. 4 and V. 2. The first paper refers to an oil-water emulsion without any protective colloid, and therefore quite similar to condense water. The emulsion was prepared by three methods, (1) prolonged shaking, (2) distillation with a reflux condenser, (3) precipitation, if the term may be used, from an alcohol solution of the oil dropped into the water. The diameter of the particles is given as 0·4 μ and they bear an electric charge of definite quantity and sign corresponding to that borne by colloidal particles.

It is not stated in the paper how the measurement was effected and whether it was checked by either an actual count of the oil globules or by ultra-microscopic examination. The author has examined a very large number of samples of a similar oil-water emulsion prepared by dropping an acetone solution of the oil into water and has invariably found a considerable proportion of submicrones; he has also found the latter in a remarkably persistent emulsion of wool fat. The Brownian movements are marked in both cases and are extraordinarily vivid in the wool fat emulsion, some of the particles occasionally travelling 10 to 20 μ. Other and less stable emulsions contain globules of much larger size in milk; *e.g.* globules of the size of human red blood corpuscles can generally be found while the average diameter is not much less than half this size.

While the similarity between emulsions and colloidal solutions is considerable, there are differences almost equally marked. One of these is the size of the particle, which even at 0·4 μ. are considerably larger than those of most colloids. Another is the absence in an emulsion of any condition similar to the gel condition of a colloid. The oil-water emulsion may be boiled or mixed with large amounts of electrolytes without any change whatever. A further difference, which perhaps leads on to debatable ground, lies in the fact that oil particles of the size mentioned must still possess the mechanical properties of a liquid, whereas it is difficult to conceive the particles of at least suspension colloids as being anything but solid. As a matter of fact, some fairly strong evidence will be adduced further on to show that oil particles of this size can still be readily deformed by comparatively low pressures. These divergences notwithstanding it seemed at least probable that a septum capable of retaining colloidal particles would also retain the oil globules in an emulsion. Such a septum is available is the gel filters invented by Bechhold and called by him Ultra-filters (Kolloidzeitung, II., 1 and 2). These filters are prepared by impregnating filter paper or fabric with a colloidal solution—*e.g.*, acetic acid collodion or gelatine of definite strength—and gelatinising by immersion of the firstnamed in water, and the second in formaldehyde. The filters are then washed in running water for several days, kept under water and used under pressure. An apparatus for this purpose is described (*loc. cit.*), the author has used a somewhat different design adapted for holding larger volumes.

Various emulsions were tested with such ultra-filters of different porosities, and it was found possible to separate even oil-water emulsions containing no protective colloids. A 5 per cent. collodian filter—*i.e.*, one impregnated with a 5 per cent. solution of nitrocellulose retained all the oil from such an emulsion, and could be used under pressures up to four atmospheres without any oil being forced through. It also effected a complete separation of the wool-fat emulsion, retaining both the fat and the soap used for emulsification.

With 2½ per cent. collodion filters the results were irregular. It is pointed out in Bechhold's paper that the filters in a batch made at one and the same time are remarkably uniform, but that batches made at different times, though from the same paper and collodion, differ considerably amongst one another, probably owing to differences in temperature and consequently in viscosity. The author has found this confirmed and strikingly illustrated in the filtration of the oil-water emulsion through 2½ per cent. filters. These appear to represent the limit at which oil globules may be retained under favourable conditions but pass through at other times. The question naturally arises what is the size of the pores in the ultra-filters, *i.e.*, is it larger than that of the oil globules, or are the latter deformed sufficiently to pass through orifices of smaller diameter than their own. Very full data on the sizes of the pores in ultra-filters, are given in a further paper by Bechhold (Zeitst. physik. Chem. 64, 3). They are either calculated by one of two methods—from the flow of water through them at a certain pressure, or from the pressure required to force air through the wet filter, or the maximum possible size is ascertained from the size of the particles—determined ultra-microscopically—which the filter will just retain. The results obtained by the first two methods differ very considerably from those given by the third one, which is not surprising, as the ultra-microscopic method of calculating the size of particles is open to very serious objections. The sizes determined by the two first ones show fair agreement amongst each other, and in the case of the 2½ per cent. collodion filter come out at 170 to 930 $\mu\mu$. As the size of the majority of the oil globules is 400 $\mu\mu$. (0.4 μ.) dia., the figures are compatible both with their retention and with their passing through. The diameter of the pores in the 5 per cent. filter is 21 to 74 $\mu\mu$, which is one twentieth to one fifth of the diameter of the oil globules, and amply explains their retention even at 4 atm.

An unambiguous answer to the question whether the oil globules can be deformed to any considerable extent is, however, possible from a consideration of the calcium cabronate filter. Taking the diameter of the particles as 2 μ, and making the entirely justifiable assumption that they are in closest contact, the diameter of the largest sphere, which can pass through the orifice between three particles, is $2\left(\frac{2}{\sqrt{3}}-1\right) = 0{\cdot}308\ \mu$, *i.e.*, a little more than three-quarters of the diameter of the oil globule.

A large number of tests were made, with special precautions against the formation of cracks in the calcium carbonate layer, to ascertain at what pressure the oil could be forced through. The filter was filled with about 250 c.c. of emulsion, filtration started at the lowest possible pressure to ascertain that the filtrate was perfectly clear, and the pressure was then gradually increased, 10 c.c. fractions of the filtrate being taken continuously.

Working in this fashion, it was impossible to force oil through the filter at 5 atm., the limit of the present experiments. If, however, a fresh layer of carbonate was covered with emulsion, and the pressure at once raised to 4 atm., a turbid filtrate resulted, which cleared at once if the pressure was reduced. It is somewhat surprising that so much pressure should be necessary, as the passage of the oil globule through the spandril between three carbonate particles involves no reduction in cross section, but only considerable change in the shape of the latter. The area of the spandril between three calcium carbonate globules of 2μ. dia. is 0.1613 sq. μ, while the cross section of the oil globule 0·4 μ dia. is only 0·1256 sq. μ. The oil globule accordingly has to change its circular cross section to one roughly triangular, having an inscribed circle 0·308 μ. dia., as previously calculated, but there need be no reduction of cross section, and only a slight change in the transverse dimension caused by the deviation from the spherical form.

The fact that the calcium carbonate filter can be used with certainty for pressures up to 50 lb. per sq. in., and that it can easily be formed on the cloths of any filter press, should render it useful for the partial—and in favourable cases complete—separation of emulsions containing only a small proportion of oil or greasy matter. The application of the ultra-filter on anything like a large scale would probably involve very considerable difficulties, but its use on a laboratory scale is quite convenient, and may perhaps replace some of the recognised methods of separating emulsions, more particularly in cases where it is desirable to avoid chemical treatment.

Discussion.

The Chairman said Mr. Hatschek had dealt with an eminently practical and important subject, and starting with practical applications had soared to considerations bearing upon the theory of emulsion and colloids. What they had learnt lately of emulsions, confirmed in an unforseen manner the validity of the kinetic theory of the molecular state; and supported by the facts that radium bromide gave off helium, and by observations made under the ultra-microscope had given the deathblow to views denying the existence of molecules and showed that there was some reality underlying the assumption of the existence of molecules. As Mr. Hatschek had frequently referred to the size of the particles suspended in the emulsions, it might perhaps be useful to arrive at some idea of what was meant thereby. They all knew that physical calculations indicated that the size of a molecule would be of the order of magnitude 10^{-15} m.m., and $\mu\mu$ would be represented by 10^{-6}. Zsigmondy found the smallest particles of gold in his most diluted solution of Cassius purple to be 2 $\mu\mu$, so that they were evidently getting much nearer the supposed molecular state than had been possible before. Particles of this size would appear under the ultra-microscope somewhat like what Mr. Hatschek had shown in the two slides before the last. They were thus led to consider an emulsion as behaving like an extremely dilute solution of a colloid which might be either solid as in Zsigmondy's solution or liquid as in the case of the condense water emulsion shown by Mr. Hatschek. In passing he might say such a differentiation gave rise to the two views at present termed the suspension and the emulsion theories respectively. Turning now to the practical questions brought before them by Mr. Hatschek, their great importance was well known. In the nutrition of plants and animals, emulsions played an extremely important part. In the digestion of fats by the animal, undoubtedly the emulsified state was the first condition, without which assimilation could not take place. In practice, they had constantly to deal with emulsions. In many cases it was necessary to produce them, which, fortunately, was not very difficult. To-night, however they were not concerned so much with the production of an emulsion as with the much more difficult proposition of "breaking" or separating emulsions. It had been demonstrated by Mr. Hatschek that some emulsions could be separated by filtration; hence the old rule-of-thumb definition of an emulsion as "a solution which could not be filtered" was shown utterly to break down. In practice, the separation of emulsions was often the despair of a chemist. The crudest method was to let the emulsion stand and wait until it separated. This might do perhaps for a laboratory; but in practice it might lead even to the shutting down of the works, if the emulsion would not "break" promptly. Then other means, such as heating, adding alkali, or, acid or alcohol might prove of avail; but when one had to deal with such large quantities as had been referred to, all those palliatives were either more or less useless, or at best too expensive. Mr. Hatschek had shown that he could easily filter on a practical scale such emulsions as had hitherto been considered hopeless; as for instance, condense water. No doubt, the question of treating sewage was of a similar nature. Aluminoferric cake had been employed in that connection for the production of an hydroxide which carried down suspended matter—chiefly colloids. He believed that Bechhold had been partly led to study the subject of "ultra-filtration" through the very problem of sewage filtration. Parenthetically, he would like to point out that the method of "ultra-filtration" was first attacked by Picton and Linder in this country, these investigators having applied in their researches the method of filtering through a porous cell. Another important technical problem of a similar kind was the filtration of the effluents from wool-scouring mills, the "bête noire" of the Bradford trade. Fortunes had been sunk, in the main uselessly, because it had been left for engineers to try to deal with this emulsion. Some time ago, when Mr. Hatschek asked him to give him a very persistent emulsion, he prepared for him an emulsion of wool-fat, such as he showed now. This emulsion would stand for years and would not settle. It was made up from crude wool-fat, which contained free fatty acids and neutral wax, by adding a little alkali, which formed a soap and thus held the wax in a state of emulsion, which had hitherto defied all attempt at separation on a practical scale. The result obtained by Mr. Hatschek with this wool-fat emulsion was that he produced by means of ultra-filtration a clear aqueous solution and a small quantity of a very thick emulsion which, by a second filtration through an "ultra-filter," gave a salve-like solid. This was as far as it was possible to go. He then furnished Mr. Hatschek with the wool-scouring wash water, as produced in the Bradford district. This wash water was generally "cracked" with acid, and the curdled mass which separated out ("magma") was filtered through coke beds. The filtrate was supposed to be neutralised with lime before being run into the public water-courses. Reverting to the theoretical aspect of the subject, it was, of course, impossible to say whether they ever would get so far as to be able to observe particles of a size approaching that of the supposed molecule. According to our present views such a particle would have to be looked upon as a crystalloid.

In this connection, he would remind them of the view of a Russian chemist, von Weimarn, who refused to recognise any difference between crystalloids and colloids; indeed in von Weimarn's opinion colloids were nothing else than an aggregate of crystalline bodies. This would appear to lead necessarily to the view that if one went on diluting further and further, one ought to come to a state where only a small aggregate of molecules or one single molecule existed as such, no matter whether one started with a colloidal solution or a solution of a crystalloid. Against this, he believed, Mr. Pickering would tell them that barium-sulphate did not act as a colloid and could not therefore be used as a filtering medium; but perhaps Mr. Pickering had tried it in a crystalline state. They knew that Dr. Feilmann had prepared a barium-sulphate in a colloidal state, and possibly that might be found useful.

Mr. S. U. Pickering said that Mr. Hatschek and himself had been working, if not on two different subjects, on two different ends of the same subject; and it was a question how far they were connected. So far as he had gone, he had been dealing with coarse emulsions, in which the oil might amount to as much as 99 per cent. of the total liquid. The view which he suggested as to the constitution of these emulsions was, that it was in many cases not merely a case of surface tension, but that each particle of oil surrounded itself by tiny particles of solid; and it was to the presence of those solids that emulsification was due. Those particles could be seen under the microscope in some cases; in others, when anything which altered the surface tension was added to the emulsion it did not destroy the emulsion. It was only when something was added that destroyed the solid particle that the emulsion became de-emulsified. The particles of oil with which he was dealing were very large indeed in comparison with those spoken of that evening. One of the substances he dealt with was calcium carbonate, and that gave a very imperfect, or quasi-emulsion. Basic sulphates of iron and copper behaved better. That the size of the solid particles present was one of the chief factors concerned, could be proved by taking something which formed very fine solid particles, and which, in that state, emulsified well; but by making the particles coalesce and get bigger, it ceased to emulsify. Some of Mr. Hatschek's remarks entirely tallied with his observation that barium sulphate and graphite did not emulsify. The speaker further expressed the opinion that it was not merely the question of size, but, apparently, the nature of the body had something to do with it. In most cases, adding acid to a coarse emulsion de-emulsified it at once, because it generally dissolved the solid particles; but the peculiarity of very fine emulsions was that adding acid did not precipitate the oil. Apparently there they were dealing with something quite different. Again, the fact that apparently they could get a perfect emulsion with oil and water alone was somewhat remarkable. Apparently there was a limit in both cases, either inferior or superior; with fine emulsions as soon as the oil was increased up to about 2 per cent. emulsification could no longer be produced, whereas, in the case of the coarse emulsion, it could be increased up to 99 per cent.; and it was the water which had, as it were, an inferior limit. It appeared to him that in the very fine emulsions it was more a question of the substances being colloidal than in a state of simple emulsification. That was a point he must leave to mathematicians to deal with. Mr. Hatschek had brought forward some very interesting points, and had advanced the subject, especially in the practical direction.

Dr. E. Feilmann said the question of the supposed specific action of the amorphous calcium carbonate and basic magnesium carbonate on the oil, which was not shared by various other substances, was very curious. In that connection one often heard of the colloidal state; and, while certain definite ideas were associated with the term "colloid," it did not always mean as much as one would like, and rather tended to lead to slur over difficulties. It seemed as if there was a curious analogy between these phenomena and certain phenomena which took place in dyeing. Some time ago H. Wislicenus called attention to the extraordinary properties of a colloidal preparation of aluminium hydroxide. He allowed fine aluminium filings to oxidise in moist air, after they had been attacked by a minute amount of mercury; and he obtained long fibrous threads of hydrated alumina of very similar structure to the filaments of basic magnesium carbonate shewn in the micro-photographs. This preparation had a selective action in absorbing dyestuffs from solutions, and retained these peculiar properties even after it had been dehydrated by a red heat. Again, there were several phenomena which were shewn by Dreaper recently. If one filtered solutions of many dyestuffs through a column of comparatively coarse sand, the dyestuff was precipitated on the surface of the sand. There seemed to be some peculiar specific action between certain kinds of solids and certain substances in solution; and it was very interesting to see that minute oil particles, which were undoubtedly simply liquid particles, well above the molecular limits, could be removed from a solution in a somewhat simple fashion.

Mr. W. P. Dreaper, referring to his experiments in conjunction with Mr. Davis on the subject of the filtration of dye-solutions, said that there the conditions seemed to be entirely different. Using a very coarse filtering medium, ordinary sand, and dealing with pseudo-solutions of dyes where the particles were evidently a good deal finer than in these oil emulsions, although possibly solid in their nature, a perfect separation by simply filtering through the sand column was obtained. By filtering a solution of Night Blue quickly through a sand column 4 or 5 in. in height, a filtrate, if he might use the term, was obtained quite as clear and colourless as that Mr. Hatschek had shewn. The solution was run in from a burette on to the dry sand column. In this case, he assumed that the separation of the colloid was due apparently to well-known surface concentration effects, originally pointed out by Gore and since treated mathematically by J. J. Thomson. Referring to the ingenious method of preventing the Brownian motion by the addition of colloids, which had been mentioned, he would suggest that it might perhaps be better to freeze the solution; because in that case any possible "protective colloid" action would be eliminated. In the discussion which followed a paper by Mr. de Mosenthal, before this section, Professor Tilden was the first to suggest the de-formation of the aggregates as now suggested by Mr. Hatschek to account for the dialysis of a solution of nitrocellulose. This might however be due to molecular migration from aggregate to aggregate, as he had previously suggested.

Dr. R. Lessing said it was perhaps not generally known that the preparation of emulsions of oil and water was frequently accompanied by a cracking noise which, in fact, indicated their successful formation. From the almost explosive violence of their formation which at the same time produced a considerable increase in viscosity, one might gather an idea as to the force required to separate emulsions; it was rather a problem for physicists, but it might be worth drawing attention to. He had found a confirmation of Mr. Pickering's theory of solid bodies having an influence on emulsification in coal tar, which from the author's point of view is a very bad emulsion. He had observed that the capacity of various tars to retain water was to a certain extent dependent on the percentage of solid carbon they contained. Whilst tars made in horizontal retorts at high temperatures, being rather rich in free carbon, gave off their water with difficulty only, even on heating to 180° C. or higher, coal tars produced in the modern systems of carbonization, viz., vertical retorts or large space chambers, which contained very little solid carbon and were of an oily character, parted with their water quite freely.

Mr. Hatschek, in reply, said, in answer to the Chairman and Dr. Lessing, he had tried most assiduously to avoid going into theory, not from any other apprehension except that it might tire the meeting and be outside the scope of the paper. He did not exactly know what Dr. Feilmann suggested, or why he did not like the term "amorphous calcium carbonate." He knew the term "amorphous," like the terms "crystalloid" and "colloid," was coming to mean very little; but, when one had spherical particles which did not light up between crossed Nicols and had absolutely nothing anisotropic about them, he did not see what they could be called, except "amorphous." He had also to state, with regret, that he could not suggest a definite explanation why calcium carbonate retained the oil. With reference to the precipitation of dyestuffs by filtering through sand, he had mentioned expressly that the retention of oil by calcium carbonate might be an electro-capillary phenomenon, like the precipitation of colloidal ferric hydroxide in the capillaries of blotting-paper or glass capillaries up to 0·15 mm. diameter. Sand, if prevously dried, would discharge the colloidal ferric hydroxide. At the same time, these were phenomena which were intelligible in the case of solids; but did not seem intelligible in the case of oils. In the case of dyestuffs, where Le Blanc's aluminium hydroxide was used, there certainly was absorption of the dyestuff; whereas, if filtration was carried on long enough, the oils floated off. But that was not so in the case quoted by Mr. Dreaper; after a time, when all the dyestuff was absorbed, it passed through; it did not stop there. He quite admitted that he had no explanation of these matters. With regard to Dr. Lessing's remarks, he thought the only tenable theory was that the condition which was necessary for the existence of a stable emulsion was an equilibrium between the surface tension of the particles, which tended to decrease the diameter, and the electric charge which tended to increase the diameter. Sir Oliver Lodge had pointed out that an electrified soap-bubble got bigger. That was fully set forth in a paper by Lewis in the August number (1909) of the "Zeits. f. Kolloide," in which he attempted to define mathematically the ideal equilibrium. It was not capable of experimental verification, because it introduced the surface tension of spheres of extremely small diameters; and the surface tensions they could determine experimentally were on surfaces which were approximately flat. In an emulsion with particles to the number of 3 million per cub. mm., there was an enormous development of the surface; and the surface energy must be reduced to the same extent. It was possible to calculate the surface tension of that small sphere and on this basis determine experimentally the electric charge. So that there must be equilibrium between those two things, the electric charge, which tended to increase the diameter, and the surface tension, which tended to reduce it: when they were in equilibrium, there was a stable emulsion. He had made lots of emulsions, but he never heard the cracking noise described by Dr. Lessing. As to the presence of solid particles, the consideration of that point would carry them far beyond the scope of the paper; but his view was that if there were any present it made no difference.

SIGNIFICANCE OF THE ABEL HEAT TEST OF GUNCOTTON AND NITROGLYCERINE.

BY ROBERT ROBERTSON, M.A., D.SC., AND BERTRAM J. SMART.

A. *Introductory.*

The explosives dealt with in this paper are ungelatinised guncotton, nitroglycerine, and mixtures of these, and an effort is made to determine the significance of the results obtained when they are subjected to the Abel heat test. The details of carrying out this test, now well known, were worked out by Dr. Wm. Kellner, *emeritus* Chemist to the War Department, and are laid down in the Government specifications.

It should be stated at the outset that a strict adherence to uniform methods of procedure was observed, that the test papers were from one uniform source of supply (Waltham Abbey) and that the explosives tested were fully stabilised and purified.

Such matters as the masking of the test by certain substances are not dealt with, nor is comparison made with any of the other tests which have been proposed in its stead.

The true significance of the Abel heat test when applied to various explosives does not appear to have received much attention in the past, but, although not definitely expressed, the following views are implied in the literature on the subject.

1. That the reaction on the test paper is due to nitric peroxide produced by a true decomposition of the explosive during test (Guttmann, this Journal, 1897, 16, 290; Will, "Untersuchungen über die Stabilität von Nitrozellulose" 2. Mitt. aus der Zentralstelle, Neubabelsberg, Dec. 1900).

2. That the coloration is produced by impurities not completely removed from the explosive (Guttmann, this Journal, 1901, 20, 11; Jacqué, Z. f. d. g. Schiess-u. Sprengstoffwesen, 1906, 1, 207).

3. That the explosive contains nitric peroxide in solution, produced by slow decomposition, the time required to produce a reaction on the test paper being inversely proportional to the solution-pressure of the gas.

It is now well known that the rate of decomposition of guncotton is closely dependent on the temperature, and recently the same principle has been shown to apply to the rate of decomposition of nitroglycerine, by one of the authors (J. Chem. Soc. 1909, 45, 1248).

This principle has been used to determine the extent to which the indications afforded by the test permit of a definite conclusion upon the above points. But before they could be applied, a number of circumstances special to the test had to be worked out, such as the concentration and quantity of nitric peroxide required to produce the standard tint, the influence of the physical condition of the explosive, etc. A description of these will be found in the sequel.

B. *Relation of Heat Test Time to Concentration of Nitric Peroxide, the latter being maintained constant.*

The difficulty of obtaining quantitative information upon the exceedingly small concentrations of nitric peroxide required to affect the test paper will be recognised when it is considered that a moistened test paper will come up to its standard tint in 10 minutes when the concentration of nitric peroxide in the air surrounding it is maintained at 0·000003 mgrms. per c.c. After various methods had been tried the following was found capable of giving concordant results.

An airtight plate glass box of one cubic metre capacity was constructed with the minimum of wooden framing in the interior, and with the inner surfaces of the wood, where exposed, protected by means of non-reactive paraffin wax. In the top was a large hole of 20 cm. diameter, which could be covered by a glass plate, and through which thermometers, etc., could be introduced, and also a series of smaller holes near one edge which could be plugged with the usual cork and glass rod carrying a test paper. The air in the box was kept at 20° C. by regulating the temperature of the room, whilst its moisture content was maintained at 7—8 mgrms. per litre. Meanwhile, small capillaries were prepared containing a few mgrms. of nitric peroxide, and for the accurate weighing of these a delicate assay balance was used. One of the capillaries was chosen, placed on a porcelain dish resting on the floor of the box, and the large hole sealed by the glass plate. The capillary was then crushed by means of a long glass rod inserted through a small hole in the glass plate. Finally all the small holes were closed with rubber corks, and the nitric peroxide left to diffuse for two hours. At the end of this time tests were made by inserting the test papers through the small holes already mentioned and observing them against a north light (transmitted). For a given concentration constant times were observed over a period of many hours, provided the temperature remained constant. A rise of temperature causes the test paper to dry very rapidly, and hence prolonged times are obtained. In the following Table I. will be found some of the results obtained by varying the concentration of nitric peroxide.

TABLE I.

Concentration, mgrms. $NO_2 \times 10^{-6}$ per cc.	Mean observed Time. Mins.	Calculated Time. Mins.	No. of Expts.	Mean Difference.	
2·05	15·6	15·1	20	1·39	Series I.
2·87	11·1	10·8	23	0·79	
2·97	10·4	10·4	18	0·83	
3·12	10·8	9·96	18	0·86	
3·59	8·66	8·6	8	0·34	
3·78	8·06	8·2	8	0·11	
4·87	6·75	6·4	3	—	
5·95	5·1	5·2	3	—	
2·56	13	12·1			Series II. by a second observer.
2·68	12	11·5			
2·92	10·7	10·6			
3·17	10·0	9·8			
3·36	10·0	9·2			
3·84	8·5	8·1			
4·07	7	7·6			
4·11	7·5	7·5			
4·34	7·25	7·1			

The figures in the third column of the above table were calculated from the equation

$$TC = 31 \times 10^{-6},$$

where T = the time of the test and C = the concentration of the NO_2 in mgrms. $NO_2 \times 10^{-6}$.

From the following considerations there is theoretical ground for supposing that the curve obtained when the time is plotted against the concentration is a rectangular hyperbola, as indicated by the above equation.

For low concentrations it is reasonable to assume that the quantity of nitric peroxide (q) absorbed by a heat test paper in a small unit of time is proportional to the partial pressure (p) of the nitric peroxide present, *i.e.*, to the concentration (c):

$$q = kp = k_1 c.$$

To produce a visible line a certain quantity (Q) must be absorbed, and the time (T) for attaining this will be $\frac{Q}{q}$ if we assume that the rate of absorption by the paper is constant. Therefore

$$\frac{Q}{k_1 c_1} = T_1 \quad \frac{Q}{k_1 c_2} = T_2$$

$$i.e.,\ T_1 C_1 = T_2 C_2 = \text{a constant.}$$

These assumptions lead us to expect that a rectangular hyperbola is the most probable curve for the law of absorption by a heat test paper.

C. *Determination of the Quantity (Q) of Nitric Peroxide required to produce the Heat Test Tint.*

In order to apply the results obtained with constant concentrations of nitric peroxide to explosives it was necessary to determine experimentally the quantity Q of nitric peroxide which a paper must absorb in order to produce the standard tint.

Attempts were first made to estimate the total nitrogen absorbed by exposing a large number of papers until the tint was produced, and then estimating the total nitrogen, after reduction to ammonia, by means of Nessler's solution.

It was found in practice, however, that papers nearly always contained nitrogen in larger quantity than the amount to be estimated. Hence the difference between unexposed and exposed papers was obscured.

Recourse was therefore had to a method which depends upon the loss in concentration of a small volume of gas due to the absorption by heat test papers. In the case of the glass box used in the previous section a very large numbers of papers can be introduced without diminishing the concentration of NO_2 to a measurable extent. It is, possible, however, to choose a vessel of such a volume that the depletion of NO_2 can be accurately measured by the insertion of heat test papers.

The apparatus consisted of a spherical Jena glass vessel immersed in a bath of water at 20° C. To the neck, which protruded just above the water, was sealed a ground glass plate with a hole in the centre, on which a specially designed aluminium carrier could slide, thereby enabling papers to be introduced into the atmosphere in the flask and removed without allowing leakage to take place.

The concentration was first determined by hanging in the flask two papers, one after the other, and calculating from the equation already given.

A large number of papers was then introduced and left in the vessel until the standard tint in each case had been developed.

The concentration was again determined by hanging two papers in the flask and noting the time as before.

Blank experiments were carried out to ascertain that no nitric peroxide was absorbed by the walls of the vessel during the period of the experiments.

Experiment 1.—The capacity of the vessel was 5 litres. Three tests taken at intervals of a quarter of an hour gave 6′ 20″, 6′ 40″ and 6′ 30″ (mean 6′ 30″) showing that the concentration was constant and equal to

$$\frac{31\times 10^{-6}}{6{\cdot}5}=4{\cdot}77\times 10^{-6} \text{ mgrm. } NO_2 \text{ per c.c.}$$

Twenty papers were simultaneously hung in the vessel until the standard tint was produced, and after they were removed the gas was allowed half an hour to become uniform.

The concentration was again determined by means of two test papers inserted within a period of 10 minutes, and gave 7′ 20″ and 7′ 25″ (Mean 7·37 mins.).

The final concentration was then

$$\frac{31\times 10^{-6}}{7{\cdot}37}=4{\cdot}21\times 10^{-6} \text{ mgrm.}$$

Twenty papers therefore caused the concentration to fall by $0{\cdot}56\times 10^{-6}$ mgrm., or, in other words, absorbed a total quantity of $0{\cdot}56\times 5000\times 10^{-6}$ mgrm. NO_2.

Each paper therefore absorbed 140×10^{-6} mgrm. NO_2.

Experiment 2. The capacity of the vessel was 2·0 litres. The original concentration was determined by means of two test papers, which gave times of 6′ 30″ and 6′ 35″ (mean 6·53 mins.) corresponding to a concentration of $4{\cdot}75\times 10^{-6}$ mgrm. NO_2 per c.c.

Thirteen papers were exposed in the flask and the air allowed half an hour to become uniform.

The final concentration was determined by means of two test papers, which gave times of 7′ 55″ and 8′ 0″ (mean 7·95 mins.) corresponding to a concentration $3{\cdot}9\times 10^{-6}$ mgrm.

Diminution of concentration, $0{\cdot}85\times 10^{-6}$ mgrm.

Total quantity absorbed by 13 papers, $0{\cdot}85\times 10^{-6}\times 2000$.

" " " " 1 paper, 130×10^{-6} mgrm.

The mean of these two experiments—135×10^{-6} mgrm NO_2 as the quantity of nitric peroxide absorbed by one test paper in coming up to the standard tint— is in close agreement with a result quoted by Will (2. Mitt. Zentralst. p. 28) as being obtained at the Düneberg Factory, no mention being made of the method by which the result was obtained. The figure referred to is 4×10^{-5} mgrm., of N_2, which corresponds to 130×10^{-6} mgrm. NO_2.

D. *Relation of Heat Test to rising concentration of* NO_2. Practical application to explosives.

When the Abel heat test is used for the testing of explosives we have not to deal with a constant concentration, but with a concentration rising from zero, during the period of the test, until the standard tint appears on the paper.

(1) *Calculation of Heat Test Tim from foregoing data.* From the results which have been obtained above, and a knowledge of the rate of decomposition of an explosive, it should be possible to obtain a formula from which to calculate the heat test of the explosive, provided only a process of decomposition with formation of nitric peroxide goes on during the test.

From the glass box we have the law $T=\frac{K}{C}$ where, the concentration is maintained constant.

But in a heat test tube the concentration—

(1) rises, owing to the decomposition of the explosive; if the explosive decomposes at a constant rate,* then

$$de=r\times dt, \quad\ldots\ldots\ldots\ldots\ldots\ldots(a)$$

r being the rate of increase in concentration in the tube due to decomposition. And it—

(2) falls, owing to the absorption by the paper; for a constant concentration the amount absorbed per unit of time may be taken as constant.

For a constant concentration C, the amount absorbed per unit of time $=\frac{Q}{T_c}=\frac{QC}{K}$, (since $T_c=\frac{K}{C}$), therefore the rate of fall in concentration due to absorption is shown by

$$de=-\frac{QC}{KV}\,dt, \quad\ldots\ldots\ldots\ldots\ldots\ldots(b)$$

where *V* is the volume of the vessel.

Combining (*a*) and (*b*) (since both processes go on at the same time) we get

$$de=\left(r-\frac{QC}{KV}\right).\ dt \text{ whence}$$

$$\frac{de}{r-\frac{QC}{KV}}=dt\quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(c)$$

Now, if T is the heat test time, the value of C is $rT-\frac{Q}{V}$.

Hence, integrating both sides of equation (e)

$$\int_0^C\frac{e}{r-\frac{QC}{KV}}=\int_0^T dt \text{ where } C=rT-\frac{Q}{V}\text{; herefore}$$

$$\frac{KV}{Q}\log\frac{r}{r-\frac{Q}{KV}\left(rT-\frac{Q}{V}\right)}=T$$

$$T=\frac{KV}{Q}\log\frac{r}{r+\frac{Q^2}{KV^2}-\frac{QrT}{KV}}$$

By putting in numerical values for Q, K, V and r, T, the heat test time, can be calculated.

$$\left.\begin{array}{l}Q=135\times 10^{-6}\\ K=\ 31\times 10^{-6}\end{array}\right\}\text{ which depend on the heat test paper.}$$

V = the unoccupied volume of the heat test tube = 18 c.c.

r = the rate of rise in concentration of nitrogen peroxide in the heat test tube, due to decomposition of explosive. This can be experimentally determined, as will be shown below.

---

* There is sufficiently good ground for this assumption. Thus, even at a temperature of 132° C., when the quantity of decomposition products is very largely in excess of that produced under heat test conditions, Bergmann and Junk found (Zeit. f. angew Ch. 1904, p. 1078) that up to 3 hours at least the rate of decomposition of guncotton was unaccelerated. The guncotton was heated in a tube of air, as in the heat test.

It should be pointed out that the above equation does not take into account the fact that the temperature to which the heat test paper is exposed in the tube might influence the time of reaction, seeing that the papers are standardized at a constant temperature of 20° C. To determine the point, a heat test tube was jacketed as to its upper portion, and explosives tested while cold water, and also while water near the boiling point, ran through the jacket. No differences in heat test were obtained under the considerable range of temperature of the air surrounding the paper thus produced. There is therefore no objection to applying the determinations made in the glass box to explosives heated in test tubes. . The data supporting this view are as follows :—

Smokeless Powder.	Heat test tube jacketed:	
	with cold water.	with water at 70° C.
A	4′	4¾′
B	22½′	21′

The following Table II. has been calculated from the last equation for all values of T up to 30 minutes. The table gives for each heat test time the values of r, in milligrams $\times 10^{-6}$ of nitrogen peroxide disengaged per unit of volume of tube from the explosive.

Table II.

Rate of rise of concentration of nitrogen peroxide in heat test tube due to decomposition of an explosive, corresponding to the times of heat test given. (Initial lag in heating of test tube not taken into account).

Heat test Time (mins.)	r Mgms. $NO_2 \times 10^{-6}$. per minute per c.c. of airspace.
1	67·0
2	18·1
3	8·65
4	5·21
5	3·56
6	2·55
7	2·07
8	1·68
9	1·40
10	1·20
11	1·046
12	0·926
13	0·829
14	0·749
15	0·683
16	0·627
17	0·580
18	0·539
19	0·503
20	0·472
21	0·444
22	0·419
23	0·397
24	0·377
25	0·359
26	0·343
27	0·328
28	0·314
29	0·301
30	0·290

Although, only approximate, the calculated heat tests may be used to ascertain whether the nitric peroxide liberated during the heat test owes its existence entirely to a process of decomposition, or whether the heat test represents the sum of stored up products which have accumulated in the explosive by slow decomposition, or which have been left behind owing to imperfect purification, having regard always to the physical condition of the explosive.

Up to the present the proper consideration of this subject has been somewhat neglected. Many workers have been inclined to regard the heat test time as being merely the time required for the elimination by the explosive of a "trace" of nitric peroxide, without regard to the quantitative side of the question.

In the sequel, guncotton, nitroglycerine, and ungelatinised mixtures of these, will be treated separately, and the actual mechanism of the heat test analysed.

2. *Application to Guncotton.*—Heat tests taken with a large number of purified guncottons show that the heat test when carried out under the proper standard conditions is fairly constant at 15+or—3 minutes at 170° F.

Necessity for conditioning guncotton.—Under specification conditions the amount of water present in the sample tested is secured by exposing the guncotton for 4 hours to the air. Experiments have shown that only an extreme variation in the amount of water present in the guncotton causes a variation in the time of the test ; but if the specification conditions of exposure are properly carried out the variation in the amount of water present would not be appreciable.

Table III.

Percentage of moisture.	Heat test at 170° F.	Remarks.
2·01	14½′	Prepared under normal conditions of exposure.
0·82	16½′	Another portion of above sample placed in cabinet desiccator over calcium chloride for 24 hours.
0·78	18½′	After 3 days over calcium chloride.
2·0	16′	Sample taken from desiccator and placed under bell jar over water for 24 hours.
2·2	16½′	Sample over water for 14 days.
0·6	20′	Sample then taken from the bulk which had been dried over calcium chloride *in vacuo* for 2 days.
0·29	55′	Sample taken from the bulk dried over phosphoric anhydride *in vacuo* 24 hours.

The figures given in this table point to the danger of accepting such results without taking sufficient account of the preliminary treatment of exposure to air. The effect of this is to permit the guncotton to take up a quantity of water sufficient to prevent the drying of the heat test paper. If the exposure be sufficient, the guncotton cannot take up more than a certain proportion of water, the quantity, as is shown by Will (Mitt. Zentralstelle, 1904, IV, 1—33 ; this J., 1905, **24**, 148) being a function of the degree of nitration. If the guncotton be very wet through imperfect drying or insufficient exposure, thereby leaving adherent water, the heat test is prolonged and unsatisfactory, a diffused band being obtained, with a large excess of moisture visible in the cold part of the tube. As a further example of the necessity for having the normal or constitutional quantity of water in the guncotton, the following experiment may be quoted.

	Heat test at 170° F.
Normally exposed	15′
Dried 4 hours at 80° C., and cooled in desiccator......	25′
Sample of the same with some damp Jena glass wool over the guncotton	14¾′

In order to ascertain whether the heat test time in the case of a stable guncotton was sufficient for the production of the standard tint on an Abel paper by the decomposition of the explosive, the calculation has been carried out in accordance with the equation given above.

Determination of the rate of heating in the test tube.

The necessity of taking into account the fact that a heat test tube requires some minutes to rise to the temperature of the bath was pointed out by Guttmann (this Journal, 1897, **16**, 290). In the present work the rate of heating of tubes of guncotton under test conditions was observed when the bath was maintained at constant temperatures of 110°, 120°, 140°, 160°, 170° F. In carrying this out, however, it was decided not to use a mercurial thermometer to measure the rise of temperature, since on account of the large mass of the bulb a considerable amount of heat might be conducted away from the explosive. The temperature was measured by means of a very small thermojunction of copper and eureka wire embedded in the guncotton. By means of a delicate galvanometer readings were taken at intervals of 15 seconds and the curves (Fig. 1) were plotted.

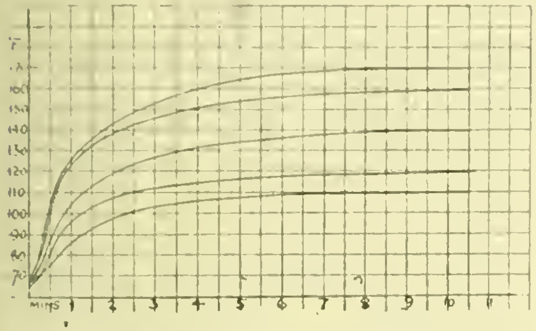


Fig. 1.

These curves show that in all cases a certain time must elapse before the tube rises to the temperature of the bath.

Allowance must therefore be made for the lag caused by the time of heating up of the tube. This will be dealt with below.

Discussion of exterpolation-formula for the decomposition of guncotton.

When guncotton is subjected to thorough purification by an appropriate method of boiling (Cf. Robertson, J.S.C.I. 1906, 25, 624) its rate of decomposition when subjected to the Will test (2. Mitt., Zentralst.) is constant.

The quantity of nitrogen disengaged was indicated by Will, who put forward the equation

$$\log N = 8{\cdot}84221 - 22{\cdot}857 \times 0{\cdot}9932^{t};$$

but it has been long recognised that the simpler law of a doubling of the rate of decomposition for every 5° C. (suggested by Guttmann from heat test considerations [*loc. cit.*]) fits the results equally well. We thus have

$$\log N = -8{\cdot}5047 + 0{\cdot}060206\ \Delta$$

N being the number of milligrammes of N evolved per quarter hour by 2·5 grammes of guncotton.

In calculating these figures we have taken as a basis the result of a large number of determinations: that 2·5 grammes of stable guncotton yield 0·42 milligrammes of N per quarter hour at 135° C.

The following Table IV. shows the rate at which guncotton decomposes at different temperatures.

TABLE IV.

Temperature, Centigrade.	Milligrammes N per quarter hour from 2·5 grammes of guncotton.
135°	0·42
130°	0·21
125°	0·105
80°	0·000205
76°·7 (=170° F.)	0·000130
70°	0·000051

Calculation of Heat Test of stable guncotton according to (1).

The specification quantity of guncotton taken in a heat test is 1·33 grms. (20 grains), and this is heated at 170° F. (76·7° C). The nitric peroxide given off is distributed through 18 ccm. of gas in the heat test tube.

The value of r at 76·7° C. (see Table IV.) is therefore

$$0{\cdot}000130 \times \frac{1.33}{2.5} \times \frac{46}{14} \times \frac{1}{15} \times \frac{1}{18} =$$

$$0{\cdot}84 \times 10^{-6} \text{ mgrms. of } NO_2 \text{ per min. per c.c.}$$

The values of r at other temperatures may be obtained from the following equation

$$r = 10^{0{\cdot}000206\,\Delta - 10{\cdot}69276}$$

where Δ is the temperature in centigrade degrees.

In order to calculate what the lag at any temperature will be, the value of r at each instant is ascertained from the above equation.

We thus arrive at the following table:—

TABLE V.

Heating of Guncotton at 170° F.

Time from commencement, seconds.	Temperature in degrees C.	r mgrms. $\times 10^{-6}$
15	27·3	·0009
30	40	·0052
45	49·3	·0188
60	51·5	·025
75	55·6	·045
90	57·2	·056
105	59·4	·076
120	62·2	·113
135	63·9	·143
150	64·7	·159
180	67·2	·225
210	69·4	·308
240	71·1	·387
270	72·8	·490
300	73·6	·547
330	74·2	·595
360	74·7	·638
390	75·0	·662
420	75·3	·693
480	75·6	·722
540	76·1	·774
660	76·7	·841 Bath temp.

The temperature of the guncotton was practically equal to that of the bath at the end of 9 mins. If therefore the values of r are plotted against time we find that by integration the sum up to 9 minutes is $3{\cdot}76 \times 10^{-6}$ mgrms. of nitric peroxide.

But if the guncotton had remained steadily at the final temperature (76·1° C.) from the commencement, the total amount of nitric peroxide would have been produced in 3·76/0·77 = 4·9 mins. Hence the lag is 9—4·9 = 4·1 mins. By a similar method the lag at other temperatures may be computed, as follows:—

TABLE VI.

Degrees F.	Minutes.
210	4·5
170	4·1
160	4
150	4
120	3

Comparison of results obtained with the calculated results.

It is thus possible to calculate the heat test of a guncotton at any temperature. From the above equation the value of r is obtained and the time corresponding to this is found by reference to Table II.

To the resulting time is added the amount of lag. The following table shows a comparison between the results obtained by calculation and by experiment.

TABLE VII.

Temp. °C.	r	Time from Table II	Lag.	Calculated time.	Observed time.
70	0·332	27′	4′	31′	28′ 29′
72	0·43	21′·5	4′	25′·5	25′ 25½′
74	0·59	17′	4′	21′	21′ 21½′
76·7	0·84	13′	4′	17′	15′
79·5	1·24	10′	4′	14′	12′
82·25	1·81	7·5	4′	11·5	11½′
100·	21·26	1′·75	4½′	6·25	4½′

Tests were also carried out with quantities less than those given in the specification. In these cases the rate of heating has not been determined, but it is obvious that the lag will be less.

Thus, when half the ordinary heat test quantity is heated at 170° F., the test is obtained in 22 minutes: calculated time (no lag) 22 mins. Half a gramme of guncotton was also tested at 100° C. and gave 4½′ and 5½′, whereas the calculated time (no lag) was 3½′.

It is to be noted that guncottons which contain non-volatile catalysers (*cf.* Robertson, this Journal, 1902, **21**, 820, and 1909, **28**, 457) give much the same heat tests as the stable guncottons referred to in the present work. This is owing to the fact that the initial decomposition of such guncottons is not accelerated by the catalyser. By the Will test even at 135° C. such guncottons may be heated for 15 minutes to 13 minutes before an accelerated rate of decomposition sets in.

Experiments with guncotton to ascertain (a) if its heat test is due to dissolved nitric peroxide or (b) to some adventitious removable impurity.

(a) To determine whether the heat test of guncotton is due to dissolved nitric peroxide the following experiments were carried out.

1. An attempt was made to improve the heat test of guncotton by prolonged storage *in vacuo* over caustic potash.

A sample of guncotton was prepared in the usual way for heat test. After the customary 15 minutes' heating at 50° C. it was divided into two portions, A and B.

Portion A was exposed for 4 hours, and heat tested. It gave two results of 15, 15 minutes.

Portion B was placed *in vacuo* over KOH for one week at 40° C. At the end of that time it was exposed for 4 hours to the air and heat tested again. The results obtained were 15, 15½ minutes.

It was therefore apparent that guncotton contains no easily removable NO_2 in solution, or an improved heat test would have been obtained.

2. Some guncotton was prepared in the usual way for the following series of continuous heat tests.

Two tubes of guncotton were first heat-tested (at 170° F.). The times obtained were 13½, 14 minutes. The tubes were taken off the bath and set aside to cool, with the corks (and papers) still inserted, for about 18 hours. The corks were then removed and the air in the tubes changed. Fresh papers were inserted and the tubes put on again for heat test. The times obtained were 9½, 9 minutes.

Clearly more NO_2 is now present inside the test tube than in the previous test, and it cannot have arisen from anything but the decomposition of the guncotton.

In order to prove that this lower test is due to the retention by the guncotton of some of the NO_2 formed in the previous heat test the two tubes were then treated separately as follows:—

A.	*B*.
1. Removed from heat test bath, disconnected cork, and cooled for 15 minutes in air. Put in fresh paper and heat-tested again. Time, 8½ minutes 2. Repeated this process Time, 8 minutes	1. Connected heat test tube to vacuum and kept on heat test bath for 1 hour. Then allowed to cool *in vacuo* for 15 minutes. Put in fresh paper and heat-tested Time, 13½ minutes.

From A it appears that when the products of decomposition can remain in contact with the guncotton they do so, and hence a lower heat test is obtained.

From B it is seen that it a tube which has given a low test on reheating is evacuated and heated, the adhering products can be removed and a result approximating to the original heat test is obtained.

It may be concluded from these experiments that normally prepared guncotton of a heat test of 15 minutes at 170° F. does not contain any appreciable quantity of nitric peroxide in solution.

(b) To test the view held by some that the heat test indication is the result of the presence of some small adventitious and removable impurity, the following experiments were carried out.

In support of the view that the decomposition of a trace of impurity left in the guncotton, and of little moment in regard to the real stability of the substance, is the cause of the heat test indication, experiments have been adduced from time to time in which the explosive is subjected to a continuous test; that is, the tube is kept in the bath and fresh heat test papers are inserted as those in position come up to tint. Under these circumstances a fall occurs in heat test, followed later by a rise. This rise, however, does not by any means indicate that the guncotton is getting more stable by the elimination of an impurity, but is simply due to the desiccation of the heat test paper by the dried and heated guncotton in the tube. When a trace of moisture is added to the tube at this stage, the paper resumes its normal ability to react with the nitrous acid present, and a prompt fall in heat test occurs. The necessity for avoiding an excessive desiccation of the paper has been referred to already (page 132). The results of the experiments which bring this out are as follows:—

TABLE VIII.

Continuous Heat Tests of Guncotton.

Guncotton at start exposed in specification manner.

Expt. I.		*Expt. II.*	
15′	(normal test, with small plug of Jena glass wool on top of guncotton).	14½′	(normal test).
5′		4¼′	
4½′		4½′	
3′		2¾′	
2½′		3¼′	
3′		2¾′	
3′		3¼′	
2¾′		5¾′	
4½′		6′	
4½′		6½′	
6′		5½′	
8½′		9½′	
9′		7½′	
8′		9½′	
9½′		9′	(plug of damp glass wool dropped in).
4½′	(1 drop of water dropped on to glass wool).	6′	
3½′		3½′	
3½′		3½′	

3. *Application to nitroglycerine. Importance of considering the liquid state.*—In the ordinary method of heat testing nitroglycerine, 50 grains (2 c.c.) of the explosive are used, and this by virtue of its liquid character remains in bulk at the bottom of the heat test tube, the only exposed surface being the meniscus of the liquid. Consequently, on heating, if there is any nitric peroxide formed, it will distribute itself between the liquid and the gas in proportion to the solution-pressure of the liquid with respect to nitric peroxide at the particular temperature.

In an actual heat test of nitroglycerine, there will be a gradual flow of nitric peroxide, as it is liberated, from the liquid to the gas above, the liquid however, retaining all the time a definite quantity of the nitric peroxide in solution. It is obvious that the higher the temperature at which the test is carried out, the smaller the amount of nitric peroxide which remains in solution in the nitroglycerine.

From the fact that nitroglycerine decomposes at about ten times the rate of guncotton (Robertson, J. C. S., 1909, **45**, 1248) and that the quantity used in a heat test is double, whilst the temperature of the test is 10° F. higher, it would be expected that if all the nitric peroxide liberated were free to pass into the gas in the heat test tube the heat test would be far lower than that of guncotton. In actual practice, however, nitroglycerine usually has a heat test of about 20 minutes at 180° F.

When, however, precautions are taken to increase the surface of the nitroglycerine, by comminution on purified silica wool, much lower heat tests are obtained even with considerably smaller quantities than 50 grains (3·2 grms.).

Experiments on comminution of nitroglycerine.—The glass wool made from ordinary soda glass cannot be used for the purpose of comminuting nitroglycerine, owing to its alkaline character. Thus, when 1·8 grms. of ordinary soda-glass wool were introduced into 3·2 grms. of nitroglycerine and the mixture heat tested at 180° F., a very high heat test was obtained.

Nitroglycerine alone	17	minutes.
,, + soda-glass wool	60	,,

The same quantity of the wool, on titration with $\frac{N}{1000}$ H_2SO_4 with iodeosin indicator, was found to contain 1 mgrm. of alkali (calculated as NaOH). Difficulties were also experienced in purifying wool made from Jena glass, which in the drastic purification employed is partially disintegrated, with liberation of a small quantity of oxide of iron.

After a large number of trials, it was found that non-reactive wool could be made from silica rod which was drawn off in an oxyhydrogen flame on to a rapidly revolving drum. It was washed with acid and alkali, and purified by boiling with distilled water until the washings were perfectly neutral.

It was found that in the process of comminution care was necessary to prevent felting of the nitroglycerine by small fragments of wool. This was partially overcome by using the latter in the form of long parallel fibres, but even then it was found difficult to introduce the long fibres into the heat test tube without smearing the upper portion of the walls of the tube with nitroglycerine. Finally the following process was adopted:

The silica wool is cleansed and purified so as to remain in the form of parallel bundles of fibres about 4—5 cms. long. Two grammes of silica wool are weighed into a carefully cleaned porcelain basin, and 0·5 cc. = 0·8 grm. (or in some cases half this quantity) of nitroglycerine allowed to fall upon it drop by drop, and preferably on the ends of the fibres as it then spreads throughout their length by capillarity.

Care is then taken to smear the fibres as thoroughly as possible with the nitroglycerine without either breaking or entangling them. When this is accomplished, the fibres are broken into lengths of about 1 cm. by means of a glass rod with a flat end. The small bundles are then thoroughly mixed and entangled without further breaking. They are then dropped into a heat test tube and pressed lightly down.

It was found that the bulk of silica wool convenient for the test was two grms. In some cases, however, larger amounts of both wool and nitroglycerine were used.

The following experiments illustrate the effect of such comminution.

Heat test of nitroglycerine (3·2 grms.) (specification) 17 mins. at 180° F.

Heat test of nitroglycerine (0·8 grms). 19 mins. at 180° F.

2 grms. silica wool. 0·8 grm. N.G. 5 mins. at 180° F.

Determination of the rate of heating in test tubes.—The rate of heating of test tubes containing 2 grms. of silica wool and 0·8 grm. of nitroglycerine was determined by the same method as that used in the case of guncotton (p. 13).

The results are shown plotted in the curves, Fig. 2.

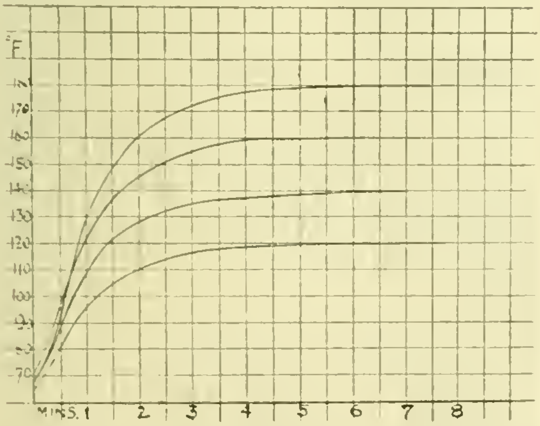


Fig. 2.

It will be observed that they are very similar to those for guncotton, but that the silica wool rises to the bath temperature rather more rapidly than the guncotton.

Calculation of the Heat Test of Nitroglycerine.—The rate of decomposition of nitroglycerine has been determined experimentally down to a temperature (90° C.) which is much nearer the actual heat test temperature (82·2° C.) than is the case with guncotton. (Robertson, *loc. cit.*). By estimation of total nitrogen, checked by the spectroscopic estimation of the nitrogen existing as nitrogen peroxide, it was found that the results showed a uniform increase with rise of temperature, obeying the law:—

$N = 10^{a + b \triangle}$, where $\triangle$ = temperature in degrees centigrade,
a = 7·32163,
b = 0·060206, and
N = mgrm. nitrogen evolved per quarter hour from 2·5 grammes of nitroglycerine.

This equation can readily be modified to give as the rate of rise of concentration (r) of NO_2 in a heat test tube when 0·8 grammes of nitroglycerine are heated at any temperature. We thus get:—

$$r = 10^{0·060206 \triangle - 0·731231}$$

The following table shows the value of r for different temperatures and quantities of nitroglycerine.

TABLE IX.

Temp. F.	Temp. C.	Value of r in milligrams per minute for different weights of Nitroglycerine. 0·8 grm.	0·4 grm.	0·1 grm.
180°	82°·2	$16·4 \times 10^{-6}$	$8·2 \times 10^{-6}$	$2·05 \times 10^{-6}$
170°	96°·7	7·69 ,,	3·84 ,,	0·96 ,,
160°	71°·1	3·54 ,,	1·77 ,,	0·44 ,,
150°	65°·6	1·65 ,,	0·82 ,,	0·20 ,,
140°	60°·0	0·76 ,,	0·38 ,,	0·09 ,,

Since the quantity of silica wool present will determine the rate of heating, the amount of lag will be practically the same for the different quantities of nitroglycerine used.

This was calculated in a manner similar to that employed for guncotton, with the following results:—

TABLE X.

Temperature F.	Minutes.
180°	3·7
170°	3·5
160°	3·0
150°	2·5
140°	2

From the above material the theoretical heat test of any quantity of nitroglycerine at any temperature can be ascertained by referring to the value for r (Table IX.) and then to the time corresponding to this r value as shown in table II (page 132).

To this time is added the amount of the lag given above (Table X).

Thus, if 0.4 grm. of nitroglycerine are heated at 150° F., the value of r is $0·82 \times 10^{-6}$ Referring to Table II, we see that this value corresponds to a time of a little over 13 minutes (say 13¼ minutes).

The lag given above is 2·5 minutes. Hence the heat test should be 15¾ minutes.

Comparison of results actually obtained with the calculated results.—In carrying out heat tests of nitroglycerine comminuted on silica wool it is found that a very satisfactory agreement between theoretical and observed values can be obtained at high temperatures. At lower temperatures, however, the degree of comminution obtained plays a much more important part in the actual result. With experience it is possible to get fair approximations to the theoretical values at temperatures at low as 150° F. It is obvious that at this temperature the solubility of the NO_2 in the nitroglycerine itself is a serious factor. Possibly this will account for the fact that if a tube of comminuted nitroglycerine is heated until the test paper is just up to standard tint (even at 180° F.), taken off the bath and allowed to cool, the colour disappears rapidly, just as it would if the test paper in an ordinary heat test were taken out and hung in air. This would show that the concentration of the NO_2 is rapidly diminished by reabsorption in the nitroglycerine.

The following table of experiments shows the results obtained compared with the calculated values.

TABLE XI.

Expt. No.	Quantity of silica, grms.	Quantity of nitroglycerine, grms.	Heat-test of nitroglycerine at 180° F.	Temp. of Test° F.	Observed Time.	Calculated Time.	Remarks.
1	2	0·8	27′	180	5½′	6′	long fibres.
2	2	0·8	27′	180	6′	6′	,, ,, (another observer)
3	2	0·8	27′	140	25′	16¼′	long fibres.
4	2	0·8	27′	180	6′	6′	,, ,,
5	2	0·8	27′	160	14′	8′	,, ,,
6	2	0·4	27′	160	20′	10¾′	,, ,,
7	2	0·4	27′	160	20½′	10 ′	short fibres.
8	2	0·4	27′	160	19½′	10 ′	,, ,,
9	2	0·8	17′	180	5½′	6′	long fibres.
10	2	0·8	17′	160	8′	8′	,, ,,
11	2	0·8	17′	140	19′	16¼′	,, ,,
12	2	0·8	17′	170	7′	7′	,, ,,
13	2	0·8	17′	150	20′	10¼′	,, ,,
14	2	0·4	17′	160	14½′	10¼′	,, ,,
15	2	0·4	17′	160	13′	10 ′	short fibres as specified
16	2	0·4	17′	180	6′	7′	,, ,,
17	2	0·4	17′	150	17′	16′	,, ,,
18	2	0·4	17′	150	15½′	16′	,, ,,
19	4	0·8	17′	140	14′	16¼′	,, ,,
20	2	0·4	17′	140	33′	25′	,, ,,
21	2	0·4	17′	140	35′	25′	,, ,,
22	2	0·4	17′	150	18′	16′	,, ,,
23	2	0·4	15½′	160	17½′	10½′	silica recovrd. (once used: felting)
24	2	0·4	15½′	160	13½′	10¼′	as specified
25	2	0·4	15½′	160	16′	10¾′	,, ,,

Experiments on the influence of dissolved nitric peroxide on the Heat Test of Nitroglycerine. The possibility of the existence in nitroglycerine of dissolved nitric peroxide was dealt with by a method similar to that applied to guncotton.

Nitroglycerine is an excellent solvent for nitric peroxide, and evidence of its containing that gas in solution might be expected from the fact that its rate of decomposition is about ten times that of guncotton, as has already been stated. The results of the following series of experiments supply this evidence, and serve to show that the Abel heat test, as applied to uncomminuted nitroglycerine, is dependent to a considerable extent on the amount of nitric peroxide already in solution in the nitroglycerine.

1. *Elimination of nitric peroxide on standing.* It is well known that when samples of nitroglycerine are allowed to stand in gutta-percha bottles, the heat test rises, probably, on account of the absorption of nitric peroxide by the gutta percha. Exposure to the air in a non-reactive vessel of large surface will often bring up the heat test. Examples are :—

Before exposure.	After 24 hours exposed to pure air in platinum dish.
10′	16½′
13′	17′

2. *Elimination of nitric peroxide by warming.*—Samples of nitroglycerine were filtered and divided into two portions. One portion was heat-tested, whilst the other was heated exposed to the air at 70° C. for 30 minutes on a water bath, and then tested. Results :—

Heat test before heating.	Heat test after heating.
18′	26′
30′	32′
28′	31′

The heating has more effect on a nitroglycerine of low heat test than on one of high heat test.

3. *Elimination of nitric peroxide by air-blowing.*—In many cases the heat test of nitroglycerine may be improved by blowing air through it. Examples are :—

Before blowing.	After blowing.
13′	18′

4. The following experiment shows conclusively that in an ordinary Abel heat test there is an increase in the amount of free NO_2 in the heat test tube.

A sample of nitroglycerine was heat-tested and a test of 16½ minutes obtained. The tube was allowed to cool completely with the cork left in. When cooling was complete the test paper was changed and the nitroglycerine re-tested. Result : 10 minutes. A further test, after cooling, was made, with a result of 6 minutes.

The lower test can only mean that the solution-pressure of nitric peroxide in the nitroglycerine has increased.

The sample, exposed in a platinum dish, was now placed in a vacuum over KOH overnight, and retested in the morning. Result : 13 minutes. Finally, after two more days' evacuation, the test rose to 32 minutes, showing that the nitric peroxide previously liberated can be removed by evacuation.

5. When the same experiment was carried out with the nitroglycerine comminuted on silica wool, a very slight difference was observed.

In the case of 3·2 grms. nitroglycerine comminuted on 5 grms. of silica wool, the heat test only rose half a minute, from 4½ minutes to 5 minutes.

It is thus very clear that, in the usual method of heat testing purified nitroglycerine, little indication of the real decomposition of the explosive is obtained, but rather an index of the amount of dissolved nitric peroxide. The latter fluctuates considerably as the methods of storage of the explosive vary, but if it does not become absorbed by the containing vessel its concentration may increase, on account of the slow decomposition of the nitroglycerine itself.

6. *Application to Mechanical Mixtures of Guncotton and Nitroglycerine.*—The heat test of these mixtures, technically termed "pastes," has always been regarded as somewhat anomalous. Jacqué (Zeit. f. d. g. Schiess-u. Sprengstoffwesen, 1, 1906, 396), says : "For example, a guncotton gives me 25 minutes with the Abel test at 80°C. ; a nitroglycerine gives half an hour by the same test at 72° ; I mix the two bodies, and I take a test of them. I find 12 minutes at 70°. . . . Am I justified in concluding that the simple act of mixing the nitrocellulose with the nitroglycerine and the water is the cause of the instability of the substance ?" Guttmann also (Cantor Lectures, J.R.S.A., 1909, 175) calls attention to this effect.

An actual example, in which the heat test was applied to the ingredients in the quantities used for the mixture, may be quoted.

The ingredients were nitroglycerine of 19′ heat test at 180° F. for 3·2 grms., and guncotton of 16½′ at 170° F. for the usual 1·3 grms. Under the conditions of the experiment, 0·8 grm. of this nitroglycerine gave 35′ heat test at 170° F., and 0·8 grm. of this guncotton gave 68′ (as dried from oven) heat test at 170° F. The mixture, however (1·6 grms.), gave a heat test of 19′ at 170° F.

The effect of mixing guncotton with nitroglycerine was more closely followed up by testing mixtures containing three guncottons of different types. These were : A, a guncotton containing 0·15 per cent. of alkaline matter as calcium carbonate, B, a neutral guncotton, and C, a guncotton containing 0·7 per cent. of sulphuric acid as sulphuric acid ester.

TABLE XII.

		Heat tests of ingredients.		Heat tests of mixture.	Total weight 1·3 grammes.					
Type of guncotton used.		Nitroglycerine (on 3·2 grms	Guncotton (on 1·33 grms.)	Nitroglycerine, per cent. Guncotton, per cent.	97·5 2·5	95 5	90 10	80 20	70 30	60 40
A	At 170° F.	—	17′		—	—	120′	36′	19′	16′
	At 180° F.	19′	—		31′	32′	86′	28′	17′	13′
B	At 170° F.	—	17′		—	—	—	—	—	10′
	At 180° F.	14½′	—		—	15′	38′	13′	—	6½′
C	At 170° F.	—	16′		—	—	40′	11′	7′	5′
	At 180° F.	19′	—		21′	30′	34′	9′	6′	4′

It will be seen that in all cases a rise in heat test occurs at first on adding small proportions of guncotton, but that this is soon succeeded by a fall. It was noticed that this fall occurred when sufficient guncotton was added to break up the meniscus of the liquid nitroglycerine. As the nitroglycerine became more and more comminuted, the heat test steadily declined.

The initial rise, during the existence of the unbroken meniscus, was at first attributed to the presence of the small quantity of alkaline matter in the guncotton. The same effect was obtained, however, with a guncotton (B) quite free from alkali, and it therefore became necessary to seek other explanations. These may be found in the lowering of the solution-pressure of nitric peroxide in nitroglycerine by the suspended guncotton, which has an appreciable, though feeble, affinity for nitric peroxide (from work by Dr. R. C. Farmer), or possibly to increased viscosity due to gelatinisation of the soluble nitrocellulose in the guncotton.

The lowering of the heat test of the paste made with guncotton containing sulphuric acid ester (C) is very marked. Under the Will test, such a guncotton gives a highly accelerated evolution of nitrogen (Cf. Robertson, this Journal 1902, **21**, 820, and 1909, **28**, 457), and the same catalytic effect of the sulphuric acid ester is exerted in the case of the paste on the more reactive and more readily decomposed ingredient, the nitroglycerine.

The above experiments and views serve to elucidate what has hitherto been considered the anomaly of the paste heat test. The quantitative consideration of the heat test shows that the stability is not to be regarded simply as the time of the heat test, but rather as the rate of formation of nitric peroxide from a constant weight of the explosive. Surface is all-important. If the nitroglycerine were as well comminuted in a paste as it was in the experiments described with silica wool, even lower results would be obtained. The felting of the fibres, however, prevents the elimination of nitric peroxide to some extent.

E. *Summary and Conclusions.*—In the following summary it is to be understood that, unless otherwise stated, reference is made to fully purified guncotton and nitroglycerine:

1. When Abel heat test papers are exposed to an unlimited quantity of air containing nitric peroxide, the time required to produce a standard tint is inversely proportional to the concentration of nitric peroxide.

2. For the standard heat test papers, now prepared at Waltham Abbey, the product of time in minutes by the concentration in milligrammes of nitric peroxide per cubic centimetre is 31×10^{-6}

3. The total quantity of nitric peroxide absorbed by one of these test papers in coming to standard tint is 135×10^{-6} milligrammes.

4. It is possible to calculate the heat test of an explosive the rate of decomposition of which at a given temperature is known.

5. The calculated heat test of guncotton at various temperatures and with varying quantities agrees very well with the results of experiment.

6. This agreement, taken in conjunction with many other experiments, serves to show that in the case of guncotton the Abel heat test represents the decomposition during the test of the guncotton itself, and is not due to dissolved impurities.

7. When guncotton is to be heat-tested it is necessary to "condition" it. Very dry guncotton gives a high test, owing to the drying of the test paper, whereas very wet guncotton gives a high test, owing to the excess of water which condenses in the test tube, absorbing a good deal of the nitric peroxide.

8. Since the heat test of a guncotton is only a measure of its initial decomposition, the test cannot safely be regarded as an absolute indication of its stability. Under the Will test, non-volatile catalysers may not give rise to an abnormal rate of decomposition until after 15—30 minutes at 135° C. have elapsed, which, at 170° F., would correspond to much more than the actual duration of the heat test.

9. When nitroglycerine is heat-tested in the normal fashion, the test obtained is very much higher than would be expected from the known rate of decomposition of nitroglycerine, but the calculated test is supported when the nitroglycerine is comminuted on specially purified silica wool.

10. The solubility of nitric peroxide is so marked that at lower temperatures the observed results were mostly too high.

11. As ordinarily heat-tested, the time represents merely the solution-pressure of nitric peroxide in the nitroglycerine.

12. When small quantities of guncotton are added to nitroglycerine, the heat test rises, owing to the lowering of the solution-pressure of the nitric peroxide in the nitroglycerine, or to the increased viscosity of the liquid,

As soon as sufficient guncotton is added to break up the liquid meniscus, the heat test falls rapidly, owing to the comminution of the nitroglycerine. On account of the felting of the fine fibres, the comminution of the nitroglycerine is never so perfect in pastes as it is when the nitroglycerine is spread out on silica wool.

13. When guncotton containing sulphuric ester is mixed with nitroglycerine, the ester readily accelerates, by catalysis, the decomposition of the nitroglycerine, and low heat tests of pastes are obtained.

In conclusion, it should be stated that although admittedly there are points in connection with the Abel test which sometimes render it difficult to interpret the results obtained, yet in a very large number of cases, if the test is regarded from a physical point of view, much information on the intrinsic decomposition of explosives can be obtained. It will be seen from Table II., that, for any explosive which decomposes on heating with evolution of nitric peroxide, the differences between the Abel tests have a smaller quantitative value as the test becomes prolonged. This has always been appreciated by explosive chemists, although we doubt whether it has previously been deduced from theoretical grounds. The methods developed above in connection with Abel heat test papers are in many cases applicable to the investigation of other indicators, and should serve to settle the choice from among these on a more solid foundation than the results of merely empirical comparisons.

Finally, we are indebted to Major J. H. Mansell, R.A., for the interest he has taken in this work, and to the Director of Artillery for permission to publish the results.

Discussion.

Captain T. G. Tulloch, said that he had noticed on several occasions, especially with nitrocellulose powders, great fluctuations from time to time in the heat tests obtained with any one sample. Only that day he had had some heat test results sent him of a batch of nitrocellulose sporting powder which was now about 9 years old. When new this gave a heat test of about 20 minutes. After about 4 years the heat test had dropped to 9 minutes, but a few days ago it was tested again and found to give a heat test of 85 minutes. It was difficult to account for such fluctuations, but perhaps Dr. Robertson could give some idea as to what had happened to cause them.

Captain M. B. Lloyd asked Dr. Robertson if he was satisfied that his assumption that r, the rate of rise of concentration was truly a constant. From certain facts which had come under his notice, he was inclined to think that, with such an explosive as cordite, that was not the case. It was well known that heat tests, of the same guncotton in the neighbourhood of 25 to 27 minutes with two different heat test papers, might give very closely concordant results. But there might be a cordite which, with one of these test papers, might give 25 minutes; and with the other make of test paper, 45 minutes. It appeared to him that if the rate were constant for guncotton, with which the two papers which gave practically concordant results, it was impossible that the rate could be constant with cordite, where such widely different results were given by the two makes of paper.

Dr. J. N. Goldsmith asked if the action of light on nitrocellulose had been studied, because he understood that when previously exposed to illumination there was some decomposition. Nitrocellulose was usually dried in the dark, but in the laboratory it was dried in desiccators exposed to light.

Mr. G. W. MacDonald said with regard to Dr. Robertson's experiments on the drying of guncotton in vacuum desiccators, and then heat testing, that his experience had been totally the reverse, with the exception of the case of sulphuric acid. He had exposed guncotton over calcium chloride and phosphorus pentoxide, and found, in those cases, that the heat test was lower than the original sample, containing a normal amount of moisture. But using sulphuric acid as a desiccating agent it was always extremely high, from 30 up to 40 minutes. He did not know what explanation could be offered to account for this difference.

Dr. Robertson, in reply, said the questions asked by Captain Tulloch and Captain Lloyd dealt with gelatinised explosives, with which he said at the beginning he was not dealing. He was glad to learn that Mr. MacDonald confirmed the lengthening of the heat test by desiccation of guncotton over sulphuric acid, but he could not say why he had not obtained the same effect with phosphoric anhydride, unless the latter had contained some impurity. In reply to Dr. Goldsmith, the action of light on guncotton had not been approached from the present point of view.

Mr. B. J. Smart said Capt. Lloyd raised the point that if two different kinds of test paper were tested against different explosives, although with one explosive they might give identical results, when tested with another explosive the results might be very different. In the Abel heat-test, the sensitiveness of the test paper could be expressed as the quantity of nitrogen peroxide required to produce the standard tint, that is the Q value in the equation given on page 130. By varying Q and K in this equation, it would readily be seen that cases of this kind could easily be calculated. With explosives of *r* value 2·55 and 0·539 respectively, the Abel times would be 6 and 18 minutes, but with a smaller Q value these times would be brought much nearer together.

Scottish Section.

Meeting held at Glasgow, on Tuesday, 23rd November, 1909.

D. J. PLAYFAIR IN THE CHAIR.

THE ANALYSIS AND COMPOSITION OF COFFEE, CHICORY, AND COFFEE AND CHICORY "ESSENCES."

BY R. R. TATLOCK AND R. T. THOMSON.

It might be thought, from the volume of literature on coffee and chicory, that the subject had been dealt with sufficiently to serve all purposes for the detection of adulteration in the former article. But when we examine the literature in this connection it is clear that there is something to be done in improving, and if possible, in shortening the methods of analysis, and above all in revising and correcting data which are obviously unreliable. It is in this direction that we propose to go in the present paper, and to extend our observations to the "essences" coffee and chicory which are such prominent articles of of food at the present day.

In making analyses of coffee, the data generally relied upon to determine the genuineness, or otherwise, of coffee are the mineral matter soluble, and insoluble in water, and the specific gravity of a 10 per cent. extract of the sample, or the percentage of extract yielded by boiling a weighed portion of the sample repeatedly with water until exhausted. An item generally omitted is the caffeine, but since the introduction of "coffee freed from caffeine" it seems to be necessary that the percentage of this alkaloid should be determined, as the article referred to cannot be regarded, and is not sold, as genuine coffee, seeing the caffeine has been abstracted, which is certainly not allowed by Section 9 of the Food and Drugs Act, 1875.

Caffeine.—The methods given in text books for the estimation of this alkaloid are either unreliable or tedious and elaborate, but the following simple and rapid process which we devised and have employed for several years, supplies the want. Boil 6 grams of the coffee with 600 c.c. of water for 2 hours, under a reflux condenser, cool, filter off 500 c.c. of the solution (equal to 5 grams of the coffee), evaporate the filtrate to about 40 c.c. in bulk, cool, add 10 c.c. of normal caustic soda or ammonia, and transfer to a separator, washing in with as little water as possible, which need not be more than 10 c.c. Now shake up with three successive quantities of chloroform, consisting of 40, 30, and 10 c.c. respectively, collect these together in a clean separator and shake up first with 10 c.c. of normal caustic soda, and then with 10 c.c. of water, in order to remove all traces of colouring matter, etc. Distil off the chloroform, dry at 100° C., and weigh the caffeine. If the caffeine is coloured it may be dissolved in a little dilute caustic soda, and extracted again with chloroform but if the process is carefully carried out this is not necessary.

Water extract and specific gravity of extract.—The methods generally given for the determination of water extract in coffee or tea, and especially in the latter case, do not appear to give consistent results, too much being allowed to depend on chance. The instructions are to boil with repeated quantities of water till colouring matter ceases to come out, but we do not find this method to give quite consistent results, so we can recommend the following as always giving results within less than a half per cent. Boil 1 gram of the sample with 400 c.c. of water under a reflux condenser for one hour, collect the insoluble matter on a weighed filter, wash two or three times with boiling water, dry at 100° C., and weigh. Traces of oil contained in the coffee may be left in the flask in which the boiling is conducted, and if this is the case it may be dissolved in ether, evaporated, weighed, and added to the insoluble matter contained in the weighed filter. All that now requires to be done is to add together the insoluble in water and the water, and subtract the sum from 100, when the difference will represent the water extract.

In the annexed Table I., we have recorded analyses of well-known varieties of coffee, roasted and unroasted, also of a well-known brand of "coffee freed from caffeine," and of chicory. In addition to the caffeine and water extract, we have also given other data, among which are the specific gravity of a 10 per cent. extract, the ash soluble and insoluble in water, the silica, and the oil extracted by petroleum spirit. These need only be referred to, as they were estimated in the usual way. The dextrose stated in the analyses is simply the copper-reducing power, towards Fehling's solution, of the sample without any preliminary treatment to clarify or decolorise the coffee or chicory solution. The moisture was estimated by drying 5 grams of the sample at 100° C. until no further loss in weight was observed. Two hours generally sufficed for this, but if the heating was prolonged after the maximum loss, the sample began to gain in weight.

Having dealt with the methods employed in testing coffee, we have now to deal with the results of analysis as bearing on the genuineness, or otherwise, of any sample submitted to the analyst, and for this purpose we refer to Table I. From our experience, the water extract, taken singly, is the most reliable of all, as the variations observed in different coffees are not so great as shown by any of the other ingredients, so that it gives the best basis for the calculation of percentage of adulteration, once the fact of adulteration has been proved. It may be held that the specific gravity of the 10 per cent. extract gives quite good results, but these are more variable than the water extract, and the former are dependent, to some extent, on the fineness of the particles of the ground coffee, a condition which does not influence the latter method of testing. As a basis of calculation, 30 per cent. of water extract in coffee and 75 per cent. in chicory, both taken on the sample dried at 100° C., may be assumed where admixture with chicory is proved. The further proofs absolutely necessary are the percentage of caffeine and the mineral matter, including the proportions of soluble and insoluble in water, as well as the silica. If, in a sample, the caffeine falls materially below 1·2 per cent., while the other items just referred to come out practically normal, then the presumption is that the article in question is coffee freed from caffeine, or a mixture of that with genuine coffee. In this case an opinion must be based on the percentage of caffeine found, and the sample may be described as deficient in caffeine, or as coffee from which caffeine has been abstracted, to the extent found. This is the case with what is now advertised as "Lifebelt" coffee, but it will be observed in the analysis given in Table I. that the water extract is fully 1½ per cent. lower than the lowest of the genuine coffees. Of course this difference is too small to make one positive that anything has been removed, but the large deficiency in caffeine proves this, and also shows, when the other figures are taken into account, that little more than caffeine has been extracted.

Such, briefly stated, are the conclusions we should arrive at in certain circumstances. It is necessary, however, to deal with recorded results of coffee analyses. In different text books as low as 0·5 per cent. of caffeine is stated to be present in genuine coffee, but we are quite satisfied that this alkaloid does not fall materially below 1·2 per cent. in any coffee. The low results need not be assigned to inaccuracy on the part of the analyst, but probably to the methods of analysis employed, most of which required very careful manipulation to obtain anything like reliable results. So far as our experience goes, the percentage of caffeine in coffee procured in this country, lies between 1·19 and 1·46 per cent. on the dry sample. These figures are purposely given in our table, because they are the lowest and highest we have found after making a very large number of analyses. It should be stated, however, that since our results were obtained, Lendrich and Nottbohm have reported as high as 2·95 per cent. of caffeine in roasted African coffee, but the finding of such an exceptional percentage of alkaloid would not point to tampering with the article, supposing the other constituents were in order.

The water extract as stated in our table also gives the lowest and highest found, and it will be observed that the range is very limited. These results are considerably higher than those (from 21·5 to 26·5 per cent.) generally given, and cannot be accounted for by the mere difference of method of treatment.

The ash soluble and insoluble in water are much as stated by Allen, and the oil extracted by petroleum spirit is higher than is generally given (10 to 12 per cent. in coffee and 1 per cent. in chicory).

The only other point to which reference may be made is as to whether coffee contains tannin or not. In one of the most recent books on Food Analysis there is an elaborate process given for the determination of tannin in roasted coffee, this being dependent on a 48 hours' fermentation of the coffee after soaking with water, then extraction with alcohol, and final precipitation as tannate of lead in the alcoholic solution. How this distinguishes tannin from colouring matters it is difficult to understand, so that a definition of the former term is required. In our view tannin is a substance which will tan the skin or hide of animals, that is, a body that will be fixed by or combine with the nitrogenous bodies contained in that article, and under the proper conditions should be precipitable by gelatin and certain alkaloids, such as quinine and cinchonine. Now, the so-called tannin or caffetannic acid of roasted coffee has no such properties, so that it cannot be regarded as a real tannin. We have found, however, that unroasted or raw coffee does contain a genuine tannin to the extent of about 4·5 per cent. This was estimated by precipitation with quinine sulphate, a process which we have successfully applied to the estimation of tannin in tea, and which has been corroborated by Löwenthal's volumetric process. From these results it seems clear that although tannin exists in the raw coffee it is destroyed during the roasting. In the foregoing statement about tannin in roasted coffee, we have the support of Professor Procter in his recent book on "Leather Industries," 1908, where he says that "certain bodies (caffetannic acid etc.,) have been described as tannins, but do not precipitate gelatin or tan hide, and are more closely related "to the colouring matters than the tannins." As far as we are aware, the presence of tannin, in the sense which we have described, in raw coffee, has not been previously noted.

There are now a number of brands of essence of coffee and of coffee and chicory in the market, and it is sometimes necessary for the analyst to determine whether the purchased article answers to the name given to it. Thus an essence of coffee should not contain any other extractive matter than what is derived from coffee, with, of course, the legitimate addition of sugar for sweetening purposes, and essence of coffee and chicory should not contain the latter in large excess of the former. It is obvious, however, that as regards the analysis of these articles the conditions must be altered to some extent from those of the original coffee and chicory, and that the data applied to coffee are not quite applicable to the essences. In fact, a knowledge of the composition of the water extract of coffee and chicory are absolutely necessary, and that of commercial caramel requires also to be kept in view. We have, therefore, devoted our attention to the analysis of these products, and find that the estimation of caffeine and ash or mineral matter are imperative, although the proportions of crystallisable and uncrystallisable sugar may be useful in some cases. In the following table are given the average results of our observations in this connection:—

TABLE II.

Average composition of the water extracts of coffee and chicory, and of commercial caramel dried at 100 C.

	Per cent.		
	Coffee Extract.	Chicory Extract.	Enamel.
Organic matter	87	95	97
Mineral matter	13	5	3
	100	100	100
Caffeine	4	none	none
Copper reducing power, as dextrose	2	35	50
Mineral matter soluble in water	12	4	2·5
Specific gravity of 10 per cent. solution	1·0441	1·0395	1·0385
Water originally present ..	—	—	30

In Table III. are given analyses, more or less complete of two different brands of coffee and chicory essence (Nos. 1 and 2) and one of a French essence of coffee (No. 3).

TABLE III.

	Per cent.		
	No. 1.	No. 2.	No. 3.
Caffeine	0·20	0·32	0·68
Crystallizable sugar	38·43	39·73	40·05
Uncrystallizable sugar	12·91	10·05	
Other organic matters	16·26	15·92	
Mineral matter (ash)	1·50	1·63	3·27
Water	30·70	32·35	56·00
	100·00	100·00	100·00
Dry water extract of coffee ..	5·00	8·00	17·00
Equal to coffee (dry)	16·7	26·7	56·7
Dry water extract of chicory .	17·00	11·8	20·00
Equal to chicory (dry)	22·6	15·7	26·6

In the above table, the analyses as regards caffeine and mineral matter of the water extracts of coffee and chicory have been applied in calculating the proportions of coffee and chicory. The method is to calculate the equivalent of coffee from the caffeine, then give this its proportion of mineral matter and calculate the proportion of chicory from the remaining mineral matter. In these cases we must assume that all the mineral matter in excess of that required for the coffee comes from chicory, and in Nos. 1 and 2 the results come fairly close to 100 when the ingredients are added up, but in No. 3 there is a distinct deficiency. In Nos. 1 and 2 it is assumed that the sugar, employed for sweetening and preserving purposes, did not contain any mineral matter, which is probably the case, although traces may be derived from a small proportion of commercial starch glucose, which was present in No. 1, but not in No. 2. No. 3 was an unsweetened variety, and does not contain anything like the proportion of caffeine or mineral matter which ought to be present if it were a pure coffee extract or essence but the excess of other extractive matters may be due to caramel and not to extract of chicory. In fact, the results point rather in the direction of caramel than of chicory, but the difference between the composition of these does not warrant any dogmatism on the question. There is one point, however, which requires attention and that is the composition of a water extract of coffee, if the latter is only partially exhausted. From trials we have made we have come to the conclusion that, whatever the extent of the exhaustion of the coffee, the caffeine and mineral matter bear the same relationship to the total water extract, whether the coffee is fully or only partially exhausted.

So far the course is fairly clear, but we may have a sample in which the caffeine is high in relationship to the total extractive matter, or to the mineral matter, or to both of these. This may be due to enrichment with caffeine, or to the use of a coffee containing an extra high percentage of caffeine. But definite rules cannot be laid down for every case that may present itself, and the analyst can only apply his knowledge and common sense to the varying problems.

We append the results of the examination of the fixed oil that is, oil not volatile at 100° C, extracted from raw and roasted coffee respectively, as regards some of the constants.

	Oil from Raw coffee.		Oil from Roasted coffee.
Iodine value, per cent.	99·00	..	99·00
Saponification value, per cent.	17·95	..	17·95
Unsaponifiable matter	5·26	..	5·51
Specific gravity at 15° C.	—	..	·9354

It will be observed that the constants for the oil contained in roasted and unroasted coffee are practically the same, and that the unsaponifiable matter is higher than that generally found in vegetable oils. The iodine value of the unsaponifiable matter was found to be 171·7, which seems to point to the presence of a heavy resinous oil.

Table I.

Analysis of Coffee and Chicory. Per cent. in samples dried at 100° C.

	Costa Rica (raw).	Costa Rica (roasted).	Costa Rica (roasted).	Mysore (raw).	Mysore (roasted).	East India (roasted).	Mocha (roasted).	Coffee freed from caffeine.	Chicory.
Caffeine	1·22	1·20	1·38	1·18	1·25	1·46	1·19	0·08	none
Water extract	30·80	30·26	30·77	31·02	29·06	29·10	30·76	27·42	75·84
Ash soluble in water	3·06	2·96	3·21	3·01	3·15	3·32	3·14	3·30	1·95
Ash insoluble in water, less silica	0·77	0·88	0·98	0·93	0·96	0·97	0·85	1·01	2·01
Total mineral matter, less silica	3·83	3·84	4·19	3·94	4·11	4·29	3·99	4·31	3·96
Silica (chiefly sand)	trace	trace	trace	trace	trace	trace	trace	trace	4·77
Oil	14·26	12·48	12·96	11·90	12·01	12·90	14·04	13·12	2·73
Tannin	3·75	none	none	4·50	none	none	none	none	none
Specific gravity of 10 per cent. extract	—	1·0102	1·0099	—	1·0102	1·0101	1·0102	1·0101	1·0274
Copper reducing power (as dextrose)............	—	·60	—	—	·62	—	—	—	21·19
Moisture originally present.	8·24	5·50	2·20	10·87	6·68	3·10	5·74	1·22	4·80

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I.—GENERAL PLANT; MACHINERY.

Inflammable goods on ships. Chem. Trade J., Jan. 29, 1910. [T.R.]

The following rules have been drawn up for the guidance of the Board of Trade's Surveyors in dealing with shipments of inflammable liquids at ports in the United Kingdom. The carriage of these liquids on vessels carrying explosive is regulated by byelaws made by the various local authorities; and their carriage on vessels containing Indian stores is dealt with by special regulations made by the India Office.

Turpentine.—Pure turpentine ($C_{10}H_{16}$), and compound of pure turpentine, flashing at 93° F. and over (close test), and packed in drums not exceeding 5 gallons, or in cases containing two 4-gallon tins, or in cases containing 16 1-gallon tins, may be allowed below deck in emigrant ships, but not more than 1,000 gallons may be carried in any one emigrant ship, whether it is on deck or under deck, without the special permission of the Board. The India Office Regulations allow these liquids to be carried below deck in ships carrying stores for the Indian Government if the above conditions as to purity, flashpoints and packing are complied with. No special rules are laid down as to the conveyance of pure turpentine or its compounds on other vessels, except that turpentine in casks is not allowed in sailing ships carrying explosives. Turpentine in casks is not allowed in vessels carrying stores for the Indian Government. These rules as to turpentine do not apply to mineral turpentine or turpentine substitutes.

Alcohol compounds.—Varnishes and other compounds made with alcohol may be carried on deck in emigrant ships if made up in tins containing not more than 1 gallon, packed in sawdust in strong iron-bound cases containing not more than 12 gallons, provided that the total quantity carried in any one ship is not excessive and has been agreed to by the Emigration Officer. If these conditions are complied with, these substances will be allowed on deck in vessels carrying Indian stores. In the case of ordinary passenger and cargo ships, these compounds may be carried either on deck or under deck if the above conditions are complied with.

Compounds of petroleum flashing above 73° F.—The same considerations hold good as in the case of alcohol compounds.

Compounds of petroleum flashing under 73° F.—These are not allowed at all in emigrant ships, ships carrying Indian stores, or ships carrying explosives, without special consideration. Permission may be given to carry these compounds under deck in ordinary cargo vessels if they are made up in small quantities packed in sawdust in strong cases, but each application must be dealt with separately on its merits.

Ships' compositions.—(*a*) A limited quantity may be allowed on deck in emigrant ships if the flashpoint is 93° F. or over, and if the composition is packed in drums containing not more than 2 cwt. (*b*) In vessels carrying stores under the India Office regulations, compositions having a flashpoint of 110° F. or over are allowed under deck; if under 110° they may be carried on deck. (*c*) In other ships the compositions are allowed below deck on the conditions mentioned in par. (*a*) above, but special stowage is required in the case of vessels carrying explosives.

Marking.—In all cases the name of the substance, and the flashpoint as determined by Abel's close test, must be clearly scrieved or stencilled on the outside of the package.

Nitrates in boiler waters. Jamieson. *See* XIXb.

PATENTS.

Separating solids from liquids; Centrifugal apparatus for ——. J. Grossmann, Manchester. Eng. Pat. 24,483 of 1908; date of application, May 14, 1909.

The mixture to be separated is fed into the basket (which is not perforated) of a centrifugal machine by a vertical pipe, which delivers it at a point as near the centre of the bottom of the basket as possible. As the machine rotates, a vertical layer of solid and liquid forms on the peripheral wall of the basket. The portion of the layer farthest from the centre, contains the greatest proportion of solid matter and that nearest the centre is practically all liquid. A curved sliding siphon which passes over the upper edge of the basket is adjusted so that it skims off the liquid layer. As the operation proceeds and the layer of solid matter increases in thickness, the siphon is moved towards the centre so that it continues to carry off the liquid only. When the cake is judged to be of sufficient thickness, the feeding is stopped and the siphon is moved slowly backwards from the centre, so as to skim off the thinner layers of mud, and at this point it may be desirable to increase the speed of rotation. When all the thinner layers have been removed, the machine is stopped, the siphon is lifted out, and the solid cake adhering to the basket is removed.—W. H. C.

Separating liquids from solid substances; Centrifugal machines for ——. E. Jones, Dinting, Derby. Eng. Pat. 27,939, Dec. 23, 1908.

In a centrifugal machine with a non-perforated drum, a scoop is used to remove the layer of liquid after separation has taken place. The scoop is mounted on a cross-bar and may be moved laterally and turned to bring its face into suitable position against the walls of the drum. A second scoop or scraper may also be provided for removing the solid matter.—J. W. H.

Centrifugal [drying] machines. J. W. Macfarlane, Cathcart, N.B. Eng. Pat. 4295, Feb. 22, 1909.

In centrifugal machines in which the dried material is discharged from the bottom, the basket is supported by radial arms, between which discharge takes place. According to this invention the spaces between the arms are provided with flaps, which are hinged in such a way that they close the spaces when the machine is running and fall open when the machine stops.—J. W. H.

Vessels capable of resisting chemical action. H. O. Traun, Hamburg. Eng. Pats. 26,577, Dec. 8, 1908, and 13,338, June 7, 1909.

A tube is formed by bending a piece of sheet metal into a suitable shape and then seaming, rivetting, or making the joint in any other suitable way. The tube is coated on the inside or on both the inside and outside with india-rubber composition capable of being vulcanised, and a bottom piece formed of a sheet of similar rubber composition is then fastened to one end of the tube, the latter being pressed down into the bottom so that the exposed end of the metal of the cylinder is bedded in the rubber to about one-half of the thickness and all the rubber surfaces are in actual contact. The rubber is then vulcanised, when the separate pieces on the side and bottom are cemented together into one piece.—W. H. C.

Pumping or propelling liquids and gases; Rotary apparatus for ——. J. G. Calvert, Gothenburg, Sweden. Eng. Pat. 214, Jan. 4, 1909.

The claim is for a more or less conically shaped casing which surrounds the screw-blades forming the propelling part of the apparatus. The casing may either be fixed, or rotated with the blades, and is provided with an internal conical core or a disc. The pitch of the blades is decreased as they recede from the inlet end of the apparatus.—W.H.C.

Conveying and compressing gases; Process and apparatus for ——. H. Keller, Zürich, Switzerland. Eng. Pat. 14,115, June 16, 1909. Under Int. Conv., March 6, 1909.

A wheel, B, having curved radial blades, C, is rotated by the shaft, A, within a casing. Water enters through the pipe, D, and is discharged from a number of nozzles, F. As the wheel rotates, the action of the curved blades separates the jets of water, as they strike the blades, into a number of separate plugs or pistons, K, K, which enclose portions, L, of the gas which enters at I, between them. The gas is thus compressed and delivered into the exit conduit, H.—W. H. C.

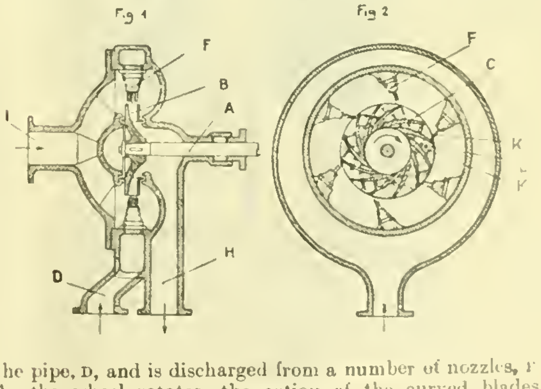
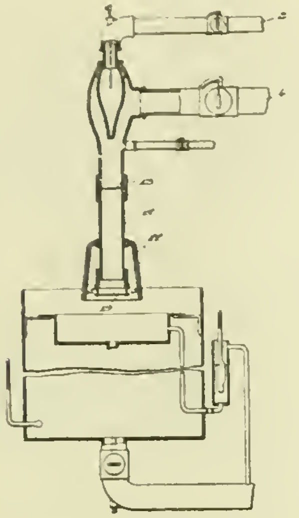


Fig 1 Fig 2

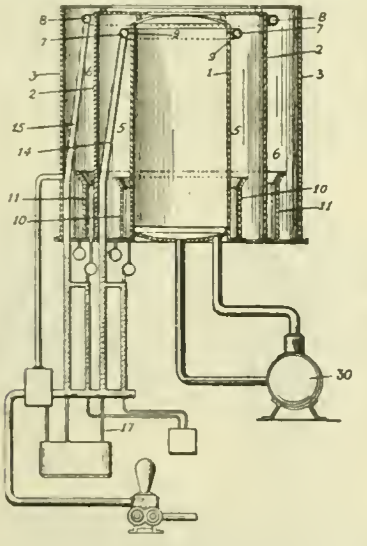
Mixing liquids; Apparatus for ——. J. Szamek, Cambridge, Mass. U.S. Pat. 945,143, Jan. 4, 1910.

The liquids are delivered through the branch pipes, 3, 4, into the upper end of the mixing pipe, 12, and receive a preliminary mixing by means of a star-shaped baffle-plate, 13. At the lower end of the pipe, 12, a plate, 19, causes the vertical column of liquid flowing from the pipe to be discharged through the orifice, *a*, as a horizontal sheet, which impinges against the bell-shaped hood or screen, 22, by which its direction is again changed to the vertical.—W. H. C.



Evaporating liquids; Apparatus for ——. P. Thelen, San Francisco, and J. B. Speed, Berkeley, Cal. U.S. Pat. 945,640, Jan. 4, 1910.

The apparatus consists of a series of concentric shells, 1, 2, 3, spaced apart. The inner shell, 1, is heated internally by steam from the boiler, 30. The liquid to be evaporated is delivered by the pipes, 14, 15, to the perforated rings, 7, 8, from which it flows as a film down the outer surface of the shells, 1, 2. The film, 5, is evaporated by the heat from the inner shell, and the steam given off evaporates the film 6. Partitions 10, 11, in the lower part of the annular spaces, prevent the concentrated liquid flowing down the outer surfaces of the shells from mixing with the condensed liquid which flows down the inner surfaces. The two liquids are withdrawn by separate pipes.—W. H. C.



Rectifying columns. F. Kyll, Cologne, Germany. Eng. Pat. 16,198, July 12, 1909.

See Fr. Pat. 404,152 of 1909; this J., 1910, 77.—J. W. H.

Filtering mediums and the like; Method of cleansing ——. J. Wilson, Wandsworth. U.S. Pat. 945,146, Jan. 4, 1910.

See Eng. Pat. 15,019 of 1908; this J., 1909, 873.—T.F.B.

Filtering materials and analogous substances; Process and apparatus for cleansing ——. J. Wilson. Fr. Pat. 404,734, July 5, 1909.

See Eng. Pat. 15,019 of 1908; this J., 1909, 873.—T. F. B.

Filtering-machine. G. Ridgway, Kalgoorlie, Western Australia. U.S. Pat. 945,193, Jan. 4, 1910.

See Eng. Pat. 5830 of 1908; this J., 1909, 15.—T. F. B.

Separator for pulverulent materials. J. M. Seaver. Fr. Pat. 404,280, June 22, 1909.

See Eng. Pat. 12,958 of 1909; this J., 1909, 1113.—T.F.B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Argillaceous bituminous rocks; Elementary analysis of ——. A. Lissner. Chem.-Zeit., 1910, **34**, 37—38.

Attempts to determine the percentage of hydrogen in the carbonaceous substance contained in an argillaceous rock, by the ordinary method, are vitiated by the "water of constitution" of the clay. Accurate results may, however, be obtained by heating the mineral for some time with a mixture of two parts of fuming hydrofluoric acid and one part of hydrochloric acid (sp. gr., 1·18), filtering off and washing the residue, drying it at 100° C., and determining the carbon and hydrogen in the usual way; the ratio of hydrogen to carbon in the carbonaceous substance is thus obtained, and by determining the percentage of carbon in the original mineral, the corresponding organic hydrogen may be calculated.—F. Sodn.

Coke; Rapid determination of ash and phosphorus in ——. H. M. Ullmann and N. W. Buch. Chem. Eng., Oct., 1909. Chem. News, 1910, **101**, 6.

The ash is determined in 5 grms. of the finely powdered sample (100-mesh) contained in a round-bottomed platinum dish about 3½ inches in diameter. By means of a few c.c. of alcohol, the coke is spread in an even layer over the bottom and sides of the dish, which, after the alcohol has evaporated, is heated over the blast lamp until the carbonaceous matter is completely oxidised—an operation requiring about twenty minutes. For the estimation of the phosphorus, 10 c.c. of strong nitric acid, 10 c.c. of water and 3 to 5 c.c. of hydrofluoric acid are successively added to the ash, and the contents of the dish are boiled down to between 10 and 5 c.c. in about ten minutes. 30 c.c. of hot water are then added, the liquid is boiled for a further five minutes and filtered into an Erlenmeyer flask. The insoluble residue is washed from four to six times, and the filtrate—now containing all the phosphorus—is treated with ammonia until a slight precipitate ensues. The latter is re-dissolved in nitric acid, and, after heating the liquid to 85° C., 50 c.c. of molybdate solution are added. The flask is then wrapped, shaken for five minutes, and again at intervals during a further ten minutes, to effect the complete precipitation of the phosphorus. The precipitate, after being washed with two per cent. potassium nitrate solution until free from acid, is returned to the flask and titrated with sodium hydroxide solution, of which 1 c.c. is equivalent to 0·00025 grm. of phosphorus. A table is appended showing the close agreement between results obtained by the above and the United States Geological Survey methods.—W. E. F. P.

Influence of the volatile constituents of solid fuels on the efficiency of boiler installations with internal firing. E. J. Constam and P. Schläpfer. Z. d. Ver. d. Ing., 1909, **53**, 1837—1844, 1880—1887, 1929—1934, 1972 1976. Chem.-Zeit., 1910, **34**, Rep., 27.

The higher the percentage of volatile constituents in a fuel employed for heating boilers, the greater also is found to be the loss of heat through incomplete combustion, deposition of soot, conduction, and radiation; and evaporation experiments show the smallest efficiency with coal yielding the highest proportion of volatile matter. With internal firing and a plane grate, the greatest heating-power and best evaporation have been obtained with fuels containing 16–23 per cent. of volatile constituents.—F. Sodn.

Petroleum, Galician; Optical examination of ——. M. A. Rakusin and E. Laszlo. Petroleum, 1910, **5**, 373—378.

Specimens of crude oils from Boryslaw, Brelikow, and Leszczowate were examined, and found to exhibit approximately equal "carbonisation constants." The Boryslaw oil was rich in paraffin and resembled Saghalien oil The rotatory power was similar to that found for other Galician oils by Zaloziecki and Klarfeld. Distillation resulted in an approximately five-fold concentration of the "carbonisation products." The Leszczowate oil was slightly dextro-rotatory. In composition, this oil was almost analogous with the Brelikow oil, except that it yielded 10·75 per cent. of light fractions distilling over at 37°—120° C., as compared with 3·23 per cent. (50°—120° C.)—C. S.

Petroleum; Refining —— with sulphur dioxide. Edeleanu Rev. du Pétrole, 1909, [20]; Petroleum, 1910, **5**, 383—384.

Treated with an excess of sulphur dioxide (see Ger. Pat. 216,459, following), Bustenari lamp-oil distillate (sp. gr. 0·820—0·823) furnishes a refined lamp-oil (sp. gr. 0·800—0·805), equal to best Pennsylvanian, and a mixture of heavy hydrocarbons (sp. gr. 0·860—0·865), which, on distillation, furnishes products that can be used as solvents, or as raw materials in the chemical industry.—C. S.

Petroleum oils in leather manufacture. Earp. *See* XV.

Petroleum production of the United States in 1909. U.S. Geol. Survey. [T.R.]

The total production of petroleum in 1909 is estimated by the United States Geological Survey at between 173,000,000 and 178,000,000 barrels, as against 179,572,479 barrels in 1908. The decrease was less than had been expected in view of the great accumulation of stocks during the preceding year in States east of the Rocky Mountains. California showed a great gain, in which nearly all its pools participated. That the production of 1908 was more than the market could stand was shown by the decline in price in the Eastern and middle fields. The price for Pennsylvania crude oil, which had been $1·78 per barrel, began to decline on May 3, 1909, and had fallen to $1·43 per barrel by December 9. A cut was made in Lima oil from $1·04 to 84 cents per barrel; in Illinois oil from 68 cents to 60 cents per barrel, and in the Oklahoma fields the price declined from 41 cents to 35 cents per barrel. There were no significant disveries of new fields during the year, although outside of the well-known regions prospecting was particularly active in Wyoming, Utah, and New Mexico. The decline in Pennsylvania amounted to about 3 per cent. The statements of pipe-line runs show a gain from 10,938,603 barrels in 1908 to about 11,300,000 in 1909, the run for December being estimated, but this amount includes a small quantity of outside oil run through the Tidewater line. West Virginia did not share the general decline on account of the active development in Roane, Harrison, and Lincoln Counties. Production in the Lima field (Ohio and Indiana) continued to decline, and an increased number of wells were pulled and abandoned, the material to be used in Illinois and farther west. Kentucky and Tennessee showed little change from 1908, though there was a slight decline in Kentucky. In Illinois the decline in production was offset in its significance for the future by the discoveries in several localities of deeper oil sands, some of which gave large yields. In Oklahoma the efforts of the Producers' Association to suspend drilling operations was successful in reducing production and stocks. In September an exceptionally large gusher was developed five miles north of Okmulgee. The success of this well led to the development of the Pearson pool. Kansas continues to decline in its production of both petroleum and natural gas. The decline in Southern Louisiana was offset by increase in production in the Caddo field. All the Western States flourished. Considerably increased attention is being given to all portions of the Wyoming fields. The discovery here and there of light-gravity oil has had a stimulating effect. California now stands first in oil production, producing fully 10,000,000 barrels more than Olkahoma, which ranks second. Developments begun in 1908 continued with increasing rapidity in 1909, many sections producing wells of large capacity. One of the important events of the year was the drilling in September of the Silver Tip well on the Coalinga field. This is said to be the greatest well ever drilled in the State. Other important developments have extended the Coalinga field to the west and south. Successful wells drilled in the Sunset, Midway, and other districts show the wonderful richness of the fields of the State. During 1909 several pipes lines were under construction to carry the increasing product.

Natural gas and petroleum in Canada. Times. Eng. Suppl., Jan. 19, 1910. [T. R.]

A report issued by the Canada Department of Mines states that the production of natural gas is greatly on the increase in Canada. In 1907 the total value of the production was £163,000, an increase of 39·7 per cent. as compared with 1906, whereas in 1908 the production reached a value of about £202,550, this figure being the largest ever recorded, and showing an increase of 24·2 per cent. as compared with 1907. In 1908 the gas was produced entirely by the provinces of Ontario and Alberta. The figures relating to petroleum show a decrease of nearly 33 per cent. for 1908 as compared with 1907, the production in the two years being 527,987 and 788,872 barrels, each containing 35 gallons. These figures are based on the amount of the bounty, which is at the rate of 1½ cents a gallon, paid by the Dominion Government on the crude petroleum produced from wells in Canada.

Patents.

Coal; Method of washing ——. J. R. Campbell. Scottdale, Pa. U.S. Pat. 945,692, Jan 4, 1910.

The heavier impurities are separated from the coal by immersing the latter in a solution of higher density than water, and not containing acids having a deleterious effect upon the coal. After removal from the tank, the separated portions are independently treated for the recovery of the adhering solution, being subjected to the action of a blast, and finally sprayed with water.—W. E. F. P.

Combustible briquettes; Manufacture of ——. A. Gutensohn, London. Eng. Pat. 3981, Feb. 18, 1909.

A mixture of coal dust with about ten per cent. by weight of gas-tar (in place of pitch, which is usually employed) is slightly pressed into suitable moulds, which are then passed into a retort or oven heated externally to about 300° C. After about an hour's heating, the moulds with their contents are withdrawn, the briquettes being removed when cold.—W. E. F. P.

Alcohol and hydrocarbons; Process for the production of a mixture of —— stable in the cold, for explosion-engines. Verein der Spiritus-Fabrikanten in Deutschland. Ger Pat. 216,699, Nov. 11, 1906.

The process consists in adding a mixture of benzol and benzine to alcohol of a higher concentration than 90 per cent. by volume, in such quantities that the product contains at least 40 per cent. by volume of the benzol-benzine mixture. It is stated that the mixture has approximately the same efficiency as an equal volume of benzine alone when used in an explosion-engine: that no separation of its constituents occurs at temperatures considerably below 0° C.; and that it can be used directly for starting the engine in the same manner as benzine alone. The term "benzine" is defined as "petroleum distillate that begins to boil at 70° C. or lower; yields 50 per cent. by volume up to 100° C; and distils over completely or nearly so at temperatures up to 125° C."—A. S.

Firing furnaces with tar and other heavy hydrocarbon liquids. F. Köhn, Stade, Hanover. Eng. Pat. 16,464, July 14, 1909. Under Int. Conv., July 15, 1908.

The hydrocarbon liquid is pumped through a system of coils heated by hot gases, and, having been raised to, or above, its vaporisation temperature, is finally atomised. The more volatile vapours pass to the furnace, sufficient air for combustion being simultaneously supplied, while the molten pitch flows away through a vessel containing one of the coils, to collecting tanks. The heat of the pitch is thus utilised for the preliminary heating of the hydrocarbon liquid, the temperature of which is then raised to the desired extent by its passage through the second coil situated in the flue of the furnace.—W. E. F. P.

Coking and gas generating ovens. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 12,363, May 25, 1909.

In gas-fired coking ovens of the regenerative type, the heating flues are fed from vertical and co-axial gas ducts, which extend directly through the walls supporting the flues, from longitudinal gas channels also extending through the walls. Apertures are provided in the roof of the oven, above the heating flues, to facilitate the removal of obstructions from the various ducts, and to allow of the inspection of the gas nozzles.—W. E. F. P.

Coking furnace. L. L. Summers, Chicago, Ill. U.S. Pats. 943,609 and 943,610, Dec. 14, 1909.

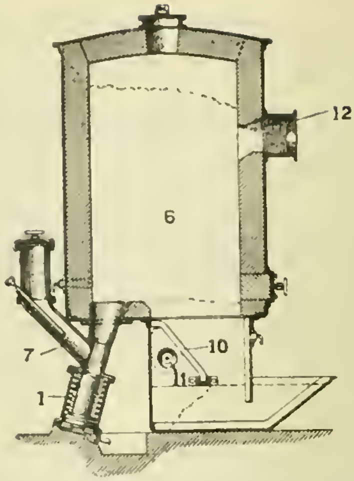
In a horizontal coking furnace containing a retort provided with a movable floor, the material passes slowly from the charging, or cooler, end to the discharge, or hotter, end of the retort, the gases liberated at the lower temperatures passing through the previously charged, hotter material, before escaping through openings in the retort floor.—W. E. F. P.

Gas under pressure for motive power purposes; Means for producing a ——. C. J. Varicas, Weymouth. Eng. Pat. 27,718, Dec. 21, 1908.

For the production of a gas under pressure, an excess of liquid air, in a finely-divided or atomised condition, is brought into rapid contact with liquid, vaporised liquid, or gaseous fuel, the ignition of which has been initially effected by means of a suitable primer.—W. E. F. P.

Gas; Apparatus for the manufacture of ——. A. M. Gow, Edgewood Park, Pa., Assignor to the Westinghouse Machine Co., Pennsylvania. U.S. Pat. 945,715, Jan. 4, 1910.

The fuel is introduced into the producer through the pipe, 7 (see Fig.), being forced by a reciprocating plunger 1, into the producer-chamber, 6, in a direction approximately parallel to the walls thereof. The blast inlet, 11, is situated below the fuel-inlet, and delivers against grate-bars, 10, from which the ashes fall into a water-sealed ash-pit. The gas is delivered through the pipe, 12, in the upper part of the producer.—A. S.



Purification of gas obtained from the distillation of carbonaceous materials, and the recovery of by-products. G. Wilton, London. Eng. Pat. 23,043, Oct. 29, 1908.

The condensed water (virgin liquor) obtained in the distillation of coal, is treated with sufficient alkali to liberate the fixed ammonia, and is then sprayed into the hydraulic main or hot gas main. This facilitates the condensation of the tar from the gas, the liquor being at the same time deprived of the bulk of its ammonia, which is recovered from the gas in the ordinary way. Any ammonia remaining in the liquor is subsequently recovered by passing the latter through a tar-separator and boiling.—W. E. F. P.

Treating gases and separating smoke and dust therefrom. E. G. Knoepfel, San Francisco, Cal. U.S. Pat. 943,422, Dec. 14, 1909.

The gas and washing liquid are introduced into the top of a tower, down which they pass to separate outlets at the bottom. The tower is provided with a series of superposed centrally arranged cones and laterally arranged conical baffle-plates, both cones and baffle-plates having their lower edges serrated. The cones are rotated by mechanism from below, and the liquid is sprayed alternately from the cones to the baffle-plates, and *vice-versa*, the gas being forced to pass through the spray produced.—W. H. C.

Ammonia from gas; Process of obtaining ——. H. Koppers, Essen-on-the-Ruhr, Germany. U.S. Pat 945,332, Jan. 4, 1910.

Gas, obtained by the destructive distillation or gasification of fuels, is cooled to condense tar and water, and, after separating the tar, the gas is superheated and conducted to an "acid saturation bath." The condensed water is treated in a column still, and the resulting mixture containing steam and ammonia is cooled, to separate tar and water, and the residual ammonia is added to the gas; or, the mixed steam and ammonia may be added to a further quantity of the raw gas before cooling.—F. Sodn.

Petroleum; Process for the purification of crude or partially refined —— or its distillates, especially for the separation of the aromatic and unsaturated heavy hydrocarbons. Disconto-Ges. Ger. Pat. 216,459, May 23, 1908.

Petroleum either in the crude state, or after preliminary treatment by known methods, is mixed with such a quantity of liquefied sulphur dioxide, at a temperature below the critical temperature of solution (below 0° C.) that the mixture, on standing, separates into two layers. The lower layer consists of a solution of the aromatic and unsaturated heavy hydrocarbons in the liquefied sulphur dioxide, whilst the upper layer consists of the petroleum hydrocarbons contained in commercial burning oils. It is necessary to use large quantities of the sulphur dioxide, small amounts dissolving in the petroleum to a clear solution. The sulphur dioxide can be recovered quantitatively by evaporation under diminished pressure. The process is stated to be specially applicable to Texas, Ohio, Californian, Roumanian, and Galician oils. (See also Edeleanu, Petroleum, 5, 383, preceding.)—A. S.

Coke-oven walls; Method of preventing the destruction of —— through the alkalis contained in the charge. H. Koppers, Essen on Ruhr, Germany. U.S. Pat. 945,331, Jan. 4, 1910.

See Fr. Pat. 400,648 of 1909; this J., 1909, 1026.—T.F.B.

Coke-oven: Vertical-flue ——. C. Wilke, Sheffield. Assignor to Simon-Carves Bye-Product Coke-Oven Co., Ltd., Manchester. U.S. Pat. 946,181, Jan. 11, 1910.

See Fr. Pat. 370,599 of 1906; this J., 1907, 248.—T. F. B.

Gas; Process for making ——. The Coal Products and Power Co. Fr. Pat. 404,650, July 2, 1909. Under Int. Conv., July 3, 1908.

See U.S. Pat. 922,857 of 1909; this J., 1909, 647.—T. F. B.

Gases; Process and apparatus for purifying ——. E. L. Hall. Fr. Pat. 404,732, July 5, 1909.

See U.S. Pat. 911,494 of 1909; this J., 1909, 237.—T.F.B.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Specific gravities of mixtures of methyl alcohol and water. Doroszewski and Roshdestwenski. *See* XX.

Specific heats of mixtures of fatty alcohols and water. Doroszewski. *See* XX.

Patents.

Incandescence mantles. J. O. Zdanowich, London. Eng. Pat. 27,755, Dec. 21, 1908.

The object of the invention is to increase the strength, hardness and durability of incandescence mantles by utilising the well known property of certain metallic hydroxides of shrinking and hardening during their conversion into oxides by ignition. The fabric (either before or after the usual treatment) is impregnated with a solution of one or more salts of aluminium, magnesium, or equivalent metal, then the oxide or hydroxide of the metal is precipitated by any known means, and the mantle subsequently calcined.—W. E. F. P.

Incandescent gas filaments. R. Laigle, Paris. Eng. Pat. 28,435, Dec. 30, 1908. Under Int. Conv., Jan. 10, 1908.

In the manufacture of infusible and indestructible incandescent gas filaments of the kind described in Eng. Pat. 3785 of 1908 (this J., 1908, 620), claim is made for the incorporation of one or both of the agglutinants, arabin and ammonium oleate, in the plastic paste (consisting of thorium, cerium and beryllium oxides). Other substances such as alumina, silica, or silicate of aluminium, may also be added.—W. E. F. P.

Electric incandescence lamp filaments; Manufacture of ——. C. H. Weber, Berlin. Eng. Pat. 16,328, July 13, 1909.

Finely divided metallic tungsten (or one of its lower oxides) is treated at a low temperature with pyridine or quinoline, either of which it absorbs to the extent of from 6 to 10 per cent. by weight. After incorporation with the ordinary binding agents (of which smaller quantities than usual are required, thus allowing of the manufacture of thinner filaments than hitherto), the filaments are prepared from the mixture by squirting, heating, and flashing in the usual manner. It is claimed that the finished filaments have a smoother surface and greater rigidity than those previously made from tungsten.
W. E. F. P.

Incandescent [electric] lamps; Metallic filament for ——. C. Farkas, New York, Assignor to H. J. Jaeger, New York, and C. T. Jaeger, Brooklyn. U.S. Pat. 945,504, Jan 4, 1910.

The process consists in producing a highly refractory coating on a conducting core, by decomposing, by means of the electric current, the vapours of a salt of a highly refractory metal, in the presence of the vapours of pyrogallol, and completing the reduction to metal in an atmosphere of hydrogen.—F. Sodn.

Destructive distillation of coal; Apparatus for the ——. T. Parker. Fr. Pat. 404,693, July 3, 1909. Under Int. Conv., July 3, 1908.

See Eng. Pat. 14,167 of 1908; this J., 1909, 1080.—T.F.B.

Incandescent gas mantles. V. B. Lewes, Greenwich. Eng. Pat. 1629, Jan. 22, 1909.

See Fr. Pat. 403,195 of 1909; this J., 1909, 1241.—T.F.B.

Refractory electric conductors. Eng. Pat. 282. *See* XI.

III.—TAR AND TAR PRODUCTS.

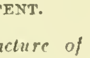
Patent.

Anthracene series; Manufacture of new derivatives of the ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5998, March 12, 1909.

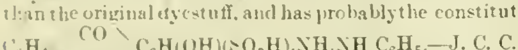
See Fr. Pat. 400,500 of 1909; this J., 1909, 976.—T.F.B.

IV.—COLOURING MATTERS AND DYES.

Aromatic amino- and hydroxy-compounds; Action of sulphites on —— Part 8. Behaviour of hydrazines, especially phenylhydrazine, in the sulphite reaction. H. T. Bucherer and E. F. Sonnenburg. J. prakt. Chem., 1910, 81, 1—48.

The action of phenylhydrazine and bisulphite on naphthol and naphthylamine and their derivatives is not a simple one: in the case of the α-derivatives hydrazinesulphonic acids, $R.NH.N(SO_3Na).R^1$, are first formed, which, on treatment with alkali, yield azo-compounds, $R.N:N.R^1$, and with hydrochloric acid are converted partly into carbazoles, $NH\langle\begin{smallmatrix}R\\|\\R^1\end{smallmatrix}$, and partly into diamino-derivatives, $H_2N.R.R^1.NH_2$. In the case of the β-derivatives, carbazole-N-sulphonic acids,  $SO_3Na.N\langle\begin{smallmatrix}R\\|\\R^1\end{smallmatrix}$, are formed which on decomposition by acids or alkalis pass into carbazoles. Thus α-naphthol yields α-phenonaphthocarbazole, and 1 : 4-naphthol- or naphthylamine-sulphonic acid gives phenyl-α-naphthylhydrazine-N-4-disulphonic acid which with alkali yields benzeneazo-α-naphthalene-4-sulphonic acid, $C_6H_5.N:N.C_{10}H_6.SO_3Na$, and with hydrochloric acid yields p-aminophenyl-1-amino-naphthalene-4-sulphonic acid: phenyl-α-naphthyl-hydrazine-N-monosulphonic acid, benzeneazo-α-naphthalene, α-naphthol and α-phenonaphthocarbazole are also formed as by-products. 1 : 5-naphthylaminesulphonic acid yields 1 : 2 : 5-carbazolesulphonic acid, and the 1 : 6-acid is converted into the corresponding carbazole and 1 : 6-

benzeneazonaphthalenesulphonic acid. Similarly, 2 : 1-naphthylamine- and naphthol-sulphonic acids furnish 2 : 1-naphthophenocarbazole, 2 : 1-carbazolesulphonic acid, and 2 : 3-phenonaphthocarbazole; 2 : 6-naphtholsulphonic acid and 2 : 3 : 6-naphtholdisulphonic acid give 2 : 1-carbazole-6-sulphonic acid and 2 : 1-carbazole-3 : 6-disulphonic acid respectively. In the interaction of azobenzene and bisulphite, hydrazobenzene-N-monosulphonic acid is probably an intermediate product, benzidine being the final one. Certain azo-dyestuffs were also treated with phenylhydrazine and bisulphite: thus benzeneazo-β-naphthol-3 : 6-disulphonic acid is reduced to the hydrazo-compound, and benzeneazo-a-naphthol-6-sulphonic acid yields a disazo-dyestuff, 1 : 4-bisbenzeneazo-a-naphthol-6-sulphonic acid, together with a compound of the formula, $SO_3Na.C_{10}H_4(NH.NH.C_6H_5)_2.NH.N(SO_3Na).C_6H_5$. Under similar conditions Naphthol Blue Black is converted into a violet black dyestuff, and Alizarin Red S is transformed into a dyestuff which gives more violet shades on chromed wool than the original dyestuff, and has probably the constitution



$$C_6H_4\begin{matrix}CO\diagdown\\CO\diagup\end{matrix}C_6H(OH)(SO_3H).NH.NH\,C_6H_5.$$—J. C. C.

The Indian indigo crop. Final Memorandum of Commercial Intelligence Dept. of India. Chem. Trade J., Jan. 22, 1910. [T. R.]

On the average of the five years ending 1907—8 the area under indigo in the four provinces dealt with was 487,000 acres, while that in 1908—9 was 283,900 acres. The total area of the present season is estimated at 290,600 acres. The total yield of dye is estimated at 39,600 cwt., which exceeds last year's figures by 800 cwt. The following is a summary of the provincial reports. The figures in brackets, following the name of each province, indicate what percentage of the total indigo area of British India is ordinarily cultivated in that province.

Bengal (31·1 *per cent.*).—The total area sown is reported to be 107,400 acres as compared with 135,300 acres last year. The season has been unfavourable. Deficiency of winter rain affected February sowings, and in May the rainfall was very defective. In June the rainfall was more than sufficient, and the heavy rainfall in the end of August affected the outturn of the second cuttings. The yield is estimated at 17,000 factory maunds (= 11,400 cwt.) as compared with the trade estimate of 16,000 maunds (= 10,700 cwt.). Last year the official estimate was 26,300 maunds (= 17,600 cwt.), against the trade estimate of 25,000 maunds (= 16,700 cwts.).

Madras (33·7 *per cent.*).—The total area under indigo in *raiyatwari* villages up to the end of November is reported to be 61,000 acres, which is about 29 per cent. more than the area at the corresponding date of last year. The increase is attributed to timely rains. The condition of the crop is fair to good, and the expected outturn is estimated at 67 per cent. of the normal. On the basis of these figures the total area and yield in *raiyatwari* villages for the whole of the current season may be estimated at 102,900 acres and 15,400 cwt. respectively, as compared with 79,800 acres and 12,100 cwt. last year. Villages other than *raiyatwari* report an area of about 1,600 acres, expected to yield 240 cwt., as against 2,000 acres and 300 cwt. of last year.

United Provinces (16·7 *per cent.*).—The total area is now reported to be 35,000 acres compared with 30,600 acres last year. In the western and southern districts the season was favourable, but in the eastern districts the crop was damaged by floods and insects. The total yield is estimated at 7,000 factory maunds (= 4,700 cwt.) compared with 5,700 factory maunds (=3,800 cwt.) for last year. Some portion of the dye is consumed locally or exported to other provinces.

Panjab (10·8 *per cent.*) now reports the total area to be 43,400 acres, as against 36,200 acres last year, attributed to sufficient water supply at the time of sowing. The season has been favourable. The yield of seed is estimated at 1,791,500 sers (= 30,000 cwt.), and of dye at 494,300 sers (= 8,300 cwt.).

The exports by sea to foreign countries in each of the last three years have been:—1906—7, 25,102 cwt.; 1907—8, 32,490 cwt.; 1908—9, 24,946 cwt.

Patents.

[Green wool] dyestuff; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9908, April 26, 1909.

Diazotised 6-chloro-4-nitro-2-aminophenol is combined in neutral or slightly acid solution with 1 : 8-diaminonaphthalene-4-sulphonic acid, and the resulting product is treated with nitrous acid. Or, the diazo-compound may be directly combined with 1 : 8-aziminonaphthalene-4-sulphonic acid. The product dyes wool violet shades, which, on chroming, become yellowish green.—J. L. H.

Monoazo dyestuff for chrome-mordanted wool; Manufacture of a ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 6727, March 20, 1909.

See Fr. Pat. 401,092 of 1909; this J., 1909, 1082.—T. F. B.

Azo dyestuff; Black ——. O. Günther and L. Hesse, Elberfeld, and A. Zart, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 945,780, Jan. 11, 1910.

See Eng. Pat. 1397 of 1909; this J., 1909, 1309.—T. F. B.

[Azo] dyestuffs; Brown ——. M. Kahn, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 946,050, 946,051, and 946,052, Jan. 11, 1910.

See Fr. Pat. 403,208 of 1909; this J., 1909, 1309.—T. F. B.

Dyestuffs of the anthracene series; Process for producing new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 404,345, June 23, 1909. Under Int. Conv., Aug. 4, 1908.

See Ger. Pat. 213,500 of 1908; this J., 1909, 1191.—T. F. B.

[Azo] dyestuffs; Process for preparing ——, *and for developing them on the fibre.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 404,346, June 23, 1909. Under Int. Conv., Sept. 8, 1908.

See U.S. Pat. 936,456 of 1909; this J., 1909, 1120.—T. F. B.

Sulphide dyestuff and its manufacture. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 404,719, July 3, 1909. Under Int. Conv., Aug. 31, 1908.

See U.S. Pat. 935,009 of 1909; this J., 1909, 1190.—T. F. B.

Vat [thioindigo] dyestuffs; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 404,266, June 21, 1909. Under Int. Conv., July 22, 1908.

See Ger. Pat. 216,224 of 1908; this J., 1909, 1310.—T. F. B.

Vat dyestuffs; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 404,727, July 3, 1909. Under Int. Conv., July 27, 1908.

See Eng. Pat. 17,265 of 1909; this J., 1910, 81.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Proteins; Products formed by the partial hydrolysis of ——. E. Abderhalden. Z. physiol. Chem., 1909, 63, 401—404. (See also this J., 1909, 240, 323, 518, 978, 1083.)

The author has continued his investigations upon silk fibroïn, and has now obtained a larger yield of d-alanylglycine. The total yield of crude crystals was 12 grms., calculated upon 100 grms. of silk fibroïn, and the product gave the reactions of glycyl-l-tyrosine. These crystals were separated into two fractions by water, the insoluble fraction containing tyrosine, whilst the soluble fraction was free from this compound. By precipitation with alcohol the latter fraction yielded a purified product equal to 3·8 grms.; there is no doubt however, that the mother liquor still contained more of the soluble dipeptide. From the analytical constants, the soluble fraction was proved to be *d*-alanyl-glycine. On hydrolysis, 2 grms. yielded 1·08 grms. of *d*-alanine and 0·95 grm. of glycocoll. In addition to the two dipeptides mentioned, a third dipeptide has been obtained, and in conclusion it is pointed out that by careful procedure, it is possible to obtain polypeptides without the necessity of forming derivatives. —W. N. B.

Norwegian paper and wood pulp industries in 1909. Farmand; through Wochenbl. Papierfab. 1909, **40**, 4449—4450.

In the Norwegian paper trade the year 1909 is described as one of the worst which has been experienced since the industry was established. This situation is attributed to the general slackness of the world's markets. In certain grades, thin wrappings and printings for the far East, there has been a recovery since the autumn, and this recovery appears likely to continue and extend. The statistics of the production of sulphite wood pulp in Norway and Sweden for the last four years are: 1906, 400,000 tons; 1907, 500,000; 1908, 575,000; 1909, 515,000 tons. The decrease for 1909 is due to the Swedish general strike, which lasted for two months and is estimated to have reduced the probable production by about 100,000 tons. But even this decreased production has been more than the market could absorb. The prices of wood have advanced in Sweden on account of the increase in the number of mills, but they are still slightly lower than in Norway; on the other hand the Norwegian mills have the advantage of geographical position. The tendency in Norway has been to concentrate on the higher grades of pulp. Until some agreement is reached, a keen struggle is likely to continue between the Scandinavian manufacturers. The market for sulphate pulp is not in quite such a critical situation, but remunerative prices are obtained with great difficulty. The position of mechanical pulp is of a totally different order; the production of 1909 was for the most part sold in advance, and the stocks were practically exhausted. Great difficulty was experienced in meeting the demand early in the year, owing to the shortage of water, and very high prices were realised for small parcels outside the contracts, but several mills were compelled to shut down. However, in July, prices began to weaken, and after being supported at a slightly reduced level during the contracting season, they registered a distinct drop in December. Mechanical pulp will be slightly cheaper this year than last, but the price of pulp wood has not fallen and the unsold production is not very great. The reason for the fall is the increased number of mills and the enlarged capacity of the old ones, together with a good rainfall during the latter months of the year. If the rumours of extensive new erections of grinding mills be realised, there is a danger of this industry suffering the same fate as the chemical pulp industry, from reckless speculation, since the prices of pulp wood are already high. —J. F. B.

PATENTS.

Textile fibres [*from nettles, etc.*]; *Process for obtaining* ——. T. E. Pfiel and C. Seibert, Vienna. Eng. Pat. 27,676, Dec. 19, 1908.

Nettle stems are decorticated by boiling them for from 2 to 3 hours with an 8 per cent. solution of soda-lye, milk of lime, or the like, followed by thorough washing with water and removal by hand of the lignified portions. The bast thus obtained is heated for five minutes under 15 atmospheres pressure with a solution of caustic soda (8 per cent.), washed, and again heated with fresh lye under 10 atmospheres pressure for the same period. Degumming is completed by immersion in calcium bisulphite solution (9 per cent.) for about 2 hours. If necessary, bleaching is effected by twice boiling out with caustic lye, with an intermediate treatment in a bisulphite bath, followed by treatment with permanganate.—J. L. H.

Flax and hemp fibres separated in the usual manner; Process for improving ——. A. von Tupalski and W. von Schewelin. Ger. Pat. 216,892, Nov. 2, 1907.

The flax or hemp fibres, which have been separated in the usual manner, are placed in a closed boiler, from which the air is then pumped out. Hot alkali lye is now introduced and the contents of the boiler heated either by direct superheated steam or by means of a steam coil. The alkali lye is next run off, and the fibres pressed and treated with warm alcohol (ethyl alcohol or other alcohols or mixtures of alcohols) for 1½—3 hours, this treatment being repeated if necessary. The fibres are then again pressed, and dried with warm air and superheated steam. It is stated that by this process, flax and hemp fibres suitable for the production not only of yarn of medium fineness, but even of yarn finer than No. 40, are obtained. The process may also be applied to yarn spun from the fibres or to woven fabrics.—A. S.

Megass and other vegetable fibre; Treatment of —— [*for production of lignocellulose pulp*]. N. Malcolmson, London. From L. B. de Lamarre, Trinidad. Eng. Pat. 28,163, Dec. 24, 1908.

The fibre is soaked in water and allowed to spontaneously ferment. When fermentation is started, 2 per cent. of caustic soda is added to assist the process. The mass is then washed with water, treated with sulphurous acid, and boiled in a rotary boiler, under a pressure of from 20 to 100 lb. per sq. in., with a solution of from 12 to 25 per cent. of caustic soda and 2 per cent. of caustic potash, calculated on the weight of dry material. It is hereupon washed with water and converted into paper pulp in the usual manner. The process may be applied to sugar cane, bamboo, sunflower stalks, aloes, &c. In the case of sugar cane, a brown colouring matter may be obtained as a by-product, by doubling the amount of caustic potash employed for boiling.—J. L. H.

Cellulosic films; Manufacture of ——. E. Brandenberger, Thaon-les-Vosges, France. Eng. Pat. 15,190, June 29, 1909. (See also this J., 1910, 83.)

The apparatus for the manufacture of cellulose films, in continuous form, from viscose, consists of a hopper, containing the viscose, and provided with an adjustable slit. The viscose is delivered through this slit on to a roller revolving in a coagulating medium, *e.g.* a solution of ammonium sulphate. From this roller the film is led and supported over a number of rollers revolving in a series of vats containing solutions of brine, to remove the alkaline and sulphide by-products from the film, solutions of mineral acids, to decompose the xanthate and render the film insoluble, and finally through a series of washing vats, after which the film is reeled up. In the earlier vats of the series, all the rollers are driven by suitable gearing and are placed very close together, but without actual contact, in order to support the film whilst it is still plastic, but the rollers in the vats later on in the series are simple guide rolls, over which the film is led in a zigzag direction through the various liquids in the vats. —J. F. B.

Acetylcellulose; Manufacture of sheets or objects from ——. H. J. G. Reeser, London. Eng. Pat. 12,976, June 2, 1909.

When acetylcellulose, of the type which is soluble in acetone or ethyl acetate, is heated with a mixture of equal parts of benzene and alcohol, it dissolves near the boiling temperature, but separates again on cooling. If the liquid be poured off from the deposit and camphor or a camphor substitute be added to the latter, the mixture again becomes fluid on heating, and the product, when cold, forms a plastic solid having the properties of celluloid. For example, 2 kilos. of acetylcellulose of the type specified, are mixed with 20 kilos. each of alcohol and benzene, the mixture is heated for some time at 60° C., and then to boiling until the acetylcellulose is dissolved. After cooling, the solvent is poured off from the mass which separates, 600 grms. of camphor and 400 grms. of acetochlorhydrin are added, and the whole is again heated at 50° C., in order to produce a transparent fluid which sets on cooling. If desired, the camphor may be added to the original acetylcellulose and the whole heated with the solvent until dissolved. Homologues of alcohol and benzene respectively may be used.—J. F. B.

Paper webs coated on both sides; Means for drying ——. P. F. Hentschel, Charlottenburg, Germany. Eng. Pat. 15,107, June 28, 1909.

The web of paper, coated on both sides, passes, without solid support, between two parallel series of slotted plates, through which hot air is forced against the surface of the paper in order to dry it. The slots are pierced through the plates in a slanting direction, so that the hot air emerges in a plane not at right angles to the plane of the surface of the paper. The direction of the blasts of air varies on either side of the middle of the web, and their inclination is always towards the nearest edge of the paper, both above and below. This inclination has the effect of keeping the paper stretched out flat, and preventing shrinkage and curling. Moreover, curling is also prevented by the fact that the driest air is near the middle of the web, whilst the more saturated air passes away at the edges.—J. F. B.

Spent pulping liquors; Process of treating ——. W. J. Hough, Toledo, Ohio. U.S. Pat. 945,394, Jan. 4, 1910.

The process of treating spent alkaline pulping liquors containing resinous salts consists in separating the resinous salts therefrom, concentrating the residual liquors, subjecting the residue to destructive distillation to produce an oil suitable for creosoting and other purposes, and recovering the alkali.—J. F. B.

Artificial threads and the like; Process of producing solutions for spinning ——. R. Linkmeyer, Bremen, Germany. U.S. Pat. 945,559, Jan. 4, 1910.

See Eng. Pat. 4104 of 1909; this J., 1909, 934.—T. F. B.

Solutions for use in making artificial threads or other products; Process for making stable ——. P. Friedrich. Fr. Pat. 404,372, June, 24, 1909.

See Eng. Pat. 11,700 of 1909; this J., 1909, 1246.—T. F. B.

Vegetable fibres contained in straw, grasses, bast, harl, and the like; Process of opening for spinning and weaving purposes the ——. F. A. Reichmann, Barmen, Germany. U.S. Pat. 946,272, Jan. 11, 1910.

See Eng. Pat. 12,059 of 1909; this J., 1909, 1193.—T. F. B.

Silk weighted with stannous chloride; Process for increasing the resistance of ——. E. Herzog. Fr. Pat. 404,239, June 21, 1909.

See Ger. Pat. 213,471 of 1908; this J., 1909, 1194.—T. F. B.

Celluloid; Process for making products similar to ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 404,886, July 8, 1909. Under Int. Conv., July 8, 1908.

See Eng. Pat. 15,855 of 1909; this J., 1909, 1163.—T. F. B.

Barrel bodies from paper pulp; Process of making ——. W. H. Decker, Syracuse, N.Y., U.S.A. Eng. Pat. 26,762, June 30, 1909.

See U.S. Pats. 928,247, 928,248, and 928,249 of 1909; this J., 1909, 958.—T. F. B.

Peat fibre; Process for the treatment of —— and its manufacture into paper, &c. L. Franz, Admont, Austria-Hungary. U.S. Pat. 945,313, Jan. 4, 1910.

See Eng. Pat. 13,994 of 1908; this J., 1909, 905.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Paranitraniline Red on cotton; Formation of ——. E. Justin-Mueller. Bull. Soc. Chim., 1910, 7, 60—64.

The observations of Prudhomme and Colin (this J., 1909, 87, 306) on the production of the best colour are criticised by the author, who states that the addition of a fatty body such as sodium ricinoleate to the naphthol bath is essential for obtaining a fast and brilliant red. He gives the following proportions:—β-naphthol, 20 grms.; sodium hydroxide, 38° B., 20 grms.; sodium ricinoleate, 100 grms.; water to make 1 litre. The well boiled out hanks are padded in this bath, then dried and passed into the diazotising solution, the proportions for which are:—Paranitraniline, 14 grms.; sodium nitrite, 7 grms.; hydrochloric acid, 22° B., 31 grms.; crystallised sodium acetate, 28 grms.; water to make 1 litre. The colour is developed almost immediately and in about 20—30 seconds a full red is obtained which loses very little on washing in running water. The colour is spoilt by longer contact with the developing solution. Chalk can be used instead of sodium acetate to neutralise the free acid, but its use is inconvenient in practice. The fatty substance used is stated to unite with the colour to form a complex colloid. (See also this J., 1906, 532; 1907, 45).—A. Sbld.

Alizarin Red and Pink on unoiled material. M. Battegay. Bull. Soc. Ind. Mulhouse, 1909, **79**, 348—353.

The production of Alizarin Red upon unprepared material has been carried out for some years in many works and is on the increase. Comparative bulk trials by the well-known methods of application show that with equal quantities of alizarin fixed upon the fibre, the shade upon oiled material is richer and fuller than that upon the unprepared cloth and that the lake is more transparent and brilliant. With the previously prepared cloth the lake is fixed only upon the surface of the fibre, whilst the unoiled cloth is dyed throughout. The colour lakes contain the same ingredients, but in the case of the unprepared cloth, these ingredients are brought upon the material at one and the same time, and the omission of any previous manipulation compensates for the poorer quality of the shade obtained. The fatty acid required is incorporated with the printing paste containing the alizarin and calcium and aluminium compounds, but a perfect reaction between the ingredients is only obtained when the fatty acid in the mixture is in a very finely divided condition, *i.e.* well emulsified. Comparative trials showed that the best results are obtained with ricinelaidic acid and with Lizarol (see Eng. Pat. 13,790 of 1908; this J., 1909, 519).—F. M.

Turkey-red oil and its derivatives, and their application in the production of Alizarin Pink and Turkey-red on unoiled material. M. Tschilikin. Rev. Gen. Mat. Col., 1910, **14**, 4—6.

By treating one molecular proportion of ricinoleic acid with ¾ of a molecular proportion of sulphuric acid, esterification takes place, but the double linkage is not affected. With one and a half molecular proportions of sulphuric acid, esterification is accompanied by a certain amount of addition, and with 3 molecular proportions, this addition, reaches a maximum. The iodine value and acid value of the products obtained, are lower, the greater the proportion of sulphuric acid employed; the diminution in the acid value being due to internal condensation (with elimination of the elements of water) between the sulphonic and carboxylic acid groups. By treatment with gaseous hydrochloric acid, esterification alone results, but in presence of formaldehyde the esterification is accompanied by addition, as proved by the diminished iodine value of the product. By treating with ¾ of a molecular proportion of sulphuric acid, in presence of formaldehyde, there is an addition besides esterification, and it is shown that it is the formaldehyde which reacts with the hydroxyl group, and the sulphuric acid which is added at the point of double linkage. The products thus obtained, mixed with water in the proportion of 1 : 10, yield emulsions which are permanent for months and may be employed in the production of Alizarin Pink and Reds on cloth which has not been previously oiled. —F. M.

Sodium tungstate as a reserve under steam colours or mordant dyestuffs. A. Scheurer. Sealed note No.1030, April 25, 1898. Bull. Soc. Ind. Mulhouse, 1909, **79**, 347—348.

A saturated solution of sodium tungstate, thickened with starch, acts as a good reserve under Aniline Black, and colours fixed by chromium, iron, and aluminium mordants. Direct cotton dyestuffs may be printed with the reserve paste, and various effects thus obtained.—F. M.

Patents.

Dyeing and similarly treating textile material upon bobbins or the like ; Apparatus for ——. J. W. Platt and the Times Coloured Spinning Co., Ltd., Heywood. Eng. Pat. 22,986, Oct. 8, 1909.

A modification of the machine described in Eng. Pat. 24,327 of 1903 (this J., 1904, 59). Yarn, slubbing, etc., is wound on perforated tubes which are inserted in the machine. Each bobbin is surrounded by an outer perforated case which is screwed to the base of the machine. To the upper part of this case is attached a smooth conical plug or valve, fitting into the open end of the perforated tube, and this, by means of a spring, which is compressed as the case is screwed on, is firmly wedged in, thus ensuring a liquid-tight joint. Should it be desired to dispense with the outer case, an alternative arrangement is provided for compressing the springs and wedging the plug into the perforated tube.—J. L. H.

Ornamentation of textile and like fabrics. R. Gottlieb, Brünn, Austria. Eng. Pat. 1579, Jan. 22, 1909.

Solutions of dyestuffs are sprayed upon the fabric as it is carried over a table and past the spraying nozzles. These are arranged in suitable series and are movable to a small extent, to produce an even " field " ; the spray should impinge vertically upon the cloth. The design is obtained by passing a stencil (in the form of a lace fabric) between the spray and the material to be ornamented, and pressing the two fabrics closely together, so that the outlines are well defined. Upon leaving the table, the stencil is separated from the fabric and cleaned ready for further use.—F. M.

Calico printing machines. R. Robertson, Dinting, Derby. Eng. Pats. 6034, March 13, 1909, and 13,483, June 9, 1909.

Indicators such as index scales and pointers are attached to the box wheels of calico printing machines to enable attendants to quickly adjust them to the varying thicknesses of cloth passing through.—J. L. H.

Fabrics and other goods and articles ; Means for rendering —— non-flammable. S. Levene, Ramsgate, and S. M. Harris, Southport. Eng. Pat. 27,225, Dec. 15, 1908.

The material is treated with a solution of ammonium chloride and ammonium sulphate to which is added a certain proportion of talc, alum, or borax.—F. M.

Cleaning and bleaching wool or other animal or vegetable fibres, and also fabrics, tissues, and the like ; Apparatus for electrolytically ——. A. Dassonville, Roubaix, France Eng. Pat. 3200, Feb. 9, 1909.

See Fr. Pat. 387,104 of 1908 and Addition thereto ; this J., 1908, 817, and 1909, 241.—T. F. B.

Dyeing wool in a single bath by means of chrome colours ; Process for ——. L. Cassella und Co. Fr. Pat. 404,217, Oct. 13, 1908.

See Eng. Pat. 22,097 of 1908 ; this J., 1909, 791.—T. F. B.

Printing ; Process of ——. E. Bourcart, Mülhausen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U. S. Pat. 946,326, Jan. 11, 1910.

See Fr. Pat. 390,979 of 1908 ; this J., 1908, 1110.—T.F.B.

Conversion of halogens into haloid salts. [Removing chlorine from spent bleach-liquors.] Ger. Pat. 217,035. See VII.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Sulphuric acid chambers ; Increase of yield in ——. H. Rabe. Z. angew. Chem., 1910, **23**, 8—12.

The author suggests several methods by which the circulation of the gases in rectangular chambers, in the spiral progress suggested by Abraham, may be facilitated and maintained, with consequent increase in the yield of acid per unit volume of chamber space. The first is the introduction of the gases, either in one place or in several, in the direction of the Abraham currents at the place ; the second is the gradual diminution of the height of the chamber, so that the roof shall slope downwards from front to back ; the third is the introduction of lead curtains hanging at intervals so far down from the roof, parallel with the ends of the chamber, as to preserve the spiral movement, and prevent longitudinal motion of the gases ; and the fourth is the introduction of sprays of acid, of just higher strength than that formed in the chamber, in the direction of the gas-currents. If these sprays are injected by means of compressed gas, then the gas from a further portion of the system should be taken for the purpose. Such acid sprays would serve the same purpose in keeping down the temperature of the chamber as water-sprays, and they would be much less troublesome to regulate, inasmuch as the introduction of a greater or less quantity of acid of this strength could have no noticeable effect in disturbing the process. They could also be introduced with advantage in tangential chambers ; and if they were used, the direction of introduction of the gases into the chamber (of either system) would be a matter of indifference, provided they were introduced through such large openings as to have no sensible speed ; for the sprays themselves would be capable of initiating the spiral or tangential motion. The cost of introduction and of maintenance of any of these improvements would not be very considerable, in comparison with the economies in working effected by them.—J. T. D.

Perchloric acid from sodium perchlorate ; Preparation of ——. F. C. Mathers. J. Amer. Chem. Soc., 1910, **32**, 66—71.

Kreider (Amer. J. Science, [3], **49**, 443) proposed a method for the preparation of perchloric acid from solid sodium perchlorate and excess of concentrated hydrochloric acid, based on the facts that the sodium chloride produced is almost insoluble in the excess of hydrochloric acid and may be removed by filtration, whilst from the solution of hydrochloric and perchloric acids, the former may be expelled by heating at about 135° C. The conditions for obtaining the best results are as follows :—For 20 grms. of sodium perchlorate, 25 to 30 c.c. of hydrochloric acid (sp. gr 1·16 at 24° C.) are used. The insoluble sodium chloride is collected on an asbestos filter in a Gooch crucible and washed with ten 1 c.c. portions of hydrochloric acid. The filtrate and washings are evaporated, and heated to 135° C. to drive off the hydrochloric acid. A yield of about 95 per cent. of the theoretical can be obtained, the product containing a small amount of sodium perchlorate, but no chlorides. —F. Shdn.

Calcium carbonate ; Decomposition of ——. E. H. Riesenfeld. J. Chim. phys., 1909, 7, 561—569.

The author confirms the results obtained by Pott and by Zavrieff (this J., 1909, 137) ; he finds (908° ± 5°) C.

to be the temperature at which the dissociation pressure of calcium carbonate is equal to one atmosphere. The dissociation curve corresponds to the equation,

$$CaCO_3 \quad CaO+CO_2,$$

and neither basic salt nor solid solutions are formed. The heat of reaction between calcium oxide and carbon dioxide is calculated to be 40,500 cals.—F. SODN.

Acid sulphates. V. Solubility of ammonium sulphate in mixtures of water and sulphuric acid at 25° C. J. D'Ans. Z. anorg. Chem., 1909, **65**, 228—230. (Compare this J., 1909, 980.)

AT 25° C., the solid phase in equilibrium with mixed aqueous solutions of ammonium sulphate and sulphuric acid, is, according to the concentration of the latter, either the normal salt, $(NH_4)_2SO_4$, or one of the acid salts, $(NH_4)_3H(SO_4)_2$ and NH_4HSO_4.—F. SODN.

Algae of the Pacific coast; Chemistry of [Potassium salts and iodine from] certain ——. D. M. Balch. J. Ind. Eng. Chem., 1909, **1**, 777—787.

THE author gives a description of some of the algæ found off the Pacific coast of North America, together with analyses of their inorganic constituents; and he then discusses the question of their technical utilisation, especially by carbonisation, the volatile products being condensed, and the charred residue treated for the recovery of potassium salts and iodine. *Nereocystis gigantea* (*Pelagophycus porra* Setchell) is fairly abundant over a distance of 100 miles north and south of San Diego Bay; its life period is about 12 months. On exposure to the sun and wind, the plant dries rapidly; and the walls of the bladder and apophysis become covered with a heavy saline efflorescence. Specimens of various parts of the plant at different stages of growth were dried in the sun and then at 125° C., the dried material was charred, the residue lixiviated with water, and the extracted salts analysed. 2100 grms. of dried material from bladders collected at a very early stage of growth, yielded 1316 grms. of crude salts consisting mainly of potassium chloride (78 per cent.) and sodium chloride, with a little carbonate and sulphate, and containing about 0·1 per cent. of iodine. 407 grms. of similar material from mature plants yielded 243 grms. of crude salts containing 80 per cent. of potassium chloride. 210 grms. of dry substance from branches of the plant yielded 104·7 grms. of crude salts of approximately the same potassium content as the salts from the bladders, but containing 0·328 per cent. of iodine, and somewhat richer in sulphate. The dry substance of the leaves yielded only about half as much crude salts as the other parts of the plant, but the iodine content of the salts was as high as 0·85—0·875 per cent. 90 grms. of the dry substance of the stem of the plant yielded 33·76 grms. of crude salts containing 0·55 per cent. of iodine. Experiments with *Nereocystis Leutkeana*, which occurs from a little south of Port Conception, California up into the Arctic regions, and *Macrocystis pyrifera* (from Magdalena Bay, Mexico, to Sitka, Alaska, and off the coasts of South America, New Zealand, Australia, and Antarctic islands), gave similar results. One of the most interesting facts brought to light by the analyses is that the algæ, although growing in a medium rich in sodium compounds, assimilate the far less abundant potassium; the effloresced salt consists of nearly pure potassium chloride. The author advocates: (1), collection of the algæ by steamships fitted with suitable labour-saving appliances; and (2), drying the wet kelp on the shore until an efflorescence of salts begins to appear, at which stage the material is soft and pliable and can be pressed into small bales of about 250 lb. weight (corresponding to one ton of wet kelp), which can be easily transported and kept indefinitely without undergoing alteration. The dried kelp could then be carbonised under conditions similar to those obtaining in wood distillation, with the exception that care must be taken that complete carbonisation is effected, so that colourless solutions can be obtained on lixiviating the charred residue. The volatile products are stated to be similar to those produced in wood distillation, except that the aqueous distillate is slightly alkaline instead of acid in character. In addition to the condensed volatile products, of approximately the same value as those obtained from one ton of dry wood, one ton of air-dried kelp would yield at least 500 lb. of pure potassium salts and 3 lb. of iodine. The author considers that as a raw material for the production of pure potassium salts, kelp stands in an exceptionally favourable position.—A. S.

Silver chloride, barium sulphate and calcium sulphate; Solubility of —— *at high temperatures.* A. C. Melcher. J. Amer. Chem. Soc., 1910, **32**, 50-66.

THE salts, of which solubilities were determined, were placed with water in a platinum-lined steel bomb which could be rotated in a bath. The electrical conductivity was determined at various temperatures between 18° and 218° C. The solubilities were determined by dividing the values of the specific conductivity by the appropriate values of the equivalent conductivity. The results are given below in milli-equivalents per litre.

	18° C.	50° C.	100° C.	156° C.	218° C.
Silver chloride ..	0·0105	0·0365	0·147		
Barium sulphate	0·0190	0·0288	0·0334		
Gypsum	29·5	30·0	23·3		
Soluble anhydrite			22·8	6·4	
Anhydrite			9·2	2·7	0·7

The solubilities of the three forms of calcium sulphate are shewn graphically. The transition temperature of the metastable system, gypsum, soluble anhydrite, solution, appears from this to be 97° C. The equivalent concentrations of ionised calcium sulphate in saturated solutions at different temperatures are also given.—F. SHDN.

Sulphuryl chloride; Transport of —— *in tank wagons.* G. Badermann. Z. angew. Chem., 1910, **23**, 54—55.

THE permanent Tariff Commission of the German Railways has decided, on technical and hygienic grounds, that sulphuryl chloride be added to the list of liquids that may be transported in tank-wagons.—A. S.

Ferric oxide; Evolution of oxygen from —— *at high temperatures.* S. Hilpert. Ber., 1909, **42**, 4893—4895.

THE temperature at which evolution of oxygen from ferric oxide begins, depends not only on the source of the oxide but also on the conditions of heating. The same oxide which, heated slowly (during 4 hours) to 1250° C., gave off at that temperature, during six hours, 2·8 per cent. of its weight of oxygen, was perfectly stable at 1250° C. when heated rapidly to that temperature. Only above 1350° C. was the loss of oxygen in any case greater than corresponded to the formation of about 5 per cent. of ferrous oxide. Even at 1600° C., the loss of oxygen was very slow.—J. T. D.

Zirconium dioxide; Natural ——. L. Weiss and R. Lehmann. Z. anorg. Chem., 1909, **65**, 178—227.

BRAZILIAN zirconia, as now obtainable cheaply, contains 85—90 per cent. of zirconium dioxide, and has the sp. gr. 4·9, and hardness about 7. Its value as a refractory material is well-known, but the authors have made a thorough investigation of the properties of the mineral and of the purified oxide, with a view to extending their usefulness. Pure fused zirconium oxide has, like quartz, a very small coefficient of expansion (linear coefficient = 0·00000084) and, when white hot, may be plunged into cold water without fear of fracture; its sp. gr. is 5·75. It is, however, very difficult to melt, and vessels said to be made of the fused oxide were found to contain alkali. Crucibles made from a mixture of the oxide (9 parts) and magnesia (1 part), using 10 per cent. of phosphoric acid as a binding agent, are extraordinarily resistant towards sudden changes of temperature and practically unaffected by molten alkalis or bisulphate. The oxide also can replace lime and silica in the manufacture of glass. It is not reduced by aluminium (Goldschmidt's method), but a mixture of the oxide and ferric oxide, when thus treated, gives an alloy of zirconium and iron. To obtain the practically pure oxide, the powdered mineral (100 parts) is mixed with anhydrous sodium sulphate (120 parts) and powdered carbon (35 parts), one-third of its weight of common salt is added, as a flux, to the mixture, and it is very strongly heated in a wind furnace; the product is powdered and boiled with water for some hours, the residue containing iron sulphide, is filtered off, treated with hydrochloric acid, filtered again, and the carbonaceous residue is finally ignited. For quantitative analysis the following method is recommended:—The mineral is very finely ground, and thoroughly fused with an excess (4—5 times) of sodium bisulphate. The melt is dissolved in water, the slight white residue of silica is filtered off, and any platinum precipitated from the filtrate by sulphuretted hydrogen. The filtrate from this operation is evaporated three times to dryness, and heated to 110° C.; the silica, thus rendered insoluble, is well washed, and, after weighing, is treated with hydrofluoric acid, any residual zirconium oxide being fused with sodium bisulphate and added to the main filtrate. This is nearly neutralised with ammonia and mixed with excess of ammonium oxalate and tartrate; ammonium sulphide is added to the warm solution, and, after continuing to warm for an hour, the precipitate of iron sulphide, which also contains practically all the aluminium, is filtered off. The filtrate is evaporated to dryness and the residue ignited until white; it is then fused with sodium bisulphate, and the melt is dissolved in water. Hydrogen peroxide is added to the solution and then sodium hydroxide to precipitate the zirconium as hydroxide; the precipitate is dissolved in hydrochloric acid, ammonia is added, the excess boiled off, and the precipitate ignited and weighed as zirconium oxide. The alkaline solution is heated to decompose excess of hydrogen peroxide, acidified with hydrochloric acid, and the titanium precipitated with ammonia. The composition of the mineral has been exhaustively investigated by the decomposition of a large quantity (2 kilos.) of material and the systematic fractional precipitation of the solution obtained, each fraction being examined spectroscopically. Besides the constituents already mentioned, vanadium, niobium, and rare earth elements were detected in small quantities.—F. Sodn.

Phosphorus; A new chloride of ——. A. Besson and L. Fournier. Comptes rend., 1910, **150**, 102—104.

The chloride, P_2Cl_4, is obtained by the action of a silent electric discharge on a mixture of hydrogen and the vapour of phosphorus trichloride. It is a colourless oily liquid, smelling strongly of phosphorus (m. pt.,—28° C., b. pt. about 180° C., or 95° at 22 mm.). It fumes and oxidises in air, and under suitable conditions ignites spontaneously. It decomposes spontaneously *in vacuo* (more readily when warmed and in the light), forming phosphorus trichloride and yellow bodies of varying composition. Attempts to prepare the corresponding dibromide (P_2Br_4) in the same way have not been successful.—W. H. P.

Action of metals on fused sodium hydroxide. Le Blanc and Bergmann. *See* X.

Patents.

Metallic chlorides [sodium chloride]; Decomposition of ——, *and the obtainment of useful products [sodium and sodium hydroxide] therefrom.* A. C. Vournasos, Athens. Eng. Pat. 23,689, Nov. 5, 1908.

A mixture of 100 parts of anhydrous common salt and 200 parts of lead, in powder or fine shot, is heated, until homogeneous, at a temperature not above a red heat, in a reverberatory or other suitable furnace, having a hearth adapted to prevent contact of the flame with the materials under treatment, and the dome of which is provided with a pipe leading to a combustion or condensing chamber. During the first stage of the process, this pipe is closed by a damper. Communication is afterwards opened with the combustion or condensing chamber, whereupon the sodium produced by the interaction of the materials distils freely, and is condensed, or, by admitting air, is converted into sodium oxide, which is subsequently treated with water for the production of sodium hydroxide. The lead chloride also formed is electrolysed for the recovery of the lead and chlorine, or is reduced by other means. Lead oxide may be used in the place of lead, and this acts upon the fused salt to form a mixture of lead oxychloride and sodium oxide, which can be converted into sodium hydroxide and separated by treatment with water.—F. Sodn.

Barium hydrate [hydroxide]; Manufacture of anhydrous ——. C. Rollin and Hedworth Barium Co., Ltd., Newcastle-on-Tyne. Eng. Pat. 27,587, Dec. 18, 1908.

Pure, amorphous, anhydrous barium hydroxide is prepared by heating crystallised barium hydroxide in a partial vacuum at a comparatively low temperature. The product is porous and specially suitable for conversion into barium oxide for the manufacture of barium dioxide.—A. S.

Alkaline cyanides; Manufacture of ——. J. Dewrance and H. E. Williams, Charlton, Kent. Eng. Pat. 28,074, Dec. 24, 1908.

Materials containing ferrocyanides are treated with a small quantity of a cuprous or cupric salt, especially cuprous chloride, and with acid, and the hydrocyanic acid liberated is absorbed in alkali. It is stated that owing to the continuous formation and decomposition of cuprous cyanide, the whole of the cyanogen of the ferrocyanide is obtained in the form of hydrocyanic acid.—A. S.

Ammonium salts and ferrous oxide from ferrous liquors; Manufacture of ——. F. J. R. Carulla, Derby. Eng. Pat. 1585, Jan. 22, 1909. Addition to Eng. Pat. 27,302, Dec. 16, 1908 (this J., 1909, 1126).

After the addition of ammonia to the ferrous liquor, as previously described, the mixture is allowed to settle until the upper part is clear (about 20 minutes generally suffices). The top half is then removed by means of air pressure, without passing it through the filter-press; then the lower portion, containing the iron oxide, is stirred and filtered, no water being added. The connecting pipe, leading to the filter-press, is washed clear by steam, or otherwise, before the next operation.—F. Sodn.

Calcium nitrite; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 11,275, May 12, 1909.

Crystallised calcium nitrite of the formula, $Ca(NO_2)_2,4H_2O$, which is claimed as a new product, is made by evaporating a solution containing the salt, such as that obtained in the recovery of oxides of nitrogen from admixed air by means of lime, to such a point that, on allowing to cool, the greater part of the calcium nitrite separates at a temperature not above 36° C.; large crystals are thus obtained, which are readily separable from the mother liquor. The product is converted into anhydrous calcium nitrite on heating.—F. Sodn.

Bisulphite liquor; Apparatus for making ——. J. Vollmer, Boston, Mass., and R. S. Talbot, Appleton, Wis. U.S. Pat. 945,426, Jan. 4, 1910.

The apparatus consists of a tank with a distributor located at the bottom, and having connections to supply gas and liquid to the distributor. The liquid-inlet is arranged beneath the gas-inlet, so that the streams of gas and liquid are discharged into each other, and the combined gas and liquid flow from the distributor into the lower part of the tank; the gas-inlet has an enlarged extension forming a chamber round the liquid-inlet, and the outlet is restricted, so that the mixture is delivered into the tank under pressure.—F. Sodn.

Halogens; Process for the conversion of —— into haloid salts, especially of bromine and iodine into alkali bromide and iodide respectively. [Removing chlorine from spent bleach-liquors.] J. Meschorer. Ger. Pat. 217.035, July 26, 1908.

THE process consists in treating the halogen with an alkali hydroxide or carbonate in presence of a thiosulphate, the solutions being heated, and the quantities used being such that for each molecule of thiosulphate, 10 mols. of alkali hydroxide (5 mols. of carbonate) and 8 atoms of halogen are used. For example to a hot solution of thiosulphate, alkali and a halogen are added alternately and gradually, until the requisite amounts have been used. Or, alkali and thiosulphate are added to a solution containing the halogen. It is stated that under these conditions, the thiosulphate is converted completely into sulphate and the whole of the halogen into alkali halide, no halogenate, thionates, or other by-products being formed. The application of the process to the removal of chlorine from spent bleach-liquors and from bleached goods is specially claimed.—A. S.

Zinc hydrosulphite-sodium sulphite double salt; Process for the preparation of a solid, high-percentage ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 217,038, March 21, 1909.

A SOLID double salt of zinc hydrosulphite and sodium sulphite, containing 75 per cent. of the former, is obtained by adding sodium bisulphite to a solution of zinc hydrosulphite. For example, 100 kilos. of a solution containing 32·5 per cent. of zinc hydrosulphite are treated with 92 kilos. of sodium bisulphite solution of 37° B. The mixture sets to a paste of fine crystals; on warming and stirring, the crystals of the double salt become larger and separate as a heavy sandy powder.—A. S.

Compounds containing unstable oxygen [hydrogen peroxide, sodium peroxide, perborate, and percarbonate, &c.]; Process of increasing the keeping quality of ——. L. Sarason, Berlin. Eng. Pat. 23,676, Nov. 5, 1908.

ALKALI pyrophosphates are added to compounds containing unstable oxygen, such as hydrogen peroxide and sodium peroxide, perborate, and percarbonate, whether in the dry form or in solution, to improve their keeping qualities by rendering them more stable towards catalysts and under the influence of heat. Sodium pyrophosphate is specially suitable for the purpose.—F. SODN.

Nitrides; Process of producing ——. C. E. Acker, Assignor to The Nitrogen Co., New York. U.S. Pat. 943,132, Dec. 14, 1909.

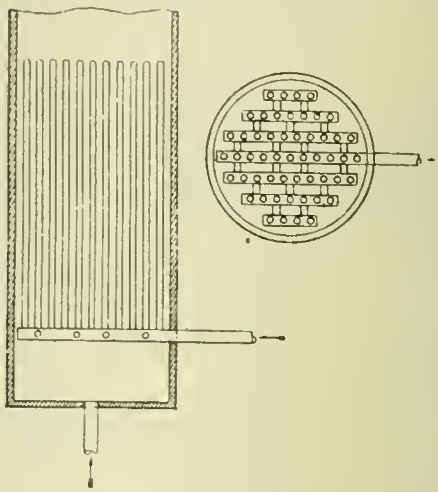
THE process is a continuous one and consists in the alternate treatment of an alloy, comprising an inert metal and a metal capable of forming a nitride, with nitrogen, and the separation of the resulting nitride, the residual inert metal being again used for preparing the alloy. To obtain the alloy, a molten compound of the nitride-forming metal may be electrolysed, employing the inert metal as cathode.—F. SODN.

Oxides of nitrogen; Production of —— from the air. F. I. du Pont, Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 943,661, Dec. 21, 1909.

FOR the production of oxides of nitrogen, air is made to pass through a "container," which is an electrical non-conductor, and is subjected to a cooling medium. An arc is produced longitudinally in the container, and externally a series of oppositely placed rotary magnetic fields extend between the electrodes.—F. SODN.

Oxides of nitrogen; Process for the manufacture of ——. O. Bender. Ger. Pat. 217,079, Nov. 4, 1908.

IN the process of oxidising atmospheric nitrogen by burning a combustible substance containing carbon or hydrogen in a mixture of nitrogen and oxygen, claim is made for burning the combustible substance in a number of small flame jets kept separate throughout their length. It is stated that a higher yield of oxides of nitrogen is thus obtained, owing to the rapid and efficient mixing of the combustible gas with the nitrogen and oxygen. In one method of carrying out the process, a bundle of narrow tubes is disposed in the furnace as shown in the figure. The combustible gas is introduced into the lower ends of the tubes, and the mixture of nitrogen and oxygen, passed in at the lower end of the furnace, is preheated in flowing up around the tubes. On issuing from the upper ends of the tubes, the combustible gas burns in the form of a number of small flame jets. Other methods of carrying out the process are also described, in one of which, Bunsen burner-tubes are used, in order to obtain efficient mixing before combustion.—A. S.



Sulphur; Apparatus for recovering ——. P. S. Smith, Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 945,111, Jan. 4, 1910.

SULPHUR dioxide, mixed with water-gas, is led into a retort where reduction takes place. Producer gas is also passed into the retort and by its combustion produces the heat necessary for the reaction of the mixed gases. The apparatus consists of a system of generators and retorts. The generators are fitted with steam- and air-pipes, the latter being provided with blowers. Water-gas is conveyed from the generator to the upper end of the retort, where sulphur dioxide is also introduced. Producer gas is led into the lower end of the retort. The exit gases are carried from the lower end of the retort to a condenser.

—G. W. McD.

Sulphur from sulphur-bearing gases; Apparatus for recovering ——. P. S. Smith, Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 945,112, Jan. 4, 1910.

THE apparatus is similar to that described in the preceding abstract, but special claim is made for the mode of construction of the retort. It consists of a series of concentric passages, alternate passages having ports communicating with each other and successively arranged at opposite ends of the retort, thus providing two sets of passages, in which any passage of either set is contiguous to a passage of the other set.—G. W. McD.

Carbide; Method of manufacturing —— and products of same. H. L. Hartenstein, Constantine, Assignor to Continental Development Co., Duluth, Mich. U.S. Pat. 946,432, Jan. 11, 1910.

SEE Eng. Pat. 20,653 of 1907; this J., 1908, 160.—T. F. B.

Calcium carbide; Manufacture of ——. H. L. Hartenstein, Constantine, Assignor to Continental Investment Co., Duluth, Mich. U.S. Pat. 946,510, Jan. 11, 1910.

SEE Eng. Pat. 20,652 of 1907; this J., 1908, 281.—T. F. B

Carbide ; Method of manufacturing ——. H. L. Hartenstein, Constantine. Assignor to Continental Investment Co., Duluth, Mich. U.S. Pat. 946,511, Jan. 11, 1910.

See Fr. Pat. 383,054 of 1907 ; this J., 1908, 281.—T. F. B.

Fullers' earth ; Material for replacing ——, *and its manufacture.* L. G. Hill. Fr. Pat. 404,945. July 10, 1909.

See Eng. Pat. 27,500 of 1907 ; this J., 1908, 1018.—T. F. B.

Oxygen ; Apparatus for making ——. C. Ridley, London. U.S. Pat. 945,048, Jan. 4, 1910.

See Eng. Pat. 15,060 of 1908 ; this J., 1909, 884.—T.F.B.

Obtaining ammonia from gas. U.S. Pat. 945,332. *See* II*A*.

Electrolytic decomposition of alkali salts. Eng. Pat. 25,208. *See* XI.

Electrolytic apparatus [*for producing chlorates from chlorides*]. U.S. Pat. 944,650. *See* XI.

VIII.—GLASS ; CERAMICS.

Leadless glaze. Times, Eng. Suppl., Jan. 5, 1910. Rev. Prebendary Stuart, Rector of Stoke-on-Trent.

There are in the pottery trade two main branches in which lead is used. The first is the glazing of the ware, which process takes place for the most part after the first firing. During this stage the persons who come in contact with the ware are the "dippers" who actually put it in the glaze ; the attendants who handle the ware afterwards for various purposes, some of them being "ware-cleaners," who when the glaze is dry remove it from the rims at the bottom of cups, saucers, plates, &c. ; and the "glost-placers" who pack the ware into the saggars for its second firing, which turns the opaque glaze into a transparent coating. All these operatives come into contact with the lead where it is used in the glaze, and may be affected thereby.

The second branch in which lead is used is the decorative branch. Some kinds of decoration have no lead in them, but in others, especially majolica painting, and to a less extent aerographing, there is risk of plumbism.

The figures of new certified cases of lead poisoning for the whole country during the ten months ended October 31, 1909, were 45 ; for the same periods in 1907 and 1908 the figures were 86 and 105. The fatal cases during the same periods were 8 in 1907, 10 in 1908, and 3 in 1909. It is estimated that there are about 5,500 leadworkers engaged in the industry, out of a total of about 55,000.

In the present practice the ware when glazed is fired in an oven measuring about 16 ft. in diameter and 20 ft. in height, and holding from 1500 to 1800 dozen of articles. Of this large space only a small proportion can be occupied by articles glazed with leadless glaze, as this glaze requires firing at such a special temperature as is only obtainable in a small part of the oven. Then the leadless glazed ware that is fired in ovens alongside of ordinary ware will be found to have the even flowing of the glaze assisted by the lead-glazed ware, as the lead is, when fired, so volatile as to combine readily with the other glaze. It thus happens that many articles which are marked as "leadless glaze" really contain lead, which has found its way into the glaze during the firing. Other articles on which leadless glaze is used are fired in saggars thickly coated with lead glaze, from which their own glaze absorbs lead. The possibility of making in small experiments a leadless glaze suitable for many purposes is not disputed, but it is contended that as yet this cannot be done on a commercial scale. A further difficulty is that with time all glaze is liable to craze, especially with articles liable to frequent changes of temperature, hence it is natural that manufacturers should hesitate to adopt so-called "improved" glazes. Many firms in the Potteries have spent hundreds of pounds in experimenting to find a satisfactory leadless glaze, but have so far found it to be impracticable.

Natural zirconium dioxide. Weiss and Lehmann. *See* VII.

Patent

Potter's kilns or ovens for firing bricks, pipes, and the like T. West, Glascote, and W. I. G. Lewis, Tamworth, Warwick. Eng. Pat. 5722, Mar. 10, 1909.

The kiln is provided with an inner wall of refractory material, and the furnace-gases from each fire-hole are made to pass up flues constructed between the inner and outer walls, and then over partitions and down other flues, alongside the first, to a common combustion chamber, which extends below substantially the whole of the firing chamber. The floor of the firing chamber is perforated and supported by a short central pillar which offers no impediment to the mixing and ready circulaton of the gases from the different fire-holes. Two or more kilns may be used in series, the gases passing through the saggars in the first kiln, out through the crown, to the flues or combustion chamber of the next. A shelf, supported by the inner and outer walls of the kiln and forming a roof for the gas flues, may extend round the kiln ; it is intended for the firing of gulleys and similar articles, and may be perforated, to allow a portion of the furnace-gases to pass into the kiln at this level. Besides effecting a saving in fuel, the kiln is said to produce goods of an improved quality.—F. Soon.

IX.—BUILDING MATERIALS.

Natural zirconium dioxide. Wiess and Lehmann. *See* VII.

Patents.

Electric furnace product [*abrasives and refractory materials*] ; *Method of treating* ——. A. C. Higgins and G. N. Jeppson, Worcester, Mass. U.S. Pat. 944,436, Dec. 28, 1909.

The bonding qualities of abrasive and refractory aluminous materials, produced in the electric furnace, are improved by grinding the materials to a sufficiently fine state of division, and then treating them with an alkaline reagent.—C. A. W.

(1), *Refractory brick,* (2), *cement flint clay brick, and* (3), *cement-silica brick for metallurgical and other uses.* C. E. Pope, Pittsburg, Pa. U. S. Pats. 944,692, 944,693, and 944,694, Dec. 28, 1909.

Claim is made for a refractory brick composed of six parts of a mixture in equal proportion of coarse and fine angular fragments of broken Portland cement clinker, and one part of Portland cement as binding agent. Half of the mixture of coarse and fine fragments of cement clinker may be replaced by a similar mixture of coarse and fine fragments of flint clay brick or of silica brick.—A. S.

Portland cement ; Process and apparatus for artificially ageing or seasoning ——. T. A. Edison, Llewellyn Park Orange, N.J., Assignor to Edison Portland Cement Co. Stewartsville, N.J. U.S. Pat. 944,481, Dec. 28, 1909.

A current of moist heated air is made to flow continuously in a closed circuit, and the ground cement is showered through it and then moved forward in an opposite direction.—A. S.

Cement ; Process of and apparatus for burning —— ; *and multitubular cement kiln.* H. L. Doherty, New York. U.S. Pats. 945,307 and 945,498, Jan. 4, 1910.

The kiln comprises an inclined rotary clinkering chamber, in which a clinkering flame is maintained, and a number of calcining chambers of smaller diameter and rounded section, which are arranged in parallel and are rotatable about a common axis, the whole forming an integral structure. The cement material passes through the various calcining chambers, and the different streams

of material then unite in the clinkering chamber, means being provided for preventing the discharge of calcined material at an upper point of the clinkering chamber. Each calcining chamber receives a portion of the flame-gases from the clinkering chamber, and these gases are maintained at a substantially uniform distance from the material during its passage through the chamber.
—F. Sodn.

Concrete and like materials; Apparatus for mixing and consolidating ——. F. G. S. Price, Glasgow. Eng. Pat. 18,242, Aug. 7, 1909.

The apparatus consists of a mixing table or platform, swung upon pivots carried by crank discs or like devices, so that a vertical jogging or vibratory movement and also an orbital movement may be simultaneously imparted by means of suitable mechanism arranged beneath. In the example described, the vertical movement may be reduced or entirely suspended, thus adapting the machine for use as a mixer only.—F. Sodn.

Wood; Process of preserving ——. J. Chateau and J. Merklen, Paris. U.S. Pat. 945,693. Jan. 4, 1910.

See Fr. Pat. 375,859 of 1907; this J., 1907, 926.—T.F.B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Ferro-silicon; Supplement to Report of Medical Officer on the nature, uses, and manufacture of ——. Local Government Board. [Cd. 4958.]

The following is a summary of the conclusions arrived at in this report:—Numerous accidents have been caused within the last few years by the escape of poisonous and explosive gases from consignments of ferro-silicon, which, in every instance, have been found to consist of so-called high-grade ferro-silicon, produced in the electric furnace. These accidents, for the most part, have occurred during transport of the ferro-silicon by water, whether in sea-going vessels or in barges and canal-boats plying on inland waters. The accidents have occurred in various countries and on vessels of different nationalities, while the ferro-silicon carried has, in almost every instance, been the product of a different manufactory. Ferro-silicon, especially of grades containing from 40 per cent. to 60 per cent. of silicon, is invariably found to evolve considerable quantities of phosphoretted hydrogen, and, in less amount, of arseniuretted hydrogen. A certain amount of the gas evolved is occluded in the alloy. Certain grades of ferro-silicon—notably such as contain about 33 per cent., 50 per cent., and 60 per cent., of silicon*—even when manufactured from fairly pure constituents, are both brittle and liable to disintegrate spontaneously, especially in the case of the 50 per cent. grade. All these grades are commonly employed at the present time. Evolution of poisonous gases is greatly increased by the action of moisture, or of moist air, under the influence of which phosphoretted hydrogen is generated from calcium phosphide, which, in turn, is formed, in large part, at any rate, from the calcium phosphate present in anthracite and quartz, at the temperature of the electric furnace. If spontaneous disintegration of the alloy also occurs, much larger quantities of gas would be given off from such friable and unstable material, other conditions being equal. The greater or less tendency of a given sample to evolve poisonous gases, and even a rough estimate of their probable amount, may be arrived at by the use of test-papers prepared with silver nitrate. There is no evidence that low-grade ferro-silicon (10 to 15 per cent.), produced in the blast furnace, has ever given rise to accidents of similar character to those known to have been caused by the high-grade electrically-produced alloy. Blast-furnace ferro-silicon does not evolve poisonous gases even in presence of moisture. As regards ferro-silicon produced in the electric furnace certain percentage grades appear to be practically innocuous. This statement applies to grades of alloy of a silicon content up to 30 per cent. and probably also, though in considerably less degree, to those of 70 per cent. and over. In view of the fact that the use of ferro-silicon of grades ranging between 30 per cent. and 70 per cent. apparently is not essential in metallurgical operations, with the possible exception of basic steel manufacture, it will be advisable that the production of this alloy of grades ranging between these percentages should be discontinued in the future. The proprietors of iron and steel works making use of ferro-silicon will assist in the protection of their work-people, and at the same time act for the public benefit, by restricting their orders to grades of this material, either not exceeding 30 per cent., or of 70 per cent. and upwards, according to the special nature of their requirements. But as, pending international agreement on the question, intermediate percentages of ferro-silicon will doubtless continue to be manufactured and sold, the issue, by the Board of Trade, of special regulations will be necessary in order to obviate, so far as may be possible, chance of further accidents during the transport of this substance. *Inter alia*, these regulations should require a declaration of the nature, percentage, date of manufacture, and place of origin of any such consignment.

Suggested Regulations as to precautionary measures in connection with the storage and transport of ferro-silicon.

1. Ferro-silicon should not be sent out from the works immediately after manufacture, but, after being broken up into pieces of the size in which it is usually sold, should be stored under cover, but exposed to the air as completely as possible, for at least a month before being despatched from the works.

2. Manufacturers should be required to mark in bold letters each barrel or other parcel of ferro-silicon with the name and percentage grade (certified by chemical analysis) of the material; the name of the works where it is produced; the date of manufacture; and date of despatch.

3. The carriage of ferro-silicon on vessels carrying passengers should be prohibited. When carried on cargo boats it should, if circumstances permit, be stored on deck. If it be considered necessary to store it elsewhere, the place of storage should be capable of being adequately ventilated, and such place of storage should be cut off by airtight bulkheads from the quarters occupied by the crew of the vessel.

4. This regulation should apply to the transport of ferro-silicon on river or canal barges as well as on sea-going vessels.

5. Storage places at docks or at works where ferro-silicon is used should have provision for free access of air, and should be situated at a distance from work-rooms, mess-rooms, offices, &c.

Mineral and metal production of the United States in 1909. Eng. and Min. J., Jan. 8, 1910. [T.R.]

The following table summarises the estimated production of the more important minerals and metals in the United States in 1909, so far as it has been possible to collect the statistics at so early a date. The figures for copper, lead, and spelter are based on reports received directly from the producers, who have communicated their actual output during the first 11 months of the year, together with their estimates of probable production in December; in many cases the estimates are for the last few days of December only. The other statistics are based chiefly on the reports of producers, State mine inspectors, and special correspondents:—

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* Corresponding possibly to the formulæ, $FeSi$, $FeSi_2$, and $FeSi_3$, respectively. Moissan and Lebeau both claim to have isolated the first two of these three silicides of iron in crystalline forms.

Product	Unit.	1908.		1909.	
		Quantity.	Value.	Quantity.	Value.
Non metallic—			Dollars.		Dollars.
Coal, bituminous	Short ton (*a*)	337,929,632	387,678,972	360,076,905	414,448,517
Coal, anthracite	..	80,329,578	159,122,961	77,099,336	153,757,678
Iron ore	Long ton (*b*)	33,789,987	60,821,976	53,033,873	95,460,971
Limestone flux	..	9,563,158	4,720,485	14,070,000	7,316,400
Petroleum	Barrel (*c*) ...	184,711,413	136,347,831	180,717,696	133,864 299
Metallic—					
Copper	Pound	948,196,490	127,438,536	1,098,287,425	146,456,628
Iron, pig	Long ton (*b*)	15,936,018	267,540,378	25,711,846	437,101,382
Lead	Short ton (*a*)	318,876	26,785,584	374,579	32,011,521
Quicksilver	Flask (*d*)	17,969	805,690	20,000	926,000
Zinc (*e*)	Short ton (*a*)	210,511	19,897,500	267,069	29,660,683

(*a*) Short ton = 2,000 lb. (*b*) Long ton = 2,240 lb. (*c*) Barrels of 42 gals. (*d*) Flasks of 75 lb. (*e*) Includes zinc from foreign ore.

Mineral production of New Zealand in 1908. Board of Trade J., Jan. 27, 1910. [T.R.]

The quantity and value of the mineral produce obtained during the years ended 31st December, 1907 and 1908 were as follows :—

	1907.		1908.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Gold ....ozs.	508,210	2,027,490	506,423	2,004,025
Silver	1,562,603	169,484	1,731,336	175,337
Copper-ore ..tns.	56	595	13	275
Antimony-ore ..	98	2,118	5	73
Manganese-ore ..	5	26	—	—
Hematite-ore. ..	—	5	—	—
Coal output (less exports) ..	1,702,059	851,029	1,760,473	880,236
Coal exports ..	128,950	114,737	100,502	85,846
Coke exports ..	15	15	2	4
Shale	—	—	1	4
Kauri-gum... ..	8,708	579,888	5,530	372,798
Other minerals ..	1,492*	30,448	1,690†	16,179
Total ..	—	3,775,835	—	3,535,677

* Including auriferous ore, 1,244 tons ; ironsand, 73 tons ; tin ore, 1½ tons ; scheelite ore, 137 tons ; unenumerated, 37 tons.

† Including auriferous ore, 654 tons ; scheelite ore, 68 tons ; ironsand, 2 tons ; pyrites, 2 tons ; stone, 30 tons ; greenstone, 6½ tons ; pumice stone, 922 tons ; unenumerated, 6 tons.

Tin production in 1909. Eng. and Min. J., Jan. 8, 1910. [T.R.]

For the 12 months ended Nov. 30 the production of tin is estimated as follows, in long tons :

	1908.	1909.
Straits	62,392	59,870
Banka and Billiton	13,785	15,014
Australia	6,119	5,800
Bolivia	16,250	16,500
Chinese exports	4,000	3,500
Cornwall	4,400	4,800
Miscellaneous	250	500
Total	107,196	105,984

No attempt was made to estimate the Chinese production, and it is not included above. The total output showed a small decrease.

The deliveries of tin, in long tons, for the 12 months ended Nov. 30, are estimated by the trade authorities as below, in long tons :

	1908.	1909.
United States	31,700	39,550
Great Britain	29,400	29,334
Other European countries	28,050	30,068
India and China, from the Straits	3,265	3,400
Other countries	4,250	4,350
Australian consumption, &c.	500	500
Total	97,165	107,202

The available figures indicate that there was an increase in deliveries in 1909 ; and that the consumption exceeded the production. At present there are no indications of any large new supplies. In the Malay Peninsula more careful and thorough methods of mining are being introduced, and the same is the case in the Banka mines. In Australia, however, the industry appears to be declining.

The production of the Federated Malay States for the 10 months ended Oct. 31 was as follows : Perak, 372,333 pikuls ; Selangor, 216,408 ; Sembilan, 39,597 ; Pahang, 33,935 ; total, 662,273 pikuls—or 39,421 long tons—which is a decrease of 46,203 pikuls as compared with the previous year.

Copper production of the United States. Eng. and Min. J., Jan. 8, 1910. [T.R.]

The following statistics of copper production in North America are based upon reports from all of the producers and represent the Michigan production, plus the fine-copper content of blister copper and the copper content of the very small quantity of matte exported.

The total production of refined copper in the United States in 1909 was about 1,410,000,000 lb. against 1,153,000,000 lb. in 1908. The production of Lake copper was 227,019,646 lb. ; of, blister copper, in North America, 1,065,615,990. The amount of pig copper imported from foreign countries other than Canada and Mexico was 126,000,000 lb. Consequently the supply of blister copper to the American refineries was 1,191,615,990 lb. Estimating that 1 per cent. of the blister copper was recovered as bluestone, the total available from this source was 1,181,000,000 lb. in round numbers, and adding to this the 227,000,000 lb. of Lake copper the grand total is 1,408,000,000, which is a close check of the refinery statistics.

Titaniferous iron ore ; Crucible experiments on the smelting of ——. G. H. Stanley. J. Chem., Met., and Mining Soc., S. Africa, 1909, **10**, 162—172.

The author has made a series of crucible experiments on the smelting of titaniferous iron ores, with the object of investigating the truth of the statement that these ores are difficult to reduce in the blast-furnace on account of the formation of pasty and infusible slags. The ore employed was a South African product and contained 0·8 per cent. of silica, 15·2 of titanium dioxide, 3·51 of alumina and chromic oxide, 0·32 of lime, and 81·43 of ferric oxide (equivalent to 57 per cent. of iron). Varying quantities of silica (silver sand) and lime (marble or dolomite) were taken, the charges being heated in a Deville furnace worked by forced draught at temperatures ranging from 1400° to 1600° C. Employing a charge to produce a slag of the CaO,SiO_2,TiO_2 type (sphene), good fusible slags were obtained, but the yield of metal was rather low (39·5 per cent.). Using somewhat higher temperatures (1600° C.), it was found that the more basic mixtures made the best slags as far as the yield of iron was concerned, but that these slags showed a tendency to escape through the graphite crucible. Experiments were now made on the fusibility of various mixtures containing titanium oxide, silica, and lime. The results seemed to indicate that the compound, CaO,TiO_2,SiO_2, was the most satisfactory of those examined, as regards fusibility. But the action on the crucible being still rather marked, the proportion of silica was increased; as an example, taking the proportions, TiO_2 34, SiO_2 41, CaO(MgO) 25, and heating at 1400° C., a yield of 54·4 per cent. of iron was obtained. It then appeared certain that the titanium oxide always acted as a base. Assuming this, the most satisfactory slags approximated to monosilicates of titanium and the other bases. In determining the melting points of the artificial slags, discordant results were at first obtained, until it was found that these results were influenced by the state of oxidation of the material. Thus, in the case of the artificial sphene, prolonged heating in a reducing atmosphere lowered the melting point to 1000° C., while re-oxidation raised it to 1250° C. It appears evident that, considering the reducing conditions of the blast-furnace, the titanium may exist in the slags in different states of oxidation, but chiefly as a lower oxidised compound, probably Ti_2O_3, which generally acts as a base, although, like alumina, it may act as an acid in very basic slags. In another experiment the charge was proportioned to yield a slag of the composition, $3CaO, Ti_2O_3, 3SiO_2$. A good glassy slag was obtained, the yield of iron being 51·5 per cent. In most cases, white iron was produced, but grey metal could be obtained by increasing the silica in the slag, and especially by using a higher temperature. The author admits that these crucible experiments might not be duplicated in the blast-furnace, where nitrogen and other gases are always present and where the formation of the cyanonitride is probable. He therefore intends to erect a small blast-furnace and make further tests under these conditions.—C. A. W.

Chromium in chrome iron ore; Determination of ——. J. A. Muller. Bull. Soc. Chim., 1909, 5, 1133—1136.

THE following fusion mixtures were tested on known quantities of chromium sesquioxide:—

Sodium carbonate and potassium nitrate gave	99·6	per cent. of the chromium oxide as chromate.
Peroxides of sodium and potassium ,,	99·2	
Soda-lime and potassium chlorate ,,	96·5	

The last result is distinctly inferior, though the method is recommended by Fresenius. Chrome ore is fused with much greater difficulty than the pure calcined oxide. The author recommends the following methods:—

(I.) *Fusion with peroxides of sodium and potassium.* An intimate mixture of the finely ground ore with 5 parts of sodium peroxide and 8 parts of potassium peroxide is gradually heated in a silver crucible to 500°—600° C., and kept at that temperature for 30 minutes, occasionally agitating the crucible. The melt is extracted with water and filtered; any residue left is washed, dried, and fused again as above. Four or five fusions of the successive residues (grinding if necessary) may be needed for a complete extraction of the chromium. The united filtrates are boiled with a few drops of alcohol; any manganese separating is filtered off, and to the filtrate a small quantity of hydrogen peroxide is added. It is then boiled for 30 minutes to destroy excess of the peroxide and made up to a known volume. An aliquot portion is acidified in a conical flask with hydrochloric acid (which should not produce a blue colour, indicating the presence of hydrogen peroxide); the liquid is cooled to the ordinary temperature, the air displaced by carbon dioxide, potassium iodide added, and the solution titrated with thiosulphate.

(II.) *Fusion with sodium carbonate and potassium nitrate.* The finely ground ore is fused with 4 parts of sodium carbonate and 8 parts of nitre exactly as described above. The melt is also treated as above, but owing to the presence of nitrites the filtrate from the manganese must be treated differently. It is acidified with dilute sulphuric acid, boiled to drive off nitrous fumes, and reduced with sodium sulphite. From the green liquid chromium is precipitated by the addition of just sufficient ammonia. The precipitate is washed, dissolved in a porcelain dish with sodium carbonate and hydrogen peroxide; the solution heated carefully, whilst covered with a funnel, and then boiled for 45 minutes, after which it is made up to a known volume and titrated with thiosulphate as already described.

Taking 0·5 grm. of ore both methods gave exactly the same percentage of chromium (22·7 per cent. of the dry ore). For rapid work the first method is considered preferable, but the crucible is attacked; after 5 fusions it had lost 0·15 grm.—A. SELD.

[Martin] Steel; Present state of production of —— from pig iron by the open-hearth process. O. Petersen. Stahl u Eisen, 1910, 30, 1—39, 48—83.

THE author has collected a large amount of valuable information regarding the production of steel by the Martin open-hearth process, as carried out by all the large Continental, British, and American firms. Tables are given showing the absolute record and working of furnaces in each country, with analyses of the metal and slag at all the important stages of the process; these include all the important modifications of the methods of working the process as practised by different firms. Curves are also included showing the alteration in the composition of the metal and the slag from the time of adding the charge till the metal was poured. Forty-six tables and thirty-three diagrams are included in the paper, which is a very complete record of the present day conditions and results of the steel manufacture by this process.—A. H. C.

Steel making in foundries; Cost of ——. B. Stoughton. Trans. Amer. Foundrymen's Assoc., 1909, 217—226.

THE author, in a series of tables, compares the net cost of the steel in castings at foundries using the various processes, the figures being based on the current prices of materials in Pittsburg in May 1909. His results are summarised in the following table:—

Method.	Net cost of steel in castings.	
	per short ton (2000 lb.)	per long ton (2240 lb.)
	Dollars	£ s.
Acid open-hearth	27·9	6—10·2
Basic open-hearth	27·64	6—9
Converter....................	30·56	7—2·6
Acid open-hearth, small castings	30·64	7—3
Basic open-hearth, small castings	35·43	8—5·3
Crucible	83	19—7·3
Electric furnace, with power at 1 c. (½d.) per kilowatt-hour	39·03	9—2·1
Electric furnace, with power at 5 c. (2½d.) per kilowatt-hour	94·49	22—1

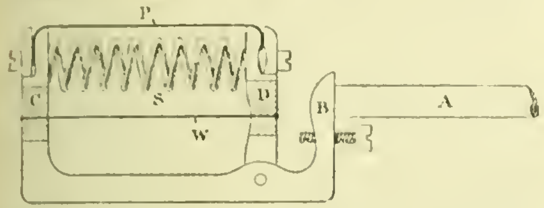
—A. H. C.

Steel; Magnet —— and permanent magnetism. G. Mars. Stahl u. Eisen, 1909, 29, 1673—1678, 1769—1781.

A STEEL containing 3·5 per cent. of silicon and from 0 to 0·1 per cent. of carbon is shown to be a nearly perfect material for dynamo armatures, because of its great demagnetisation properties, also, the coarser the structure of the metal the better is it suited for this purpose. As entirely opposite qualities are required for the steel for magnets, the author has investigated the magnetic properties of a large number of steels of varying carbon content, and alloys containing tungsten, chromium, silicon, and nickel. It was found that the maximum of residual magnetism occurs in steels containing 0·97 per cent. of carbon, probably at the eutectic carbon content, and not as stated by M. Curie at 1·2 per cent. of carbon. The diminution of this residual magnetism in hypo-eutectic steels is due to the hardness being low, while its diminution in hyper-eutectic steels is due to too small a content of free iron. The more powerful action of special steel magnets depends on the presence of more free iron in these steels than in carbon steels of the same hardness. For high permeability it is essential that the steel should be glass hard, of a fine grain, and containing as much as possible of free iron, and the degree of permanent magnetism is greater, for an equal hardness, the more free iron the steel contains. A special steel containing 0·60 per cent. of carbon and about 5 per cent. of tungsten shows the highest residual magnetism for normal hardening from about 950° C.—A. H. C.

Iron; Crystalline structure of —— at high temperatures. W. Rosenhain and J. C. W. Humfrey. Proc. Roy. Soc., 1910, A 83, 200—209.

Some preliminary experiments are described, in order to determine the modes of deformation of metals at high temperatures. A very mild steel was used of the following composition: carbon, 0·029; silicon, 0·118; sulphur, 0·012; phosphorus, 0·044; manganese, 0·014; and arsenic 0·016 per cent.; with the recalescence points on heating occurring at 770°C. and 941° C., and on cooling, at 904° C. and 763° C. A steel stem (A) (see fig.) carried a rectangular frame (B) open on one side. The bar (D) was hinged to the bottom bar of the frame, and the specimen (P) in the form of a strip of a sheet of the metal, previously carefully polished, was held between (C) and (D), insulated, and could be suitably electrically heated. The stress from a compressed spring (S) was applied to it by electrically heating or even melting the wire (W) which had previously relieved the specimen of all strain. The whole apparatus was placed in a conical filter-flask, the stem (A) and the electrical connections passing out through a rubber stopper, the flask being then evacuated. The authors examined the behaviour of the specimen on heating, both with and without straining whilst hot, and were thus able to determine those effects, which were due to the straining of the metal alone. They found three very distinct regions as shown by microscopical examination, and illustrated by microphotograms. The temperatures reached in these regions were determined by the use of small particles of sodium chloride and potassium sulphate, and it was found that the transition lines between these regions corresponded to the recalescence points, and that the regions coincided with the α-, β-, and γ-modifications of iron at varying temperatures. Platinum and copper, which have no recalescence points, showed no discontinuity of appearance on being heated and strained. In the case of iron, with a high stress, fracture occurred at the line marking the temperature of the α/β change. The region corresponding to α-iron was weaker and softer with an increasing temperature; that corresponding to β-iron had very few signs of slip, showing it to be of great tensile strength; whilst the presence of numerous slip bands following the steps of twin-crystals in the γ-iron region showed it to be truly crystalline. The authors conclude from these preliminary experiments: (1), that iron at temperatures up to 1100° C. behaves as a crystalline aggregate, and undergoes plastic deformation by a process of slip on the cleavage plane of constituent crystals; (2), that iron up to 1000° C. exists in three distinct modifications possessing widely different mechanical properties, and corresponding to the temperature ranges of the α-, β-, and γ-iron of Osmond and Roberts-Austen; (3), that β-iron although at a higher temperature, is stronger and harder than α-iron, and that the α/β transformation involves a volume change; (4), that γ-iron found in pure iron at high temperatures possesses the structure and properties of γ-iron found in the nickel-iron alloys.—A. H. C.



Manganese in steel; Rapid determination of ——. G. Auchy. J. Ind. Eng. Chem., 1909, 1, 813.

In the colorimetric or volumetric methods for the determination of manganese in steel, based on oxidation to permanganic acid by means of red lead or lead dioxide, the author has observed that in certain cases the carbon is not completely oxidised and subsequently exerts a reducing action on the permanganic acid, thus causing low results. This difficulty is overcome by using for the manganese determination, the filtrate from the silica obtained in the estimation of the silicon.—A. S.

Tungsten in tungsten-steel; Determination of ——. L. Wolter. Chem.-Zeit., 1910, 34, 2—3.

The method is based upon the ascertained fact that tungsten-steel, even in a coarsely divided state, may be rapidly dissolved by fusion with potassium bisulphate; it is carried out as follows:—0·2—0·5 grm. of the steel is cautiously fused with 10 times its weight of bisulphate in a covered platinum crucible; as the action proceeds, two more like quantities of bisulphate are added, and finally the crucible is heated to full redness. After about 15 minutes the whole should be in a state of quiet fusion and free from undecomposed particles; it is then allowed to cool, and the crucible and lid are boiled with water and carefully rinsed, the total volume of solution not exceeding 60—75 c.c.; to this, 20 c.c. of strong hydrochloric acid are added, and the mixture is boiled, until the colour of the precipitate becomes a pure yellow. After half an hour on the water-bath, the liquid is filtered and the precipitate washed with a 10 per cent. solution of ammonium nitrate; it is then treated on the filter with warm dilute ammonia, the solution of ammonium tungstate being received in a weighed platinum crucible; the filter is washed with ammonium nitrate solution and the solution is evaporated to dryness on the water-bath, the ammonium salts being then carefully driven off by heat and the residue ignited; it should be almost white when cold. To determine the small quantity of tungsten present in the filtrate from the tungstic acid precipitate, this is evaporated to dryness in a platinum dish, the residue heated for 1—2 hours at 120°—130° C., and extracted with warm dilute hydrochloric acid; the solution is filtered, and the filter washed with ammonium nitrate solution, and ignited, the filter-ash being moistened with nitric acid and re-ignited, along with the main portion of the tungstic acid. If the steel contain silicon, this is present as silica with the tungstic acid and is finally separated by treatment with hydrofluoric acid. The completion of the whole analysis occupies less than a day.
—F. Sodn.

Cyanide solutions; Errors due to the presence of potassium iodide in testing —— for protective alkalinity. B. Collingridge. Inst. Min. and Met., Jan. 20, 1910. [Advance proof.]

The author's experiments show that the use of potassium iodide in testing cyanide solutions leads to erroneous results. The following method of procedure is recommended:—To the measured portion of test solution, containing a few drops of phenolphthalein, silver nitrate solution is added until the indicator colour remains constant. The amount of protective alkali present is then determined by titration with standard acid in the ordinary manner.—W. E. F. P.

Ore slime; Treatment of ——. A. F. Crosse. J. Chem., Met. and Min. Soc., S. Africa, 1909, 10, 172—174.

The plant consists of a conical vat, which contains an interior conical baffle-plate open at the bottom and reaching about half-way down the vat. A pipe extends up the middle of the vat to a point about two feet above the top. This pipe is left open at the lower end and a smaller pipe inserted in the aperture; through the latter pipe a current of air can be forced, the whole arrangement forming, in fact, an air-lift pump. The slime, after decantation from any excess of water, is washed by a weak cyanide solution into the treatment vat through the conical baffle-plate at the top. More cyanide solution is added and air passed in through the pipe at the bottom. The pulp, as it settles down into the narrow bottom of the conical vat, reaches the open end of the vertical tube and is carried up the interior by the current of air, attaining a point above the surface of the liquid and finally falling back through pipes arranged so as to give a circular motion within the baffle-cone. This pulp settles again to the bottom and is again carried up the central pipe, becoming thoroughly aërated in the process. Meanwhile the clear surface liquid rises outside the baffle-cone and finally overflows into the zinc-box, where the gold is precipitated, the residual liquid being subsequently brought back to the interior of the conical baffle-plate by a second air-lift pump.—C. A. W.

Black sands; Treatment of ——. F. Alexander. J. Chem., Met. and Min. Soc., S. Africa, 1909, 10, 174—176.

CROSSE's method (see preceding abstract) for the treatment of slimes was applied to the extraction by cyanide of the battery by-product commonly called black sands. A conical water purifier, fitted with supply connections for air, cyanide solution and water, was employed. After washing the charge into the cone with the ordinary working solution, a certain amount of lime (10 lb. for 500 lb. of charge) was added, together with the additional cyanide. The solution, before passing into the extractor boxes, was filtered through coir and sand filters. Taking sands having an average value of 23·0 oz. per ton, it was found possible to extract 97—98 per cent. of the gold content, a large amount of mercury being recovered at the same time.—C. A. W.

Platinum; The solution of —— in sulphuric acid, and the products of this reaction. M. Delépine. Comptes rend., 1910, 150, 104—106. (See also this J., 1905, 132; 1906, 24, 314, 695.)

THE presence of oxygen is not essential, as Quennessen has suggested, for the reaction between platinum and sulphuric acid, and it merely plays a secondary part in modifying the equilibrium of the initial reaction, $2Pt + 7H_2SO_4 = 2Pt(OH)(HSO_4)_2 + 3SO_2 + 4H_2O$. The author establishes this by observing the course of solution in successive currents of carbon dioxide, air, oxygen, carbon dioxide again, and finally carbon dioxide containing sulphur dioxide. From the final solution are obtained two crystalline platinum compounds, the one, $Pt(OH)(HSO_4)_2$, yellow, and the other, probably $Pt(OH)_2HSO_4.H_2O$, red brown.—W. H. P.

Slags; Some analyses of copper blast-furnace ——, and determination of their melting points. A. T. French. Inst. Min. and Met., Jan. 20, 1910. [Advance proof.]

BY means of Seger cones, the author has determined the melting points of a series of ten slags—practically ferrous-calcium-aluminium silicates containing a few per cent. of magnesia and small quantities of copper and zinc. The oxygen ratios were calculated by assuming the alumina to be (a), basic; (b), acid; (c), neutral; and (d), half acid and half basic. According to (a) the most refractory slag is almost a monosilicate, those more fusible varying in composition between that of the mono- (1 : 1) and the sesqui- (1 : 1·5) silicate. In (b) the ratios of the most fusible slags appear to lie between that of the bisilicate (1 : 2) and 2 : 5; while in (c) and (d) the most infusible slag would seem to be a sesquisilicate, the fusibility rapidly increasing as the ratio becomes higher, and decreasing again at the bisilicate mark. The author concludes that the composition of such slags may vary considerably without material alteration of their melting points; thus the silica may vary from 40 to 47 per cent., the ferrous oxide from 18·5 to 28, the lime from 16 to 22, and the alumina from 9·0 to 12·2, any departure from these limits (especially as regards silica, or silica plus alumina) tending to infusibility.—W. E. F. P.

Copper in slags; Rapid method of determining ——. F. D. Aller. Eng. and Min. J., 1909, 88, 1278.

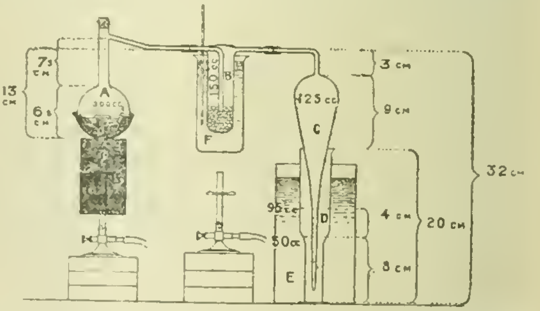
FIVE grms. of the thoroughly chilled and finely powdered sample are placed in a beaker with 200 to 400 c.c. of water, and when boiling, 10 to 15 c.c. of sulphuric acid, previously diluted, are added with constant stirring. The slag immediately dissolves with the exception of any metallic copper, matte, lead sulphate or carbon which may be present. The solution is diluted to about 500 c.c. and the dissolved copper is precipitated by boiling for 20 min. with sheet aluminium. It is stated that no separation of silica occurs. The precipitate and residue are separated and washed by decantation, dissolved in nitric acid, and the copper determined as usual by titration or electrolysis. It is stated that a single determination can be made in 35 min.—F. R.

Copper; Oxidation of the impurities in the refining of —— in reverberatory furnaces. W. Wanjukoff. Metallurgie, 1909, 6, 749—759, 792—801.

IT was found possible to follow the temperature of the melted copper bath during refining; the temperature fell before roasting, and then rose, owing to the reaction: $2Cu_2O + Cu_2S = 6Cu + SO_2 + 39$ cals. The very slight removal of arsenic during the first refining was owing to the protection of the metal by the slag and sulphur compounds, and these being absent in the second refining, the removal of arsenic and antimony proceeded rapidly. From a series of analyses, it is shown that the sulphur is present in the copper, up to the end of the oxidation, as both cuprous sulphide and sulphur dioxide. From the beginning of the poling the sulphur dioxide is no longer present, and it is pointed out that, since cuprous sulphide is not reduced by hydrogen, Hampe's process for the determination of sulphur in copper is unsound. Fifty microphotograms illustrate the paper, and it is concluded that a study of the microscopic structure of the metal during the different phases gives a clear idea of the changes taking place, and explains many points not understood by earlier investigators.—A. H. C.

Arsenic in copper; Determination of ——. E. Azzarello. Gazz. Chim. Ital., 1909, 39, II., 450—453.

THE apparatus shown in the figure is recommended for the rapid determination of small quantities of arsenic in copper. The cylinder, D, is charged with dilute hydrochloric acid (sp. gr. 1·1), whilst glass beads are introduced into the vessel, B, which is heated in an oil-bath, F. When the temperature of the latter has reached 170° to 175° C., 5 grms. of the copper in shavings are placed in the flask, A, together with a spiral of fine platinum wire. 155 c.c. of a 33 per cent. solution of ferric sulphate in strong hydrochloric acid (sp. gr. 1·19) are next introduced by means of a thistle funnel, and the flask immediately closed with a stopper of white rubber. The flask is gently heated until its contents boil, and the temperature then gradually increased until the end of the distillation. The arsenious chloride formed in the reaction, passes into the cylinder, D, which is, meanwhile, immersed in ice-water, whilst any antimony present remains in the distillation flask, or is retained in the vessel, B. As soon as 45 c.c. of distillate have been collected (which should take about 55 minutes from the beginning of the boiling) it is poured, together with the washings of the tube, C, into a large beaker, and cooled with ice-water. About 80 c.c. of ammonia solution (sp. gr. 0·910) are added to render the liquid alkaline, then a few drops of hydrochloric acid to make it acid again, and finally a slight excess of sodium bicarbonate (in powder) and 5 c.c. of a 1 per cent. starch paste. The solution (about 300 c.c. in all) is titrated with a solution of iodine (3·3858 grms. per litre; 1 c.c.=0·001 grm. of arsenic), and 0·4 c.c. deducted from the result for the amount of iodine required to produce a blue coloration in the same volume of liquid free from arsenic.—C.A.M.



Zinc ores; Crude petroleum as a reducing agent for ——. H. H. Hughes and H. Hale. J. Ind. Eng. Chem., 1909, 1, 788—789.

THE authors state that laboratory tests in which a mixture of zinc oxide and crude petroleum was fed into a piece of ⅜-in. gas-piping heated in a Brown assay furnace, show that it is quite practicable to successfully reduce roasted zinc ores in this manner; and they believe that on the large scale, a continuous process based on these principles would be cheaper, more rapid, and more easily controlled than the methods now in use.—A. S.

Zinc: Electrolytic extraction of ——. V. Engelhardt and M. Huth. Metallurgie, 1910, **7**, 1—5.

Since the purity of the electrolyte is one of the essential conditions necessary for the successful electro-deposition of zinc, the use of a soluble anode, as in copper refining, is inapplicable, owing to the impurities of the anode contaminating the bath. The chloride and sulphate also are the only salts economically available. Using the former of these, the Hœpfner process has been in successful operation for a year in spite of the difficulty of keeping the atmosphere free from chlorine. The greatest difficulty in the economical application of this process is the profitable disposal of the bleaching powder produced. The electrolysis of the sulphate appears to be more likely to be successful in dealing with ores low in zinc content, the sulphuric acid produced at the same time being used again for the extraction of more ore. The causes of a spongy deposit, and the conditions necessary for the formation of a coherent metal are discussed. With the use of lead peroxide as the anode, a coherent electrolytic zinc has been obtained, containing 99·98 per cent. of zinc, with the consumption of 3·9 kilowatt-hours per kilo. (2·2 lb.) of zinc, and the production of sulphuric acid of 10 per cent. concentration. The authors call attention to the advantages and successful use of manganese peroxide as the anode.—A. H. C.

Aluminium-zinc alloys; The tensile strength of ——. W. D. Bancroft. Trans. Amer. Brass Founders' Assoc., 1909, 47—54.

The alloys were prepared from aluminium of 99·9 per cent. purity, and zinc containing not more than 0·2 per cent. of impurities. Crucibles made of pure artificial graphite were used, as molten aluminium in contact with clay absorbs silicon; and the alloys were poured at a temperature 50° C. above their melting points. The curve of tensile strengths consists of three parts, which correspond to the three classes of alloys indicated by the equilibrium diagram. From 0 per cent. to 4 per cent. of aluminium the tensile strength increases from about 4 to 11 tons per sq. in.; from 4 per cent. to about 60 per cent. it increases more gradually to 16 tons per sq. in., and then decreases to about 6 tons per sq. in., which is the strength of pure aluminium. The alloys at the zinc end of the series were cast into ice-cold moulds made of artificial graphite, and the castings quenched in ice water, in order to obtain a finely crystalline product.—O. F. H.

Nickel-carbon alloys; Freezing point diagram of ——. K. Friedrich and A. Leroux. Metallurgie, 1910, **7**, 10—13.

A freezing-point diagram derived from the cooling curves of nickel-carbon alloys containing up to 2·6 per cent. of carbon and from 0·2 to 0·6 per cent. of iron, is given, in which it is shown that: (1), while pure nickel solidifies at 1451° C., the freezing point falls with increasing carbon content up to 2 to 2·5 per cent. of carbon, the eutectic point; (2), the eutectic line lies at a temperature between 1307° C. and 1318° C.; and (3), nickel containing from 0·2 per cent. to 0·6 per cent. of iron forms a solid solution with carbon up to about 1 per cent. Microscopical investigation showed that the solubility limit of carbon in solid nickel at 1300° C. is about 0·9 per cent. of carbon, and from this limit the eutectic can be traced up to 2·6 per cent. of carbon, when the whole field of vision becomes filled with what appears to be primary crystals of the carbon carrier. Quenching the melted material produces no difference in structure from that observed in alloys slowly cooled from a temperature above the arrest point.—A. H. C.

Nickel; Two new phosphides of ——. P. Jolibois. Comptes rend., 1910, **150**, 106—108.

The author has obtained two new phosphides of nickel, NiP_2 (sp. gr. 4·62 at 18° C.), and NiP_3 (sp. gr. 4·19 at 18° C.) They are both crystalline substances of metallic appearance. The method of preparation is to heat a nickel-tin alloy (5 per cent. of nickel) with phosphorus in a sealed evacuated Jena glass tube to 700° C. Using 1—4 grms. of phosphorus with 21 grms. of the alloy, the diphosphide, NiP_2, is isolated from the product by treatment with warm concentrated hydrochloric acid. Using more phosphorus, this treatment leaves a mixture of the phosphides, SnP_3 and NiP_3. The former may be decomposed by heating to 360° C. under reduced pressure, and then further treatment with hydrochloric acid leaves the nickel triphosphide, NiP_3, as a crystalline residue.—W. H. P.

Cobalt alloys; Study of some —— with respect to their electromotive forces. F. Ducelliez. Comptes rend., 1910, **150**, 98—101.

E.M.F.-curves are given for alloys of cobalt with tin, antimony, bismuth, lead, and copper. They indicate the existence of the compounds, CoSn, CoSb, and (less definitely) of $CoSb_2$. The curves for the alloys of lead, bismuth, and copper with cobalt show the existence of solid solutions, and the approximate limits of solubility.—W. H. P.

Metals and alloys; Contraction of ——. F. Wüst. Metallurgie, 1909, 6, 769—792.

An apparatus is described by means of which a record can be made of the contraction of a metal or alloy after setting, simultaneously with the temperature observations through equal intervals of time, thereby constructing a contraction-curve in which the contraction is represented as a function of temperature. The metals are in the form of bars, 500 mm. long, and at the ends of the mould are coils of iron wire, which, becoming embedded in the metal, operate pistons working in polished cylinders, the latter being filled with distilled water and communicating with a graduated capillary tube. Any alteration in the length of the bar, after solidification, is magnified in the capillary tube, and all errors of a lever are eliminated. A thermo-junction in a narrow porcelain tube piercing the mould gives a record of the temperature. The author experimented with lead, zinc, tin, aluminium, copper, antimony, bismuth, and a large number of alloys of these metals, including cupro-nickel, the analyses of which are given. The cooling-curve with its associated contraction curve is given for each metal and alloy, as well as forty-two microphotograms illustrating their structure. From the curves the true formula coefficient of expansion of the metal up to its melting point can be at once determined. The author finds in general that: (*a*), those alloys, the components of which in the free state are insoluble in one another, possess a smaller contraction than any of their components, the eutectic alloy having the smallest coefficient; (*b*), those alloys which, after solidification, contain one or more solid solutions, contract more than any of their components; (c), the presence of a halt-point between the melting point and the contraction was not observed either in any of the metals or in their alloys. A list of papers previously published, and bearing on the subject, is added to the paper.—A. H. C.

Electro-deposited alloys [silver-copper]; Conditions which determine the composition of ——. S. Field. Faraday Soc. Trans., Jan. 18, 1910. [Advance proof.]

Copper and silver, unlike copper and zinc (this J., 1909, 891), can be deposited together, only between very narrow limits, even from solutions of their double cyanides. Excess of potassium cyanide renders simultaneous deposition more difficult.—F. Sodn.

Electro-deposition of metals. F. M. Perkin and W. E. Hughes. Faraday Soc. Trans., Jan. 18, 1910. [Advance proof.]

An extended series of experiments, carried out in order to ascertain the most efficient form of apparatus for the electro-deposition of metals, has led the authors to recommend the use of a cylinder of platinum gauze of very fine mesh, as cathode, and a rotating anode, consisting of a closely wound spiral of iridio-platinum wire, the funnel proposed by Price and Judge (this J., 1906, 643) being used for holding the electrolyte. This apparatus gives good results even with very high current densities, and it may be used, not only for the rapid deposition of metals, but also to obtain single electrode potentials; for this latter purpose the funnel has a side tube fused into the middle, down which is inserted the capillary end of the auxiliary electrode cell, so as to come just at the back of the cathode.—F. Sodn.

Sodium hydroxide; Action of metals on fused ——. M. Le Blanc and L. Bergmann. Ber. 1909, 42, 4728—4747.

Sodium hydroxide was heated in a gold crucible contained in a silver tube to determined temperatures, alone and in contact with various metals, in a stream of pure nitrogen to exclude air. At 400° C., any absorbed water is expelled, and dehydrated sodium hydroxide remains; no dissociation of this, according to the equation, $2NaOH=Na_2O+H_2O$, occurs up to 720° C., the highest temperature employed in the experiments. The only metal used which was entirely without action on the hydroxide was gold. Silver and sodium caused evolution of hydrogen only; platinum, copper, iron, nickel, aluminium, zinc, and magnesium caused evolution of both hydrogen and water-vapour. Probably the substance formed by the reaction, $M+x\ NaOH=M(ONa)x+xH$, reacts to form a complex compound with sodium oxide and thus facilitates dissociation of the hydroxide. In the case of silver, nickel, and platinum (but of no other metal), the proportions between the amounts of metal entering into reaction and of hydrogen evolved, do not correspond with the usual valency of the metal. In the experiments with copper, the gold crucible lost weight, and a copper-gold alloy was found in the fusion: such an alloy is not formed when copper and gold are directly heated together to 720° C. Silver, when used, was gilded during the experiment, and a ring of gold appeared on the silver tube at the level of the top of the crucible, an appearance which also occurred when nickel was used, but in no other case. With magnesium, a gold-magnesium alloy was formed.—J. T. D.

Patents.

Zinc; Extraction of —— from its ores or compounds, and apparatus therefor. W. Hommel and The Metals Extraction Corp., Ltd., London. Eng. Pat. 21,759, Oct. 14, 1908.

A mixture of powdered ore and water is forced into a closed mixing vessel by means of a jet of sulphur dioxide or sulphurous acid, acting as an injector, the mixing vessel being maintained under such a pressure that the sulphur dioxide is held in solution. Under these conditions, the zinc in the ore is dissolved out as zinc bisulphite. The zinc solution and undissolved residue are continuously discharged into a filtering apparatus and the zinc precipitated as mono-sulphite, from the separated solution, by heating it in a vacuum. The heated solution is subsequently used to preheat fresh zinc solution on its way to the precipitating tank.—F. R.

Zinc; Apparatus for use in solution and precipitation processes and particularly for the extraction of —— from its ores or compounds. W. Hommel and The Metals Extraction Corp., Ltd., London. Eng. Pat. 26,152, Dec. 3, 1908.

Powdered ore and water are simultaneously fed into a pipe, which is inclined downwards, and terminates in a small enclosed chamber, into which a vertical pipe is fitted. A jet of sulphur dioxide, or other gas, employed as an injector, forces the liquid, containing the ore in suspension, up the vertical pipe into an enclosed receiving chamber, from which it is discharged, or from which it may in turn pass to one or more units of similar V-shaped design. A pipe is provided in the upper chamber to remove any excess of gas.—F. R.

Zinc and/or copper from complex ores or the like; Obtaining ——. J. R. Williams and H. W. and B. Bradley, Sheffield. Eng. Pat. 26,711, Dec. 9, 1908.

The powdered ore is leached with a slightly acid solution of zinc or copper sulphate or a mixture of the two, of such a strength that it will dissolve the zinc or copper in the ore, but will not gelatinise the silica. The solution is then run into a tank where the excess of zinc or copper is electrolytically deposited, leaving the solution at substantially its original strength, ready for leaching a new lot of ore.—F. R.

Extraction of metals [gold]; Arrangement and construction of appliances employed in lixiviation processes for the ——. J. Williams, London. Eng. Pat. 26,831, Dec. 10, 1908.

The apparatus consists of one or more percolating vats, the spaces below the filters of which are connected by pipes to a vacuum tank. The ore is charged into a percolation vat and the contained gold dissolved out by treatment with a solution of potassium cyanide. The auriferous solutions, together with the subsequent wash-waters, are evaporated in the vacuum tank to the volume of the original cyanide solution, and after making up to strength by the addition of potassium cyanide, are used for the leaching of a fresh supply of ore. When the cyanide solution has become sufficiently enriched, it is evaporated to dryness and the gold recovered from the residue by suitable means.—F. R.

Pickling metals [iron and steel]. A. G. Bloxam, London. From La Comp. des Forges de Chatillon, Paris. Eng. Pat. 27,353, Dec. 16, 1908.

In the pickling of iron and steel with a heated solution of sulphuric acid, saturated at ordinary temperatures with ferrous sulphate, in place of regenerating the solution by cooling to separate out the excess of ferrous sulphate, reheating and adding sufficient additional sulphuric acid to make up to the original strength, the required acid is added to the cooled solution, thereby causing a further precipitation of ferrous sulphate, owing to its lesser solubility in more strongly acid solutions.—F. R.

Steel; Process of making ——. L. M. Atha, Newark, N.J. U.S. Pat. 943,171, Dec. 14, 1909.

A mixture of steel scrap and pulverised oil-retort carbon is "boiled down" in the furnace. A suitable flux, such as limestone, and a certain amount of iron may be added to the charge before smelting.—C. A. W.

Steel; Refining ——. E. Humbert, South Chicago, Ill. U.S. Pat. 943,192, Dec. 14, 1909.

The method is applicable to the treatment of steel containing phosphorus. The steel, melted in an electric furnace, is mixed with an oxidising slag, which combines with the phosphorus and forms a phosphate. By maintaining a reducing atmosphere in the furnace and adding a reducing agent to the molten charge, this phosphate is subsequently reduced to a phosphide.—C. A. W.

Alloys of tin and copper; Treatment of —— to separate the metals. C. H. Stewart, London. Eng. Pat. 28,508, Dec. 31, 1908.

The alloy of tin and copper, preferably in a granulated condition and if necessary after a preliminary roasting, is smelted with a sulphate, such as calcium sulphate or sodium sulphate, or a mixture of both. The copper is converted into sulphide and the tin is oxidised, a copper matte and a stannate of the base being obtained, together with "bottoms" containing any lead, antimony, gold, silver or bismuth. The reaction proceeds more easily under slightly reducing conditions, and the addition of a small proportion of carbon, such as crushed coke, is advantageous. If the copper in the alloy be in excess of the tin, sulphur or a source of sulphur must be added to the charge, or the excess of base must be neutralised by the addition of silica. If the tin be in excess, the addition of a second base may be necessary: for this purpose lime or sodium carbonate may be employed.—C. A. W.

Tin alloys containing silver; Treatment of —— to separate the metals. C. H. Stewart, London. Eng. Pat. 28,509, Dec. 31, 1908.

The alloy of tin and silver is smelted with an oxidised lead material such as lead carbonate, litharge, or red lead, other bases such as lime or soda being added if necessary. If copper be present, the addition of a source of sulphur, such as lead sulphate, is desirable, but in any case the proportions of the charge are calculated so that the tin will be nearly all removed in the slag as fusible stannates. The copper is obtained as a matte, and the remaining metals such as gold or bismuth are found in the alloy of lead and silver produced.—C. A. W.

Tin or other metals; Process of separating —— from waste metal, metallic ware, alloys and the like. C. A. Jensen, London. From G. Spitz, Brünn, Austria. Eng. Pat. 28,551, Dec. 31, 1908.

The tin-plate scrap is heated in a closed vessel, to a temperature above 150° C., with a solution of caustic potash or soda and an oxidising material such as saltpetre, dissolved in such proportions that the liquid has a specific gravity of 1·06 to 1·20; this corresponds to about 6 to 20 per cent. of alkali in the solution. In some cases atmospheric air may be employed as an oxidising agent. It is of great importance that considerably more alkali be present than is theoretically required according to the equation: $2Sn+3NaOH+NaNO_3=2Na_2SnO_3+NH_3$. It is therefore recommended that such an amount of alkali be taken that, at the end of the operation, the solution will still contain at least 3 to 5 per cent. of free sodium hydroxide. An excess of oxidising material is also required. If lead be present in the form of solder, this will also be dissolved, but in this case a still greater excess of alkali will be required. It is claimed that, in this process, no iron is dissolved.—C. A. W.

Tin scraps; Process of detinning —— and producing tin compounds. O. K. Zwingenberger, New York. U.S. Pat. 943,508, Dec. 14, 1909.

The tin scrap or similar material is treated, in suitable receptacles, with dry chlorine gas. In order to present to the gas as large a surface of tin as possible, a number of receptacles are arranged in parallel and a partial vacuum maintained equally throughout the system during the reaction. In this way an equal quantity of gas is delivered simultaneously into each receptacle. The stannic chloride and residual gases are removed by compressed air, the iron scrap being subsequently washed with a solution of sodium sulphate, which collects the last traces of stannic chloride and removes the iron chloride from the surface of the scrap. The sprinkling with sodium sulphate may be effected in a second receptacle, but in any case the scrap is finally washed with water.—C. A. W.

Iron; Process of treating detinned——and residues. W. W. Murray, Baltimore, Md., and H. M. Fernberger, Philadelphia, Pa. U.S. Pat. 943,986, Dec. 21, 1909.

The material, consisting of detinned iron and residues, is washed with an anhydrous liquid solvent of the methane series which is capable of dissolving the stannic chloride. Carbon tetrachloride may be employed The mass is then heated in order to drive off the last traces of the solvent.
—C. A.W.

German silver; Improvements in the alloy known as ——. W. R. Barclay and J. Rodgers, Sheffield. Eng. Pat. 1365, Jan. 20. 1909.

The addition of a small percentage of cadmium to low-grade German silver, increases the hardness, general working qualities and colour to that of a first or second-grade alloy containing say 22 to 30 per cent. of nickel. The following is an example of a modified German silver:—copper, 57 per cent.; nickel, 12·5; zinc, 28·5, and cadmium, 2 per cent.—F. R.

Aluminium and metals rich in aluminium; Method of soldering ——. C. E. Steinweg, Lüdenscheid, Germany. Eng. Pat. 6138, March 15, 1909.

The flux, which should possess a melting point approximating to that of the solder, may be composed of sodium, potassium or lithium chlorides, mixed with certain fluorides such as cryolite. As an example, a composition, containing 60 per cent. of lithium chloride, 30 of potassium fluoride, and 10 of cryolite may be employed. In order however to prevent its decomposition by the direct action of the flame, the flux is heated indirectly by enclosing it in a tube composed of the soldering metal, which is subsequently melted in the ordinary way. The solder may be composed of an alloy of aluminium and cadmium containing, for example, 5 per cent. of the latter metal.
—C. A. W.

Metallurgical process. [Production of aluminium.] A. G. Betts, Troy, N.Y. U.S. Pat. 938,634, Nov. 2, 1909.

The method is applicable to the production of pure aluminium, the ore being smelted in presence of a comparatively easily reduced and not very volatile metal. The resulting alloy is caused to react with a suitable metallic compound so that a pure compound of aluminium is obtained; this compound is employed for the production of the metal. As an example, a mixture of iron ore and bauxite or kaolin is reduced in a blast-furnace, a higher temperature than usual being employed in the smelting zone; this may be obtained by using a more highly heated blast. An alloy of iron and aluminium, containing more or less silicon, is produced, and this may be treated at a high temperature with silica. But it is preferable to treat the aluminium alloy with a metallic sulphide, such as sulphide of iron, nickel or copper, and to employ the resulting pure aluminium sulphide for electrolysis. The crucible employed is provided with trunnions and with two spouts, one, communicating with the bottom of the vessel, is used for pouring off the metallic iron, copper or nickel produced in the reaction. In order to obtain an aluminium sulphide absolutely free from other metals, the reaction is carried on in two stages. The fused alloy is run into the crucible, which contains a molten mixture of iron and aluminium sulphides obtained in a previous operation. The amount of iron sulphide is insufficient to react with the whole of the aluminium present, so that a practically pure aluminium sulphide is obtained. This is poured off and fused ferrous sulphide added. In the ensuing reaction, an iron alloy, containing considerably less aluminium, is produced, and removed. The residue in the crucible, consisting of aluminium-iron sulphide is then employed as before. Thus, only the aluminium sulphide obtained in the first fusion is used in the subsequent electrolysis. A natural sulphide is always smelted beforehand in order to free it from any gangue; should iron pyrites be employed, it is converted to ferrous sulphide by the addition of iron oxide to the charge.—C. A. W.

Furnaces having superposed working chambers. U. Wedge, Ardmore, Pa. Eng. Pat. 8943, April 15, 1909. Under Int. Conv., April 16, 1908.

The furnace is cylindrical in form and contains a number of superposed circular hearths or working chambers, the space between the hearth of one chamber and the arch of the chamber beneath, serving for the passage of the heating gases. The important feature in the construction is the method of supporting the various floors of the furnace. A number of vertical columns, placed at suitable intervals in a circle, carry supporting rings at the various levels on which the furnace arches are to be situated. These rings support the outer courses of the brickwork of which the arches are composed, and in this way the latter are rendered quite independent of the outer furnace wall, which is built in sections extending from arch to arch. One or more of these sections can be removed, when it is desired to gain access to any chamber of the furnace; moreover, any material capable of resisting heat and providing a gas-tight enclosure can be employed in the construction. The hearth of the lowest working chamber is supported, at a certain distance above the ground, by rings on the upright columns and by transverse girders, but the hearth of any other chamber is supported upon the arch of the chamber beneath. The spaces thus left between arch and floor comprise heating chambers, into which the hot gases are passed from a stack on either side of the furnace, through flues which may be wholly or partially closed when necessary. These stacks are in communication with a suitable fire-place, and similar stacks are provided for carrying away the gases, which are finally passed back through the top chamber. Up the centre of the furnace there passes a hollow shaft which can be rotated by suitable mechanism placed at the bottom. It is protected from the heat by a covering of refractory blocks, and carries a series of arms which project into the working chambers and agitate the bodies of ore or other material on the floors. For this purpose the arms are provided with stirring and feeding blades. The working chambers are connected in the usual manner by vertical passages from floor to floor, so that, in the working of the furnace, any material fed on to the top hearth will be carried over the various hearths in succession and finally discharged at the bottom.—C. A. W.

Furnace ; Roasting ——. G. H. Niles, Newark, N.J. U.S. Pat. 945,041, Jan. 4, 1910.

The furnace comprises a heating chamber which is divided into two parts by a wall. One of these portions communicates with a gas-generating chamber, this last being connected by flues with the other portion of the heating chamber on the other side of the wall. In this second portion an opening is provided for the admission of air, if desirable. Each portion of the heating chamber is connected independently with the discharge flue, and each contains a support for the material to be roasted, extending along the dividing wall. All the flues can be controlled by dampers.—C. A. W.

Furnace ; Ore-roasting ——. B. Hall. Nevada City, Cal. U.S. Pat. 945,225, Jan. 4, 1910.

This reverberatory furnace is of the horizontal type, the ore being fed in at one end and discharged at the other. A number of triangular shoes are laid lengthwise along the hearth ; a section of one of these shoes resembles a right-angled triangle, the taper end being disposed towards the outlet of the furnace. These shoes are suspended by means of vertical rods from points above the arch of the furnace and are given a pendulous motion in a direction transverse to the length. In this way the ore as it falls on the hearth is gradually advanced from one end to the other. Slots are provided in the arch of the furnace for the passage of the rods, these slots being kept closed by pieces swinging with the pendulums. —C. A. W.

[*Modified thermite process.*] *Generation of heat ; Composition of matter for the* ——. F. J. Tone, Niagara Falls, N.Y., Assignor of Pat. 939,930 to the Carborundum Co., Niagara Falls. U.S. Pats. 939,570 and 939,930, Nov. 9, 1909.

The claim is for a composition to take the place of the mixture of aluminium and ferric oxide used in the "thermite" process for the reduction of metallic oxides, welding metals, &c. The new composition consists of one part of a mixture of silicon and potassium chlorate in proportions corresponding with the equation : $3Si+2KClO_3=3SiO_2+2KCl$, and three parts of a mixture of silicon and ferric oxide in the proportions represented by the equation: $3Si+2Fe_2O_3=4Fe+3SiO_2$. A portion of the ferric oxide may be replaced by potassium permanganate. The composition is ignited and used similarly to the "thermite" mixture and is said to give a greater heat intensity than that mixture, owing to its smaller mass. It is also stated that when the mixture is ignited locally, the reaction proceeds throughout without undue violence. —W. H. C.

Metals ; Method of protecting molten ——. W. S. Rockey and H. Eldridge, New York, N.Y. U.S. Pats. 943,161 and 943,639, Dec. 14, 1909.

(1) A suitable quantity of a halogen salt, such as potassium chloride, is fused in a crucible. The metal or metals having been immersed beneath the liquid salt, heat is again applied until a molten bath of the metal is formed at the bottom of the crucible. The method may be applied to the simultaneous plating and brazing of iron or steel articles, by passing them through the liquid salt into the bath of molten metal. (2) Boron trioxide, or a suitable borate, is fused in a crucible, the resulting liquid being then employed as a protecting bath, beneath which the metal is reduced and fused by the further application of heat.—C. A. W.

Metal ; Reclamation of purified ——. W. C. Hyzer, Philadelphia, Pa. U.S. Pat. 943,248, Dec. 14, 1909.

The metal is melted in a furnace which comprises a grate and combustion chamber communicating with a chimney through a horizontal flue. The melting pot is situated within the combustion chamber, the hemispherical bottom of the pot forming the roof of the chamber. The supporting framework for the pot is so arranged that the removal of the lid allows no escape for the products of combustion from the chamber. As the metal becomes melted, the dross is skimmed from the top and transferred to a supplemental melting pot situated on the bottom of the horizontal flue between the chamber and the chimney, a covered opening being provided in the flue immediately over the pot, for the admission of the dross. This supplemental pot is provided with gently sloping walls, and with a discharge pipe at the bottom, through which the melted metal is allowed to escape.—C. A. W.

Copper matte ; Bessemerizing of ——. E. A. C. Smith, Baltimore, Md. U.S. Pat. 943,280, Dec. 14, 1909.

An initial bath of molten matte having been formed, a charge of acid flux, containing matte-forming constituents, is added. The whole is then blown until a portion of the iron is fluxed and the matte-forming material from the acid flux has become incorporated with the initial body. By admitting the air in a volume proportional to the amount and composition of the flux, a thin and fluid slag is formed at a temperature insufficient to attack appreciably the lining of the converter. This slag is poured off, a further charge of molten matte and acid flux added, and the process continued in the same way, the iron being fluxed in portions at a time, until the matte is in a condition to be blown to blister copper. A certain amount of iron, in excess of that required to neutralise any residual silica, is left in the matte, and this prevents foaming during the final operation. The converter has a non-corrodible lining, and the volume of the liquid matte is always kept small, in order that the bath may retain its fluidity.—C. A. W.

Converter ; Metallurgic ——. W. H. Peirce, Baltimore, Md. U.S. Pat. 944,905, Dec. 28, 1909.

The converter comprises a cylindrical shell open at the upper side and capable of being rotated in the ordinary manner. The lining, arched over at the top and free to expand under the influence of heat, is supported by means of flanged heads which engage telescopically with the ends of the shell, the connections being made adjustable. In this way the supporting heads are enabled to move outwards as the lining expands.—C. A. W.

Converter-bottoms ; Process for the burning of basic ——. J. Klein. Ger. Pat. 215,539, March 23, 1909.

The converter-bottom is burnt by passing an electric current through the metal rods inserted to prevent blocking of the tuyères, and so heating these rods to incandescence. —A. S.

Values ; Process of reclaiming —— from dust. N. H. Livingston, Globe, Ariz. U.S. Pat. 943,752, Dec. 21, 1909.

The process is applicable to the recovery of values from flue-dust. The dust is delivered by gravitation into a chamber and thence conveyed to a converter by means of separate high- and low-pressure currents of air. The values are here reduced to molten metal, the residual dust mixing with the matte in the converter.—C. A. W.

Alkali-earth metals, &c.; Production of alloys of ——. G. O. Seward and F. von Kügelgen, Holcombs Rock, Va., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 941,826, Dec. 28, 1909.

Alloys of alkaline-earth metals with less electro-positive metals are produced by electrolysing a fused mixture of compounds of the metals, such as the chlorides. The concentration of the less electro-positive metal is kept constant and so low that the two metals are deposited together. —C. A. W.

Scrap metal; Apparatus for recovering material from ——. S. W. Egbert, Joliet. Ill. U. S. Pat. 945,024, Jan. 4, 1910.

The scrap metal, after passing under a roller by which it is levelled and compressed, is conveyed through an electrolyte by means of a trough conveyor. The tank containing the electrolyte is constructed with inclined ends, so as to enable the conveyor to travel through it in a horizontal plane. The conveyor itself acts as an anode, the cathode being immersed in the electrolyte.—C. A. W.

Mineral [slag] wool; Process of manufacturing ——. T. B. Parkison, Muncie, Ind., Assignor to Union Fibre Co., Winona, Minn. U.S. Pat. 945,583, Jan. 4, 1910.

The molten slag as it emerges from the cupola and comes into contact with the air or steam blast, is subjected to the action of a vaporised hydrocarbon oil. The oil may be allowed to fall directly in a thin stream upon the stream of molten slag before it enters the blow-tube. In this way each individual filament becomes coated with the products of combustion, and a waterproof material is obtained. —C. A. W.

Drying air [for metallurgical furnaces] by refrigeration; Method of ——, and apparatus therefor. J. Gayley, New York. Eng. Pat. 13,556, June 9, 1909.

See Fr. Pat. 404,058 of 1909; this J., 1910, 95.—T. F. B.

Electroplating baths. B. J. B. Mills, London. From A. Van Winkle, Newark, N.J., U.S.A. Eng. Pat. 16,931, July 20, 1909.

See U.S. Pat. 930,815 of 1909; this J., 1909, 988.—T.F.B.

Furnace. U. Wedge, Ardmore, Pa. U.S. Pat. 946,178, Jan. 11, 1910.

See Eng. Pat. 8943 of 1909; preceding.—T. F. B.

Iron or steel; Treatment [case-hardening] of ——. W. R. Hodgkinson, Blackheath. U.S. Pat. 946,360, Jan. 11, 1910.

See Eng. Pat. 19,493 of 1906; this J., 1907, 1052.—T.F.B.

Armour plate and other article of steel. F. Giolitti, Rome, Assignor to Soc. Anon. Italiana G. Ansaldo Armstrong & Co., Genoa, Italy. U.S. Pat. 946,428, Jan. 11, 1910.

See Fr. Pat. 393,355 of 1908; this J., 1909, 145.—T. F. B.

Ores and carbonaceous earths; Process for treating ——, and for preparing oils for the purpose. The L. and S. Synd., Ltd. Fr. Pat. 404,329, June 23, 1909.

See Eng. Pats. 26,294 of 1908 and 8287 of 1909; this J., 1910, 95.—T. F. B.

Blast furnaces and converters; Method of working ——. J. Gayley. Fr. Pat. 404,432, June 18, 1909.

See U.S. Pat. 935,628 of 1909; this J., 1909, 1140.—T.F.B.

Steel-preservative paint. U.S. Pat. 943,670. *See* XIII.

Refractory brick for metallurgical and other uses. U.S. Pats. 944,692—944,694. *See* IX.

XI.—ELECTRO-CHEMISTRY.

Patents.

Electrolytic decomposition of alkaline salts; Process and apparatus for the ——. J. Greenwood, London. Eng. Pat. 25,208, Nov. 23, 1908.

The apparatus is intended for the electrolytic decomposition of alkali salts (sodium chloride) by the diaphragm method. It comprises a series of hollow inverted cones fitting one into the other, these cones constituting the anode and cathode-diaphragm casings respectively. An anode section, constructed of ferrosilicon or other unattackable material, is situated at the top of the series and has an outlet at the apex. This anode section is placed inside and above a double-walled cathode section of similar shape, a space being left for the circulation of the electrolyte, which, falling through the outlet in the anode, rises up between the sections and falls over the top of the cathode into the following anode section, and so proceeds through the series. The inner wall of a cathode section is composed of asbestos-porcelain, or a similar porous asbestos material; the outer, or lower, wall is constituted by a sheet of ebonite. This cathode section, comprising the space between the porous and the ebonite walls, is hermetically sealed by an ebonite cover, but is connected with a vacuum pump by an ebonite tube leading to the bottom of the section. In this way the pressure within the section may be reduced, or the caustic soda may be withdrawn as fast as it is formed. The cathode inside this section is of copper gauze or other suitable material and is arranged in close contact with the asbestos-porcelain. Any number of these anodic and cathodic sections may be arranged concentrically one below the other, the whole being encased in a cylindrical iron vessel, lined with porcelain enamel, mounted on a slate bed and provided with two holes in the cover, through one of which the salt solution is conveyed to the top anode section, the other serving for the egress of the chlorine. Projections on the anode sections are connected to three upright columns, which serve as positive terminals; copper rings around the tops of the cathode sections are connected to the negative terminals of the apparatus. When a high current density is employed, the vacuum in the cathode sections is increased to a maximum, so that a greater quantity of the electrolyte percolates through the diaphragm and thereby diminishes the resistance. Similarly, with a low current density, the vacuum is diminished. In this way products of constant strength and quality are obtained from the cell. The apparatus may also be made in the form of V-shaped rectangular vessels provided with side walls of slate or other suitable material.—C. A. W.

Electrolytic apparatus [for producing chlorates from chlorides]. H. H. Bates and F. Adam, Joliet, Ill. U.S. Pat. 944,650, Dec. 28, 1909.

This electrolytic cell is designed for the production of chlorates from chlorides. The anodes and cathodes may be mounted on a common axis and arranged so as to rotate in the same direction within the solution, which in this way becomes agitated. Alternatively, the cathode alone may be constructed with vanes and given a rotary movement; or, finally, the anode may be formed of a thin sheet of metal, which is rotated, the cathode being made to face both sides of the anode sheet.—C. A. W.

Refractory electric conductors; Manufacture of ——. W. D. Coolidge, Schenectady, N.Y., U.S.A. Eng. Pat. 282, Jan. 5, 1909. Under Int. Conv., Sept. 23, 1908.

For the manufacture of electric conductors (such as wires, rods, plates, tubes, &c.), from refractory metals and other materials, the latter are first incorporated with a metallic binder consisting of a cadmium-bismuth amalgam. The amalgam is prepared by melting together 44 parts of cadmium, 44 of mercury and 12 of bismuth; it is plastic when partially cooled, and may then be easily impregnated with the required refractory substance by rubbing the materials together in a mortar, the resulting mixture being amenable to the ordinary metal-working processes. The conductors, having been produced from such mixture by extrusion or other suitable means, are then "dried out," that is, brought to such a state that subsequent heating will not affect them. This is accomplished by subjecting them, while in an externally heated tube, to a blast of hydrogen or other inert gas, or of air or dry steam; or to the action of such vapours as hydrochloric acid, chlorine, bromine, &c., with or without supplemental heating. They may also be dried out by being baked (in a vacuum or inert atmosphere) in a packing of finely-divided metal, such as copper, aluminium, zinc, tin, &c., or in finely-powdered alumina, magnesia, calcium carbonate, &c., the function of the packing material being, in either case, to soak up the excess of amalgam which oozes from them during the heating. The final or firing treatment is effected by heating with current in a vacuum or in an atmosphere of hydrogen, or hydrogen and nitrogen, until the vaporisable components are expelled and the refractory material is sintered into a strong, coherent conductor; or the wires, filaments, &c., may be externally heated to a high temperature in a tubular resistance furnace supplied with a suitable treating gas. The furnace used in this operation consists essentially of a vertical tube, composed of alumina, electrically heated by an external spiral of platinum ribbon, and connected at its lower end with a detachable, water-jacketed iron tube. The compound tube so formed is plugged with asbestos at each end, and hydrogen is circulated through it at a suitable and adjustable rate. For supporting the wires, &c., a standard of alumina or tungsten is provided, the lower end of which is attached to a rod passing through the lower asbestos plug. In the treatment, the wires, &c., are allowed to stand for some time in the lower or cool part of the apparatus, and then raised into the hot zone; when finished, they are lowered again to cool in the hydrogen before being finally removed.—W. E. F. P.

Electrodes; Method of securing metal contacts to carbon ——. S. Benkö, Budapest, Hungary. Eng. Pat. 15,737 of 1909; date of application, Dec. 28, 1908.

The method is primarily intended for application to hollow carbon electrodes, say of rectangular shape. The hollow carbon body is provided near its free opening with perforations through both the lateral walls. In this condition it is supported head downwards in a shallow mould, but not so far as to reach the bottom. The mould and carbon having first been heated to a temperature above the melting point of the metal, molten lead or aluminium is poured into the mould. The metal, in contracting, rushes into the pores of the carbon, which have been freed from air, and a firm contact is obtained, the metal rods produced across the opening exercising a strong tension. Whilst the metal is still in a semi-liquid condition, a pressure of 30 to 100 atmospheres is applied, by means of a parrallel vice or hydraulic press, to the two lateral walls of the mould, which have been made movable. In this way the pressure is increased in the direction of the rods, and the metal is forced into the pores of the carbon.
—C. A. W.

Electrical insulating material. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, New York. Eng. Pat. 2128, Jan. 28, 1909.

Asbestos fibre, 26 parts, is mixed with 80 parts of a base composed of 43 parts of calcium hydroxide and 37 parts of silica or flint. The materials are thoroughly agitated in a beating machine, the pulp being subsequently formed into paper, preferably in a machine of the cylinder type. The material, having been dried and cut into any shape desired, is subjected to the action of steam at a pressure of 120 to 160 lb. for several hours. The result is a kind of asbestos paper which is highly insulating and at the same time capable of withstanding high temperatures without injury.—C. A. W.

Insulating coating on objects of all kinds; Process for the production [from stearine-pitch] of an ——. A. Vogelgesang. Ger. Pat. 217,026, April 12, 1906.

The articles to be coated are dipped into fused soft stearine-pitch, or into a solution of the pitch in a suitable solvent, and then, after removal, heated to from 150° to 400° C., preferably 250°–350° C. Claim is also made for the production of articles by filling a mould with the fused pitch, heating to from 150° to 400° C., and then allowing to cool: the product is hard and infusible, but flexible.
—A. S.

Battery; Secondary ——. W. Morrison, Chicago, Ill., Assignor to M. A. Lumbard, Des Moines, Iowa. U.S. Pat. 945,243, Jan. 4, 1910.

The electrolyte is a solution of an alkali zincate, the positive electrode being constitued by a support coated with cadmium, or cadmium and mercury. On this support the zinc of the electrolyte is to be deposited. Any suitable negative electrode may be employed.—C. A. W.

Electrolytic apparatus. J. H. Monge and C. Arzano, St. Gilles-les-Bruxelle, Belgium. U.S. Pat. 945,132, Jan. 4, 1910.

See Eng. Pat. 18,210 of 1907; this J., 1908, 947.—T. F. B.

Metallic filaments for incandescent [electric] lamps. U.S. Pat. 945,504. *See* IIB.

Oxides of nitrogen from the air. U.S. Pat. 943,661. *See* VII.

Treating electric furnace products [abrasives and refractory materials.] U.S. Pat. 944,436. *See* IX.

Sterilising water by ozonisation. Eng. Pat. 27,226. *See* XIXB.

Electrolytic water-purifying apparatus. U.S. Pats. 943,187 and 943,188. *See* XIXB.

XII.—FATS; OILS; WAXES.

Mimusops djave; Seeds of ——. E. Fickendey. Der Tropenpflanzer, 1910, **14**, 29—36.

Mimusops djave, a member of the *Sapotaceæ*, grows in various districts in the Cameroons, and is valued for its mealy acid fruit, the fat contained in its seeds (*cf.* this J., 1908, 511), and its wood, which resembles mahogany. The fat in the dry kernels of various origin ranged from 64·53 to 70 per cent. It gave the following analytical values:—Sp. gr. at 15° C., 0·9172; acid value, 18·2; saponification value, 188·6; iodine value, 57·2; Reichert-Meissl value, 0·8; Hehner value, 94·2; unsaponifiable matter, 2·56 per cent. *Fatty acids:* m.pt., 51° C.; solidification point, 47° C.; and mean molecular weight, 282·7. The poisonous properties of the seed were found to be due to the presence of a body of the nature of saponin. No alkaloids, ethereal oils, or toxalbumins were detected. The seed-cake may be rendered completely innocuous by extraction with hot water, which removes the poison without materially affecting the food value of the product. The seeds are exported almost exclusively to England, the quantities exported being 3233 kilos. in 1906, 14,890 kilos. in 1907, and 183,697 kilos. in 1908.—C. A. M.

Pecan oil. A. C. Deiler and G. S. Fraps. Amer. Chem. J., 1910, **43**, 90—91.

The kernels of pecan nuts cultivated in Texas yielded on extraction with ether, 70·4 per cent. of a light straw-coloured oil with the characteristic odour and taste of the nuts. It gave the following analytical values:—Sp. gr. a15°t /15° C., 0·9184; saponification value, 198·0; iodine value (Hübl), 106·0; Reichert-Meissl value, 2·2; acetyl value, 1·16; Hehner value, 93·4; lecithin, 0·5 per cent., and cholesterol 0·28 per cent. The elaidin test gave a butter-like mass which was less solid than that given by olive oil. The oil is a non-drying oil, only gaining 0·7 per cent. in weight after exposure to the air for 3 days.—C. A. M.

Animal fats ; Chemical and viscosimetrical examination of ——. M. Raffo and G. Foresti. Gazz. Chim. Ital., 1909, **39**, II., 444—449.

The following results were obtained in the analysis of fats derived from animals of different species, the viscosimetrical values, η, being calculated by means of the formula :

$$\eta = \frac{d\,t}{d_0 t_0},$$

where d represents the sp. gr. of the fat, t the efflux velocity in seconds, d_0, the sp. gr. of water (= 1) and t_0 the efflux velocity of water at the given temperature.

Fat.	Age of animal.	Saponification value.	Iodine value.	Reichert-Meissl value.	Insol. acids and unsaponifiable matter.	M. pt.	Viscosity value, η, at 50° C.	55° C.	60° C.	65° C.
Ox, kidneys	5 years	196·57	34·74	—	95·30	47·8	34·63	28·31	25·35	24·18
Ox, mesentery................	..	194·65	37·17	—	94·65	47·8	34·60	28·90	26·39	24·45
Calf, kidneys	40 days	198·30	34·66	—	92·38	47·6	33·40	26·30	24·40	23·24
Calf, breast	..	198·35	43·20	—	92·49	—	—	—	—	—
Sheep, mesentery	2 years	193·65	43·83	0·57	95·83	47·8	37·90	27·90	26·31	24·29
Ass, kidneys	17 ,,	186·89	74·76	1·89	97·29	37·5	27·70	23·60	21·75	20·44
Horse, kidneys	15 ,,	196·67	77·28	1·08	96·23	31·5	26·60	22·70	21·80	20·64

When the viscosity values, η, are plotted in curves, in which the abscissæ represent the temperatures, and the ordinates the values, differences are seen in the results obtained with the fats from different kinds of animals at temperatures below 60° C. Thus the curves in the case of the fat from the horse and ass are practically parallel between 80° and 60° C., but intersect at about 58° C. Above 60° C. the curves were roughly parallel in all cases.
—C. A. M.

Turkey red oil and its derivatives. Tschilikin. *See* VI.

Patents.

Oils ; Apparatus for extracting ——. M. Kirshner, Assignor to Kirshner Rotary Oil Press Corporation, Lynchburg, Va. U.S. Pat. 945,549, Jan. 4, 1910.

The material from which the oil is to be extracted is fed into cylinders arranged on a rotating device. The cylinders are open at their outer ends and are opposite hydraulic cylinders, the pistons of which act on the material in the cylinders. As the cylinders and pressure cylinders rotate, a valve mechanism connected with a low pressure, high pressure and exhaust, is operated, so that the material is received, pressed, discharged, and the oil collected and conducted away in a continuous stream.—W. P. S.

Soap [for saline waters] ; Manufacture of ——. J. L. Buchanan, Northampton. Eng. Pat. 27,083, Dec. 14, 1908.

A solid soap suitable for use with sea-water, &c., without any addition of silicate or other filling material, is obtained by mixing together the sodium soap of an oil or fat (*e.g.* cocoanut oil), the alkali salts of which are fairly soluble in waters of this kind, with a potassium rosin soap. The admixture may be made either before, or (preferably) after the saponification of the oil and of the rosin respectively, and the best results are obtained by having the sodium soap present in a considerably larger proportion. If desired, filling material may be added.
—C. A. M.

Candles burning with coloured flames ; Process for the production of ——. R. Scheuble. Ger. Pat. 216,338, Dec. 17, 1907.

Substances, such as ammonium nitrate, nitro-compounds, organic nitrates and nitrites, which easily decompose, with evolution of gas, on heating, and metallic salts capable of colouring the flame, are incorporated in candles made of substances which burn with a faintly luminous flame, for instance the esters of amides of mono- or polybasic lower aliphatic carboxylic acids, the corresponding hydroxy-acids, their lactones or lactides, or mixtures of these substances. The nitrates or similar compounds and the colouring salts may be incorporated with the candle material, or with the wick, or with both. Or, wires or ribbons of alloys of metals capable of colouring the flame, or small tubes containing the flame-colouring material (metals or salts), may be incorporated with the wick or with the candle-material.—A. S.

Soap ; Process and apparatus for making ——. W. A. Grant. Fr. Pat. 404,706, July 3, 1909.

See U.S. Pat. 939,906 of 1909 ; this J., 1909, 1319.—T. F. B

Insulating coating [from stearine-pitch]. Ger. Pat. 217,026. *See* XI.

Machine for drying cacao, coffee, copra, etc. Eng. Pat. 20,092. *See* XIXa.

Preparation of colloidal substances. Fr. Pat. 403,592. *See* XX.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Pigments with a basis of white lead and their substitutes. S. Fachini. L'Ind. Chimica, 1909, **9**, 361—364.

Pigments of white lead, zinc white and lithopone have been subjected to comparative tests by a municipal committee at Milan, and the following conclusions have been drawn from the results : (1) Coatings produced with white lead, with Italian zinc white, and with zinc white (Vieille Montagne), and examined after a year, showed that as regards stability, the pigments were equal. The covering-power tests determined in Beck's apparatus gave the following mean results : White lead, 11·52 centimillimetres ; zinc white (V.M.), 12·83 cmm. ; and Italian zinc white, 13·18 cmm., the white lead being thus the best in this respect. (2) The samples of lithopone examined five months after application proved satisfactory as regards colour and covering power, but the conclusion as to permanency is reserved until a longer time has elapsed. (3) Taking into consideration the favourable results obtained with the substitutes for white lead and the dangers attending the use of the latter, the committee are of opinion that the municipality of Milan ought to prohibit the use of white lead for painting interiors.
—C. A. M.

West African copals ; Contribution to the knowledge of ——. A. Engel. Farben-Zeit., 1909, **15**, 132, 171, 216, 259, 304, 397. Chem.-Zeit., 1910, **34**, Rep., 35.

(1) Congo-copal. Ether extracts from the copal a resinolic acid, $C_{19}H_{30}O_2$: treatment of the ethereal solution with alkali affords α-resene, and an essential oil of b.pt. 165°—168° C. Treatment of the alcoholic-ethereal extract with alkali, yields a resinolic acid, $C_{22}H_{34}O_3$ (soluble in ether), and β-resene (insoluble in ether). Ether extracts about 60 per cent. from Congo-copal, and of the 40 per cent. residual insoluble matter, a mixture of alcohol and ether extracts 35–36 per cent. (2) Benguela-copal (white). Ether extracts a resinolic acid, $C_{19}H_{30}O_2$; treatment of the solution with alkali gives α-resene and an essential oil of b.pt. 148°–155° C.

The alcoholic-ethereal solution treated with alkali, yields a resinolic acid, $C_{21}H_{32}O_3$ (soluble in ether), and β-resene, $C_{22}H_{36}O_2$ (insoluble in ether). Ether dissolves about 55 per cent. of the Benguela-copal.—E. C. V-E.

PATENTS.

Red lead: Manufacture of ——. W. Eckford, Rhyl, Flint. Eng. Pats. 26,258, Dec. 4, 1908, and 15,423, July 1, 1909.

CONTAMINATION of the atmosphere by lead oxide during the process of manufacturing red lead, is avoided in the present patent, without wetting or damping the material, by conducting the whole series of operations continuously and automatically in dust-proof apparatus, or by working under slight suction, so that any leakage shall be inwards rather than outwards. A further saving of heat and labour is effected by dispensing with the usual levigation and separation of the oxide from metallic lead, this being instead converted ultimately into red lead. For carrying out the invention, an apparatus is described, by way of example, which consists of an encased conveyor for receiving the oxide and transferring it regularly to a pipe which feeds it close down on to the bed of a "colouring oven," where it is heated and subjected to the action of scrapers on revolving arms (or fixed arms, if the oven is made to revolve); these distribute it in furrows and work it towards the circumference, where it is discharged into another conveyor, by which it is taken to an encased grinding mill; the red lead passes thence to a second oven, and is alternately ground and heated in successive grinders and ovens until the desired tint is obtained. The apparatus may be connected by means of ducts to a suction fan, so as to maintain a slightly reduced pressure in each part. An alternate arrangement for feeding the oven is a pipe or passage formed in the shaft itself, or attached so as to revolve with it.—F. SODN.

Zinc sulphide; Manufacture of ——. J. C. A. Meyer, Lyons, and Soc. Chim. des Usines du Rhone (Anciennement Gilliard, P. Monnet et Cartier), Paris. Eng. Pat. 23,645, Oct. 15, 1909. Under Int. Conv., Nov. 6, 1908.

ZINC sulphide, it is found, especially that precipitated from acid solution, is readily and almost completely dehydrated, if allowed to remain for some considerable time in contact with a slightly acid solution. The product, which is claimed as new, has a greatly increased covering power as a pigment and a colour which remains unchanged in the air. The time allowed for the reaction, the quantity and concentration of the acid, the temperature, and the kind of sulphide employed are interdependent factors in its preparation. As an example, hydrated zinc sulphide, precipitated from acid solution, is filtered and washed until the strength of acid (sulphuric) remaining with the precipitate is about 2 per cent.; it is then left for 14 days, when the washing is completed and the product dried; the process may be hastened by keeping the mixture at 80 °C. for 24–36 hours.—F. SODN.

Steel-preservative paint. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co., New Jersey. U.S. Pat. 943,670, Dec. 21, 1909.

CLAIM is made for a composition consisting of a basis of white lead incorporated with a chromic acid compound (*e.g.* zinc chromate) to inhibit rust, a metallic substance, such as zinc dust, to neutralise impurities in the chromate, and a paint vehicle of linseed oil, with or without wood oil and a thinning agent. Graphite may also form a constituent of the composition.—C. A. M.

Turpentine and rosin; Process of extracting ——. B. F. A. Saylor, Rome, Ga., Assignor to Standard Turpentine and Pulp Co., Atlanta, Ga. U.S. Pat. 945,612, Jan. 4, 1910.

RESINOUS wood is finely divided and saturated with a light hydrocarbon oil (gasolene) in a closed vessel. The excess of the hydrocarbon is then removed, a partial vacuum is produced in the vessel, and the latter is heated to a temperature not exceeding 212° F. Hot water and air are introduced into the top of the vessel in order to separate the resinous matters from the wood; these resinous matters are then collected and the turpentine and rosin are separated therefrom.—W. P. S.

White lead; Process for making ——. J. A. Erbslow and G. Condron. Fr. Pat. 404,322, June 23, 1909.

SEE U.S. Pat. 930,057 of 1909; this J., 1909, 992.—T.F.B.

Fatty inks; Process and apparatus for recovering the constituents of ——. M. S. Hopkins and C. R. Barnett. Fr. Pat. 404,456, June 25, 1909.

SEE U. S. Pats. 932,470, 932,548, 932,549, and 932,550 of 1909; this J., 1909, 1049.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

PATENT.

Rubber and vulcanite; Process for regenerating used ——. P. D. Penn. Fr. Pat. 404,334, June 23, 1909. Under Int. Conv., June 27, 1908.

SEE Eng. Pat. 13,599 of 1908; this J., 1908, 1163.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Deliming of pelt. E. Giusiana. Collegium, 1910, 14—16.

HIDES may be delimed by scudding them on the beam, to eliminate calcium soaps, washing in fresh water, and finally treating with a mineral or organic acid. Mineral acids if not very carefully used are apt to injure the pelt, whereas organic acids do not give very satisfactory results, and are expensive to recover. The author's process is founded on the production of nascent sulphur dioxide on the surface and in the interior of the skin. The advantages claimed are that alkali sulphides are decomposed, calcium compounds are rendered soluble, iron stains due to alkali sulphide or salt are removed, and the pelt is bleached and becomes swollen, and is hence tanned more quickly. The skins are scudded, rinsed in water and treated with a solution of sodium bisulphite, the quantity varying according to the thickness of the skins. The sodium bisulphite reacts with the alkali sulphite and calcium hydroxide forming normal sodium sulphite and calcium sulphite, sodium hydroxide which decomposes the calcium soaps, and free sulphuretted hydrogen. Hydrochloric acid is now added, forming sodium and calcium chlorides and sulphur dioxide. —H. BR.

Extract tannage in America. C. M. Morrison. J. Amer. Leather Chem. Assoc., 1910, 5, 46—59.

THE beam-house work for the manufacture of extract tanned leather does not vary from that of bark-tanned. In vat tannage, in which the tanning takes place by a pressure or force system, the liquor being circulated through a series of vats, the hides are suspended in rockers by either tacking to, or hanging over sticks, the former method being preferred, as wrinkled and "pipey" grain and stick marks are avoided. The great difficulty in extract tannage is to produce every pack of a good uniform colour. Bad colour may result from the following causes. (1). The hides may be insufficiently and unevenly freed from lime. (2). The green hides may not have sufficient room in the rockers, thus preventing the calcium tannates from sinking to the bottom of the pits and allowing them to be deposited on the hides, where they produce "touch" spots or stains. (3). The acidity of the liquor in the "tail rocker" may be insufficient owing to too long use, the natural acids being neutralised by the lime in the green hides as they come in, causing dirty and cloudy grain. (4). Too many different kinds and makes of extract may be used, and these not in the same proportions for each batch. (5). The extracts may vary in quality.

Another method in use for extract tannage is to partially tan in rockers and to finish in the drum. For successful extract tannage, extracts (the fewer the better) should be chosen which best fulfil the particular requirements, and these should be used in definite proportions. Chestnut extract blended with a small percentage of quebracho seems to be mostly used by the tanners of heavy leather.—H. Fr.

Leather ; Loss of weight in the " wet work " in the manufacture of ——. F. Neuroth. Gerber, 1910, 36, 17—18.

Of all the difficulties which confront the tanner in the conversion of hide into leather, the loss of hide substance in the " wet work " is the most serious. The prevention of this loss by " filling " the skins with different materials has been tried by Knapp, who used glue, gelatin, or albuminous substances, and by Eitner, who used a mixture of fish oil, tallow, and casein. The author has made experiments with glue, gelatin, albumin, and blood, and shows that by impregnating the skins with a solution of blood and glue before tannage, excellent results are obtained. Two pieces of calf-skin of similar weight were taken after the treatment in the lime-yard was finished, and one piece was treated with a blood and glue solution for some hours, after which both pieces were tanned by the two-bath chrome tannage, when it was found that the piece which had been treated with blood and glue weighed 55 grms. more than the piece which had not been treated, representing an increase in weight of 35·5 per cent. due to the treatment. Good results were also obtained with vegetable-tanned leather.—S. H.

Leather manufacture ; Petroleum oils in ——. R. A. Earp. Leather, 1910, 2, 3—6.

It is stated by the author, that by dissolving some of the vegetable tannins, insoluble in water, in mineral oil, a product is obtained which is quite as suitable as cod oil for tanned leather. The oil is more or less emulsifiable, or may be entirely soluble, in a solution of tannin, and the fact that the insoluble tannins have a high combining power for leather, renders it possible to obtain a very heavily tanned leather by their use.—S. H.

Patents.

Leather, fur-skins and the like ; Treatment [*rendering waterproof*] *of* ——. H. W. Cave-Browne-Cave, Rickmansworth. Eng. Pat. 18,411, Aug. 10, 1909.

Successive coatings of a solution of rubber, or of rubber and gutta-percha, are rubbed into hides, &c., which have previously been degreased, and the material is given a final coating with a solution of rubber in warm turpentine oil, to which an addition of gutta-percha has been made. The solutions used for this purpose may also contain a suitable proportion of an oil such as linseed oil. The skins, &c., thus rendered waterproof, may be reinforced by superposed layers of canvas or other fabric, the warps of which are arranged at angles to one another, and a final coating of rubber may be given to the composite material. —C. A. M.

Hides ; Method of removing hair from ——. L. Cheeseman, Scranton, Pa. U.S. Pat. 945,221, Jan. 4, 1910.

The hides are treated with a preparation obtained by adding sufficient calcium oxide and water to barium sulphide to convert the latter into barium hydroxide.—W. P. S.

XVI.—SOILS ; FERTILISERS.

Potassium cyanide ; Use of ——*as soil insecticide.* T. Mamelle. Comptes rend., 1910, 150, 50—52.

Potassium cyanide in aqueous solution, when injected into the soil, reacts with the calcium bicarbonate present, slowly liberating hydrogen cyanide, and so acts as a powerful insecticide. It possesses several advantages over carbon bisulphide, in that it is slower and more thorough in its action ; insects are not made aware of its presence and therefore do not escape ; it has no effect on growing plants, even when applied in strong doses, nor does it stop the fermentative changes going on in the soil. Carbon bisulphide affects both plant growth and soil fermentation and is often very deleterious to the plant which it is applied to protect.—E. F. A.

Patents.

Phosphate-precipitates ; Production of ——. C. N. Riiber, Christiania, Norway. Eng. Pat. 27,774, Dec. 21, 1908. Under Int. Conv., Nov. 6, 1908.

Citrate-soluble di-calcium phosphate ($CaHPO_4$) is obtained from solutions containing phosphoric acid by precipitation with a strongly basic tetra-calcium phosphate, such as Thomas phosphate, Scheibler's " patent phosphate," Wolter's phosphate, or Wiborg phosphate. In effecting the precipitation, the coarser portions of the powdered precipitant are added first, and then portions of successively increasing fineness.—A. S.

Manure ; Stimulant —— *for agricultural purposes having a base of oxides of manganese.* Mines de Manganèse de Las Cabesses, Paris. Eng. Pat. 26,867, Nov. 19, 1909. Under Int. Conv., Nov. 21, 1908.

A mixture of manganic oxide, Mn_2O_3, manganous oxide, MnO, and trimanganic tetroxide, Mn_3O_4, obtained by roasting manganese dioxide at a temperature between 800° and 1200°C., is used as a stimulant manure, preferably in combination with other substances, such as phosphates, nitrates, lime, &c.—A. S.

XVII.—SUGARS ; STARCHES ; GUMS.

Syrups [*Sugar*] *; Method for determining the crystal-content of* ——. T. Koydl. Z. Zuckerind. Böhm., 1910, 34, 248—256.

In the determination of the crystal-content of raw sugar by the author's washing method, it has often occurred that the calculated purity of the syrup residue is lower than would be expected from the nature of the syrup in raw sugar. This is not due to precipitation of sugar ; in the author's method, solid sugar is not dissolved, nor is dissolved sugar precipitated. In general, it would seem that the purity of the syrup as found by this method would err on the high side, since part of the non-sugar remains in the washed crystals. The author utilises the non-coincidence between the composition of the residual or mother-syrup of raw sugar and that of the waste factory syrup to obtain information concerning changes in the syrupy portion of raw sugar caused by absorption or loss of water during storage. He proposes to describe later, methods for obtaining the mother syrup which adheres to the raw sugar, without the use of any alcoholic washing liquid. In the present paper, a method is described whereby the nature of the factory syrup may be more completely ascertained. Most centrifugal syrups contain microscopic crystals, the proportion of which may be determined as follows:—*Preparation of the dilution liquid.*—A mixture of 1000 vols. of methyl alcohol (86 per cent. by weight) and 50 vols. of concentrated acetic acid is introduced into a flask half filled with large sugar crystals; by shaking the solution several times daily for at least 8 days, saturation is effected. The saturated solution is then poured into a storage vessel (of several litres capacity) previously filled to the neck with large, dust-free sugar crystals. This vessel is provided with an exit-tube and pinch-cock near the bottom ; it must always be kept full of liquid in order to insure that the liquid withdrawn from below has stood in contact with the sugar for a few days ; it must be kept in the laboratory, and wide variations of temperature during, and before the experiments, are to be avoided. *Determination of the crystal-content.*—52 grms. of the well-mixed sample of syrup under investigation are rinsed with the dilution liquid into a dry, 200 c.c. flask, dissolved by shaking, and made up to volume with the same liquid. The whole is well shaken, and 50 c.c. are then at once transferred to a 200 c.c. flask, treated with 100 c.c. of water, 20 c.c. of basic lead acetate, and some alumina cream, made up to volume with water, and well shaken. Immediately after the 50 c.c. have been removed, the remaining 150 c.c. of the first solution are filtered, 50 c.c. of the filtrate being transferred to a 200 c.c. flask, treated with 100 c.c. of water, 20 c.c. of basic lead acetate, and a little alumina cream, made up to volume with water, and well shaken. The two solutions thus prepared are filtered, and polarised in a 200 mm. tube. The difference between the two polarisations, multiplied by 4, gives the approximate crystal-content of the syrup. Since the sample need only be in contact with the alcoholic solution for a few minutes prior to the addition of water, there is no danger of crystallisation of sugar. Should syrups of very high purity (*e.g.*, 99 per cent.) be examined, it would be advisable to use a dilution liquid of lower alcohol-content; in saturating such a liquid of course it would become correspondingly denser, and a limit is imposed on the reduction of the alcohol-content by the essential property of rapid filtration. Should, under some abnormal condition, crystallisation occur, this is immediately seen in the filtrate. Since, in the determination above-described, no account is taken of the volume occupied by the crystals, the result requires correction. The author gives a table of such corrections, though in practical work it is sufficiently accurate to increase the approximate crystal-content by one-tenth, *e.g.*, an approximate crystal-content of 10 per cent. is equal to an actual crystal-content of 11 per cent.—L. E.

Sugar series; Kinetic studies in the ——. E. Votoček and H. Němeček. Z. Zuckerind. Böhm., 1910, 34, 237—238.

On oxidation with chlorine- or bromine-water, the aldose sugars yield the corresponding monocarboxylic acids. The authors have made quantitative experiments on the action of bromine-water on dextrose, lævulose, and galactose at 20° C. The spacial configuration of the aldoses has a considerable influence on the speed of the reaction with bromine-water; galactose is much more rapidly oxidised than dextrose. The ketose, lævulose, is practically unattacked by bromine-water of low bromine-concentration. Hydrochloric, hydrobromic, and sulphuric acids retard the oxidation of aldoses by bromine-water, the hydrogen ions apparently acting as a negative catalyst. The oxidation of dextrose and of galactose by bromine-water proceeds, at the ordinary temperature, quantitatively according to the following equation:—

$$CH_2OH.(CH.OH)_4CH{:}O + 2Br + H_2O = CH_2OH.(CH.OH)_4.CO_2H + 2HBr.$$

The reaction between bromine-water and aldoses in presence of the hydrogen ion catalyst, proceeds according to the type of a bimolecular reaction. The action of bromine-water at the ordinary temperature (21° C.) on aldoses, can be utilised for the diagnosis of sugars (distinction of aldoses from ketoses). The authors propose to describe later, how this diagnosis is effected and how aldoses and ketoses may be separated for preparation purposes.—L. E.

Sucrose and lactose; Separation of —— by means of the Bulgarian ferment. L. Margaillan. Comptes rend., 1910, 150, 45—47.

The Bulgarian lactic ferment very rapidly and completely decomposes lactose. Bertrand and Duchacek (this J., 1909, 668) have shown that when cultivated under identical conditions in solutions of lactose and sucrose, it is quite without action on sucrose. Other authors have claimed that it attacks sucrose. The authors have now investigated the action of the ferment on solutions containing sucrose both alone and also together with varying quantities of lactose and of dextrose. It has been suggested that under such conditions the ferment may attack the sucrose. In every case the sucrose was recovered unchanged. The Bulgarian ferment may accordingly be made use of to estimate sucrose in presence of lactose or dextrose in condensed milks, &c. The lactose is removed by treatment with the ferment, the remaining sucrose inverted and the reducing power determined.—E. F. A.

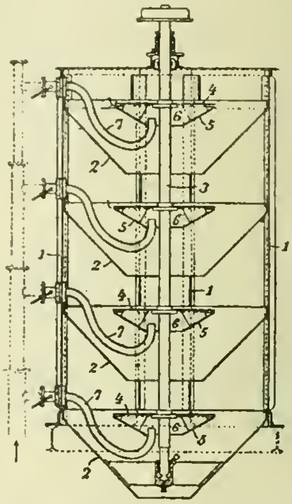
Patents.

Invert sugar and glucose [brewing sugar] in transportable form; Manufacture of ——. W. H. Steel, Bootle, Lancs. Eng. Pat. 17,637, July 29, 1909.

Commercial invert sugar, in a semi-fluid form, is enclosed in a shell of solid glucose, so that the whole block constitutes an article which is readily transportable without special packing. The glucose, whilst still hot and fluid, is poured into rectangular moulds with a rectangular core. When the glucose has solidified, the core is withdrawn and the interior of the glucose shell is filled with invert sugar. Finally the vessel is sealed with a cap of solid glucose, which is made plastic by heat and pressed on to the sides of the shell so as to make a firm joint.—J. F. B.

Drying or cooling sugar; Apparatus for ——. P. E. Pustowojt. Ger. Pat. 214,998, Sept. 1, 1908.

The apparatus consists essentially of a series of funnels or hoppers, 2, arranged one above another in a casing, 1.



The central shaft, 3, carries a number of plates, 4, below which are fixed conical plates, 5, enclosing spaces, 6, from which air, introduced through the pipes, 7, flows outwards in a radial direction, coming into intimate contact with the sugar thrown off from the plates, 4.—A. S.

Honey, artificial, or liquid fruit sugar and white sugar; Process for the manufacture of —— from raw beet sugar E. Paschen. Ger. Pat. 216,408, Dec. 9, 1908.

The raw beet sugar is covered in the centrifugal machine with concentrated invert sugar syrup containing 70—85 per cent. of sugar, or it is first mixed with the syrup, and then introduced into the centrifugal machine. The invert sugar is warmed to 50° C. before use. It is stated that by this process the invert sugar syrup removes from the beet sugar the salts and flavouring substances, and can be used directly as artificial honey, whilst the treated sugar can be easily worked up into white sugar.—A.S.

XVIII.—FERMENTATION INDUSTRIES.

Torula Wiesneri, a yeast which assimilates atmospheric nitrogen. H. Zikes. Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math.-naturw. Kl., 1909, 118. Z. ges. Brauw., 1910, 33, 38.

The author describes a yeast-like organism which occurs on leaves and is capable, when cultivated in dextrose solutions, free from nitrogen, of assimilating 0·0023—0·0024 grm. of atmospheric nitrogen per gram of the sugar fermented. When it is grown on the surface of nitrogen-free dextrose-agar, its content of nitrogen attains an average value of 3·1 per cent., that of normal pressed yeast at the conclusion of fermentation being about 3·9 per cent. The organism forms no ascospores and is named, temporarily, *Torula Wiesneri*. Other yeasts which grow vigorously on the surface of dextrose-agar, almost devoid of nitrogen, are: *Willia anomala* and *W. saturnus*, whilst with *Mycoderma cerevisiæ*, *M. rubra* and *Pichia farinosa*, growth is somewhat less vigorous; all of these organisms are budding fungi which exhibit film formation shortly after inoculation, and are intensely aerophilic. Still less intense growth on the dextrose-agar occurs with *Torula alba*. *Saccharomyces Frohberg* and *Saccharomycodes Ludwigii*, whilst *Saccharomyces thermantitonus*, *S. Pastorianus*, *Saccharomycopsis* and the *Apiculatus* yeasts exhibit no growth under such conditions.—T. H. P.

Wines; A study of the oxidation processes taking place in ——. P. Malvezin. Ann. Chim. analyt., 1910, **15**, 15—19.

The author has carried out a number of experiments with the object of ascertaining the action of various oxidising agents on wine and of the nature of the different constituents which are most affected by oxidation. Simple aeration of the wine at ordinary temperatures was without effect, but contact for 5½ hours with cupric oxide, in the proportion of 125 grms. of the oxide to 1 litre of wine, produced marked changes in certain of the constituents of the wine; the non-volatile acidity was reduced from 3·48 to 2·90, and the glycerin from 8·97 to 8·64, whilst the volatile acidity increased from 0·84 to 0·97 grm. per litre. The addition of 0·2 per cent. of 40 per cent. nitric acid to wine caused, after four days contact, the quantity of esters present to increase from 1·25 to 3·62 grms. per litre, whilst the glycerin decreased from 5·07 to 3·58. After 13 days contact, nitric acid in the above proportion increased the quantity of esters in another wine from 0·21 to 3·64 grms. per litre, the glycerin at the same time diminishing from 7·37 to 4·35 grms. per litre. Although the results of these experiments show that the quantity of esters, etc., in a wine may be increased by the addition of strong oxidising agents, the alterations taking place are accompanied by changes which affect the character of the wine. The author agrees with the statements made by other observers that traces of iron and manganese in wines have an effect on the formation of esters and aldehydes in the same, but is of opinion that these metals need not necessarily be present in organic combination to be effective. The experiments with cupric oxide mentioned above, show that mere accidental contact with a metal or oxide results in a sufficient quantity of the latter being dissolved to produce important changes in the constituents of the wine. On this account, copper vessels should not be used in wine cellars, etc.—W. P. S.

Acetaldehyde in wine; Causes of the formation of —— A. Trillat. Bull. Soc. Chim., 1910, **7**, 74—78.

The author reviews and confirms his previous researches on the formation of acetaldehyde in red wine and its action on the other constituents (this J., 1908, 463, 636, 824; 1909, 668). Acetaldehyde is also rapidly formed, together with acetic acid and acetal, under the influence of a carrier of oxygen, such as metallic iron. The deposit formed is found to be only partly due to the oxidising action of the iron on the colouring matter; the acetaldehyde formed is sufficient itself to cause a precipitate. A single nail has been known to spoil a cask of wine owing to formation of acetaldehyde. The importance of the formation of aldehyde in the various changes in wine is re-affirmed.—A. Seld.

Formaldehyde; Production of small quantities of —— *during the oxidation of ethyl alcohol by chemical, physical, or biological means.* E. Voisenet. Comptes rend., 1910, **150**, 40—43.

Minute traces of formaldehyde as distinct from other fatty aldehydes can be readily detected by the formation of a violet coloration on treating a protein with sulphuric, or better hydrochloric acid, containing a little nitric acid, in presence of the aldehyde. Most commercial samples of ethyl alcohol contain small quantities of methyl alcohol, but pure ethyl alcohol may be prepared by fermentation of dextrose or by chemical processes. When this is oxidised either by ozone, hydrogen peroxide, oxides of nitrogen, chlorine or hypochlorites, &c., in every instance small quantities of formaldehyde are produced. It is also formed when ethyl alcohol is oxidised by catalysis or electrolysis, or by the agency of *Mycoderma vini* or *aceti*. The amount produced varies according to the method of oxidation; it is least when the biological methods are followed. It is possible to detect the presence of formaldehyde, formed in this manner, in vinegar.

E. F. A.

Acetic and lactic acids; Technical manufacture of ——. F. Villani. L'Ind. Chimica, 1909, **9**, 365–367.

The method of oxidising alcohol to acetic acid with the aid of spongy platinum or platinum black has not given good results on an industrial scale, owing to the fact that the metal soon loses its porous structure. The different types of apparatus devised for the bacterial oxidation (*e.g.* those of Strube and Henneberg, Popper, and Martin and Frings) differ from one another mainly in the mechanical means adopted for the distribution of the wash. The method of Michaelis, in which the alcoholic liquid is rotated in small horizontal acetifiers, is more rapid than the ordinary (Orleans) process and produces vinegar with as fine an aroma. For the industrial manufacture of lactic acid, the use of starch is preferable to that of sugar, and calcium carbonate is advantageously used in place of zinc oxide for neutralisation. The starch (900 kilos.) is mixed with 100 kilos. of malt and sufficient water to form a paste, and the mass left at about 75° C. until it has become fluid. The solution is then mixed with 0·5 kilo. of ammonium nitrate and subjected to lactic acid fermentation for 20 to 30 days, the temperature being meanwhile maintained at 50° to 65° C. Sufficient sodium carbonate to neutralise about half the lactic acid formed is now added, and the solution evaporated until its sp. gr. is 1·21, after which 500 kilos. of calcium carbonate are introduced. The resulting precipitate of calcium lactate is collected, and decomposed with sulphuric acid, and the solution of lactic acid filtered and concentrated to a syrup. According to Jacquemin a purer preparation of lactic acid is obtained by liquefying the starch by means of malt at 50° C., and sterilising the solution by boiling. It is next cooled to 45° C., calcium carbonate added, and the whole fermented for five or six days at 40° to 45° C., with a selected lactic acid ferment, after which the calcium lactate is separated and decomposed as described above.

—C. A. M.

Film yeast infection of bakers' yeast. Henneberg and Neumann. *See* XIXA.

Patents.

Brewers' refuse, grains, hops, &c.; Apparatus for drying ——. E. Makin, Manchester. Eng. Pat. 18,742, Aug. 14, 1909.

In a drying apparatus consisting of a series of revolving drums, each containing a winding passage formed by baffle-plates, the material to be dried is fed through a hopper into a hot-air inlet pipe passing through one of the trunnions of the first drum. The material, together with the hot air, is drawn by means of an exhaust fan through the winding passage and out through the other trunnion of the drum (see Eng. Pat. 9835 of 1895; this J. 1896, 367). The exhaust fan delivers the partially dried material into an inclined ascending pipe, at the top of which is a "cyclone" separator. The vapour and saturated air escape through the "cyclone," whilst the material is delivered down another pipe into the hot-air inlet pipe of another similar drum of the series. Any or all of the inclined ascending pipes may be trapped by means of an intercepting pipe inclined downwards, into which the heavier and moister portions of the ascending materials fall, to be conducted back into the same or another drum of the series before they pass on with the drier material to the final drums.—J. F. B.

Spirits: Production of a denaturising agent for ——. J. Kluge, Görlitz, Germany. Eng. Pat. 19,257, Aug. 21, 1909.

It is proposed to utilise, as a denaturing agent for spirits, the oily portion of the product which is obtained by the fractional distillation, up to a temperature of about 200° C., of the saturated "wash-oils" (anthracene-oil, tar-oil, and the like), obtained as a by-product in the manufacture of coal gas. The fractionated oil is added to the spirit in the proportion of about 1 per cent.—J. F. B.

Spirits: Distillation of ——. J. E. Carroll. Fr. Pat. 404,797, July 6, 1909. Under Int. Conv., Sept. 15, 1908.

See Eng. Pat. 19,348 of 1908; this J., 1909, 849.—T. F. B.

Invert sugar and glucose [brewing sugar] in transportable form. Eng. Pat. 17,637. *See* XVII.

XIXa.—FOODS.

Bakers' yeast; Film yeast ("Kahmhefe") infection in ——. W. Henneberg and M. P. Neumann. Z. Spiritusind., 1910, 33, 13—14.

Film yeast is frequently found in bakers' pressed yeast; the conditions of growth of the culture yeast—a faintly acid thin wort and a plentiful supply of air—being very favourable for the development of the film yeast. The presence of a considerable quantity of film yeast in a bakers' yeast is a serious disadvantage, as the film yeast has very little fermentative power. A yeast containing 83 per cent. of film yeast only yielded about one-quarter of the normal amount of carbon dioxide and gave a loaf only about four-fifths of the normal size. In addition, the quality of the loaf is adversely affected by the film yeast. —E. F. A.

Calcium and magnesium [in foods, &c.]; Determination of —— *in the presence of phosphates and small amounts of iron.* F. H. McCrudden. J. Biol. Chem., 1910, 7, 83—100.

The following method is recommended for the determination of calcium and magnesium in such substances as foods, urine, and fæces, and is stated to be more accurate even in the presence of phosphates than is the double precipitation method usually employed. The solution containing the calcium, magnesium, phosphate, and iron (such as the hydrochloric acid solution of the ash of a sample of food, &c.) is rendered slightly ammoniacal, a few drops of a dilute solution of alizarin being added as indicator, and dilute hydrochloric acid is then added until the solution is just acid. The solution must be cooled, if necessary, during this part of the process; all the calcium phosphate will now be in solution, but a small amount of ferric phosphate may remain undissolved. To the faintly acid solution are now added 10 c.c. of *N*/2 hydrochloric acid and 10 c.c. of a 2·5 per cent. solution of oxalic acid, and the mixture is boiled gently until the precipitated calcium oxalate is coarsely granular. A 3 per cent. solution of ammonium oxalate is then added, drop by drop, to the boiling solution, the amount of ammonium oxalate added being about twice the quantity necessary to combine with all the calcium present. Eight c.c. of a 20 per cent. solution of sodium acetate are now added and the whole is allowed to stand in a cool place for from 4 to 18 hours. The precipitate is then collected on a filter, washed free from chlorides with cold 1 per cent. solution of ammonium oxalate, dried, and ignited. The filtrate containing the magnesium is evaporated almost to dryness after the addition of 20 c.c. of concentrated nitric acid. When almost dry, and nitrous fumes are no longer given off, 10 c.c. of concentrated hydrochloric acid are added and the solution is again evaporated nearly to dryness. The solution is then diluted to a volume of about 80 c.c., nearly neutralised with ammonia, and cooled. After the addition of 1 c.c. of 5 per cent. sodium citrate solution, an excess of sodium acid phosphate is added and ammonia is run in, drop by drop, with constant stirring, until the solution is alkaline, a further quantity of ammonia being then added slowly, with constant stirring, to make the solution contain about one-fourth of its volume of dilute ammonia (sp. gr. 0·96). Next day the precipitate is collected on a filter, washed a few times with an alcoholic solution of ammonia (alcohol, 1 part, ammonia of sp. gr. 0·96, 1 part, and water, 3 parts), and then redissolved in dilute hydrochloric acid. The solution is diluted to a volume of 80 c.c., 1 c.c. of the solution of sodium citrate is added, and the ammonium magnesium phosphate is precipitated as before. The precipitate is finally collected, washed as described above, and ignited. —W. P. S.

Chemical and viscosimetrical examination of animal fats. Raffo and Foresti. *See* XII.

Separating sucrose and lactose. Margaillan. *See* XVII.

Patents.

Digestive ferments and method of preparing the same. J. Sleeman, Portishead, Somerset. Eng. Pat. 23,585, Nov. 4, 1908.

Barley, maize, rice, or other grain, is steeped and allowed to germinate at temperatures and under conditions most favourable to the production of the maximum quantity of diastase and other digestive ferments. The green malt, with or without a preliminary drying at a low temperature, is subjected to pressure, whereby the ferments (diastase, cytase, peptase, and glucase) are obtained in a liquid form. This liquid may be concentrated at such temperatures as will not injure the activity of the ferments it is desired to obtain, namely, for cytase a maximum of 110° F., for diastase 120° to 150° F., for peptase 120° F., and for glucase 135° F. The liquid, which may be filtered when intended for human consumption, is then mixed with meal or other substances and pressed into the form of cakes, biscuits, &c.—W. P. S.

Flour; Treatment of —— *for bleaching or conditioning it.* A. G. Bloxam, London. From L. M. Thomas, Wilhelmshafen, Germany. Eng. Pat. 28,507, Dec. 31, 1908.

The object of the invention is to prevent loss of moisture from the flour when the latter is subjected to the action of a bleaching agent. For this purpose the flour is preferably treated with moisture in the form of moisture-laden air, steam, or a fine spray of water, before it is acted on by the bleaching agent. An alternative method is to subject the flour to the simultaneous action of the bleaching agent and moisture; for instance, the gas conveying the bleaching agent may be saturated with moisture.—W. P. S.

Machine for drying cacao, coffee, copra, and other similar materials. R. Bridge, Castleton, Lancs., and H. H. Smith, London. Eng. Pat. 20,092, Sept. 2, 1909.

The materials to be dried are placed in interchangeable perforated, horizontal cylinders or cages which are supported parallel to the axis and so that they can rotate around the periphery of a rotating frame or wheel. The frame is rotated within a fixed casing provided with doors for the introduction and withdrawal of the cylinders. The drying is effected by hot air which is passed through the casing from a heating furnace situated below the casing and provided with regulating dampers.—W. H. C.

Milk; Process for the fermentation of ——. J. P. Cabanne, St. Louis, Mo. U.S. Pat. 944,013, Dec. 21, 1909.

About 1 pint of a culture of *Bacillus Bulgaricus* is added to 8 galls. of milk which has been pasteurised and cooled to a temperature of about 90° F. The mixture is kept at this temperature until about 1 per cent. of lactic acid

has been produced. The fermentation is then arrested by cooling the mixture to 35°—40° F. and the product is maintained at this temperature until it is consumed.
—W. P. S.

Grain ; Roasted, sulphurised ——. E. Meyer, Friedrichswerth, Germany. U.S. Pat. 945,567, Jan. 4, 1910.

See Fr. Pat. 383,151 of 1907 ; this J., 1908, 351.—T. F. B.

XIXb.—WATER PURIFICATION ; SANITATION.

Nitrates in boiler waters. G. S. Jamieson. J. Ind. Eng. Chem., 1909, 1, 787–788.

The author draws attention to the necessity of making determinations of the nitrates, in cases where ground waters are used for the purpose of feeding boilers. He cites instances where the use of well waters containing relatively large quantities of nitrates resulted in rapid corrosion of boiler-tubes.—A. S.

Germicidal action of metals and its relation to the production of hydrogen peroxide. A. C. Rankin. Proc. Roy. Soc., 1910, **B 82**, 78—87.

Experiments were made to determine the cause of the germicidal action of metallic aluminium, zinc, and copper, and the part played by the associated hydrogen peroxide. When clean strips of these respective metals in the pure state, are placed in air-free water (50 grms. of metal to 150 c.c. of water) inoculated with the *B. coli*, there is no reduction in the number of organisms nor any production of hydrogen peroxide after an hour's contact ; while if ordinary aerated tap water be used, then zinc has a slight bactericidal action. When air is bubbled through the inoculated tap water, there is a very great reduction in the number of organisms after one hour in the case of each metal, and with increased quantities of the metals, complete sterility could be obtained. There is at the same time a production of hydrogen peroxide, except with copper. The amounts of the metals dissolved and hydrogen peroxide formed were shown in themselves to be too small to account for the germicidal action, nor did the bubbling of air alone produce it. Therefore the action must be ascribed to the presence of the metal and oxygen together, and a possible explanation is that the oxygen is dissociated in contact with the metal, some of the free ions acting on the bacteria, and the rest forming the hydrogen peroxide, or combining with the metal in the case of copper.—J. H. J.

Microbes ; Action of ultraviolet rays on ——. P. Cernovodeanu and V. Henri. Comptes rend., 1910, **150**, 52—54.

The action of the ultra-violet rays emitted by mercury lamps has been tested on a variety of bacteria in emulsions containing from 10,000 to 100,000 per c.c. The bactericidal action of the ultra-violet rays decreases more quickly than the square of the distance of the source from the bacteria. A 220-volt Cooper-Hewitt lamp is 5 times as active as a 110-volt lamp when close to the bacteria, and relatively far more active when further away. The bactericidal action is slightly greater when the layer of emulsion is thicker. Variations in temperature from 0° to 55° C. have no effect, and destruction of the bacteria is as rapid in the absence of oxygen as in the air. An emulsion made with water previously exposed to the rays is not more sensitive and the bactericidal action is not accelerated by the presence of traces of hydrogen peroxide. Different species of bacteria vary in their resistive power : whereas *B. coli* is killed in 15—20 seconds, *B. subtilis* requires 30—60 seconds. The most destructive of the ultra-violet rays are those possessing a wave-length above 2800. Protoplasm absorbs ultra-violet rays of wave-length above 2900 : accordingly it is the rays absorbed by the cell protoplasm which have the bactericidal action.—E. F. A.

Patents.

Water ; Means for effecting the sterilisation of —— by ozonation. Ozonair Ltd. and E. L. Joseph, London. Eng. Pat. 27,226, Dec. 15, 1908.

The water is supplied through an atomiser into the upper part of a cylindrical tower and then falls over and between a number of spherical glass balls packed in the middle portion of the tower. These balls are supported on a perforated partition, below which is a tank in which the water collects. During its passage down the tower, the water meets and is mixed with a current of ozonised air introduced through fine nozzles placed below the surface of the water in the tank at the bottom of the tower. The apparatus for producing the ozonised air is placed outside the tower and is supplied with air drawn from the top of the tower by means of a pump. Means are provided for drying and cooling this air before it enters the ozonising apparatus. The treated water leaves the tank by means of a siphon outlet.—W. P. S.

Electrolytic water-purifying apparatus and method of purifying water electrolytically. H. B. Hartmann, Assignor to McDowell Manufacturing Co., Pittsburg, Pa. U.S. Pats. 943,187 and 943,188, Dec. 14, 1909.

(1) The apparatus consists of a number of long straight metallic electrodes, arranged vertically in a casing, the water to be treated being caused to flow between the electrodes. The inlet for the water is at the top of the casing, and the outlet at the lower end ; a sludge outlet is also provided, and the inlet and outlets are fitted with valves. The cross-sectional area of the passages between the electrodes is approximately equal to the cross-sectional area of the inlet and of the outlet. (2) The water is caused to flow downwards between the electrodes whilst an electric current is passed between the latter. The flow of the water and the electric current is interrupted synchronously, and the current is reversed periodically. An equal quantity of current is caused to flow between the reversals, notwithstanding the interruptions in the flow of the water and current. The water is caused to pass rapidly between the electrodes while the current is flowing.
—W. P. S.

Liquids in filter beds ; Automatic process of treating —— and means for operating the same. A. G. Leigh, Chorley, Lancs. Eng. Pat. 7464, Mar. 29, 1909.

Two filter beds are placed side by side and separated by a partition wall having orifices at its lower part which permit of communication between the filters. The floor of each filter inclines towards the dividing wall. The water to be filtered is delivered from a conduit into a closed chamber containing a valve which delivers the water to the filters alternately. This valve is operated by a float in a chamber at the end of the filter beds and in communication therewith. While the water is being delivered to one filter, the connection with the other is cut off ; the water passes downwards through the filter in connection with the supply pipe, then through the orifices in the dividing wall and upwards through the second filter bed. As the water rises in the filter beds, the float is raised and passes upwards over a lever operating the valve. When the water has risen to a predetermined height, both filters are emptied by means of a siphon ; the float then falls and the valve delivers the water on the second filter, and so on, so that the water alternately passes downwards through one filter and upwards through the other.—W. P. S.

Filter beds and other areas ; Apparatus for automatically alternating the liquid supply to ——. A. G. Leigh, Chorley, Lancs. Eng. Pat. 18,064, Mar. 29, 1909.

Two siphons are placed in a tank in which accumulates a definite volume of liquid to be delivered to separate filters by means of the siphons. An air dome is placed over the end of each siphon, and a small pipe leads from each dome to a closed valve-chamber also placed in the tank. The ends of these pipes reach just below the cover of the valve-chamber. The latter contains a central rod, to the lower end of which is attached a float; as the liquid rises in the tank, this float is raised, and an indiarubber pad, supported on a projection on the central rod, closes one of the air pipes, leaving the other open. The liquid in the tank cannot rise in the air chamber in connection with the pipe which is closed, and consequently the other siphon discharges the liquid from the tank when the level of the liquid has become sufficiently high. When the liquid is thus run off from the tank, the float falls, and a worm and ball device fitted on the central rod causes the latter to move through one half-turn, so that when the float next rises, the other air pipe is sealed by the rubber pad and the second siphon allowed to operate. The worm and ball device only turns the rod during the downward movement of the latter.—W. P. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Morphine, narcotine, and codeine; Amount of ——, in opium preparations of the [Dutch] pharmacopœia. M. van de Kreke and F. Swart. Pharm. Weekbl., 1909, [48]; through Apoth.-Zeit., 1909, **24**, 973.

In order to obtain comparable results, the opium employed for the following galenicals was dried and powdered. It contained 4·84 per cent. of moisture; 14·70 per cent. of morphine; 3·83 of narcotine; and 0·75 of codeine.

Extract of opium from the above contained 26·7 per cent. of morphine, 3·16 of narcotine, and 1·321 of codeine; these figures were from extract evaporated on a water-bath. When evaporation was conducted *in vacuo*, the morphino content of the extract rose to 27·67 per cent. *Tincture of opium* contained 1·36 per cent. of morphine, 0·34 of narcotine, and 0·03 of codeine. *Tinct. opii crocata* contained 1·61 per cent. of morphine, 0·41 of narcotine, and 0·06 of codeine. The morphine was determined by the method of the Dutch pharmacopœia, except in the case of *Tinct. opii crocata*, in which instance the sodium carbonate was omitted. The narcotine was determined by the following modification of Van der Wielen's method. Opium is heated for several hours with ten times its weight of 70 per cent. alcohol on the water-bath, under a reflux condenser. The orginal weight is then made up, and 30 grms. of the filtrate (= 3 grms. of opium) are evaporated to a syrupy consistence, then dissolved in a small quantity of water, and transferred to a flask; 120 grms. of ether and 10 c.c. of 1 : 10 sodium carbonate solution are added, and the mixture is frequently shaken in the course of 3 hours; 3 grms. of powdered tragacanth are then added and the whole is set aside for 24 hours. The ether is now decanted and distilled off, and the residue is taken up with 3 grms. of 90 per cent. alcohol. After standing 24 hours, narcotine crystallises out. The crystals are washed on a tared filter with 5 c.c. of 90 per cent. alcohol, then dried, at first in the air, and finally at 100° C. The codeine was determined by the method of Van der Wielen (this J., 1903, 656). For determining narcotine and codeine in extracts, 3 grms. were weighed off, dissolved in the smallest possible quantity of water, not exceeding 5 c.c., then treated as above. In the case of the tinctures, 30 grms. were evaporated to a syrupy consistence, then similarly treated.—J. O. B.

Alkaloids; Application of the Volhard method to the determination of ——. E. Elvove. J. Amer. Chem. Soc., 1910, **32**, 132–139.

About 0·2 grm. of the alkaloidal substance is dissolved in 20 c.c. of 4 per cent. hydrochloric acid, and evaporated on the water-bath. The residue is evaporated twice with 5 c.c. of alcohol. The residue is then dissolved in 10 c.c. of water and titrated with alkali solution, using phenolphthalein as indicator. From this the approximate amount of acid that has combined with the alkaloid may be determined. The liquid is filtered if necessary and the precipitate washed free from chlorides. The filtrate and washings are acidified with nitric acid, and excess of standard silver nitrate solution added. After filtering off the precipitate, the excess of silver nitrate is determined by means of standard thiocyanate solution, using ferric alum as indicator. The author has previously shown that the method can be applied to quinine, quinidine, cinchonine, cinchonidine, and strychnine. In the present paper, its application to cocaine, morphine, codeine, narcotine, atropine, hydrastine, pilocarpine, and brucine is described.—F. Shdn.

Gentiopicrin; The presence of —— in Chlora perfoliata. E. Bourquelot and M. Bridel. Comptes rend., 1910, **150**, 114–116.

The aqueous extract from the plant was treated by the method of Bourquelot (this J., 1901, 1244) with invertase and emulsin, and the presence of the glucoside was thus established. The method of extraction is described. In *Chlora perfoliata* the gentiopicrin seems to exist alone, while in other plants of the gentian family it is generally accompanied by other glucosides. The quantity present is about 15 grms. per kilo. of the fresh plant collected in August.
—W. H. P.

Essential oils of Mentha arvensis, var. glabrata, Gray, and Sium cicutaefolium, Gmel. F. Rabak. Midland Drugg. and Pharm. Rev., 1909, **43**, 5—6. Chem. Zentr., 1909, **1**, 1237.

Fresh *Mentha arvensis* plants, collected in S. Dakota, yielded 0·8 per cent. of a faintly yellow oil with an odour resembling that of peppermint. The oil dissolved to a clear solution in half its volume of 90 per cent. alcohol. It had the sp. gr. 0·9267; $\alpha_D = +16^\circ\ 27'$ (100 mm.); acid value, 2·6; ester value, 13·6; ester value after acetylation, 47.

The water-plant, *Sium cicutaefolium*, from S. Dakota, yielded 0·5 per cent. of a light-yellow oil with an odour resembling that of cumin oil. The oil did not dissolve in 6 vols. or more of 90 per cent. alcohol. It had the sp. gr. 0·8447 at 22° C.; $\alpha_D = +63^\circ\ 40'$ (100 mm.); acid value, 0; ester value, 33.—A. S.

Chamomile oil. C. Hartwich and A. Jama. Apoth.-Zeit., 1909, **24**, 585—586. Chem. Zentr., 1909, **2**, 823.

The authors prepared separately essential oils from the flowers and from the calices. Both oils are very viscous at the ordinary temperature. The oil from the flowers (yield, 0·35 per cent.) has a deep blue colour; that from the calices (yield, 0·51 per cent.) is faintly greenish, but soon becomes yellowish-green. Both oils are optically inactive. The characters of the two oils are as follows:

	Sp. gr. at 15° C.	n_D^{21}	Saponification value.
Flower oil ...	0·954	1·363734	74·4
Calyx oil	0·949	1·363717	33·7

—A.S.

Citral in lemon extracts and lemon oils; Determination of ——. R. S. Hiltner. J. Ind. Eng. Chem., 1909, **1**, 798—800.

The method proposed is a colorimetric one based on the fact that a 1 per cent. solution of *m*-phenylenediamine hydrochloride in 50 per cent. alcohol gives a clear yellow coloration with citral at ordinary temperatures. The determination is performed in a similar manner to the ordinary colorimetric process, 90—95 per cent. alcohol in the case of lemon extracts, and 50—60 per cent. alcohol in the case of terpeneless extracts, being used for adjusting the volumes of the liquids. The method is claimed to be more accurate than the magneta-sulphurous acid process (see Chace, this J., 1906, 1116), since, under the experimental conditions, the reagent gives no coloration with acetaldehyde or citronellal. The method fails in the case of lemon oil which has become altered by oxidation, the coloration produced varying from yellowish-green to greenish-blue according to the degree of oxidation of the oil.—A. S.

l-Pinene and its transformation into dipentene. W. Smirnow. J. Russ. Phys.-Chem. Ges., 1909, **41**, 996—1004. Chem. Zentr., 1910, **1**, 30.

A MIXTURE of 5 c.c. of *l*-pinene, 15 c.c. of alcohol, 0·6 c.c. of water, and 1 c.c. of 2 per cent. alcoholic sulphuric acid was heated to boiling, and from time to time, the liquid, after cooling to 18°—20° C., was examined polarimetrically. It was found that the optical activity increased rapidly at first and then fell slowly to zero. After 2½ hours, when the optical activity was at its highest, the reaction product contained, in addition to pinene, a compound, $C_{10}H_{17}OC_2H_5$, boiling at 216°—217° C. at 740 mm.; sp. gr., 0·9010 at 17·5°/°4°C.; $n^{17\cdot5}_{D}=1\cdot4619$; $[a]_D=-66\cdot95°$. After 4 hours, the reaction product still contained this compound, but no *l*-limonene could be detected, and hence the author is unable to agree with Flawitzki that the latter is formed as an intermediate product in the transformation of *l*-pinene into dipentene. It was observed that even carefully purified pinene contained small quantities of fenchene.—A. S.

l-Camphene. P. Golubew. J. Russ. Phys.-Chem. Ges., 1909, **41**, 1004—1014. Chem. Zentr., 1910, **1**, 30.

BY careful fractionation, followed by refrigeration and crystallisation, the author succeeded in isolating *l*-camphene from the essential oil of Siberian fir. The hydrocarbon melted at 50° C., boiled at 159°—160° C., and had the rotatory power, $[a]_D=-92\cdot37°$. By heating it with acetic acid and dilute sulphuric acid for 2—3 hours at 50°—60° C., isobornyl acetate, $CH_3COOC_{10}H_{17}$, was obtained, but the reaction was reversible, one-fifth of the camphene being found unchanged after the treatment. On treating the fraction of the essential oil distilling up to 170° C., directly with acetic acid and dilute sulphuric acid, a yield of 57·9 per cent. of isobornyl acetate was obtained, and from the mother-liquor, after saponification, some *i*-camphene and cymene were isolated.—A. S.

Amino-acids, peptones, and proteins; Catalytic action of —— in effecting certain syntheses. H. D. Dakin. J. Biol. Chem., 1909, **7**, 49—55.

MANY condensations between aldehydes and acids can be made to take place at comparatively low temperatures in the presence of such substances as amino-acids, peptones, or proteins. The author took one molecular proportion of malonic or other acid together with half its weight of an amino-acid or other catalytic substance, the whole being dissolved in the least possible amount of water. One molecular proportion of the aldehyde was then added. The mixture was heated to either 100° C. or 37° C. Good yields were obtained in the following condensations; furfuralmalonic acid from furfural and sodium malonate at 37° C., using alanine; *o*-nitrocinnamic acid from *o*-nitrobenzaldehyde and malonic acid at 100° C., using alanine; cinnamylidenemalonic acid from cinnamic aldehyde and malonic acid, using glycocoll, alanine, leucine, aspartic acid, glutamic acid, arginine carbonate, or peptone, each at 37° C.; vanillidenediaceto-acetic ethyl ester from vanillin and acetoacetic ester at 60° C., using arginine carbonate.—F. SHDN.

Ketones; Catalytic preparation of aromatic ——. J. B. Senderens. Comptes rend., 1910, **150**, 111—112. (Compare this J., 1909, 489, and 1910, 45.)

THE author now finds that neither benzoic acid nor its anhydride can be converted into benzophenone by thoria at 400° C., and that a mixture of acetic and benzoic acids gives only acetone and acetophenone. The acetophenone tends to predominate, and would probably be formed almost exclusively if the acids were in equimolecular quantities. Such a mixture is, however, not easily manipulated, as it is difficult to keep molten, and the high temperature (over 500° C.) necessary for the reaction decomposes the ketones; hence it is better to use not less than two or three molecules of acetic acid to one of benzoic acid. Commercial benzoic acid reacts quite as readily as the pure substance, and a variety of mixed aliphatic aromatic ketones may thus be prepared in large quantities.—W. H. P.

Alcohols; New method of detecting traces of ——. E. de Stoecklin. Comptes rend., 1910, **150**, 43—45.

ONE cubic centimetre or less of the liquid is taken, made faintly acid with acetic acid; or, if acid, it is made almost neutral to phenolphthalein. Two drops of a solution, made by adding a ferric salt to a solution saturated with quinol (hydroquinone) and diluted to contain 1 mgrm. of iron per c.c., are then added, followed immediately by four drops of hydrogen peroxide solution. After shaking for a few seconds a small quantity of rosaniline bisulphite solution is next added. If alcohols were originally present, a more or less intense violet coloration is produced by the aldehyde formed by the peroxydase system (see this J., 1909, 111, 327) acting on the alcohol. The test is repeated using a solution containing 1 mgrm. of iron per c.c. made by adding a ferric salt to a 3 per cent. aqueous solution of tannin. A positive result indicates a monohydric alcohol belonging to one of the first four members of the fatty series. If the test liquid be first boiled to expel volatile alcohols and still shows the above reaction, the presence of glycerol is indicated. The test may be applied directly to detect alcohols in many pharmaceutical or physiological preparations; in some cases it is advisable to distil these and apply the test to a few drops of the distillate.—E. F. A.

Alcoholic solutions; Specific gravities of ——. I. Mixtures of methyl alcohol and water. A. Doroszewski and M. Roshdestwenski. J. Russ. Phys.-Chem. Ges., 1909, **41**, 977—996. Chem. Zentr., 1910, **1**, 154—155.

THE authors determined by means of two different pyknometers the specific gravities, at 15°/15° C., of 25 different mixtures of carefully prepared, anhydrous methyl alcohol (see this J., 1902, 720; 1906, 1172) and water. From the data thus obtained, the average values given in the following table were calculated by two different interpolation methods. The percentages of methyl alcohol are by weight.

Methyl alcohol.	Sp. gr. at 15°/15° C.	Methyl alcohol.	Sp. gr. at 15°/15° C.	Methyl alcohol.	Sp. gr. at 15°/15° C.
per cent.		per cent.		per cent.	
0	1·00000	34	0·94817	68	0·88048
1	0·99814	35	0·94653	69	0·87816
2	0·99630	36	0·94487	70	0·87584
3	0·99457	37	0·94319	71	0·87347
4	0·99285	38	0·94149	72	0·87109
5	0·99116	39	0·93976	73	0·86868
6	0·98950	40	0·93802	74	0·86622
7	0·98787	41	0·93625	75	0·86376
8	0·98633	42	0·93447	76	0·86126
9	0·98480	43	0·93266	77	0·85876
10	0·98327	44	0·93082	78	0·85626
11	0·98179	45	0·92896	79	0·85374
12	0·98031	46	0·92708	80	0·85122
13	0·97887	47	0·92517	81	0·84868
14	0·97745	48	0·92323	82	0·84610
15	0·97603	49	0·92128	83	0·84348
16	0·97462	50	0·91932	84	0·84082
17	0·97322	51	0·91733	85	0·83815
18	0·97181	52	0·91531	86	0·83548
19	0·07040	53	0·91328	87	0·83280
20	0·96899	54	0·91124	88	0·83010
21	0·96758	55	0·90918	89	0·82740
22	0·96617	56	0·90710	90	0·82468
23	0·96476	57	0·90500	91	0·82196
24	0·96335	58	0·90289	92	0·81921
25	0·96192	59	0·90075	93	0·81639
26	0·96047	60	0·89859	94	0·81356
27	0·95901	61	0·89641	95	0·81070
28	0·95752	62	0·89419	96	0·80784
29	0·95601	63	0·89195	97	0·80498
30	0·95449	64	0·88968	98	0·80213
31	0·95296	65	0·88739	99	0·79929
32	0·95139	66	0·88510	100	0·79647
33	0·94979	67	0·88280		

(See also this J., 1888, 510, 581.)—A. S.

Fatty alcohols and water ; Specific heats of mixtures of ——. A. Doroszewski. J. Russ. Phys.-Chem. Ges., 1909, **41**, 958—977. Chem. Zentr., 1910, **1**, 156—157.

The author has determined the specific heats of mixtures of methyl, n-propyl, *iso*propyl, and *iso*butyl alcohols with water. Corresponding results for mixtures of ethyl alcohol and water have been given previously (see this J., 1909, 853). The results are given in tables, those for mixtures of methyl alcohol and water over the interval, 18° to 100° C. being as follows :—Pure methyl alcohol, 0·6581 ; 90·01 per cent. methyl alcohol, 0·7200 ; 80 per cent., 0·7744 ; 69·99, 0·8287 ; 60·03, 0·8689 ; 49·98, 0·9162 ; 40, 0·9542 ; 30·02, 0·9871 ; 24·98, 1·0001 ; 20, 1·0021 ; 15·01, 1·0065 ; 10·01, 1·0114 ; 5 per cent. methyl alcohol, 1·0085 ; water, 1·0060.—A. S.

Ammonium benzoate ; [U.S.] pharmacopœial tests for ——. A. Seidell and G. A. Menge. Amer. J. Pharm., 1910, **82**, 12—20.

The litmus test for the presence of free acid and the so-called melting point test are shown to be valueless. The quantitative determination of ammonia is suggested for adoption in the following terms. About 0·5 grm. dissolved in water and made alkaline with 50 c.c. of $N/10$ sodium hydroxide solution, is distilled into 50 c.c. of $N/10$ sulphuric acid solution. The excess of this acid remaining after the distillation is completed should require not more than 14·1 c.c. of $N/10$ solution of ammonium hydroxide with cochineal indicator.—J. O. B.

Patents.

Colloidal substances ; Process for the preparation of —— *in either a liquid or gelatinous condition.* T. Svedberg. Fr. Pat. 403,592, June 2, 1909.

The process claimed is specially applicable to organic substances such as waxes, hydrocarbons, alcohols, fatty acids, fats, &c. It consists in dissolving the substance in a suitable volatile solvent, heating the solution, and then introducing the solution gradually into a heated dispersing medium, in which the substance, in the crystalline form, is insoluble. The volatile solvent is removed from the colloidal solution by heating. By adding a protective colloid to the solution, and then evaporating, the substance may be obtained in a dry soluble form ; or by adding to the solution an electrolyte, it may be obtained in the gel form. To obtain a colloidal solution of wax, for instance, this is dissolved in alcohol, and the solution is heated nearly to the boiling point of the solvent, and added gradually to boiling water. When the colloidal solution is of the desired concentration, the addition of the alcoholic solution of the wax is stopped, and the aqueous solution is kept boiling until quite free from alcohol.—A. S.

Hydrocarbon mixtures containing sulphur compounds ; Process for the manufacture of —— *from fossils containing sulphur, such as ichthyol shales.* N. Zwingauer. Ger. Pat. 216,908, June 14, 1907.

The process claimed consists in the distillation of the shales under diminished pressure in a current of superheated steam. In this way a thick brown oil of sp. gr. 1·000, and with only a faint odour, is obtained, which can be readily sulphonated, yielding products of higher therapeutic value than so-called ichthyolsulphonic acid. —A. S.

Preparation, soluble in water, from Peru balsam and formaldehyde ; Process for obtaining a ——. O. Börner. Ger. Pat. 217,189, March 19, 1909. Addition to Ger. Pat. 208,833, July 28, 1906.

The preparations obtained by the process described in the chief patent (this J., 1909, 674) separate into two layers when kept for a long time. According to the present patent, this is prevented by replacing a portion of the alcohol by glycerin. For example, 50 grms. of glycerin and 50 grms. of 90 per cent. alcohol are added to 50 c.c. of potassium hydroxide solution of 42° B., then 100 grms. of Peru balsam are introduced, and the whole is heated for several hours at 60° C. whilst gaseous formaldehyde is led in, the treatment being continued until the product forms a clear solution with water.—A. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographs in colour ; Printing on paper of ——. Soc. Anon. La Photographie des Couleurs, Antwerp, J. Sury, Wyneghem, and E. Bastyns, Antwerp. Eng. Pat. 27,687, Dec. 19, 1908.

Successive printings are made from three negatives, made by the three-colour process, on a single paper basis. This is prepared by first impregnating a sheet of moist paper with gum solution, drying, and coating with the usual ferro-prussiate sensitising solution, when the blue negative is printed on ; it is then sensitised in the usual manner with bichromated gum for the yellow and red printings. The first treatment with gum solution of suitable strength ensures that the paper shall have the same dimensions for the first printing as for the other two. —T. F. B.

Chromate glue pictures on metal, porcelain, glass, and other bodies impermeable to water ; Method of producing ——. A. Hans, Berlin. Eng. Pat. 7800, April 1, 1909.

See Ger. Pat. 212,764 of 1908 ; this J., 1909, 1006. A composition consisting of 400 parts of fish glue, 50 parts of ammonium bichromate, about 50 parts of pigment, and 1000 parts of water, is claimed.—T. F. B.

Colour photography ; Process of making screens for ——. C. Späth, Steglitz, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 946,470, Jan. 11, 1910.

See Eng. Pat. 3601 of 1909 ; this J., 1909, 1327.—T.F.B.

XXII.—EXPLOSIVES ; MATCHES.

French service powder " B " ; The stability of the ——. L. Lheure. Mem. des Poudres et Salpêtres, 1909—1910, **15**, 1—34.

In March 1907 a disastrous explosion took place on board the French battleship Jena in Toulon harbour. As the result of an enquiry by a special commission the explosion was attributed to spontaneous decomposition of the French service powder " B." The experiments detailed in the present work, although carried out in 1905, have only now been published. The greater number of the powders experimented with, had been manufactured in 1902. The French service powder " B " is a pure nitrocellulose powder, gelatinised with a mixture of ether and alcohol, and, in certain circumstances, amyl alcohol is added as a stabiliser. The samples were submitted, for prolonged periods, to continuous heating under varying conditions. 12 grms. of powder were placed in tubes of 16 mm. diameter, with walls 2 mm. thick. A wad of unravelled silk, weighing from 2·5 grms. to 3 grms., was, in some of the experiments, placed in the tubes about 2 cm. above the powder. Vieille's work has shown that silk has a very strong affinity for oxides of nitrogen. The powder in the heated tubes was in some cases freely exposed to the air, whilst in others it was contained in tubes drawn out to a fine point, leaving only a very narrow channel for access of air. In other experiments the tubes were sealed up after being filled either with air, carbon dioxide, or nitrogen. In all cases the samples, before being subjected to long periods of heating, were submitted to the Vieille test—the French service test. This is carried out by heating the powder, in contact with standard blue litmus paper, in glass cylinders provided with well-fitting stoppers clamped down. The tubes are kept at a constant temperature at 110° C., and the number of hours taken to completely redden the litmus paper is noted. The sample is then removed, placed in another cylinder with fresh litmus paper, and the process repeated until a period of less than one hour is taken to redden the litmus paper. The number of hours of the preceding tests are then added together and this number is taken as the figure of merit for the Vieille test. The larger this figure, the better is the stability of the powder considered to be.

Continuous heating at 110° *C.* In all cases the samples of powder had, before heating, a Vieille test of approximately 50 hours. After heating continuously for 40 to 50 hours in open tubes, the test had fallen very considerably; in the greater number of instances to about 1½ hours. The same result was obtained when the open tubes contained either a layer of diphenylurea or a wad of silk. The same samples of powder sealed up in tubes containing air, showed better tests (22 hours) at the end of the same time of heating; whilst the most satisfactory tests (35 hours) were obtained when a wad of silk was placed in tubes which had been sealed up with air present. The content of nitrogen in the powders was originally about 12·7 per cent. After heating it had fallen to between 12·3 and 12·5 per cent. The loss of weight (moisture and solvent) in the open tubes was about 3 to 6 per cent., whilst in the closed tubes it was only about 2 per cent.

Continuous heating at 75° *C.* Heating was continued for some 40 days, and, under these conditions, the Vieille test which was originally 50 hours, dropped to half an hour in the case of the powder in the open tubes, whilst with the same powder enclosed in sealed tubes containing a wad of silk, no alteration was observed after the same period of heating. Powder heated in the tubes drawn out to a fine point, even when containing wads of silk, gave practically the same Vieille test as that heated in tubes freely open to the air. The same sample of powder, even after 60 days heating in sealed tubes in the presence of air, nitrogen, carbon dioxide, and silk wads did not alter in its behaviour in the Vieille test. The nitrogen content in the samples heated in the open tubes had fallen from 12·7 to 9 per cent., and the samples had lost about 20 per cent. in weight. It was also found that the ballistics of the powder from the sealed tubes had not altered appreciably, and that the internal pressure in the tubes was relatively small. Powder in tubes drawn out to a fine point, and containing diphenylurea, behaved in the same manner as in the open tubes, in that the Vieille test, at the end of 38 days, fell to about half an hour. The general conclusions, arrived at as the result of 133 comparative experiments, were as follows:—The French service powder "B" from the point of view of chemical stability, as determined by the Vieille test, deteriorates very considerably when heated at either 75° C. or 110° C. in open tubes. The same powder, however, after heating in sealed tubes in an atmosphere of air, nitrogen, or carbon dioxide, and with a wad of silk present, withstands this treatment for considerable periods without deteriorating in chemical stability, as determined by the Vieille test. A certain amount of decomposition, however, undoubtedly goes on, seeing that there is a drop in the percentage of nitrogen, and the dark coloration of the wad of silk shows that it has been attacked by oxides of nitrogen. The internal pressure in the sealed tubes after 80 days at 75° C., was not greater than 1 kilo. In the case of sealed tubes heated to 110° C., the pressure developed was, in course of time, sufficient to burst the tubes. An investigation was carried out to determine whether the more satisfactory results, as regards stability of powder heated in sealed tubes when compared with open tubes, were due to pressure or to the traces of solvent retained in the powder after manufacture. The tubes used for the experiments had a small side tube leading to a U-tube, the latter being placed in a freezing mixture so as to condense the solvent; or, in some instances, being charged with sulphuric acid to absorb the solvent. Comparative tests in open tubes were carried out in the same bath. In three comparative experiments samples of powder having an original Vieille test of 50 hours were heated under the above conditions for 60 to 70 hours at 100° C. It was found that the Vieille test at the end of this time was, in both instances, practically the same; on the average 17 hours. This showed that the removal of the solvent had caused the powder to decompose more rapidly. Wads of silk saturated with ether and with a mixture of ether and alcohol, and also with amyl alcohol, were introduced into the tubes. After 72 hours of heating the beneficial effect of the presence of these solvents in preventing deterioration was very apparent. The author considers that the marked deterioration in the chemical stability of powder on being heated in open tubes, compared with sealed tubes, was due, in the former case, to the elimination of solvent, which left the powder in a porous condition, greatly accelerating the rate of decomposition.

—G. W. McD.

French service powder "*B*"; *Decomposition of* —— *by heat.* M. G. Patart. Mem. des Poudres et Salpêtres, 1909—1910, 15, 39—51.

Six different samples of powder were selected for these experiments. Two of the samples had been manufactured in 1889 and were about five years old. At the time of the experiments they gave an inferior Vieille test. The other four samples were of recent manufacture and contanied amyl alcohol, in varying proportions, up to 2 per cent. The samples were heated continuously, for 1400 hours in all, to 110° C. in open copper capsules. The loss in weight was determined every 50 hours. This loss, during the second 50 hours of heating, varied in the different samples from 1·1 to 1·9 per cent., and increased to a maximum as shown in the following table. From the maximum point, the loss fell gradually to between 0·55 and 0·9 per cent., for the last 50 hours of heating.

Sample.	Maximum percentage loss in 50 hrs. heating.	Maximum loss attained between :	Total percentage loss after 1400 hrs. heating.
		hours.	
5 years old (inferior Vieille test)	7·3	200—250	57·8
5 years old (inferior Vieille test)	7·3	250—300	60·5
New powder	6·0	300—400	59·3
" "	5·0	350—400	56·2
5 years old treated with amyl alcohol	4·7	400—450	59·2
New powder treated with amyl alcohol	6·2	300—350	58·9

Another series of similar experiments on powder of recent manufacture showed the relationship between the loss of nitrogen in the nitrocellulose, and the loss in weight of the powder. The loss of weight during the first 100 hours of heating was 3·5 per cent. It rose to a maximum of 11·43 per cent. after 400 to 500 hours and fell to a minimum of 1·3 per cent. after 1300 to 1400 hours, when the experiment was discontinued. The total loss in weight had then risen to 65 per cent. When the experiment was concluded, the nitrogen in the powder had fallen from 12·65 to about 5 per cent. Samples of guncotton were also subjected to the same treatment. In one instance a sample lost 8·2 per cent. in weight after 860 hours continuous heating at 110° C., and the nitrogen content had fallen from 13·1 to 12·3 per cent. Other experiments on powder were carried out in stoppered tubes similar to those used for the Vieille test. In these experiments the heating was not continuous. The tube was usually heated at 110° C. for 10 hours, and then allowed to cool down for 14 hours before being heated again. Red vapours appeared in the tubes after heating for between 40 and 50 hours, and the samples had lost about 4 to 7 per cent. in weight. From this point the loss in weight increased very rapidly and had risen at the end of 100 hours heating to from 30 to 37 per cent. The action of the acid products of decomposition was undoubtedly the determining factor in accelerating the decomposition.—G. W. McD.

Guncotton and the French service powder "*B*"; *Denitration of* ——. P. Vieille. Mem. des Poudres et Salpêtres, 1909—1910, 15, 61—70.

A sample of Stowmarket guncotton manufactured in 1887 was found, after 21 years storage, in a loosely stoppered flask in the French Government explosives laboratory, to have an Abel heat test of over 20 mins. and a Vieille test at 110° C. of over 7 hours. The nitrogen content was 12·65 per cent. Although no records were in existence of the nitrogen content of this particular sample when received, the author concludes that it was probably the same as that of guncotton then being manufactured in France and that no appreciable drop in nitrogen had taken place during 21 years storage. Samples of the French service powder which had been kept for 22 years in loosely stoppered bottles, and also in flasks filled with water, showed no decrease in nitrogen content. Two samples of powder were tested at the end of 11 years. The one had been kept in the laboratory magazine, the other had been for several years in a magazine in Algiers. They both had practically the same Vieille test (about 5 hours) and a nitrogen content of 12·48 per cent. The sample from Algiers contained 1·02 per cent. of solvent, the other 0·35 per cent. In neither case had the nitrogen content fallen to an extent greater than 0·1 per cent. Experiments were carried out with samples of powder stored under the following conditions:—(1) Magazine. (2) Freely exposed in a bag to all conditions of weather. (3) Buried half a metre in damp earth. (4) Buried in damp sand. (5) Buried in damp hay and placed in a cellar. The samples were submitted, annually, to the Vieille test during 7 years. The whole of them, originally, gave tests between 50 and 55 hours. After one year they gave, variously, values ranging from 38 to 45 hours. At the end of 7 years the magazine sample gave a test of 43 hours; the sample exposed to all conditions of weather, 35 hours; those in damp earth and sand, 29½ hours; and the sample in damp hay, 17½ hours. The nitrogen content of all the samples was practically the same (12·5 per cent.), whilst the residual solvent varied from 1·59 to 1·82 per cent. The author concluded that guncotton can be stored for some 20 years without loss of nitrogen and that gelatinised nitrocellulose powder can be stored for a similar period with a very small decrease in the percentage of nitrogen, although the stability, as determined by the Vieille test, may have fallen to a very low limit.—G. W. McD.

French service powder "B"; Denitration of dry —— under the influence of high temperatures. [Significance of the French service Vieille test.] P. Vieille. Mem. des Poudres et Salpêtres, 1909—1910, **15**, 71—88.

Samples of guncotton were heated in well-stoppered tubes at 108·5° C. until a piece of blue litmus paper in the tube was reddened. The tube was then allowed to cool, fresh litmus paper was introduced, and the process repeated. Under these conditions, the nitrogen content of a sample of guncotton fell from 12·85 to 12·37 per cent. after 361 hours of non-continuous heating, or an average loss of 0·0013 per cent. of nitrogen per hour of heating—a figure representing the normal loss sustained by guncotton under the conditions of the service test. Samples of service powder, with Vieille tests ranging from half an hour to over 100 hours, were examined as to their nitrogen content before and after being submitted to the test. The original content of nitrogen varied from 12·36 to 12·65 per cent. In the case of a powder with only a half hour Vieille test, the sample had, during this period of heating, lost 0·075 per cent. of nitrogen. During a 5-hour Vieille test the loss was 0·11 per cent.; 24 hours test, 0·1 per cent.; 52 hours test, 0·3 per cent.; whilst during the longest Vieille test (102 hours), there was a loss of 0·9 per cent. of nitrogen. Further experiments on powders with a test of over 100 hours showed, as an average of a considerable number of tests, that 0·51 per cent. of nitrogen was lost in the first 50 hours and a total of 0·91 per cent. at the end of 100 hours. In the Vieille service test the denitration of the powder is proportional to the length of the test and is approximately a loss of 0·009 per cent. of nitrogen, for every hour of heating, during a test of 100 hours, and the significance of the test lies in the power of the powder to reduce the oxides of nitrogen produced by the decomposition of the nitrocellulose. The same proportional drop in the percentage of nitrogen was also obtained on powders with a Vieille test of 100 hours when the samples were heated either in tubes closed at one end or in U-tubes. Experiments on continuous heating at 75° C. showed that as regards decrease in nitrogen content of the powder, one day's heating at 75° C. is roughly equivalent to one hour's heating at 110° C. When a powder, either owing to prolonged storage or previous heating, has reached a point where it gives a Vieille test of under one hour, further heating at 75° C. causes a considerable increase in the rate of the daily percentage loss of nitrogen. Certain powders of recent manufacture (AM_8), have not this disadavantage. Experiments on heating guncotton and powder continuously at 40° C., for periods ranging from 5 to 10 years, showed that the loss of nitrogen per month of heating was, on the average, about 0·006 per cent. for the powders, but less for guncotton itself. It is considered that at 20°—25° C. the loss of nitrogen per year would probably be equivalent to that obtained per month at 40° C. The following general conclusions are drawn. The action of heat alone upon guncotton and the French service powders produces a slow denitrification, the rate of change increasing regularly with increase of temperature. For the service powder "B" this loss of nitrogen is equivalent to 0·006 per cent. per hour at 110° C., per day at 75° C., and per month at 40° C. This rate is only true for the powder "B" within the limits of the time of heating corresponding to the Vieille test at 110° C. Experiments at 75° C. showed that the powder, "AM_2," when heated beyond the period corresponding to the Vieille test, had a rate of loss of nitrogen four to six times the normal amount. The powder, AM_8, however, when heated for 300 days at 75° C., beyond the period determined by the Vieille test, showed practically no increase in the rate of loss of nitrogen. The Vieille test is not significant either of the commencement of deterioration of a powder, or of equal degrees of deterioration, but solely of the limit to which a powder can be heated with an approximately constant rate of loss of nitrogen during equal periods of time. Beyond this point a greatly accelerated rate in the loss of nitrogen may occur.—G. W. McD.

French service powder "B"; The action of oxides of nitrogen on ——. P. Vieille. Mem. des Poudres et Salpêtres, 1909—1910, **15**, 89—113.

Oxides of nitrogen may be produced from a stable powder, as a whole, owing to the action of heat, or, on the other hand, they may arise from local and visible points of very inferior stability, in a generally stable product. This latter condition was not uncommon in the French service powder manufactured previous to 1897; but in the powder manufactured since that date, with the addition of amyl alcohol, this condition has not been observed.

Production of oxides of nitrogen by heating the French service powder "B." 50 grms. of powder were heated continuously for 10 and 20 days at 75° C. in a sealed flask of about 170 c.c. capacity, in the presence of carbon dioxide. The amount of total nitrogen evolved (as nitrogen, nitrous oxide, and nitric oxide), under these circumstances, was about 0·045 c.c. per grm. of powder, per day of heating. The amount of nitrogen existing as nitric oxide, was only about one-tenth of the total nitrogen evolved. At the end of 20 days heating the gas in the flask, unabsorbed by a solution of caustic potash, consisted of nitric oxide (13), carbon monoxide (7), nitrous oxide (8) and nitrogen (72 parts).

Denitration of powder "B" at 40° C. and 75° C. in presence of air. The samples were heated in sealed flasks, with 2·67 c.c. of air present per grm. of powder. The absorption of oxygen was found to be very rapid, due on the one hand to oxidation of the nitric oxide evolved from the powder, and on the other to oxidation of the residual solvent in the powder. At the end of 7 days heating at 75° C., the whole of the oxygen, originally present in the air in the flask, had disappeared; and it was further shown that, as regards absorption of oxygen, 2 and 4 days heating at 75° C. were approximately equivalent to 2 and 4 months respectively at 40° C. No free nitric oxide could be detected in the atmosphere of the flask at the conclusion of the experiments. By calculation the author concludes that at the end of a years heating at 40° C., in the circumstances mentioned, only about 0·1 c.c. of oxides of nitrogen, per grm. of powder, would be present in the atmosphere of the flask, or 0·0002 per cent. by weight of the powder present. Other experiments showed that the powder could absorb at least twenty times this amount of oxides of nitrogen without showing a diminished Vieille test.

Production of oxides of nitrogen from unstable powder. Unstable powder developes white spots evolving a very marked acid smell. The powder loses its colloidal condition and becomes, at these points, quite friable. A litre flask provided with a ground-in stopper and mercury manometer was filled with a sample of moderately unstable powder. It was heated continuously for 4 months at 15° C. No appreciable increase of pressure was observed. The same experiment was repeated with a very unstable sample. The pressure did not increase until the expiration of 20 days, when it began to rise at the rate of 15 to 25 mm. per day. During a period of 20 days from the time that an increase of pressure was first noticed, 373 c.c. of gas were evolved from 510 grms., or 0·033 c.c. per grm. of powder, per day of heating at 15° C. The gas disengaged had the following composition:—Carbon dioxide (20·8), nitric oxide (5·3), carbon monoxide (3·3), nitrous oxide (11·05), nitrogen (59) and hydrogen (0·25 parts). An exceptionally unstable sample of powder withstood only 16 days heating at 15° C. before pressure was developed in the flask, and the rate of evolution of nitrogen rose to 0·07 c.c. per grm. per day, an amount approximately equal to that developed by a stable powder, in the same time, when heated to 75° C. The rate of decomposition of this powder was thus some 700 to 800 times more rapid than that of a stable product.

Action of oxides of nitrogen upon stable powder. Samples of powder with a moisture content of 1·7 per cent. were placed in a flask filled with nitrogen peroxide, prepared by the action of nitric acid on arsenious acid. 100 grms. of the powder absorbed during five minutes exposure, 0·9 grm. of nitrogen peroxide; during 1 hour, 3 grms., and during 17½ hours, 13 grms. The sample of powder acquired a dark greyish-green colour; but on exposure to the air for 15 days it returned to its original weight. The action of nitrogen peroxide on nitrocellulose powder causes a very rapid decrease in the nitrogen content. In the case of a sample of powder sealed up in a flask filled with nitrogen peroxide, and standing 7 days at the ordinary temperature and 6 days at 40° C., the nitrogen content fell from 12·5 to 9 per cent., and at the end of 11 extra days to about 3 per cent. When the quantity of nitrogen peroxide in the atmosphere of the flask was only 1·5 to 2 per cent., it required, in this case, some 21 days before the nitrogen content of the powder fell from 12·5 to about 9 per cent. 100 grms. of powder which had been exposed so as to absorb 4·7 grms. of nitrogen peroxide, were then sealed up in a flask provided with a manometer. On standing at 15° C. the powder evolved gas at the rate of 0·3 c.c. per grm. of powder per day during the first two months, and 0·2 c.c. from the sixth to the seventh month. When the concentration of nitrogen peroxide in the atmosphere of the sealed flask was small (0·68 mgrm. per grm. of powder) it was found that the powder was not sensibly affected either in the Vieille test or nitrogen content. Where the concentration of nitrogen peroxide was equal to 2·86 mgrms. per grm. of powder, it was found after 15 days heating at 40° C., that the old type of powder (without amyl alcohol) was adversely affected, when subsequently submitted to the Vieille test, whilst the new types of powders (containing from 2 to 8 per cent. of amyl alcohol) were unaffected. With a concentration of nitrogen peroxide in the flask equivalent to 12·96 mgrms. per grm. of powder, it was found, after several days heating at 40° C., that the old type of powder had lost about 0·5 per cent. of nitrogen and gave a Vieille test of 14 minutes instead of the original 44 hours. The new types of powder, though showing a loss in nitrogen, still gave a total Vieille test of some 50 hours, although the length of time required for reddening the standard blue litmus paper had fallen, for the first period of the test, from some 8 hours to very slightly over 1 hour.

The author's general conclusions are as follows:—(1). The French service powder "B" can absorb very considerable quantities of nitrogen peroxide without being adversely affected in the Vieille test. (2). The service method of storage of powder, in sealed cases, offers a high degree of security, because it limits the possibility of the production of nitrogen peroxide, to an extent which would be detrimental, even where magazines are at a somewhat high temperature. (3). With the new type of powders, AM_2 and AM_8 (containing amyl alcohol), which are inspected annually, no absorption of nitrogen peroxide is likely to take place in sufficient amount to be detrimental to the stability of the powder. This statement remains true even though the powder should be exposed to the following disadvantageous conditions. (*a*), a temperature of 40° C.; (*b*), leaky cases of such a character as to allow a renewal of the air contained in them six times per annum, owing to atmospheric variations of pressure and temperature; (c), the presence of unstable powder to an extent equal to that found in the old type of powder. (4) The first indication of a reduction in the stability of the powder is to be found in the decrease of the time required during the Vieille test to first redden the standard blue litmus paper, and also in the decrease of the nitrogen content of the powder. These two points should be considered in conjunction with the total time of the Vieille test. (5). Where the absorption of nitrogen peroxide by the powder has reached 1·5 per 100, none of the service powders remains unaffected in stability. Even those powders containing 1·5 per cent. of diphenylamine continue to decompose slowly at the ordinary temperature without action on the stabiliser, which does not act as an indicator of instability. (6). The newest type of powders, AM_8 (containing 8 per cent. of amyl alcohol), has in the same circumstances, shown better keeping qualities than powders containing 1·5 per cent. of diphenylamine.
—G.W.McD.

Carbon monoxide poisoning by explosion-gases. Investigation of poisoning due to the explosion of organic nitro-products. L. Lewin and O. Poppenberg. Z. ges. Schiess.-u. Sprengstoffw., 1910, 5, 4—7, 25—29.

The gaseous products obtained by the decomposition of different explosives in an explosion-bomb contained the proportions of carbon monoxide and dioxide shown in the following table:—

Explosive.	Carbon monoxide.	Carbon dioxide.
	per cent.	per cent.
Nitrocellulose powder	46·87	16·8
Gelatin-dynamite	34·00	32·68
Carbonite	36·0	19·2
Picric acid	61·05	13·46
Trinitrotoluene	57·01	1·93
Ammonal	23·74	6·09

It was found that the gases collected after blasting with picric acid and trinitrotoluene, and after firing nitrocellulose powder with a normal cartridge, contained the same percentages of carbon dioxide and monoxide as the products obtained in the explosion-bomb. If, however, on firing, muzzle-flame was produced, most of the carbon monxide was oxidised to dioxide. Physiological experiments with the explosion gases showed that these produce typical carbon monoxide poisoning.

Under abnormal conditions (*e.g.*, in blown-out shots), oxides of nitrogen may be produced by the explosion of nitro-products. In experiments with 0·5 grm. of explosive in an iron tube open at one end, 68 c.c. of nitric oxide were obtained from dynamite, 32 c.c. from picric acid, and 25 c.c. from trinitrotoluene. Small quantities of hydrocyanic acid were also detected in the gases from picric acid, trinitrotoluene, and carbon-carbonite ("Kohlencarbonit.").—A. S.

Potassium iodide-starch paper. [Abel heat test]. C. G. Storm. J. Ind. Eng. Chem., 1909, 1, 802—803.

The method adopted by the author for the preparation of the test-paper is the same as that usually employed, except that the potassium iodide and starch solutions are cooled before mixing, and that the paper, before being impregnated, is washed only for a short time in distilled water (immersion for about 10 seconds). Properly prepared paper is ready for use within 24 hours after dipping, and will keep unaltered for eight years in black bottles fitted with tightly-fitting glass stoppers. Exposure to light appears to have no injurious effect provided moisture and deleterious fumes are excluded, although it is probable that freshly-prepared paper is more sensitive to the action of light than paper which has been kept for some time. The author finds that the test-paper always gives a coloration with acetic acid and he is unable to confirm the statement in the 1907 report of H.M. Inspector of Explosives (see this J., 1908, 960) that this can be prevented by washing the paper in 10 per cent. acetic acid, and then in water, before impregnation.—A. S.

PATENTS.

Explosives. W. A. Andersen, Bröndersley, Denmark. Eng. Pat. 28,544, Dec. 31, 1908.

THE explosives claimed contain considerable quantities of lead peroxide, which is said to increase the bursting power. The following examples are given: Lead peroxide (60 parts) and picric acid (40 parts). Lead peroxide (45), picric acid (20), trinitrotoluene (10), guncotton (15) and nitroglycerin (10 parts). Lead peroxide (45), resin (10), nitrotoluene (10), guncotton (15) and nitroglycerin (20 parts). Lead peroxide (40), picric acid (50), guncotton (5), and nitrobenzene (5 parts). It is stated that lead peroxide does not give dangerously sensitive mixtures with picric acid. Lead peroxide mixed with such substances as glycerin, sugar, fats, flour, paraffin, &c., also forms explosives.—G. W. McD.

Explosive. L. N. Bent and H. Talley, Carthage, Mo., Assignors to Independent Power Co., Joplin, Mo. U.S. Pat. 943,589, Dec. 14, 1909.

THE explosive consists of ammonium nitrate, another solid inorganic oxidising agent, such as manganese dioxide, and comminuted zinc, to which may also be added a nitrated compound.—C. A. M.

Explosive mixtures; Method of evaporating ——. F. I. du Pont, Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 944,500, Dec. 28, 1909.

A STEAM-jacketed tube containing a screw conveyor is used. The explosive mixtures are fed into the tube, and the screw rotates at such a speed that the particles are thrown by centrifugal force to the heated sides of the tube and are, whilst being carried through the tube, subjected to a rubbing action.—G. W. McD.

Explosive mixtures; Apparatus for evaporating ——. F. I. du Pont, Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 945,109, Jan. 4, 1910.

THE evaporator consists of a number of steam-jacketed tubes each provided with a screw conveyor. A multisectional pump, in connection with a main supply pipe, delivers the explosive mixture separately, to each evaporating tube.—G. W. McD.

Nitrocellulose bodies [explosives]; Method of making horny ——. V. Vender, Milan, Italy. U.S. Pat. 946,294, Jan. 11, 1910.

SEE Fr. Pat. 372,267 of 1906; this J., 1907, 553.—T. F. B.

Explosives. B. E. D. Kilburn. Fr. Pats. 404,301 and 404,302, June 22, 1909. Under Int. Conv., July 27, 1908.

SEE Eng. Pats. 15,916 of 1908 and 12,506 of 1909; this J., 1909, 816 and 916.—T.F.B.

XXIII.—ANALYTICAL PROCESSES.

Copper; Determination of —— *volumetrically.* J. A. Sanchez. Bull. Soc. Chim., 1910, 7, 9—17.

THE method is based upon the fact that, when copper ferrocyanide is dissolved in a solution of potassium cyanide, the completion of the reaction is accompanied by a very sharp change of colour. The copper solution must be exactly neutral and free from iron, lead, zinc, nickel, cobalt, manganese, and ammonium salts. The solution in nitric acid is, therefore, evaporated to dryness with sulphuric acid, any lead sulphate is filtered off, after adding cold water to the residue, and the copper is precipitated as cuprous sulphide, by acidifying with sulphuric acid and boiling with 10—20 c.c. of a 50 per cent. solution of sodium thiosulphate. The sulphide precipitate, washed with boiling water, is dissolved in nitric acid, the excess of acid is boiled off, and the solution made up to a known volume. An aliquot part is titrated with standard alkali, using methyl orange as indicator, and another portion is then exactly neutralised, without the addition of an indicator, this solution, after adding potassium ferrocyanide, being ready for titrating with potassium cyanide. The potassium cyanide solution is made by dissolving 6·5 grms. of the salt per litre and is standardised by titration against a solution containing 1 grm. of copper per litre: for this purpose, 1 c.c. of a 10 per cent. solution of potassium ferrocyanide is added to 10 c.c. of the copper solution, followed by the potassium cyanide solution, until the reddish-brown colour suddenly changes to greenish-yellow. The determination is not affected by the presence of tin, arsenic, antimony, or organic acids, but, in the last case, phenolphthalein is used as indicator, in the place of methyl orange, and a very dilute solution of copper is employed.—F. SODN.

Ammonia; Source of error in the determination of ——. E. Barral. Bull. Soc. Chim., 1910, 7, 8—9.

IT is found that some samples of tin, when quite new, are able to absorb appreciable quantities of ammonia, and attention is drawn, therefore, to the necessity for exercising care in the employment of a tin condenser-tube in the determination of ammonia by distillation.—F. SODN.

Elementary analysis of argillaceous bituminous rocks. Lissner. *See* IIA.

Determining ash and moisture in coke. Ullmann and Buch. *See* IIA.

Natural zirconium dioxide. Weiss and Lehmann. *See* VII.

Determining manganese in steel. Auchy. *See* X.

Determining tungsten in tungsten-steel. Wolter. *See* X.

Errors due to the presence of potassium iodide in testing cyanide solutions for protective alkalinity. Collingridge. *See* X.

Rapid determination of copper in slags. Aller. *See* X.

Determining arsenic in copper. Azzarello. *See* X.

Determining chromium in chrome iron ore. Muller. *See* X.

Electrodeposition of metals. Perkin and Hughes. *See* X.

Determining crystal-content of [sugar] syrups. Koydl. *See* XVII.

Separating sucrose and lactose. Margaillan. *See* XVII.

Determining calcium and magnesium [in foods, &c.] in presence of phosphates and iron. McCrudden. *See* XIX.A.

Morphine, narcotine, and codeine in opium preparations. Van de Kreke and Swart. *See* XX.

Application of Volhard method to determination of alkaloids. Elvove. *See* XX.

Determining citral in lemon extracts and lemon oils. Hiltner. *See* XX.

Detecting traces of alcohols. De Stoecklin. *See* XX.

U.S.P. tests for ammonium benzoate. Seidell and Menge. *See* XX.

Patent.

Analysing gaseous mixtures and recording the result; Apparatus for ——. M. C. Brenot, Issy-les-Moulineaux, France. Eng. Pat. 9518, April 21, 1909. Under Int. Conv., April 22, 1908.

See Fr. Pat. 389,498 of 1908; this J., 1908, 1000.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS,

Sounding tubes; Coating ——. C. E. Munroe. Chem. Eng., 10, [2]; through Chem. News, 1910, 101, 17.

In Lord Kelvin's sounding machine for rapidly moving vessels, a glass tube closed at the upper end and coated inside with silver chromate is lowered vertically into the sea water. The depth is determined from the pressure, which is measured by the rise of the water in the tube and the consequent conversion of the red silver chromate into the white chloride. The author finds that the most adherent and sensitive coating is made with a gelatin basis by adding 3·4 grms. of silver nitrate and then 1·95 grms. of potassium chromate to 100 grms. of Le Page's liquid glue. This is applied in a thin film to the cleaned tubes, which must then be stored in a cool dark place, since the chromate is altered both by strong light and by heat.
—W. H. P.

Books Received.

Supplement to the Report of the Medical Officer on the Nature, Uses, and Manufacture of Ferro-silicon. Local Government Board Report. [Cd. 4958.] Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 11d. (See p. 154.)

Report on the Progress of Agriculture in India for 1907–1909. Superintendent of Government Printing, Calcutta. Price 7d.

Census of Production (1907). Preliminary Tables summarising the Results of the Returns received under the Census of Production Act, 1906. Part II.—Containing particulars relating to—(6) Shipbuilding Yards and Marine Engineering Works:—(a) Private, (b) Government, (7) Engineering Factories (including Electrical Engineering), (8) Cycle and Motor Factories, (9) Leather Factories (Tanning and Dressing), (10) Papermaking Factories. [Cd. 5005.] Wyman and Sons, Fetter Lane, E.C. Price 4d.

A Manual of Dyeing. for the use of Practical Dyers, Manufacturers, Students, and all interested in the Art of Dyeing. By E. Knecht, Ph.D., M.Sc. Techn., F.I.C., C. Rawson, F.I.C., F.C.S., and R. Loewenthal, Ph.D. Second Edition. Two Volumes. C. Griffin and Co., Exeter Street, Strand, London. 1910. Price 45s.

Two large 8vo volumes containing 884 pages of subject matter, 120 illustrations, 5 plates, and an alphabetical index. The following classification is adopted: Vol. 1.—(I.) Introduction. (II.) Chemical technology of the textile fibres (III.) Water. (IV). Washing and bleaching. (V.) Acids, alkalis, mordants, &c. (VI.) Natural colouring matters. Vol. 2. (VII.) Artificial organic colouring matters. (VIII.) Mineral colours. (IX.) Machinery used in dyeing. (X.) Experimental dyeing and fastness of dyed colours. (XI.) Analysis and valuation of materials used in dyeing. Appendix.

Modern Coking Practice, including the Analysis of Materials and Products. A handbook for those engaged in coke manufacture and the recovery of by-products. By T. H. Byrom, F.I.C., F.C.S., and J. E. Christopher. Crosby, Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, E.C., and 121a, Victoria Street, S.W., London. 1910. Price 8s. 6d. net.

Demy 8vo volume containing 152 pages of subject-matter, with 109 illustrations, and an alphabetical index. The chapter-headings are as follows:—(I.) Introductory. (II.) General classification of fuels. (III.) Coal washing. (IV.) Sampling and valuation of coal, coke, &c. (V.) Calorific power of coal and coke. (VI.) (VII.) and (VIII.) Coke ovens. (IX.) Charging and discharging of coke ovens. (X.) Cooling and condensing plant. (XI.) Gas exhausters. (XII.) Composition and analysis of ammoniacal liquor. (XIII.) Working-up of ammoniacal liquor. (XIV.) Treatment of waste gases from sulphate plants. (XV.) Valuation of ammonium sulphate. (XVI.) Direct recovery of ammonia from coke oven gases. (XVII.) Surplus gas from coke ovens. Useful tables are also given.

Official Chemical Appointments. Compiled by direction of the Council of the Institute of Chemistry and under the supervision of the Proceedings Committee, by R. B. Pilcher, F.C.I.S. Third Edition, revised and enlarged. Institute of Chemistry of Great Britain and Ireland. 30, Bloomsbury Square, London, W.C. 1910. Price 2s. net; post free 2s. 3d.

Demy 8vo volume, containing 207 pages of subject matter and indexes of names and of places. The list of appointments is arranged in three main divisions:—(1), A list of appointments in Great Britain and Ireland, under the various departments of State, County and Borough Councils, and other Authorities, and the professional and teaching appointments; (2), A list of professional and teaching appointments in India, Canada, Australia, New Zealand, British South Africa, the British Colonies and Protectorates, and in Egypt and the Sudan Provinces; and (3), an appendix giving concise information regarding Societies and Institutions for the advancement of Chemical Science and of professional chemical interests.

Paints for Steel Structures. By H. Lowe. Fifth Edition. Revised. J. Wiley and Sons, New York. Chapman and Hall, Ltd,. London. 1910. Price 4s. 6d. (1 dol.) net.

12mo volume containing 109 pages of subject-matter and an alphabetical index. The subject is treated under the following headings:—Hypothesis; Paint and painting; Steel; Rust; Cleaning; Liquids and solids: Tests.

Modern Bleaching Agents and Detergents. By Prof. M. Bottler. Translated from the German by C. Salter. Scott, Greenwood and Son, 8. Broadway, Ludgate Hill, London, E.C. 1910. Price 5s. net.

Crown 8vo volume containing 159 pages of subject-matter, with 16 illustrations, and an alphabetical index. The text is divided as follows:—Part I. Bleaching agents: (1). Old and new bleaching methods and bleaching agents. (2). Sodium peroxide. (3). Perborates. (4). Ozone. (5). Sodium bisulphite and hydrosulphurous acid. (6). Discharging colour from textile fabrics with hydrosulphurous acid. (7). Permanganate. (8). Hydrogen peroxide. (9). New processes for bleaching fats and oils, &c. (10). Solid stable calcium hypochlorite and bleaching soda. (11). Electric bleaching. Part II. Detergents: (1). Benzine soaps. (2). Extractive detergents and detergent mixtures. (3). Carbon tetrachloride. (4). Aceto-oxalic acid as a detergent; special methods of removing stains. (5). Bleaching processes used in chemical cleaning. (6). Hydrogen peroxide as a detergent. (7). "Oxygenol" as a detergent. (8). Sodium peroxide as a detergent. (9) Sundry new detergents and cleansing agents.

Die binären Metallegierungen. Von Dr. K. Bornemann. 1. Teil. W. Knapp, Halle a. S., Germany. 1909. Price M. 7.

Large 8vo volume containing 56 pages of subject matter, with 22 illustrations (curve-diagrams), and 38 plates of equilibrium-diagrams. The text is classified as follows:—(1). Alloys of the alkali metals. (2). Alloys of copper. (3). Alloys of silver. (4). Alloys of gold.

CRYSTALLINE STRUCTURE AND CHEMICAL CONSTITUTION. By A. E. H. TUTTON, D.Sc., M.A., F.R.S., A.R.C.Sc. Macmillan and Co., Ltd., St. Martin's Street, London. 1910. Price 5s. net.

8vo volume containing 200 pages of subject matter, with 54 illustrations, and an alphabetical index. The text is classified as follows:—I. Introduction. II. The Haüy-Mitscherlich controversy. Establishment of the types of homogeneous crystal structures. III. Influence of the periodic generalisation. Memoir (1884) explaining it by, and asserting, the composite nature of the atom. IV. Investigations of isomorphous series. V. Improved apparatus for the investigation of crystals. The cutting and grinding goniometer. VI. The spectroscopic monochromatic illuminator. VII. The interferometer. VIII. The dilatometer. IX. The elasmometer. X. Goniometrical results of the investigation of the series $R_2\genfrac{}{}{0pt}{}{S}{Se}O_4$ and $R_2M(\genfrac{}{}{0pt}{}{S}{Se}O_4)_2.6H_2O$. XI. Volume relationships of the simple and double sulphates and selenates, and the conception of molecular distance ratios. XII. Optical relationships of the simple and double sulphates. XIII. General explanation of crossed axial-plane dispersion of the optic axes. XIV. Results of the thermal investigation of the sulphates. XV. General results of the investigations.

DAS RADIUM UND DIE FARBEN. Einwirkung des Radiums und ultravioletter Strahlen auf organische und anorganische Stoffe sowie auf Mineralien. Von Dr. C. DOELTER. Verlag von T. Steinkopff, Dresden, Germany. 1910. Price M. 4; bound M. 5.

8vo volume containing 129 pages of subject-matter, with 6 illustrations, and alphabetical indexes of authors' names and of subjects. The text is classified as follows:—I. Introduction. II. Methods of investigation. III. Changes of colour of inorganic substances. IV. Coloration of glasses. V. Coloration of rock salt. VI. Coloration of precious stones. VII. Organic substances. VIII. Coagulation of colloidal solutions by radium- and ultraviolet rays. Conversion of amorphous phases into crystalline. IX. Action of radium on gases. X. General remarks on colorations caused by radium.

KOLONIAL-HANDELS-ADRESSBUCH, 1910 (14 Jahrgang). Mit Karten der Kolonien in Buntdruck sowie Eisenbahn- und Bergbaukarten von Deutsch-Südwest- und Deutsch-Ostafrika. Kolonial-Wirtschaftliches Komitee. Wirtschaftlicher Ausschuss der Deutschen Kolonialgesellschaft Berlin. 1910. Price M. 2·50.

New Books.

Abderhalden, Dr. E. Handbuch der biochemischen Arbeitsmethoden. Lex. 8°. Wien, Urban and Schwarzenberg. 1910. II. Bd. Spezieller Bd. 2. Hälfte. Mit 11 Textabbildgn. (xxviii u. S. 497—1101). 1910. M. 24 (II. Bd. complete, M. 42; half-mor. M. 45). III. Bd. Spezieller Tl. 1.Hälfte. Mit 121 Textabbildgn. (478 S.).. 1910. M. 18.

Adressbuch der gesamten Textilindustrie, Spinnereien, Webereien, Zwirnereien, Appreturanstalten, Bleichereien, Färbereien, usw., u. der m. diesen Branchen verwandten Geschäfte v. Russland. 1909/10. (VI, 192 S.) gr. 8°. Leipzig, Schulze and Co. Cloth net M. 15.

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Sirk, H.: Versuche üb. die kathodische Ausfällung der Thoriuminduktion aus ihren salzsauren Lösungen. Ak. Wien. 1909. 9 S. gr. 8°.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the books and dissertations in the foregoing list can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

1199. Pottier. Drying apparatus.* Jan. 17.

1227. Altonaer Margarine-Werke Mohr und Co. Mechanism for grinding or mixing emulsions. [Ger. Appl., June 29, 1909.]* Jan. 17.

1353. Burgess and Muir. High-pressure filter. [Australian Appl., Sept. 6, 1909.]* Jan. 18.

1416. Happel. Filters. [Ger. Appl., Jan. 20, 1909.]* Jan. 19.

1906. Kros. Regenerative furnaces. [Ger. Appl., Jan. 27, 1909.]* Jan. 25.

1925. Gebr. Siemens und Co. Manufacturers of fire- and acid-proof moulds, crucibles, &c. [Ger. Appl., March 25, 1909.]* Jan. 25.

1960. Scherf. Drying apparatus.* Jan. 26.

2207. Scott and Co., Ltd., and Pooley. Apparatus for effecting extraction by means of liquid solvents. Jan. 28.

Complete Specifications Accepted.

1781 (1909). Pagès, Camus, et Cie., and Bardy. Apparatus for pulverising, spreading, and mixing fluids. Feb. 2.

3477 (1909). Andrews. *See under* VII.

3609 (1909). Von Becken. Siemens-Martin or other regenerative furnaces. Jan. 26.

5395 (1909). Soc. L'Air Liquide. Recovery of vapours of volatile liquids, particularly alcohol and ether, from admixture with air. Jan. 26.

5735 (1909). Yates, and Matthews and Yates, Ltd. Centrifugal separators for separating dust and the like from gases. Feb. 2.

6211 (1909). Martin. Filter presses. Jan. 26.

6533 (1909). Dicker (Oesterr. Chem. Werke A.-G., and Löwenstein). Fractional condensation of vapours. Feb. 2.

13,551 (1909). Gayley. Apparatus for drying air by refrigeration. Feb. 2.

14,544 (1909). Steger. Apparatus for separating particles of liquid from gases and vapours. Feb. 2.

II FUEL; GAS; MINERAL OILS AND WAXES; DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

1500. Fielden. Gas producers for use with bituminous fuel. Jan. 20.

1501. Spurr and Taylor. Gas producer for anthracite coal or coke. Jan. 20.

1523. Stringfellow. Gas making and fuel. Jan. 20.

1565. Stinchcombe. Suction gas-producers. Jan. 21.

1566. Stinchcombe. Production of suction gas. Jan. 21.

1900. Gutehoffnungshütte Akt.-Ver. f. Bergbau u. Hüttenbetrieb. Gas producers. [Ger. Appl., Feb. 8, 1909.]* Jan. 25.

2298. Nauss. Manufacture of gas for filling balloons of airships. [Ger. Appl., Mar. 30, 1909.]* Jan. 29.

Complete Specifications Accepted.

1484 (1909). Dempster and Sons, Ltd., and others. Gas retorts. Jan. 26.

1858 (1909). Royley. Treatment of shales. Feb. 2.

1866 (1909). Bansart. Regenerative coke ovens. Jan. 26.

2027 (1909). British Thomson-Houston Co. (General Electric Co.). Electric arc electrodes. Feb. 2.

3918 (1909). Hutchins. Gas producers. Jan. 26.

11,058 (1909). Wright. Oxide support for gas purification. Feb. 2.

12,652 (1909). Mehler and Lohmann. *See under* XXIII.

14,200 (1909). Hall. Purification of gas. Jan. 26.

III.—TAR AND TAR PRODUCTS.

Complete Specification Accepted.

18,281 (1909). Vender. Purification of trinitrotoluene (1. 2. 4. 6). Feb. 2.

IV.—COLOURING MATTERS AND DYES.

Applications.

1212. Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. Jan. 17.

1411. Newton (Bayer und Co.). Manufacture of dyestuffs of the triphenylmethane series. Jan. 19.

1781. Jäger. Azo dyes. [Ger. Appl., June 18, 1909.]* Jan. 24.

1807. Meister, Lucius, und Brüning. Manufacture of dyestuffs of the anthraquinone series. [Addition to No. 24,920 of 1909.]* Jan 24.

2105. Newton (Bayer und Co.). Manufacture of vat dyestuffs. [Addition to No. 27,773 of 1909.] Jan. 27.

2106. Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. Jan. 27.

Complete Specifications Accepted.

8677 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. Jan. 26.

9219 (1909). Newton (Bayer und Co.). Manufacture of vat dyes of the anthracene series. Feb. 2.

12,653 (1909). Ullmann. Manufacture of dyestuffs of the anthraquinone series. Jan. 26.

13,917 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of azo dyestuffs for chrome mordanted wool. Feb. 2.

20,127 (1909). Soc. Chem. Ind. in Basle. Manufacture of orange sulphurised vat dyestuffs of the anthracene series. Feb. 2.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

1417. Homberger. Artificial silks or like yarns or threads. Jan. 19.

1441. Eichengrün. Manufacture of cellulose acetate. [Ger. Appl., Jan. 25, 1909.]* Jan. 19.

1641. Haddan (Ferd-Lüttgen). Chemical cleansing by means of benzine, benzol, &c.* Jan. 21.

1799. Brückner. Rendering linen waterproof and washable. [Ger. Appl., Jan. 25, 1909.]* Jan. 24.

2018. Arledter. Manufacture or treatment of pulp for making paper and other fabrics. Jan. 26.

Complete Specifications Accepted.

28,056 (1908). Rylance. Reducing the inflammability of textile fabrics. Jan. 26.

1407 (1909). Luxburg. Production of threads of artificial silk. Jan. 26.

10,604 (1909). Opfermann, Friedemann, and A.-G. f. Maschinenpapier-Fabr. Treatment of wood cellulose to produce artificial threads and nitrocellulose. Feb. 2.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

1233. Rossini. Bleaching, dyeing, and polishing articles made from nuts of the doom palm.* Jan. 17.

1309. Jaumandreu. Apparatus for conveying skeins of yarn through bleaching or dyeing baths.* Jan. 18.

Complete Specifications Accepted.

7538 (1909). Calico Printers' Assoc., and Ashton. Production of certain effects in calico printing. Feb. 2.

10,189 (1909). Johnson (Badische Anilin und Soda Fabrik). Production of brown shades on vegetable fibrous material. Jan. 26.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

1315. Jeanneret and Chapoy. Calcium carbide. [Swiss Appl., Jan. 22, 1909.]* Jan. 18.

1585. Somerville. Manufacture of barium sulphate and alkaline compounds. Jan. 21.

1646. Swan and Kendall. Manufacture of oxide of barium. Jan. 21.

1647. Swan and Kendall. Manufacture of sodium and potassium. Jan. 21.

1808. Boult (Ashcroft). Manufacture of cyanides, cyanamides, amides, and other like derivatives of metals and the metals themselves. Jan. 24.

2143. Hepburn. Lime waste treating. Jan. 28.

2228. Sulman and Picard. *See under* X.

Complete Specifications Accepted.

27,905 (1908). Woltereck, and Sulphate of Ammonia Co. Production of ammonia from peat. Jan. 26.

1424 (1909). Wakefield. Treatment of calcium carbide. Jan. 26.

1735 (1909). Schmidt. Disintegrating silica direct from natural silica and silicates. Jan. 26.

2521 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable sodium hydrosulphite and mixtures containing the same. Feb. 2.

3477 (1909). Andrews. Stills for distilling ammoniacal and other liquids. Feb. 2.

7507 (1909). Serpek. Production of aluminium nitride. Jan. 26.

10,592 (1909). Aktiebolaget Swedish Nitric Synd. Concentration of nitric acid. Jan. 26.

26,140 (1909). Rollin, and Hedworth Barium Co. Manufacture of barium oxide. Jan. 26.

VIII.—GLASS; CERAMICS.

Application.

1790. Benedictus. Glass. [Fr. Appl., Aug. 10, 1909.]* Jan. 24.

Complete Specifications Accepted.

1319 (1909). Thomas. *See under* IX.

1918 (1909). Oppermann (Hitchcock). Manufacture of sheet glass. Jan. 26.

23,852 (1909). Kasseker. Printing ink or colour for pottery or ceramic transfer pictures. Jan. 26.

IX.—BUILDING MATERIALS.

Application.

1173. Louat. *See under* X.

Complete Specifications Accepted.

1319 (1909). Thomas. Kiln for making bricks, tiles, pottery, &c. Jan. 26.

1858 (1909). Royley. *See under* II.

8193 (1909). Pavin de Lafarge. Manufacture of cement. Jan. 26.

18,887 (1909). Forrester (Blanc Stainless Cement Co.). Manufacture of Portland cement. Jan. 26.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

1173. Louat. Manufacture of clay smelting and assay pots, furnaces, &c. Jan. 17.

1220. Hopkins. Condenser for zinc-smelting furnaces. Jan. 17.

1341. Wintle (Laszcynski and Stoeger). Recovery of metals in complex or low-grade ores. Jan. 18.

1639. Fabr. Chem. Gravüren Luppe und Heilbronner. Imparting black coatings to metals. [Ger. Appl., June 1, 1909.]* Jan. 21.

1708. Boult (Ashcroft). Metallurgy of lead-bearing zinc sulphides. Jan. 22.

1709. Boult (Ashcroft). Metallurgy of zinc-bearing lead sulphides. Jan. 22.

1808. Boult (Ashcroft). *See under* VII.

2002. Corey. Electrodeposition of metals.* Jan. 26.

2130. Baillot. Cupola furnace.* Jan. 27.

2228. Sulman and Picard. Treatment of zinc-bearing solutions. Jan. 28.

Complete Specifications Accepted.

27,683 (1908). Cowper-Coles. Protection and decoration of surfaces of copper or copper alloy. Jan. 26.

1339 (1909). De St. Laurent and others. Manufacture of aluminium alloys. Jan. 26.

1403 (1909). Bryant and Ivinson. Solders for metals and alloys. Feb. 2.

1404 (1909). Bryant and Ivinson. Treatment of metals and alloys. Feb. 2.

1789 (1909). Horwood. Separation of zinc blende and other metalliferous constituents from ore concentrates and slimes. Feb. 2.

1882 (1909). Sulman and Durant. Treatment of metalliferous ores or compounds by wet processes. Feb. 2.

4563 (1909). Howard and Hadley. Treatment of the fumes from zinc retorts. Jan. 26.

4574 (1909). Soc. Franç. Electrolytique. Extraction of copper from its ores and alloys. Feb. 2.

11,073 (1909). Dewey. Treatment of arsenide ores and compounds. Feb. 2.

13,849 (1909). Carrick and Pattison. Treatment of pyritic copper and copper nickel ores. Feb. 2.

14,946 (1909). Soc. Electrometallurg. Franç. Manufacture of pure nickel. Jan. 26.

16,210 (1909). Kunheim und Co. Alloys. Feb. 2.

18,198 (1909). Soc. Anon. Le Ferro-Nickel. Aluminium alloys. Feb. 2.

XI.—ELECTRO-CHEMISTRY.

Applications.

1189. Reid. Electric furnaces.* Jan. 17.

1459 to 1462. Hartman. Purification of liquids by electricity and apparatus therefor.* Jan. 19.

1558. Naylor. Regenerating and improving lead electrodes of secondary batteries. Jan. 21.

2032. Crocker. Electrolytic cells.* Jan. 26.

Complete Specifications Accepted.

2127 (1909). British Thomson-Houston Co. (General Electric Co.). Electric insulating material. Feb. 2.

8195 (1909). Nya Ackumulator Aktiebolaget Jungner, and Estelle. Electrodes for secondary electric elements. Jan. 28.

14,858 (1909). Bingham. Electric furnace electrodes. Jan. 26.

19,466 (1909). Salpetersäure-Ind.-Ges. Electric furnaces for treating gases by means of flame arcs. Jan. 26.

XII.—FATS: OILS: WAXES.

Applications.

1373. Lewis. Production of soap. Jan. 19.

2265. Boardman. Manufacture of soap. Jan. 29.

Complete Specification Accepted.

10,075 (1909). Newton (Bayer und Co.). Medicinal soaps. Jan. 26.

XIII.—PAINTS; PIGMENTS; VARNISHES: RESINS.

Applications.

1178. Krüsemann and Pool. Production of zinc white.* Jan. 17.

1579. Newman and Newman. Gold, silver, and bronze paints, varnishes, &c., Jan. 21.

1800. Terrisse and Coffignier. Manufacture of paints. [Fr. Appl., Jan. 30, 1909.]* Jan. 24.

Complete Specifications Accepted.

8532 (1909). Child and Johnson. Manufacture of printing and lithographic inks. Feb. 2.

10,073 (1909). Newton (Bayer und Co.). Preservative coating compositions. Jan. 26.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

1207. Smith. Rubber compound.* Jan. 17.

1331. Sauer and Gössel. Production of artificial india-rubber. Jan. 18.

1335. Tarver. Manufacture of articles from waste rubber, ebonite, &c Jan. 18.

1355. Higgins and Kemp. Reclaimed rubber. Jan. 18.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

2027. Lebreil and Desgeorge. Process for rendering casein plastic. [Fr. Appl., Jan. 27. 1909.]* Jan. 26.

Complete Specification Accepted.

9870 (1909). McLennan. Treatment of leather. Feb. 2.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

1195. Overbeck. Dealcoholisation of beer.* Jan. 17.

1949. Harrison. Combined mash tun and wort back for use in brewing. Jan. 26.

2063. Epstein. Cultivation of bacteria. Jan. 27.

Complete Specification Accepted.

12,881 (1909). Boult (Henius). Preparation of wort from malted and unmalted grain. Jan. 26.

XIX.—FOODS. WATER PURIFICATION; SANITATION.

Applications.

1231. Sefton-Jones (Reisert). Purification of water.* Jan. 17.

1328. Hübner. Extraction of caffeine from coffee.* Jan. 18.

1459 to 1462. Hartman. *See under* XI.

1606. Loring. Manufacture of flour. Jan. 21.

2073. Schilling. Apparatus for removing fat from effluents.* Jan. 27.

2309. Woosnam (Whetham). Manufacture of food stuffs. Jan. 29.

Complete Specifications Accepted.

1444 (1909). Rittman (Herendeen). Flour for making bread. Jan. 26.

2514 (1909). Lilley. Purification of air. Feb. 2.

9682 (1909). Johnson (Chem. Fabr. vorm. Goldenburg, Geromont, und Co.). Manufacture of baking powders. Feb. 2.

16,651 (1909). Sureties. Substance for use as food or for medicinal purposes. Jan. 26.

19,858 (1909). Sargent. Cocoa preparation. Feb. 2.

XX.—ORGANIC PRODUCTS: MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

1616. Foelsing. Preparation of boric-diorthotic oxybenzoic acid zinc.* Jan. 21.

2104. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. [Addition to Eng. Pat. 28,045 of 1909.] Jan. 27.

2212. Chem. Fabr. von Heyden. Manufacture of bromisovalerylphenetidide. [Ger. Appl., Sept. 20, 1909.]* Jan. 28.

Complete Specifications Accepted.

5395 (1909). Soc. L'Air Liquide. *See under* I.

6114 (1909). Ransome. Pharmaceutical compounds. Jan. 26.

12,206 (1909). Newton (Bayer und Co.). Manufacture of β-methyltetramethylenediamine. Feb. 2.

16,651 (1909). Sureties. *See under* XIX.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

1234. Pal. Photographic process for obtaining images in natural colours. [Ger. Appl., Feb. 3, 1909.]* Jan. 17.

Complete Specifications Accepted.

883 (1909). Caster. Sensitised paper. Jan. 26.

6652 (1909). Kent, and Oppenheimer, Son, and Co. Preparation and packeting of chemical substances used in photography. Feb. 2.

10,284 (1909). Wilson. Photographic emulsions. Jan. 26.

XXII.—EXPLOSIVES; MATCHES.

Applications.

1310. Hale. Manufacture or treatment of explosives. Jan. 18.

2039. Marks (Maxim). Explosives.* Jan. 26.

Complete Specifications Accepted.

10,604 (1909). Opfermann and others. *See under* V.

18,551 (1909). Easton. Explosives. Feb. 2.

XXIII.—ANALYTICAL PROCESSES.

Complete Specification Accepted.

12,652 (1909). Mehler and Lohmann. Measuring the calorific value of solid fuel. Feb. 2.

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DR. MILTON L. HERSEY IN THE CHAIR.

POINTS IN THE RELATIONSHIP OF THE PULP MILL TO THE PAPER MILL.

BY T. LINSEY CROSSLEY.

There are three characteristics of wood pulp that enter largely into the economics of the paper mill, namely, cleanliness, moisture contents, and bleaching qualities. There are other points of relationship affecting details of finish and beating, but in this paper it is proposed to consider the points above mentioned, which are sometimes different or co-related effects of the same causes, as, for instance, when fine dirt is present as a result of insufficient water in treatment for opening and washing; this affects its cleanliness, its bleaching economy, and indirectly its moisture content.

I. *Cleanliness.*—In cases where rossed pulp wood is transported by rail or steamer, the conditions attending loading and unloading deserve close attention. Some dirt from the vat of a news machine was found to contain a very large proportion of particles of unburnt coal. In this works pulp wood was conveyed into the mill from the cars on the same conveyor as the steam coal.

Perhaps the most important point in the dirt problem is the wood room at the pulp mill. To prevent waste from excessive cutting in the barker, and at the same time prevent the introduction of rotten knots or gum seams to the chipper, requires intelligent consideration. A ten-inch block may be trimmed down to 8 in. in an attempt to take out a gum seam which should only be treated with an axe by hand. Too much reliance is placed on machine work in many mills. A good splitter and a few good men with axes will prove profitable in the wood room, and remove a cause of much heartache to the paper maker; for once the rotten knot is in the digestor, a large proportion of its contents will surely find its way to the finished paper.

The pulp maker endeavours, of course, to turn out good qualities of fibre, but chips may get charred round the steam inlet over larger or smaller areas, or acid may not be properly distributed in the digestor, resulting in raw chips. Both these abnormal products are intimately mixed with the stock when the digestor is discharged and resort is had to various mechanical devices to try to eliminate them. The success of these devices depends in most cases on the proper appreciation of their capacity, limits, and functions, *i.e.*, a screen is a screen and not a conveyor. In many cases the capacity is overtaxed, resulting in wasteful tailings, which apparently affects only the pocket of the pulp man, but he does not by any means pay all the bill. He may screen these tailings and run the fines back to the stuff chest as good, or he may put them through a grinder to mix with stock from his save-alls and get rid of a lot of it to the paper mill in the form of wet laps which will probably take 25 per cent. or even 50 per cent. more bleaching powder than his best quality. Various forms of riffles and flow boxes are used for the sedimentation of the heavier dirt, but often a pulp mill has not been designed in such a way as to allow a sufficient amount of water to thin the stock, and the dirt is carried along. The weight of the stock tends to force soft dirt through even the reliable flat screen, and much more through the various forms of centrifugal or revolving screens.

Pulp mills would often sort their stock to more uniform grades if adequate provision had been made for this in designing the mill, *i.e.*, large and well arranged warehousing. A small machine for making wrapping would in many cases be not only profitable, but would remove the temptation to keep down the screenings pile at the expense of the No. 1 stock.

II. *Moisture contents.*—There are several important considerations affecting this point, yet these may be traced to, and in large measure could be remedied at, one part of the pulp mill; that is, the stuff-chest in its relation to the wet end of the drying machine or the vat of the wet machine, if the product is in wet laps. The maximum variation of moisture in the wet lap is very much less than that in the dry pulp, and thus it is a simpler matter to take an average sample. Dry pulp may vary more than 30 per cent. as running on the machine, and if everything is not in first class order, there may be a variation of from 3 to 8 or even 10 per cent. between the moisture test at one side of the sheet and that on the other. It is this great variation that makes adequate sampling difficult. It arises from several causes, *e.g.*, insufficient steam in the dryers, not as many driers as there should be, the desire of the machine tender to put out a heavy run, and other minor causes; but the trouble may often be traced to the fact that the stuff chest is not large enough to maintain a reserve, resulting in the production of alternate thick and thin sheets, incidentally bringing with the thin sheet much of the accumulated dirt at the bottom of the chest. This variation in the sheet renders inaccurate any system of testing which relies on equal area of strips or sheets. A test for this class of pulp must take account of bulk, but here another difficulty presents itself; many pulp mills do not put up their product in packages of equal weight. This is not a difficult thing to do, and it would materially assist in correct sampling, permitting the taking of a test sample from some stated weight, say every 1000 lb.

III. *Bleaching qualities.*—Given a fairly well cooked sulphite pulp, its bleaching quality depends, in very large measure, upon its treatment between the digestor and the drying machine, and in some measure, upon its passage over the drying machine.

From observation of the bleaching of sulphite pulp received as wet laps and that received in the machine dried form, both of nearly equal paper-making quality, it seems probable that some of the bleach-consuming impurities in the stock were eliminated either by oxidation or evaporation upon their passage over the drying machine. The pulp received as wet laps when first received, required from 15 per cent. to 18 per cent. of its weight of bleach, though as result of better treatment noted below, the consumption of bleach was reduced to from 12 per cent. to 15 per cent., whereas the pulp received as dry seldom required more than 12 per cent. and should, with a more modern arrangement or a little more time, not require more than 10 per cent. of its bone dry weight for good book bleaching.

It is an open question whether the quick cook blow-off system as used at present does not produce a pulp which is expensive to bleach; with slower cook and the dumping system, a more economically bleaching pulp is produced. It is quite possible for a sulphite mill to cook pulp for one or the other of two main classifications, not merely cooking all the pulp they can handle, and selling for all purposes irrespective of quality. These two main divisions might be :—(*a*) Slowly cooked, dumped and well-washed pulp to be bleached for "book," "magazine" and "writing." (*b*) Quickly cooked, blow off pulp for news, manilla, etc.

The effect of more generous use of water in washing pulp was shown in a make of pulp in wet form which, during a period of low water, was taking an equivalent of about 18 per cent. of its weight (bone dry) of 36 per cent. powder, but later, after more careful washing, was

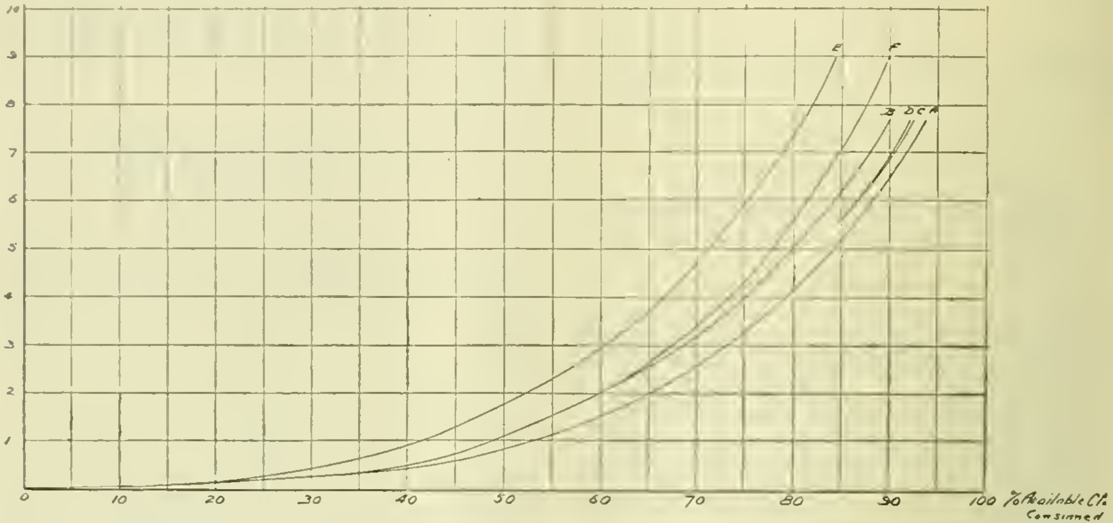

Diagram of Consumption of Chlorine for Bleaching Sulphite Pulp Showing Effect of Washing.

bleached in less time with about 15 per cent. of its dry weight of powder. As a result of a series of experiments, of which the diagram below is representative, it was concluded that a more economical pulp for bleaching may be produced by a hot-cold-hot series of washings, running off over a drying machine to finish at about 90 per cent.—95 per cent. air-dry. Pulp over 95 per cent. air-dry does not disintegrate quickly in the bleaching tubs and the bleach does not penetrate so well as with pulp containing a little more moisture. The washings referred to do not as a rule require any more plant than pulp mills are usually provided with, saving, in some cases, a more adequate water supply. The first hot wash can be given by running water in with the stock when a digestor is being discharged; the heat of the pulp from the digestor being sufficient to bring the whole mass up to a sufficiently high temperature to wash out much of the resinous liquor remaining in the pulp after draining in the digestor. The size man and the beater man are often in this matter the scapegoats of the pulp maker, for many of the resinous spots found in the finished sheet may be easily traced to the sulphite mill. The pulp now in the blow pits can be drained and washed once more with cold water, or may be taken after the first hot wash into the system, relying on the flow box, strainers, and screens for the subsequent cold washing. In most mills there are arrangements for thickening the stock before it goes to the machine chests. In cases where this is not so, such machinery would have to be installed, as the stock flowing to the machine should be fairly uniform in fibre content. The final hot washing is to be done at the wet end of the machine by means of a continuous sheet of hot water running on the pulp before it comes to the suction boxes. This arrangement not only improves the bleaching qualities of the pulp but materially aids in the elimination of moisture at the suction boxes by reducing the internal friction. It is sometimes difficult to secure the flow of hot water on the felt in a continuous sheet without breaking the pulp sheet, but it can be done and will pay both in freight and bleaching quality.

With the above considerations in mind, more valuable pulp for paper making may be produced, and friction between the pulp mill and the paper mill be avoided, by attention to the following points:—

I. More careful culling of wood blocks.

II. Provision for hot washing at time of dumping and ample water supply for sedimentation of dirt. As a basis for water in the flow boxes and riffles, a supply of water should be provided that will reduce the fibre contents at these points to 0·5 per cent.

III. Stuff chest reserve sufficient to maintain average sheet on drying machines for at least one hour and a half.

IV. Proper and uniform steam provision for dryers on machine; a sufficient number of dryers to dry sheet without overheating; regulation of stock at wet end of machine and provision for hot water treatment at this point.

V. Sampling of individual packages on loading in preference to sampling at machine. Bales or packages to be made as nearly as possible of equal weights to permit of samples being of uniform bulk from same weight of pulp.

Treatment on the above lines would produce a pulp that would require, on the average, about 10 per cent. of its bone dry weight of 36 per cent. powder for bleaching instead of the 12 per cent. to 20 per cent. limits now expected.

Explanation of Diagram.

Stock used, wet laps, vacuum system with blow pits.

Bleach strength equivalent to 13 per cent. of 36 per cent. powder calculated to air-dry stock.

Amount of bleach, water, and stock were the same in all cases.

A.......... Pulp as received.
B.......... „ after washing in cold water.
C.......... „ „ „ boiling water.
D.......... „ washed in water at 110° F.
E.......... „ „ over night in cold water, squeezing and soaking again over night at 212° F.
F.......... Pulp after being dried bone dry in oven at 212° F. for 15 hours. B, C, D, and E, were best colour and about equal.

It will be noted by referring to "C" and "D" curves that there was no economy attained by the much higher temperature of "C" as compared to "D." "E" of course represents an extreme case. Maximum colour was attained about the seventh hour and with a variation of about one-sixth of the bleach between the two extreme cases.

London Section.

Meeting held at Burlington House, on Monday, January 17th, 1910.

DR. J. LEWKOWITSCH IN THE CHAIR.

NOTE ON THE ESTIMATION OF IRON IN FERRIC SOLUTION.

BY A. F. JOSEPH, A.R.C.S., B.SC.

It may not be generally known that ferric iron may be very rapidly estimated with fair accuracy by an iodometric method (which does not involve reduction) without taking any special precautions. To obtain the best results, it is doubtless necessary to follow the method of Mohr as stated by Treadwell (Analytical Chemistry, Treadwell and Hall, ii. page 532, and in "Sutton's Volumetric Analysis"). In this, the ferric solution is placed in a stoppered bottle, the free acid nearly neutralised, and the air displaced by a current of carbon dioxide. Solid potassium iodide is then added, the bottle closed, shaken, and allowed to stand in the cold for 20 minutes. The liberated iodine is then titrated with decinormal thiosulphate. Treadwell states that the results obtained by this method are satisfactory. Moderate accuracy may, however, be obtained without taking any of these precautions. The ferric solution is acidified with hydrochloric acid (the amount used does not seem to be of any importance), a few grams of potassium iodide added, and the iodine liberated titrated at once with standard thiosulphate. If the substance under analysis is, as is almost invariably the case, insoluble in water, it is dissolved in strong hydrochloric acid, to which a few grams of potassium chlorate are added if any ferrous iron is present, in which case the liquid is boiled almost to dryness before titration. The thiosulphate may be standardised with iodine, or with a ferric salt of known purity such as iron alum (de Koninck, Bull. Soc. Chim. Belg., 1909, p. 222).

In this laboratory starch solution is never used as an indicator in iodometric processes unless the solution being titrated contains a coloured compound other than iodine (*e.g.* bichromate). We find the end point just as sharply by watching the disappearance of the last trace of yellow colour due to the iodine.

As illustrations of the degree of accuracy to be expected in rapid work, the following examples are given. The thiosulphate solution used was standardised against pure iodine. Thiosulphate is quite a convenient standard for general use, as if carefully made and standardised in the first instance, it can be kept unchanged for months. In this respect it is more satisfactory than permanganate. 1 c.c. of decinormal thiosulphate is equivalent to 0·005585 grm. of iron.

I. Analysis of iron alum, containing 11·58 per cent. iron:—(*a*) 11·44 per cent. (*b*) 11·55 per cent., (c) 11·65 per cent., (*d*) 11·59 per cent. Mean 11·56 per cent.

II. Analysis of iron oxide, containing theoretically 69·94 per cent. Found 69·46 per cent.

III. Analysis of a sample of ferrous sulphate:—By bichromate, 20·68 per cent.; by thiosulphate, 20·76 per cent.

IV. Apparent value of iron wire:—By bichromate, 100·17 per cent.; by thiosulphate, (*a*) 100·46 per cent; (*b*) 100·52 per cent. Mean 100·49 per cent.

Meeting held at Burlington House, on Monday, February 7th, 1910.

DR. LEWKOWITSCH IN THE CHAIR.

PRESENTATION TO MR. JULIAN L. BAKER.

The CHAIRMAN said that two months ago Mr. Baker felt himself obliged to resign the position of Hon. Sec., which he had filled with distinction for six years, during which time there had been two Annual Meetings. A resolution was then passed and recorded in their transactions expressing their thanks to Mr. Baker, and it had also been decided to present him with an illuminated address, the text of which was as follows:—"The Members of the London Section of the Society of Chemical Industry wish to record their sense of gratitude to Mr. Julian L. Baker for the untiring zeal which he devoted to the welfare of the Section for the six years during which he served as Hon. Sec. and Treasurer." That was signed on behalf of the members by Mr. Walter F. Reid (Chairman, 1903), Mr. Alfred Gordon Salamon (Chairman, 1904—1906), Dr. J. Lewkowitsch (Chairman, 1907—1909), and by Mr. J. H. Coste, Hon. Sec. and Treasurer. They also asked him to accept a writing-desk and an arm-chair as a more substantial proof of their appreciation of his services. The Chairman referred in appreciative terms to the assistance rendered by Mrs. Baker, and presented her, on behalf of the Section, with a purse as a token of their esteem. In handing the address to Mr. Baker, he could only wish him long life, happiness, health, and strength to continue his work; and to assure him that if at any time he was able to devote some of his leisure to the Society, they would gratefully accept it; for they really required the work of such men as Mr. Baker.

Mr. JULIAN L. BAKER, in reply, thanked the Chairman most cordially for his kind expressions, and the whole of the members for the emblems of their good wishes and their appreciation of any work he had been able to do for the Section. He could not help feeling that in reality he was in debt to the Society; for any work he had done was quite counterbalanced by the advantages which accrued to him from the experience he had gained. For those reasons, and also on account of the many friends he had made, not only in the Home Section but in the foreign, he felt really very much indebted to the members. He believed that great good had accrued to the Society, and, no doubt, to the London Section in particular, from the meetings to which the Chairman had referred, namely, in 1905 and 1909. It was only after careful consideration that he decided to relinquish this post; but his professional work allowed him no alternative. He could not conclude without referring to the very kind way in which Mrs. Baker had been referred to; she would value very much indeed this expression of the good wishes of the members.

AMMONIA SODA.

ITS PRESENT STATE AND ITS FUTURE.

BY ALBERT COLSON, PROFESSOR AT THE ÉCOLE POLYTECHNIQUE, PARIS.

In the following lines, I propose to explain the scientific basis of the present state of the manufacture of ammonia soda, and to point out, finally, the possibility of modifying this process.

ADVANTAGES OF THE PROCESS.

The output of ammonia soda amounts at present to two million tons per annum. The French production, which reaches almost 300,000 tons, is smaller than that of England, as also of Germany. This is due to the large number and the small output of the French salt mines, which submit to the law of the salt mines rather than combine for mutual defence.

The ammonia process plays, to-day, the most important part in the soda industry, and of its alkaline derivatives. At the first sight its dominating position appears to be a legitimate one, and it would seem that it is destined to retain this for a long time to come, for the competition of the electrical processes is not likely, at any rate not in the near future, to reverse the position. These views find their support in the following argumentation, which however, should be accepted only in a general way.

The process comprises the following operations:—

(1) The manufacture of caustic lime. $CaCO_3 = CaO + CO_2$.

(2) The carbonatation of the ammoniacal brine. $2(NaCl + NH_3 + H_2O + CO_2) = 2(CO_3NaH + NH_4Cl)$.

(3) The calcination of bicarbonate.

$$2CO_3NaH = CO_3Na_2 + H_2O + CO_2.$$

(4) The regeneration of the ammonia.

$$2NH_4Cl + CaO = CaCl_2 + H_2O + 2NH_3.$$

The total cycle of the operations is the resultant, *i.e.*, the algebraical sum, of all the foregoing reactions, and it can be summed up in the following equation :—

$$\underset{\text{(solid)}}{CaCO_3} + \underset{\text{(dissolved)}}{2NaCl} = \underset{\text{(solid)}}{CO_3Na_2} + \underset{\text{(dissolved)}}{CaCl_2} - 5200 \text{ cal.}$$

This final equation expresses the following facts :—(1) The ammonia plays only an intermediary part, in that it induces a double decomposition between the salt and the calcium carbonate. (2) This double decomposition takes place almost without evolution of heat, so that it is not necessary to have recourse to energetic reactions to produce it.

It goes, of course, without saying, that in practice it is not sufficient to supply 5200 calories in order to effect the final reaction. In the case at present under our consideration, it is necessary, as will be shown below, to decompose the limestone by heat. This decomposition requires 44,500 calories. If this decomposition be effected in a separate operation, then, theoretically, the cycle of successive reactions can take place, and whilst yielding sodium carbonate, leave an excess of 39,300 calories. For this reason then, speaking theoretically, it appears to me necessary to decompose the limestone in a special operation and to exclude this operation from the cycle of reactions which furnish soda. It is well known that the determining factor of the reaction is not the quantity of heat which is set free.[*]

In my opinion, it is the height of the temperature, and not the quantity of heat, resulting in the course of any reaction, which plays the predominant part. To give an example, I would say that in the production of aluminium by heat, the aluminium decomposes the chromium oxide, because the compound alumina sets free, not a larger quantity of heat, but a higher temperature, than does the compound chromic oxide; this conception accords with the relative stabilities of these compounds, *i.e.*, their resistance to the action of high temperatures. This condition is, however, subordinate to another condition, which I will explain, as it is by no means familiar to chemists, namely the temperature of the reaction :—If aluminium and copper are heated in a saturated petroleum ether solution of sulphur, the copper is attacked and not the aluminium, in spite of the greater heat and higher temperature which the formation of aluminium sulphide would develop; evidently the copper combines with the sulphur at low temperatures, and not the aluminium.[†] The facts speak for themselves.

If we consider the manufacture of soda in the light of these theoretical considerations, we arrive at the following conclusion :—

The reaction requiring the highest temperature is the decomposition of the limestone, and none of the reactions taking place in solution, and really characteristic of the ammonia process, attains to this temperature. Hence it is necessary to burn coal to obtain the above decomposition, whereas all the other operations take place without such aid.

OPERATIONS.

I now pass on to the consideration of the four fundamental operations, corresponding to the above given four chemical equations. Every one of them implies a special apparatus and presents special difficulties. To the brothers Solvay and to the engineer Hanrez belongs the honour of having been the first who designed and erected apparatus permitting a remunerative yield. It would, however, be a mistake to believe that the apparatus used by the Solvay company are indispensable for the manufacture, or even that they are superior to other types of apparatus. Hence I omit the description of apparatus, which may be of various types.

I. *Lime kilns.*—The kilns used for the decomposition of limestone are heated either by gas, or by coke or coal mixed with the limestone. The kilns must be of closed type, so that the carbonic acid, resulting from the decomposition of the limestone, can be drawn off, and pumped into the carbonating towers. It would seem, therefore, a very simple device to apply to a continuous lime-kiln a pump which draws off the gas, and presses it into the towers, and apparently one could not see why there should be any difficulty in so simple an operation. As a matter of fact, I could cite the case of an ammonia soda works which had to be closed, because the pumps were rapidly destroyed by the flue dust and the gas, and could not perform the work expected of them.

Moreover, a simple change in the duty of the pumps may alter the routine of the manufacture to such an extent, as to nonplus the most experienced manager. I myself have had to deal with such difficulties, and it was not without trouble that I was able to overcome them.

II. *Carbonatation.* The preparation of the ammoniacal lyes, though requiring careful attention, offers no difficulty. On the contrary the brothers Solvay had so many obstacles to overcome in the carbonatation that for a long time afterwards it was held that their apparatus was exclusively suitable for the manufacture of soda. As a matter of fact, this apparatus represents a perfect arrangement. It consists of a column, divided into compartments, the bottoms of which are perforated with holes. (See illustration.)

The brine runs through the column from top to bottom, whilst the carbonic acid gas passes, counter-current fashion, from the bottom to the top. Thus the most highly carbonated lyes come into contact with those gases which are the richest in carbonic acid. Hence, the theoretical conditions, for a methodical exhauston of the gases, are perfectly realised.

Nevertheless, intermittently working apparatus, simpler in design, and more easy to manage, furnish almost identical results, provided they are properly controlled. Such in particular are the apparatus which Roland and Schloesing used at Puteaux in 1855.

I shall detail below the principal conditions for a good carbonatation, which is an essential condition for a good yield.

It is, however, not sufficient to obtain an abundant precipitate, for it is also necessary that the soda grains be large and colourless. Each factory has its own secret methods for obtaining this result, whilst there is a general similarity between them. These details, however insignificant, apparently, are very important in practice. If the grains are discoloured, the soda is difficult to sell, and if the deposit is muddy, it clogs the filters or the hydro-extractors. The separation and the washing of the bi-carbonate then becomes difficult, the yield decreases, and the quality of the product is lower.

III. *Calcination.* The bicarbonate, after separation and washing is subjected to calcination. The facility with which this salt is decomposed appears to point to ready desiccation. On the contrary, this operation represents one of the rocks on which a manufacturer of ammonia soda may founder. On the one hand, it is convenient to work with a closed vessel, so as to recover the carbonic acid and the ammoniacal vapours. On the other hand, the material should be made to revolve in furnaces, for the bi-carbonate is always moist. Besides, its decomposition leads to the evolution of water, so that the material agglomerates in more or less large lumps. Under the influence of the heat, the outer crust of these lumps becomes hard, and forms a layer which protects, by reason of its bad conductivity, the innermost parts from the influence of heat. Hence, the drying out takes

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[*] *Note.*—According to the laws of thermo-dynamics, the non-compensated heat determines the possibility for a chemical reaction to take place. This does not appear to be in agreement with the following experience :—

The decomposition of methyl salicylate by lime proceeds, as is well known, according to the following equation :—

$$(OH)C_6H_4CO_2CH_3. + CaO = C_6H_5O.CH_3 + CaCO_3.$$

If the quantity of heat evolved, either the total or the compensated heat, is really the cause of the reaction, it would appear that the heat of formation of the carbonate, CO_3Ca, which is enormous, should have a great influence on the reaction. My experiments, however, prove that this is not so, for under the same conditions, the reaction, expressed by the following equation :—

$$(OH)C_6H_4.CO_2CH_3 = C_6H_5O.CH_3 + CO_2.$$

precedes the complementary formation of the carbonate that is to say the reaction :—$CaO + CO_2 = CaCO_3$ is in no way connected with it.

[†] Even in the case of a chemical equilibrium where the heat of formation L is related to the pressure P, and the temperature T as expressed by a formula analogous to that of Clapeyron, the formula only holds good above that temperature at which the equilibrium is established.

place with difficulty, even at very high temperatures. Here also, to overcome the difficulties, a number of different and well-known apparatus are in use.

IV. *Regeneration.* The regeneration of ammonia offers a number of problems. The regeneration is carried out in columns, analogous to those which are used for the rectification of alcohol; but the dimensions are much larger, for the columns must be capable of recovering ammonia from 15 to 20 cubic metres of mother liquors, per hour. In this operation leakages, the production of foam, and the running empty of the plates, must be avoided. Above all, it is necessary to keep the lime in continuous contact with the ammonium chloride in the mother liquors. For this purpose the column is fitted, in each of its compartments, with agitators. The milk of lime, in regulated quantities, is introduced by means of a pump which forces the liquor into the column at the desired height, to act on the chloride. At present, it has become possible to replace the milk of lime by caustic lime. In any case, the working of the columns, like that of every other apparatus, must be controlled by continuous sampling, so as to leave nothing to chance. The stoppage of this apparatus would lead to a stoppage of the whole factory; hence, two columns must be provided, although it entails a somewhat heavy expense.

V. *Losses of ammonia.* An important operation following in the wake of the working of the carbonators and the calciners of the bi-carbonate, is the recovery of the ammonia. For, as shown above, the ammonia acts as an intermediary, which must do its work indefinitely; in fact the realisation of this condition is the essence of the whole process. The loss must not exceed 2·5 kilos. per ton of dry carbonate, and even this means already an expense of 2s. 1d. It is difficult to carry the recovery even to *this* point, and the best thought-out means do not always lead to success. I have seen Glover towers fed with sulphuric acid which did not yield good results.

Can one therefore maintain that theory differs from practice? In reality it was not the chemistry which was at fault, but the application which was faulty. Suspecting that the free section left in these Glovers for the passage of the gas was too small, and hence that in order to obtain the requisite output, it had been found necessary to provide a more active circulation, which no longer permitted the thorough contact between the liquid and the gas, I enlarged the sections of the recuperating towers. In consequence of the diminished rapidity of circulation thus produced, the absorption of the ammonia then took place. Moreover, the employment of apparatus for a methodical extraction furnished me with excellent results, which have been constantly confirmed since 1894; thus, water, in a vesicular state, saturated with carbonic acid has replaced, with advantage, the sulphuric acid.

Evidently, empiricism, which is frequently confounded with practice, has forestalled well reasoned operations. I may not be able to explain why the gall of an ox should revive the colour of carpets, but empiricism no longer reigns supreme in industry in our days. Men like Berthollet, Chaptal, Deacon, Solvay, Schloesing, Mond, and many others have put an end to its sway.

PRECIPITATION.

Having reviewed the operations, and pointed out the difficulties they offer, I will revert to the fundamental equation which determines the yield:—

$$NaCl + NH_3 + H_2O + CO_2 = CO_3NaH + NH_4Cl.$$

This reaction proceeds by itself, *i.e.*, takes place without any extraneous intervention. But in practice the precipitation of the soda must be complete and rapid. Such precipitation is limited by the solubility of the bicarbonate in the generating liquid and even by the possibility of ammonium chloride being deposited. It is clear that if these two salts fall out simultaneously, they will react upon each other during the calcination and thus regenerate sodium chloride in equivalent quantities. In practice it is necessary to work under conditions which are most favourable to the precipitation; moreover the latter must be stimulated, for the output of any given apparatus depends evidently on the duration of the carbonatation. As long as the liquid is alkaline, precipitation does not take place. In fact, if we bring bicarbonate into contact with the ammonia, there is formed the product CO_3NaNH_4, that is to say, a mixture of the neutral carbonates of soda and ammonia, both of which are soluble.

I have carried out some experiments with a view to determining to what extent ammonia interferes with the solubility of pure sodium bicarbonate. For this purpose I dissolved sodium bicarbonate in water heated to from 40°—50° C. I took equal volumes of the hot, clear solution, added ammonia gas, and allowed to cool, side by side with a blank test in which there was no ammonia. The alkalimetrical determinations of the crystals which were deposited from the solutions placed in melting ice, yielded the following results:—

Blank test.	Ammoniacal solution titrating 5 c.c.	Difference.
12·5 c.c.	8 c.c.	4·5 c.c.

When the ammoniacal solution contains as much free ammonia as corresponds to 10 c.c. of the standard solution, the deposition of the carbonate ceases, but reappears at once, when the carbonic acid gas is brought into contact with it; it is, therefore, indispensable to carry out rapidly the saturation of the ammonia with the carbonic acid. Without doubt, the employment of gas rich in carbonic acid is very favourable for this purpose. Besides, it offers the advantage of improving the yield, for, according to the measurements of Dibbits, the tensions of carbonic acid gas in saturated solutions of bicarbonate are as follows:—120 millimetres at 15° C. 212 mm. at 30° C., and 356 mm. at 40° C.

If then, one operates at 25° C. with gas of which the tension, due to carbonic acid, is only 120 millimetres, that is to say with gas containing only 15 to 16 per cent. of carbonic acid by volume, the precipitation of bicarbonate would no longer take place.

These theoretical predictions agree with the following results, which I have accidentally observed in practice. An apparatus capable of yielding 4800 kilos. of carbonate in 8 hours with the aid of a gas containing 42 per cent. of carbonic acid, all other conditions being equal, has yielded the following results:—(*a*) 2000 kilos. of carbonate in 15 hours with gas containing 23 per cent. of carbon dioxide. (*b*) 3200 kilos. of carbonate in 11 hours with gas containing 32 per cent. of carbon dioxide. (*c*) 4800 kilos. of carbonate in 8 hours with gas containing 42 per cent. of carbon dioxide. In all these three cases it was useless to prolong the carbonatation.

The climax of the Solvay process.—In a factory where the reaction is not only carefully studied, but actually so carried out in practice, there is nothing else left but to perfect the mechanical means, so as to reduce, to a minimum, the manual labour, which, even at present is not very considerable. This tendency is strongly marked everywhere, especially in those countries where the law regulates the hours of work. Already, manual labour has almost disappeared in the establishments generating electrical energy. At Saint Denis, charging and discharging of the furnaces of the boilers takes place automatically. Naturally, as such installations can be used anywhere, they are also employed in the manufacture of soda.

As a mechanical arrangement is the more efficacious, the greater the quantity of material operated upon, the tendency is to increase the capacity of the apparatus and we observe already automatic lime kilns, each of which is capable of keeping up the yearly manufacture of 50,000 tons of soda. Installations of this size diminish the loss of heat through radiation, and permit the heating of the limestone in the form in which it is quarried, without it being required to break it, before charging into the kiln.

Assuming, somewhat arbitrarily, the cost of this kiln to be £40,000, and further assuming that it saves the wages of one hundred men, *i.e.*, a sum of £5,000 to £6,000 per annum, and setting off against this the writing off, at 10 per cent. per annum, of the cost of the installation, the saving obtained under this heading amounts to £2,000 per annum, that is to say to 10d. per ton. This saving is, of course, not negligible, but it necessitates an outlay of capital which is not at the command of every manufacturer. Certainly, no one would erect a special factory, entailing an outlay of about £40.000, with the object of making a product which leads only to a profit of 10l. per ton.

Small works would find it more to their advantage to direct their efforts towards, and lay out their capital for a number of different details. I would recommend principally the enrichment of carbonic acid gas in the carbonating gases, the importance of which I have shown above.

Possibilities of a transformation of the process.—It would seem that the ammonia-soda industry has reached its zenith of perfection, and that it is only necessary to improve the details of this beautiful process. However, this is not altogether my opinion, and I wish to show now that there are other directions in which progress is possible.

Let me detail the cost-price of sodium carbonate. The resultant of the limiting reactions which give rise to this product may be summed up approximately by the following reaction :—$3NaCl + CaCO_3 = Na_2CO_3 + \underbrace{CaCl_2 + NaCl}_{\text{Residue}}$, and the total expenses comprise: 1. The cost of limestone. 2. The cost of salt, which must be used in great excess. 3. The cost of the coal for heating the lime kilns. 4. The cost of coal for the calcining furnaces. 5. The cost of coal necessary for the regeneration of the ammonia. 6. The cost of coal to produce steam for the engines. 7. The loss of ammonia. 8. Wages. 9. Depreciation. 10. Removal of the residues. Instead of endeavouring to obtain economies under each of these heads, *i.e.*, to reduce the expense inherent to each of these items by a fraction which must necessarily be small, it would seem much better to endeavour to effect the radical disappearance of some of these items.

To begin with, one is struck by the excessive, although indispensable, use of salt. If this product must be employed in its solid state, as is the case at the Solvay works in Belgium, and in the south of France, one surcharges the price of soda by at least 20 per cent. This saving alone would constitute an incontestable advantage. Now this is possible by replacing sodium chloride by nitrate of soda.

The residue of the manufacture will then consist of calcium and sodium nitrates, and after evaporation to dryness by waste heat, which is always to be had in large quantities in an ammonia-soda works, this residue retains the agricultural value of the nitrate from which it has been obtained.

But not even herein lies the true solution of the integral transformation of the ammonia soda process.

Before indicating such a radical change, I wish to show that the reaction with the aid of nitrate :—$NaNO_3 + NH_3 + H_2O + CO_2 = CO_3NaH + NO_3NH_4$ is at least as advantageous as is the reaction by means of sodium chloride :—$NaCl + NH_3 + H_2O + CO_2 = CO_3NaH + NH_4Cl$. To begin with, the nitrate is more soluble than the chloride; hence, all other conditions being equal, the limit of the chemical change is put back because the ammoniacal solutions of nitrate will contain more soda. But even for the same amount of soda, the yield from a solution of nitrate should exceed that from a solution of sodium chloride. The decomposition of sodium nitrate by ammonium carbonate actually sets free 8,000 calories, whereas that of sodium chloride only sets free 7.100 calories. Now, in consequence of the rise of temperature, the deposited bicarbonate is redissolved by the mother liquors from which it has been separated, just like any solid salt redissolves on re-heating the saturated solution from which it has separated. These two reversible reactions are then comparable, with this difference, however, that the precipitation of the bicarbonate, being the result of a chemical change, depends upon the heat L which has been set free by the generating reaction, whereas for the solutions it is the heat of dilution which enters into the formula :—

$$\text{Log } S = 500\ L \int \frac{dT}{T^2}$$

which correlates the solubility S to the temperature T.

At the same constant temperature, the solubility S, referring to the bicarbonate obtained from sodium chloride, and the solubility S^1 referring to the bicarbonate from the nitrate, are then correlated by the formula :—

$$\frac{\log S}{\log S^1} = \frac{L}{L^1}$$

which shows that if L is smaller that L^1, S is also smaller than S^1.

I wished to ascertain whether experiments would confirm this theoretical postulate.

I used a solution of nitrate containing as much sodium per litre of water as a saturated solution of sodium chloride would contain. Both solutions were treated with 87 grms. of ammonia gas per litre, and into both solutions carbon dioxide was passed under exactly the same conditions. In both cases the amount of precipitated bicarbonate, as ascertained by titration, was approximately the same (sometimes higher and sometimes lower in the case of nitrate). The reason why the experimental results do not agree well with the theoretical formula, is partly, the fact that the values L (=8000) and L_1 (=7100) relate to dilute solutions, whereas the actual precipitation takes place in concentrated solutions.

Be this as it may theoretically, it is certain that the yield of soda even increases when more concentrated solutions are employed. Furthermore, the substitution of the nitrate for the chloride furnishes a residue consisting of nitrates of calcium and of sodium, which has an agricultural value identical with that of the original nitrate. If, then, the residue is recovered by means of waste heat, the total cost of the sodium chloride would be saved.

In practice, the hygroscopicity of the calcium nitrate diminishes the value of the residue. Hence, the following procedure seems preferable :—In the "nitrate process" the mother liquors, from which the bicarbonate has been precipitated, have a higher value than the ammonia and the sodium nitrate with which we started. Let us save the lime by evaporating these liquors, before they are passed into the columns. By utilising the gases given off during evaporation, viz., ammonia and carbonic acid, and by extracting, partially at least, the ammonium nitrate dissolved in the mother liquors, there would be left a residue, extremely rich in nitrogen, and useful as a fertiliser, or, at least, as a source of nitric acid and ammonia.

Compared with the manufacture of soda with solid salt as carried out by Solvay at Salins and at Couillet, one would save per ton of carbonate :—(1). 1600 kilograms of salt. (2). 1000 kilograms of limestone. (3). 120 to 150 kilograms of coal necessary for the transformation into quicklime. (4). The cost of heating required for liberating the combined ammonia. (5). The cost of installation of these columns. (6). The cost of disposal of the residues.

This is not simply introducing improvements in the essential operations, but the absolute suppression of these operations.

The ammonia process would then leave the circle within which it appears at present to be enclosed, and would start on a new career of development, which has some evident drawbacks, but exhibits also striking advantages. Among these advantages, the feature that the production of sodium carbonate would be transferred to the neighbourhood of the sea ports, where the nitrate arrives, does not seem to be devoid of interest.

The cheapness of the sodium sulphate coming from powder mills and dynamite works, would also permit the substitution of this salt for the sodium chloride by concentrating the mother liquors from the bicarbonate and producing a mixture of ammonium sulphate and hydrated sodium sulphate, which would constitute a fertiliser easy to handle.

In conclusion, I should like to point out that the chapter of chemical processes which leads to the production of soda is not yet closed.

DISCUSSION.

The CHAIRMAN said the history of the ammonia soda process had been dealt with by Ludwig Mond and by Solvay, whereas the present paper entered into the philosophy of the process. Little was said by authors who wrote on this process, as the manufacturing details were jealously guarded as valuable secrets. At present it appeared, that in the carrying out of those well known reactions, involved in the ammonia soda process, the engineer had the predominance over the chemist, much as was the case in gas manufacture, where the process had been taken out of the hands of the chemist and transferred to the hands of the gas engineer; it was therefore a satisfaction to hear from Prof. Colson that the chemistry of the ammonia soda process was by no means a closed chapter. Prof. Colson had opened up altogether new fields which had at any rate foreshadowed a new vista of experiments. Ten years ago, it might have seemed as if the suggested "nitrate process" had no future, because all the sodium nitrate was required, chiefly for manurial purposes, and there was none to spare in other directions; and, although in the "nitrate process" the nitric acid was not lost, but reappeared as a new manurial product, it might prove difficult, at any rate for some time, to persuade the farmer to use an unfamiliar product. But, now that they had another source of nitrates by oxidising the nitrogen of the air, the raw materials seemed to be assured for this process. Furthermore, if that paper had been read 10 years ago, it would have appeared absolutely necessary to think of recovering the enormous quantities of sodium nitrate lost at present in the mother liquors, a subject with which he (the speaker) had dealt in a paper read by him some years ago before that Section. He was not in a position to discuss the details of the "nitrate process," but he confessed that the chemistry of the process appealed to him; and he certainly hoped it would lead to experiments which would demonstrate whether this new process had a future before it.

Sir **William Ramsay** said there were two points in this paper which struck him as curious and as deserving of particular attention and consideration: one a chemical, and the other an economic one. It was familiar to everyone that heat flowed from a body of high temperature to a cold body; not from a body containing a great deal of heat to a body containing less heat. And it appeared to him that in pointing that out, the author had struck a vein which ought to be extremely fertile: it was to the effect that it was not the reaction in which the greatest amount of heat was involved which would most readily go; but the one in which the highest temperature was required. That was a question which involved a considerable amount of study. He was not at all sure that it was not a question of temperature alone but of entropy. The other point was purely economical: the author made the remark that the restriction of the hours of labour was a strong inducement to bring in the use of machinery. He wondered whether it had struck the working man, as it struck him, that that was one of the most important things in the world. No doubt everything could be done mechanically, if it only paid to do it; and if workmen increased their demand for wages, or lowered the hours of work, machinery would be a still more serious competitor than it had ever been. In this case, machinery had already almost superseded the use of hand-labour.

Mr. T. W. **Stuart** said it seemed to him that the nitrate process as against the ordinary process became a pure question of cost, whether, if carried out on the manufacturing scale it would be cheaper than the present method of working. Ammonia-ash was manufactured from ammonia, salt, carbonate of lime, and coal. Beginning with ammonia, one question was whether, taking the cost per ton of ash of 2s. 1d., which the author mentioned, the loss of ammonia would be less or more by the nitrate process than at present. He thought that using nitrate there would be a fair amount of loss, and it would be a question of interest in the future, whether the loss of ammonia per ton of ash, would be less or more as compared with the present working. A strong point was made of the saving in the rock-salt used by Solvay in Belgium and the South of France. No doubt, where the ammonia-soda process was worked with rock-salt it was worked at a great disadvantage; and in this there might be a field for effecting a considerable saving; but there was no such thing as rock-salt used in this country. A thousand gallons of brine containing 1 ton of salt cost 6d., so that there was a very small margin for effecting improvement in that direction. With regard to the question of fuel, there again they were dealing with the cost of a process well-worked out with one which was proposed on theoretical grounds; and it was very difficult to make any comparison. As to labour, he thought it very difficult for this process to beat the ordinary one as now worked, since ammonia-ash made in this country was never touched by human hands until it was put into the bags. So that whatever modification would be represented by the nitrate process, he thought the question of process-labour had been brought to such a point of perfection that there was very little room left for improvement there; repairs might be the same in both cases. He should like to know whether this process had been tried in anything beyond laboratory scale. They were now discussing two processes one of which was carried on on a large scale as a manufacturing process; and he should like to know if this new one had got beyond the laboratory stage. It had certainly opened out new ideas, which he hoped would be followed up and possibly tried on a large scale. Why did they use rock-salt instead of brine in the South of France when they considered that mining rock-salt cost in England about 3s. a ton to bring to the surface, and then it had to be dissolved: whilst natural brine or brine artificially produced, would cost only 6d.? There must be some geological or other conditions which rendered it extremely difficult for the works in the South of France to use brine instead of rock-salt. What average percentage of carbonic acid was it possible to obtain from such a lime-kiln as the author had mentioned? Generally, Professor Colson proposed, for English conditions of working, nitrate of soda at a cost of £10 per ton to substitute salt at 6d. per ton, as brine, obtaining a by-product consisting of nitrate of lime and nitrate of soda, instead of a mixture of calcium chloride and salt, the calcium chloride being now, to some extent, recovered as a valuable product. The mixed nitrates would be sold for agricultural purposes. Whether the large sum of money expended on nitrate of soda, as a substitute for brine, would all be recovered in the residue, whether there would be sufficient waste heat to concentrate all the liquors, and whether the final cost of ash would be reduced, was a problem which can only be solved by working Professor Colson's proposal on a manufacturing scale.

Mr. R. H. **Davidson** said he gathered that Prof. Colson thought the present ammonia-soda process had about reached finality. This opinion was of importance to those interested in the old Leblanc process. Some 25 years ago, Walter Weldon, speaking of ammonia-soda development, had been one of the first to drive a nail into the coffin of the older process, but the Leblanc process, by the help of its many ramifications still managed to hold out; and if ammonia-soda had now really touched bottom in cost of manufacture, it was certain the Leblanc process had not yet done so.

The **Chairman** said that the Leblanc process had not been mentioned in the paper, for the reason that in France that process was practically dead. Some years ago in Marseilles he was surprised to find that the soap-makers there bought their caustic soda in the liquid form from Solvay's. The liquid was delivered in drums and was run through pipes into the cellars of the soaperies. The works who had supplied the Leblanc soda before were, amongst others, chiefly the St. Gobain Works in Lyons, whence the soda went to Marseilles; but since Solvay had planted himself down in the South between the two arms of the Rhône, he manufactured all the soda there from solid salt produced in the "salt gardens" of the immediate neighbourhood.

Mr. G. F. **Berry** said some years ago he was engaged in ammonia-soda manufacture, when it seemed that the success of the process largely depended on the amount of carbon dioxide generated in the lime-kilns. They had heard of 22, 32, and 42 per cent. From what he remembered, 42 was very high. He should be interested to know what was the average amount of carbon dioxide now obtained; what was the maximum, and how could it be obtained.

Mr. **Churchill Shann** said the remark as to the chemical combination which involved the highest temperature rather than the largest amount of heat seemed to confirm certain electrical experiments he had been making. Probably the explanation lay in the fact, that it was a question of the decrease of resistance. There would be undoubtedly the same analogy there: the high temperature would be acting with less energy, because there was less resistance.

Professor Colson, (replying in French) said the most powerful soda manufacturing company in France, the Société de St. Gobain, had steadfastly refused to produce ammonia-soda, and continued working the Leblanc process up to 1907, when the Company acquired an ammonia soda works, the Soudière de la Meurthe. By this act, the most convinced and powerful champion of the Leblanc process sealed the fate of that process in France. In the South of France solid salt was used in the ammonia-soda process, by reason of the special conditions obtaining there. In the neighbourhood of Marseilles there were no salt mines. Hence Solvay, forced to buy the refined, solid salt, produced in the neighbourhood, must dissolve it again in water. The consumption of soda products by so large a commercial centre as is Marseilles, furnished him with ample compensations for the increased cost, particularly by the savings in the cost of transport and by being able to sell caustic soda in solution. In such a case, the "nitrate process" would be more convenient as it not only assured the same advantages as did the ammonia-soda process, but in addition thereto, offered the further chance of saving the items enumerated in the paper. The cost of evaporating the mother liquors from the "nitrate process" as compared with that expended in the case of the present ammonia process was lower, as the nitrate salts were more soluble than was common salt, and for the further reason that there was always a considerable amount of waste heat available in an Ammonia Soda Works. The cost of evaporation was certainly much below the value of the salt, if employed in the solid state. On comparing the cost of evaporation with the cost of dissolved salt, one must not forget that the cost of dissolving comprised not only the cost of preparing a saturated solution of salt, but included also the cost of purification. Therefore it was the properly calculated total cost of dissolving which must be set against the cost of evaporating the mother liquors of the nitrate process. Nor should it be forgotten that the cost of the common salt in the ammonia-soda process was great because the reaction, $NaCl+H_2O+NH_3+CO_2=CO_3NaH+NH_4Cl$, was a limited reaction, and in order to establish equilibrium, a large excess of salt, at least one and a half molecules of sodium chloride, was required. There were further advantages depending on the special conditions of the localities, where the "nitrate process" might be worked. The percentage of carbonic acid depended on special devices in conducting the successive operations in the routine of the ammonia-soda process.

New York Section.

Meeting held at the Chemists' Club on Friday, November 19th, 1909.

MR. MAXIMILIAN TOCH IN THE CHAIR.

ANALYSIS OF ILLUMINATING GAS.

BY DR. A. H. ELLIOTT.

The gas analysis apparatus which I use in my laboratory consists of three tubes, one of which is water jacketed. These are connected to one another and with aspirator bottles by means of rubber tubing. There are three aspirator bottles, and each is filled with water of the temperature of the room. The gas is introduced by means of rubber tubing also filled completely with water, attached after removing the funnel above, and connecting with the source of supply. The apparatus must be used with water at a constant temperature. For this purpose we have in our laboratory a tank that is kept at the uniform temperature of the room, and fills automatically from time to time. The temperature remains very constant. The first operation is to fill the glass collection tubes (which hold 200 c.c.) with water from the tank, and then, upon opening the stopcocks, the outflow of the water allows the gas to flow in. By reversing the operation, connecting by a water-filled rubber tubing, the gas can be forced into the gas-analysis apparatus. Having drawn the gas into the first tube, which is marked below indicating 100 c.c. more gas is taken in than required. It is then introduced by the aspirator bottles into the second or middle graduated tube and measured accurately, arranging the bottles so that the water in the lower one is level with that in the tube; and after the upper stopcock is closed the excess in the first tube is rejected through the funnel. The chemicals are introduced by means of the funnel, which fits on the outside of the end of the stopcock on the first tube, called the laboratory tube; transferring the gas (100 c.c.) from the middle tube, where it has been measured, back into the laboratory tube which is full of water, the water is driven over from the middle tube until it occupies a position marked on the capillary part of the laboratory tube above. Owing to the peculiar shape of the bulb of the laboratory tube, the gas is pulled down at the sides by the solutions used, and returns up the middle of the tubes, thus circulating. A very little (a few drops) of the chemical makes an enormous surface and gives the gas a chance to be absorbed. The first fluid put in is sodium hydroxide solution (1 in 5) to absorb carbon dioxide. A little water is then added to wash out the capillary tube of the funnel, and a little is also forced from the middle tube. The upper surface of the fluid in the laboratory tube is then nearly clear water. The gas is driven into the middle measuring tube by means of the aspirator bottles, the fluids being stopped at the zero point above. We do not measure the gas at once, but wait for the tube to drain; in order to allow the water to settle uniformly, the lower and upper stopcocks on the laboratory tube are opened, the sodium hydroxide and carbonate solution allowed to drain out, and the tube washed with clean water. The water is now passed up into the laboratory tube from its aspirator bottle below, and through the top of the tube at the funnel point to expel the air. The loss of volume in the middle measuring tube gives the carbon dioxide in the gas. The next step is the introduction of the gas into the laboratory tube again by means of the aspirator bottles and the bringing up of the water from the central tube into the capillary tube above the laboratory tube.

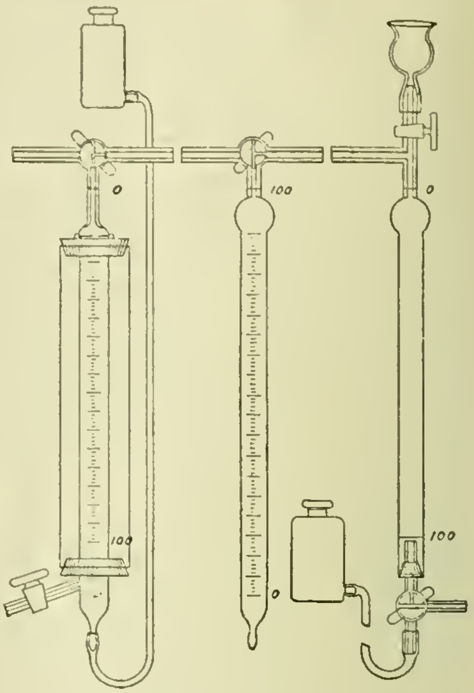


Fig. 1.

Two or three drops of liquid bromine are now introduced, using a little clean water in the funnel: too much bromine must be avoided, or the gas will expand so much from the bromine vapours that it will pass through the rubber tubing into the aspirator bottle and be lost. The bromine as it enters, is volatilised, and the bromobenzene and other bromo-hydrocarbons condense upon the sides of the laboratory tube. After this some sodium hydroxide is run into the funnel and thence to the tube to absorb the bromine vapours; as soon as these are absorbed the stopcoks are washed with water. After transfer of the gas to the middle tube as before, contents of the laboratory tube are washed into the waste below. The difference between the last and the former reading on the measuring tube is called "illuminants." The same series of operations is repeated in regard to allowing the water to settle a definite time in the measuring tube, as was mentioned above, to insure a correct reading. Pyrogallol solution in water (one in ten) and the sodium hydroxide solution (used as above) mixed together in equal volumes are used to absorb oxygen, and the cuprous chloride (solution in hydrochloric acid) is used to take out carbon monoxide. This cuprous chloride is troublesome in the transfer of the gas between the tubes. Between the absorption and transference of the monoxide, water is added to the laboratory tube to wash out the chemical, and to absorb the hydrochloric acid vapours. This water will make the fluid milky, but there will be a little clear water on the top, which alone must be transferred.

The residue of the gas which is in the measuring tube consists of hydrogen, nitrogen, methane, and possibly some other hydrocarbons, the nature of which is not well known. Formerly the explosion apparatus was used with oxygen, but uniform results could not be obtained, and sometimes the nitrogen was exploded. In the first explosion the excess of oxygen is kept within one per cent.; anything much higher will give erratic figures for the nitrogen. The gas in the measuring tube is drawn into the jacketed explosion tube by its aspirator bottle. Twelve or thirteen c.c. is sufficient for the test; six or seven times its volume of air is added from a quantity drawn into the laboratory tube for this purpose. Rejecting excess of air from the laboratory tube, this is used with the explosion tube and the two aspirator bottles, to transfer the gas and air mixture several times between the explosion and laboratory tubes to thoroughly mingle the gases. After final transfer to the explosion tube, several minutes are allowed to elapse before making a reading, to allow the water to drain down to the proper level. The mixture is exploded by a spark from an induction coil and the contraction "C" read after several minutes. Transferring the gas to the laboratory tube, the carbon dioxide is removed from the mixture by means of the sodium hydroxide solution, and the gas is returned to the central tube for measurement with the usual precaution of waiting. This loss we call "D." The pyrogallol mixture, first used for oxygen in the original gas is then added, and the excess of oxygen is determined. If there is not an excess of oxygen then the exploded mixture will contain carbon monoxide, and the explosion must be repeated, using another portion of the gas residuum from the middle measuring tube, adding more air to make the explosion mixture. It is rarely that more than two explosions are necessary; but about 0·5 to 1 per cent. of oxygen must be in excess to get the best results. After absorbing the oxygen and measuring the remainder (nitrogen), the nitrogen contained in the air used for the explosion is subtracted from this residual nitrogen, the balance being the nitrogen in that portion of the residuum of gas which was used for the explosion, and is calculated to the original gas residuum. The figures which we call "C" and "D" are used in calculation, by the following formula: $\frac{2C-4D}{3}$ = hydrogen. The difference between the sum of the constituents determined and 100, is called methane. It will be found that the figure "D" will also equal methane if the work is properly done, and serves as a check on results.

FLUE-GAS TESTER.

BY DR. A. H. ELLIOTT.

This is an apparatus for determining the carbon dioxide in flue gases, and also in the crude water-gas generator gases. The Hempel bulb contains sodium hydroxide of the same strength as used in the larger apparatus. The bulb burette is fitted with a three-way cock, which is doubly perforated. This bulb is so fixed that when the water in the aspirator bottle is at zero level below, the bulb and tube together hold 100 c.c. of gas. The stopcock may be turned so that gas may be drawn into this burette, the apparatus being full of water. To the other tube above the burette is attached the Hempel bulb, filled with sodium hydroxide. The use is obvious. It is an excellent apparatus for those in charge of boilers.

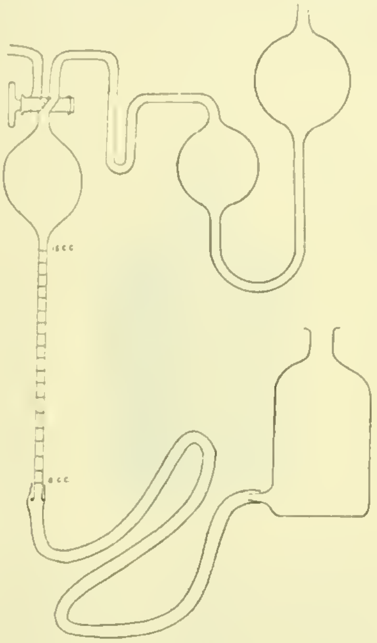


Fig. 2.

APPARATUS FOR DISTILLING GAS-OIL.

BY DR. A. H. ELLIOTT.

In this apparatus, which consists of a flask surrounded by the sheet iron cover, the distillation flask must be kept

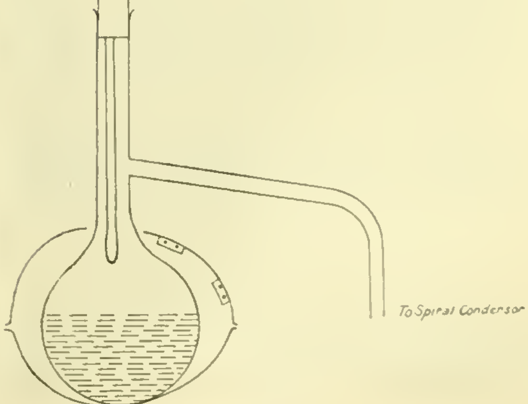


Fig. 3.

uniformly hot so that it will not crack. These flasks crack when the least blast of air strikes them, owing to the high boiling points of the oils, but they are rarely broken when using this iron cover made of two deep sand baths.

APPARATUS FOR DETERMINING SULPHUR IN SPENT OXIDE.

BY DR. A. H. ELLIOTT.

The apparatus is a modification of that used by Dr. E. Graefe for determining the volatile sulphur in coal. It consists of a large bottle holding about 8 litres, fitted with a rubber stopper held in place by a flat brass spring slipped on sideways. Through the stopper is a hole to carry a 100 c.c. separating funnel and two perforations for copper wires. One of these wires is short, reaching about one-third down the height of the bottle; the other carries a brass deflagration cup, as used in experiments with phosphorus in oxygen. At a point where the short wire comes near the longer one it is covered with platinum foil and the adjacent deflagration wire is also covered. Between these platinum terminals a connection is made with very fine iron wire, capable of being melted by the current from six dry cells.

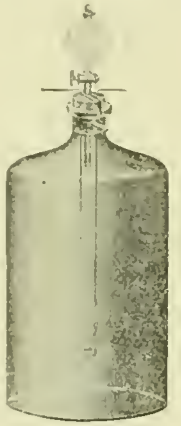


Fig. 4.

Into the deflagration cup put a very little dry cotton wool, then connect the cotton by strands of cotton wicking with the iron at the terminals. Using 1 grm. of dry spent oxide mix it with 1 grm. of a mixture of chlorate and nitrate of potassium (3 to 1) and place upon the cotton. To start the apparatus the bottom of the bottle is covered with a little distilled water, and the bottle then filled with oxygen by displacement. The deflagration spoon and wires are inserted into the bottle, the spring adjusted and the charge fired by means of the battery. The action is immediate and the bottle must be cooled to condense vapours. The separating funnel contains 50 c.c. of 10 per cent. solution of sodium peroxide which is allowed to run into the bottle when it cools. The bottle is washed out and the solution made to 300 c.c. To 10 c.c. of this are added methyl orange and 5 c.c. of dilute hydrochloric acid, and the volume made up to 100 c.c. One grm. of barium chloride crystals is added, the whole allowed to stand 15—30 minutes and the turbidity determined. A table of barium sulphate turbidities is used for the determination. Or the solution may be filtered, the barium sulphate washed, dried, and weighed as usual.

PORTABLE BAR PHOTOMETER.

USED BY DR. E. G. LOVE, CHIEF GAS EXAMINER, CITY OF NEW YORK.

This photometer consists of a wooden frame-work supporting a platform on which is placed the bar and sight box, the candle balance, gas pillar, governor, and special small wet meter. The whole is enclosed with opaque black curtains (not shown in the figure). In these curtains there are openings at the top over the gas pillar and the standard light. The operation of the photometer does not differ from that of any ordinary open bar photometer constructed for a dark room.

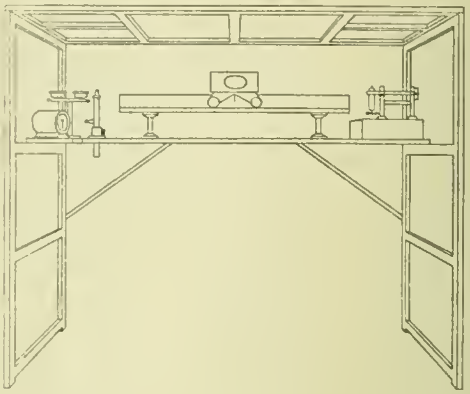


Fig. 5.

Mr. C. H. Stone, Gas Engineer for the Public Service Commission at Albany exhibited an excellent portable photometer and explained its uses. It is very compact when closed and shuts up into the space of a large dress suit case; yet when unpacked and set up in five minutes is a regular working photometer.

He also gave his experiences with the Jenkins sulphur and ammonia apparatus; testifying to its usefulness and accuracy in the case of sulphur and ammonia tests. This apparatus was described in the Journal of American Chemical Society, April 1906, and has been improved by Mr. Stone to include ammonia test simultaneously with the sulphur test.

THE ELLIOTT GAS ANALYSIS APPARATUS.

BY E. C. UHLIG.

Comparative results obtained with the Elliott and Hempel gas-analysis apparatus in my laboratory gave the following results:—

A volume of gas (3 cu. ft.) was taken into a 5 cu. ft. holder; the water in this holder had been standing there for about two years, the evaporation being replaced from time to time, so that the water was as saturated with gas as was possible. Samples of the gas were taken from this holder for both apparatus. These samples were analysed with the following results:—

	Elliott Per cent.	Hempel Per cent.
Carbon dioxide	3·6	3·7
Illuminants	13·6	13·4
Oxygen	0·6	0·6
Carbon monoxide	27·0	26·5
Hydrogen	29·3	29·3
Methane	19·5	18·6
Nitrogen	6·4	7·9

The above methane and nitrogen results were calculated from the explosion, using the regular contraction factors. Calculating the same from the residual nitrogen left after explosion and absorption of carbon dioxide and oxygen with sodium pyrogallol, the following figures were obtained:—

	Elliott Per cent.	Hempel Per cent.
Methane	19·6	17·5
Nitrogen	6·3	9·1

From the residual gas of the Hempel sample 20·2 c.c. of the gas were taken and mixed with 47·9 c.c. of air and burned in a palladium tube with the following results calculated on the residual gas:—Hydrogen, 30·3; carbon monoxide unabsorbed by the cuprous chloride, 1·1.

The absorptions in the Elliott apparatus were done in the usual manner by allowing the reagents to spread over the inside surface of the absorption tube, and in the Hempel apparatus by allowing the gas to remain in contact with the reagent with shaking of the pipette until two successive readings agreeing within 0·1 c.c. were obtained. Carbon dioxide was absorbed in sodium hydroxide in both apparatus. Illuminants were absorbed with bromine in the Elliott apparatus, and with fuming sulphuric acid in the Hempel apparatus. It was found that this reagent was more effective than bromine in the Hempel apparatus, and that bromine in the Elliott apparatus was as effective as fuming sulphuric acid in the Hempel apparatus. Bromine in a Hempel pipette is in an aqueous solution, and on shaking weak bromine vapours are given off which do not act very strongly on the illuminants, this makes the absorption slow and repeated absorptions are necessary. Fuming sulphuric acid acts rapidly and one or at most two absorptions are all that are needed. Bromine in the Elliott apparatus is applied as liquid element and not in aqueous solution, strong vapours are given off which act at once, in fact the reaction may be watched and the bromides formed can be seen running down the tube. Oxygen was absorbed in the Elliott apparatus with alkaline pyrogallol, and in the Hempel apparatus with phosphorus. The results agree very well. Carbon monoxide was absorbed in both apparatus with acid cuprous chloride. The results show that the absorption is perhaps slightly more complete in the Elliott apparatus. Two pipettes were used in the Hempel apparatus; constant readings were first obtained in one pipette and on trying the second pipette a further absorption of 1·5 c.c was obtained. Cuprous chloride is slow in its action and any unabsorbed carbon monoxide will affect the subsequent explosion.

The explosion was done over water in the Elliott apparatus, and over mercury in the Hempel apparatus. All comparative analyses made with different apparatus appear to agree as far as the explosion, at this point variations are noticed. These differences have been ascribed to several causes, principal stress being laid on the solubility of the carbon dioxide in water. It is my opinion that while this may be one of the causes it is not the main cause. It will be noticed in the above analyses that explosion over mercury gives even more divergent results than explosion over water. I think that the reasons for these differences are principally unabsorbed carbon monoxide in the residual gas and too much air mixed with the part taken for explosion. In regard to the latter I find that the best results are obtained by taking just sufficient air so as to leave about 0·5 to 0·7 c.c. of oxygen after the explosion. This lessens the possibility of the nitrogen of the gas being oxidised in the explosion. The amount of air to be taken is variable, and can only be found by experimenting with a portion of the residual gas. Illuminating gas may also contain ethane, and as this forms two volumes of carbon dioxide in the explosion it will cause some difference in calculating the methane.

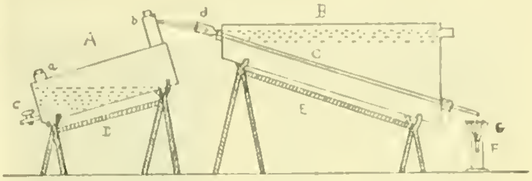
Almost any apparatus will give good technical results in the hands of a careful operator, but in gas works practice preference must be given to that apparatus which will produce the results in the shortest time. With the Elliott apparatus an analysis can be finished in from 30 to 40 minutes, in cases of great hurry in possibly 25 minutes, the best results are probably obtained in about 45 minutes.

DISTILLATION APPARATUS FOR WATER-GAS TAR.

BY E. C. UHLIG.

Great difficulty has always been found in carrying out distillations of water-gas tar especially when the operation was conducted in a glass flask, the tar will bump, break the flask and cause not only loss of time, but also danger to the operator and damage to his clothing.

This apparatus was designed to overcome these difficulties and supply a rapid and ready method to ascertain the percentage of water a tar may contain, thus furnishing a means of knowing the efficiency of the settling tanks. It was constructed by the works blacksmith and consists of a piece of wrought iron pipe A 12 inches long and 2½ inches internal diameter with plugs welded into the ends. It has a 1 inch nipple *a* closed with a screw plug and another 1 inch nipple *b* about 2 inches long closed with a cork, and having a bent piece of ¼ inch pipe *d* connecting with the condenser C. A cock *c* allows the retort to be emptied of the pitch left after the distillation is finished. D is a stand made of wrought iron supporting A in an inclined position. The object of the cork in *b* is to allow the insertion of a thermometer when a fractional distillation is to be made, and to provide a vent in case of an explosion in A allowing the cork to blow out. This has heretofore not happened as the explosions have been so weak that their force has been directed through the condenser tube C. The retort A may be attached to an ordinary Liebig condenser but the condenser shown in the figure is used because a burner may be placed under E to heat the water around C when naphthalene oils are coming off. The tube C passes through a copper box which has water running through it. C is 30 inches long, and the box has the following dimensions, upper side 16 inches, bottom 26 inches, sides 3 inches and 6 inches, width 2½ inches. It is supported by a wrought iron stand E similar in construction to D. A graduated cylinder F supports a glass funnel G in which is placed a piece of wet filter paper, which acts as a separator for the oil and water dropping from C, the water passing through into F where its volume may be read, while the oil remains on the paper.



To use the apparatus the plug in *a* is unscrewed, the tar weighed in the can in which it comes and some tar (about 300 grams) poured into A. The can is reweighed, the difference in weight being the tar to be distilled. The plug is then screwed into *a*, and *d* connected with C by means of a perforated cork. The dotted lines show the position of the tar in the retort. A triple Bunsen burner is placed under D at the end nearest the condenser and as the distillation proceeds the burner is moved toward the other end. This movement is gradually done and when the other end is reached the flame is increased, and the heating continued until no more water is seen dropping into the funnel. The burner is extinguished, and after waiting a short time to allow the retort to cool somewhat, the cock *c* is opened and the warm pitch allowed to run out. The volume of water in F multiplied by 100 and divided by the weight of tar taken gives the per cent. of water in the tar.

If naphthalene should form in C it can readily be pushed out with a piece of cotton on the end of a long wire. Naphthalene does not appear until all the water has been driven off the tar, so this cleaning out is done when the operation is finished. In case of a fractional distillation where naphthalene was one of the constituents to be determined, the water in the copper box would be heated when this point was reached.

The great advantage of this apparatus, apart from the impossibility of breakage, is the manner in which the heat is applied to the tar. It will be noticed that the tar is first heated where it is shallowest, and then as the distillation goes on at the deeper parts. This insures a quiet distillation and prevents bumping.

When the retort becomes stopped with pitch from many distillations adhering to the inside, and cleaning is necessary, the parts *a*, *b*, and *c* are unscrewed, the retort taken from the support D and placed in a forge fire where it can be heated until all the pitch is burned out. The parts are then reassembled.

Water-gas tar containing upward of 75 per cent. water has been distilled with this apparatus without loss of material or danger to the operator.

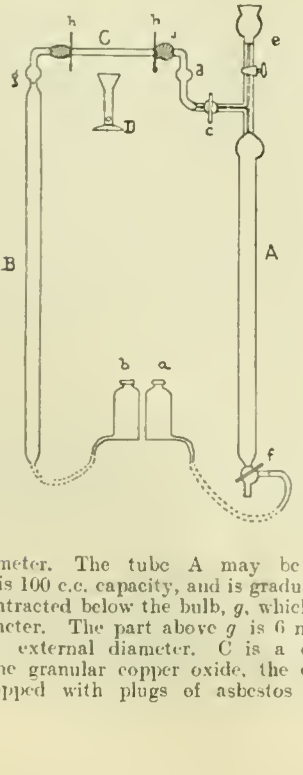
OIL-GAS ANALYSIS APPARATUS.

BY E. C. UHLIG.

This apparatus was designed for gases in which the methane is in greater proportion than the hydrogen. It is based on the observation of E. Jaeger (this J., 1898, page 1190), that when a mixture of methane and hydrogen is passed through copper oxide at 250° C. the hydrogen is burned to water, the contraction in volume being a direct measure of the hydrogen that was present, while the methane is unchanged until the copper oxide is heated to redness when it is burned to carbon dioxide which may be absorbed in sodium hydroxide. The residue of gas left after combustion and absorption is then read, added to the other constituents and the sum subtracted from 100 gives the methane. This apparatus has been used for gases made by decomposing oil in retorts. These gases are of the following type :—

	Per cent.		Per cent.
Carbon dioxide	0·0	..	0·0
Illuminants	54·2	..	45·4
Oxygen	0·4	..	0·4
Carbon monoxide	0·3	..	1·2
Hydrogen	9·8	..	5·0
Methane	32·8	..	43·6
Nitrogen	2·5	..	4·4

The apparatus consists of an absorption tube, A, similar to that used on the Elliott apparatus, but having the part *cd* in addition. This part is made of tubing 1 mm. internal diameter to the bottom of the upright part *d*, this upright part has an internal diameter of 6 mm. and an external diameter of 10 mm., the bulb is 15 mm. external diameter. The tube A may be graduated. The tube, B, is 100 c.c. capacity, and is graduated in 1/10 c.c. It is contracted below the bulb, *g*, which is 15 mm. external diameter. The part above *g* is 6 mm. internal and 10 mm. external diameter. C is a quartz tube filled with fine granular copper oxide, the ends of this tube are stopped with plugs of asbestos fibre. The connection with A and B is made with rubber tubing wired on and covered with wet lamp wick shown at *jj*. This wick must be kept wet during the combustion by running water over it. Two discs of asbestos board through which the tube, C, passes are shown at *hh*. The tube, C, is heated by the burner, D.



To prepare the apparatus, the tubes, A and B, are filled with water by raising the bottles, *a* and *b*, which are attached to the tubes by rubber tubing. The next step is to fill the apparatus from the cock, *c*, to the narrow part under *g* with atmospheric nitrogen. This is done by lowering the bottle, *a*, and opening the cock, *e*, thus admitting air into A, e is then closed and the funnel filled with sodium pyrogallate solution, which is gradually allowed to flow into A. When all the oxygen has been removed from the air in A the cock, *c*, is opened and the nitrogen passed from A to B and back several times, applying some pyrogallol solution when the nitrogen is in A. Finally the bottle, *b*, is raised so that the level of its water is at the narrow part of B under *g*. When the water in B is at this mark, the cock, *c*, is closed, the 3-way cock, *f*, opened to drain A, and *e* also opened. The tube A, is then emptied and washed out with water admitted through the funnel, the bottle, *a*, is emptied, washed out, and filled with fresh water. It is then raised above *e*, and when A is full of water the cock, e, is closed The apparatus is now ready for the gas which is to be analysed.

The funnel is removed and the gas admitted to A. When a little more than 100 c.c. has been admitted to A, the cock, e, is closed and the funnel replaced. The excess of gas over 100 c.c. is expelled and the volume adjusted in the usual manner. We now have 100 c.c. of gas in A, and proceed to make the absorptions in the same manner as in the Elliott apparatus, admitting the reagents in turn through the funnel; the tube A being graduated the various contractions are read on it. When all the constituents of the gas have been determined except hydrogen, methane, and nitrogen, the residual gas is passed into B and the cock, c, closed. A and *a* are now washed out and refilled with fresh water. The burner, D, is lighted and a small flame permitted to burn about 3 inches below C. The gas is passed from B to A and back about six or eight times. The burner is removed and water run over C to cool the gas, when cool to room temperature a reading is taken by raising *b* until its water level coincides with the water level in B, the heating and cooling may be repeated to ensure that all the hydrogen is burned. The contraction found gives the hydrogen. The burner, D, is replaced and C raised to a red heat, the funnel is filled with sodium hydroxide solution (10 per cent.) and the gas passed from B to A and back; when in A the cock, *c*, is closed and some sodium hydroxide admitted. This is continued until no further contraction is observed in the gas volume. The burner is removed and the tube, C, cooled with water as before, when at room temperature a reading is taken of the gas in B, this gives the nitrogen. The sum of the constituents subtracted from 100 gives the methane. Any ethane is burned and reported as methane.

This apparatus, as originally used, had a platinum tube at C, but it was found that the reduced copper alloyed with the platinum and this caused the tube to crack. A quartz tube was tried and found to answer very well; it may be heated to redness and suddenly cooled with water without danger of cracking, and neither copper nor copper oxide have any effect on it. It may be readily cleaned by immersing in *aqua-regia* in a test tube, allowing to stand over night, washing out with water, and drying in a flame. It then can be cooled and refilled with copper oxide.

When an analysis is finished the tube, C, is heated again to redness and air passed through; this oxidises the reduced copper to copper oxide; the last of the oxygen is then removed by pyrogallol and the level of the water in B adjusted to the narrow part as before. A and *a* are emptied, washed out, and refilled with water and the apparatus is ready for the next analysis.

The following comparisons were made of results from this apparatus and from an Elliott apparatus. A portion of the residual gas from the Elliott apparatus was passed into A by means of a capillary tube, and the combustions made as above described.

	Elliott.		Copper oxide apparatus.		Difference.
	per cent.		per cent.		per cent.
Hydrogen	32·5	..	32·7	..	0·2
Methane	17·9	..	18·8	..	0·9
Nitrogen	4·6	..	5·3	..	0·7

THE ELLIOTT STANDARD PHOTOMETRIC LAMP.

BY E. C. UHLIG.

This lamp is designed as a secondary standard for the determination of candle power by the works men, it is intended for the guidance of the gas-maker in place of the unreliable jet photometer. It is of the well-known "student lamp" type of about 16 candle power, the light of which is reduced by means of a screen to 10 candle power and in the latest models to 5 candle power. The fuel burned is "Astral oil." It is furnished with a reservoir which will hold sufficient oil to burn 12 hours. These lamps have also been made with 24 hour reservoirs. The lamp is standardised against candles or against a standardised sample of gas which may be taken from a 5 cubic foot gas holder. When once standardised the lamp will maintain its candle power for 12 hours or even longer. The 5 candle standard permits of more accurate adjustment in this respect. It requires reasonable care in its use; the wick must be properly trimmed according to the directions given with the lamp, the oil must be clean, the burner kept clean particularly in the air holes. Observing all these precautions a careful operator will get results which agree very closely with those obtained with other standards.

The method of using the lamp is as follows: After cleaning, filling, and trimming, it is placed in position at the end of the photometer bar, at the other end of which the candles or standardised gas is burning. The lamp is lighted and allowed to burn about 15 minutes, then readings are taken and the usual corrections applied. The gas to be tested is then put in the place of the candles or standard gas and readings taken with the value of the lamp as standard. These readings may be taken as often as required during the day.

It has been found that this lamp varies very little each day from the value found on the first standardisation, generally the 10 candle power lamp will not vary more than 0·1 candle from day to day, while the variation of the 5 candle power lamp is even less. Any variation will be due mostly to a change in the quality of the oil used. It is good practice to reserve a quantity of oil for use in the lamp only, and not take oil from a receptacle in general use. Of course variations will occur due to wear particularly in the burner, but this can be corrected by occasional repair.

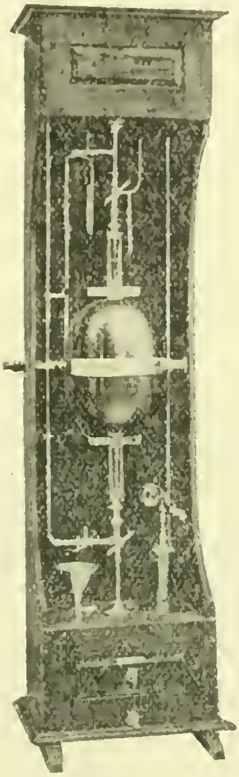
A test of this lamp was made by taking the candle power of gas delivered to two photometers, on one of which (60 inch) the lamp was used as a standard, on the other (100 inch) the standard was sperm candles. The lamp was 10 candle standard, and tests were made hourly on each photometer for 13 hours. The average results were as follows:—C.P. of gas by the lamp, 24·30. C.P. of gas by standard candles, 24·00.

The following results with a 5 candle lamp are communicated. Elliott lamp against Hefner amyl acetate lamp. Hefner lamp adjusted to 1 standard candle.

Elliott lamp =5·02 candle power.
After 2 hours =5·01 ,,
,, 3 ,, =5·01 ,,
,, 4 ,, =5·01 ,,
,, 5 ,, =5·00 ,,
,, 6 ,, =5·00 ,,
,, 7 ,, =5·00 ,,
,, 8 ,, =5·00 ,,
,, 9 ,, =5·00 ,,
,, 10 ,, =5·00 ,,
,, 11 ,, =5·00 ,,
,, 12 ,, =5·00 ,,

MOUNTED CUBIC FOOT BOTTLE FOR CALIBRATING VOLUMETRIC GAS TESTING APPARATUS.

BY E. C. UHLIG.



This consists of an oval copper vessel joined at the top and bottom with water tanks. These tanks are of wood, metal lined, and are connected with each other directly by piping. At the bottom there is a pump which enables the water to be forced from the lower to the upper tank. There is a funnel on the lower tank, through which water may be added, and a cock by which it may be drawn off. Immediately above and below the copper vessel are two small wooden shelves, which are fastened to the wooden back of the instrument, running from the upper to the lower tank and binding the whole together. The pipe leading from the copper vessel both above and below is all glass for about six inches, and on these glass portions are marked the upper and lower limits of the cubic foot. Six inches above the upper glass tube are a three-way cock and a small tube which permits of the escape of air. Above this is a valve by which the cubic foot may be shut off from the apparatus under test, and there is a similar valve below the copper vessel for controlling the flow of water from the upper tank to it. There is also a three-way cock connecting with the lower tank, the pipe and the vessel above.

This apparatus is standardised and certified by the Bureau of Standards at Washington, and by its means a cubic foot of air or gas can be passed through the outlet connection, and by repeating the operation any number of cubic feet may be passed.

Scottish Section.

Meeting held at Glasgow on Tuesday, January 18th, 1910.

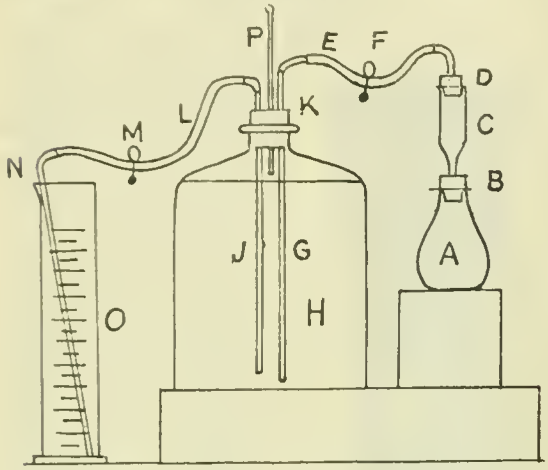
MR. D. J. PLAYFAIR IN THE CHAIR.

EASY PROCESS FOR ESTIMATING WATER IN PETROLEUM.

BY R. WIGHTWICK ROBERTS AND ALFRED FRASER.

A large portion of Californian petroleum—or rather petroleum residues, for it has been freed from the lighter oils by distillation—that comes to the coast of Chile for use as fuel, contains quantities of water varying up to about 20 per cent. This water seems to form an emulsion with the heavier constituents of the oil, and, besides detracting from its calorific value, causes at times serious trouble by clogging the nozzles of the blowers.

As the estimation by distillation is difficult and often unsatisfactory, the attempt was made to determine the water by adding calcium carbide to the oil and measuring the amount of acetylene given off. The experiment was entirely successful. A number of concurrent tests were made (1) by taking two equal portions of the same oil, adding a weighed quantity of water to one, treating both with carbide, and taking the difference in the amount of acetylene given off, and (2) by treating a portion of oil with excess of carbide, till no more gas was evolved, adding a weighed quantity of water, and measuring the acetylene subsequently given off. The two tests gave an average of 580 c.c. (at 0°C. and 760 mm. barometric pressure), per gram of water in the sample; a number which agrees very closely with that obtained by P. V. Dupré (this Journal, Aug. 15, 1906, p. 780), in his somewhat similar experiments on the determination of moisture in cordite.



Apparatus.

In the apparatus shown in the accompanying sketch, A is an Erlenmeyer flask of about 300 c.c.; B is a perforated india-rubber stopper; C a cylindrical glass funnel with perforated stopper, D; H a bottle of about 5 litres capacity, with an india-rubber stopper, K, with four perforations, through two of which glass tubes, G and J, reach to the bottom of the bottle. G is connected with the funnel, C, and J with the long glass tube, N, by means of india-rubber tubes, E and L, with clips, F and M. The tube, N, dips into the graduated litre measure, O. Through another hole in the stopper, K, is inserted the thermometer, P, while through the fourth passes a glass tube with cock (not shown in the diagram), connected with a suction pump.

The bottle, H, is filled with a saturated solution of common salt, and, by blowing gently at D, the tube, N, is filled with the solution and the clip, M, is closed. The flask, A, is tared, and 17·24 grms. of the petroleum to be tested are weighed into it. If this is very thick, as is usually the case, about 20 c.c. of kerosene are added and well mixed with the thick oil. The clip, F, being open, and the measure, O, empty, a few fragments of calcium carbide are dropped into the funnel, C, then about 20 grms. of finely ground carbide are poured on the top of the loose fragments, the stopper, D, is quickly inserted, and the clip, M, opened. A few taps with the finger causes the finer carbide to fall gradually into the flask, A, which is gently shaken. The evolution of acetylene commences immediately, and this, passing through the tube, G, into the bottle, H, causes an equal bulk of water to flow into the measure, O. If there is a large quantity of water in the sample and the flask, A, becomes warm, it is immersed in a beaker of cold water to keep down the temperature and prevent the distillation of any gas from the oils. When the evolution of acetylene ceases, and no more is produced by a brisk shaking of the flask, A, after it has stood a minute or two, the reaction is considered finished. The measure, O, is now raised so that the water in it may stand at the same level as that inside the bottle, H, and allowed to remain so a minute or two for the levels to adjust themselves; then the reading of the thermometer, P, is taken, the clips, F and M, are closed, the tube, N, is withdrawn, and the amount of water in the measure read off. The proper correction for temperature and barometric pressure having been made, each 100 c.c. of the reduced volume indicates 1 per cent. of water in the sample. The whole operation occupies from 15 to 20 minutes.

In the first tests that were made the saline solution was run from the tube, N, into a tared flask and weighed, and, its specific gravity having been taken, its exact volume was easily calculated. A correction was also made for the amount of acetylene dissolved by the oils in the flask, A. The saline solution in the bottle, H, was also first saturated with acetylene so that it could absorb no more from that given off by the sample.

Several tests may be made without refilling the bottle, H. To refil this the tube, N, is dipped into a large flask or beaker in which the saline solution has been collected from the various tests, the clip, M, is opened and also the cock of the glass tube which goes to the suction pump, and the solution sucked back into the bottle, H. This also prevents the acetylene polluting the air of the laboratory. We are indebted to Mr. J. Southward for his valuable help in carrying out the details of this investigation.

Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, 13th December, 1909.

PROF. W. M. GARDNER IN THE CHAIR.

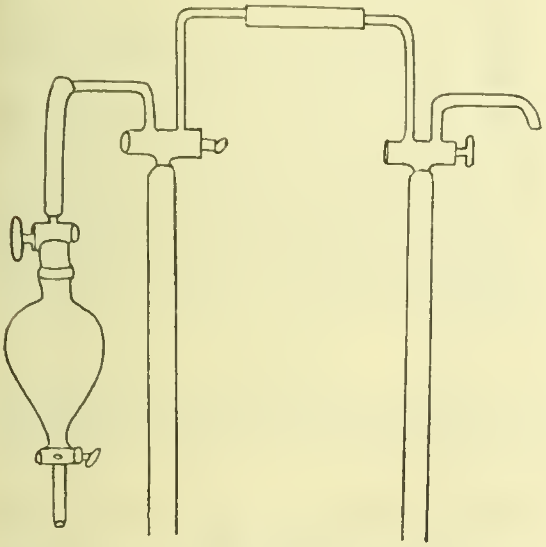
A SIMPLIFIED FORM OF EUDIOMETER FOR GENERAL GAS ANALYSIS.

BY F. W. RICHARDSON AND A. JAFFÉ.

The illustration will suffice to show the simple modification of and addition to the ordinary nitrometer. The side flask with its stoppered thistle funnel and small reflux bulb, or the bulb made from an ordinary pear shaped separator, is exhausted of its air by means of a Geissler glass filter pump. Any small amount of residual air is now removed by means of the mercury columns of the eudiometer. In this manner a perfect vacuum can be obtained. The entire absence of air or gas of any kind is a desirable feature in a number of operations. By means of the side bulb *in vacuo*, the estimation of gases dissolved in water is easily done. The bulb, with the measured volume of water, is immersed in water at about 80° C. The gases are soon extracted and removed to the more remote tube, or laboratory vessel. Into this the usual solutions for removing the carbon dioxide and then the oxygen are admitted and these gases are calculated from the losses observed. A well boiled and cooled water was shaken vigorously with air until presumably saturated. In our eudiometer a rapid estimation of the dissolved gases measured at 0° C. at 760 mm. showed 0·64 per cent. of oxygen and 1·32 per cent. of nitrogen, the amounts observed by various authorities. Where the amount of gas dissolved in a water is very small, quite a large flask may be used for the extraction. We use a 500 c.c. flask and insert a perforated rubber cork bearing a stoppered glass tube. After producing a complete vacuum a known volume, about 400 c.c. of the water is allowed to enter the flask. At a temperature of about 80° C. the whole of the gases can now be extracted and transferred to the laboratory tube. If the perforated rubber cork containing the straight tube with stopper is inserted into a large pear-shaped separator with the terminal tube cut short, we are able not merely to estimate the dissolved gases in the water, but also to determine the amount of combined carbon dioxide. A few c.c. of normal sulphuric acid are allowed to enter by the bottom tap to liberate this carbon dioxide. That the estimation can be accurately made is shown by the fact that 0·2514 grm. of pure monocarbonate of sodium, after solution in gas-free water, gave carbon dioxide corresponding to 100·1 per cent. of Na_2CO_3 in the sample taken.

For the estimation of combined carbon dioxide in baking powders and mortars, and in minerals generally, the apparatus works well. The substance can either be weighed in the flask above referred to or in a dry, pear-shaped 50 c.c. bulb, stoppered at both ends. In the latter case strong hydrochloric acid is allowed to flow in from the lower end. A baking powder was made to contain 6·28 per cent. of carbon dioxide as sodium bicarbonate; 6·21 per cent. was found by means of the apparatus.

For the analysis of such complex mixtures as coal-gas we have used the excellent eudiometer devised by Dr. Bone (this J., 1908, p. 10), but this piece of apparatus is complex and requires very careful handling. Moreover it is expensive. By attaching a gas explosion burette to the side outlet from the laboratory tube we are able to make a fairly accurate analysis of coal-gas. The carbon dioxide is first absorbed by potassium hydroxide, the oxygen by pyrogallate, and the olefines by bromine water. As the bromine acts upon the mercury and produces a species of scum which interferes with the readings we tried several chemicals to remove the mercury bromide; at last we found potassium cyanide effected this completely. Of course all cyanide must be subsequently washed out of the eudiometer.



The following figures show a comparison between the results obtained from the analysis of a coal-gas by Dr. Bone's apparatus and our eudiometer :—

	Bone.		Richardson and Jaffé.
Hydrogen............	47·19	..	48·02
Methane	37·22	..	37·81
Hydrocarbons (C_nH_{2n})	5·01	..	5·04
Carbon dioxide.......	1·39	..	1·17
Carbon monoxide	6·79	..	6·58
Oxygen	0·18	..	trace
Nitrogen (by difference)	2·22	..	1·38
	100·00	..	100·00

We are applying the eudiometer to the estimation of such metals as zinc, aluminium, and iron, and are seeking the best conditions of determining organic carbon in a variety of substances such as glycerine and sugars, also in waters and sewages by an improved "moist combustion" process, using a mixture of chromic acid, sulphuric acid, and water as the oxidising solution. The carbon dioxide evolved can then be easily determined. 100 milligrams of glycerine will give as much as 72·73 c.c. of carbon dioxide and 0° C. at 760 m.m., therefore the result multiplied by 1·375 gives the percentage of glycerine directly. 10 c.c. of a 1 per cent. solution of ordinary pharmaceutical glycerine were drawn into a flask *in vacuo*, and 20 c.c. of the chromic and sulphuric acid solution were added. The flask was immersed in water in a beaker, and after the communication had been opened to the eudiometer, the mercury column was depressed to about the 40 c.c. mark and by means of a small flame the water in the beaker was kept at about 90° C. After an hour the carbon dioxide was recovered and found to measure 74·0 c.c. at 14·2° C. and 30·25 in pressure, equal to 79·91 c.c. at 0°C. at 30° in pressure, which corresponds to 97·5 per cent. of glycerine, the actual amount present in the sample.

For "moist combustion" of carbon compounds the chromic and sulphuric acid mixture has been long used; but the carbon dioxide has hitherto been determined by the tedious process of collecting the gas in potash bulbs. We propose to use our apparatus for the purpose, as the operation is so very simple and can be so quickly performed.

The oxidising solution which gives us the best results we make by dissolving 20 grms. of chromic acid in 145 c.c. of water and adding 100 c.c. of strong sulphuric acid. The mixture is filtered through glass wool. The large proportion of acid prevents the liberation of water while it is not in sufficient proportion to liberate oxygen from the chromic oxide. If the tap communicating with the apparatus should be left closed there might be an explosion and the risk of serious injury to the operator by the out rush of such a powerfully oxidising and acid fluid :—We therefore tie the flask up in several folds of cloth before putting it into the beaker. To ascertain whether the carbon could be readily estimated in other substances we applied the process to 100 milligrams of sugar in 10 c.c. of water, exactly as with the glycerine. The carbon dioxide obtained corresponded to 97·33 per cent. of sucrose—a result confirmed by polarimetry. We propose to apply the method to the determination of carbon in sewages and waters, using the residues left after these have been acidified with sulphuric acid and evaporated down to a low bulk on the water bath.

Discussion.

Mr. J. W. **Cobb** said that he had been fascinated by the simplicity of the nitrometer but disappointed with its lack of accuracy. The absorption of such gases as carbon dioxide in the liquid of the reaction bottles and the sensitiveness to change of temperature made exact work difficult: standardising for carbon dioxide by using a pure carbonate was a partial remedy, good enough for many works purposes, but the implied correction was large.

Mr. T. **Fairley** thought that considerable care would be necessary in the use of the apparatus, but it supplied a want and had many useful applications. It would take the place of the Lunge apparatus. He noted with surprise the small amount of nitrogen in Bradford gas, which he thought compared very favourably with coal gas as usually supplied.

Prof. W. M. **Gardner** suggested the checking of the results obtained by this apparatus against results obtained volumetrically and gravimetrically.

Mr. F. W. **Richardson**, in reply, said it was perhaps rather difficult to check gasometric methods by gravimetric methods since it was not easy to prevent moisture passing over. One great advantage of the apparatus was that it was possible to tell quite easily when a complete vacuum had been obtained. Bradford gas contained only a small quantity of nitrogen.

Journal and Patent Literature.

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English.—8*d*. each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.
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I.—GENERAL PLANT; MACHINERY.

Reinforced concrete chimney construction. E. R. Matthews. Concrete Institute, Jan. 20, 1910. [Advance proof.]

Among the chief advantages of reinforced concrete chimneys are the lower cost, the saving of space, and the rapidity of erection. In the United States it has been found that reinforced concrete chimneys cost less than half as much as brick shafts, the saving being greater the larger the shaft. With regard to saving of space, whilst a brick shaft, 300 ft. high, would be 4 ft. 10 in. thick at the base, the dimensions at the base of a concrete chimney of the same height would be: outer wall, 9 in.; inner wall, 5 in.; intermediate space, 4 in. From a series of tests on the effect of high temperatures on reinforced concrete, it was found that the strength of briquettes of neat cement, after exposure to a high temperature, was greater than that of similar briquettes kept in water. With concrete composed of 3 parts of sand to 1 of Portland cement, after allowing to set for 14 days in air, the strength diminished very considerably on exposure to a high temperature, but when the concrete was allowed to set for 2 months, it was not affected in the least when subsequently exposed to a temperature of 900° F. This latter temperature may be taken as the safe limit in reinforced concrete chimneys. Heat should not be applied to concrete until the latter has set for 2 or, preferably, 3 months. It is essential also to ensure that the concrete is free from voids.—A. S.

Underground pipes; Protection of —— from electrolysis. A. F. Ganz. J. Gas Lighting, 1910, **109**, 234—237.

Cement joints break up the electrical continuity of a pipe line, and if they occur at frequent intervals are of considerable utility in reducing corrosion by electrolysis, though they do not necessarily prevent it entirely, especially in sections in the vicinity of large power stations. It is comparatively immaterial whether the electrical resistance of the cement joint is very high or not, as in any case it is very high in comparison with that of a section of the pipe system. Paints do not as a rule check electrolysis, and corrosion of the metal may take place beneath the paint without apparently affecting its appearance. In general "dips" (tar and pitch preparations applied hot) are more effective than paints, but in any case the metallic body must be freed from rust, moisture, loose scale, and foreign matter before being coated. Concrete is not an efficient protection against electrolysis. Admixture of rubber, tallow, and so on usually has a deleterious effect on the efficiency of coal-tar pitch. The electrical resistance of a lead joint in a cast iron pipe system tends to increase with age, and after some years may effectively break up the electrical continuity. The only kind of insulating covering which appears to afford certain protection is a layer of at least 2 in. of a material like coal-tar pitch or asphaltum of such grade that it will not crack, but is hard enough to remain in position. This is best applied by enclosing the pipe in a wooden box and filling in with the molten material, but the cost is prohibitive except in special cases. The author insists on the importance of electrolytic surveys, properly carried out; voltmeter readings alone are insufficient, and must be supplemented by measurements of current flow along pipes.—E. F.

Patents.

Evaporating or concentrating liquids; Apparatus for ——. E. Shaw, Dartford Heath. Eng. Pat. 20,765, Oct. 2, 1908.

The liquid to be evaporated is forced by a pump, in regulated quantities, through a tube heated externally and provided with a spiral passage of gradually increasing area.—W. H C.

Evaporating apparatus; Continuous vertical ——. Maschinenfabr. Grevenbroich. Ger. Pat. 214,936, Nov. 17, 1908.

The concentrated liquor is run off continuously through a pipe mounted in the wide liquor-circulating pipe, and ending at its upper part in a funnel or an annular trough or gutter. The funnel or annular gutter is spaced away from the wall of the liquor-circulating pipe, so that only part of the liquor is discharged, the remainder being again passed through the heating tubes. By this device, the concentrated liquor is discharged without mixing with the fresh liquor entering the evaporator, and the larger portion of the liquor is heated for only a relatively short time.—A. S.

Evaporating or heating apparatus; Vacuum ——. F. Hallström. Ger. Pat. 216,738, Nov. 24, 1908.

In vacuum evaporators with conical bottoms, a spherical or lens-shaped heating device is mounted in the conical portion.—A. S.

Evaporating apparatus. F. Duisberg. Ger. Pat. 216,744, April 15, 1908.

In evaporators of the type in which the liquor flows downwards through an externally heated coiled pipe, the coils of which are provided with steam-outlet pipes leading to a common steam-outlet main, it is proposed to make the diameter of the coiled pipe increase gradually from the inlet to the outlet end, so that as the liquor becomes concentrated, its velocity is reduced and the heating surface with which it comes in contact becomes larger. The diameter of the steam-outlet pipes is increased in accordance with the increased diameter of the coils. It is also proposed to wind the coil in a prismatic form and to provide at the bends, openings which can be closed in any suitable manner, in order to facilitate the cleaning of the coils.—A. S.

Distillation of liquids; Process and apparatus for the continuous ——. W. G. Perks, Teddington. Eng. Pat. 26,301, Dec. 4, 1908.

The apparatus, which is particularly applicable to the distillation of volatile spirits from oil, consists of a vessel in which a number of superposed trays are arranged. The liquid to be distilled, flows down from tray to tray and is discharged from the bottom of the vessel. The trays are heated by coils through which steam or hot air is circulated, and, if desired, steam may be injected into the liquid in the trays. The vapours pass to a condenser, the condensed liquid being received in a separator from which the water is returned to one or more of the trays, so that any spirit dissolved in the condensed water is recovered.—W. H. C.

Cooking, concentrating and distilling in vacuo. P. S. Hervé. Fr. Pat. 404,377, June 24, 1909.

The claim is for a steam-jacketed still provided with vertical and horizontal agitators, combined with a condensing still head, tubular condenser, and water-jacketed vacuum receiver.—W. H. C.

Kiln. T. M. Wilson, Philadelphia, Pa. U.S. Pats. 946,086, 946,087, 946,088, and 946,089, Jan. 11, 1910.

The claims relate to kilns of bee-hive form having perforated floors supported on walls forming a series of longitudinal flues and cross flues. These flues communicate with vertical passages in the side and end walls and are provided with dampers. A single flue below the kiln and in communication with the longitudinal flues leads to the chimney stack.—J. W. H.

Filter for metallurgical and other purposes. C. G. Patterson, Berkeley, Cal., Assignor to The Butters Patent Vacuum Filter Co., Nevada. U.S. Pat. 946,862, Jan. 18, 1910.

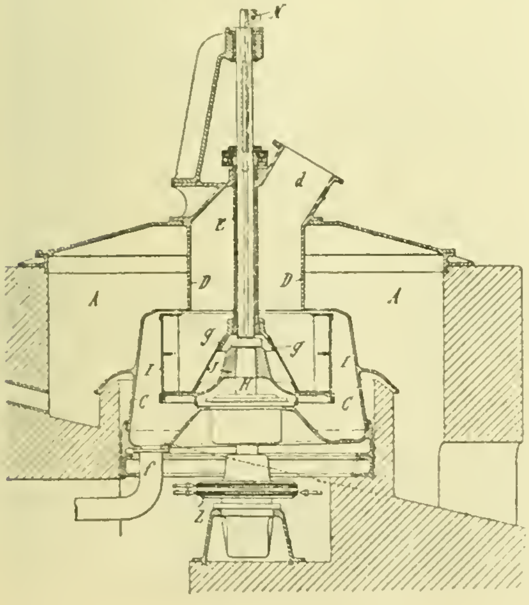
The filter-frame comprises a series of upright supports connected at top and bottom by transverse members. On this frame are slung a number of separate detachable forms, which are used as supports for the filtering media, so that each unit presents the appearance of a vertical elongated bag. Passages, communicating with the interior of the filters, are provided in the supports, for the removal of the filtrate.—C. A. W.

Purifying, cooling and mixing gases; Apparatus for ——. H. Theisen. Fr. Pat. 404,336, June 23, 1909.

The claim is for an apparatus similar in construction to a "Carr" disintegrator. It consists of an outer casing, provided with inlet and outlet pipes for the gas, in which a number of concentric, perforated, interpenetrating cylinders are arranged. The alternate sets of cylinders may be rotated in opposite directions, or one set may be rotated and the other fixed.—W. H. C.

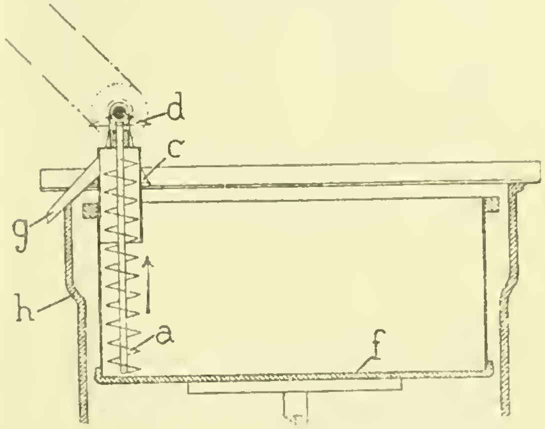
Hydro-extractor, with continuous automatic charging and discharging. T. Robatel, J. Buffaud et Cie. Fr. Pat. 404,412, May 24, 1909.

The material to be dried is fed into the basket of the machine through the shoot, *d*, and the cylinder, D. The drum has an outer perforated basket, I, and a movable inner basket, *g*, both of which are rotated together by the motor, Z. As the machine rotates, the liquid passes through the perforated basket, I, into the casing, C, and is discharged through *f*. As soon as sufficient dry material has accumulated, the feeding is stopped, and the inner basket, *g*, is raised by lifting the sleeve, E, to which it is attached, by the mechanism, N. The outer basket is not lifted, and both continue to rotate, and as the inner basket, *g*, rises, the cake of material rises above the upper edge of the outer basket, I, and being no longer confined, is thrown off by the centrifugal force into the space, A, from which it is removed by a stream of water or in any other convenient manner.—W. H. C.



Centrifugal drum, with continuous discharge of the solid residue. V. H. Uhland Ges.m.b.H. Fr. Pat. 405,119, July 16, 1909. Under Int. Conv., Feb. 11, 1909.

In order to remove the solid cake without stopping the rotation of the drum, an endless screw, *a*, is fixed within, but independent from the drum, *f*, near the periphery, as shown. It is driven by the mechanism, *d*, in the opposite direction to that in which the drum rotates. The upper part of the screw is enclosed in a tube or casing, *c*, provided with a delivery spout, *g*, which projects beyond the outer casing, *h*, and through which the solid matter is discharged.—W. H. C.



Sediments containing only small quantities of liquid; Process and apparatus for obtaining ——. Ges. f. Abwässerklärung m.b.H. Fr. Pat. 404,760 July 5, 1909.

The apparatus consists essentially of a settling tank, the walls of which slope towards the centre and are prolonged to form a deep, narrow well. The sedimentary matters contained in the liquid flowing through the tank, collect in this well and are discharged through a narrow pipe passing down the centre and reaching nearly to the bottom of the well; the upper end of this pipe passes through the wall of the tank below the surface of the liquid.—W. P. S.

Vapours of volatile liquids, particularly alcohol and ether; Recovery of —— from their admixture with air. Soc. l'Air Liquide, Paris. Eng. Pat. 5395, March 5, 1909. Under Int. Conv., March 6, 1908.

See Fr. Pat. 397,791 of 1908; this J., 1909, 880.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Smokeless combustion of coal in boiler plants. D. T. Randall and H. W. Weeks. U.S. Geol. Surv., Bull. No. 373. Pp. 188.

The authors inspected over 400 industrial installations, and made special trials with many varieties of coal at the Government fuel-testing station. They conclude that bituminous coals rich in volatile matter can in practice be burned without smoke, and that even when banked fires have to be quickly forced, there need be no objectionable smoke. No one type of mechanical stoker is equally valuable for different fuels. It is essential that the stoker or furnace be so set that combustion is complete before the gases strike the heating surface of the boiler. When large volumes of gases are distilled from fresh fuel, intimate admixture with air is necessary. When the raw fuel is added gradually, as in mechanical stoking, the addition of mixing structures reduces the amount of air required to ensure complete combustion and enables the distance from the grates to the heating surface to be shortened. The results obtained in practice with different types of mechanical stoker are discussed separately. With chain-grate stokers properly set, there should be no smoke when the load is uniform. With a variable load the draught must not be too greatly reduced by means of the damper, but below a certain limit, further regulation should be effected by varying the speed of the grate and the thickness of the fire. The speed of the grate should never be sufficient for it to be hot on re-entering the fire. With stokers of the front overfeed type, smokeless combustion has been attained by the continuous use of steam-jets, or by plentiful admission of air above the grate. Side-feed stokers give good results even with fluctuating loads, but it is important that the arch should extend over the whole grate. With underfeed stokers combustion is complete within a very short distance, and the combustion space required over the fuel-bed is smaller than with any other type. Since forced draught is used, the stack may be smaller. These stokers are most successful when the coal used is low in ash. The trials at the fuel-testing station showed that the same furnace and stoker will burn many kinds of coal without smoke up to a certain rate of combustion, which varies with the fuel. The efficiency is lowest with coal rich in volatile matter and is decreased by forcing the furnace. Small sizes of coal give less smoke, but cannot be burned so rapidly as larger sizes. Slack coal and coal rich in volatile matter can be burned without smoke when briquetted. Washed coal burns more quickly than unwashed, but gives more smoke in a hand-fired furnace. Coals that do not clinker excessively give less smoke when burned on a rocking grate than on a fixed grate. The admission of air at firing, and for a short time afterwards, reduces the amount of black smoke.—A. T. L.

Fuel tests with house-heating boilers. J. M. Snodgrass. Univ. of Illinois Bulletin, 1909, **6**, No. 19. Univ. of Illinois Eng. Expt. Station, Bull. No. 31, Feb., 1909.

Benzol enrichment of gas. Committee of American Gas Institute on Benzol Enrichment. J. Gas Lighting, 1910, **109**, 239—240.

The most important use of benzol as an enricher of illuminating gas is to raise the candle-power of the coal-gas from coke-ovens. Enrichment by benzol adds very little to the heating power of the enriched gas, and benzol can therefore never entirely replace gas-oil for the enrichment of water-gas. On the other hand coal-gas, both from retorts or coke-ovens, is comparatively low in illuminating power, but possesses the necessary initial heating power to render it suitable for enrichment with benzol. It is useless to enrich with benzol a gas already saturated with hydrocarbon vapours, as the low-tension vapours will then be deposited during transmission. To ensure a permanent and commercially successful increase in candle-power by the use of benzol, it is usually necessary to first remove a portion of the low-tension hydrocarbon vapours. This may be done by compression, by cooling, or by washing the gas with an absorbent oil.—E. F.

Carbon monoxide in illuminating gas ; Determination of —— by iodine pentoxide. A. H. Gill and E. H. Bartlett. J. Ind. Eng. Chem., 1910, **2**, 9—11.

Smits, Raken, and Terwogt (this J., 1901, 73) claim that the carbon monoxide in illuminating gas can be accurately determined by absorption with iodine pentoxide (see this J., 1898, 377, 490, 603, 694 ; 1900, 275). The authors tried the method with a mixture of carbon monoxide, methane, hydrogen, and nitrogen of about the composition of the residue left after the absorption of carbon dioxide, "illuminants," and oxygen from illuminating gas. They found it impossible to obtain accurate results, and conclude that for considerable quantities of carbon monoxide, the method of absorption with iodine pentoxide is of no use.—A. S.

Oil-gas producer ; A new ——. A. B. Davis. Ohio Soc. of Mech. and Elect. Steam Engineers, Nov. 19, 1909 ; through Engineer, 1910, **109**, 47.

The chief feature of the producer, which is stated to yield a gas free from tar, is that a regulated supply of air is admitted to the retorts in which the carburetting is effected, whereby the formation of tar is prevented, and the calorific value of the gas can be varied. The retorts, which are of cast iron, are divided longitudinally into eight cells. The mixture of oil and air is admitted from a regulating nozzle at a pressure of 35 lb. per sq. in., and passes successively through the cells until it reaches the outside chambers in a gaseous state. The retorts are heated by oil-gas produced in burners of similar construction to the retorts, but having holes in the outer chamber from which the gas issues. It is suggested that the higher olefines, produced by the dissociation of the oil, are decomposed immediately, owing to the presence of the oxygen, into hydrogen, acetylene, ethylene, etc., without polymerising into tar. Using an oil of calorific value, 18,200 B.T.U. per lb., the author found that in a run of one hour, 1486 cb. ft. of a gas of 844·5 B.T.U. per cb. ft. were produced, 75·6 lb. of oil and 250 cb. ft. of compressed air entering the retort, and 28·8 lb. of oil being used in the burner. This gives an efficiency of 91 per cent. if the oil burner supply is neglected, and of 66 per cent. if this is taken into account. In another producer, 1000 cb. ft. of a gas of 750 B.T.U. per cb. ft. were produced at a cost of about one shilling. The percentage composition of the gas is as follows :—Carbon dioxide, 2·0 ; illuminants soluble in bromine, 25·5 ; heavy hydrocarbons, 0·5 ; carbon monoxide, 1·5 ; methane, 35·0 ; hydrogen, 5·5 ; nitrogen, 30·0. The specific gravity of the gas approximates to that of air.—H. H.

Mineral oils ; Behaviour of high-boiling —— when heated in currents of air and steam. F. Schreiber. Z. angew. Chem., 1910, 23, 99—103.

The author has studied the effect of heating various mineral lubricating oils to temperatures of 200°, 250°, and 280° C. in an apparatus specially constructed to obtain conditions similar to those of actual practice. After 16—24 hours exposure to the high temperature, the mobility and colour of the residue were noted, and determinations were made of the extent of evaporation and of the formation of bodies insoluble in petroleum spirit. It was found that high viscosity and flash-point do not necessarily mean low evaporation and the absence of resinification at high temperatures, so that it is advisable to make separate tests of all these properties. The products insoluble in petroleum spirit generally described as "asphaltic," are almost completely insoluble in hot benzene and are therefore more probably charred products. Formation of these substances apparently only takes place in an oxidising atmosphere, so that determination, after heating, of the amount insoluble in petroleum spirit, is most important in the case of compressor-oils, and not so necessary in the case of cylinder-oils if the steam used is previously freed from air. The general behaviour on heating, is found to agree satisfactorily in these respects with lubricating value in practice.—W. H. P.

Flash-, fire-, and explosion tests on mixtures of carbon tetrachloride and naphtha [light petroleum]. E. A. Barrier. J. Ind. Eng. Chem., 1910, 2, 16-19.

The author examined mixtures of carbon tetrachloride and light petroleum with respect to danger from fire and explosion. The characters of the four samples of light petroleum used are shown in the following table.

	I	II	III	IV
Specific gravity	0·7556	0·7241	0·6982	0·6811
Flash point (open cup)	8° C.	12° C.	Below —18° C.	Below —18° C.
Distillation test :				
50—60° C.	—	—	2·0 c.c.	3·5 c.c.
60—70° C. . . .	—	—	5·0 c.c.	23·0 c.c.
70—80° C. .	—	—	19·0 c.c.	24·0 c.c.
80—90° C. . .	—	12·5 c.c.	24·5 c.c.	18·0 c.c.
90—100° C.	—		21·0 c.c.	13·0 c.c.
100—110° C. . . .	—	23·5 c.c.	11·0 c.c.	5·5 c.c.
110—115° C. . . .	—	—	4·0 c.c.	—
Above 110° C.	—	—	—	12·0 c.c.
Above 115° C.	—	—	14·0 c.c.	—
110—120° C. . . .	—	22·0 c.c.	—	—
120—130° C.	17·0 c.c.	18·0 c.c.	—	—
130°—140° C.	20·5 c.c.	8·0 c.c.	—	—
Above 140° C.	61·5 c.c.	16·0 c.c.	—	—

The danger from fire of the mixtures of carbon tetrachloride and light petroleum was ascertained by determining the flash point in the open cup of the New York State Board of Health tester and also in a 6-in. evaporating dish; no definite fire-points could be observed. For determining the danger of explosion, a strong box fitted with inlet and outlet pipes, and with a heavy cover, resting in a water-seal, was used. By means of a suction pump, air was drawn first through the mixture under examination and then through the box, and after a definite period, the gaseous mixture in the box was ignited electrically. The results of the experiments are given in tabular form. They show that at the ordinary temperature (about 20° C.), the mixtures of light petroleum with carbon tetrachloride, in order to be reasonably safe from danger of fire, under the conditions of the experiments, must contain: for sample I., 30 per cent.; II., 45 per cent.; III., 60 per cent.; and IV., 70 per cent. of carbon tetrachloride. With regard to danger of explosion at the ordinary temperature, samples I. and II. are practically safe, but for the other samples, reasonable safety is attained only with mixtures containing: III., 50 per cent., and IV., 60 per cent. of carbon tetrachloride.—A. S.

Gas-volumetric determination of hydrogen. Paal and Hartmann. *See* XXIII.

Patents.

Coal; Method of burning powdered ——. S. Hughes, Joplin, Mo. U.S. Pat. 945,846, Jan. 11, 1910.

The powdered coal is mixed with a powdered basic substance, such as limestone, which on combustion of the coal will prevent the formation of clinker.—J. W. H.

Fuel briquettes; Manufacture of —— *from coal and petroleum.* V. E. F. Brun. Fr. Pat. 404,965, July 6, 1909.

The briquettes are composed of coal, tar, petroleum, and soap, in the proportions of 1 to 10 parts of petroleum, containing 1—5 per cent. of soap, and 1 to 10 parts of tar to every 100 parts of coal.—J. W. H.

Coke-oven. W. Mueller. Fr. Pat. 404,671, May 18, 1909.

A coke-oven is claimed in which the charge is coked by the heat of the side walls, whilst the roof of the coking space, upon which is carried the main gas-flue, remains at a comparatively low temperature. The gas given off from the charge, after passing through condensers for the separation of by-products, is returned to the coke-oven and injected together with air into the upper and lower extremities of the vertical flues in the side walls.—J. W. H.

Coke of low sulphur content; Process for the production of —— *from coals of high sulphur content and containing sulphur in organic combination.* N. Caro. Ger. Pat. 216,681, July 1, 1908.

The ground coal is freed from the finest particles (up to 2 mm. size) before washing, and is carbonised whilst still wet. The portions of the coal rich in organic sulphur compounds are more easily powdered than the portions poor in sulphur and are hence largely removed by the above treatment, whilst by carbonising the wet coal, a larger proportion of sulphur is carried away in the distillation gases.—A. S.

Vertical retorts for carbonisation of coal or the like; Settings of ——. H. W. Woodall, Lytchett Matravus, Dorset, and A. McD. Duckham, Little Bookham, Surrey. Eng. Pat. 21,554, Sept. 21, 1909.

In order to provide adequate support for the retorts without obstructing the spaces between them, and without covering too great an area of the retort surface by the supporting walls between adjacent retorts, these walls are made comparatively thin, and have oval or lanceolated openings for the passage of the heating gases. As applied to retorts of elliptical section, the columns supporting the longer faces of the retorts are formed of bricks which engage ribs on the retorts, as described in Eng. Pat. 24,695 of 1906 (this J., 1907, 1271), and each alternate brick has a lateral flange to the right or left, so as to bear on a greater area of the retort face.—A. T. L.

Retort-furnace for the manufacture of lighting-gas. C. M. Stein et Cie. Fr. Pat. 405,060, July 13, 1909. Under Int. Conv., Sept. 18, 1908.

The patent is for a method of converting a coal-fired retort-furnace of the ordinary type into a gas-fired furnace with regenerators. A producer chamber is built beneath the original furnace chamber, so that the producer can be charged from the same fire-door, and an arch is built over the producer. This arch is provided with gas outlets adjacent to air-outlets in a horizontal air-heating flue above it, so that the gas burns in the space between adjacent columns of retorts. At each side of the producer is built a small regenerator, formed with special hollow bricks, such that the passage through the interior of the bricks has corrugated walls, thus aiding in the transfer of heat.
—A. T. L.

Metal retort with a casing of refractory material. A. Heinrich. Ger. Pat. 216,462, Dec. 2, 1908.

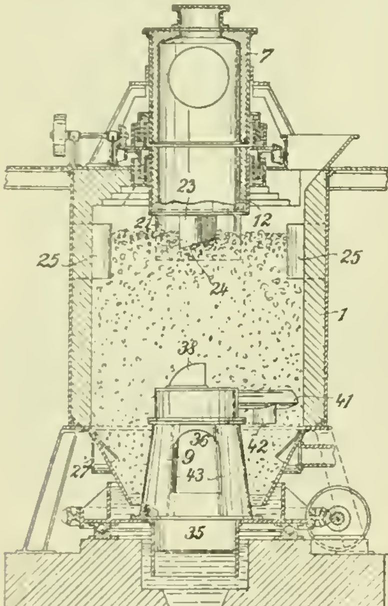
In metal retorts provided with casings of refractory material, it has been found impossible to maintain the whole gas-tight, owing to the different coefficients of expansion of the metal and of the casing. According to the present patent, a space is provided between the retort and the casing, and this is filled with a powdered or gritty reducing substance such as retort carbon or coke. When leaks occur, the oxidising flame from the furnace burns the carbon or coke at those parts until the ash produced blocks the openings. Apertures are provided at the top and bottom of the retort for filling and emptying the intermediate space. The carbon or coke is introduced only after the retort has first been heated to incandescence.—A. S.

Suction gas-producer for use with bituminous coal. R. V. Farnham, Wemyss Bay, N.B. Eng. Pats. 26,199, Dec. 4, 1908, and 11,675, May 18, 1909.

The producer is of that underfeed type in which, at charging, the grate is first raised and a temporary grate then inserted above it to support the column of incandescent fuel, while the grate proper is lowered, cleaned, and charged with a body of raw fuel. The vertical movement of the grate is effected by pinions engaging with vertical racks formed on it. The grate moves within an annular or ring-shaped boiler, having perforations near the top to admit steam to the lower part of the producer fire. The temporary grate is formed by a perforated plate moving in horizontal guides and operated by a screwed spindle and a hand-wheel. A lateral shoot and screw conveyor are provided for charging.—A. T. L.

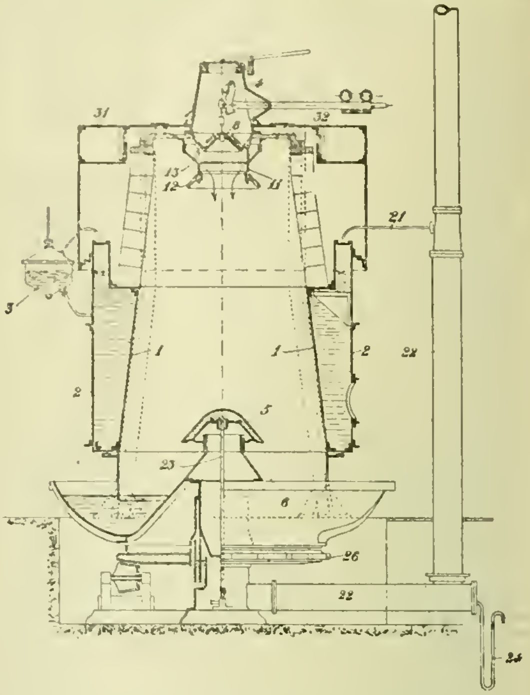
Gas-producer. Hannoversche Gas-Generator-Banges. Fr. Pat. 404,494, June 26, 1909. Under Int. Conv., Feb. 19, and May 28, 1909.

The producer comprises a fixed body portion, 1, a rotating gas-outlet chamber, 12, arranged beneath a fixed chamber, 7, and a rotating ash-pit, 35, provided with means for automatically removing clinker and ash. A casing, 21, forming an extension of the gas-outlet chamber, 12, is provided with wedge-shaped projections, 23, at opposite sides, these projections having their vertical faces tangential to the casing, 21, and their lower surfaces, 24, inclined, so that as the chamber, 12, and casing, 21, rotate, the fuel is spread laterally and also pressed downwards to prevent the formation of a hollow fire. Wedge-shaped projections, 25, on the producer walls assist in breaking up the fuel-bed. The ash-pit, 35, carries a casing, 9, with lateral openings, 36, for the passage of clinker and ash. The clinker and ash are guided towards these openings as the structure rotates, by a projecting arm, 41, which is curved in plan and triangular in cross-section, and which carries a curved guide plate, 42. Webs, 43, on the casing, 9, aid in directing the clinker and ash through the openings, 36, and a cap, 38, in the form of a spherical segment arranged excentrically on the top of the casing, 9, assists in preventing the formation of large masses of clinker. In a modification, the cap, 38, is in the form of an oblique cone arranged excentrically and provided with projecting helical surfaces. The air inlet to the producer is by way of the annular chamber, 27.—A. T. L.



Gas-producer. F. Dor-Delattre. Fr. Pat. 405,079, July 15, 1909. Under Int. Conv., May 21 and June 18, 1909.

The producer comprises a body portion, 1, mounted above a rotating ash-pit, 6, the lower part of the body-portion forming an annular boiler, 2. The ash-pit is moved intermittingly by means of a reciprocating pawl engaging with ratchet teeth, 26. Air from the pipe, 22, mixed with steam from the pipe, 21, enters the producer by a central tuyère, 5. This tuyère is cooled by a continuous supply of water from the pipe, 23, the overflow falling into the blast-pipe which is fitted with a drain, 24. The charging hopper, 4, is provided with fuel-spreading cones, 8, 12, and 13, of which the cone 8 is movable in the vertical guides, 11. With the cone, 8, in the highest position as shown, the fuel is guided by the cone, 13, to the centre of the producer, but when the cone, 8, is in its lowest position, forming a continuation of the cone, 12, the fuel is directed towards the producer walls, and in intermediate positions of the cone, 8, the fuel is spread evenly over the surface of the fuel column. The boiler, 2, is fed from a float-chamber, 3. The platform, 31, for the operator, is arranged above the top-plate, 32, of the producer, and the intervening air-space is connected to the stack-pipe, thus preventing overheating of the platform, and escape of gas into the producer-house.—A. T. L.



Gas-scrubber apparatus. A. M. Gow, Edgewood Park, Pa., Assignor to The Westinghouse Machine Co. U.S. Pat. 945,936, Jan. 11, 1910.

The apparatus comprises a vertical cylindrical casing divided into superposed compartments by horizontal partitions. Each partition has a large central orifice provided with deflecting blades for checking rotary motion of the gas passing through the orifice. A rotating vertical spindle extends through all the compartments and carries blades adjacent to the stationary deflecting blades. A water supply is provided in each compartment, the water flowing at the centre of each partition on to the rotating blades beneath it.—A. T. L.

Gas-purifying materials; Revivification of —— by ozone. Soc. d'Eclairage, Chauffage, et Force Motrice. Fr. Pat. 404,995, July 10, 1909.

Ferric oxide, sawdust, and lime, which have been used in the purification of lighting gas, are treated with ozone in the presence of moisture in a closed vessel, the ozone being in the form either of ozonised air or ozonised oxygen. —A. T. L.

Gas-purifying materials; Utilisation of ——. H. Simonin. Fr. Pat. 405,096, Nov. 5, 1908.

The purifying materials, comprising ferric oxide, sawdust, and lime, are first extracted with carbon tetrachloride or other organic solvent in an autoclave, in order to dissolve out the sulphur, which is afterwards separated from the extract by distillation of the solvent. The insoluble residue is treated with steam in an autoclave for two or three hours and, finally, the residue is submitted to destructive distillation or to distillation with alkali in order to obtain the nitrogen as ammonia. The residue, after treatment with steam, may alternatively be treated with sulphuric acid, and the latter then used to obtain a superphosphate containing nitrogen.—A. T. L.

Fuel; Manufacture of ——. T. Parker, Wednesfield. U.S. Pat. 947,400, Jan. 25, 1910.

See Eng. Pat. 15,872 of 1907; this J., 1908, 930.—T. F. B.

Combustible briquettes; Manufacture of ——. J. P. Nelson. Fr. Pat. 405,188, July 17, 1909.

See Eng. Pat. 15,086 of 1908; this J., 1908, 1143.—T. F. B.

Coke ovens; Regenerative ——. L. Bansart, St. Pierre, Belgium. Eng. Pat. 1866, Jan. 26, 1909.

See Fr. Pat. 398,843 of 1909; this J., 1909, 1026.—T. F. B.

Gas for heating and lighting; Apparatus for producing ——. C. B. Tully. Fr. Pat. 405,084, July 15, 1909. Under Int. Conv., Nov. 18, 1908.

See Eng. Pat. 24,803 of 1908; this J., 1909, 1240.—T. F. B.

Gas; Process of purifying ——. E. L. Hall, Portland, Oregon, U.S.A. Eng. Pat. 14,200, June 17, 1909. Under Int. Conv., July 11, 1908.

See U.S. Pat. 911,494 of 1909; this J., 1909, 237.—T. F. B.

Obtaining nitrogen and carbon dioxide from combustion gases. Fr. Pat. 404,690. *See* VII.

Gas of high calorific value [from gases escaping from Bessemer converters]. Ger. Pat. 216,302. *See* X.

Apparatus for gas analysis. U.S. Pat. 945,740. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Bunsen flame; The inner cone of the ——. F. Haber and B. S. Lacy. Z. physik. Chem., 1910, 68, 726—752.

A discussion of the course of the chemical reactions in the inner cone, and of the cause of its sharply defined luminous boundary, starts from the knowledge that it is the zone of disappearance of oxygen and of hydrocarbons, with the rapid attainment of thermal equilibrium according to the water-gas equation:—

$$\left(K = \frac{C_{H_2O} \cdot C_{CO}}{C_{H_2} \cdot C_{CO_2}}\right)$$

In the next zone (the intermediate cone of cooling) the temperature falls gradually till contact with atmospheric oxygen is attained in the outer cone. In the middle cone however the water-gas equilibrium only changes slowly with temperature. In a well-regulated burner the boundary between the inner and intermediate cones is very sharp and quite stationary, and the sudden change in luminosity cannot be attributed to temperature or to the superior radiating powers of the hydrocarbons of the inner cone. The change seems to be connected in some way with the remarkable difference in the electrical conductivity of the two regions, observed by Davidson (Phys. Zeit., 1906, 7, 108, 115) and by Tufts (Phys. Review, 1906, 22, 193). The work on this subject has been now carefully repeated and extended, using the separated flame and investigating the inner cone and the interconal gas. The conductivity values were obtained by using electrodes of thin platinum wire with a thin film of lime or magnesia on both electrodes or on the cathode only. By this means much higher values were obtained than with the bright wires or with only the anode coated. Under these conditions Ohm's Law was obeyed for low E.M.F. values, and assuming that the ionic velocity is the same in both regions, a calculation can be made which gives 10^{10} ions per c.c. and a degree of dissociation of $2{\cdot}5 \times 10^{-9}$ for the intermediate zone, the values for the inner cone being $3{\cdot}3 \times 10^{12}$ and 10^{-6} respectively. The luminosity is attributed to the relatively high ion-concentration, and the rapid attainment of the water-gas equilibrium is explained by assigning a catalytic function to the ions themselves. This is comparable with the reaction in electric sparks, ozone-tubes, etc., except that the origin of the ions is in those cases electrical and not chemical.—W. H. P.

Thermometry; Platinum resistance —— *at high temperatures.* C. W. Waidner and G. K. Burgess. Bull. Bureau of Standards (U.S.A.), 1909, 6, 149—230.

The subject is treated very fully and a very large number of experimental data are given, especially in the appendix. Very detailed accounts of the methods of experiment are also included. The subject matter comprises methods of measurement, construction of thermometers, calibration of thermometers, determination of their constants, measurement and reproducibility of freezing and melting points, correction of scale for thermometers of impure platinum, calibration formulæ, changes in thermometer constants at high temperatures, comparison of resistance and thermo-electric scales, the palladium thermometer, the boiling point of sulphur and other matters. The authors arrive at the following conclusions:—Temperatures defined by the resistance thermometer of pure platinum calibrated by Callendar's formula at 0° C., 100° C., and the boiling point of sulphur (444·7° C.), agree with temperatures on the generally accepted gas scale over the range 0°—1100° C. to within the degree of reproducibility of the latter. Thermometers of impure platinum, calibrated in the same way, give a temperature scale, the divergence of which from the normal scale increases with the temperature. If thermometers of impure platinum are calibrated at a fourth temperature, such as the freezing point of silver, and the difference coefficient of the Callendar formula is written $d=a+bt$, then the scale so defined is in very close agreement with that of the normal platinum thermometer. The palladium thermometer, calibrated by the Callendar method, agrees with tho platinum thermometer up to 600° C., to within 1° C. It requires a fourth degree equation to express its resistance-temperature relation from 0° C. to 1100° C. The following freezing points were determined: Tin, 231·92° C.; cadmium 321·01° C.; lead, 327·43° C.; zinc, 419·37° C.; antimony, 630·71° C.; aluminium, 658·0° C.; the eutectic mixture, $Ag_3 : Cu_2$, 779·20° C.; silver, 960.9° C.; copper, 1083·0° C.; the eutectic mixture, $Cu : Cu_2O$, 1063·2° C. The average deviation for the pure metals ranges in the several cases from 0·02° C. for tin, cadmium, and zinc, to 0·5° C. for aluminium and copper, and the reproducibility figure ranges from 0·06° C. for tin and zinc to 2·3° C. for antimony. The ordinary thermo-couples of platinum and rhodium-platinum and platinum and iridium-platinum calibrated at three temperatures in terms of the formula, $E=a+bt+ct^2$, are in agreement with the platinum resistance scale, in the interval 200° C.—1100° C. to within 0·3° C. At high temperatures the constants of platinum thermometers undergo gradual changes, which are greatly reduced, but not eliminated, by annealing for several hours at a temperature higher than that for which they are to be used. After annealing, the changes in the constants are much less for thermometers of pure than of impure platinum; they are least for pure platinum wires of large diameter and free from strains. The freezing points of the metals are the most satisfactory calibration temperatures. The temperature of separation of the silver-copper eutectic is an entirely satisfactory fixed point, as is also that of the copper-cuprous oxide eutectic, if proper precautions are taken. The boiling point of sulphur at known pressure and under carefully specified conditions is a most satisfactory fixed point, reproducible to within a few hundredths of a degree.—E. F.

Patents.

Destructive distillation in continuously-working retorts or ovens; Preventing the decomposition of the gases formed in the ——. A. Zindler. Fr. Pat. 404,554, June 29, 1909.

The gases drawn off by different conduits from the retorts or ovens are kept separate until they have been cooled and freed from condensable products. The gases are then taken by a single main or by separate mains to the gas holder or to the burners.—A. T. L.

Separation of particles of tar, oil, etc., from gases or vapours Soc. C. Menzel. Fr. Pat. 404,255, June 21, 1909.

The scrubber comprises a vertical cylindrical casing divided into superposed compartments by a series of conical partitions, the angle of the cone being about 120°. These partitions are perforated with rectangular openings, about 8 mm. by 2 mm., the metal being cut along three sides of the rectangle and then bent back so as to form a blade or wing. Immediately above each of these partitions is a similar perforated plate mounted on a central spindle and rapidly rotated. The rotation may be effected by the pressure of the gases against the blades on the perforated plates. The lowest of the rotating plates may have a cylindrical extension provided with turbine-blades adjacent to a jet in the casing. Means are provided for adjusting the rotating spindle vertically, so as to regulate the distance between the fixed and rotating plates. The several compartments are provided with drain-pipes for the separated liquor.—A. T. L.

Tar; Separation of —— from hot distillation gases. Dr. C. Otto und Co. Fr. Pat. 404,569, June 30, 1909. Under Int. Conv., Dec. 22, 1908.

The process consists in washing the gas with tar or gas-liquor, the temperature of which is not allowed to exceed 80° C. The gas may be cooled before washing, so that the stated temperature cannot be exceeded, or the desired limitation of the temperature may be effected by using a sufficient quantity of tar or liquor; or liquor may be added as required.—A. T. L.

Radio-incandescence bodies; Manufacture of material for ——. E. Gossieaux. Fr. Pat. 404,992, July 10, 1909.

The incandescence body consists of asbestos threads treated with suitable salts, supported on a suitable framework of metal, preferably nickel. The asbestos thread may be passed through perforations in a thin metal plate so as to lie partly along each surface of the plate, or it may be interwoven in a coarse metal gauze. The asbestos thread may be treated before or after it is mounted on the metal support, a suitable solution consisting of cerium nitrate, 30 grms., aluminium nitrate, 10 grms., zirconium nitrate, 5 grms., lanthanum nitrate, 5 grms., dissolved in 50 grms. of water.—A. T. L.

Electric incandescent metal filament lamps; Manufacture of ——. H. Hirst, and Wolfram (Tungsten). Metal Filament Lamps, Ltd., London. Eng. Pat. 142, Jan. 4, 1909.

The invention consists in joining the leading-in wires to the filaments by means of the phosphides of copper, manganese, cobalt, chromium, molybdenum, tungsten, gold, or platinum in their molten state. The phosphides are prepared by heating the metals with amorphous phosphorus in an indifferent atmosphere, or by reducing phosphates by heating them with carbon. These metallic phosphides have a low melting point, are good conductors, and resist oxidation. The finely divided phosphides are made into a paste with water or a volatile liquid, such as pseudocumene. The paste is applied to the junction of the filament in such quantity that the final joint will have the desired size. The filament carriers thus prepared are, after drying, inserted in a glass jar containing an indifferent or reducing gas, where the melting of the paste is effected electrically. It may also be carried out in a current of air or non-inflammable gas, whereby any disadvantageous overheating of the joint can be avoided by regulating the current of air or gas.—G. W. McD.

Electrodes for arc lamps. G. Senftner, Berlin. Eng. Pat. 8150, April 5, 1909. Under Int. Conv., April 14, 1908.

Pyrophoric metal alloys, such as are described in Eng. Pat. 16,853 of 1903 (this J., 1904, 716, 484) when used either alone as electrodes, or added to a carbon electrode, produce a very intense arc light. A suitable alloy consists of iron (30 parts) and cerium or lanthanum (70 parts). The same alloy may also be advantageously used for cored electrodes.—G. W. McD.

Electrodes arc lamps; Method of producing the ——. G. Senftner, Berlin. Eng. Pat. 8151, April 5, 1909. Under Int. Conv., Dec. 17, 1908.

Instead of first producing a pyrophoric alloy and then adding it to the carbon electrode (see preceding abstract), the desired results can be obtained more simply and inexpensively by adding the constituents of the alloy to the carbon. The passage of the current through the electrode causes the formation of the alloy, which then acts to produce the increased illumination.—G. W. McD.

Graphite conductors [for electric incandescence lamps]; Manufacture of ——. Cie. Franç. pour l'Exploitation des Proc. Thomson-Houston. First Addition, dated July 3, 1909, to Fr. Pat. 380,378, July 30, 1907 (this J., 1908, 16).

Instead of using graphite obtained by heating lampblack in an electric furnace, as described in the principal patent, a form of graphite similar to that which forms the surface layer of a "metallised" carbon filament is employed. This is obtained by heating a very thin carbon filament, which may be of ribbon form, for a long time in hydrocarbon vapours, so as to obtain a thick deposit of carbon. The binding agent preferred consists of cadmium, 42 per cent.; mercury, 53 per cent.; and bismuth, 5 per cent. The addition of a small quantity of platinum and of potassium is advantageous.—A. T. L.

Filament of metallic tungsten for electric incandescence lamps. C. H. Weber. Fr. Pat. 405,041, July 13, 1909. Under Int. Conv., July 15, 1908.

See Eng. Pat. 16,328 of 1909; this J., 1910, 145.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Patents.

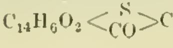
Hydro-aromatic β-ketonecarboxylic esters; Process for preparing α-monohalogen substitution products of ——. A. Kötz. Ger. Pat. 215,423, Nov. 16, 1907.

By treating hydro-aromatic β-ketonecarboxylic esters with halogens or other halogenating agents, α-monohalogen substitution products are obtained.—T. F. B.

Chloro- and bromo-anthraquinonesulphonic acids; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 216,071, Sept. 21, 1907.

Anthraquinonesulphonic acids are converted into their chloro- or bromo-derivatives by treatment with chlorine or bromine or substances which produce chlorine or bromine, in presence of concentrated sulphuric acid or sulphuric acid containing anhydride.—T. F. B.

Anthraquinone series; Process for preparing compounds of the —— containing sulphur. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 216,480, April 7, 1908.

Thiosalicylic acid or one of its derivatives is condensed with a halogen derivative of anthraquinone, and the product, *e.g.*, $C_{14}H_7O_2.S.C_6H_4.COOH$, treated with dehydrating (condensing) agents, when compounds of the type  $C_{14}H_6O_2 <^{S}_{CO}> C_6H_4$, are obtained.—T. F. B.

Thiophenolcarboxylic acids ; Process for preparing o- and peri- ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 216.269, June 26, 1908.

When *o*- or *peri*-cyanoarylsulphinic acids or their salts (obtained by reducing cyanoarylsulphochlorides with zinc dust and water) are treated with acid reducing agents until evolution of nitrogen has ceased, the corresponding thiophenolcarboxylic acids are obtained, the nitrile group being hydrolysed at the same time as the sulphinic group is reduced.—T. F. B.

Anthranilo-diacetic acid and its derivatives ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 216.749. Dec. 13, 1908.

Anthranilic acid is treated with at least two mols. of formaldehyde, and the products are treated with 2 mols. of hydrocyanic acid or a cyanide (with or without the intermediate preparation of an *ω*-sulphomethyl compound). The *a*-dicyanodimethylanthranilic acid is then converted into anthranilo-diacetic acid, $HO.CO.C_6H_4.N(CH_2.COOH)_2$, by saponification. The same process may be applied to the preparation of derivatives of anthranilo-diacetic acid from derivatives of anthranilic acid substituted in the nucleus. The products serve for the preparation of indigo dyestuffs.—T. F. B.

Tar ; Separation of —— from hot distillation gases. Fr. Pat. 401,569. *See* III.

IV.—COLOURING MATTERS AND DYES.

Patents.

Trisazo dyestuffs ; Production of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8144, Apr. 5, 1909.

The process consists in combining the diazo compounds of mono-acidylmetadiamines of the benzene series with aminonaphtholsulphonic acids, eliminating the acidyl radical from the products, tetrazotising the resulting azo-compounds, and combining the tetrazo compounds thus produced with two molecules of metadiamines of the benzene series or of their derivatives. The shades obtained from the new dyestuffs thus produced are fast to acids and alkalis. They can be further combined with diazo compounds and if the reaction is carried out on the fibre, the shades become deeper and fast to washing. Example:—The diazo compound from 15 parts of acetyl-*m*-phenylenediamine is introduced into an alkaline solution prepared by dissolving 24 parts of 2-amino-8-naphthol-6-sulphonic acid in an aqueous solution of 36 parts of sodium carbonate. After combination is complete, the product of the reaction is heated to boiling, and the acidyl group is then eliminated by heating the mixture for an hour to boiling with a 35 per cent. solution of sodium hydroxide. The excess of alkali is afterwards neutralised with hydrochloric acid, and the diamine thus obtained is cooled and tetrazotised with 30 parts of hydrochloric acid (20° B.) and 15 parts of nitrite. The mixture is stirred for 4 hours and then added to a cooled solution of 21·6 parts of *m*-phenylenediamine containing 30 parts of sodium carbonate. After an hour the product is filtered off and dried. It dyes cotton deep reddish-brown shades.—P. F. C.

Dyestuffs of the diphenylnaphthylmethane series ; Chrome ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 404,800, July 6, 1909. Under Int. Conv., Oct. 21, Nov. 17, and Dec. 17, 1908.

In the preparation of chrome diphenylnaphthylmethane dyestuffs as described in Ger. Pat. 216,305 of 1908 (this J., 1909, 1309), the carboxylic-sulphonic acids of hydroxynaphthaldehydes may be employed on the one hand, and phenols on the other hand. After chroming on the fibre, fast shades ranging from red to violet are obtained.—T. F. B.

Dyestuffs of the diphenylnaphthylmethane series ; Process for preparing chrome, acid ——. Farbenfabr. vorm. F Bayer und Co. Ger. Pat. 216,921, Nov. 29, 1908. Addition to Ger. Pat. 216,305, Oct. 22, 1908.

Aldehydo-hydroxybenzoic acids or their derivatives are condensed with hydroxycarboxylic acids of the benzene or naphthalene series to form leuco-compounds, which are subsequently oxidised to dyestuffs as in the principal patent (see this J., 1909, 1309 ; also Fr. Pat. 401,800 ; preceding). The new dyestuffs give violet to blue shades when chromed.—T. F. B.

Anthracene dyestuffs ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 216,773, Dec. 8, 1908. Addition to Ger. Pat. 195,139, March 5, 1907.

1.4-Dihalogenanthraquinonesulphonic acids are treated with primary or secondary aliphatic amines in presence of copper or copper compounds. The dyeings produced by the resulting products are clear blue (cf. Fr. Pat. 384,471 of 1907 ; this J., 1908, 142).—T. F. B.

Monoazo dyestuffs ; Process for preparing mordant ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 216,812, Dec. 12, 1908. Addition to Ger. Pat. 215,264, Oct. 13, 1908. (See Fr. Pat. 401,092 of 1909 ; this J., 1909, 1082.)

Diazotised *o*-chloro-*p*-nitraniline is combined with *o*- or *p*-cresotinic acid ; the dyestuffs produced are redder in shade, when chromed on wool, than those from the chloronitraniline and salicylic acid.—T. F. B.

Dehydroindigo, its homologues and substitution products ; Process for preparing ——. L. Kalb. Ger. Pat. 216,889, Aug. 4, 1908.

Dehydroindigo or its homologues or derivatives are obtained from indigo or its homologues or derivatives by treating the latter, in absence of water, with oxidising agents such as silver oxide, lead dioxide, manganese dioxide, or permanganate, either in presence of an indifferent solvent or suspending agent, or in presence of a small quantity of an anhydrous acid and a dehydrating agent. Another process consists in heating indigo or its derivatives with chlorine or bromine and a substance which will unite with the acid formed, in presence of an indifferent solvent or diluent (excluding water). The salts of dehydroindigo, such as the diacetate (oxyacetoindigotin) are converted into dehydroindigo by heating with an indifferent solvent, with or without a substance which will combine with the acid. (See this J., 1909, 1189 and 1192.)—T. F. B.

Anthracene derivatives [dyestuffs] ; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2702, Feb. 4, 1909.

See Fr. Pat. 400,653 of 1909 ; this J., 1909, 1029.—T. F. B.

Azo dyestuffs ; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4768, Feb. 26, 1909.

See Fr. Pat. 402,126 of 1909 ; this J., 1909, 1191.—T. F. B.

Sulphurised [sulphide] dyestuffs ; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 8677, April 10, 1909.

See U.S. Pats. 934,302 and 934,303 of 1909 ; this J., 1909, 1082.—T. F. B.

Monoazo dyestuff for chrome-mordanted wool ; Process for producing a ——. Act.-Ges. f. Anilinfabr. First Addition, dated June 16, 1909, to Fr. Pat. 401,092, March 22, 1909.

See Ger. Pat. 216,812 of 1908 ; preceding.—T. F. B.

Vat [thioindigo] dyestuffs ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on Maine, Germany. Eng. Pat. 16,996, July 21, 1909. Under Int. Conv., July 22, 1908.

See Ger. Pat. 216,224 of 1908 ; this J., 1909, 1310.—T. F. B.

Vat [thioindigo] dye and process of making same. A. Schmidt and E. Bryk. Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 947,030, Jan. 18, 1910.

SEE Ger. Pat. 216,224 of 1908; this J., 1909, 1310.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Textile materials; Determination of grease in ——. H. P. Pearson. J. Soc. Dyers and Col., 1910, 26, 6—7.

ZINC and aluminium chlorides, ferric chloride and stannous chloride being all soluble in dry ether, it is necessary to take steps to eliminate them in estimating grease in textile fabrics by extraction with ether.—H. P. P.

Sulphite wood pulp; Red coloration of ——. Legrand. La Papeterie; through Papierfabrikant, 1910, 9, 32—33.

THE author deals with the tendency which is shown by unbleached sulphite wood pulps to turn reddish in colour during their manufacture into paper. He regards this reddening as due to the oxidation of residues of the "incrusting" matters of the wood, possibly of a resinous nature. The tendency is greater the lower the degree of purification effected by the digestion process, and is generally less marked in the case of pulps prepared by the high-temperature Ritter-Kellner process, than in the case of Mitscherlich pulps digested at lower temperatures. The pulp generally preserves its normal colour whilst stored in bales, but as soon as the bales are brought into the paper mill, where the air is impregnated with acid vapours, the red colour develops. For many purposes a hard, low-digested pulp is necessary, and such pulps when used in the unbleached condition are liable, for the above reasons, to give great variations in the shade of the paper during manufacture. A most striking improvement may be effected in such cases by toning the pulp with a very bright yellow or pale green dyestuff, which has the effect of neutralising the red tint and giving a matt-white paper. —J. F. B.

Paper; Determination of the hardness of sizing of ——. L. Kollmann. Zentr. œsterr.-ungar. Papierind., 1909; through Papierfabrikant, 1909, 8, 1314—1317; 1910, 9, 7—10, 26—32.

IN a previous paper (this J., 1906, 905), the author proposed a method for testing the hardness of sizing of paper by placing a drop of phenolphthalein solution on one side and a drop of sodium hydroxide solution on the other side of the paper, and noting the time which elapses before the first signs of a pink coloration appear. The author now defends this method against criticisms by Klemm and Herzberg. First, as regards the specific solvent action of the reagents on the rosin size, the author contends that this is immaterial, since the time required for the meeting of the two reagents must be proportional to the resistance offered by the paper to the penetration of any liquid, whether solvent or indifferent. Although the author has tried a large number of other colour reactions on the same principle, he found none which was so delicate or which appeared so sharply as the pink coloration adopted. The order of the application of the drops and the side of the paper to which each is applied should be constant for comparative series of tests, since the alkali penetrates far more rapidly than the indicator, and the top side of the sheet is more resistant than the under (wire) side. The standard procedure is to apply the drop of phenolphthalein, turn the frame on which the paper is stretched, apply the drop of sodium hydroxide, simultaneously starting the stop-watch, turn the frame back again and observe the first appearance of the pink stain from the side on which the phenolphthalein was placed. Owing to the vastly superior penetrative power of the alkali, the time which elapses between the placing of the drops whilst turning the frame, has no influence on the results within reasonable limits. This method possesses the advantage over the various "ink methods," advocated by the author's critics, in the fact that the results are expressed in sharp numerical terms, and the variations due to the variable composition of different inks are avoided. The author has carried out a large number of tests which show that the numerical classification afforded by his method is in substantial agreement with the general classification obtained by the older methods.—J. F. B.

Pollution by sulphate wood-pulp mills. *See* XIXB.

PATENTS.

Artificial silk; Improving the elasticity and resistance to water of ——. J. Gebauer. First Addition, dated June 27, 1909, to Fr. Pat. 403,264, May, 22, 1909 (this J., 1909, 1311).

ALBUMIN is now used along with the caoutchouc, which, according to the chief patent, was added to the spinning solution. The albumin is coagulated by the heating produced in the passage of the material through the orifice, so that no extra treatment is required. Egg-, blood- or vegetable albumin may be used.—S. H. H.

Artificial silk; Process for producing threads of ——. H. Luxburg, Stettin, Germany. Eng. Pat. 1407, Jan. 20, 1909.

SEE Fr. Pat. 398,424 of 1909; this J., 1909, 880.—T. F. B.

Paper having relief effect; Process for making —— on the paper machine. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated June 26, 1909, to Fr. Pat. 389,892, May 4, 1908. Under Int. Conv., July 20, 1908.

SEE Eng. Pat. 15,555 of 1909; this J., 1910, 17.—T. F. B.

Producing continuous thin sheets of gelatin, celluloid, etc. Fr. Pat. 404,795. *See* XV.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Indigo White; Condition of —— in aqueous solution. E. Knecht and J. P. Batey. J. Soc. Dyers and Col., 1910, 26, 4—5.

P. FRIEDLAENDER ("Indigenoid dyestuffs," Seventh Int. Congr. Appl. Chem., London, 1909) has ascribed the dyeing of cotton in the indigo vat to the adsorption of the colloidal Indigo White by the colloid substance of the fibre. The authors have previously shown (this J., 1909, 697) that certain typical dyestuffs exist in solution as crystalloids and not as colloids, and they now show that the molecular weight of the calcium salt of Indigo White in aqueous solution is between 329 and 437 as determined by the boiling point method. Moreover, a solution of the sodium salt of Indigo White, prepared by digesting a large excess of crystallised Indigo White with less than the calculated quantity of pure caustic soda, and filtering (the whole process being conducted in an atmosphere of hydrogen) is a strong electrolyte.—A. S.

PATENTS.

Washing and other treatment of fibrous material and apparatus therefor. T. J. Hutchinson, Manchester, and United Railway and Trading Co., Ltd., London. Eng. Pat. 23,655, Nov. 5, 1908.

THE material after digesting in a mild alkaline solution, is drained and then lifted by forks arranged upon a travelling conveyor belt and delivered to squeezing rollers disposed above the front edge of the first of a series of rooted-in washing tanks. The liquid expressed by the rollers may be led away by a channel. The squeezed material is subjected inside the tank to the action of two beaters which rotate rapidly in opposite directions upon the same vertical axis, and are arranged to intermesh or closely pass each other. Near the rear end of the tank is a partition which does not extend to the bottom, but allows the partly washed material which has left the range of the beaters to travel underneath it and upwards through the washing liquor to a second pair of squeezing rollers. These rollers deliver the material into a second tank similar to the first, and the same process is repeated. The squeezing rollers of the last tank of the series are disposed so as to deliver the material on to an endless belt, which passes round the lower roller and also round the lower roller of an additional pair of squeezers. This belt, which is perforated to assist drainage, is made to run underneath a rapidly rotating drum provided with projecting pegs, which engage with the material on the belt and spread it out in a more even sheet, which is afterwards conveyed to a drying machine. —P. F. C.

Bleaching cotton and other vegetable fibres. F. Hardman, Radcliffe, and F. Edmondson, Birkdale, Lancs. Eng. Pat. 28,042, Dec. 24, 1908.

In order to dispense with the usual expensive system of treating in steam-heated kiers, it is proposed to treat the goods in a simple washing machine with cold caustic soda solution of 4—6° Tw. containing a small proportion of castor oil which has been made soluble by treatment with sulphuric acid and washing with brine.—H. P. P.

Mercerised cotton goods; Treatment of ——. Chem. Fabr. Griesheim Elektron, Frankfurt a/M., Germany. Eng. Pat. 11,729, May 18, 1909. Under Int. Conv., Oct. 19, 1908.

It has been proposed previously (see Fr. Pat. 308,238 of 1901; this J., 1902, 50) to add 5 to 10 grms. of sodium acetate per litre of the acetic acid bath to prevent the tendering of mercerised cotton fabrics which have been dyed with sulphide colours and afterwards worked in consecutive soap and acetic acid baths to give them a a silk-like scroop. This addition however detracts from the silky scroop. It is now claimed that an acid bath composed of 5 grms. of tartaric acid and 25 grms. of sodium tartrate per litre, or of 5 grms. of lactic acid and 15 grms. of sodium lactate per litre, produces a very good silky scroop and at the same time prevents equally well the eventual liberation of sulphuric acid from the dyestuff, to which the tendering is due.—H. P. P.

Silk for dyeing or other operations; Preparation of ——. M. Stine. Fr. Pat. 404,862, July 8, 1909.

0·75 c.c. of Turkey-red oil are dissolved in a litre of water, 0·075 c.c. of ammonia and 0·75—1·5 grm. of sodium carbonate are added, and the solution is heated nearly to the boil. The silk is treated with this solution for about twenty minutes, and may afterwards be dyed without washing or drying. If the material be hydro-extracted after the above treatment, the expressed liquor if rendered slightly acid with sulphuric acid is valuable as an addition to the dye-bath, since it contains in solution the sericin which has been dissolved from the silk.—P. F. C.

Hank dyeing machine; Automatic skein or ——. T. D. Garscadden and H. Ingram, Kidderminster. Eng. Pat. 625, Jan. 11, 1909.

At the ends of a rectangular dye-vat are fitted iron uprights, to which, immediately above the liquor, a frame carrying the dye sticks is attached. The sticks are fixed in hollow cylinders running in bearings on either side of the frame, and which by means of teeth round the periphery, engage with one another, forming a train of wheels. The cylinders at either end of the frame engage with pinions, actuated by racks cut in long rectangular counterpoise weights. These weights are suspended from chains running over wheels fixed to the tops of the iron uprights. To the wheels are fastened pinions gearing into a horizontal rackwork which is moved backwards and forwards by means of a cam driven by shafting. The vertical racks are thus caused to alternately rise and fall, raising and lowering the yarn, while imparting to the dye-sticks a rotary and "sousing" motion. Arrangements are made for lowering or raising the framework containing the yarn in or out of the dye-vat, and for keeping the yarn from floating.—J. L. H.

Dyeing. F. H. Daniell, Franklin, and J. C. Hebden, Providence, R.I. U.S. Pat. 942,166, Dec. 7, 1909.

The yarn is wound on to hollow bobbins, one end of each bobbin being tapered and the other end hollowed out to correspond with the tapered end. The bobbins are arranged in series, with the tapered end of one fitting into the cavity of the next. The ends of the series are then pressed together so as to compress the yarn into a continuous mass, and the dye-liquor is forced through the mass.—H. P. P.

Dyeing fabrics; Machines for ——. Vulliod, Ancel et Cie. Fr. Pat. 405,069, July 12, 1909.

In order to equalise the rate of dyeing of pieces on a jigger, the machine is provided with devices whereby the duration of the immersion of the fabric in the dye-liquor is prolonged as the concentration of the bath decreases. This is effected either by gradually diminishing the velocity of the cloth, or by increasing the time of immersion in the dye-liquor.—P. F. C.

Dyeing and printing; Process for ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 3055, Feb. 8, 1909.

Claim is made for the dyeing and printing of cotton wool and silk fibres with acidyl compounds of amino-anthraquinones or derivatives thereof (see this J., 1909, 1079; 1910, 81). Dyeing and printing are effected in the well-known manner from an alkaline hydrosulphite vat or by means of "Rongalite" respectively. The shades obtained from a number of acidyl compounds are described.—J. L. H.

Vat dyestuffs; Resists for ——. Farbenfabrik. vorm. F. Bayer und Co. Fr. Pat. 405,151, July 16, 1909. Under Int. Conv., Aug. 24, 1908.

A resist containing sulphur and also either a sulphide dyestuff or a vat dyestuff or a mixture of the two, is printed on the material. A suitable printing colour containing indigo or some other vat dyestuff or mixtures of such dyestuffs is next applied to the fabric and the colours are developed in the usual manner. At the places where the resist has been printed the fixing of the indigo or other printed colour is prevented by the action of the sulphur. The dyestuff contained in the resist however is fixed by the joint action of the sulphur with the alkali contained in the printing colour.—P. F. C.

Printing fabrics; Machine for ——. D. Tarpent, dit Terpent, and M. Garaude. Fr. Pat. 405,256, July 20, 1909.

A roller provided with a doctor carries the printing colour to two gelatin rollers which transfer it to a metallic printing roller having a smooth surface. This printing roller is provided with a doctor of square section, which has serrated edges, the serrations being spaced according to the effects desired. When this doctor is placed in position, it removes the printing colour from the cylinder in those places which come in contact with the teeth, so that a line effect is produced on the fabric. Wavy lines are produced if a to and fro motion is imparted to the doctor.—P. F. C.

Silk threads; Process for lustering ——. E. Pohl, New York. U.S. Pat. 947,027, Jan. 18, 1910.

The silk yarn is dipped in a finishing solution, partially dried, and then ironed. The density of the finishing solution and the time of immersion vary according to the thickness of the yarn. The drying takes place until the yarn is "90 per cent. dry."—S. H. H.

Bleaching cotton and other vegetable fibres, either raw or in the form of threads or fabrics. F. Hardman and F. Edmendson. Fr. Pat. 404,497, June 26, 1909. Under Int. Conv., Dec. 24, 1908.

See Eng. Pat. 28,042 of 1908; preceding.—T. F. B.

Brown shades on vegetable fibrous material; Production of ——, with or without white or coloured discharge effects. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,189, April 29, 1909.

See Addition of May 1, 1909, to Fr. Pat. 357,472 of 1905; this J., 1910, 19.—T. F. B.

Production of chlorine gas. Eng. Pat. 3395. *See* VII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Soda lakes; East African ——. Chem.-Zeit., 1910, **34**, 103.

It now appears certain that the recovery of soda from the soda lake at Magadi in the East Africa Protectorate will be undertaken, recent experiments having given good results. The lake is about 93 miles from the Ku station on the Uganda railway. The proposed railway between Ku and Magadi will have an important bearing on the question of the working of the soda lake in German East Africa, which is only about 31 miles from the English lake, and is four times as large as the latter.

Carbon tetrachloride; Action of the vapour of ——, on anhydrides and oxides. P. Camboulives. Comptes rend., 1910, **150**, 157—177.

The reaction between the vapours of carbon tetrachloride and most anhydrides and oxides furnishes a good general method of preparing metallic chlorides. The oxide placed in a boat in a Bohemian glass tube is heated (after displacement of all the air) in a current of the tetrachloride vapour. The beginning of the reaction is indicated by incandescence, copious disengagement of carbon oxychloride, changed appearance of the substance, or by the appearance of vapours of volatile chloride. The temperature required is usually low, varying between 215° C. (niobic anhydride) and 580° C. (chromium oxide). A chloride is almost always obtained, the formation of an oxychloride being exceptional. Chlorides are obtained from the following:—Oxides of barium, strontium, calcium, cerium, lanthanum, neodymium, praseodymium, samarium, beryllium, magnesium, zinc, zirconium, cadmium, aluminium, cobalt, nickel, iron, manganese, and chromium, and tantalic and titanic anhydrides. An oxychloride is obtained from tungstic anhydride and a chloride and oxychloride from thorium oxide and niobic anhydride. Antimonic and molybdic anhydrides yield pentachlorides, arsenious and antimonious anhydrides trichlorides. Tetrachlorides are obtained from stannic oxide and vanadic anhydride. Uranium oxide yields both a tetra- and a pentachloride. Silicic and boric anhydrides are not attacked. Carbonic anhydride and carbon oxychloride are formed in nearly all the reactions, and chlorine is produced at a high temperature. The reaction can be applied in the examination of certain minerals.
—A. Sbld.

Sapphires; Synthetical production of ——, by fusion. A. Verneuil. Comptes rend., 1910, **150**, 185—187.

By fusing alumina containing 1·5 per cent. of magnetic oxide of iron and 0·5 per cent. of titanic oxide with the oxy-hydrogen blowpipe, sapphires were obtained, possessing the fine blue colour, crystalline structure, and optical properties of the natural stone. The proportions have to be varied according to the time taken for fusion, and the operation is a difficult one. Experiments made without titanic oxide were unsuccessful.—A. Sbld.

Cerium; Substitution of bromine and of iodine for chlorine, in the separation of —— from the other cerium earths. P. E. Browning and E. J. Roberts. Amer. J. Science, 1910, **29**, 45—46.

In Mosander's process (J. prakt. Chem., **30**, 267) for the separation of ceria from allied earths, chlorine gas is passed into a mixture of the hydroxides suspended in excess of a solution of alkali hydroxide. The ceric hydroxide remains undissolved, whilst the other hydroxides pass into solution. It is necessary to repeat the process in order to effect a complete separation. Experiments showed that by using bromine instead of chlorine, about 50 per cent. of the other allied earths can be separated from ceric hydroxide by a single treatment, and that practically complete separation can be effected by three treatments. The action of iodine is similar, but is too incomplete to be of practical value.—A. S.

Hydrogen peroxide; New reagent for ——. K. Charitschkoff. Chem.-Zeit., 1910, **34**, 50.

The reagent employed consists of the cobalt salts of the naphthenic acids obtained from the waste liquors from the refining of petroleum with alkali. This mixture of salts is pinkish-red in colour but in presence of hydrogen peroxide is converted into a dark drown or olive-green substance. In carrying out the test, a strip of filter paper saturated with a solution of the cobalt salt in petroleum spirit, and dried, is moistened with the liquid under examination; in the presence of hydrogen peroxide, the colour immediately changes to olive-green. This reaction is said to be more sensitive than the chromic acid test; 0·03 per cent. of hydrogen peroxide can readily be detected. Ozone has no effect upon the colour of the test strip.
—E. W. L.

Percarbonates. S. Tanatar. Ber., 1910, **43**, 127—128.

The distinction drawn by Riesenfeld and Reinhold (this J., 1910, 21), between true percarbonates and carbonates with hydrogen peroxide of crystallisation, is a false one. The percarbonate solutions prepared by their method contain, besides hydrogen peroxide, alkali bicarbonate, which does not react with iodine: those prepared by the author's method contain normal carbonate, with which the liberated iodine at once reacts, producing hypoiodite, which again by reaction with hydrogen peroxide, liberates oxygen.—J. T. D.

Calcium carbide; Action of water of crystallisation on ——. I. Masson. Chem. Soc. Proc., 1910, **26**, 6.

On mixing excess of powdered calcium carbide with powdered crystalline hydrates, generation of acetylene takes place with great velocity, in some cases at laboratory temperature, in others at higher temperatures. The volume of gas can, after standardisation, be used as a measure of the amount of dehydration. Of twenty-two hydrated salts examined, many were rendered anhydrous, whilst others formed stable lower hydrates, some of which have not previously been recorded. When ammonium salts are dehydrated with calcium carbide, it is found that in most cases no ammonia is liberated, even at 160° C., and in spite of the presence of calcium hydroxide. Crystalline acids and acid salts do not react as acids on the carbide or hydroxide.

Phosphorus-sulphur compounds. V. Tetraphosphorus trisulphide. A. Stock. Ber., 1910, **43**, 150—157.

None of the methods given in chemical literature for the preparation of this substance yields the pure compound. The author prepares it by heating a mixture of amorphous phosphorus and sulphur (in the proportions $P_5 : S_3$) till reaction begins, then after reaction is complete, heating till distillation begins. The whole of the sulphur is thus converted into trisulphide, which is separated from the surplus phosphorus, after cooling, by means of carbon bisulphide, in which it is very soluble. The product is boiled for some time with water, which decomposes any other phosphorus sulphides present, and the trisulphide is again separated by means of carbon bisulphide. The solid left after evaporation of the solvent is extracted with boiling benzene, and crystallises out on cooling as pure trisulphide, P_4S_3. The best criterion of its purity is the melting-point, 171°–171·5°–172·5° C. (see this J., 1909, 705); it boils under 760 mm. pressure at 407°—408° C. Its density is 2·03 at 17° C. It undergoes slight decomposition at its melting-point, but even at its boiling-point the speed of dissociation is very low. It is decomposed by boiling with potassium hydroxide solution, evolving mixtures of hydrogen and phosphine, but the reaction is very complex.—J. T. D.

Selenium plates; Crystallisation of thin ——. W. S. Gripenberg. Physikal. Zeits., 1909, **10**, 957. Chem. Zentr., 1910, **1**, 379.

Thin plates of crystalline selenium, sensitive to light, are best prepared in the following manner:—A deposit of selenium is produced on a microscope cover-glass by sublimation, a piece of plate-glass, 2 mm. thick and about four times the size of the cover-glass, is placed on the latter, and the two are pressed together in a press provided with an opening in the middle. The cover-glass is then heated strongly, by means of a micro-burner, to such a degree that the temperature of the piece of plate-glass rises a little above the melting point of selenium. It is stated that the crystalline selenium produced on cooling, adheres firmly to the cover-glass and separates easily from the piece of thicker glass.—A. S.

Ionium. B. Keetman. Jahrb. Radioaktivität u. Elektronik, 1909, **6**, 265–274. Chem. Zentr., 1910, **1**, 243–244.

Ionium-thorium oxalate (see Marckwald and Keetman, Ber., 1908, **41**, 49), which can now be obtained commercially, has a strong and approximately constant radioactivity, and is thus well suited for testing electrometers and for other purposes where comparative measurements are necessary. It can also be used as an ioniser for Bronson resistances. The residues from Joachimsthal pitchblende contain only about 20 per cent. of the quantity of ionium corresponding to the uranium content of the ore; hence the larger portion of the ionium passes into the uranium liquors.—A. S.

Decomposition points of some sulphates in an air current. Landis. *See* X.

PATENTS.

Oxides of nitrogen; Process for the production of ——. O. Bender, Potsdam, Germany. Eng. Pat. 18,203, Aug. 6, 1909.

Coal, lignite, peat, or other suitable fuel, producing large quantities of water on combustion, is burnt in a gas-producer so as to yield producer-gas; or, steam is injected below the grate, so that water-gas or a mixture of water-gas and producer-gas is obtained. The gas is burnt immediately above the layer of fuel by means of oxygen or a mixture of oxygen and nitrogen, which is supplied in such a manner that a portion of the upper layer of fuel is caused to burn, in addition to the gas. The combustion and the supply of oxygen are so regulated that the combustion gases contain 20—40 per cent. of carbon dioxide and 10—20 per cent of oxygen. In order to prevent decomposition of the nitric oxide formed, the combustion gases are cooled by means of a system of pipes or the like, the cooling surfaces being so inclined that the condensed water from the steam in the combustion gases cannot flow back into the reaction-chamber. It is stated that the presence of water so facilitates the formation of nitric oxide, that a reaction product containing from 15 to 20 mgrms. of nitric oxide per litre of gas can be obtained.—A. S.

Nitrous gases; Method of producing ——. G. Pauling, Gelsenkirchen, Germany. Eng. Pat. 22,037, Sept. 27, 1909.

Dilute nitric acid is heated to a temperature at which it is decomposed into a mixture of nitrogen peroxide, oxygen, and water, and the products are rapidly cooled; a mixture of nitrogen peroxide and oxygen, nearly free from water, is thus obtained, from which concentrated nitric acid is readily prepared. The cooling may be brought about by the addition of cold air or other indifferent gas to the vapours.—F. Sodn.

Oxides of nitrogen; Apparatus for the manufacture of —— *by means of the electric arc projected in a mixture of nitrogen and oxygen.* Le Nitrogène, Soc. Anon. Fr. Pat. 404,230, June 19, 1909. Under Int. Conv., June 23, 1908.

In apparatus for the production of oxides of nitrogen by means of the electric arc, it is proposed to overcome the want of stability of the arc by protecting the ends of the electrodes from the cooling action of the moving gas; this is done by introducing appropriately arranged shields of refractory insulating material to shelter the electrodes. The cathode only need be protected if a continuous current be employed.—F. Sodn.

Oxides of nitrogen; Process of recovery and utilisation of ——. P. A. Guye. Fr. Pat. 404,630, Oct. 24, 1908.

The process, which is based on the fact that many organic solvents readily dissolve oxides of nitrogen (nitrous anhydride and nitrogen peroxide), consists in recovering these oxides from mixtures containing air or other indifferent gas by bringing the mixture into contact with such a solvent in a suitable apparatus and at an appropriate temperature and pressure, the solution being subsequently treated, if desired, by oxygen (air) or nitric oxide, in order to convert the dissolved oxide entirely into nitrogen peroxide or trioxide respectively; the solutions thus obtained are claimed as new products. Suitable indifferent solvents are chloroform, carbon tetrachloride, ethyl bromide, chloro- and bromo-benzene, a solution of nitronaphthalene in nitrobenzene, etc., and the gases may be recovered from solution by distillation or crystallisation of the solvent. In some cases solvents which react with the gases are to be preferred, the solutions being directly useful. In order that metal apparatus may be employed, the gases are dried by means of sulphuric acid charged with nitrous fumes, before absorption. Solvents with low boiling points are unsuitable, if the oxides of nitrogen are diluted with much air.—F. Sodn.

Nitric acid of about 65 per cent. strength; Process for preparing —— *by the absorption in water of oxides of nitrogen mixed with a gas containing oxygen.* Le Nitrogène, Soc. Anon. Fr. Pat. 404,720, July 3, 1909. Under Int. Conv., July 7, 1908.

Water is used to absorb the oxides of nitrogen produced in such a mixture as air, through the agency of the electric arc, but means are taken to ensure the previous drying of the gases, either before or after the formation of the oxides of nitrogen, by a dessicating agent or by refrigeration. The process may be realised by first cooling the gases coming from the arc, then aspirating them through one of two drying vessels, and finally through a series of absorption vessels, in which water passes in the opposite direction to the gas; from the first absorption vessel acid of about 65 per cent. strength is obtained, since the acid here comes in contact with dried gases only. When a drying vessel loses its efficiency, it is cut out from the system and revived by passing through it a portion of the uncooled gases, the contained water and acid being thus got rid of and carried forward to one of the absorption vessels receiving weak acid.—F. Sodn.

Acetic and formic acids [from sawdust]; Apparatus for separating ——. Comp. Industrielle des Alcools de l'Ardèche. Fr. Pat. 404,360, Oct. 16, 1908.

An apparatus is described for the elimination of acetic and formic acids and other volatile substances from

saccharified sawdust, so as to recover valuable products and prepare the material for subsequent fermentation. The sawdust is fed into a vessel, in the lower part of which is a "distributer," which brings it in contact with a powerful jet of high or low pressure steam: this carries the material through a pipe into the upper part of the vessel, from which, by reason of the sudden expansion of the steam and the presence of baffle-plates, the material falls back into the lower part of the vessel and goes through the cycle again, the steam carrying the volatile products to a saturator containing alkali. The process may be made continuous by causing the steam to carry the material to another vessel of a series, instead of into the same vessel again. Non-saccharified sawdust or wood-pulp may be treated in the same apparatus.
—F. Sodn.

Sulphuric acid; Process for supplying nitrous gases direct to the lead chambers employed in the manufacture of ——. N. Pozzati. Fr. Pat. 404,708, July 3, 1909. Under Int. Conv., July 7, 1908.

The nitrous fumes required in the manufacture of sulphuric acid are supplied directly to the lead chambers, instead of passing through the Glover tower, the losses in this tower being thus avoided. The gases pass from the generator, through a condensing vessel, to the suction apparatus supplying the first chamber, and air or sulphur dioxide or both may be admitted to the generator as required.—F. Sodn.

Ammonia; Process for manufacturing ——. F. W. Frerichs, St. Louis, Mo. U.S. Pat. 946,427, Jan. 11, 1910.

Commercial ammonium sulphate is purified by dissolving it in water, adding ammonia until the solution is alkaline, and then distilling, when any volatile carbon compounds and most of the nitrogenous organic compounds are eliminated. "Liquefied ammonia gas" may be freed from pyridine by adding water and distilling off the ammonia; pyridine and water are retained in the still.—F. Sodn.

Alumina; Process for the manufacture of pure ——. O. Serpek. Fr. Pat. 404,923, July 9, 1909. Under Int. Conv., April 10, 1909.

In this process pure alumina is obtained by heating bauxite or other raw material to a temperature at which impurities are volatilised, a current of air or other gas being maintained to completely carry away the volatile products. Or, carbon may be added and the heating effected in the presence of nitrogen or a gas rich in nitrogen, which, at a temperature above 1600° C., causes impurities to volatilise and gives aluminium nitride, the latter being transformed into pure alumina, with the liberation of ammonia as a valuable by-product, by treatment with water under pressure. If iron be present, it may be removed from the nitride by means of dilute acids or chlorine, or in other manner. Even clays may be economically treated by the process and give a product pure enough for use in the preparation of aluminium.—F. Sodn.

Alumina; Process of manufacture of ——. A. Simon and L. Pernot. Fr. Pat. 405,135, Nov. 6, 1908.

The process is divided into two stages, in the first of which a mixture of lime (55 parts), sodium chloride (116 parts), and bauxite (171 parts), or other mineral containing aluminium, is heated in the presence of steam and carbon dioxide, *e.g.*, on the hearth of a reverberatory furnace; this gives sodium aluminate, calcium silicate, and iron oxide, with the liberation of hydrochloric acid. The gases, containing hydrochloric acid, then pass into a retort containing a mixture of bauxite and charcoal, which may be heated in a contiguous chamber by gases from the furnace; chlorides of iron and aluminium are thus formed and are sublimed into a receiver. The sodium aluminate obtained in the first stage of the process is extracted with water, and this solution and the mixture of chlorides obtained in the second stage are treated by known methods for the separation of alumina, which is thus prepared free from iron and silica.—F. Sodn.

Potassium carbonate; Process for the transformation of the sulphates of potassium into ——. [Utilisation of vinasse.] J. Effront. Fr. Pat. 405,127, July 16, 1909.

The process is as follows:—Vinasse from beetroot or grain, or peat liquefied by the action of acid and pressure, is evaporated to a strength of 8°—12° B., and the liquid, after cooling to 40°—50° C., is neutralised and mixed with an excess of lime, to the extent of 150—300 grms. per 100 litres. The alkaline liquid is fermented, either by adding 1—5 per cent. of cultivated soil, or by sowing it with an active culture of putrefying or butyric ferments. The fermentation lasts 3—5 days, during which time the alkalinity is maintained at 3—5 grms. per litre and the temperature at about 40° C., and, when the fermentation is finished, 25—30 grms., per litre, of lime are added, and then to the clear filtered liquid, potassium sulphate, in the proportion of 25—33 per cent. of the quantity of lime present in the solution. The liquid is evaporated to 24°—26° B., calcium sulphate is separated, and the solution is treated in a furnace, yielding by calcination a salt rich in potassium carbonate. The sulphate precipitate is also calcined and lixiviated, to extract any potassium sulphate present.—F. Sodn.

Chlorine gas; Production of ——. F. W. Bartelt, Bristol. Eng. Pat. 3395, Feb. 11, 1909.

The process is for the generation of chlorine in small quantities as required, either alone or mixed with air, as a bleaching mixture for laundry use. For this purpose, water is allowed to drop at intervals upon a dry mixture of bleaching powder and crystals of an acid or an acid salt, 1 part of bleaching powder to 2 parts of sodium bisulphate being specially suitable. The apparatus preferably comprises a lower chamber, with detachable bottom, and an upper chamber, forming a stopper, a turn of which opens suitable passages for the admission of water from the upper to the lower chamber and for the entry of air if desired. The ingredients are introduced into the lower chamber in a removable tray.—F. Sodn.

Nitrogen and carbon dioxide; Process for obtaining —— from combustion gases. L. Gerstenberger. Fr. Pat. 404,690, July 2, 1909. Under Int. Conv., Sept. 8, 1908.

Combustion gases are led over a heated mixture of copper and copper oxide, in order to convert any unburnt gas into carbon dioxide and water and at the same time get rid of atmospheric oxygen. When the proportion of copper in the mixture becomes too small to be effective, a current of reducing gas is added to the combustion gas, so that copper oxide is reduced to the desired extent, without interfering with the combustion process and without preventing, therefore, the uninterrupted utilisation of the heat of combustion. After condensation of the water from the gaseous mixture produced, the nitrogen and carbon dioxide are separated by known methods.—F. Sodn.

Hydrogen; Process for the preparation of ——. Internat. "Wasserstoff" Akt.-Ges. Fr. Pat. 405,200, July 19, 1909.

The process consists in the alternate treatment of iron oxide by reducing gases and the oxidation of the reduced metal by steam, the raw material employed being iron pyrites waste, deprived of sulphur, arsenic, and zinc by roasting; this material is porous and refractory and, moreover, retains these properties after repeated use.
—F. Sodn.

Nitric acid; Process of and apparatus for concentrating ——. Aktiebolaget Swedish Nitric Syndicate, Stockholm. Eng. Pat. 10,592, May 4, 1909. Under Int. Conv., May 6, 1908.

See Fr. Pat. 402,079 of 1909; this J., 1909, 1197.—T. F. B.

Lactic acid; Process of manufacturing ——. W. Klapproth, Nieder-Ingelheim on Rhine, Germany. U.S. Pat. 947,078, Jan. 18, 1910.

See Eng. Pat. 7094 of 1909; this J., 1909, 674.—T. F. B.

Alkali chloride solutions ; Apparatus for the electrolytical decomposition of ——. J. J. Rink, Copenhagen. U.S. Pat. 947,741, Jan. 25, 1910.

See Fr. Pat. 365,838 of 1906 ; this J., 1906, 1053.—T. F. B.

Peroxide of hydrogen ; Method of making durable solutions of ——. J. Arndts, Paderborn, Germany. U.S. Pat. 946,529, Jan. 18, 1910.

See Ger. Pat. 196,370 of 1907 ; this J., 1908, 448.—T. F. B.

Zinc oxide ; Apparatus for the production of ——. W. and H. Simm, Portico. U.S. Pat. 946,688, Jan. 18, 1910.

See Eng. Pat. 21,787 of 1906 ; this J., 1907, 1151.—T. F. B.

Cuprammonium hydroxide ; Process of making solutions of ——. A. Lecoeur, Assignor to Soc. Anon. Le Crinoid, Rouen, France. U.S. Pat. 947,715, Jan. 25, 1910.

See Fr. Pat. 401,741 of 1909 ; this J., 1909, 1121.—T. F. B.

Solutions or pseudo-solutions of iron oxides and other substances usually considered insoluble ; Process and means for obtaining ——, for use in dyeing and for other purposes. Z. Cartwright. Fr. Pat. 405,068, July 13, 1909. Under Int. Conv., Nov. 18, 1908.

See Eng. Pat. 24,842 of 1908 ; this J., 1910, 24.—T. F. B.

Gases [oxygen] from solid materials ; Process for extracting ——. C. Ridley. Fr. Pat. 405,082, July 15, 1909. Under Int. Conv., July 15, 1908.

See Eng. Pat. 15,000 of 1908 ; this J., 1909, 884.—T. F. B.

Calcium carbide cartridges. A. Barnett. Fr. Pat. 405,085, July 15, 1909.

See Eng. Pats. 19,939 and 24,679 of 1908 and 2301 of 1909 ; this J., 1909, 1117.—T. F. B.

VIII.—GLASS ; CERAMICS.

Kaolin sandstone ; Use of washed Hirschau —— for glass and ceramic purposes. E. Plenske. Sprechsaal, 1910, **43**, 3—5, 19—21.

Kaolin-bearing sandstones are found in the Oberpfalz at Hirschau and at Kohlberg, the former being the more important deposit. Geologically it belongs to the upper new red sandstone. It is found on a southerly slope, and its length is 5 km., its breadth from 50 to 100 m., and its depth 40 m. The deposit, on which several companies are at work in the open, varies somewhat in composition, but may contain from 10—22 per cent. of kaolin. "Schlicker," a fine-grained felspar-sand containing kaolin, is obtained as a by-product. The washed kaolin-sandstone yields a kaolin, a felspar-sand, a quartz, and "Schlicker," their compositions being given by the following table :—

	Clay substance.	Felspar.	Quartz.
	per cent.	per cent.	per cent.
Raw kaolin-sandstone	19·5	19	61·5
Hirschau kaolin	87·01	9·73	3·26
,, felspar-sand	22·69	70·44	6·87
,, "Schlicker"	36·62	57·29	6·09
,, quartz sand.......	3·62	25·86	70·52

By substituting these materials for kaolin, spar and quartz already found in commerce, successful reproductions were made of a porcelain consisting of 50 per cent. of clay, 25 per cent. of felspar, and 25 per cent. of quartz, and also of a white enamel and a blue glaze for wrought iron, a bright green bottle-glass, pale, bright green, green, golden, brown, and black blown glass, medicine-bottle glass, plate glass, cast black glass, blown window glass, and opal glass.—H. H. S.

Bunzlau stoneware. W. Pukall. Sprechsaal, 1910, **43**, 1—3, 17—19, 33—35, 47—49.

In his experiments on crystalline glazes (Sprechsaal, 1908, **41**, Nos. 36—38) the author used Bunzlau stoneware as body. The present paper consists of a detailed account of the manufacture of Bunzlau stoneware. The clay used is found in the upper cretaceous sandstone, and contains 76·50 per cent. of clay-substance, 21·84 of quartz, and 1·66 of felspar. By adding spar and Hohenbocka sand, a body is made of the composition—clay, 45 ; quartz, 43 ; and felspar, 12 per cent. It is ground to pass a sieve of 200 meshes per inch, and then fired to cones 7—9, first in a reducing atmosphere, and then in alternately reducing and oxidising atmospheres. The result is a body of small expansion and low absorptive power, which can be used for art ware and for chemical stoneware. The following glazes were successfully applied to it. Brown underglaze with transparent over-glaze :—Under-glaze : 4·8 SiO_2, 0·7 Al_2O_3, 0·40 CaO, 0·12 MgO, 0·48 K_2O, with 5 per cent. of iron oxide and 1 per cent. of rutile ; over-glaze : 2·7 SiO_2, 0·3 B_2O_3, 0·10 Al_2O_3, 0·5 PbO, 0·15 K_2O, 0·15 Na_2O, 0·1 CaO, 0·1 BaO. A clear glaze, fired at cone 4, had the composition : 3·5 SiO_2, 0·4 Al_2O_3, 0·7 CaO, 0·2 K_2O, 0·1 MgO : and another, at the same temperature : 4 SiO_2, 0·5 Al_2O_3, 0·7 CaO, 0·3 K_2O. A durable glaze, free from cracks, was composed of : 7·1 SiO_2, 0·75 Al_2O_3, 0·25 CaO, 0·38 MgO, 0·37 K_2O. For enamel colours, the metallic oxides were fritted at cones 7—9 with a mixture of the composition : 2·5 SiO_2, 0·2 Al_2O_3, 0·7 PbO, 0·3 CaO. A white enamel glaze had the formula : 3 SiO_2, 0·18 Al_2O_3, 0·4 SnO_2, 0·5 PbO, 0·2 Na_2O, 0·4 K_2O. Matt glazes can be made from the three formulæ, 2·6 SiO_2, 0·54 Al_2O_3, 0·73 CaO, 0·27 K_2O ; 2·6 SiO_2, 0·7 Al_2O_3, 0·7 CaO, 0·3 K_2O ; 3·1 SiO_2, 0·96 Al_2O_3, 0·73 CaO, 0·27 K_2O. A crystalline glaze of especial value is obtained by adding 30 per cent. of iron oxide to the frit, 2·4 SiO_2, 0·6 B_2O_3, 0·1 Al_2O_3, 0·25 K_2O, 0·25 Na_2O, 0·25 CaO, 0·25 BaO, and firing at cone 4. The author states that the gold-spangled ware of the Rookwood Pottery in Cincinnati is made by firing the above baryta frit with 30 per cent. of iron oxide at cone 7, and then covering the cooled vase with a thin layer of a stoneware glaze containing 2·5—5 per cent. of copper oxide. Beside all the above glazes, Bunzlau stoneware will take salt-glaze well, owing to its high silica content.—H. H. S.

Fluorspar and its function in enamels. H. Tafner. Sprechsaal, 1910, **43**, 36—37.

The melting point of fluorspar has been given variously as 900° C., and as 1400° C. The author finds that artificial calcium fluoride and pure clear crystals of fluorspar melt at 1000° C., whilst opaque impure fluorspar melts at 1400°—1600° C. Fluorspar is usually regarded as insoluble in water, but if powdered and heated for a long time with distilled water, the filtrate gives a marked reaction with ammonium oxalate. Artificial calcium fluoride gives this reaction, but not so clearly, and the author states that the solubility and fusibility of fluorspar vary together. Enamels containing fluorspar or cryolite are not stable, as enamel and body attack each other with evolution of silicon tetrafluoride. An enamel containing 35—40 per cent. of cryolite melted in a platinum vessel at cone 010, but when burnt on bisque it became dull and opaque, and difficult to melt at cone 14. The cause was the volatilisation of silicon tetrafluoride, alumina being left as a refractory residue.—H. H. S.

Action of heat on aluminium in vacuo. Kohn-Abrest. *See* X.

Patents.

Clay ; Apparatus for cleaning and separating ——. M. Bohn. Nagykikinda, Hungary. Eng. Pat. 12,114, May 22, 1909.

The apparatus consists of a cylinder in which mixing and conveyor screws are made to rotate, so as to press the clay through sieves fitted in the wall of the cylinder. The conveyor is made in two or more parts which are operated separately, in such a manner that, near the inlet opening, it rotates more rapidly than further away, which secures more efficiency and preserves those portions of the conveyor which are in contact mainly with stones. In the apparatus described, the framework of the cylinder is made in two halves, bolted together in such a way that the sieves may be adjusted with regard to the conveyor, and the slow-moving portion of the conveyor is secured upon a tube, loosely mounted on the shaft carrying the other portion, so that the two parts may be rotated independently, in the same sense or in opposite directions, by means of suitable gearing. To the discharge end of the cylinder is attached another cylinder, serving as a collecting receptacle for the separated stones; into this cylinder water is admitted, so as to flow towards the mass of advancing clay, and, at intervals, the stones are removed through a discharge nozzle by introducing water at high pressure.—F. Sodn.

Glass; Manufacture of sheet —— and apparatus therefor. M. A. Oppermann, Marcinelle Lez Charleroi, Belgium. From H. K. Hitchcock, Tarentum, Pa., U.S.A. Eng. Pat. 1918, Jan. 26, 1909.

See U.S. Pat. 918,323 of 1909; this J., 1909, 522.—T. F. B.

IX.—BUILDING MATERIALS.

Slag cement; Examination of a ——. G. Bellotti. Fifth Congress of the Internat. Assoc. for Testing Materials, 1909. Tonind.-Zeit., 1910, **34**, 64—65.

The blast-furnace slag was granulated in a 6 per cent. solution of magnesium sulphate, and stored for three months before being ground fine along with 1·25 per cent. of slaked lime and 1·75 per cent. of calcium sulphate.

The percentage composition of the slag and of the cement obtained therefrom was as follows:—

	Blast furnace slag.	Cement from same.
Silica	32·52	31·71
Alumina	15·08	14·50
Ferric oxide	1·44	1·50
Lime	46·84	47.50
Magnesia	1·01	1·31
Sulphuric anhydride	1·02	1·37

The cement was mixed with 27 per cent. of water, and began to set in 3 hours at 20° C., setting being complete after 10 hours, without production of any increase in temperature. To test the resistance of the cement to the action of sea-water, specimen blocks were immersed in this water (renewed every fortnight) for four months, and subsequently in a 3 per cent. solution of magnesium sulphate for 10 months. No disintegration of the specimens could be detected, whereas both natural cement and quick-setting Portland cement suffered considerable corrosion under the same treatment, though a slow-setting Portland cement of American origin proved more resistant than either of these latter.—C. S.

Sand; Austrian standard ——. O. Friedensohn. Tonind.-Zeit., 1910, **34**, 100.

The author points out that sand, complying with the standard specification of the Austrian Association of Architects and Engineers, may give very irregular tensile strengths when mixed with one and the same Portland cement, the fluctuations in one instance examined being as much as 6·87 kilos. A comparison of different standard sands has shown that some of them regularly give tensile values as much as 30 per cent. lower than others. It is therefore considered desirable for Austrian cement manufacturers to come to some arrangement as to obtaining standard sand from some one particular source, in order that the tensile strength values may be relatively comparable.—C. S.

Reinforced concrete chimney construction. Matthews. *See* I.

Patents.

Staining wood and stone; Process for ——. C. J. Faller. Fr. Pat. 405,234, July 20, 1909. Under Int. Conv., July 23, 1908.

The wood or stone to be stained is immersed in a solution of an aniline dyestuff or other colouring matter in a liquid hydrocarbon; this soon penetrates the material, giving a uniform tint, but heat or pressure may be applied, if desired, to accelerate the process. A suitable solution is made by dissolving 10 kilos. of dyestuff in 500 litres of petroleum-benzine, of b. pt. 90°—105° C. and sp. gr. about 0·7, the object to be stained being left in this solution for about 24 hours. Unseasoned wood may be successfully treated by the process.—F. Sodn.

Cement; Process for the manufacture of ——. J. et A. Pavin de Lafarge, Viviers, France. Eng. Pat. 8193, April 5, 1909. Under Int. Conv., May 15, 1908.

See Fr. Pat. 390,290 of 1908; this J., 1908, 1021.—T. F. B.

Portland cement; Manufacture of —— H. J. C. Forrester, Birmingham. From Blanc Stainless Cement Co., Allentown, Pa., U.S.A. Eng. Pat. 18,887, Aug. 17, 1909.

See U.S. Pat. 932,374 of 1909; this J., 1909, 1038.—T.F.B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Cast-iron; Decarburisation of —— by gaseous oxidising media. H. Becker. Metallurgie, 1910. 7, 41—59.

White cast-iron rods containing 0·35 per cent. of silicon, 0·17 of manganese, 0·03 of phosphorus, 0·02 of sulphur, 3·18 of carbon, and free from graphite, as well as the same after tempering in a vacuum for ten hours at 950° C., were heated in an Heræus electric furnace for five hours, while about three litres of a mixture of pure dry carbon dioxide and carbon monoxide were passed over them. The temperatures employed were 800° C., 900° C., and 1000° C., respectively, and the carbon dioxide content of the gaseous mixture was determined before and after the gas was passed over the heated iron. The weights of the metal before and after the experiments indicated that the decarburisation increased with the increase of carbon dioxide content, and with a rising temperature; but since there is also the danger of an oxidation of the iron with an increasing carbon dioxide content, experiments were carried out which showed that no observable oxidation of iron took place at 800° C. in a mixture containing 30 per cent. of carbon dioxide, at 900° C. with 28 per cent. of carbon dioxide, and at 1000° C. with 24 per cent. of carbon dioxide. Since decarburisation is slow at a temperature of 800° C. it is suggested that the most practical condition for decarburisation is the use of a mixture containing 24 per cent. of carbon dioxide and 76 per cent. of carbon monoxide at a temperature of from 900° C. to 1000° C. There was no alteration in the carbon content of a softened cast-iron, when heated to 800° C. in a mixture containing 30 per cent. of carbon dioxide, to 900° C. in a mixture containing 12 per cent. of carbon dioxide, and to 1000° C. in a mixture containing 2·8 per cent. of carbon dioxide. In the case of a white cast iron, the decarburisation at a temperature of 800° C. was less than in a softened iron, while at 900° C. to 1000° C. their behaviour was similar.—A. H. C.

Cementation of iron by solid carbon. G. Charpy and S. Bonnerot. Comptes rend., 1910, **150**, 173—175.

Soft Martin steel and carbon (purified sugar charco purified graphite or white transparent diamond) after being heated in separate tubes to 1000° C. under a high vacuum, until the disengagement of gas was less than 0·1 c.c. per hour, were placed in contact, with as little exposure to air as possible; then heated to 700° C. *in vacuo* until the evolution of gas ceased, and finally heated together to 1000° C. for several hours under a high vacuum. In all the experiments, not the slightest trace of carbon was absorbed, but if even very small quantities of air were present, or if the metal was subjected to an imperfect vacuum at first, cementation was observed, confirming the results obtained by Guillet and Griffiths (this J., 1909, 838). Experiments were also made under pressure, the carbon being pressed between a cylinder and piston of steel. A pressure of about 3000 atmospheres was obtained in the cold, but there was a rapid fall in the pressure as the temperature was raised. The adherence obtained between the carbon and metal was always very weak. The authors conclude that carbon in exterior contact with iron does not carburise it without a gaseous vehicle, but further experiments are needed to ascertain if the carbon in the interior of iron and steel can diffuse without the intervention of occluded gases.—A. Seld.

Iron-nickel alloys; Magnetic and electrical properties of ——. C. F. Burgess and J. Aston. Metall. and Chem. Eng., 1910, 8, 23—26.

The alloys examined were prepared from electrolytic iron of 99·97 per cent. purity and very pure electrolytic nickel, the metals being melted together in a magnesia crucible supported by a graphite jacket in an electric resistance furnace. The ingots, of about 1 lb. weight, were heated in a forge fire and drawn under a steam-hammer into rod of about ⅝ in. diam. and 18 in. long. Eighteen alloys with percentages of nickel ranging from 0·27 to 75·06 were examined. The results obtained are given in tables and curve-diagrams. They show broadly that on adding nickel to iron, the magnetic quality decreases at first gradually and then more rapidly, until with 25, 26, and 28 per cent. of nickel, the alloys are non-magnetic; with larger proportions of nickel, the magnetic quality is restored, especially at about 47 per cent. of nickel. Annealing at 670° and 1000° C., caused in general an improvement of the magnetic quality of the alloys, the effect of annealing at 1000° C. being especially marked in the case of the alloy containing 47 per cent. of nickel. The alloys containing from 10 to 20 per cent. of nickel are very susceptible to heat treatment, the magnetic quality being considerably improved by quenching. The effects of such small proportions of nickel (2—4 per cent.), as are most largely used in practice, on the magnetic qualities of iron, are relatively so slight, that the addition of nickel is to be recommended where the improvement of the mechanical properties of the metal is of sufficient importance to warrant it. Hysteresis tests, with a maximum magnetising force of $H=50$, on alloys annealed at 1000° C., showed that the alloy with 47 per cent. of nickel has a loss of only 53 per cent. of that of the standard (forged electrolytic iron), but the high cost of such a large proportion of nickel would prevent the extensive use of this alloy for transformer purposes. The electrical resistance of the iron-nickel alloys increases gradually with the content of nickel up to 22·11 per cent., then much more rapidly up to a point between 30 and 40 per cent. (probably 34 per cent., corresponding to the compound, Fe_2Ni). With still higher percentages of nickel, the resistance falls, at first rapidly, and then more slowly. (See also Barrett, Brown and Hadfield, this J., 1902, 411; and Carpenter, Hadfield, and Longmuir, this J., 1906, 22).—A. S.

Chromium in chrome and chrome-nickel steels; Rapid determination of ——. N. M. Randall. Metall. and Chem. Eng., 1910, 8, 17—18.

The following method is stated to give accurate results and can be completed in 10 minutes. One gram of the steel is dissolved in 25 c.c. of a reagent composed of 300 c.c. of nitric acid of sp. gr. 1·42, 300 c.c. of sulphuric acid (1 : 3), 300 c.c. of water, 100 c.c. of 85 per cent. phosphoric acid, and 1·5 grms. of manganese sulphate; the solution is diluted with 15 or 20 c.c. of water, and then rotated in the beaker containing it, whilst 1 grm. of sodium bismuthate is introduced. The rotation is continued for a few seconds, then the solution is boiled vigorously. The permanganate produced by the action of the sodium bismuthate is decomposed with formation of violet manganic metaphosphate, which, on continued boiling, oxidises the chromium to chromic acid. Any excess of manganic metaphosphate is decomposed by adding a small quantity of dilute hydrochloric acid and boiling for 1 min. After cooling, the solution is diluted to 200 c.c., a slight excess of ferrous-ammonium sulphate added, and the solution titrated with permanganate.—A. S.

Gold bullion; Assay and valuation of ——. F. P. Dewey. Trans. Amer. Inst. Mining Engineers, 1909, 705—722.

The author has attempted to establish certain commercial standards of agreement or accuracy in the assaying of gold bullion for purchase in the U.S. Mint Service, the present paper indicating the variations in the assay results obtained, in the different laboratories of the Service, upon identical samples ranging from electrolytic "fine" gold of 999·9 fineness to cyanide bars of about 340 fineness. Many of the samples were thus assayed over 60 times each, the variations in the results generally increasing with the baseness of the bullion. Specimens of low-grade "bullion" were also prepared in which one base metal, such as iron, zinc, copper, arsenic and antimony, was predominant, these alloys being also distributed for assay among the same Institutions. The least concordant results (varying from 779·7 to 792·4 fineness) were obtained from the arsenical alloy, which contained 7·5 per cent. of arsenic; those from the antimonial sample, containing 1 per cent. of antimony, varied between 721·3 and 725·1 fineness.—W. E. F. P.

Gold alloys: The assay of industrial ——. E. A. Smith. Inst. of Metals, Jan., 1910. [Advance proof.]

The author deals mainly with the standard English gold alloys used for jewellery, etc., and considers in detail each of the operations comprised in the usual methods of assay, the latter involving the removal of the oxidisable metals by cupellation with lead, inquartation with silver, and subsequent parting with nitric acid. The methods adopted in sampling the various commercial forms of such alloys are given, the proportions of lead required for the removal of the base metals from them being next considered. The composition and uses of checks, the losses of precious metal occurring in the various operations, and the surcharges on assays made under varying conditions are likewise fully discussed; while examples of the usual methods of reporting the assay results, and a considerable amount of tabulated experimental data are also included.—W. E. F. P.

Optical pyrometers; Determination of the temperature of copper by means of ——. G. K. Burgess. Bull. Bureau of Standards (U.S.A.), 1909, 6, 111—119.

By means of molten copper, the author has compared the readings obtained with optical pyrometers of the monochromatic and total-radiation kinds with the actual temperatures indicated by a platinum and platinum-rhodium thermo-couple, the junction of which was placed just beneath the metal surface. The optical (monochromatic) pyrometer employed was of the Holborn and Kurlbaum type, in which red and green glasses were used in succession; whilst the total-radiation instrument consisted of a Féry reflecting telescope with gold mirror. The thermo-couple and pyrometers were calibrated on the standard temperature scale, the melting points of pure zinc, antimony, and copper being taken as 419·0°, 630·5° and 1084° C. respectively. The copper, contained in a shallow crucible, was melted in a small gas-furnace in which the gas and air supplies were regulated to produce a clear copper surface, or one of oxide, upon the liquid copper, as desired; and the crucible was so set that the readings of the pyrometers were not influenced by radiation other than that from the metal surface. For the monochromatic instrument, sighted upon liquid copper possessing a mirror surface, the following equations were found to hold good for all practical purposes:—

(1) Red light ($\lambda = 0{\cdot}65\mu$): $t = 1{\cdot}515r - 359$

(2) Green light ($\lambda = 0{\cdot}55\mu$): $t = 1{\cdot}515g - 477$

where t is the true temperature centigrade of the copper, and r and g the apparent temperatures given by the optical pyrometer, using red and green light respectively. At the melting point of copper, the red-light readings were 130° C. too low, whilst over the whole temperature range these readings were 78° below those obtained with green light. With a thin oxide coating on the liquid copper, the pyrometer using red light gave readings about 100° C. higher than when sighted on the clear metal; whilst by the use of green light, the change from metal to oxide increased the apparent temperature by only about 35° C., indicating the relatively greater intensity of the green in the light emitted by the liquid copper. With the Féry total-radiation pyrometer, the measurements of surface temperature were found to be much less satisfactory than with the monochromatic instrument: the difference in reading at the melting point of copper, sighting first on the clear copper, and then on the oxide, was from 275° to 300° C.; and the apparent temperature of freezing, when sighting on the clear liquid, was less than 600° C. instead of 1075° or 1080° C. as given by the thermocouple. Hence, according to the condition of the copper surface, the corrections to the readings of the Féry total-radiation pyrometer lie between 480° and 175° C. at the melting point of copper, the observations recorded being found to satisfy the following equations:—

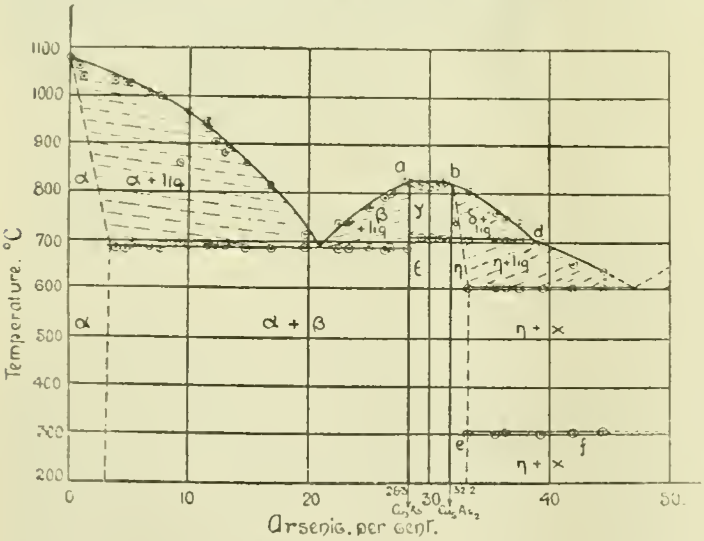
Liquid copper: $t = 3{\cdot}55F - 1018$

Cuprous oxide: $t = 1{\cdot}41F - 169$

where t is the true temperature centigrade and F the reading of the Féry instrument.—W. E. F. P.

Copper-arsenic alloys; The properties and constitution of ——. G. D. Bengough and B. P. Hill. Inst. of Metals, Jan., 1910. [Advance proof.]

THE authors' equilibrium diagram (see Fig.) which, it is pointed out, only refers to such equilibrium as is attained by the fairly slow cooling (20° C. per minute) of 250-grm. ingots of the alloys, in the main agrees with that previously published by Friedrich (Metallurgie, 1905, 477: 1908, 532). The existence of the two compounds, Cu_3As and Cu_5As_2, is confirmed, but the latter, which solidifies at 830° C., undergoes a polymorphic change at 710° C., whilst no evidence is found for the existence of the compound, Cu_2As, mentioned by Hiorns (this J., 1904, 547). Five series of hard rolled bars containing 0·94 per cent., 0·25 per cent., 0·75 per cent., 0·94 per cent., and 1·9 per cent. of arsenic respectively were annealed for various times and at different temperatures in oxidising and reducing atmospheres, and the treated bars tested mechanically. It was found that in an oxidising atmosphere the mechanical properties were not seriously affected by annealing at any temperatures up to 900° C. for three hours or less. The effect, however, of annealing in reducing gases, such as coal gas and hydrogen was very marked in all cases except those bars containing 1·9 per cent. of arsenic, the mechanical properties being completely ruined by treatment at any temperature much above 600° C. The explanation given of the injurious effect of reducing gases is that hydrogen and carbon monoxide can penetrate freely at a temperature of about 650° C., into copper and copper-arsenic alloys containing less than 1·5 per cent. of arsenic, and that these gases then react with arsenious oxide present in the interior of the mass of metal, causing a sudden evolution of steam, or carbon dioxide. The evolution, and subsequent expansion, of these gases, which are probably insoluble, or only slightly soluble, in solid copper, causes cracking or disrupture in the interior of the alloy. It was found that these reducing gases were not harmful when the copper contained no oxide or only cuprous oxide.—O. F. H.



Phosphor bronze; A contribution to the study of ——. O. F. Hudson and E. F. Law. Inst. of Metals, Jan., 1910. [Advance proof.]

IN alloys containing less than about 4·5 per cent. of tin, the phosphorus is present as rounded, more or less detached particles of copper phosphide, Cu_3P, the tin being in solution in the copper. With more than about 4·5 per cent. of tin, the alloys contain in addition a ternary eutectic of copper, Cu_3P, and Cu_4Sn, which has the composition 81 per cent. of copper, 14·2 per cent. of tin and 4·8 per cent. of phosphorus, its melting point being 620° C. Copper is capable of holding a small quantity of phosphorus as well as tin in solution, and in the malleable phosphor bronzes in which tin does not exceed about 6 per cent. and phosphorus 0·3 per cent., the phosphorus is present mainly in this state. In the cast phosphor bronzes which may contain as much as 12 per cent. of tin and 1·5 per cent. of phosphorus, the ternary eutectic is an essential constituent. The paper is fully illustrated by photo-micrographs.—O. F. H.

Non-ferrous metals and alloys; Failure in practice of ——, *with particular reference to brass loco-tubes.* T. V. Hughes. Inst. of Metals, Jan., 1910. [Advance proof.]

IN the examination of a fractured brass loco-tube, which had been externally scraped and wiped, the interior was found to be much corroded, especially near the fracture, which occurred in that part of the tube nearest the fire-box. The inside of the tube was also covered with a light-green deposit consisting of the mixed basic sulphates of copper and zinc, beneath which a dark-red scale of cuprous oxide, permeated with the basic sulphates, appeared. Neither the green coating nor the scale contained zinc oxide or cupric oxide, indicating that the tube had not been over-heated and oxidised, the corrosion having evidently proceeded from the interior towards the exterior. Microscopical examination of sections of the tube indicated slight overheating at the ends (possibly for expanding purposes), and abnormal overheating near the fracture. In the working of the boiler, draught was produced by means of a steam blast, the fuel used being coke containing 0·89 per cent. of volatile, and 0·37 per cent. of fixed, sulphur; and the author concludes that two explanations of the failure of the tube are possible. In the first, the zinc in the surface layers of the interior of the tube may have evaporated, the exposed copper being converted into cuprous oxide, which, by the joint action of the steam and sulphur dioxide evolved after stoking with damp coke, would be sufficient to account for the production of the basic sulphates, the repetition of this combined action resulting in the breakdown of the tube at the fire-box end where the reactions would be most pronounced. In the second, interaction between the hot carbon monoxide, gaseous sulphur compounds and the metals composing the tube may have taken place, the tendency being towards the formation of cuprous oxide which, by the action of the cooler and moist sulphurous gases, would give rise to the sulphates of the metals. Examination of further tubes (from the same boiler), which had not been wiped or scraped, showed them to be externally covered, where in contact with the boiler water, with an even and bright chocolate-coloured deposit of the average thickness of 0·1 mm. This covering had been deposited in a series of layers, the innermost being black, very compact, and firmly adherent. The deposit was found to contain a considerable proportion of heavy hydrocarbons corresponding to cylinder oil (a quantity of which was afterwards discovered in the water-tank), while a small quantity of copper was present as oxide, together with a certain amount of basic zinc sulphate. From the determination of the electrical conductivity of the deposit, it would appear that, even when damp, it formed an excellent non-conductor of electricity and hence, probably also of heat.—W. E. F. P.

Smelting of zinc; Use of carbonaceous filters in the ——, as employed in the Hopkins fumeless zinc process. C. O. Bannister. Inst. of Metals, Jan., 1910. [Advance proof.]

In the Hopkins process, the zinc vapour issuing from the retort passes through a filter of incandescent carbon (coke) before entering the condenser, the exit of which is also fitted with a tube or nozzle packed with carbon. The former, and larger, filter absorbs the lead, etc., present in the vapour; while the latter filter or nozzle, by excluding air, prevents the formation of fume. Extended series of commercial trials (particulars of which are given) indicate that the use of the Hopkins system not only prevents the formation of fume, but results in the production of a purer metal and a higher yield than that obtainable by the ordinary method of smelting.—W. E. F. P.

Lead in ores; Determination of —— with the aid of the centrifugal machine. F. Castek. Oesterr. Z. Berg. u. Hüttenw., 1909, 57, 665—670. Chem. Zentr., 1910, 1, 382—383.

The lead is precipitated as sulphate, and the liquid and precipitate whirled in a centrifugal machine (for 4 mins. at 1000—1200 revolutions per minute) in a vessel provided with a graduated tube (2·5 mm. diam., with 40 divisions of 5 cb. mm. each) in which the precipitate collects, as in the Eggertz method for the determination of phosphorus (Wedding, Ausführl. Handbuch der Eisenhüttenkunde, Bd. I., p. 712). The percentage of lead is estimated from the volume of the precipitate, by comparison with the result of a control test. The author draws the following conclusions from the results of his experiments:—With ores containing less than 35 per cent. of lead, and taking at least 1 grm. of the sample, concordant but somewhat high results are obtained, but with richer ores, where less than 1 grm. is taken, the results are unreliable, unless a longer graduated tube is used, and the rate of rotation of the centrifugal machine is increased. The control test must be performed with an ore of similar character to the one under examination. —A. S.

Silicon; Separation of —— from silicates, and the employment of aluminium silicate for the manufacture of aluminium. K. Gröppel. Metallurgie, 1910, 7, 59—63.

With the primary object of preparing pure aluminium oxide for the manufacture of aluminium in the electric furnace, endeavours were made to reduce the silica in aluminium silicate to silicon by the use of aluminium in a resistance electric furnace. All attempts to obtain pure alumina failed. A silicon containing about 90 per cent. of silicon, and an aluminium oxide containing about 10 per cent. of silica were the best products obtained. By using carbon, in such quantity that no silicon carbide could be produced, it was only found possible to reduce the silica in aluminium silicate as far as the formation of a basic aluminium silicate of the composition, $SiO_2,7Al_2O_3$. Cryolite was the only flux that made the slag more fusible. It is suggested that the silicon obtained could be used for the manufacture of ferro-silicon as a by-product, and the carbon monoxide evolved utilised for the production of power. Since the reduction of aluminium silicate for silicon yields a slag containing no more silica than is contained in bauxite, this slag may be used instead of that mineral for the source of pure alumina. It is possible, therefore, to work up clays according to the following scheme; (*a*), smelting for silicon; (*b*), roasting the slag with sodium hydroxide; (*c*), washing out the sodium aluminate; (*d*), precipitation of the aluminium hydroxide; (*e*), filtering, drying and roasting the precipitate; (*f*), electrolysis of the aluminium oxide. All efforts to reduce calcium and magnesium silicates failed. —A. H. C.

Aluminium and its alloys; Analysis of ——. R. Seligman and F. J. Willott. Inst. of Metals, Jan., 1910. [Advance proof.]

Details are given of the methods used by the authors, mainly in commercial work, for the determination of the impurities in "pure" aluminium, and for the analysis of aluminium alloys. For total silicon, 1 grm. of turnings is placed in a beaker, 5 c.c. of concentrated nitric acid are added and subsequently 20—25 c.c. of 25 per cent. sulphuric acid and sufficient strong hydrochloric acid to effect solution. The contents of the beaker are slowly evaporated until copious fumes are given off, and then cooled, diluted, and boiled until all the aluminium sulphate is dissolved, boiling beyond this point being avoided to prevent solution of traces of silica. The silicon and silica are filtered off, washed carefully, strongly ignited and weighed as silica. For graphitic silicon the nitric acid is omitted, care being taken to absorb any silicon hydride, SiH_4, evolved. The residue of graphitic silicon and silica is filtered on a tared platinum felt filter (see Hunt, Clapp, and Handy, Chem. News, 1892, 65, 223, 235), washed and slowly dried until its weight is constant. From the difference between this weight and that of the total silicon, the amount of graphitic silicon is calculated. Iron is determined by dissolving the aluminium in caustic soda, then the iron in sulphuric acid, and titrating with permanganate. Sodium is determined by dissolving the aluminium in nitric acid with, if necessary, the aid of a small quantity of hydrochloric acid. The solution is evaporated to dryness (a second evaporation with nitric acid is necessary if hydrochloric acid has been used), and the aluminium nitrate decomposed, giving insoluble alumina by heating to about 250° C. The residue is boiled with water, the alumina filtered off and washed, and the filtrate evaporated to dryness and again heated. The residue is dissolved in hot water, to which a few drops of ammonium carbonate have been added, allowed to stand, filtered, and the filtrate evaporated to dryness in a platinum dish, the residual sodium salt being converted into sulphate or chloride and weighed as such. In alloys the copper is estimated by precipitation with sulphuretted hydrogen or, in case of "heavy alloys," by electrolysis; nickel and zinc are determined in the same sample, the nickel being separated from the zinc by dissolving the alloy in caustic soda solution; magnesium is determined by separating the iron and aluminium as basic acetates and precipitating the magnesium as magnesium-ammonium phosphate; titanium and manganese are estimated colorimetrically, and tungsten is determined as tungstic acid.—O. F. H.

Aluminium; Action of heat on —— in vacuo. E. Kohn-Abrest. Comptes rend., 1910, 150, 169—173.

Dry aluminium (of 99·2 per cent. purity), in small pieces or powder, was placed in boats of porcelain, graphite or alumina, and heated electrically in a porcelain tube, under a high vacuum. At 1100° C., the metal slowly and partly volatilised; the rate of volatilisation was not proportional to the duration of heating; it was most rapid after about 8 hours; then it fell off very rapidly. The vapours attacked the walls of the porcelain tube. In all cases a notable proportion of silicon was found in the remaining globules or crystalline residue. Porcelain boats were coated a deep brown colour and made iridescent after 2 hours at 1100° C.; on prolonged heating the boats were attacked, a crystalline silicide being formed, from which hydrochloric acid liberated silicon in black crystalline spangles. The silicides varied in composition with the duration of the experiment—one having the composition, Al_2Si, was isolated. Graphite boats absorbed a portion of the volatilised aluminium; from the remaining globules a black carbide of silicon, C_5Si_3, insoluble in acids, was obtained. When an alumina boat was employed there was a loss in weight, after 20 hours, of 23·8 per cent.; the remaining globules contained silicon amounting to 13·7 per cent. of the aluminium taken. The interior of the porcelain tube was coated with a grey deposit. The author concludes that the vapours of silicon liberated by the volatilisation of the aluminium are absorbed by the unvolatilised liquid metal and crystallise on cooling. The author suggests that the vapours of aluminium might possibly be utilised in the pottery industry.

—A. Sbld.

Zirconium; Preparation and properties of fused ——.

L. Weiss and E. Neumann. Z. anorg. Chem., 1910, 65, 248—278.

Zirconium was prepared both in the amorphous form, by the reduction of potassium-zirconium fluoride by sodium, and in the crystallised form, by using aluminium in place of sodium. The former process yielded a product containing 98 per cent. of metallic zirconium and a small quantity of oxide. The latter gave an alloy containing about 27 per cent. of aluminium, removable only by volatilisation by long-continued heating at a high temperature. As the crystallised metal was found to be no more suitable than the other for the further experiments, the amorphous metal alone was used. This was formed into rods by pressure, which were first heated in hydrogen in a quartz tube to the highest temperature attainable in a combustion furnace, then "fritted" by the passage through them, *in vacuo*, of a sufficient current of electricity. These fritted rods were then used as the poles between which an electric arc was struck, either *in vacuo*, in nitrogen, or in ammonia. In each case globules of the fused metal were obtained, practically pure; no nitride was formed in nitrogen or ammonia. The fused metal has a white colour and lustre like white pig-iron, a hardness of 7 to 8 on Mohs' scale, and is very brittle; it emits flashes of light whilst being powdered in a steel mortar. Its density is 6·400 at 18° C., corresponding to an atomic volume of 14·2; its specific heat between 20° and 100° C. is 0·0804. In compressed oxygen in a bomb calorimeter it burns completely to dioxide, with evolution of 44·56 calories for 1 grm.-equivalent (¼ atomic weight). When heated strongly in air it oxidises; the product is never pure dioxide, but probably always a mixture of dioxide with the oxide Zr_2O_3, which is produced by the combustion of the hydrogen compound (see below). Heated to redness in chlorine, the powdered fused metal slowly reacts, forming tetrachloride, which sublimes. Bromine and iodine are without sensible action on it. Hydrogen at a red heat is slowly absorbed by the metal, with formation of a black powder, of formula, ZrH_2. This when heated in oxygen, yields water and the greenish-white oxide, Zr_2O_3. The metal is very indifferent towards acids, being readily dissolved only by hydrofluoric acid.—J. T. D.

Tungsten; Metallic ——.

L. Weiss. Z. anorg. Chem., 1910, 65, 279—340.

An elaborate and detailed examination of the various methods of obtaining metallic tungsten. Wolfram reduced by aluminium gave a metal containing 80—90 per cent. of tungsten, and by heating this metal, out of contact with air, with hydrochloric acid, the tungsten content could be somewhat increased. Zinc failed to effect reduction to metal, as did magnesium. Wolfram heated with carbon in the electric furnace gave a metal containing 81 per cent. of tungsten and above 2 per cent. of carbon; and this metal when re-melted under tungstic acid and fluorspar had its carbon reduced to 0·24 per cent. and its tungsten raised to 86 per cent. Tungstic acid was then prepared from wolfram, the best method being to fuse or frit with calcium carbonate and salt or calcium chloride; the product dissolves completely in hydrochloric acid, and the separation of tungstic anhydride is then effected by ordinary methods. Tungstic anhydride mixed with zinc-dust in excess (30—35 per cent.) and rapidly heated to redness, enters into reaction, and yields a mass from which hydrochloric acid dissolves away the excess of zinc, leaving a residue which, when washed and dried, consists of practically pure tungsten. Electrolysis of fused tungstic anhydride gave a product containing 90 per cent. of metallic tungsten; and when the electrolysis was conducted under cryolite, some of the melted globules contained 96 per cent. of tungsten, but no considerable quantity of melted metal could be obtained. Barium tungstate electrolysed under barium chloride gave a metal of 94·5 per cent. purity, and calcium tungstate and aluminium one containing 93·4 per cent. of tungsten. Tungsten trisulphide heated with lime in the electric furnace, in proportions corresponding to the equation, $WS_3+2CaO=W+2CaS+SO_2$, gave tungsten of 99 per cent. purity, with a little carbon and silicon. By none of these methods, however, was a really melted metal obtained, and after many failures to melt the amorphous metal, success was finally attained on lines similar to those adopted for zirconium (see preceding abstract). The fritted rods were held horizontally, and the arc between them concentrated by means of a magnet; the beads of melted metal dropped into a zircon crucible placed below. The fusion could be carried out either *in vacuo*, in nitrogen or in ammonia—no nitride was formed. The metal has a mercury-white lustre, shewing a fine granular fracture (hardness 7·5) when rapidly cooled, and a conchoidal fracture (hardness 6·5) when slowly cooled. It is very brittle when rapidly cooled, but after annealing from redness is moderately malleable and ductile. It is non-magnetic. Its density is 18·72 at 20° C., and its specific heat 0·0358. Burnt in the bomb calorimeter it evolves 32·1 calories per grm.-equivalent (1/6 atomic weight). It is practically unaffected by atmospheric air, and when heated in it, becomes superficially oxidised, showing a fine play of colours in the process. Heated in oxygen it burns completely to tungstic anhydride. It is hardly affected by acids, the only solvent for it being a mixture of nitric and hydrofluoric acids, which form a mixture of fluoride and oxyfluoride. Heated in chlorine it is slowly converted into chloride; bromine, iodine, and hydrogen sulphide have practically no action on it.—J. T. D.

Sulphates; Decomposition points of some —— *in an air current.*

W. S. Landis. Metall. and Chem. Eng., 1910, 8, 22.

The sulphate was heated in a porcelain boat in a porcelain combustion tube, a current of air being drawn through the tube and then through a bottle containing a solution of caustic soda which had been exactly neutralised with sulphuric acid in presence of methyl orange. Any acid vapours liberated from the sulphate caused the indicator to change colour, and then by running in dilute caustic soda until the neutral tint was restored, an indication of the rate of decomposition was obtained. The temperature was measured by means of a Le Chatelier thermocouple, the hot junction of which rested on the sulphate in the porcelain boat. Under the conditions described, ferrous sulphate began to decompose at 550° C. The decomposition was only slight up to 580° C., then became somewhat more marked up to 600° C., at which temperature there was a sudden increase in the rate of decomposition. The decomposition was practically complete after two hours at 600° C., as very little acid was produced on heating further to 650° C., and none at all from 650° to 960° C. From copper sulphate, acid was first produced at 400° C., but only small quantities were formed up to 690° C., when a very rapid evolution was observed. Traces of acid were still produced on heating further at 700° C., but none between 700° and 900° C. Decomposition of zinc sulphate began at 730° C., and proceeded gradually up to 760° C., at which temperature it became very rapid. The decomposition was complete at 760° C., no more acid being produced on raising the temperature to 980° C.

—A. S.

Action of carbon tetrachloride vapour on anhydrides and oxides. Camboulives. *See* VII.

Examination of a slag cement. Bellotti. *See* IX.

PATENTS.

Manganese steel; Method of producing finished shapes of ——. W. S. Potter, Assignor to Manganese Steel Rail Co., Mahwah, N.J. U.S. Pats. 938,891 and 939,164, Nov. 2, 1909.

(1) The method is particularly applicable to the manufacture of rails from manganese-steel. An ingot is cast, large end downward, in a mould of the ordinary form. It is then slowly and evenly heated, preferably in a reducing atmosphere, to a temperature between 735° C. and 930° C., *e.g.*, to about 870° C. The metal is now rapidly raised to a temperature of about 1040° C. and finally slowly heated to 1205° C. The slow increase of temperature in the last stage of heating is necessary, as otherwise the metal becomes tender and is liable to crack. The hot ingot is now cooled, preferably in a non-oxidising atmosphere, the temperature being at first slowly reduced and then quickly lowered until re-crystallisation is complete. This occurs between 650° C. and 705° C. The annealed ingot, after being heated to a sufficient temperature, is rough rolled and compressed; finally it is raised to the maximum temperature, 1065° to 1205° C., at which it was originally heated, and rolled to finished shape. The rails, after being sawed and punched, are subsequently quenched while hot from the rolls. (2) The ingot is taken direct from the mould to a soaking pit, and there allowed to remain until its temperature has become equalised. The initial heating to a temperature between 735° and 930° C. may then be omitted. The ingot, in this condition, is now slowly heated from a temperature of about 1040° C. to a temperature approximately 1205° C., but not above 1460° C. Only a slight reduction is given in the first few passages through the rolls and, when the ingot is large, an intermediate reheating may be necessary.—C. A. W.

Manganese steel ingots; Process of treating ——. W. S. Potter, Assignor to Manganese Steel Rail Co., Mahwah, N.J. U.S. Pat. 938,892, Nov. 2, 1909.

The ingot, if cold, is slowly heated to a dull red heat and thence raised more rapidly to the temperature at which the metal begins to weaken. This may be called the upper critical point, and will vary, according to the steel, from 1050° to 1120° C. From a temperature slightly below the upper critical point, the ingot is then slowly heated in a non-oxidising atmosphere to a temperature between 1150° and 1205° C., when the metal will have become soft and plastic. After the ingot has been uniformly heated throughout, the heat is cut off and a stream of cold gas or steam directed on the metal, the mass being allowed to cool until a temperature just above the re-crystallisation point has been attained. As in the heating, it is preferable to effect the initial cooling operation in a non-oxidising fluid, either liquid or gas. This rapid lowering of the temperature to 600° to 700° C. cools the outer surface of the ingot so that an enormous pressure is exercised upon the interior portions whilst in a soft and plastic condition. The cooling, having been arrested until the temperature of the ingot has become uniform, is then continued with rapidity until the whole mass is finely crystallised. Below a dull red heat the rapid cooling should be discontinued and the temperature allowed to fall uniformly, lest internal strains be set up in the metal. —C. A. W.

Manganese steel; Process of rolling ——. W. S. Potter, Assignor to Manganese Steel Rail Co., Mahwah, N.J. U.S. Pat. 938,893, Nov. 2, 1909.

The ingot is first heated slowly, preferably in a non-oxidising atmosphere, to about 535° C., the temperature being then raised until the upper critical point, ranging from 1010° to 1050° C. is attained. The heating is now continued slowly, until the metal has become soft and plastic and is uniformly heated to a temperature of 1230° C., or rather less if the ingot be thin. The temperature of the skin or outer portion is then reduced rapidly by subjecting the metal to the action of a gas or vapour, and the ingot in this condition, with a soft and plastic interior at a temperature above the upper critical point, is passed through the rolls or treated in the manner desired. If finally, before passing the metal to the finishing mill, the temperature has so fallen that the ductility is destroyed, the ingot is again heated to a temperature above 1150° C., and the outer skin cooled as before. The finished shape, after reheating if necessary, is finally quenched in water. —C. A. W.

Iron manufacture and ingot. R. B. Carnahan, jun., Middletown, Ohio, Assignor to the Internat. Metal Products Co., Newark, N.J. U.S. Pats. 940,784 and 940,785, Nov. 23, 1909.

A high-power basic open-hearth furnace containing a charge of lime or limestone is charged with pig iron or molten iron, to which is added, if desired, a varying amount of low-carbon steel or iron scrap. The metal is then refined as in the production of soft steel, the sulphur and phosphorus being removed by the limestone and the carbon and manganese by agitation or by the addition of iron ore. The temperature is raised as the operation goes forward until it ultimately attains at least 2850° F., the process being prolonged until the metal contains no more than 0·14 per cent. of sulphur, phosphorus, carbon, manganese, and silicon taken together. For the best results, this aggregate should not be greater than 0·07 per cent., and neither carbon nor manganese should exceed 0·02 per cent. The refined metal at a high temperature is finally poured into ingot moulds and, while still molten, is deoxidised and freed from gas by the addition of aluminium in a proportion of about 2½ lb. per ton of metal. If desired, a partial deoxidation may be effected, before pouring, by the addition of pig iron. In any case the ultimate product should contain at least 99·80 per cent. of iron, and not more than 0·05 per cent. of oxygen as determined by Ledebur's method. The metal is stated to possess a very high degree of malleability and ductility, and to be very resistant against corrosion.—C. A. W.

Steel; Transferring dephosphorized molten ——. R. H. Wolff, New York. U.S. Pat. 946,302, Jan. 11, 1910.

The dephosphorised molten steel, taken from a basic converter or open-hearth furnace, is charged on to a layer of basic slag, where the sulphur and oxygen are thoroughly and rapidly removed. It is then transferred immediately to an electric furnace.—C. A. W.

Metallic contents of [gold and platinum] ores and the like; Apparatus for the recovery of the ——. G. Goodland, Lavasheeda, Ireland, W. K. Ferro, Birstall, Yorks, and W. A. Thornton, Bridlington, Yorks. Eng. Pat. 1677, Jan. 23, 1909.

The claims are for a special woven fabric for covering the bottom of the sluice-boxes used in the washing of certain ores. The fabric has a smooth back and a raised or blanket-like face; and on the raised face, transverse ridges are produced either by weaving, or by inserting wooden or metal bars in pockets formed in the material between the raised face and the smooth back.—A. S.

Mattes; Wet treatment of ——. J. T. Carrick and B. S. Pattison, Johannesburg. Eng. Pat. 21,164, Oct. 7, 1908.

Copper-nickel matte is dissolved in hydrochloric acid, and after removing the copper as sulphide, the residual solution is treated with a large excess of ammonia, and air is drawn through it for a prolonged period at the ordinary temperature. The precipitate thus produced consists of a black, magnetic, ferro-ferric compound, containing also a small proportion of nickel. It is removed by filtration, and then digested with dilute acid to remove the nickel, the acid solution being used for dissolving a fresh quantity of matte. The ammoniacal solution containing most of the nickel is boiled with lime, the evolved ammonia being recovered, and the precipitated nickel hydroxide (or oxide) separated by filtration. The residual calcium chloride solution is evaporated with sulphuric acid under such conditions of temperature and pressure that the precipitated calcium sulphate is not dehydrated; the hydrochloric acid is condensed.—A. S.

Nickel-copper alloys; Method of treating ——. J. F. Thompson, Bayonne, N.J., Assignor to Internat. Nickel Co., New York. U.S. Pat. 947,067, Jan. 18, 1910.

In order to remove the superficial oxides of nickel and copper, the alloy is immersed in a tank containing dilute sulphuric acid. A ferric salt having been added, the solution is heated until a clean surface is obtained, whereupon the metal is removed and washed with water. The presence of the sulphuric acid is not always essential; in some cases the pickling may be effected in a solution containing a ferric salt alone.—C. A. W.

Copper; Reverberatory furnaces applicable for the production of blister —— and sulphuric acid. T. Walker, Widnes. Eng. Pat. 9918, April 27, 1909.

The furnace is provided with two flues at the further end of the hearth, one of which leads to the chimney, and the other to a sulphuric acid chamber. Above the bridge of the furnace is a third flue leading to a regenerator, and thence to a flue connected with the chimney flue. The charge of copper matte and silicious material is placed on the hearth, the chimney flue at the end of the hearth being open and the others closed. When the charge has been melted by the flames from the fire-box, the chimney flue is closed, the fire-gases then passing through the flue above the bridge. Compressed air is now blown into the charge, and the sulphur dioxide produced is led away to the acid chamber. The regenerator is used for heating air which is subsequently introduced into the furnace at the bridge.—A. S.

Copper ores; Treatment of ——. C. H. N. Williams, Johannesburg, Transvaal. Eng. Pat. 14,434 of 1908; date of application, May 20, 1909.

The method relates to the treatment of copper ores for the extraction of the metal, in which the ore, if necessary after the addition of alkali, is treated with a solution of sulphuric acid or sodium bisulphate together with an oxidising agent. By the present method the crushed ore is treated in shallow vats with a solution containing 1 to 3 per cent. of sulphuric acid according to the amount of copper. To this solution is added a calculated amount of potassium permanganate, say 3 to 6 lb. per ton of ore when the latter contains 2½ to 3 per cent. of copper. When the acid solution is placed on the charge, one-half of the permanganate is added. After the action has proceeded for about twelve hours, the solution is drained away; eventually, after the addition of half the remaining permanganate, it is used for the treatment of a fresh body of ore and then passed to the precipitating boxes, the remainder of the permanganate being added beforehand. Meanwhile the original charge is treated with a fresh quantity of solution together with a corresponding amount of permanganate. After twelve hours this solution is also drawn away and brought in contact with the second charge in exactly the same manner as before. Sulphide ores are roasted before treatment with the solvent solution.
—C. A. W.

Metal, wood, and other hard substances; Composite materials for use as substitutes for ——. H. B. and W. F. Bourne, Caterham. Eng. Pat. 710, Jan. 11, 1909.

The product claimed is prepared by electrolytically depositing metal on a substance consisting of ebonite containing sufficient fine particles of conducting material, such as powdered carbon, to render it electrically conducting. In order to obtain the conductive ebonite substance, a mixture of india-rubber and sulphur in the proportions necessary for the production of ebonite, together with, if desired, rubber "substitute," reclaimed rubber, and similar materials, is added to powdered carbon, the whole is heated until it becomes plastic, then moulded and vulcanised. Special claim is made for the two following mixtures:—(1) Sulphur, 4·5; india-rubber, 9; pontianac, 2; linseed oil, 4·5; whitening, 22; and ground retort carbon, 58 per cent. (2) India-rubber, 13; sulphur, 4·8; boiled linseed oil, 4·8; and ground carbon, 77·4 per cent.—A. S.

Soldering aluminium or its alloys. G. Stoker, London. Eng. Pat. 12,019, May 21, 1909.

The parts of the aluminium or aluminium-alloy to be soldered, are heated to a temperature near the melting point of the solder which is to be used, and are then exposed for a short time to the action of ozonised air or ozonised oxygen. It is stated that after this treatment, aluminium and its alloys can be satisfactorily soldered with the aid of zinc or of ordinary tin solders.—A. S.

Air; Method of and apparatus for drying —— particularly for use in metallurgical work. J. Gayley, New York. Eng. Pat. 13,553, June 9, 1909.

The claim relates to the drying of air by refrigeration, part of the moisture being abstracted in the form of rain and part in the form of snow or ice congealing on the cooling coils. In order however to obtain a uniformly low content of moisture, the air before it enters the ordinary refrigerator is brought into direct contact with a stream of artificially cooled water. The apparatus consists of two parts, the cooling tower and the refrigerating building. The air is passed into the bottom of the cooling tower by means of a vertical conduit extending down the outside of the building, being exposed in its passage to a preliminary spraying, which removes its coarser impurities and cools it slightly. The spray is obtained from an overflow in the cooling tower. The air as it enters the four chambers of the tower, is forced upwards by means of fans and comes into contact with the water or brine, trickling downwards. The water or brine in the supply reservoir is cooled to a temperature of 35° F. by means of the coils of an ammonia condenser which pass through it. In this way the air will leave the cooling tower and enter the refrigerating building at a temperature of about 40° F. and will contain a maximum of 3 grains of moisture per cubic foot. The water as it reaches the bottom of the tower is pumped up again into the reservoir, the additional volume, obtained by the continuous abstraction of moisture from the air, being removed by means of an overflow. Means are provided for admitting the air directly to the refrigerating building during the winter months, when the amount of moisture in the atmosphere is small.—C. A. W.

Drying air [for metallurgical purposes]. J. Gayley, New York. Eng. Pat. 13,558, June 9, 1909.

In the process of drying air by refrigeration, the snow and ice deposited on the refrigerating coils are periodically thawed by allowing water to flow over the coils, the thawing water being afterwards fed to an ammonia condenser or to some other device in which its low temperature is utilised. A part or the whole of the liquid may be again used for thawing.—A. T. L.

Sulphur ores; Smelting ——. R. Fleming, Swampscott, Mass., Assignor to General Electric Co., New York. U.S. Pat. 945,926, Jan. 11, 1910.

The ore is melted by any means whatever and afterwards maintained in fusion by electrical means in an enclosed furnace. In this condition and while out of communication with the atmosphere, it is subjected to the action of currents of air and steam, or steam alone, which are forced through the molten mass. The resulting vapours are collected and condensed in cooled receivers.—C. A. W.

Electrolyte and method of electro-depositing copper. E. F. Kern, Knoxville, Tenn., Assignor to P. S. Brown, New York. U.S. Pat. 946,903, Jan. 18, 1910.

The electrolyte consists of a solution containing copper fluosilicate, ammonium fluosilicate, and ammonium fluoride.—B. N.

Metals; Process for the electro-deposition of —— by wet processes dispensing with the preliminary scouring of the objects. A. Levy. Third Addition, dated May 27, 1909, to Fr. Pat 385,058, Feb. 25, 1907 (this J., 1908, 818 and 948; 1909, 990).

The anodes described in the main patent are replaced by insoluble ones, *e.g.*, of carbon or platinum, or by soluble ones, of such a nature that the by-products formed by the action of the current, when mixed with the electrolyte, have no influence on the result of the operation, for example, anodes of iron may be employed, the deposition being carried out in the presence of a salt of the metal to be deposited. Or, the soluble anode may consist of a metal, so that the product formed at the anode, in a bath of an appropriate salt, contributes to the formation on the cathode of a determined alloy, the action being accompanied by simultaneous scouring.—B. N.

Spring for timepieces. W. v. Bolton, Charlottenburg, Germany, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pats. 946,993, 947,146, and 947,147, Jan. 18, 1910.

The spring may be composed of pure tantalum or of a tantalum alloy. In the latter case, the alloy may contain, in addition to the other elements, a hardening agent having an atomic weight of less than 30; or it may be composed of tantalum and a hardening agent alone. Finally, it may contain tantalum and a member of the iron group, alone or in combination with other components. —C. A. W.

Furnace; Electric ——. Westdeutsche Thomasphosphat-Werke, Ges.m.b.H. Second Addition, dated June 4, 1909 (under Int. Conv., June 10, 1908), to Fr. Pat. 388,668, March 28, 1908 (this J., 1908, 948 and 1026).

With a continuous current, employing a system of three conductors, the intermediate conductor is connected separately by two wires with the electrodes passing through the base of the furnace. If an alternating current, monophase or triphase, is employed, the nodal point of the dynamo is untied, and the extremities connected separately with the electrodes passing through the base of the furnace, thus transferring the neutral point into the bath itself. In order to increase the heating effect in the metallic bath, a transformer is connected with the electrodes of the base, or is fixed on them, thus transforming the current brought to the metallic bath by the electrodes of the base to any required intensity. Instead of the electrodes at the base being in direct contact with the metal of the bath, they may be covered with a refractory material, which is non-conducting when cold, and this, acting first as a resistance material, is brought to incandescence, afterwards transmitting and conducting the current to the bath of metal. —B. N.

Electric induction furnaces; Starting —— for metallurgical uses. Röchling'sche Eisen- und Stahlwerke Ges. m.b. H., J. Schoenawa, and W. Rodenhauser. Fr. Pat. 404,571, June 30, 1909. Under Int. Conv., Dec. 23, 1908.

The electric induction furnace is started by using closed heating rings as the secondary, the rings being embedded in a metallic filling of the same melting point, or preferably of lower melting point than the rings themselves.—B. N.

Gas of high calorific value [from the gases escaping from Bessemer converters]; Process for obtaining ——. J. I. Bronn. Ger. Pat. 216,302, Feb. 16, 1909.

In order to obtain a gas of relatively high calorific value, only that portion of the gases escaping from a Bessemer converter, is collected, which is produced during the combustion of the carbon contained in the charge, that is the gas produced during the middle stage of the blowing. —A. S.

Nickel; Process for the manufacture of pure ——. La Société Electro-Métallurgique Française, Froges, France. Eng. Pat. 14,946, June 26, 1909. Under Int. Conv., June 27, 1908.

See Fr. Pat. 400,910 of 1908; this J., 1909, 1090.—T. F. B.

Electric furnaces for the treatment of gases by means of flame arcs. Salpetersäure Industrie-Ges., Gelsenkirchen, Germany. Eng. Pat. 19,466, Aug. 24, 1909. Under Int. Conv., Aug. 25, 1908.

See Ger. Pat. 216,090 of 1908; this J., 1909, 1317.—T. F. B.

Copper-matte converter. E. A. C. Smith, Baltimore, Md. Reissue No. 13,080, Jan. 25, 1910, of U.S. Pat. 942,675, Dec. 7, 1909.

See this J., 1910, 94.—T. F. B.

Leaf metal and the like; Apparatus for manufacturing ——. L. Kurz, Fuerth, Germany. U.S. Pat. 946,676, Jan. 18, 1910.

See Eng. Pat. 28,081 of 1908; this J., 1909, 608.—T. F. B.

Zinc oxide; Process for the preparation of —— for reduction. H. Pape, Hamburg, Germany. U.S. Pat. 947,399, Jan. 25, 1910.

See Fr. Pat. 400,547 of 1909; this J., 1909, 1044.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Protection of underground pipes from electrolysis. Ganz. *See* I.

Patents.

Electrolytic cells [of the aluminium type]; [Electrolyte for use in ——]. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, New York. Eng. Pat. 6872, Mar. 22, 1909.

When an electrolytic cell of the aluminium type, containing a solution of a borate as electrolyte, has been in continuous operation for some time, an objectionable deposit is liable to be formed on the plate. In the present invention, the growth of this deposit is in great part suppressed, and its injurious effects are reduced, by the addition of tartrates to the electrolyte; this also improves the character of the film, in cutting down the leakage current and in raising its critical or breakdown voltage, besides reducing the resistance of the electrolyte. The solution may be made by mixing 6 parts of boric acid and 1 part of tartaric acid and then approximately neutralising the mixture with ammonia or other alkali; or a tetraborate may be used instead of boric acid. In some cases, it is preferred to add also about 10 per cent. of glycerin, and, in a modification of the invention, the acidity thus produced is neutralised or partly neutralised by again adding alkali.—F. Sodn.

Electrolytic cell. J. L. R. Hayden, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 946,040, Jan. 11, 1910.

The cell comprises a vessel containing a layer of heavy non-conducting liquid, and above this a lighter layer of electrolyte. Terminals project from the base of the cell into, and are submerged by, the layer of heavy liquid, the electrodes being electrically connected to, and mounted on, the terminals so as to project above the heavy liquid into the electrolyte.—B. N.

Storage battery. T. A. Edison, Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 946,540, Jan. 18, 1910.

The active material for alkaline storage batteries is impregnated with an oxygen compound of bismuth, by first soaking the mass in a solution of a bismuth salt, then subjecting the material to centrifugal action, and afterwards drying. The dried mass is then heated in a caustic alkali solution, and finally washed to remove the excess of alkali.—B. N.

Electric charges; Effecting interchange of —— between solid conductors and gases. F. G. Cottrell. Berkeley, Cal.. Assignor to International Precipitation Co., San Francisco, Cal. U.S. Pat. 945,917, Jan. 11, 1910.

The process relates to a method of effecting the interchange of electric charges between electrified solid conductors and gases, these being brought into contact with each other at a surface covered with fine hairs or filaments which forms part of the solid conductor. A difference of potential is maintained between the solid conductor and the body of gas.—B. N.

Electrolytic apparatus with liquid anode. Schott und Gen. Fr. Pat. 404,332, June 23, 1909. Under Int. Conv., June 26, 1908.

The invention relates to a form of apparatus in which a liquid anode, such as mercury, is employed, and in which the metal is transferred to the cathode as in certain types of electric meters. A solid body is fixed either above the anode in the electrolyte, or immersed in the bath of the anode; or the body may be fixed, or allowed to float freely, between the two liquids. The body prevents the displacement of the liquid anode, thus preventing the metal from being projected out of the bath by vibration.—B. N.

Furnace with electric heating. W. C. Heraeus. Fr. Pat. 404,369, June 24, 1909. Under Int. Conv., Dec. 9, 1908.

The furnace is heated by means of a platinum wire, which is rolled in spirals, the latter being pressed closely together, and the whole completely buried in the layer forming the refractory mass of the furnace.—B. N.

Furnaces; Electric —— with high output. R. Catani. Fr. Pat. 404,684, June 18, 1909. Under Int. Conv., Dec. 28, 1908.

The furnace is provided with prismatic electrodes, fed by one or more electric currents, which may be either continuous or alternating, monophase or polyphase, the currents being brought to the furnace by means of hollow prismatic conductors cooled by a convenient fluid. From the conductors, the currents pass either directly to the electrodes, with or without the interposition of a conducting plastic medium, or indirectly to an electrode-holder of prismatic form, sliding contact being made by means of plane surfaces. Suitable mechanism is arranged for pressing two or three prismatic conductors against one or two groups of prismatic electrodes, or five prismatic conductors may be similarly employed for three groups of prismatic electrodes.—B. N.

Electrolytic apparatus having a liquid anode. Schott und Gen., Jena, Germany. Eng. Pat. 14,288, June 18, 1909. Under Int. Conv., June 26, 1908.

See Fr. Pat. 404,332 of 1909; preceding.—T. F. B.

Batteries; Primary ——. W. A. F. Bleeck. Fr. Pat. 405,077, July 15, 1909.

See Eng. Pat. 15,194 of 1909; this J., 1909, 1144.—T. F. B.

Electric incandescent metal filament lamps. Eng. Pat. 142. *See* IIb.

Electrodes for arc lamps. Eng. Pats. 8150 and 8151. *See* IIb.

Graphite conductors [for electric incandescence lamps]. Addition to Fr. Pat. 380,378. *See* IIb.

Manufacture of oxides of nitrogen by means of the electric arc. Fr. Pat. 404,230. *See* VII.

XII.—FATS; OILS; WAXES.

Japan wax; Unsaponifiable matter of ——. H. Matthes and W. Heintz. Arch. Pharm., 1909, **247**, 650—657.

The Japan wax examined yielded 0·68 per cent. of amorphous semi-solid unsaponifiable matter. This was found to consist of the following substances: (1), About 60 per cent. of a liquid unsaturated body containing oxygen; (2), myricyl alcohol; (3), a phytosterol containing a double linkage in its molecule, and melting at 139° C.; (4), ceryl alcohol; (5), a saturated alcohol, probably $C_{19}H_{40}O$, melting at 65° C.—C. A. M.

Mucuna capitata; Oil of seeds of ——. W. P. H. van den Driessen-Mareeuw. Pharm. Weekblad, 1909, **46**, 881. Apoth.-Zeit., 1990, **24**,, 886.

The seeds of the cow-itch bean, *Mucuna capitata*, contain an alkaloid, a tannin, and a fixed oil having the following characters: Sp. gr., 0·865 at 100°/15° C.; solidifying pt., 3·5° C.; m. pt., 16° C.; acid value, 6·7; ester value, 171·5; iodine value, 104; Reichert-Meissl value, 0·77; titre test, 37° C. The fatty acids are composed of palmitic, stearic, and probably oleic acids.—J. O. B.

Fats and oils; A critical study of the natural changes occurring in ——. J. S. Hepburn. Seventh Int. Congr. Appl. Chem., London, 1909. J. Franklin Inst., 1909, **168**, 365—384, 421—456; 1910, **169**, 23—54.

A review of the various researches concerning the natural changes in fats and oils, and a resumé of the views of different investigators with respect to the causes of these changes.—A. S.

Oil mixtures; A comparison of the calculated and determined values for the specific temperature reactions of —— with sulphuric acid. W. H. Boynton and H. C. Sherman. School of Mines Quart., 1909, **31**, 64—66.

Experiments on mixtures of fatty oils with mineral oils and with each other, showed that the specific temperature reaction with sulphuric acid did not, as a rule, differ materially from the calculated value in the case of a mixture of two fatty oils (where differences were observed, the experimental value was lower than the calculated one), but was invariably higher in the case of mixtures of fatty and mineral oils.—A. S.

Glycerin; Coefficient of expansion of ——. A. M. Comey and C. F. Backus. J. Ind. Eng. Chem., 1910, **2**, 11—16.

From the results of a series of determinations, at 15·5°, 20°, 25°, and 30° C. respectively, with 12 samples of glycerin of sp. gr. ranging from 1·25465 to 1·26418 at 15·5°/15·5° C., the authors give the coefficient of expansion of glycerin as 0·00061 at 20° C., 0·000615 at 25° C., and 0·00062 at 30° C.—A. S.

Use of antipyrine for determining the iodine value of fatty and essential oils. Borde. *See* XXIII.

Hops; The fat [fatty oil] of ——. Briant and Harman. *See* XVIII.

Patents.

Oils; Method of converting —— into viscous products and their use in the manufacture of lubricating oils. A. de Hemptinne. Fr. Pat. 440,843, July 7, 1909.

Vegetable or animal oils are rendered viscous by being subjected to the action of an electric current in an atmosphere of any gas or in a partial vacuum. Oils thus polymerised do not solidify when chilled, and, on the other hand, only become slowly fluid when heated.—C. A. M.

Oils, fats, etc.; Emulsification of ——. The Arabol Manufacturing Co. Fr. Pat. 404,959, June 22, 1909.

Oils, fats, etc., are intimately mixed with a viscous vegetable substance (*e.g.*, marine algæ, etc.) previously soaked in a suitable quantity of water, to which has been added a small amount of an aldehyde, preferably formaldehyde. Compounds, with nitrogenous bases, of substances prepared from marine algæ, such as ammonium "tangate," may be used in place of the algæ themselves. Products thus obtained are suitable for lubricants, therapeutical purposes, etc.—C. A. M.

Cosmetic soap and process of manufacture thereof. E. Weyner, Budapest. Eng. Pat. 23,111, Oct. 9, 1909.

An addition of organic or inorganic bismuth compounds is made to the constituents of the soap, preferably prior to saponification.—C. A. M.

Medicinal soaps and process of making them. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,075, April 28, 1909.

See Fr. Pat. 402,740 of 1909; this J., 1909, 1211.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Patents.

Paint and other materials; Mills for grinding ——. F. W. Follows, Gorton. Eng. Pat. 5151, Mar. 3, 1909.

In constructing paint mills of the type in which the bottom stone or grinding surface is capable of being raised and adjusted towards the upper surface, claim is made for the use of an unjointed vertical driving shaft. This is provided with a boss (having an external screw thread) and with a worm wheel, which are constructed in one piece. The boss, turning within a fixed bearing provided with an internal screw, raises or lowers the shaft and the lower grinding surface. Connected with the lower part of the driving shaft is a bevel gearing wheel having a fixed key sliding in a slot upon the shaft, which can thus be raised or lowered without disturbing the bevel wheel.—C. A. M.

Ferric oxide [pigment]; Manufacture of ——. J. Gill, Pendleton, Lancs. Eng. Pat. 5618, Mar. 9, 1909.

Galvanisers' or wire drawers' waste liquor, or other liquor containing ferrous chloride, is treated with calcium carbonate (300 lb. to every 100 galls. of liquor of 60° Tw.), and a mixture of carbon dioxide and air, in approximately equal volumes, at a pressure of 20—30 lb. per sq. in., is blown through the material until nearly all the iron has been precipitated as ferrous carbonate and subsequently oxidised to ferric hydroxide; the temperature is maintained at about 180° F., and the process requires about 4 hours. The reaction vessel consists of an enclosed steam-jacketed pan, provided with an agitator, and having a perforated false bottom, through which the gases are made to enter; a pipe at the top carries the spent air and gas to another similar vessel, or to a condenser, for the condensation of steam, from which the gases are pumped again into the original vessel. Manganese, if present, is converted into chloride by treating the precipitated hydroxide with hydrochloric acid; the solution is then decanted for use in the manufacture of siennas and umbers, and the residual ferric hydroxide is washed, dried, and calcined. A product containing 97—98 per cent. of ferric oxide is obtained.—F. Sodn.

Zinc white; Manufacture of ——. E. Leriche. Fr. Pat. 404,840, July 7, 1909.

The zinc is dissolved in dilute sulphuric acid and then precipitated from the solution by means of sodium hydroxide, whilst the filtrate is subsequently electrolysed to recover economically the acid and the alkali. The solution of zinc sulphate may be purified before precipitation of the zinc oxide: (*a*), by eliminating the iron by the addition of a "milk" of zinc oxide; (*b*), by electrolytic precipitation of copper, manganese, silver, etc.; whilst magnesia may be removed (after precipitation of the zinc oxide) by the addition of a suitable quantity of the cathodic solution obtained in the electrolysis of the sulphate solution. In the case of zinc ores very rich in calcium compounds, the residue may be treated with a quantity of the cathodic solution in the presence of carbon dioxide derived from furnace gases, with the object of precipitating the calcium as carbonate and recovering the sulphuric acid in the form of sodium sulphate.
—C. A. M.

Oil or vehicle for paints, colours, and pigments. A. Hahn, New York, Assignor to C. P. Haesloop, Brooklyn, N.Y. U.S. Pat. 946,126, Jan. 11, 1910.

An aqueous starch solution is mixed with an aqueous solution of caustic potash, and the mixture stirred, whilst still hot, with a suitable proportion of hot boiled linseed oil, until an oily liquid is obtained. If desired, the product may be thinned with oil of turpentine. Special claim is made for a preparation obtained in this way from 2 galls. of starch solution (containing 1 lb. of starch), 3 fluid oz. of caustic potash solution (containing about ¼ oz. of the alkali), and 10 galls. of boiled linseed oil.—C. A. M.

Linseed and similar oils; Process and apparatus for treating [boiling] ——. A. Genthe. Fr. Pat. 405,074, July 15, 1909. Under Int. Conv., Jan. 29, 1909.

The object of the process is to produce a thickened oil suitable for use in printers' ink, etc. For this purpose linseed oil is heated in a vessel provided with a cover in which are arranged a number of cooling or condensing plates in connection with a cold-water jacket surrounding the lower part of the cover. Volatile matters given off by the heated oil are condensed on these plates and flow into a channel at the bottom of the cover, whence they are removed through a siphon tube. Before the oil is heated, the air in the vessel is replaced by carbon dioxide or other inert gas, the tube for introducing the gas reaching nearly to the bottom of the vessel. The current of gas is continued during the heating, and the gas collecting in the upper part of the vessel is re-mixed with the oil by means of fans placed in a wide tube, the lower end of which is below the surface of the oil. A trapped outlet is provided in the cover for the escape of the excess of gas.—W. P. S.

Preservative coating compositions. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,073, April 28, 1909.

See Fr. Pat. 403,103 of 1909; this J., 1910, 33.—T. F. B.

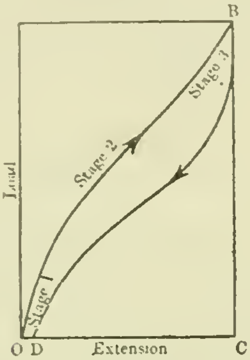
Inks. R. W. Hochstetter. Fr. Pat. 405,048, July 13, 1909.

See U.S. Pats. 928,450 and 928,915 of 1909; this J., 1909, 879 and 880.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber for electrical work; The testing of ——. A. Schwartz. Electrician, 1910, **64**, 585—588, 629—632.

The author describes a machine by means of which he has tested rubber mechanically in tension by hysteresis methods, and shows how the quality of the material may be discriminated. The strip of rubber to be tested is fixed in grips and supported in the machine by the side of the load-measuring spring. The free ends of the test piece and spring are connected to the ends of a cord passing over a "floating" pulley, the movement of which by means of a screw, hydraulic cylinder, or by a water-loading device, determines the rate of loading and extension. The end of the test-piece is connected by a cord with a recording pencil moving over a chart paper, the movement of which at right angles to that of the pencil, is controlled by a similar cord attached to the spring. The autographic diagram obtained by extension and retraction of the test piece is shown in the figure; OB is the extension- and BD the retraction-curve. The area of the loop, OBD, is a measure of the energy absorbed or the hysteresis of the material. The form of these curves is characteristic for a particular quality of rubber.



With high-grade correctly vulcanised rubbers, stage 2 is large, and stages 1 and 3 small; with hard rubbers, stage 1 is large, and stages 2 and 3 small or suppressed. The loops obtained with different specimens of homogeneous material are characteristic of it, provided that, in the case of newly-made material, the specimens are of the same age. The variations in the diagram through variations in laboratory temperature are small, and the rate of working of the machine is not of much consequence. The author confirms for pure rubber, the results of Stévart, that for a given extension, the load is proportional to the cross-sectional area of the test-piece. With test-pieces varying in length from 1 to 5 inches and with varying times of vulcanisation, using a mixing containing 88 per cent. of Para rubber, and a 200 per cent. extension, the work done in extension, retraction, and in the rubber itself, is proportional to the length of the specimen multiplied by a coefficient proportional to the time of vulcanisation. By making a series of successive extensions and retractions to limits of maximum extension or loading, the areas of the loops obtained approach a constant value. The rate of increase of extension with each cycle, after the first, follows a logarithmic law.

Extension = a + b log. number of cycles.

Four cycles are sufficient to obtain the characteristics, *a* and *b*, representing the power of recovery of the rubber. A series of constant extension-time tests at temperatures of 150° to 200° F. showed that high-grade rubber deteriorates less rapidly than low-grade rubber, except at 200° F., when the rate for all the specimens was about the same. The decrease in tension was least for the correctly vulcanised specimens. With the constant load-time test, the formula is *extension = a + b log. time*, and the value of *a* and *b* are characteristics of a given mixing. The author considers that the use of the hysteresis machine should lead to reliable physical tests which would ensure the use in a mixing, of a given percentage of rubber of definite quality and the restriction of the employment of recovered rubber and substitutes; and would give indications of the degree of vulcanisation and the character of the mineral filling.—J. W. H.

Rubber goods; Determination of vermilion and of "golden sulphide" of antimony in ——. F. Frank and K. Birkner. Chem.-Zeit., 1910, **34**, 49—50. (See this J., 1909, 614.)

0·5 GRM. of the rubber or ebonite, containing antimony sulphide or vermilion, or both, is roughly comminuted, and introduced into a round-bottomed flask of 100—150 c.c. capacity. 10 grms. of ammonium persulphate are added, and then 10 c.c. of fuming nitric acid (sp. gr. 1·5). After a few minutes, the flask is gently heated on a sand-bath until the vigorous evolution of gases is at an end. Should any particles of red mineral matter or of carbonised organic substance remain, a further quantity of ammonium persulphate (2—3 grms.) should be added gradually in the form of crystals during a space of 10 to 15 minutes. If any nitric acid remains, this is driven off by heat, when a clear colourless melt is obtained. Excessive heating should be avoided. The mass is allowed to cool, and as soon as it begins to crystallise, 10 c.c. of hydrochloric acid (sp. gr. 1·124) are added, and the solution diluted with warm water. The insoluble mineral residue is filtered off, and the antimony and mercury estimated in the filtrate as sulphide or oxide. For technical purposes the two sulphides may be precipitated together, freed from free sulphur, weighed, the antimony dissolved out by polysulphide, and the residual mercury sulphide freed from sulphur by extraction, and weighed. The proportions given of nitric acid and ammonium persulphate should be adhered to, as they have been found in practice to be the most suitable.—E. W. L.

Tackiness in Guayule rubber. C. P. Fox. India Rubber J., 1910, **39**, 108*d*—111.

GUAYULE rubber is much subject to "tackiness." With mechanically prepared Guayule, much of the trouble is no doubt due to excessive milling. With the chemically-prepared product, however, this factor is eliminated, as also, one would suppose, the possibility of bacterial action. Moreover the rubber is dried in a cool dark place, thus eliminating the effect of heat and light. Guayule may become either "tacky" or "clammy." In the former case the rubber becomes soft and sticky locally, the trouble finally spreading. In "clammy" samples the rubber becomes covered with a pellicle similar to that which forms on linseed oil. The author suggests that the stability of the rubber may depend upon the age and condition of the plants from which it is obtained. Old shrubs (which contain a low percentage of moisture) have a tendency to give sticky samples, possibly owing to the action of air or light, or both, on the partly dried shrub.——E. W. L.

Rubber resins. F. W. Hinrichsen and J. Marcusson. Z. angew. Chem., 1910, **23**, 49—52.

THE authors have studied, for purposes of further characterisation, the following properties of the resins obtained from a number of different crude rubbers:—(1), optical activity; (2), behaviour towards alkalis; (3), iodine value. (1) *Optical activity.* Of the resins examined, only those derived from *Hevea* rubbers (Para and Ceylon rubbers) were devoid of optical activity. The mean values obtained for the specific rotation, $[a]_D$, in the case of the other rubber resins were as follows:—Upper Congo, +13°; Manaos, +17·5°; Peru, +30·3°; Dead Borneo, +50·1°; Padang, +29·4°; Guayule, +12·5°; Guayule (another sample), +15·1°; Kassai, +29·8°; Kickxia, +32·9°; balata, +27·5°; guttapercha, +46·7°. In order to ascertain whether the specific rotation of these resins is affected by vulcanisation, samples of vulcanised rubbers were extracted with acetone and the extracted resins examined polarimetrically in benzene solution, with the following results:—Ceylon, $[a]_D=0$; Para, 0°; Equateur, +7·1°; Soudan sheets, +17·1°; Guayule, +7·1°. The low value obtained for Guayule resin may possibly be explained by the fact that the total weight of extract, which includes some free sulphur, was taken as the weight of the resin for the purpose of calculating $[a]_D$. A vulcanised sample of Kassai rubber was also found to yield an optically inactive acetone extract. Hence as far as the authors' experiments have proceeded, although it is not possible to conclude from the optical inactivity of its resins that a given sample of rubber consists of pure Para, it nevertheless follows that unless the resins of a given rubber are optically inactive, that rubber is not pure Para (or Ceylon). (2) *Behaviour towards alkalis.* The following percentages of the respective rubber resins were found to be insoluble in *N*/2 alcoholic potash:—Dead Borneo, 100·0; Kassai, 92·6; Padang, 90·2; Guayule, 78·2; Kickxia, 74·0; Congo, 56·6; Ceylon, 20·8; Para, 15·0; guttapercha, 83·6. It will be noted that those resins with high optical activity, contain a large proportion of unsaponifiable constituents. The authors therefore isolated the unsaponifiable constituents and determined their specific rotations. They found, as expected, that the values obtained were, in

general, much higher than those of the original resins. The mean values of $[\alpha]_D$ were as follows:—Ceylon and Para, 0°; Dead Borneo, +49·9°; Kassai, +34·5°; Padang, +40·1°; Guayule, +27·9°; Guayule (another sample), +28·1°; Kickxia, +27·5°; Upper Congo, +24·5°; guttapercha, +50·6°. The apparent exception of *Kickxia* resin may be explained by the presence of some dextro-rotatory, alkali-soluble substances in the resin, due to imperfect washing of the rubber. The two sets of results show that the alkali-soluble constituents are practically inactive; this fact was demonstrated directly in the case of the guttapercha resins. The authors therefore distinguish between two types of rubber resin:—(*a*), those accompanying the caoutchouc globules in the latex—the optically active resins must belong to this class, since they cannot be derived from optically inactive caoutchouc; (*b*), resins derived from the caoutchouc by oxidation—these are included amongst the saponifiable constituents of the resin. (3) *Iodine value.* The following iodine values were determined by the Hübl-Waller process:—Dead Borneo, 30·6; Para, 118·0; Padang, 87·1; Kassai, 107·0; Guayule, 94·1. The unsaturated character of the resins is indicated by these relatively high values.
—E. W. L.

Patents.

Indiarubber, gutta percha, balata and the like; Means or apparatus for removing foreign matter from ——. The British Murac Syndicate, Ltd., and M. M. Dessau, London. Eng. Pat. 24,438, Nov. 13, 1908.

The crude rubber, etc., is fed, together with water or other liquid, on to the surface of a rocking platen or plunger, the oscillations of which facilitate the separation of lighter impurities, while the material is passed on under pressure to the rolls. The surfaces of these are formed with crests and indentations, so as to effect a more thorough disintegration of the mass.—C. A. M.

Indiarubber; Manufacture of —— *and apparatus therefor.* H. S. Smith, Caledonia, Tobago. Eng. Pat. 7433, Mar. 27, 1909.

The rubber latex is separated into its solid and "liquid" constituents by means of centrifugal force in a drum, the inner surface of which is covered with a layer of felt or other material which will retain the gum, whilst the heavier or "liquid" portion can be discharged from the absorbent material while the machine is still rotating. Means are also provided for retaining the contents of the drum as long as desired before the fluid portion is discharged through the periphery.—C. A. M.

Waste rubber; Utilisation of ——, *and manufacturing useful articles therefrom.* H. Markus, Salford. Eng. Pat. 9284, Apr. 20, 1909.

The waste rubber is cut into pieces of about the size and thickness of heel pads or other articles, which are subsequently heated under pressure in moulds, preferably at a temperature higher than that used for the original vulcanisation.—C. A. M.

Caoutchouc; Method and apparatus for separating —— *from resinous products.* General Caoutchouc Co., Ltd. Fr. Pat. 404,307, June 22, 1909.

The substance containing the caoutchouc is treated with a solvent, such as carbon bisulphide or carbon tetrachloride, in a proportion just sufficient to convert the caoutchouc into a gelatinous condition. The mixture is then beaten up in a mixing machine provided with horizontal arms, and treated at the same time with a solvent capable of dissolving resins or other impurities, without dissolving the caoutchouc. The solvents are separated by decantation, the process being repeated several times until the resins have been completely extracted, after which the caoutchouc remaining in the apparatus is freed from the last traces of solvent by the use of a vacuum, with or without the application of heat.—C. A. M.

Elastic products and substitutes for natural gums; Preparation of ——. L. Turcat and G. Nuth. Fr. Pat. 404,357, Oct. 16, 1908.

Elastic or hard products are obtained by the action of ammonia or an amine, or by the successive action of different amines upon the products of the reaction of protohalogen compounds of sulphur with fatty oils, oxidised oils, sulphonated and oxidised oils, polymerised oils, fats containing glycerides of unsaturated fatty acids, etc., in the presence or absence of substances, such as sodium acetate, which facilitate the reaction. Products thus obtained may be hardened (polymerised) by the action of heat or oxidising agents or both; or they may be vulcanised by means of sulphur or halogen compounds of sulphur. Before either treatment they may be subjected to a slight vulcanisation with sulphur. Substances varying in their properties may be prepared by the interaction of these products (containing amino- or imino-groups) with bodies that will yield alkyl-, aryl-, and acidylamino derivatives (*e.g.*, ethyl halogens, alcohols, phenols, primary and secondary amines, acetyl chloride, glacial acetic acid, acetic anhydride, formaldehyde, benzaldehyde, etc.)
—C. A. M.

Rubber; Process for the manufacture of spongy ——. E. Poizot, Glos, France. Eng. Pat. 16,540, July 15, 1909. Under Int. Conv., July 17, 1908.

See Fr. Pat. 401,303 of 1908; this J., 1909, 1261.—T. F. B.

Chewing-gum; Manufacture of ——. J. D. Darling, Philadelphia, Assignor to Keystone Trading Co. U.S. Pat. 947,635, Jan. 25, 1910.

See Eng. Pat. 186 of 1909; this J., 1909, 1051.—T. F. B.

Substitute for leather and rubber. Fr. Pat. 404,749. *See* XV.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning process; On the knowledge of the ——. J. von Schroeder. Sonderausgabe aus den Kolloidchemischen Beihefte, Band I., Heft 1, 1909.

The theory of tanning is discussed from the standpoint of colloid chemistry and experiments are recorded bearing on points as yet little investigated. Pure gallotannic acid was used for these experiments and estimations were made by the Löwenthal method of analysis. Investigations were first made with alcoholic solutions of tannin. In such solutions tannin is not present in a colloidal form, but shows a normal molecular weight of 322, corresponding to the formula, $C_{14}H_{10}O_9$. The adsorption of tannin from these solutions by means of charcoal and of the "sprouted alumina" of Wislicenus was measured and recorded for solutions of different strengths. The solution and absorbent were first shaken together for some time and then allowed to stand. Quite similar experiments were also made with aqueous solutions, in which solutions the apparent molecular weight of the tannin is about 3500. The results, which are given in a series of tables, show that for alcoholic solutions there is an excellent agreement with the ordinary adsorption law, but that in aqueous solutions there are considerable deviations. In the case of charcoal and aqueous solutions, the adsorption law is approximately obeyed only for small concentrations, and in the case of alumina and these solutions, the law is only true over a certain range of tannin concentration. With hide powder and aqueous tannin solutions, the results could be represented by the adsorption curve, and experiments at different concentrations show that tannin solutions when remaining in contact with hide powder have at first a definite adsorption equilibrium. In attempts to investigate how far time was a factor in this equilibrium, it became evident that to obtain results of any significance it was essential to use both sterile tan solutions and sterile hide-powder. The former were sterilised by mercuric chloride, and the hide-powder by keeping in absolute alcohol for some time and washing shortly before use with ether. The results obtained under these conditions,—the experiments extending up to 30 days—show a very small and gradual decrease in the concentration of the tannin solution, and also that the longer the hide powder is in contact with the tannin infusion, the less tannin can be afterwards washed out. Further experiments of a similar nature showed that the longer the samples remained in contact with the tan-liquor, the less soluble they became in solutions of caustic potash. Some investigations on the effect of adding acids indicated that the adsorption of tannin was little affected, but the formation of gallic acid [from the tannin was observed, apparently depending more on the specific nature of the acid than on the concentration of hydrogen ions formed therefrom. Addition of alkalis, on the other hand, had considerable influence on the adsorptive capacity of hide-powder, reducing greatly its power for adsorption of tannin. The adsorption of tannin from alcoholic solutions by means of hide-powder was also found to be quite small. The author concludes from these experiments that the adsorption of tannin by hide-powder is dependent upon the colloidal nature of the latter. Experiments were also carried out on the precipitation of gelatin by tannin. Varying quantities of gelatin, tan, and acid were employed, and the gelatin was used in the form of a freshly prepared solution, in jelly form, and in the form of a solution which had been boiled for 4 hours. The results are recorded in tables and indicate that organic acids hinder the precipitation of gelatin by tannin according to their strength, but that the mineral acids do not. The protective action of the acids is found, however, to be dependent upon the previous history of the gelatin and the precise method of manufacture. Other experiments with gelatin and tannin solutions without acid showed that the precipitation of gelatin by tannin may be represented by the ordinary adsorption curve, and that this adsorption is independent of the previous treatment of the gelatin. The author then compares his results with hide powder and with gelatin, and discusses the bearing of his experiments on the theory of tanning. He defines leather formation not merely as due to the adsorption of tannin, but also to changes which take place in the course of time in the adsorption product, which changes cause the tannin to be much more firmly bound. He points out that adsorption of tannin only reaches its maximum when the hide-powder is presented in its most "soluble" form, and that if it be first treated with formaldehyde, much less tan is then taken up. The author considers that mineral tannages show many points of similarity with the colloidal precipitation of the hide by tannin, but that other processes of tanning (*e.g.* formaldehyde and quinone tannages) may be regarded as cases of purely chemical action, whilst others again (*e.g.* fat tannages) may be regarded as cases of purely physical action.—H. G. B.

Sumac extract: Influence of temperature in the dissolving —— on the colour measurement as measured by Lovibond's tintometer. M. C. Lamb. Collegium, 1910, 29—30.

The extent to which the colour measurement in a Lovibond tintometer, of solutions of sumac extract, may be affected by the temperature at which the extract was dissolved is shown in the following table:—

Dissolved at a temperature of:	Sulphited sumac extract.		Sulphited sumac extract after standing 24 hours.		Chestnut extract.		Sulphited quebracho extract.	
	Red.	Yellow.	Red.	Yellow.	Red.	Yellow.	Red.	Yellow.
20° C.	0·5	2·1	1·3	3·6	—	—	—	—
30° C.	—	—	—	—	—	—	6·4	8·0
40° C.	0·7	2·4	1·1	3·6	2·0	6·0	7·8	9·7
60° C.	0·6	2·1	1·2	3·5	2·0	6·2	7·7	9·0
80° C.	0·7	2·1	1·1	3·5	2·0	6·2	7·7	8·5
98/100° C.	0·5	1·7	0·9	2·9	2·0	6·2	7·3	9·0

The author suggests a temperature of 60° C. for dissolving sumac extract for colorimetric measurement, the readings being taken immediately after cooling and filtering.—H. Br.

Zeiss immersion refractometer; Determination of tannin in tan-yard liquors by means of the ——. P. Falciola and M. Corridi. Collegium, 1910, 21—25.

When a tannin solution is detannised, it sustains, among other variations of physical properties, an alteration in optical density and hence in refractive power. Zwick (Chem.-Zeit. 1908, 460; Collegium, 1908, 281) proposed to make the measurement of this a basis for the estimation of the tannin in the liquor. The authors have compared the results obtained with the Zeiss immersion refractometer with those obtained by gravimetric estimations of the tannin, detannisation being effected by means of the filter-bell method, and have calculated the percentage of tannin corresponding to one scale division of the refractometer. Tables of results are given showing the refractometric equivalents obtained for the tannin in various extracts. In all cases the value for this factor lies between 0·170 and 0·180, and in the case of quebracho extract is almost identical with that obtained by Zwick; with other extracts, however, variations occur.

The authors are of opinion that the method is not likely to be of use as a method of identification of various tannins, the difference of refractometric equivalent of tannins from various sources being so small. (See also Sager, this J., 1909, 534.)—D. J. L.

Errata.

This Journal, Sept. 15, 1909, page 948, column 1: The top line should read: "glycocoll 12·4, alanine 1·6, proline 10·4, leucine 4·2," line 3 from top: for "oxypyroline," read "oxyproline."

Patents.

Quebracho extracts; Method of treating ——. A. Redlich and J. Wladika. Fr. Pat. 440,305, June 22, 1909.

In order to render more soluble the difficulty soluble matters of quebracho extracts, the latter are heated with either sodium or potassium carbonate (about 1 grm. of alkali to 100 grms. of the insoluble matter) *in vacuo* for about two hours. A quantity of either hydrochloric or sulphuric acid, equivalent to the alkali used, is then added, and the solution allowed to cool. The resinous matters settle to the bottom of the vessel, and the clarified extract is siphoned off. If the extract is heated with alkali under pressure, a similar result is obtained.—H. Br.

Hides; Process for bating ——. G. Eberle, Stuttgart, Germany. Eng. Pat. 21,202, Sept. 16, 1909. Under Int. Conv., Nov. 16, 1908.

Claim is made for the use, in bating hides, of mixtures of gall with pancreatic secretion and intestinal fluid, the quantity of gall required depending upon the amount of lime in the water used in the process. Or, the active enzymes contained in these secretions, or enzymes (trypsin, steapsin) derived from the vegetable kingdom may be used. It is stated that this artificial bate has the same qualitative composition (as regards active constituents) as dogs' dung, over which, however, it has the advantage of not dissolving so much albuminous matter. If desired it may be obtained in solid form by adding sawdust or kieselguhr, and drying the mixture at 30° to 40° C.—C. A. M.

Tanning machinery. G. C. Vogel and C. P. Bossert, Milwaukee, Wis. U.S. Pat. 945,878, Jan. 11, 1910.

The apparatus consists of a large vat divided by partitions into a number of compartments containing the tan-liquor. The hides to be tanned are placed in cages with curved bottoms, which are supported in the several compartments. A travelling-frame mounted above the vat, carries a rotating paddle-wheel, which agitates the liquor inside the cage. The upper parts of the partitions are pivoted, so that they can be turned into a horizontal position, to allow the paddle-wheel to be moved from one compartment to the next. A crane is provided for lifting a cage from one compartment and transferring it to another.—A. S.

Tanning; Art of —. F. Van Voorhis, Finleyville, Pa. U.S. Pat. 917,169, Jan. 18, 1910.

A mixture in the following proportions is suggested for tanning hides:—gambier, 25 lb.; ground canaigre, 10 lb.; ground Sicilian sumac, 10 lb.; soda ash, 12½ oz.; water, 50 gallons.—H. Br

Tanning; Method of ——. H. Morin. Fr. Pat. 404,318, Oct. 15, 1908.

The addition of formaldehyde to a solution of a vegetable or mineral tanning material facilitates considerably the penetration, and also lessens the quantity of material required to produce a supple leather. For 1500 grms. of pelt, the use of 15 grms. of neatsfoot oil and 15 grms. of white soap, emulsified with 3 litres of water containing 30 grms. of formaldehyde, results in the production of a good white leather.—H. Br.

Tannage of hides; Apparatus and method for the rapid ——. A. G. Lauro. Fr. Pat. 405,039, July 13, 1909. Under Int. Conv., July 3, 1909.

Hides are suspended in tanning liquors contained in a system of vats, communicating with each other by means of tubes, and provided with cocks. The liquor can be removed from any vat by means of the cocks, and the tubes provide a means for circulating the liquor.—H. Br.

Tanning extracts; Method of manufacturing. ——. Nitritfabrik Akt.-Ges. Fr. Pat. 405,110, July 15, 1909. Under Int. Conv., July 20, 1908.

The tanning materials are submitted to a temperature higher than 40° C. for some time, before extraction. It is stated that this preliminary heating prevents decomposition of tannin substances during the subsequent operations.—H. Br.

Glacé leathers; Method of preparing a substitute for animal excrement (dog dung) in puering hides for ——. L. Lederer. Fr. Pat. 404,926, July 9, 1909.

A mixture of about 10 parts of purified, dried, and finely ground bones with 1 part of crushed lupin seeds or beans, or other matter containing vegetable albumin, is formed into a paste with water and allowed to ferment. The skins are first de-limed in water and then treated with a solution of the above mixture. The removal of the lime is facilitated by the addition of 2 per cent. of fat, three quarters per cent. of sodium polysulphide and 1½ per cent. of common salt on the weight of the ground bones.—H. Br.

Leather; Machine for preparing and dyeing.——. Farbleder-Werke S. Max und Söhne. Fr. Pat. 404,979, July 10, 1909. Under Int. Conv., July 14, 1908.

In a machine for applying preparations and dyestuffs to leather by means of rotating brushes, the latter are mounted on a carriage, and have a to-and-fro motion at right angles to the direction of movement of the skins. Half the brushes rotate in one direction, and half in the other, so as to treat the skin from the centre outwards to the edges.—H. Br.

Leather for gloves; Method of preserving ——. L. Grässer. Fr. Pat. 405,167, July 17, 1909. Under Int. Conv., Sept. 18, 1908.

Gloves which have been made from leather dressed with egg-yolk and flour, sometimes cause inflammation on the hands of the wearer, as the dressing remaining in the leather acts as a medium for the development of bacteria. The addition of the methyl, ethyl, or amyl esters of salicylic acid or the ethyl, methyl, or benzyl esters of benzoic acid, or mixtures of them, to the dressing is found to prevent these injurious effects.—H. Br.

Leather and rubber; Substitute for ——. C. D. Lightband. Fr. Pat. 404,749, July 5, 1909.

Thin slices of vegetable- or chrome-tanned leather are treated with vulcanised rubber solution, in order to fill up the pores. The slices are then pressed together, and re-vulcanised.—H. Br.

Casein and like compounds; Process of making ——. B. B. Goldsmith, New York. Eng. Pat. 412, Jan. 7, 1909.

The spotting and adhesion to the moulds which is liable to occur in the preparation of plastic substances from casein (Eng. Pat. 14,098 of 1907, this J., 1908, 911) may be prevented by treating the casein or casein derivatives with a suitable proportion of a hardening agent, such as formaldehyde, before, during, or after the action of the converting agent.—C. A. M.

Gelatin, celluloid, etc.; Machine for producing continuous thin sheets of ——. C. Soulier. Fr. Pat. 404,795, July 6, 1909.

Solutions of gelatin, celluloid, etc., are run on to an endless travelling band which is protected from dust by a cover and supplied with a current of dust-free air to dry the material. The band carrying the material passes through a dehydrating or coagulating bath such as alcohol, formaldehyde, alum, water, etc., and finally through a drying chamber where the continuous sheet is wound round a drum.—H. Br.

XVI.—SOILS; FERTILISERS.

Acidity of soils; Albert's method of determining —— H. Süchting and T. Arnd. Z. angew. Chem., 1910, 23, 103—106.

Albert's method (this J., 1909, 432) in which a known quantity of barium hydroxide solution is added, followed by excess of ammonium chloride, the ammonia being then distilled off and estimated, is shown to be subject to the following errors:—(1) The evolution of ammonia continues after the solution has become neutral, owing to dissociation of the excess of ammonium salt. The amount of error is conditioned by the intensity and duration of heating and is reduced but not removed by the presence of barium chloride. The barium salts of the soil acids, which are insoluble, have no such preventive influence. (2) The soil acids are very unstable in the presence of alkalis, and the use of baryta tends to give high results. (3) The acid silicates which Albert claims to estimate have no effect on the result, owing to the ready dissociation of the ammonium silicate which is produced by reaction of ammonium chloride and barium silicate. The method therefore gives results which are discordant among themselves and show considerable discrepancies when compared with the Tacke-Süchting method, so that the economy in time of operation is more than neutralised by the inaccuracy of the results.—W. H. P.

Acidity of soils; Determination of ——. Albert. Z. angew. Chem., 1910, 23, 106—107.

See preceding abstract. Results are given which are concordant and nearly identical with those obtained by the Tacke-Süchting method. To obtain them the following precautions are necessary:—(1) Only a slight excess of baryta over the quantity necessary to give a coloration with phenolphthalein must be added. This reduces the second error mentioned by Süchting and Arnd to a minimum. (2) Similarly, in order to eliminate the effects of the first cause of error, the minimum quantity of ammonium chloride must be used.—W. H. P.

Fertilisers for cotton soils. M. Whitney. U.S. Dept. Agric., Bureau of Soils. Bull. No. 62, Sept. 29, 1909.

Patents.

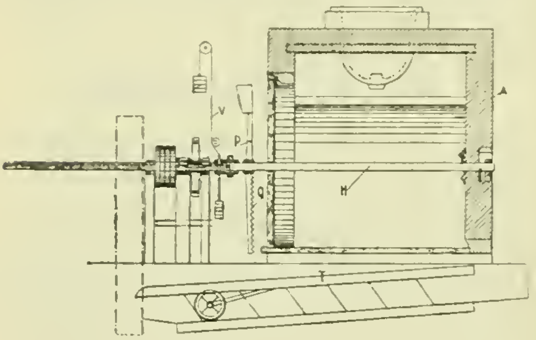
Borated fertiliser and borated insecticide fertiliser. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co., New Jersey. U.S. Pats. 943,668 and 943,669, Dec. 21, 1909.

Lime-borax waste material from the manufacture of borax is adapted for use as a fertiliser, by adding to the damp material, 5—10 per cent. of quicklime or 2—3 per cent.

of calcium saccharate or other neutralising substance, the material being meanwhile agitated and heated. This treatment renders the material pulverulent and non-toxic towards nitrifying bacteria, whilst not affecting its power of destroying noxious bacteria and fungi. The treated material may be mixed with the salts of potassium, ammonium, and phosphoric acid, or with other suitable substances, and claim is made in the second patent for an insecticide fertiliser made by adding an arsenate or other compound of arsenic.—F. SODN.

Superphosphate; Appliance for the mechanical extraction [subdivision] of ——. F. Benker. Fr. Pat. 403,685, Sept. 30, 1908.

THE appliance consists essentially of a vertical knife, P, mounted on a horizontal shaft, H, which consists of a long screw working inside tapped bearings of the same pitch, so that the knife moves forwards or backwards horizontally when it rotates with the shaft. The lower half of the knife is provided with sharp, inclined teeth, Q, like a saw, and the upper half is furnished with a scoop-like arrangement at its free end, the scoop being situated on the side opposite to the toothed edge of the lower blade. When the shaft is rotated, the knife moves forward into a horizontal cylinder, A, into which the mass of superphosphate is admitted. The rotating teeth cut the material into ribbons, which break up into small pieces and are caught by the rotating scoop, and carried forward as the knife progresses inside the cylinder, until they reach an opening situated in the floor at its further end. The disintegrated material falls through this opening into a screw conveyor or other suitable apparatus, T, for its convenient removal. To protect the shaft from the action of the superphosphate inside the cylinder, a long strip of cloth, V, suitably counterpoised, is so disposed with reference to the shaft, that it winds itself regularly round the latter in the course of its forward movement into the cylinder. When the knife has reached the end of the cylinder, and the latter is empty, the machinery is reversed, whereby the knife is withdrawn and the apparatus is ready for the next charge.—O. R.



Stimulating manure, composed essentially of a mixture of manganese carbonate and calcium carbonate. Soc. des Mines de Manganèse de Las Cabesses. Fr. Pat. 405,140, Nov. 7, 1908.

THE difficulty hitherto experienced in using manganese compounds as stimulating and fertilising manures, by reason of the acidity produced is overcome in the present patent by employing a mixture of manganese carbonate and calcium carbonate, in the proportion, as a rule, of about 1 to 3. Small proportions of other substances, capable of increasing the activity of the mixture, may also be added, if desired.—F. SODN.

Treating night-soil and household refuse to produce a manure. Fr. Pat. 404,751. *See* XIXB.

XVII.—SUGARS; STARCHES; GUMS.

Sugar factory; Claassen's method for the return of the waste waters to the battery in the Dormagen ——. A. Herzfeld. Deutsche Zuckerind., 1910, **35**, 49—70.

THE author gives an exhaustive account of an investigation of Claassen's method of returning waste waters to the battery (see this J., 1906, 327; 1907, 704), as applied at the Dormagen factory. The investigation was continued for a week. Four batteries were in use; the water returned to one of these consisted of its own waste waters (draining- and press-waters) mixed with the press-waters from the other batteries, and no fresh water was required for this battery. The other batteries were supplied with their own draining waters and the requisite quantity of fresh water. All the returned waters were carefully freed from pulp prior to their re-entrance to the battery. The diffusion work was found to go quite smoothly throughout the week, and the return of the waste waters had no prejudicial influence on the subsequent factory operations. The proportion of juice withdrawn was fairly high, and the exhausted slices were not strongly pressed; these conditions facilitate the process of returning the waste waters. Since, however, all the press-waters were returned to one battery, this battery received as much press-water as would generally be obtained by the stronger pressing customary in Germany. The loss of sugar in the diffusion process only amounted to 0·18 per cent. (calculated on the roots). As compared with results obtained by the ordinary diffusion process, this result shows that, with the return of the waste waters, an increase in the sugar-content of the diffusion juice is obtained. The exhausted and pressed slices from the battery that received the whole of the press-waters, had a sugar-content of 1·5—1·6 per cent.; the whole of these slices was subsequently dried. The exhausted and pressed slices from the other batteries contained 0·54 per cent. of sugar on the average. The coarse pulp and fine particles were removed from the waste waters, prior to the return of the latter to the battery, by means of special sieves and settling vessels. The thin, pasty mass finally obtained in the sedimentation process, was subsequently treated with milk of lime and utilised in the extraction of the saturation mud; this work proceeded without interruption during the week's experiment. The fine particles of pulp remaining in the waste water returned to the battery, and the bulk of the dissolved substances in the waste water, coagulated by heating, were retained by the slices and did not, therefore, pass into the diffusion juice. No deleterious changes occurred either in the waste waters or in the diffusion juices during the experimental period.—L. E.

Vicianose, a new reducing C_{11} sugar. G. Bertrand and G. Weisweiller. Comptes rend., 1910, **150**, 180—182.

A NEW reducing sugar, *vicianose*, $C_{11}H_{20}O_{10}$, has been obtained by the action of a diastatic extract of the seeds of *Vicia angustifolia*, for 6 days at 35°—37° C., on vicianin, the cyanogenetic glucoside obtained from the seeds of this plant (this J., 1906, 1231). It has a slightly sweetish taste, is crystalline, very soluble in water, but little soluble in concentrated alcohol even when heated, and it is not attacked by bakers' yeast in two days. Vicianose is the first definite biose prepared by the diastatic hydrolysis of a glucoside.—A. SELD.

PATENTS.

Sugar-content of condensation—and other waters; Apparatus for automatic determination of the ——. W. Raabe. Fr. Pat. 404,940, July 10, 1909.

THE apparatus serves for the automatic colorimetric determination of sugar in condensation water. A clock-work mechanism, rotating about a vertical axis, carries, at its circumference, a number of tubes, funnel-shaped at the upper end, and each provided with a siphon by means of which the contents of the tubes are emptied to a certain level. During rotation, each tube passes in succession under the outlet tubes of three vessels which contain respectively, the water under investigation, a solution of α-naphthol, thymol, or camphor, and sulphuric acid. The outlet tube of the vessel containing the water is jointed, its lower, movable part being pushed by a guide over each tube and then back again over a waste pipe until the next tube is in position. The outlet tubes of the other vessels are provided with a measuring cock common to both, the amounts of liquid delivered being determined by the sizes of the two cavities in the cock. The cock may be rotated by the clock-work mechanism; the outlet tubes depending from it are bent horizontally to prevent the liquids from falling abruptly into the tube. The bottom of each tube is closed with a hinged lid, fitted with an arm which comes in contact with an inclined plane once in each rotation and thus opens the lid. The contents of the tube are emptied thereby, and since this operation is effected only just prior to refilling, most of the tubes are in action simultaneously.—L. E.

Flexible, elastic, and plastic compositions [from amylaceous substances]. F. W. J. Henning, London. Eng. Pat. 2914, Feb. 6, 1909.

A modified method is claimed for the manufacture of roller composition, buffers or cushions, printer's blankets or other flexible sheets, and tyre-cores. Not less than 60, nor more than 120 parts of wheaten or other cereal flour, or flour produced from cassava, or similar material, are mixed with 100 parts of a saturated solution of magnesium chloride. The magnesium chloride may be mixed with a small quantity of another strongly hygroscopic salt, or with a small quantity of formaldehyde, or of zinc chloride or oxide, or of magnesia, or of other suitable substance. The mixture is cast or forced into suitable moulds.—L. E.

XVIII.—FERMENTATION INDUSTRIES.

Hops; The fat [fatty oil] of ——. L. Briant and H. Harman. J. Inst. Brew., 1910, **16**, 5—9.

A sample of hops which had been pressed under a pressure of 700 lb. per sq. in., showed on analysis an apparent content of 16·88 per cent. of soft resin, whereas another part of the same growth which had been normally pressed only gave 13·47 per cent. Investigation revealed the fact that under the higher pressure most of the hop seeds had been crushed. The seeds therefore were separated from a part of the sample and found to represent 18·9 per cent. of the total weight. After removal of the perigoneum the seeds were extracted with ether, which dissolved out 28·5 per cent. of a drying oil having an iodine value of 161·5. This oil had an unpleasant coarse flavour. Beer hopped with these highly compressed hops was considered to be inferior in flavour to that in which ordinary hops of the same growth had been used. They showed also a greater tendency to greyness from chill, than did those hopped in the ordinary manner.—R. L. S.

Fermentation; Explanation of cell-free —— by means of the ultra-filter. A. v. Lebedew. Biochem. Zeits., 1909, **20**, 114—125. (Compare this J., 1908, 824.)

If the author's conclusion that the disappearance of sugar and the formation of carbon dioxide during fermentation are two independent processes is accurate, sugar added to an inactive pressed yeast extract free from co-enzyme should also partly disappear. Attempts to ascertain whether this is really the case were made with dialysed yeast extract, but it was found that dialysis only weakens the fermentative properties of the extract. By means of Bechhold's ultra-filter (see this J., 1906, 1177; 1907, 993), however, a residue was obtained which had a fermentative power equal to only about 5 per cent. of the original value, whilst the filtrate was completely inactive. Determinations of the sugar and phosphoric acid on the residue and in the filtrate, with and without addition of sugar and phosphate, and before and after hydrolysis, showed that, in the residue, especially without addition of phosphate, about 30 per cent. of the sugar disappeared, whilst in the filtrate the quantity of sugar remained almost unchanged. The expressed extract of dried yeast contains no glycogen, but at least two hydrolysable sugar compounds, one of which passes through the densest collodion filter and gives phosphoric acid on hydrolysis, whilst the other seems to contain no phosphorus and is highly colloidal in character. The part which traverses the filter is probably an ester of a sugar-phosphoric acid and can be precipitated in the form of a liquid by means of 50 per cent. alcohol or acetone. It forms metallic salts, reduces Fehling's solution, and with phenylhydrazine gives a crystalline compound, $C_{24}H_{29}O_6N_6P$, m.pt. 148°—149° C. (with decomposition), which is probably the phenylhydrazine-phosphoric acid derivative of a hexosazone. With methylphenylhydrazine it forms a white crystalline compound, with *p*-nitrophenylhydrazine a deep-red osazone, m.pt 188°—190° C., turning blue on contact with alkali, and with semicarbazide a small quantity of white, non-crystalline flocks. This phosphoric ester may be the co-enzyme of zymase and probably forms an intermediate compound in the decomposition of dextrose into alcohol and carbon dioxide during alcoholic fermentation.—T. H. P.

Wines; Desulphitation of —— by means of hexamethylenetetramine. Rouillard and Goujon. Ann. Falsific., 1910, **3**, 14—16.

The authors have investigated the desulphitating action of hexamethylenetetramine on wines which have been treated with sulphurous acid, and find that a considerable proportion of the sulphurous acid present may be fixed by the aldehyde resulting from the decomposition of the hexamethylenetetramine; this portion of the sulphurous acid is not obtained when the wine is acidified with phosphoric acid and distilled in the usual way. The quantity of sulphurous acid thus combined increases with the acidity of the wine, as the dissociation of the hexamethylenetetramine is the more rapid the greater the acidity. It is, in this way, quite possible to combine 75 per cent. of the sulphurous acid present. Although the ordinary method of determining sulphurous acid does not yield the total amount present, the aldehyde-sulphurous acid compound is not entirely stable when the wine is distilled with phosphoric acid, and the formaldehyde liberated may be detected in the distillate by means of Schiff's reagent (magenta-sulphurous acid). It is also possible to detect the presence of formaldehyde in the wine directly; for this purpose the latter is treated with animal charcoal, filtered, and the filtrate treated with the reagent after being acidified with sulphuric acid. The presence of formaldehyde may be taken as denoting that the wine has been treated with hexamethylenetetramine.—W. P. S.

Wines; Desulphitation of —— by means of hexamethylenetetramine. Circular issued by the Minister of Agric. (France). Bull. Internat. Repression Fraudes, 1910, **3**, 5—6.

Official notice is taken of the practice of desulphitating wines by the addition of hexamethylenetetramine (see preceding abstract), and, as desulphitation by means of such substances as sodium peroxide, potassium permanganate, etc., is not allowed (in France), it is suggested that means be taken to prevent the use of hexamethylenetetramine. Tests are described for detecting the presence of formaldehyde or hexamethylenetetramine in wine (*loc. cit.*).—W. P. S.

Patents.

Amylaceous materials; New process of boiling —— with a view to saccharification and alcoholic fermentation. Soc. Franç. des Distilleries de l'Indo-Chine. Fr. Pat. 404,880, Oct. 29, 1908.

The amylaceous material is boiled with the hot vinasse from previous fermentations, the vinasse serving as a substitute, completely or in part, for other liquefying agents.—L. E.

Brewery; Process for making colouring substances for the ——. F. and E. Piot. Fr. Pat. 405,257, July 20, 1909.

The process consists in caramelising the products obtained either directly by the saccharification of malt, or by the action of any malted grain on raw grain. The colouring substances thus obtained do not modify the flavour of the beer and their use does not involve the introduction of any impurity.—L. E.

Alcohol; Process for the manufacture of —— from sawdust, cellulose, starch, etc. J. J. d'Orlowski. Fr. Pat. 405,187, July 17, 1909.

The raw material, such as sawdust, etc., is placed in an autoclave and mixed with about five times its weight of an aqueous solution of hydrofluoric acid containing from 2 to 6 per cent. of the acid and having a sp. gr. of about 1·15. The autoclave is then rotated slowly and its contents are heated for 1½ hours to a temperature of 115° C., the pressure being about 3 atmospheres. The temperature is next raised to from 120° to 122° C. for one hour; at the end of this time, the source of heat is removed and the steam and hydrofluoric acid vapour are allowed to escape from the autoclave into a condenser. The condensed acid solution is received in a lead vessel and is employed for treating a further charge of material. The contents of the autoclave are transferred to a vat, cooled, and sown with a suitable fermenting agent. The fermented mass is then submitted to centrifugal action, and the alcohol is obtained by distilling the liquid portion.
—W. P. S.

Wort from malted and unmalted grain; Preparation of ——. A. J. Boult, London. From M. Henius, Chicago, U.S.A. Eng. Pat. 12,881, June 1, 1909.

See U.S. Pat. 925,700 of 1909; this J., 1909, 807.—T.F.B.

Transforming the sulphates of potassium into potassium carbonate. [Utilisation of vinasse.] Fr. Pat. 405,127. *See* VII.

XIXa.—FOODS.

Evaporimeter; Cold-storage ——. M. M. Hastings. U.S. Dept. Agric., 1909. Circular No. 149.

An instrument is described for determining the humidity of the air in cold-stores. It consists of a horizontal porous porcelain tube, the open end of which is connected with a narrow graduated tube situated below the porous tube. This graduated tube is also fixed horizontally and is connected at either end with a larger tube placed below it; one end of the large tube is closed by means of a rubber stopper through which passes a short tube connected with a bulb inside the tube so as to allow freedom of air pressure in the apparatus, and a tap is provided on the tube connecting the other end of the large tube with the graduated tube and porous tube. Dilute sulphuric acid is introduced into the apparatus so as to fill the porous tube and partially fill the graduated tube, this operation being performed by holding the tubes vertically and closing the tap when sufficient acid has been admitted. The apparatus is then placed in a horizontal position in the cold-store. The strength of the acid employed depends on the temperature and "saturation deficit" desired in the cold-store, and tables are given showing the relation of the sp. gr. of the acid to temperature, humidity, etc. When the instrument has been set for a definite temperature and humidity, any change in the latter is shown by the movement of the acid in the graduated tube.
—W. P. S.

Xanthine bases; Determination of —— in cocoa and chocolate. A. Prochnow. Arch. Pharm., 1909, **247**, 698—711.

A mixture of 6 grms. of the powdered cocoa (or 12 grms. of the chocolate) with 197 c.c. of water and 3 grms. of dilute sulphuric acid (so as to yield an acid of about 3 to 4 per cent. strength) is boiled in a weighed litre flask for 30 minutes under a reflux condenser; after which 400 c.c. of water and 8 grms. of powdered magnesia are introduced, and the boiling continued for an hour. From 30 to 50 c.c. of water are then added (according to the quantity evaporated), and the weight of the contents of the flask (apart from the cocoa or chocolate) determined. After the insoluble matter has subsided, the supernatant liquid to the extent of five-sixths of the weight found (= 5 or 10 grms. of the cocoa or chocolate) is filtered, and the filtrate evaporated to dryness in a porcelain basin. The residue is taken up with about 25 c.c. of water, and, after the addition of 25 drops of melted phenol, the liquid is extracted for 6 hours with boiling chloroform in Katz's extraction ("perforation") apparatus (this J., 1903, 1154). The chloroform in the extraction flask is then distilled off, the 25 drops of phenol expelled by blowing into the warmed flask, and the flask and residue dried until constant in weight. The amounts of theobromine and caffeine thus found in samples of cacao beans and husks of various origin were as follows:—Roasted cacao husks, 0·578 to 1·380 per cent.; unroasted cacao beans (kernels), 1·460 to 1·812 per cent.; and roasted kernels, 1·536 to 1·880 per cent.
—C. A. M.

Salicylic acid; A source of error in the examination of foods for ——. H. C. Sherman. J. Ind. Eng. Chem., 1910, **2**, 24—25.

Baked cereal products and roasted coffee contain a constituent, probably Brand's maltol (this J., 1894, 896, 1213; 1895, 378), or some similar substance, which is volatile with steam, soluble in ether, can be sublimed and crystallised, and gives a violet coloration with ferric chloride similar to that yielded by salicylic acid. The presence of salicylic acid in such substances can be detected by means of Jorissen's reaction with alkali nitrite, acetic acid, and copper sulphate, which is not given by maltol.
—A. S.

Sweet corn; Influence of environment on the composition of ——, 1905—1908. H. W. Wiley, M. N. Straughn, and C. G. Church. U.S. Dept. Agric., Bureau of Chemistry, Bull. No. 127, Nov. 30, 1909.

XIXb.—WATER PURIFICATION; SANITATION.

Sulphate wood-pulp mills; Pollution by ——. Papierfabrikant, 1910, 9, 61—64.

In Finland the damage done to the lake and river fisheries by the effluents discharged by the sulphate wood-pulp mills has formed the subject of an enquiry by a committee. From the report it would appear that the greatest damage is caused by the suspended particles of cellular debris discharged with the effluents from the washing of the pulp. This cellulose sludge clogs the respiratory organs of the fish and fouls their breeding places in the beds of the streams and lakes. The proportion of oxygen dissolved in the water is seriously diminished by the reducing action of the products formed by the putrefaction of the deposits of this cellular debris. The maximum density due to the presence of dissolved salts, etc., in the effluents is 0·5° B., these compounds consisting chiefly of sodium carbonate and sulphide, with small proportions of sodium hydroxide. Of these compounds the sulphide is certainly the most noxious to fish, but under the conditions which prevail, the effluents become diluted 100 times within a very short distance from the point of discharge, and the dissolved salts may be considered as practically innocuous. In the case of Lake Lojo, serious damage to the fisheries is not yet apparent, owing to the large size of the lake, but if pollution be allowed to go on unchecked, the position must become serious in a few years. At present no attempt is made by any of the mills to modify the nuisance, and yet the removal of the highly objectionable cellulose débris from the washing operation might be readily effected at very little cost by the provision of settling ponds. Besides these effluents, certain of the mills dispose of their calcium carbonate residues from the causticising process by running them into the streams. This practice is likely to be stopped, and the calcium carbonate is being utilised in some cases as an agricultural dressing, or in one case as a

raw material for an adjacent sulphite pulp mill. Until quite recently, turpentine oil constituted an effluent polluting the streams. This is exceedingly toxic to the fish, but the problem of recovering and refining it is now receiving attention. Many of the mills are dealing with the nuisance caused by the evil odours connected with the manufacture by the provision of large condensing apparatus and conducting the uncondensed gases through a furnace.
—J. F. B.

Bacteria; The habituation or acclimatisation of ——, to antiseptics. L. Masson. Comptes rend., 1910, **150**, 189—191.

Experiments were made with *B. subtilis*, *B. anthracis*, and *B. pyocyaneus* and four representative antiseptics (resorcinol, salicylic acid, copper sulphate, and mercuric chloride). The proportion of each antiseptic required to prevent the growth of each species on a nutrient medium was first ascertained. Sowings from these (after a change to a normal medium) were taken for the trial with an increased proportion of antiseptic, and so on. In proportion as the chemical is increased, a longer contact is needed by the bacillus, amounting finally to 5—6 days. The various stages of tolerance are only obtained by allowing the bacteria to resume their normal life in an ordinary medium, before submitting them to the next increased toxic action. The bacteria gradually adapted themselves to increasing amounts of the antiseptics, reaching a limit of resistance, followed by a rapid fall, the whole of the acquired resisting power being lost. In some cases there was even an increased sensitiveness. The increased tolerance is therefore a temporary phenomenon, an example of the resistance of the species to variation. The following table gives the successive quantities (in grms. per litre) of the antiseptics required to prevent growth. The sowings with the normal bacillus are marked N, and the successive stages alphabetically :—

Bacillus subtilis.

	N.	A.	B.	C.	D.	E.	F.	G.	H.
Resorcinol	4·02	4·92	5·61	5·40	6·41	5·93	5·40	3·97	—
Salicylic acid	0·68	1·04	1·20	1·71	2·05	1·44	1·44	1·44	1·04
Copper sulphate	0·53	0·63	0·63	0·42	0·53	0·74	0·74	0·74	0·74
Mercuric chloride	0·07	0·11	0·22	0·30	0·44	0·93	0·93	0·59	0·05

Bacillus anthracis.

	N.	A.	B.	C.	D.	E.	F.	G.	H.
Resorcinol	0·45	0·53	0·31	0·53	0·74	0·79	0·63	0·63	0·53
Salicylic acid	0·44	1·02	0·74	0·74	1·00	1·00	1·00	1·00	—
Copper sulphate	0.44	0·53	0·63	0·63	0·63	0·79	0·79	0·26	0·05
Mercuric chloride	0·03	0·03	0·03	0·03	0·03	0·03	0·03	—	—

Bacillus pyocyaneus.

	N.	A.	B.	C.	D.	E.	F.	G.	H.
Resorcinol	3·00	3·45	3·97	3·97	4·98	2·98	2·98	2·98	—
Salicylic acid	1·02	1·20	1·44	1·44	1·44	1·71	0·69	0·69	0·69
Copper sulphate	1·71	2·01	2·27	2·27	2·27	2·01	1·48	1·48	1·48
Mercuric chloride	0·28	0·36	0·64	0·64	0·93	0·51	0·18	0·18	0·18

—A. Sbld.

Patents.

Water; Addition of reagents to ——. J. Wilson, Wandsworth, Surrey. Eng. Pat. 15,083, June 28, 1909.

The water-softening reagent is formed into a paste and a portion of the water to be softened flows over a perforated plate, which delivers it, in a gentle stream, on to the surface of the paste. This portion then joins the main body of water and flows past baffle-plates to a precipitating chamber, and through a filter to the delivery pipe.
—G. W. McD.

Water; Process for treating and storing ——. W. A. Powers, Topeka, Kans. U.S. Pat. 946,463, Jan. 11, 1910.

Quicklime and water are mixed together in a rotating drum until the lime is thoroughly slaked and the mixture has a creamy consistence; soda-ash is then added, and the whole is placed in a tank provided with a stirring device. This mixture is added and mixed with the water to be treated as the latter flows into a settling tank.—W. P. S.

Factory effluents and waste-waters in general; Process for the purification and clarification of ——. G. Hogermann and F. Wellensiek. Fr. Pat. 404,556, June 29, 1909.

A compound, obtained by treating powdered peat or lignite with an alkali, is added to the liquid to be purified; salts which precipitate the humic acid contained in the compound are then added, and the precipitate, which enmeshes the organic impurities suspended in the liquid, is allowed to settle. The treatment also removes dissolved matters and deodorises the liquid.—W. P. S.

Night-soil and household refuse; Installation for treating —— to produce a manure and to utilise the debris. Soc. Générale des Engrais Organiques. Fr. Pat. 404,751, July 5, 1909.

The refuse to be treated is delivered in automatically measured quantities into a series of mills and thence passes through rotating sieves. The finely divided material passing through the latter is collected in a conveyor, whilst the coarse particles are carried by a separate conveyor to another set of mills and sieves. The whole of the finely powdered material is mechanically delivered to a drying tower, in which are placed revolving conical devices separated from each other by perforated horizontal partitions, and, as the material falls downwards through this tower, it meets a current of hot air produced by the combustion of the coarse material which has not passed through the above-mentioned sieves, this coarse material having been carried to furnaces placed below the tower. The material may be passed through a second drying tower in order to ensure complete drying.—W. P. S.

Formaldehyde vapour by combustion of substances impregnated with trioxymethylene; Production of ——. S. Effantin and C. Bouhard. Fr. Pat. 404,933, July 10, 1909.

Vapours of formaldehyde can be produced by burning a substance impregnated with trioxymethylene. A suitable substance can be made by mixing paper pulp or powdered charcoal with potassium nitrate or chlorate and some adhesive.—F. Shdn.

Sewage sludge; Process for treating —— to obtain valuable products. J. Grossmann. Fr. Pat. 405,251, July 20, 1909. Under Int. Conv., Aug. 4, 1908.

See Eng. Pat. 16,397 of 1908; this J., 1909, 1000.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloids of ergot. Part II. G. Barger and A. J. Ewins. Chem. Soc. Proc., 1910, **26**, 2.

Ergotoxine (Barger and Carr, this J., 1907, 483) has now been shown to possess a carboxyl group; ergotinine, its anhydride, is probably a lactone. When ergotinine is warmed with a dilute solution of phosphoric acid in absolute alcohol, the crystalline phosphate of ergotoxine ethyl ester, $C_{34}H_{40}O_4N_5{\cdot}CO_2C_2H_5H_3PO_4$, is formed. This new base is amorphous; it differs from ergotoxine in being insoluble in dilute sodium hydroxide, and in yielding a series of salts having a different crystalline form from that of the corresponding ergotoxine salts. It is probable that the ester is also formed to some extent when ergotinine and ergotoxine are heated with alcohol in the absence of acids. On destructive distillation, both of ergotinine and of ergotoxine, a small quantity of a crystalline sublimate is formed, which has been identified as *iso*butyrylformamide, $CH(CH_3)_2{\cdot}CO{\cdot}CO{\cdot}NH_2$.

Jalap; Chemical examination of ——. F. B. Power and H. Rogerson. J. Amer. Chem. Soc., 1910, **32**, 80–113.

The authors extracted the jalap tubers with hot alcohol and distilled the extract with steam, when a small amount of an essential oil was obtained. The portion of the extract soluble in water contained a sugar, which yielded *d*-phenylglucosazone. The portion of the extract insoluble in water, known as "resin of jalap," amounted to 9·4 per cent. of the drug, and 11·6 per cent. of it was soluble in ether, as found by a special assay. When the crude resin was purified by means of animal charcoal, it had $[a]_D$ = —37° in alcoholic solution. The crude resin was successively extracted with several solvents. The light petroleum extract amounted to 1·9 per cent. of the total resin. It was found to contain fatty acids; a phytosterol, $C_{27}H_{46}O$, m. pt. 134°—135° C., [a] = —32·4° in chloroform; cetyl alcohol; and a substance, $C_{18}H_{36}O$, m. pt. 56°—57° C. The amount of the ether extract was 9·7 per cent. It contained a small amount of a new alcohol, termed *ipurganol*, $C_{21}H_{32}O_2(OH)_2$, which crystallised in colourless needles melting at 222°—225° C., and had $[a]_D$ = —44·9° in pyridine. It resembles the phytosterols in its colour reactions. The chloroform extract amounted to 24·1 per cent. It contained a very small amount of *β*-methylaesculetin. After treatment with alkalis and dilute sulphuric acid, it yielded volatile acids, convolvulinolic acid, $C_{15}H_{30}O_3$, and apparently a higher homologue of the latter, together with dextrose. Similar substances were yielded by the ethyl acetate extract, which amounted to 22 per cent. The alcohol extract of the resin (38·8 per cent.), after treatment with animal charcoal, was obtained as a nearly white powder, which melted at 150°—160° C., and had $[a]_D$ = —37·1°. This extract was hydrolysed by means of baryta, when *d*-methylethylacetic acid and other volatile acids were isolated, and an amorphous product soluble in water was obtained. The latter was designated as the hydrolysed resin. After treatment with dilute sulphuric acid, it yielded volatile acids, convolvulinolic and ipurolic acids, together with sugar. The ether, chloroform, ethyl acetate and alcohol extracts of the original resin possessed decided purgative action.—F. Shdn.

Ecballium Elaterium fruit; Constituents of ——. F. B. Power and C. W. Moore. Chem. Soc. Trans., 1909, **95**, 1985—1993.

The alcoholic extract of the fresh fruit yielded, on concentration, a quantity of a green resin, and, on further evaporation, a small amount of a brown resin. From the latter nothing definite could be isolated, except a small quantity of "elaterin." The green resin, when systematically examined, yielded:—a small amount of a hydrocarbon, m. pt. 68° C., probably hentriacontane, $C_{31}H_{64}$; a phytosterol, $C_{27}H_{46}O$, m. pt., 148° C., $a]_D$ = +3·2° in chloroform; a substance melting at 258°—260° C., apparently allied to ipuranol, $C_{23}H_{38}O_2(OH)_2$; a mixture of fatty acids; and "elaterin." The authors have previously shown (this J., 1909, 1221) that this crystalline "elaterin" is not a simple body but is separable by fractional crystallisation into a laevo-rotatory, physiologically inert substance, and a dextro-rotatory substance of high physiological activity, both of apparently the same percentage composition: the former has been named *a*-elaterin, and the latter *β*-elaterin. Official "elaterin" contains from 60 to 80 per cent. of *a*-elaterin. No evidence was obtained of a glucoside of elaterin, nor of any other glucoside. The "elaterin" occurs, as such, in the fruit. The portion of the alcoholic extract soluble in water, contained a sugar which yielded *d*-phenylglucosazone, m. pt. 216° C.—J. O. B.

Rumex Ecklonianus; Constituents of ——. F. Tutin and H. W. B. Clewer. Chem. Soc. Trans., 1910, **97**, 1—11.

Rumex Ecklonianus, Meisner, is an herb indigenous to South Africa, where it is reputed to possess medicinal properties. An alcoholic extract of this plant yielded, together with resinous products and a small amount of essential oil, the following compounds: Ceryl alcohol; a phytosterol, $C_{20}H_{34}O$, apparently identical with rhamnol; palmitic, stearic, oleic, linolic, and *iso*linolenic acids; a small amount of ipuranol, $C_{23}H_{38}O_2(OH)_2$; kaempferol; chrysophanic acid; emodin; and emodin monomethyl ether; together with traces of other crystalline substances and large amounts of inorganic salts. A sugar which yielded *d*-phenylglucosazone was also present in small amount, but no evidence could be obtained of the presence of a glucoside. The emodin monomethyl ether which was isolated was identical with that obtained by Perkin and Hummel from *Ventilago madraspatana* (Chem. Soc. Trans., 1894, **65**, 932), and with that prepared synthetically by Jowett and Potter (Chem. Soc. Trans., 1903, **77**, 1330). The *dimethyl ether* of *chrysophanic acid* was prepared, and obtained in yellow prisms, melting at 190° C.

Essential oils [and their constituents]; Refractive indices of ——. E. J. Parry. Chem. and Drugg., 1910, **76**, 178.

All the determinations were made by the author on either a Pulfrich or a Zeiss- Abbé instrument. Figures are for 20° C.:

1.—*Constituents of essential oils.*

Dipentene	1·4709–1·4720	
Limonene	1·4750–1·4758	(Kremers, 1·47459)
Pinene	1·4649–1·4656	(Bayer, 1·46553)
Cadinene	1·5068	(Wallach, 1·50647)
Cedrene	1·5022	(Wallach, 1·50150)
Geraniol	1·4779–1·4787	(Tiemann, 1·4766)
Linalol	1·4650–1·4662	
Eucalyptol	1·4595–1·4610	
Citronellol	1·4655–1·4660	
Benzaldehyde	1·5425–1·5440	
Citral	1·4860–1·4868	(Tiemann, 1·4860–1·4900)
Citronellal	1·4475	(Tiemann, 1·4481)
Eugenol	1·5445	
Safrol	1·5390	
Geranyl acetate	1·4609	
Linalyl acetate	1·4564	
Ionone	1·4970–1·4986	(Tiemann, 1·4980)

2.—*Essential oils.*

Almond oil (bitter) (6 samples)	1·5500–1·5570
Angelica oil (1 sample)	1·4793
Aniseed oil (10 samples)	1·5530–1·5580
Bergamot oil (11 samples)	1·4640–1·4692
Cajuput oil (5 samples)	1·4828–1·4679
Cassia oil (15 samples)	1·5932–1·6065
	(rises with cinnamic aldehyde)
Celery oil (1 sample)	1·4794
Citronella oil (Ceylon) (20 samples of drum oil)	1·4800–1·4850
	(not pure)
,, ,, (Java) (5 samples)	1·9630–1·4730
,, ,,	1·4774
(washed with water = 1·4820; contains 6 % of alcohol)	
Clove oil (10 samples)	1·5305–1·5360
	(rises with eugenol value)
Cinnamon oil (pure) (5 samples)	1·5750–1·5769
,, ,, (Ceylon) (4 samples)	1·550–1·5600
	(contains leaf oil)
Cubeb oil (3 samples)	1·4880–1·4960
Cumin oil (2 samples)	1·5011–1·5050
Caraway oil (6 samples)	1·4870–1·4980
	(rises with carvone value)

Dill oil (5 samples)	1·4850–1·4900
Eucalyptus oil (20 samples)	1·4610–1·4660 (B.P. oils)
Fennel oil (3 samples)	1·5250–1·5339
Geranium oil (8 samples)	1·4650–1·4669
.. .. (so-called) Indian (6 samples)	1·4829–1·4908
Hop oil (1 sample)	1·4900
Juniper oil (8 samples)	1·4710–1·4795
Lavender oil (10 samples)	1·4629–1·4678
Lemongrass oil (15 samples)	1·4840–1·4879
Lemon oil (24 samples)	1·4740–1·4762
Lime oil (3 samples)	1·4760–1·4780
Nutmeg oil (4 samples)	1·4750–1·4775
Origanum oil (7 samples)	1·4825–1·5115 (rises with phenol value)
Orange oil (6 samples)	1·4729–1·4742
Patchouli oil (3 samples)	1·5060–1·5080
Parsley oil (1 sample)	1·5070
Peppermint oil (American) (10 samples)	1·4665–1·4680
.. .. (English) (5 samples)	1·4670–1·4689
.. .. (Japan de-mentholised) (6 samples)	1·4622–1·4650
Petitgrain oil (4 samples)	1·4635–1·4665
Rosemary oil	1·4669–1·4720
Rose, otto (30 samples) (at 25°)	1·4615–1·4645
Spike oil (8 samples)	1·4670–1·4689
Santal oil (22 samples)	1·5060–1·5085
Tarragon oil (1 sample)	1·5143
Wintergreen oil (6 samples)	1·5319–1·5380
Vetivert oil (1 sample)	1·5197
3.—*Adulterants and other bodies.*	
Benzene (C_6H_6)	1·5000
Olive oil (10 samples)	1·4689–1·4699
White petroleum (sp. gr. 0·870) (5 samples)	1·4755–1·4769
Glycerin	1·4710
Ethyl alcohol (at 25°)	1·3600
.. .. 90 % (at 25°)	1·3620
Water	1·3330
Phenyl-ethyl-alcohol (at 25°)	1·5220
Aldehyde	1·3320
Acetone	1·3600
Acetic acid (99 %)	1·3729
Ethyl acetate	1·3730
Amyl alcohol	1·4081
Methyl alcohol	1·3331
Amyl acetate	1·4040

Aloin. O. A. Oesterle and G. Riat. Schweiz. Woch. Chem. Pharm., 1909, 47, 717—21.

THE authors do not agree with the statement of Léger (this J., 1903, 161) that aloin is not hydrolysed by the action of acids. They found that when 100 grms. of aloin were heated on the water-bath under a reflux condenser for 80 hours with a mixture of 500 c.c. of 95 per cent. alcohol and 25 c.c. of sulphuric acid, and the mixture then set aside, in the course of a week or two, a dark red precipitate was formed, which, when removed by boiling xylene, proved to be aloe-emodin. The mother-liquor contained a reducing substance, which afforded with phenylhydrazine a yellow, crystalline osazone, m.pt. 208°—209° C. Aloin also forms aloe-emodin and a reducing body when boiled with alcoholic hydrochloric acid, hydrolysis taking place more rapidly than with sulphuric acid. In both cases besides aloe-emodin, an amorphous substance giving red solutions with alkalis is formed. This is probably the primary decomposition-product of aloin, from which aloe-emodin is ultimately formed by oxidation. Aloe-emodin is also formed when aloin is heated to 70°—80° C. with sodium peroxide and the mixture poured into dilute hydrochloric acid. In this case, no sugar could be detected as a product of hydrolysis.—J. O. B.

Iodine; Determination of ——, in syrup of ferrous iodide. A. Korndoerfer. Apoth.-Zeit., 1909, 24, 850—851.

FIVE grms. of the syrup, 5 grms. of water, and 3 grms. of commercial hydrogen peroxide solution are mixed, and allowed to stand for one or two minutes; 20 grms. of chloroform and 10 grms. of dilute sulphuric acid are then added, and the whole is thoroughly shaken until all the iodine has been dissolved by the chloroform. The excess of hydrogen peroxide is removed by the addition of sufficient potassium permanganate solution (1 : 1000) to give a distinct pink tint; and the mixture is set aside until this disappears. The iodine in the chloroform is then titrated, in the usual manner, with $N/10$ thiosulphate solution.—J. O. B.

Oxonium perchlorates. [Isolation and characterisation of ketones]. K. A. Hofmann, A. Metzler, and H. Lecher. Ber., 1910, 43, 178—183.

PERCHLORIC acid (70 per cent.) prepared from the commercial acid by evaporation up to 137° C. and subsequent distillation, forms insoluble or slightly soluble, crystalline oxonium compounds with many organic substances such as ketones, containing basic oxygen atoms, and also with imino-compounds. The oxonium perchlorates can be much more readily obtained than the corresponding sulphates, and are well suited for the characterisation and isolation of many ketones. The following compounds have been prepared:—*Xanthone perchlorate*, $C_{13}H_8O_2.HClO_4$, flat, light yellow prisms with a greenish fluorescence: soluble in chloroform, tetrachloroethane, and acetic anhydride: decomposed by water, absolute alcohol, glacial acetic acid, and ether. *Diphenylketone perchlorate*, $C_{13}H_8O,HClO_4$: orange-yellow crystals. *Carbazole perchlorate*, $C_{12}H_9N.HClO_4$: colourless, shining leaflets. *Phenanthraquinone perchlorate*, $C_{14}H_8O_2,HClO_4$: brick red needles. *Phenanthraquinone semiperchlorate*, $(C_{14}H_8O_2)_2,HClO_4$: flat prisms exhibiting pleochroism from light yellow to brownish-red. *Retene semiperchlorate* $(C_{18}H_{16}O_2)_2.HClO_4$; flat prisms similar to those of the corresponding phenanthraquinone compound. *Naphthazarin perchlorate*, $C_{10}H_6O_4.H_2O.HClO_4$; large, rectangular, thick plates, yellow to dark red, with bronze lustre. All of these compounds are decomposed by water. Quinone-di-imide, benzophenone, *a*-benzoquinone, and *a*- and *β*-naphthoquinone also yielded crystalline perchlorates, but anthraquinone and alizarin gave negative results.—A.S.

Tetrachlorethane and trichlorethylene; Examination of the physical and physiological properties of ——. V. H. Veley. Roy. Soc. Proc., 1910, B 82, 217—225.

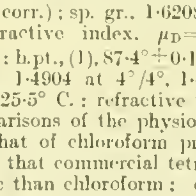
COMMERCIAL symmetrical tetrachlorethane and trichlorethylene were purified by fractional distillation with a Young's still-head with three bulbs. The pure products had the following characters:—Tetrachlorethane: b.pt., 147·2° ± 0·1° C. (corr.); sp. gr., 1·6208 at 4°/4°, 1·6013 at 17°/17° C.: refractive index, $\mu_D = 1·495587$ at 17° C. Trichlorethylene: b.pt., (1), 87·4° ± 0·1°, (2), 87·55° ± 0·1° C. (corr.); sp. gr., 1·4904 at 4°/4°, 1·4702 at 17·5°/17·5°, 1·4598 at 25·5°/25·5° C.: refractive index, $\mu_D = 1·479141$ at 17° C. Comparisons of the physiological action of the products with that of chloroform prepared from chloral hydrate, showed that commercial tetrachlorethane is four times more toxic than chloroform: commercial trichlorethylene is also rather more toxic than chloroform. Experiments with the pure compounds showed that tetrachlorethane is four times, and trichlorethylene, one and a half times, more toxic than chloroform, molecule for molecule. In both cases the recovery from anæsthesia or paralysis is more regular than with chloroform.—A. S.

Use of antipyrine for determining the iodine value of fatty and essential oils. Borde. *See* XXIII.

PATENT.

Therapeutic compounds; Manufacture of new ——. H. S. Wellcome, London, and F. L. Pyman, Dartford. Eng. Pats. 11,108, May 11, 1909, and 14,663, June 22, 1909. Additions to Eng. Pat. 314, Jan. 6, 1909 (see this J., 1909, 913).

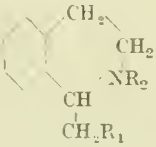
(1) BY oxidising tetrahydro-*iso*-quinolines of the general formula,



(where R. is a phenyl or substituted phenyl group; R_2 an alkyl group; R_3 and R_4 two alkyloxy groups or one methylene-dioxy group; and R_5 hydrogen or an alkyloxy group), basic substances of the general formula,

$$R_3R_4R_5C_6H(CHO)CH_2.CH_2.NHR_2,$$

together with aldehydes, R_1CHO, are produced. Thus, by heating *a*-benzylhydrocotarnine with dilute sulphuric acid and manganese dioxide, cotarnine and benzaldehyde are formed; N-ethyltetrahydropapaverine similarly is converted into veratraldehyde and 2-β-ethylaminoethyl-4·5-dimethoxybenzaldehyde; and N-propyltetrahydropapaverine furnishes veratraldehyde and 2-β-propylaminoethyl-4·5-dimethoxybenzaldehyde. The salts of the two last-mentioned bases are also claimed. (2) It is further found that tetrahydro-*iso*-quinolines of the general formula,



where R_1 is a phenyl or substituted phenyl, and R_2 an alkyl group, yield on oxidation, basic substances of the general formula, $C_6H_4(CHO)CH_2.CH_2.NHR_2$, together with aldehydes, R_1CHO. Thus, by oxidising 1-benzyl-2-methyltetrahydro-*iso*-quinoline, a new base, 2-β-methylaminoethylbenzaldehyde, is formed, together with benzaldehyde. This new base melts at 110°—111° C., and combines with acids in the usual way to form salts, which are also claimed.—T. F. B.

Therapeutic compounds; Manufacture of new ——. H. S. Wellcome, London, and F. L. Pyman, Dartford. Eng. Pat. 13,828, June 12, 1909.

By heating 1-keto-2-alkyl-6.7-dimethoxytetrahydro-*iso*-quinolines with concentrated hydrochloric acid to high temperatures (*e.g.*, for 3 hours at 170°—175° C. under pressure), 3.4-dihydroxyphenylethylalkylamines, $(HO)_2C_6H_3.CH_2.CH_2.NHR$, are formed. The new base obtained from the 2-methyl compound melts at 188°—189° C. The hydrochlorides of the new bases from the 2-ethyl and 2-propyl compounds melt at 177°—178° C., and 184°—185° C., respectively.—T. F. B.

Physiologically active base [p-hydroxyphenylethylamine]; Preparation of a —— and of intermediate compounds therefor. H. S. Wellcome, London, and G. Barger, Herne Hill. Eng. Pat. 17,171, July 23, 1909.

By treating anisaldehyde with sodium and ethyl acetate and subsequent hydrolysis, or by heating it with sodium acetate and acetic anhydride, *p*-methoxycinnamic acid is produced. On reduction this is converted into *p*-methoxyphenylpropionic acid. This is converted into the chloride and then to the amide, which, when treated with sodium hydroxide and bromine, yields *p*-methoxyphenylethylamine. The latter is converted into a salt of *p*-hydroxyphenylethylamine by heating with concentrated hydrochloric or hydrobromic acid (see also Eng. Pats. 1560 and 1561 of 1909; this J., 1909, 913, and 1910, 113).—T. F. B.

Glandular compound and process of producing same. J. Takamine, New York, Assignor to Parke, Davis, and Co., Detroit, Mich. U.S. Pat. 945,638, Jan. 4, 1910.

The "blood-pressure raising, hemostatic, and astringent principle of the suprarenal glands" (adrenaline) is treated with a solution of ferrous sulphate, the sulphuric acid liberated, is precipitated by addition of a basic oxygen compound of an alkaline earth, the solution is filtered, the filtrate evaporated to a syrupy consistency, and the iron compound precipitated. It is a non-hygroscopic substance of purplish colour, soluble in water and in dilute alcohol, and gives a green coloration with ferric chloride; the iron is not precipitated from its solutions by alkalis.—T. F. B.

Higher fatty acids; Preparation of di-iodo derivatives of ——. A. L. Arnaud and S. Posternak. Fr. Pat. 404,477, Oct. 20, 1908.

Acids of the series, $C_nH_{2n-4}O_2$, are dissolved in glacial acetic acid or chloroform and treated with the requisite amount of iodine in the solid state to form acids of the type, $C_nH_{2n-4}I_2O_2$. In this way tariric acid, $C_{18}H_{32}O_2$, can be made to yield a di-iodo acid melting at 48·5° C. Similar products can be obtained by treating acids of the same series, dissolved in dilute alkali, with iodine in potassium iodide.—F. Shdn.

Mercury compounds [from salicylic acid]; Preparation of new substituted ——. Farbenfabr vorm. F. Bayer und Co. Fr. Pat. 404,491, June 26, 1909. Under Int. Conv., July 11, 1908.

Mercuric salicylate is treated with one or two molecular proportions of a caustic alkali dissolved in water, and the liquid evaporated in vacuo. There are produced in this way the alkali phenolates of oxymercuric-salicylic anhydride, or the secondary alkali salts of oxymercuric-salicylic acid. These salts are soluble in water and methyl alcohol, and can be precipitated by means of ether.
—F. Shdn.

Tobacco; Process and apparatus for removing nicotine from ——. Soc. des Tabacs Désintoxiqués (Process du Dr. Parant). Fr. Pat. 404,584, Oct. 22, 1908.

The tobacco is steeped in a solution saturated with all the soluble constituents of tobacco other than nicotine. This solution as it becomes charged with nicotine is withdrawn and passed into a tank divided into two parts by means of a vertical partition reaching nearly to the top of the tank. The solution is rendered alkaline with ammonia in one of the compartments of the tank, whilst a similar solution, acidified with either sulphuric or oxalic acid, is placed in the other compartment. Petroleum spirit is poured over the surface of the solutions in the two compartments and extracts the nicotine from the alkaline solution, the acid solution in turn extracting the nicotine from the petroleum spirit. The latter circulates over the partition and also over the surface of the two liquids, and stirrers are fitted in the compartments in order to partially mix the solutions with the petroleum spirit. The solution from which the nicotine has thus been removed may be used again for extracting a fresh charge of tobacco.—W. P. S.

Quinotannic acid or its compounds; Preparation of stable solutions or soluble compounds containing, besides salts of iron ——. A. Meyer. Fr. Pat. 404,938, July 10, 1909.

When solutions of quinotannic acid or its compounds are treated with salts of iron, a precipitate is formed which is soluble in excess of the iron salt, especially when ammonium salts are present. Other substances, such as sucrose, dextrose, glycerol, organic acids, alcohol, etc., can be used to avoid the precipitation caused by salts of iron.—F. Shdn.

Lactalbumin compound soluble in water; Process for preparing a pure, neutral ——. J. A. Wülfing. Ger. Pat. 216,581, Dec. 23, 1908. Addition to Ger. Pat. 210,130, May 22, 1907.

Instead of treating precipitated lactalbumin with 26 grms. of sodium hydroxide per kilo. as in the original patent (see Eng. Pat. 6179 of 1908; this J., 1908, 1079), an equivalent quantity of a suitable calcium or magnesium salt is used. The magnesium salt of lactalbumin is readily soluble in water, and is tasteless, whilst the calcium salt is converted into turbid, colloidal solutions by agitation with water.—T. F. B.

β-Methyltetramethylenediamine; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 216,808, Dec. 10, 1908.

By treating the diamide of β-methyladipic acid with halogens and alkalis in aqueous solution, β-methyltetramethylenediamine, $NH_2.CH_2.CH(CH_3).CH_2.CH_2.NH_2$, is obtained. It cannot be prepared by Hofmann's reaction.
—T. F. B.

Erratum.

This Journal, Feb. 15, 1910, page 174, col. 1, line 19 from bottom, for "216,908" read "216,906."

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Bichromated gelatin; A property of ——. R. Namias. Eder's Jahrbuch, 1909, 89. Chem.-Zeit., 1909, **34**, Rep., 52.

Bichromated gelatin which has been exposed to light, contracts when warmed much more than before exposure. This property may be utilised to produce reliefs, the half-tones being also capable of reproduction by this means. The presence of glycerin is advantageous, and the relief is more marked the greater the percentage of moisture in the gelatin.—T. F. B.

Patents.

Plates and films for the production of coloured pictures by means of photography; Preparation of ——. F. M. Duncan, West Ealing. Eng. Pat. 50, Jan. 1, 1909.

In plates or films which have a colour screen between the support and the sensitive emulsion, the colour screen is composed of particles of gum such as gum tragacanth, gum dragon, and other gums obtained from plants of the *astragalus* species which contain "the calcium salt of bassorin or compounds such as cerasin, arabin, or pectin." Such a screen may be prepared by sensitising the support with a fish-glue emulsion containing the gum, exposing under a black and white screen, developing, staining, and mordanting for one colour, and repeating the process for the other colours, but producing the last colour by exposing directly through the support.—T. F. B.

Prints on cyanotype or similar iron-salt papers; Process for developing —— *to obtain a black image on a white ground.* Leperche et Cie. Fr. Pat. 404,753. July 5, 1909.

To obtain black prints on a white ground on ferroprussiate papers, the paper, after exposure in the usual manner, is developed in a solution containing potassium ferrocyanide, logwood extract, and gallic acid, fixed in a solution of an alkali bichromate, washed with water, dried, treated with a solution of dilute hydrochloric or sulphuric acid, and finally washed.—T. F. B.

Pellicles; Process for the continuous manufacture of ——. M. Ratignier and H. Pervilhac, Lyon, France. U.S. Pat. 947,457, Jan. 25, 1910.

See Fr. Pat. 395,665 of 1908; this J., 1909, 492.—T. F. B.

Producing continuous thin sheets of gelatin, celluloid, etc. Fr. Pat. 404,795. *See* XV.

XXII.—EXPLOSIVES; MATCHES.

Explosions; Report on circumstances attending —— *which occurred at the factory of Messrs. Kynochs, Ltd., Umbogintwini, Natal, on December, 7th,* 1909. W. H. Pay. The Natal Government Gazette, 1910, **3803**, 38—41.

The explosions occurred in the weighing and mixing houses, three Europeans and eight natives being killed. 2000 lb. of nitroglycerin and 100 lb. of collodion-cotton were present in the weighing house, and in the mixing house, 800 lb. of blasting-gelatin in the machines. Whilst nitroglycerin and collodion-cotton were being weighed off, the latter became ignited, and a few seconds later, the nitroglycerin in the building detonated. This was followed, 15 or 20 seconds later, by another explosion in the mixing house situated 320 ft. away. The structural damage caused by the explosions was considerable. At the site of the weighing house a crater 3 ft. deep and 18 ft. wide was formed. Two craters, 5 ft. deep by 9 ft. wide, marked the site of the mixing house. All buildings within 1000 ft. radius were affected, and in most cases the roofs had been sucked down and the walls bulged out towards the centres of the explosion. The probable causes of the explosion in the mixing house are reviewed. That spontaneous ignition of the collodion-cotton, due to imperfect purifying, was the cause, is negatived by the results of the tests carried out with samples from the same batches of collodion-cotton and blasting-gelatin. The collodion-cotton gave a heat test of 27 minutes, and the blasting-gelatin one of 21 minutes. Mercury compounds were proved to be absent. The inspector arrives at the conclusion that ignition due to friction on the scales, was the cause of the explosion. The collodion-cotton was first weighed out, and nitroglycerin from the filter-tank poured on, until the beam of the scale rose with the correct weight. The operation caused the production of a considerable quantity of dry collodion-cotton dust. The beam was fitted with two sliding weights, one of them weighing 6 lb. There was very distinct evidence that ignition of the collodion-cotton took place during weighing. The beam or its graduations would be coated with collodion-cotton dust, and in the inspector's opinion, the friction between the sliding weight and the beam would have been quite sufficient to cause ignition of this dust. The explosion in the mixing house was undoubtedly due to projected *débris*. To prevent accidents of a similar nature, the following alterations have been made in the factory: (*a*) Nitrocotton is to be weighed in a special annexe to the dry cotton store, and sent to the hand-mixing house in flax bags. All weighing parts of the scales are as far as possible to be thoroughly and efficiently protected, and the platform suitably covered. (*b*) Nitroglycerin is to be measured out and not weighed. (*c*) Mixing tables are to be covered with cork-linoleum to minimise friction, and all collodion cotton boxes and benches are to be covered with soft material for the same purpose. A special porch for collodion-cotton is to be added to the weighing house, so that only minimum quantities of this ingredient will be introduced into the main building.—G. W. McD.

Mercuric chloride in compressed guncotton; Detection of ——. S. P. Jannopoulos. Seventh Int. Congr. Appl. Chem., London, 1909. Z. ges. Schiess- und Sprengstoffw., 1910, 5, 47.

The following simple preliminary test for the detection of mercuric chloride is recommended. 30—40 grms. of the sample are mixed to a thick paste with water, and in this are placed 10—15 small pieces of bright, thin sheet copper. From 3 to 5 c.c. of pure concentrated hydrochloric acid are next added, the mixture is stirred, and then allowed to stand in a covered beaker for 1—2 days. The pieces of copper are now removed, washed successively with dilute sodium hydroxide solution, water, alcohol, and ether, and dried in an exsiccator. One or more of the pieces are then rolled up and placed in a piece of perfectly dry, narrow glass tubing, open at both ends, and the latter is heated over a small Bunsen flame, whilst held in a slightly inclined position. Any mercury which has been deposited on the copper is volatilised and is condensed on a piece of dry grass held tightly against the upper end of the tube. An indication of the quantity of mercury present is obtained by examining the piece of glass, with the mercury deposit, under the microscope. The mercury deposit may further be converted into mercuric iodide by exposing it to the action of iodine vapour.—A. S.

Patents.

Explosive compound. L. Gray, Cleveland, Ohio. Eng. Pat. 25,553, Nov. 5, 1909.

The explosive consists of approximately equal quantities of sugar and potassium chlorate. The ingredients are first mixed in a dry state and granulation is carried out by stirring in a gum solution so as to cause the particles to adhere together. After drying, the explosive is ready for use.—G. W. McD.

Safety match boxes, candle boxes and the like; Production of striking surfaces on ——. Enzesfelder Munitions and Metallwerke Anton Keller A.-G., Enzesfeld, and A. Swoboda, Vienna. Eng. Pat. 70, Jan. 1, 1909.

The composition forming the striking surface is usually applied direct to the paper surrounding the box. The disadvantages of this system are that should the striking surface become damp, it does not dry easily and the paper layer becomes spongy. According to the present patent a thin coating of Portland cement or gypsum is applied to the box, before the application of the striking layer and forms when dried, a firm, hard, and even under-layer which is not affected by damp and which prevents the igniting coating from being torn off when the match is struck. The process is carried out as follows: Glue (60 parts) is dissolved in water (250 parts), and incorporated with a mixture of Portland cement (60 parts), gypsum (60), pipe-clay (50), cork (5), and Venetian red (10 parts). The composition is then ground in a wet mill, and subsequently applied in a cold state to the bare wooden surface of the box and finally dried. The coating material for igniting the matches can then be applied.—G. W. McD.

Matches of all kinds; Igniting paste for —— prepared from neutral amorphous phosphorus, and lighting on any surface. Caussemille Jeune et Cie and Roche et Cie. Fr. Pat. 404,337, June 23, 1909.

The paste consists of neutral amorphous phosphorus (8 parts), glue (14·7), potassium chlorate (30), sulphur (2·9), zinc oxide (16), Meudon white (whiting) (5·5), plaster of Paris (6·4), and powdered glass (16·5 parts). The neutral amorphous phosphorus is obtained from ordinary phosphorus by subjecting the latter to distillation and filtration. —G.W.McD.

Gelatinous gunpowder; Machinery or apparatus for dividing —— into particles or grains. G. H. Wadsworth, Lyndhurst, Assignor to The Schultze Gunpowder Co., Ltd., London. U.S. Pat. 946,745, Jan 18, 1910.

See Eng. Pat. 23,112 of 1907; this J., 1908, 421.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Hydrogen; Gas volumetric determination of ——, by catalytic absorption. C. Paal and W. Hartmann. Ber., 1910, **43**, 243—258.

When a mixture of solution of sodium picrate and colloidal palladium (Paal and Amberger, this J., 1904, 208) is brought into contact with hydrogen, the gas is absorbed, and then reduces the picrate to triaminophenol. Thus, if a sufficiency of picrate be present, a very small amount of the palladium solution will serve for the absorption of a very large quantity of hydrogen. The authors utilise this reaction for the absorption and determination of hydrogen in gaseous mixtures. The absorption is carried out in the usual way, save that the pipette is an inverted cone with a very slightly convex base, so as to afford as large an absorbing surface as possible, for the absorption is not very rapid. Oxygen and unsaturated hydrocarbons must be first removed, for in presence of palladium, hydrogen reacts with them to form water and paraffin hydrocarbons respectively; and carbon monoxide should also be first removed, as it acts as a "poison" on the catalyst, and greatly retards the absorption. The solution retains its power of absorption unimpaired for many months.—J. T. D.

Iodine value of fatty and essential oils; Use of antipyrine in the determination of the ——. F. Borde. Bull. Sci. Pharmacol., 1909, 634; Ann. Falsific., 1910, 3, 42.

A solution of antipyrine may be used for titrating the excess of iodine in the determination of the iodine value of fats and oils; the solution is prepared by dissolving 1·88 grms. of antipyrine in 100 c.c. of 50 per cent. alcohol, and each c.c. of this solution is equivalent to 0·0254 grm. of iodine. In the case of essential oils, from 0·15 to 0·20 grm. of the sample is weighed out into a stoppered flask and dissolved in 10 c.c. of 90 per cent. alcohol; 10 c.c. of an alcoholic solution of iodine (containing 5 grms. of iodine per 100 c.c.) and 10 c.c. of an alcoholic solution of mercuric chloride (6 grms. per 100 c.c.) are added, the contents of the flask are mixed, and then allowed to stand in a dark place for four hours. The excess of iodine is now titrated with the solution of antipyrine, the end point of the titration being indicated by a faint yellow coloration. The solution of iodine employed must also be standardised with the solution of antipyrine. The procedure is the same with fatty oils except that 95 per cent. alcohol is used for dissolving the oil.—W. P. S.

Determining carbon monoxide in illuminating gas. Gill and Bartlett. *See* IIa.

Determining grease in textiles. Pearson. *See* V.

New reagent for hydrogen peroxide. Charitschkoff. *See* VII.

Determining chromium in chrome and chrome-nickel steels. Randall. *See* X.

Assay and valuation of gold bullion. Dewey. *See* X.

Assay of industrial gold alloys. Smith. *See* X.

Determining lead in ores with the aid of the centrifugal machine. Castek. *See* X.

Analaysis of aluminium and its alloys. Seligman and Willott. *See* X.

Determining vermilion and "golden sulphide" of antimony in rubber goods. Frank and Birkner. *See* XIV.

Determining tannin in tan-yard liquors with the Zeiss immersion refractometer. Falciola and Corridi. *See* XV.

Determining acidity of soils. (1). Suchting and Arnd. (2). Albert. *See* XVI.

Desulphitation of wines by means of hexamethylenetetramine. *See* XVIII.

Determining xanthine bases in cocoa and chocolate. Proehnow. *See* XIXa.

Source of error in examination of foods for salicylic acid. Sherman. *See* XIXa.

Determining iodine in syrup of ferrous iodide. Korndoerfer. *See* XX.

Detecting mercuric chloride in compressed guncotton. Jannopoulos. *See* XXII.

Patents.

Potassium; Colour screens for detecting —— (in analytical chemistry). J. H. Barron, London. Eng. Pat. 9368, April 20, 1909.

The screens are prepared by drying films of gelatin on glass, staining them with certain dyestuffs, and cementing pairs of the glasses face to face when the films have been re-dried. The essential part of the invention is the choice of pairs of dyestuffs so that only the extreme red of the solar spectrum is transmitted; such pairs are:—Methylene Blue and Methyl Orange; Aniline Blue and any red dyestuff; Malachite Green and any red or orange dyestuff; and Methyl Violet and picric acid or similar yellow. The first-mentioned pair is to be preferred.—W. P. S.

Gas analysis; Apparatus for ——. K. W. Bartlett and J. J. Staley, Assignors to Northern Water Softener, Co. Madison, Wis. U.S. Pat. 945,740. Jan. 11, 1910.

The apparatus consists of a reservoir filled with a liquid; the gas to be analysed is forced into the reservoir and the overflow of liquid is received in a second vessel. When a definite volume of liquid has been thus displaced, a valve is operated, whereby the supply of gas is cut off and that portion which has passed into the reservoir is allowed to pass into a vessel containing a solution which is capable of absorbing any one constituent of the gaseous mixture admitted. The valve is futher operated by the return of the liquid to the reservoir, and allows the unabsorbed portion of the gas to pass into a measuring device which automatically registers the volume of this unabsorbed portion.—W. P. S.

Specific gravity of liquids; Process and apparatus for determining the —— in cases where liquids form superposed layers in a vessel. T. Hillmer. Fr. Pat. 405,005, July 12, 1909.

The apparatus consists of a balance, the beam of which is supported near one end; the longer arm carries a counterpoise, and a pointer is fitted to the end of the arm. To the short arm of the beam is attached a small drum round which is wound a length of thread; a spherical weight is attached to the loose end of the thread and means are provided so that the thread may be unwound to any suitable length from the drum, thus enabling the spherical weight to be lowered as far as desired below the surface of a liquid. The specific gravity of the liquid, or of different liquids lying in superposed layers, may thus be obtained, the actual determination being carried out as usual.—W. P. S.

Apparatus for the automatic determination of sugar in condensation water. Fr. Pat. 404,940. *See* XVII.

Books Received.

Modern Printing Inks. A practical handbook for printing ink manufacturers and printers. By A. Seymour. Scott, Greenwood and Son, 8, Broadway, Ludgate Hill, London, E.C., 1910. Price, 5s. net. (Post free, 5s. 4d.; abroad, 5s. 6d.).

Demy 8vo. volume containing 80 pages of subject matter, with 6 illustrations, and an alphabetical index. The chapter headings are as follow: I. Introduction; II. Linseed oil; III. Varnish; IV. Dry colours; V. Dry colours—blacks, whites, yellows; VI. Dry colours—reds, browns; VII. Blues, greens; VIII. Lakes; IX. The grinding of printing inks; X. Ink and colour mixing; XI. The characteristics of some printing processes; XII. Driers; XIII. Bronze powders and bronzing; XIV. "Things worth knowing."

Papers of the Paint and Varnish Society. 1908—1909. Edited by the Secretary, N. Heaton, Denmark House, Stonebridge Park, London, N.W. Price, to members, 1s. 6d.; to non-members, 2s. 6d., post free.

Twelve mo. volume containing the following papers read before the Paint and Varnish Society during the session. 1908—9. (1). Action of driers on linseed oil (T. A. Davidson). (2). Notes on staining and glazing (J. A. Christie). (3). Paint, and its application to structural steel (G. Depierres). (4). Discussion on zinc oxide as compared with zinc sulphide pigments. (5). Technical notes on lac (A. F. Suter). (6). Lake pigments: their manufacture and use (W. G. Aston). (7). The physics of a pigment (J. Cruickshank Smith). (8). Anti-fouling compositions (C. Coffignier). (9). Fireproof paints (C. Coffignier). (10). Manufacture of oil varnishes (C. Coffignier). (11). Use and abuse of driers (M. B. Blackler).

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

2409. Erith. Separation of suspended matter or impurities from fluids.* Jan. 31.

2439. Lee. Furnaces. [U.S. Appl., Feb. 19, 1909.]* Jan. 31.

2496. Schneider. Producing very low temperatures, especially for liquefying and separating gases. [Ger. Appl., Feb. 1, 1909.]* Feb. 1.

2497. Lepten. Producing low temperatures. [Ger. Appl., Feb. 1, 1909.]* Feb. 1.

2522. Bratkowski. Means for drying materials. [Ger. Appl., Feb. 2, 1909.]* Feb. 1.

2975. Farmer. Freezing or cooling compounds. Feb. 7.

3031. Fischer. Roasting products from solutions or mixtures of unroasted products with liquids. [Ger. Appl., Feb. 9, 1909.]* Feb. 8.

3140. Haughton and Tungay. *See under* VII.

3162. Nixon. Removing impurities or matter held in suspension, solution, or combination from liquids. Feb. 9.

3171. Brownson. Method of filtering. Feb. 9.

3316. Hildebrandt. Liquefying gases with low boiling point.* Feb. 10.

3452. Brownson. Filtering liquids, syrups, &c. Feb. 12.

3498. Efran. Collecting the substances separating from evaporating liquids.* Feb. 12.

Complete Specifications Accepted.

4183 (1909). Longsdon and Bottomley. Centrifugal drying machines or hydro-extractors. Feb. 9.

9407 (1909). Samuelson and Backhouse. Pneumatic separators for granular substances. Feb. 16.

19,692 (1909). Maschinenbauges. Martini und Huneke. Storage of inflammable liquids. Feb. 9.

30,005 (1909). James and James. Mixing gases and vapours with air. Feb. 16.

II.—FUEL; GAS; MINERAL OILS; AND WAXES. DESTRUCTIVE DISTILLATION; HEATING LIGHTING.

Applications.

2320. Bone, Wilson, and McCourt. Heating media. Jan. 31.

2416. Wilson and Wilson. Manufacture of producer-gas.* Jan. 31.

2426. Baldwin. Separation of various materials from gases.* Jan. 31.

2444. Dunlop. Gas producers. Feb. 1.

2881. Heskett. Method of working gas producers. Feb. 5.

2887. Reuleaux. Gas producers.* Feb. 5.

2983. Westinghouse Metallfaden Gluhlampenfabrik. Decarbonising metallic filaments for electric lamps. [Austrian Appl., Feb. 19, 1909.]* Feb. 7.

3136. Valentine. Production of illuminating and heating gas. Feb. 9.

3197. Summers. Coking processes. [U.S. Appl., Feb. 9, 1909.]* Feb. 9.

3352. Lowe. Producer gas plants. Feb. 11.

Complete Specifications Accepted.

3003 (1909). Parker. Vertical retorts for destructive distillation of coal. Feb. 16.

4164 (1909). British Thomson-Houston Co. (General Electric Co.). Manufacture of filaments or conductors for incandescent electric lamps. Feb. 9.

4742 (1909). Crossley and Rigby. Gas producers for using sawdust, wood shavings, &c. Feb. 16.

6936 (1909). Westinghouse Metal Filament Lamp Co. (Lederer). Manufacture of metal filaments for electric lamps. Feb. 16.

8245 (1909). Noltenius. *See under* XII.

12,579 (1909). Neue Kramerlicht Ges. Forming and hardening mantles. Feb. 9.

17,771 (1909). Laigle. Manufacture of filaments for incandescence gas mantles. Feb. 16.

18,120 (1909). Weiser. Separation of paraffin from paraffin butter. Feb. 16.

18,123 (1909). Tigges. Gas producers. Feb. 9.

III.—TAR AND TAR PRODUCTS.

Applications.

2901. Giesbers. Treating tar derived from coal, wood, mineral oil, &c., for obtaining agglomerating pitch.* Feb. 5.

3224. Flürscheim. Nitration of *m*-nitraniline. Feb. 9.

3279. Eaton. Treatment of tar and apparatus therefor. Feb. 10.

IV.—COLOURING MATTERS AND DYES.

Applications.

2393. Newton (Bayer und Co.). Manufacture of azo dyes. Jan. 31.

2394. Newton (Bayer und Co.). Manufacture of acid mordant dyestuffs. Jan. 31.

2404. Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of tri- and tetrabromindigo.* Jan. 31.

2627. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of brown sulphurised dyestuffs.* Feb. 2.

2721. Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. Feb. 3.

3002. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the pyrazolone group. Feb. 7.

3093. Debédat. Colouring substance.* Feb. 8.

3206. Kalle und Co. Manufacture of indigoid colouring matters of the anthracene series. [Ger. Appl., Feb. 17, 1909.]* Feb. 9.

3299. Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs of the anthracene series. Feb. 10.

Complete Specifications Accepted.

3019 (1909). Imray (Meister, Lucius, und Brüning). Manufacture of pentabromindigo. Feb. 9.

4767 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Feb. 16.

4866 (1909). Tinkler. Production of colour. Feb. 16.

8416 (1909). Newton (Bayer und Co.). Manufacture of disazo dyestuffs. Feb. 9.

11,930 (1909). Newton (Bayer und Co.). Manufacture of anthracene compounds. Feb. 16.

12,456 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of monoazo dyestuffs for chrome-mordanted wool. Feb. 9.

15,625 (1909). Newton (Bayer und Co.). Manufacture of a black sulphur colouring matter. Feb. 16.

28,171 (1909). Imray (Meister, Lucius, und Brüning). Manufacture of penta- and hexa-halogenised indigos. Feb. 16.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

2560. Kron. Manufacture of paper-pulp material.* Feb. 1.

2775. Henderson and Russell. Imparting a linen or other finish to paper. Feb. 4.

3105. Soc. Anon. Banque du Radium. Fibres impregnated with actinium or other radioactive substances. [Fr. Appl., Sept. 28, 1909.]* Feb. 8.

3198. Newton (Bayer und Co.). Solution of cellulose esters. Feb. 9.

Complete Specifications Accepted.

7743 (1909). Wetter (Knoll und Co.). Treating acetylcellulose to enhance its elasticity and its power of absorbing dyestuffs. Feb. 9.

8331 (1909). Huillard. Treatment of fabrics. Feb. 16.

29,553 (1909). White and Gray. Towers for bleaching paper pulp. Feb. 16.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

3263. Riley and Co., Ltd., and Riley. Dyeing machines.* Feb. 10.

3366. Riley and Co., Ltd., and Riley. Dyeing machines.* Feb. 11.

3371. Riley and Co., Ltd., and Riley. Beam dyeing machines. Feb. 11.

Complete Specifications Accepted.

3087 (1909). Holden and Maguire. Preventing tendering of cotton, linen, or mixed goods that have been dyed with sulphide colours. Feb. 9.

8331 (1909). Huillard. *See under* V.

22,343 (1909). Scott. Printing on cotton or other fabrics. Feb. 16.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

2440. Bessler Waechter and Co., Ltd. Preparation of soluble alkaline silicates containing ferric oxide. Jan. 31.

2761. Sulman and Picard. Treatment of zinc-bearing solutions. Feb. 3.

3083. Chem. Fabr. von Heyden. Manufacture of new chemical compounds. [Ger. Appl., Feb. 10, 1909.]* Feb. 8.

3140. Haughton and Tungay. Manufacture of sulphuric and other acids and absorption of gases. Feb. 9.

Complete Specifications Accepted.

28,565 (1908). Jensen (Spitz). Production of pure oxide of tin. Feb. 9.

2109 (1909). Giana. Converting salts of tribasic phosphoric acid into salts of pyrophosphoric acid. Feb. 9.

3036 (1909). Wilton and Wilton. Saturators for making sulphate of ammonia. Feb. 16.

3061 (1909). Feld. Obtaining sulphur from sulphuretted hydrogen and sulphur dioxide. Feb. 16.

5619 (1909). Gill. Reverberatory furnaces for calcining hydrated oxides of iron. Feb. 9.

10,774 (1909). Grimm. Sulphur burners. Feb. 16.

16,224 (1909). Bunet and Badin. Manufacture of compounds of oxygen and nitrogen by electrical means. Feb. 9.

20,631 (1909). Riedel. Extracting nitrogen and carbonic acid from combustion gases. Feb. 9.

VIII.—GLASS; CERAMICS.

Application.

2548. Marks (Player). Production of sheet glass.* Feb. 1.

Complete Specification Accepted.

24,919 (1909). Baker. Ceramic marble. Feb. 16.

IX.—BUILDING MATERIALS.

Applications.

2580. Hill. Kiln for burning bricks, &c. Feb. 2.

2628. Rhodin. Manufacture of slag cement. Feb. 2.

2903. Bost. Manufacture of heat-insulating compound.* Feb. 5.

3016. Lessing. Manufacture of cement from blast-furnace slag.* Feb. 7.

3119. Kühl. Manufacture of hydraulic cement, &c.* Feb. 8.

Complete Specifications Accepted.

9229 (1909). Von Landgraf. Treating cement, ores, &c., in the rotary furnace. Feb. 16.

17,411 (1909). Amies. Building roads, streets, &c. Feb. 16.

20,479 (1909). De Villartay. Manufacture of bricks, tiles, &c., from slate waste. Feb. 9.

X.—METALS: METALLURGY INCLUDING ELECTRO-METALLURGY.

Applications.

2364. Köbler. Electrodes for the electrolytic refining of metals. Jan. 31.

2500. Dick. Treatment of copper and other ores. [Addition to No. 16,667 of 1908.] Feb. 1.

2711. Specialfabr. f. Aluminium-Spulen u. Leitungen Ges. m. b.H. Production of insulating layers of oxide or hydroxide on metal wires or bands. [Ger. Appl., Feb. 5, 1909.]* Feb. 3.

2759. British Thomson-Houston Co. (General Electric Co.). Treatment of metals. Feb. 3.

2761. Sulman and Picard. *See under* VII.

2876. Beck. Pyrophoric metal alloys. [Ger. Appl., Feb. 5, 1909.]* Feb. 5.

3061. Reid. Hardening metallic surfaces.* Feb. 8.

3357. McCowan. Extraction of zinc oxide from complex sulphide ores. Feb. 11.

3375. De Back. Recovering iron, steel, &c., from waste enamelled articles.* Feb. 11.

3439. Butikofer (Maitre). Uniting aluminium objects. Feb. 11.

3488. Arbuckle. Treatment of crushed ore products to recover the metal contents.* Feb. 12.

Complete Specifications Accepted.

23,181 (1908). Cowper-Coles, and Metalloids, Ltd.. Scaling, annealing, and coating metals. Feb. 9.

3134. (1909). Harden. and Amalgaline, Ltd. Soldering metals. Feb. 9.

6993 (1909). Johnson (Chem. Fabr. Griesheim-Elektron). Magnesium alloys. Feb. 9.

9229 (1909). Von Landgraf. *See under* IX.

13,445 (1909). Clark. Coating thin iron or steel objects with copper or its alloys. Feb. 16.

14,342 (1909). Frank. Treatment of zinc. Feb. 16.

17,103 (1909). Dor-Delattre. Charging retorts of zinc and other furnaces. Feb. 9.

XI.—ELECTRO-CHEMISTRY.

Application.

2510 and 2513. Tate. Rejuvenating storage batteries.* Feb. 1.

Complete Specifications Accepted.

8734 (1909). Backus. Electroplating apparatus. Feb. 16.

11,926 (1909). Newlands and Parkinson. Preparation for making electrolytes for primary batteries. Feb. 9.

16,224 (1909). Bunet and Badin. *See under* VII.

XII.—FATS; OILS; WAXES.

Applications.

2873. Vogt. Manufacture of benzine-petroleum tar or similar soap. Feb. 5.

2967. Krause. Rendering non-drying animal oils, particularly fish oils, siccative. Feb. 7.

2989. Dubovitz. Manufacture of stearine with acidification of oleic acid.* Feb. 7.

Complete Specifications Accepted.

3357 (1909). Eglen (Esuman-Gwira). Apparatus for extracting oil from palm or other nuts. Feb. 16.

8245 (1909). Noltenius. Recovering residuary oil from earth which has been used for clarifying or bleaching oil. Feb. 16.

17.228 (1909). Walker, Ltd., and Freestone. Washing compound. Feb. 9.

21,742 (1909). Kobe. Manufacture of cleansing preparations. Feb. 9.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Application.

2967. Krause. *See under* XII.

Complete Specification Accepted.

28,537 (1909). Forrester (Special Fabr. f. Farbenzerstäuber). Colour pulverisers. Feb. 16.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

2411. Matthews and Strange. Manufacture of synthetic caoutchouc or isomers or homologues of caoutchouc. Jan. 31.

2414. Johnson. Gutta-percha substitutes. Jan. 31.

Complete Specification Accepted.

16,663 (1909). Poizot. Manufacture of spongy rubber. Feb. 16.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

2499. Jensen (Fitzroy Tanning Co., Ltd.). Tanning process.* Feb. 1.

2780. Partridge. Process for whitening horn and giving it a pearly lustre preliminary to dyeing or staining. Feb. 4.

3437. Stiepel. Preparing chrome-tanned leather for making glue.* Feb. 11.

Complete Specifications Accepted.

7207 (1909). Glasel. Tanning drums. Feb. 9.

24,899 (1909). Damköhler and Schwindt. Treatment of tannin-containing extracts from vegetable matter, particularly extracts of mangrove bark. Feb. 9.

XVII.—SUGARS; STARCHES; GUMS.

Applications.

3004. Kantorowicz. Manufacture of soluble adhesive substances from starch-bearing roots, &c. [Ger. Appl., Feb. 13, 1909.]* Feb. 7.

3414. Kantorowicz. Manufacture of dry starch preparations for forming liquid adhesives with cold water. [Ger. Appl., March 10, 1909.]* Feb. 11.

3415. Kantorowicz. Manufacture of adhesive substances from flaked starch-containing matters. [Ger. Appl., May 21, 1909.]* Feb. 11.

3452. Brownson. *See under* I.

Complete Specification Accepted.

15,092 (1909). Thompson (Van der Kolk). Furnaces for disposing of bagasse and molasses from sugar factories. Feb. 9.

XIX.—FOODS. WATER PURIFICATION; SANITATION.

Applications.

2409. Erith. *See under* I.

2996. Loring. Manufacture of flour. Feb. 7.

3426. Meyerson. Pasteurising liquids. Feb. 11.

3466. Murphy. Converting hops, malt, &c., into foodstuffs. Feb. 12.

3508. Müller. Treatment of cow's milk.* Feb. 12.

3509. Müller. Manufacture of an alimentary product. [Addition to No. 22,006 of 1906.]* Feb. 12.

Complete Specifications Accepted.

2682 (1909). Kunick. Preservation of milk. Feb. 9.

3023 (1909). Thresh. Water purification. Feb. 9.

13,522 (1909). Sargent. Beverages. Feb. 9.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Application.

2888. Newton (Bayer und Co.). Manufacture of a new pharmaceutical product. Feb. 5.

Complete Specifications Accepted.

2400 (1909). Crépelle-Fontaine. Obtaining and recovering alcohol and ether in various industries. Feb. 9.

8069 (1909). Raschig. Manufacture of phenol esters chlorinated in the side-chain, and of oxybenzyl alcohols, oxybenzaldehydes, and oxybenzoic acids. Feb. 16.

19,805 (1909). Hoffmann-La Roche und Co., Darell, and Elger. Manufacture of guaiacol compounds. Feb. 9.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

2638. Forbes. Colour photography. Feb. 2.

Complete Specification Accepted.

23,273 (1908). Clifton and Wells. Carbon tissues for use in colour photography. Feb. 9.

XXII.—EXPLOSIVES; MATCHES.

Application.

3214. Wheelwright. Igniting compositions for making matches. [Addition to No. 21,866 of 1906.] Feb. 9.

Complete Specification Accepted.

4094 (1909). Guttmann. Buildings for the manufacture and storage of explosives. Feb. 9.

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Birmingham Section.

Meeting held at Birmingham University, on Thursday, December 9th, 1909.

MR. H. L. HEATHCOTE IN THE CHAIR.

A MODIFICATION OF ARMSTRONG'S METHOD OF TESTING TURPENTINE.

BY R. S. MORRELL, M.A., PH.D.

The literature on the examination of turpentine is very extensive and it is unnecessary to give more than two references to the most recent comprehensive contributions on the subject.

Richardson and Bowen (this J., 1908, 27, 613) have expressed their preference for the following method of estimating the amount of petroleum in adulterated pharmaceutical turpentine:—Fractional distillation of the turpentine combined with the determination of the refractive index of the distillation fractions for each 5° C. They are able to detect adulteration of American turpentine with American petroleum to 1·6 per cent. error.

J. Marcusson [Chem. Zeitung, 33] has recommended a modification of Burton's method [Amer. Chem. Jour. 12, 102] for the estimation of petroleum. The turpentine is oxidised by concentrated nitric acid and the quantity of petroleum present is determined by the weight of the unattacked spirit and by the weight of the nitro compounds separated from the products of oxidation of the turpentine. The analytical error of the method is stated to be 25 per cent.

From several years experience in the examination of American turpentine I rely chiefly on the behaviour of the oil on fractional distillation. Using a Young's 12 bulb dephlegmator, a good American turpentine gives about 90 per cent. distilling over between 155° and 165° C. The variation in the behaviour of high class American turpentine on fractional distillation is very small from year to year.

Any alteration in the colour and smell of the turpentine is accompanied by a change in the quantity and quality of the fractions.

I have found that a modification of Armstrong's polymerisation method [this J., 1882, 478] gave very satisfactory results and was accurate to within 2 per cent. The original method of Armstrong has been severely criticised. There was always an error arising from the difficulty in separating the unattacked petroleum from the liquid containing the polymerised turpentine. I found that the method could be modified to give satisfactory results if the two liquids obtained at each stage of the treatment with sulphuric acid were not separated, but the whole bulk was steam distilled. The polymerisation products of the turpentine remained in the distilling flask, whilst the hydrocarbons uncombined with the sulphuric acid passed over in the steam quantitatively. The difficulty of separating the two liquids disappeared by using this modification. I have tested the method by using turpentine adulterated with several varieties of petroleum and Borneo spirit.

It was impossible to separate the petroleum A from turpentine by the original Armstrong's method because the sulphuric acid and turpentine petroleum formed one liquid without any surface of separation. The solubility of petroleum A in cold sulphuric acid (4 : 1) was 0·35 per cent.; of petroleum B 16 per cent.; and of the Borneo spirit 3 per cent.

The accuracy of the polymerisation method is now brought to within 2 per cent., which is very satisfactory in view of the many stages of the process. I consider that the advantages of the modification lie in the simplicity of manipulation. The steam distillations require very little attention, a number can be performed at the same time, and no expensive apparatus is necessary. The time taken is really short, not more than a day and a half, and when once started, the experiment, so to speak, goes by itself.

I have found it advisable to treat the turpentine three times with sulphuric acid. The third treatment consists in warming the unattacked oil for two hours at 60° C. with concentrated sulphuric acid.

DISCUSSION.

Mr. H. L. HEATHCOTE said Richardson and Bowen had pointed out in 1908 that there was always a loss by the sulphuric acid method owing to some hydrocarbons remaining dissolved with the liquid. Dr. Morrell, by shortening the process, had actually given them a better one.

Mr. G. H. HOWSE asked for information as to the composition of the residue 1·5. Was it resin? Did Dr. Morrell know of Steifel's method for the separation of turpentine and petroleum spirit. He (Mr. Howse) understood that it depended for its success on the fact that pure turpentine was soluble in aniline oil whilst petroleum spirit was not. That test should be valuable, since it could be done in a few minutes.

Mr. F. H. ALCOCK said he supposed that Dr. Morrell did not approve of the polarimetric optical method. It was recognised that American turpentine rotated the ray of polarized light to the right; and the French variety to the left. Would it be possible to mix the two, and get a neutral optically active product? This aspect of the case came out forcibly years ago when terebine of the British pharmacopœia received considerable sanction as a remedy for bronchitis and other ailments. The polarimetric test was adopted by the pharmacopœia as a means of confirming polymerisation and the product could therefore be either genuine or a judicious mixture of the French variety with the American. They got practically an inactive rotating liquid, consequently the thing got into much disrepute. At that time during the process of polymerising turpentine he found, in the method, that much sulphur dioxide was generated: and did not know how to get rid of that and asked how Dr. Morrell succeeded? He did not quite see what the author meant by the residue referred to in his table, because in the process of distillation turpentine always left a residue unless it was rectified over alkaline substances such as soda or potash. Many years ago a Liverpool pharmacist suggested a simple method for testing

			By modification of Armstrong's Method. Per cent. Residue.		By Armstrong's Method. Per cent. Residue
American turpentine.			1·5	Mean of results from examination of samples from 200,000 galls.	2·5—3 per cent.
American turpentine	+1	per cent petroleum [A.]	2·0		
„	+2½	„ „	3·5		
„	+5	„ „	4·8		0. impossible to separate the two layers.
„	+10	„ „	9·7		
„	+20	„ „	19·0		
„	+2½	„ .. [B.]	4·4		
„	+5	„ „	5·9	.. . .	2·8
„	+16	„ ..	17·9		
„	+2½	.. Borneo spirit	2·9		
„	+5	„ „	6·2		
„	+10	„ „	11·8		
„	+20	„ ..	19·4	.. ..	11·2

Petroleum A. had a sp. gravity of 0·793 and flash-point 77° F.
B. „ „ „ 0·803 „ „ 94°
Borneo spirit „ „ „ 0·809 „ „ 74—75°

turpentines and terpene bodies. He prepared a solution of equal volumes of the sample of turpentine with absolute alcohol, and from a burette dropped into the mixture distilled water, when after a certain amount had been added, separation ensued which varied with different varieties of volatile oils of this class. Dr. Morrell would be rendering a very great service if he could suggest how to overcome such difficulties as adulteration of turpentines. He hoped he would be pardoned if he asked the question "What is turpentine?" because it seemed to him to be so very indefinite and variable in composition, especially when one considered that it was a product of the *pinaceæ*, of which natural order there were several scores of varieties.

Mr. J. C. Mann enquired how the result of 100·5 in the first column was obtained. He had not personally come across a coal tar naphtha with the flash point given, and with such a low specific gravity. Should it not be 0·880? The low specific gravity pointed to it being a petroleum product. He had tried the use of carbon tetrachloride for raising the flash point and density of turpentine substitutes to those of American turpentine. The presence of this body was however quite noticeable owing to the slight green halo imparted to the test flame when the flash point was being taken. It was a quite conclusive test for even small percentages of carbon tetrachloride in a mixture of this kind.

Dr. Morrell, in reply, said the residue of 1·5, obtained by the pulverisation process, consisted of hydrocarbon. It was not a resin body at all. With regard to the method of estimating turpentine by the use of aniline oil, he had seen an abstract of it but had not tried the process. His present paper was nearly two years old, and he believed that method was published later. As to Mr. Alcock's reference to the optical method he wished to say that it was a determination of the refractory, and not the rotary power. Upon that, he agreed, one could not rely. It was true that the use of sulphur dioxide had been abandoned, but it did no harm; and did not, in the least degree, interfere with the results. With regard to the enquiry as to what turpentine was, American turpentine generally had a distillation of about 90 per cent. between 150 and 160, with the hydrocarbon and light bodies mixed together. It was easy to distinguish between the varieties of turpentine by methods which were not chemical. Most of them differed in their fractional distillation—the Indian turpentine particularly. In reply to Mr. Mann, the result, less than 5, was merely the result of the experiment. Beyond that he could not say anything. Possibly he had placed the result a little too favourably. He believed coal tar naphtha was a blended substance. One might determine flash point by the carbon tetrachloride method, and the green light, which was a delicate test of its presence.

London Section.

Meeting held at Burlington House on Monday, March 7th, 1910.

DR. J. LEWKOWITSCH IN THE CHAIR.

SPONTANEOUS DECOMPOSITION OF BLASTING GELATINE.

BY J. B. HENDERSON, F.I.C., AND T. McCALL, F.I.C.

A most interesting, and so far as we know unprecedented case of spontaneous decomposition of blasting gelatine occurred in a Government magazine at Sellheim, Queensland, in December last.

On 19th May, 1909, a shipment of explosives arrived at Townsville, North Queensland, including one lot of sixty cases of one inch blasting gelatine which had been manufactured on the 4th of February, 1909. The explosive was in good order on arrival, and was forwarded to the Sellheim Magazine, which is situated seventy-one miles from Townsville at an elevation of 835 feet above sea level. This magazine supplies the Charters Towers Goldfield. When examined again on the 9th of September, 1909, the explosive was apparently still in good order, the samples tested giving a heat test of twenty-one minutes.

On the 15th December an urgent telegram was received in Brisbane that the explosive was in a dangerous condition, decomposition having set in and exudation showing outside the wooden case in one instance. A reply was sent authorising the immediate destruction of all explosives in this state and the removal of the remainder from the magazine. One of us then left by the first steamer for Townsville (750 miles distant) to investigate matters. It was found that on the 15th of the month the magazine keeper noticed a "dark liquid like tar" exuding through the end of one case and dropping on to a lower case and then on to the floor of the magazine. The case was opened and "fumes of an acid nature poured out." The contents of one packet in the middle of the top row had swollen up and looked yellowish except where it came in contact with the rubber lining, where it turned black; he did not see any signs of the cartridge wrappers or of the cardboard package. This case of explosives with the exception of one piece of wood from the end, was destroyed by burning, no trouble being experienced, this and the whole of the remainder of the batch burning off quietly when destroyed, without any detonations.

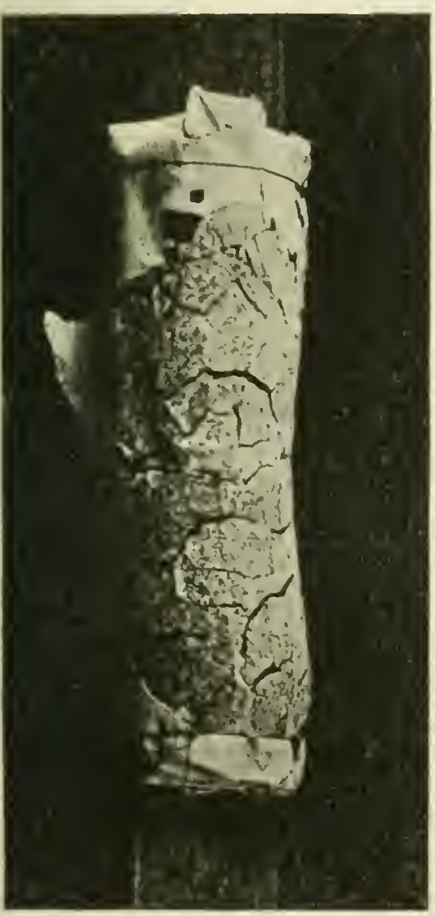
The part of the end of the wooden case was brought to Brisbane and still shows the sticky mass adhering to the inside, through the dovetail joints, and down the outside. Remains of part of the rubber lining in a much decomposed state are stuck on to the wood by the explosive, most of the rubber being dissolved, the fibre still showing. Part of a cardboard box also shows, as a thin, soft material. The "nitrous" smell is still marked (7th January, 1910), and the explosive is strongly acid to litmus paper, and moistened explosive test paper held close to the mass soon shows the usual brown-purple stains. The decomposing explosive, after partly dissolving the rubber sheeting, was dark brown, not black.

After destroying the decomposing case, the magazine keeper at once started to examine the remaining 59 cases, and on the following day (16th) found the contents of one 5 pound package, the end one of a lower row, "starting to swell up like yeast," having burst the string and giving the "same sort of smell as before." (Explosives are stored in two rows of five cardboard packages, each package holding 5 pounds, the whole 50 pounds being enclosed in rubber sheeting in a wooden case.) He at once removed the case from the magazine and stored it in the open, protected carefully from the rain by sheet iron and bags, the weather being hot and severe thunderstorms coming up nearly every day. He did not replace the top package or nail down the lid.

On Mr. McCall's arrival four days later (20th December), he found the contents of the package containing the decomposing explosive had swollen up, filled the space above where the other package had been, and had overflowed down the sides of the box, occupying probably about three times its original bulk. The mass had a greenish yellow colour and there was no appearance of the cardboard box or paper wrappers, these having been more or less destroyed. Naturally no attempt was made to investigate this mass, as it is generally admitted that when an explosive of this class once starts to decompose it soon fires and detonates. The smell of the acid fumes from this package could be easily noticed three yards off to leeward.

Other plugs from this case, from those packages which looked all right, were not only normal in appearance, but one which was brought to Brisbane and tested stood the "heat test" for twenty minutes.

About three thousand plugs in the other 58 cases were examined and although no exudation of free nitro-glycerine was found and although the gelatine was quite as resilient as usual and normal in colour, the parchment paper wrappers were in many cases extremely brittle. Any attempt to uncover the plugs by undoing the ends and rolling the plug between the hands in the usual manner resulting in the collapse of the paper.



Two plugs in this brittle paper were brought to Brisbane and on testing only stood the "heat test" eight minutes. The gelatine was normal in appearance in each.

The fact that one case contained good and also decomposing explosive is quite in a line with other explosives troubles, as it is not uncommon to find out of say sixty plugs in a five pound package as many as three plugs showing much exudation of free nitro-glycerine, all the others being good.

This was the only consignment of this particular explosive to Queensland of this date of manufacture.

The temperature of the magazine during the warm months is shown in the following table.

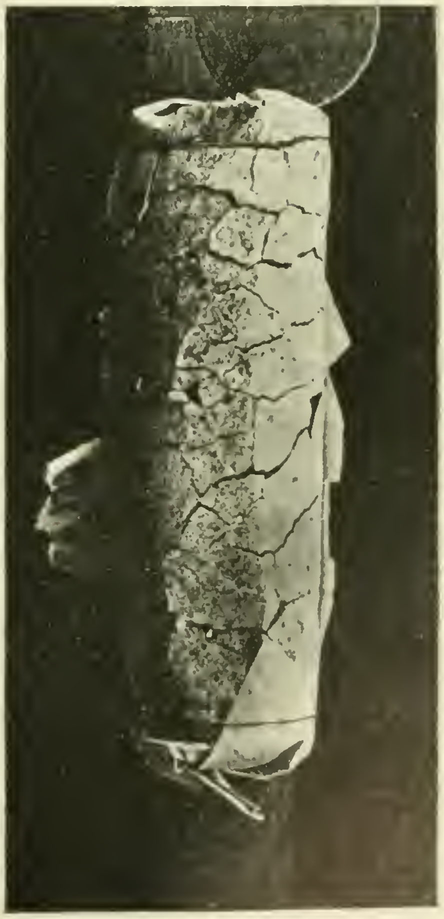
	Maximum	Mean maximum	Minimum.	Mean minimum.
October	90	86	73	75
November	95	89	74	78
December (to 20th)	91	88	73	78

Except towards the end of December the heat was a dry heat, but during the last fortnight a series of tropical thunderstorms came up making the air moist as well as comparatively hot.

We are quite at a loss to account for the cause of the decomposition. Free acid accidentally left in the parchment paper suggests itself, but the folds over the ends of the wrapper were not nearly so much affected as the parts of the wrapper touching the explosive, and in some of the least marked instances it was only the part of the wrapper actually in contact with the explosive which was at all brittle. This seems to show that the explosive affected the wrapper and not the wrapper the explosive.

The possibility of spontaneous decomposition occurring in a well-made explosive has been questioned more than once. Here is an undoubted and well-marked case of a product, presumably made under careful supervision, with part of the batch still in good order so far as could be ascertained by appearance and "heat test."

We regret very much that samples of the decomposing explosive were not investigated, but considered that, as samples had to be carried over 800 miles by train and steamer, any possible gain to science would not have justified the very serious risk to life and property involved in carrying such samples this distance. Only the three plugs mentioned and the small piece of wood with adhering explosive were brought to Brisbane.



Accompanying are photographs, actual size, of the two plugs mentioned as having brittle wrappers. The plugs were tied to an ordinary "2 foot" carpenter's rule while being photographed.

Manchester Section.

Meeting held on Friday, November 12th, 1909.

CHAIRMAN'S ADDRESS.

THE CONSERVATION OF FINISHED PRODUCTS.

BY R. H. CLAYTON.

Meeting held at Manchester on Friday, December 3rd, 1909.

MR. R. H. CLAYTON IN THE CHAIR.

THE DISTILLATION OF SEWAGE SLUDGE,

BY A. H. VALENTINE, M.SC.

Abstract.

The author described certain laboratory experiments which he had made with the sludge from the Sewage Works at Oldham, with the object of determining: (*a*) the character of the products of distillation; (*b*) the character of the residuum; and (*c*) the conditions for obtaining the most economical results.

The sludge was acidified, roughly dried by evaporation, and broken into pieces of about one inch diameter. These were placed in a flat-bottomed cylindrical steam-jacketed copper vessel with a perforated false bottom; the vessel was capable of holding about 12 lb., the depth of material in the vessel being about one foot. Attached to the cover-head of the vessel was a long referee's gas tube dipping at the bent end into a large vessel of hot water. Superheated steam was passed into the vessel at a temperature of from 160° to 250° centigrade. At the lower temperature grease began to distil over, and was deposited on the surface of the hot water as an exceedingly voluminous snow-like mass. This was periodically scooped off and brought to the liquid condition by boiling up with a drop or two of dilute sulphuric acid. The liquid fatty acid on cooling solidified into a hard compact mass, attached to which on the under side was a layer of "foots." The quantity of "foots" seemed to depend upon various factors, such as the amount of dust in the retort, the temperature of distillation and the rate at which steam is sent through the sludge. In the same way the colour of the fat, which ranges from almost white to a reddish brown, seemed to depend upon these same factors, as well as upon the quantity of acid used in acidifying the sludge. The amount of stearic acid and allied bodies thus obtained varied from 7 to 11 per cent. of the original dried material. Determinations of the saponification value indicated that the product contained from 88 to 97½ per cent. of stearic acid. Different samples were valued by various grease distillers and soap manufacturers between the limits of £12 and £20 per ton.

The residue in the retort was found to have lost from 10 to 18 per cent. of its original weight. The material burns easily with a long white flame; it is easily friable, and absorbent of water. The percentage of nitrogen closely approximates to the percentage in the original sludge, viz., from 1·7 to 3 per cent. The chemical composition and physical properties of this material indicate that it should have a value as manure. Comparative tests were made on a small scale to determine the difference in weight between vegetables grown in soils with and without the application of this material, the conditions being otherwise comparable. With carrots there was an increase in weight of 15 per cent., with beetroot of 25 per cent., and with potatoes of 18 per cent.

It is pointed out that to get the best yield of grease from sludge it is necessary that the sludge for this purpose should be obtained as far as possible in dry weather; the presence of storm water increases the percentage of useless mineral matter.

The writer suggests that the dry acidified sludge might suitably be distilled in a gas-producer so designed that the upper portion could be subjected to steam distillation alone, while the lower of two exits would take away the gases, formed by the combined action of steam and air at a higher temperature upon the residue from the first stage of the operation.

Such a process would probably work best under suction. The recovery of nitrogen as ammonium sulphate would also be an essential feature of the process.

New York Section.

Meeting held at the Chemists' Club, on Friday, January 21st, 1910.

MR. MAXIMILIAN TOCH IN THE CHAIR.

Before the regular proceedings, Prof. C. F. Chandler read the following resolution on the death of Dr. Ludwig Mond, F.R.S.

Resolved: "That the members of the New York Section of the Society of Chemical Industry, having learnt with deep sorrow of the death of their Past President, Dr. Ludwig Mond, wish to place upon the minutes of the Section an expression of their respect and admiration for his generous and noble character, his charming and genial personality, and his distinguished scientific and industrial achievements; and they tender to the members of his family the assurance of their heartfelt sympathy for this irreparable loss."

PRESENTATION OF THE PERKIN MEDAL TO DR. E. G. ACHESON.

Prof. CHAS. F. CHANDLER, in making the presentation, said:—

It is my pleasant duty as the senior Past President of the Society of Chemical Industry, in this country, to present to Dr. Edward Goodrich Acheson the fourth impression of the Perkin Medal. The first impression was presented to Sir William Henry Perkin, in whose honour it was established by the chemists of this country. The second was awarded to Dr. J. B. Francis Herreshoff. The third was awarded to Dr. Arno Behr, and we are now about to award the fourth to Dr. Edward Goodrich Acheson.

American chemists may well congratulate themselves on having among them such distinguished chemists, eminently worthy to be placed on pedestals, in the company of the great creator of the coal tar colour industry.

Dr. Acheson possesses the rare merit of combining the inventive, the constructive, and the organising faculties. He has been most successful in discovering entirely new materials suitable for a great variety of purposes, which have become indispensable to the world. He has also been able to devise most perfect methods and appliances for producing his new products on a large scale, and to organise and finance great companies to put his inventions into successful operation.

He was born in Washington, Pennsylvania, on the 9th of March, 1856, and was educated at the Bellefonte Academy, Pa.

In his seventeenth year his laborious life began, and for the following eight years he had a varied experience as a member of a civil engineering corps on railroad construction, as a surveyor of oil tanks in the oil country, and in connection with iron mining.

In 1880 he had the good fortune to make the acquaintance of Mr. Edison and being given a position with him at Menlo Park. Here he spent one year working under the direction of Mr. Edison, carrying out the ideas of that versatile genius. He made so favourable an impression upon Mr. Edison that he was sent to Paris as his representative at the electrical exposition there, and he subsequently installed the first incandescent lighting plants in Holland, Belgium and Italy.

From 1886—1892, Mr. Acheson interested himself particularly in electrical matters and obtained no less than 15 patents for improvements in conductors, thermo-electric generators, cal-electric generators, and telephone transmitters.

Carborundum.—In 1886, while making some experiments, he passed hydro-carbon gas over highly heated clay, and observed that the clay became impregnated with carbon. In the early part of the year 1891, having at his command an electric generating plant of considerable capacity, and looking about for a line of experiments, he thought to try the impregnating of clay with carbon under electric heat. The mass resulting from the experiment exhibited a few small crystalline specks. These he carefully examined and found that they not only scratched but actually cut glass. They appeared like minute gems. Grasping the possible value of his discovery he undertook further experiments and after two months' labour succeeded in obtaining a few grams of crystals. In order to test their value as an abrasive he mounted an iron disc in a lathe, charged its surface with his new unknown product, and found that this revolving disc cut the polished face off a diamond. Having satisfied himself of the abrasive quality of his new product he took it to a diamond cutter in New York, who tested it, and was glad to buy it at 30 cents. per carat, and with the proceeds of this first sale Acheson purchased a microscope to assist in the further study of the material. Having thus obtained this material from clay and carbon, and not yet knowing its chemical composition, he gave it the name "Carborundum"; but he soon learned that it was the silica of the clay, and not the alumina, which united with the carbon, producing a carbide of silicon, but the name "Carborundum" has been retained for the substance ever since.

In 1894 he established the Carborundum Company at Monongahela City, Pa., but subsequently moved to Niagara Falls, where he finally erected works and equipped a plant with 5,000 electric horse power, and where he has manufactured more than seven million pounds of carborundum. Nearly six hundred men are employed in the works at Niagara Falls, in preparing carborundum and fashioning it into wheels, sharpening stones, hones, bricks, knife sharpeners, paper, cloth, etc., fitting it for every kind of abrasive application. I should not omit to say that carborundum has proved a valuable substitute for ferro-silicon in the manufacture of steel.

Artificial Graphite.—In the carborundum furnace, Acheson noticed that in the hottest zone there was produced between the carbon core and the carborundum crystals a thin layer of graphite, which he decided must be produced by the dis-association of a portion of the carborundum and the expulsion of its silicon in vapour. The beautiful graphite constituted the skeleton of the original crystal. This discovery led Acheson to make a long series of experiments, the result of which was the discovery of a process for converting amorphous carbon, such as coke or anthracite into beautiful artificial graphite. As a result, the International Acheson Graphite Company was organised and large works erected for the manufacture of artificial graphite. This company turns out several million pounds of what is termed "bulk graphite," made principally from anthracite coal.

Graphitized Electrodes.—Graphite shapes suitable for electrodes are prepared and by subsequent exposure to the proper heat in the electric furnace are converted into hard and compact graphite. These graphitized electrodes have proved of the utmost value in various electrolytic operations, as they are found to be much more suitable than the carbon electrodes previously used. The company manufactures several million pounds of these graphitized electrodes annually.

Soft Graphite.—The artificial graphite produced by the Acheson Graphite Company was hard and well suited for use as electrodes for electric furnaces and electrolytic cells and for many other purposes. In 1906, Mr. Acheson devised a process for producing a soft graphite, for which he obtained a patent on September 22nd of that year. This graphite is especially valuable for use as a lubricant, a stove polisher, coating electrotype moulds, etc. This graphite is not only pure and soft, but unctuous and does not coalesce when compressed.

Deflocculated Graphite.—In connection with the manufacture of artificial graphite crucibles, Mr. Acheson's attention was called to the great difference in the plasticity of various clays, and especially to the fact that clays far removed from their place of origin were most plastic, and the idea came to him that this might be due to the fact that in their transportation by water they had become impregnated with vegetable extracts which might increase their plasticity. With this idea in mind he conducted a series of experiments with various clays and discovered that by treatment with tannin the soft graphite is so modified that it remains suspended indefinitely both in water and in oil, and he immediately realised the importance of the discovery, as enabling him to supply the world with a new lubricating agent invaluable for all purposes where lubricants are required. The value of this discovery is best shown by the fact that a shaft can be run from 50 to 100 per cent. faster with oil containing deflocculated graphite than with the plain oil.

Siloxicon.—In the summer of 1889 Acheson became interested in the direct reduction of silicon, and among other experiments he mixed graphite and silica, and exposed the same to the electric current with a view to producing siloxicon. He produced in this way a peculiar product which he found to be highly refractory. Analysis showed it to be composed of silicon, carbon, and oxygen, hence the name "Siloxicon." A special company was organised for the manufacture of this interesting product and for producing from it such articles as crucibles, muffles, bricks, etc.

It is impossible in the short time allotted to me to give anything like an adequate account of all of Dr. Acheson's achievements. Nor is it even possible to give a full account of any one of them. But I have said enough to make it clear that Dr. Acheson is an inventor of the first order—a thorough electrician and chemist. His efforts have not been directed merely to improving processes and products previously known. He has made entirely new departures and created new industries, supplied previously unknown materials for use in the arts and industries, and he has discovered uses for his new materials and processes for their application. He is a representative electrochemical engineer and it is eminently proper that he should have been selected by the great chemical societies of this country to receive the Perkin Medal.

It gives me gerat pleasure, Dr. Acheson, as the representative of the Society of Chemical Industry and the affiliated chemical and electrochemical societies, to place in your hands this beautiful token of the appreciation and affection of your fellow chemists.

Dr. Edward G. Acheson, in acknowledging the presentation, said :—

Professor Chandler has just reviewed the major part of my work in electrochemistry covering carborundum, artificial graphite, siloxicon, and deflocculation of amorphous bodies, and I will only refer to a few points which I hope you will find of interest.

All efforts that I am familiar with, made by my predecessors, for the direct reduction of aluminium were unsuccessful, perhaps largely due to the formation of carbide by the presence of excess of carbon. In 1903, I conducted a few experiments with the object in view of the direct reduction and succeeded in producing the desired result. My method was to form a tube of carborundum, fill it with granular carbon, and connect the carbon electrically with a circuit of the required electrical energy; around the carborundum tube was packed a mixture of carbon and alumina in theoretical proportion for the exact reduction of the alumina. After a current of sufficient amperage had passed for the required time and the furnace cooled, I found that the mixture of alumina and carbon had been fused—shrunken away from the carborundum tube, leaving a large cavity, and in the bottom of this cavity was quite a quantity of aluminium. This method of manufacture has never been put to commercial use, and remains yet, although patented, a laboratory process.

Prof. Chandler has also referred, to some extent, to "siloxicon," and it is with much regret and some mortification that I admit that this material is not now to be found, to any considerable extent, on the world's market as a commercial product. I believe it might prove to be one of the most valuable products to the industrial world that I have had the good fortune to produce. It is a compound of silicon, carbon, and oxygen, a typical formula being Si_2C_2O. When this material is pressed together in any desired form and subjected to a temperature of 2500° F., it is found to be self-bonding. It is inert to both acid and basic slags: it is absolutely infusible, decomposition occurring at a very high, but as yet undetermined temperature, resulting in a loss of the oxygen and a portion of the silicon and carbon, and the product carborundum remains in its place. It would prove an admirable lining for metallurgical apparatus when high temperatures are employed.

The reason for my not having carried it to a commercial state was due to the great amount of time that I was brought to realise would be required to accomplish those results, and this I was unable to devote to it, owing to the pressure of other matters, and also on account of the condition of my health in recent years.

Aquadag and Oildag.—In 1901, in looking about for an extended field for the employment of my artificial graphite, which I knew to be much purer than the natural product, I thought I would be able to introduce it in the manufacture of graphite crucibles. I knew there was annually imported into the United States from Ceylon approximately $1,000,000,000 worth of graphite for the manufacture of crucibles for the metal industries, and I thought I might secure at least a part of this trade.

Experiments, however, proved that my graphite was not suitable for it, as it lacked the density and fibrous structure of the Ceylon variety. In my experiments on crucibles I was, however, led into a study of clays. I learned that the crucible manufacturers in America used approximately 40 per cent. of clay for the bonding of the graphite in the crucible body, and that this clay was imported from Germany. This seemed rather singular in view of our large clay deposits, but procuring some German clays, I found them to be superior to any of the American clays that I could obtain in the matter of plasticity and strength. Chemical analysis showed them to be practically the same, and a further investigation revealed the fact that sedimentary clays, which are those found near the point of the deposition of the parent feldspathic rock, are almost entirely wanting in plasticity, while the same clay, after transportation by the running waters and deposited in the river valleys as a sedimentary clay, is found to be quite plastic and strong, and forms the clay for the potters' use. I reasoned that the plasticity was imparted to the clay during the period of transportation, and not believing that it was due to the water that carried it, I looked to the impurities in the water, and these would largely consist of washings from the forests. I tried several extracts of plants, tannin being one of them, and found that by treating a moderately plastic clay with a dilute solution of tannic acid (in this instance gallotannic acid), the clay was increased in plasticity—was in some instances rendered 300 per cent. stronger—required about 60 per cent. as much water to produce a given degree of fluidity, was caused to remain suspended in water, and was reduced to such a fine degree of subdivision that it would pass through a high grade filter paper with the water carrying it.

These results seemed remarkable, and remembering that clay working is one of the oldest arts of man, I wondered if it were not known to clay workers. Looking up all available literature, I could find but one instance of the use of vegetable matter in clay working; that was in the Bible, where we are told of the use of straw by the Egyptians, and in view of the fact of the weakness of straw, I wondered if this effect I had found were not the real cause of its being used. Straw contains no tannin, and if the effect I had secured was due to tannin only, it would not occur with the straw. Boiling some straw in water, I found that it dissolved in the water to the extent of approximately 50 per cent. of its weight, and that this extract produced the same results on clay that tannin had, and I then concluded that the Egyptians were familiar with that fact, and I called clay so treated Egyptianized Clay. I found, in one instance, a sun-dried briquette made of treated clay was of greater tensile strength than a burnt one made of untreated clay.

Extended experiments showed this same effect to be produced on clay, lampblack, alumina, amorphous silica, and on non-metallic, insoluble, non-fused, inorganic, amorphous bodies generally. I also found that the effect could be produced on these bodies by the use of the extract of straw, oak bark, spruce bark, sumac, ordinary tea leaves, catachu, some forms of dextrin, the gum of the cherry tree, and, in fact, it seemed to practically establish a general law of an action of the organic on the inorganic.

Having failed to introduce my artificial graphite into the crucible trade, I looked about for another field of application. Natural graphite had already proven itself more or less efficient as a lubricant and was used to considerable extent in the purer and especially in the flake form. My artificial product was not sufficiently soft and unctuous, but occasionally I would find in my furnace output small pieces that had the desired qualifications for lubricating graphite, and I thought possibly I would find a carbonaceous deposit at some place in the world that would be suitable for the manufacture of a soft graphite. An extended search, however, failed to produce it, but in 1906, while making an experiment, having in view the production of a product entirely foreign to graphite, I found in the furnace output a small amount of a highly unctuous, soft, non-coalescing graphite: in fact, the very material I had been in search of for five or six years. This discovery led to the development of a process for the manufacture of a high grade, non-coalescing lubricating graphite from the refuse material of the anthracite coal mines, known as "culm," of which there are immense quantities standing as a waste in the anthracite coal regions of Pennsylvania.

To make my lubricating graphite generally available as a lubricating body, it was essential to have it remain suspended in a liquid. In the finest state of disintegration that I could mechanically produce, it would still obey the law of gravity and shortly settle in any medium lighter than itself. It then occurred to me that perhaps it would lend itself to the same treatment I found occurred with clay and other inorganic, amorphous bodies, and, making a trial, I found that to be the case.

The effect was produced not as the result of what might be thought a grinding process, but simply one of mixing, thus if into two small beakers there be placed approximately the same amount of finely disintegrated, non-coalescing, lubricating graphite, and to one of them be added a little water and the mixture stirred with a glass stirrer, then diluted with more water and poured on to a high grade filter paper, the clear water with which the graphite had been mixed will flow through the paper, the graphite remaining on the filter paper. If, again, to the graphite in the second beaker, there be added a small amount of a solution of organic matter, sufficient in quantity to make a paste of the graphite, and thoroughly stirred with a glass stirrer, then diluted with water and poured on to a second filter, a black liquid flows through the paper and descends into the receptable below the filter. This black liquid does not run so rapidly as in the case of the clear water, this being due to the fine graphite partially filling the pores of the filter paper and arresting the flow. Both of these samples of graphite have been treated in every respect alike, with the exception of the addition of the organic matter, the same amount of external work was applied to the two samples in the act of stirring or mixing with the liquid, and we can only conclude that the reduction of the graphite in the second beaker to the fineness necessary for passing through the filter paper, was accomplished by means other than external work.

When pure water is added to the first sample of graphite, some difficulty is met with in wetting the graphite with the water, as it tends to remain floating on the surface of the water, and there is practically no affinity between the water and the graphite. On the other hand, when the solution of the organic matter is added to the second sample of graphite, it wets the graphite immediately, in fact, as compared with the first, quite an affinity is shown between the liquid and the particles of graphite. I think that this affinity extended beyond the wetting of the surface of the graphite and actually carries the liquid into the body of the graphite, exerting force sufficient to break asunder the flocculated particles of graphite, thereby reducing it to a deflocculated condition.

I have here before me a bottle of graphite and water, the graphite having remained in suspension in the water for more than a year without any indication of settling, and this, notwithstanding the fact, that the graphite weighs approximately two and one-fourth times that of the medium in which it is in suspension. The graphite is really setting at defiance the law of gravity. Chemists and physicists will say that the graphite is colloidal, but I do not think that this conveys an adequate conception of the state of the graphite. Graphite, as I understand the matter, is not a colloidal body, as that term is ordinarily accepted, but here we have it in the colloidal state. In reducing it to this condition, it has been deflocculated, and when it becomes deflocculated, it extracts from the water in which this state is produced, the organic matter, which has acted as the agent in producing the deflocculation. This agent becomes so strongly attached to the deflocculated body that I have not found it possible to remove it by the best solvents known for the agent. The affinity of the agent for the deflocculated body is sufficient to overcome the solvent action of the water or other solvents that may be employed. I believe the graphite in this water to be reduced to the final state of subdivision—molecular.

If a part of the contents of this bottle be poured on to a fine filter paper, the water and graphite pass with ease through the filter and collect in a receptacle beneath. Let us picture to ourselves that this black liquid is the brown-yellow waters of the Mississippi River. These muddy waters come out of the Missouri River, meet the clear water of the Ohio River over which they predominate, and the muddy stream passes on down the Mississippi to the Gulf of Mexico. Here the suspended matter is deposited and forms the great bars of the Mississippi. We have been taught to believe that this deposition of the suspended matter occurs as the result of the checking of the flow of the river by the waters of the Gulf, giving time for the settling. Let us examine the Allegheny and Ohio Rivers. They both have a more rapid flow of water than the Missouri and the Mississippi, and yet they are both perfectly clear, excepting in time of flood. The fact is that the suspended matter in the Missouri River is in a deflocculated condition and the waters being practically free from electrolytes, the suspension remains until the waters meet the salt waters of the Gulf of Mexico, and here by the rise and fall of the tides, a perfect intermingling of the salt water with the fresh water causes a flocculation of the deflocculated, suspended matter with resulting precipitation and formation of the bars. The Allegheny and Ohio Rivers are charged with lime and other mineral matters, which acting as an electrolyte, has caused a flocculation of any deflocculated bodies that may have been carried into them, and a consequent clearing of the water before reaching the Mississippi River.

The effect of the salt water of the Gulf acting on the waters of the Mississippi River can readily be illustrated by adding to the water and deflocculated graphite ordinary table salt. In a few hours the graphite will settle, but the action will be hurried by heating it. If, after heating, the black liquid be poured on to a filter paper, a clear, colourless liquid passes through the filter, the graphite, having been flocculated, remains on the paper. This, I take it, illustrates the formation of the bars and deltas of rivers where they empty into salt waters. These experiments and deductions cannot fail to impress one with the wisdom of the Creator in providing for the deflocculation of the earth's crust, its suspension in and conveyance by the flowing waters and its subsequent flocculation and sedimentation that the waters may be clarified.

I have found barnyard manure to be one of the most effective deflocculating agents, and there are reasons for believing that this effect plays an important part in the providing of plant food, I having found that carbonic acid gas, in bubbling up through water carrying deflocculated matter, becomes fixed to the suspended particles and causes flocculation and sedimentation.

Water and deflocculated graphite will pass through fine filter paper with readiness, and when I explain that in the process of preparing deflocculated graphite for practical purposes, it is first diluted with a vast amount of water, so much indeed that the water is carrying not more than three-tenths of one per cent. of its weight, and this is run into large tanks, allowed to stand for one hundred hours to permit of any possible settling, then decanted, and the water removed, leaving the deflocculated graphite in the form of a paste, composed of approximately fifty per cent. graphite and fifty per cent. water. It will be natural to inquire how the graphite is separated from the large volume of water. This is accomplished by running the water and graphite into a filter press, whose filtering medium consists of sheets of canvas which have been dipped in a solution of rubber in gasolene, and afterwards dried of the gasolene, the rubber forming delicate films in the mesh of the canvas, and through this rubber film the water, under a head of thirty pounds pressure, will readily pass, although slowly, while the deflocculated graphite is retained in the filter as a paste.

Wishing to replace the water with an oil for lubricating purposes, I succeeded in transferring the deflocculated graphite from the water to an oil by several methods of procedure, one of which is to place the paste of deflocculated graphite in water in a suitable mixing or pugging machine, and add a good grade of lubricating oil to the paste in small additions, until eventually the contained graphite has been greased or oiled and the water thrown out, leaving the deflocculated graphite in the form of a paste with oil.

Placing a little deflocculated graphite-water paste in a test tube and adding water, a slight shake puts the graphite in suspension. If, into a second test tube, there be placed a small quantity of deflocculated graphite as a paste with oil, and to this be added some kerosene, upon shaking, the graphite goes into suspension in the kerosene. In these tubes, we have two lubricating bodies.

My artificial graphite has received in the commercial world the name of Acheson-Graphite, and looking about for suitable names for these two new lubricants, I have taken the initial letters of deflocculated Acheson Graphite to form the suffix "dag," which I have added to Aqua in the one case, and oil in the other, producing the new words "Aquadag" and "Oildag."

Much could be said as to the value of these lubricants to the industrial world, but I will confine myself to a few statements only.

Lubrication is one of the greatest problems confronting man, we almost feel like placing it second to agriculture. The modern world is a world of machinery, which must be lubricated to be efficient. Last year (1909) was the fiftieth anniversary of the drilling of the first oil well by Col. Drake. Previous to that the world had been depending upon sperm oil, lard oil, and a few other mediums for lubrication, but the manufacturing and transportation of the world to-day is so vast that it would be absolutely impossible to return to those conditions of fifty years ago. Authorities have placed a limit on the life of Nature's store of petroleum as forty, fifty or sixty years. This is a very short interval in time, and anything that will tend to conserve our lubricating oils and extend their life should necessarily be of great value to the world, and after our petroleums are exhausted, a substitute for them will be of first importance. The addition of deflocculated graphite in the amount of 0·35 of 1 per cent. by weight of the oil will prolong its life in a most astonishing manner. Thus, in my own case, in the lubrication of cylinders in my automobile, I have proven that this small amount of deflocculated graphite, added to the cylinder oil, enables me to operate the machine for a distance of 750 miles per gallon, as against the 200 miles advised by the manufacturer and practised by all using plain oil. The presence of the graphite in the oil produces a fine film or veneer over the inner surfaces of the cylinders and piston rings, which results in a wiping down of the lubricant which has been splashed on to the walls, to a degree that will permit of the running of the 750 miles before one gallon of the lubricant has been able to get by the piston rings and burnt in the cylinder.

I have found that bright steel will not rust or corrode in water containing deflocculated graphite. I have not as yet been able to account for this phenomenon, and it stands as an illustration of the wonderful economy of Nature, which has added this necessary characteristic to deflocculated graphite and water, being essential for its use as a general lubricant in the stead of petroleum oils. Exhaustive experiments made by Prof. Charles F. Mabery, of the Case School of Applied Science, Cleveland, O., has proven beyond question that "Aquadag" is a superior lubricant to a high grade lubricating petroleum oil.

In carefully conducted tests to determine the relative merits of a high grade petroleum cylinder oil, petroleum fuel oil, kerosene and water, each of them carrying the same amount of deflocculated graphite, he proved that their value as a lubricant, as determined by the coefficient of friction and consequent initial loss of power in overcoming the viscosity of the lubricating body, was in this order: Kerosene, water, fuel oil, lubricating oil.

From these results, it is evident that "Aquadag" will not only be capable of providing for all kinds of lubrication when the petroleums are exhausted, but we can further conclude that the manufacturing and transportation interests would actually find a cheaper lubricant in "Aquadag" than they have in oil at the present time.

Dr. L. H. **Baekeland** said: That I have been selected to speak on this occasion is due to the fact that I happen to be, just now, the President of the American Electrochemical Society. Dr. Acheson is the past President of our Society, and one of its founders, and has always been one of its most devoted and distinguished members. Furthermore, his main work has been along lines where the electric current is used to accomplish chemical reactions.

What is more to the credit of Dr. Acheson than anything else, is the fact that he undertook experiments which probably had been attempted several times before without success by people who had more theoretical preparation than he. But his unusual keenness of observation, his logical faculty, and more than anything, his appreciation of what was of preponderant importance, and of secondary interest, brought him results, where others had failed, and by which he opened a new field of chemical investigation and industrial applications.

Dr. Acheson stands as a living example to many a chemist, loaded with theoretical knowledge and paper wisdom, and light in judgment or common sense. He entered into a new road with very little knowledge to guide him, but he had an open mind, a fertile brain, a constructive faculty, and the talents of the tireless, intelligent experimenter. Whatever he took up he started from the beginning, and developed to the end.

His very failures were changed into victories through practical channels. His work on carborundum was initiated by an experiment so simple and so meagre in results, that few people would have found an incentive to further investigation. Later on, when in the manufacture of carborundum, he had to battle with irregularities due to a partial dissociation of the silicon carbide, he created a new industry, the manufacture of artificial graphite. In the same way, he gave us Siloxicon, a product which seems to have a considerable future.

I shall not attempt to describe here the history of the work of Dr. Acheson. He, himself, in a memorable address, delivered in Boston before the American Academy of Arts and Sciences, when the Rumford Medal was awarded to him, has given us a most fascinating account of this subject, and to those of my fellow chemists who have not read his "Seventeen Years of Experimental Research." I recommend it as an inspiration.

Never did the University of Pittsburg award an "honoris causa" degree to a more worthy man, than when the doctor's degree was conferred upon our distinguished friend.

In constructing the great road of industrial progress, very few of us are path-finders; some are surveyors, other ones constructors, others again are merely switchmen, A brakemen, and conductors. Dr. Acheson not only was a path-finder, but he has been constructor, conductor, switchman, ... everything. By his manifold abilities and good judgment, he has been able to develop his discoveries into commercial successes. He has shown us that an inventor or a scientist is not necessarily a theoretical dreamer unfit for executive or practical work.

Dr. Acheson has another great claim of recognition upon us; successful as the results of his inventive genius have been; he has always made us feel that he was near to every one of us. He always took an active part in the work of our Chemical Societies, where his presence and his papers have stimulated many of us, younger in experience, or less successful in our efforts. In many instances he has allowed our chemical societies to inspect the plants where his industrial processes are carried out, and he has never hesitated to publish the results of his research work. He has thus set a praiseworthy example to those manufacturers, who try to insure by uncompromising secrecy and seclusion, the money-making end of their enterprise.

Dr. Acheson, in the name of the American Electrochemical Society, I congratulate you on this recognition of your splendid work, and congratulate the Committee in their choice of you as the recipient of the Perkin Medal.

Dr. **Wilder D. Bancroft**, of Cornell University, then spoke as President of the American Chemical Society, as follows:

"On an occasion like this it is an honour to represent anything. It is a great honour to represent the American Chemical Society. There is a personal reason why it is an especial pleasure to me to be one of the speakers on the particular evening on which the Perkin Medal is awarded to Dr. Acheson.

"Most of you can remember the time when physical chemistry was looked upon as a fad, interesting enough, but purely theoretical. Some of us preached in season and out of season that a proper training in physical chemistry was the ideal training for an industrial chemist. We were looked upon as harmless maniacs, and consequently were not ill-treated.

"I do not wish to claim for Dr. Acheson that he was the first manufacturer to employ a physical chemist at a good salary, but he was the first manufacturer who was rash enough to try the Cornell product.

"Once the ice was broken everything went well. So far as I know, the properly trained physical chemist has always made good in industrial work. You remember the French proverb: 'Ce n'est que le premier pas qui coute,' which may be rendered into the vernacular as 'It is only the first year that you don't earn your salary.'

"A man who receives the Perkin medal is expected to have made several great inventions. That has been the case so far, and, from what I know of American chemists, the supply is likely to hold out for many years to come. There is a great difference in the work of different inventors when considered as an artistic whole. From a pictorial point of view their inventions may often be said to be spotty: they are determined by business exigencies, or they are like lightning, which is said never to strike twice in the same place. I have never tried the experiment.

"Take the first man to whom the Perkin medal was awarded, Mr. Herreshoff. I remember that Dr. Chandler cited as two of his inventions improvements in the series system for refining copper electrolytically and improvements in the contact process for making sulphuric acid. Copper sulphate is the electrolyte used in the electrolytic refining of copper, and it is made from sulphuric acid; but these are really separate inventions.

"If we do not limit ourselves to the field of chemistry, everybody will admit that Mr. Edison is the greatest of American inventors. He converted electrical energy into light in the case of the incandescent lamp; he converted electrical energy into sound in the case of the phonograph or gramophone, whichever it was that he invented; he converted chemical energy into electricity in the case of his storage cell. These inventions hang together in a very satisfactory way; but how are you going to fit in his invention of monolithic cement houses?

"In the case of Dr. Acheson, there is a logical sequence about his inventions which delights the soul of any one like myself who lectures on applied electrochemistry. Dr. Acheson invented carborundum. The carbon in the cono of the furnace changed partially to graphite and he worked out a method for preparing graphite on a commercial scale. On the outside of the carborundum layer there was a ring of 'white stuff,' as it was called, and Dr. Acheson organized a company to manufacture siloxicon. There were lumps of silicon throughout the carborundum and a former assistant of Dr. Acheson, Mr. Tone, worked out a process for making silicon, thereby giving the commercial world a new element. Everything in the carborundum furnace has been worked into an industry, with the exception of the unchanged charge, and that they use over again, so that it is not wasted.

"If Dr. Acheson will forgive me for slurring over the distinction between discovery and invention, I should call him the Swiss Family Robinson of chemistry. You remember the book. The shipwrecked family went out to search for food, and they discovered a bread-fruit tree with sandwiches growing on it. They came to a stream and they invented a cantilever bridge which they constructed with the aid of a bow and arrow and a dog. They discovered or invented a palm tree with cocoanuts growing at the top. In order to get the cocoanuts they invented or discovered a shark stranded in the shallows; they made gaiters of his skin and climbed the tree. Now nature had intended the cocoanuts to be blown off the tree, and when they were brought down by hand it at once became a problem how to open them. Our friends thereupon discovered or invented a crab which inserted the points of its claws in the holes of the cocoanut and spun a yarn which broke the shell and enabled them to get the milk in the cocoanut.

"The analogy with the work of Dr. Acheson is obvious. He began by trying to make diamonds. He denies this, but the myth persists in spite of him. When the crucible was opened there were no diamonds, but instead a mass of multi-coloured jewels. When he discovered that they were not real gems it was a crushing blow and so hard that he decided to use them as an abrasive. To make carborundum he needed electrodes, so he invented graphite. A suitable refractory was needed to keep the heat in the furnace, and Dr. Acheson thereupon prepared siloxicon. The furnace had to have brick walls at first, and they were promptly forthcoming in the form of Egyptianized clay. In order to keep everything running smoothly, including the three automobiles which he had acquired in the meantime, Dr. Acheson prepared the lubricating graphite which he has shown you to-night as 'aquadag' and 'oildag.'

"When you stop to think of him, Dr. Acheson's work is really a classic for children as well as an inspiration to chemists. He has revolutionized many branches of chemistry and he has revolutionized the whole of electrochemistry.

"You may consider Acheson's discoveries as scientific inventions or as dividend payers; you may even look at them in a flippant way. It makes no difference. They stand all tests and they stamp him as one of the great inventors of the world.

"I am speaking to-night for the members of the American Chemical Society, forty-five hundred strong at Christmas. In the name of the American Chemical Society I congratulate you, Dr. Acheson, upon the honour which you have received to-night and which you have so richly deserved."

Nottingham Section.

Meeting held at Nottingham, on Wednesday, January 26th, 1910.

MR. S. J. PENTECOST IN THE CHAIR.

THE EFFECT OF NEUTRAL SALTS ON THE SODA BOILING OF COTTON.

BY S. R. TROTMAN, M.A., F.I.C.

In a recent paper (this J., 1910, page 4) Pentecost and myself have called attention to the importance of the soda boil in cotton bleaching and to the conditions necessary to obtain satisfactory results. I wish to refer more fully to one of these, viz., the purity of the reagents used, since I venture to think that this factor exercises a greater effect than is generally recognised. For all practical purposes, the reagents used in soda boiling are confined to sodium hydrate and carbonate. Although these bodies are readily obtainable in a state of approximate purity, yet they sometimes contain distinct quantities of chlorides, sulphates, alumina, and iron. One comes in contact with with so many cases of incomplete boiling, where apparently the conditions have been favourable, that one is sometimes forced to the conclusion that some substances may have been present which exercise an inhibiting effect on the saponification of fat and the solution of proteids and pectins. It seemed to me, therefore, to be a matter of some interest to bleachers to measure the effect of such neutral salts as are likely to be found in soda lyes. Sodium sulphate and chloride are always present in small quantities, particularly when a softened water has been used. Alumina and iron are more rarely met with, but when a natural hard water is employed a certain amount of lime and magnesia is always found. All the above-mentioned bodies, together with zinc, which is used as a sizing or antiseptic, may be introduced also by the cotton itself. Gardner (this J., 1905, page 392) has already suggested that the presence of such salts, and sodium sulphate and chloride may exercise a retarding effect on the process of water softening, owing to the reversibility of the equation,

$$CaSO_4 + Na_2CO_3 = CaCO_3 + Na_2SO_4.$$

It has also been shown that these salts, if present in any quantity, inhibit pedesis and so retard the detergent action of a soap. With regard to these two points, the results of a number of experiments, which are not however complete, tend to show that their effect is not appreciable when only small quantities of neutral salts are present. When, however, sodium sulphate or chloride is present to the extent of 0·25 to 0·5 per cent., the detergent effect of a soap solution is considerably decreased. On the contrary, comparatively small quantities of neutral salts exercise a distinctly inhibitory effect on the action of caustic soda on cotton. It is necessary to remember that we are not dealing simply with a process of saponification, but the solution of at least three distinct chemical bodies. For this reason it is more satisfactory to study the action on cotton itself rather than to measure the rate of saponification in the presence of the salt. The following method was adopted. Ten grammes of cotton was dried, weighed, and boiled for 45 minutes under a reflux condenser with a measured constant volume of two per cent. pure caustic soda. It was then washed thoroughly with hot distilled water, dried, and weighed. Of course the same cotton and soda solution was used for each set of experiments. The following are some of the results obtained :—

Effect of sodium chloride.

	Percentage loss.
Blank with cotton and caustic soda	4·47
Caustic soda containing 0·13 per cent sodium chloride	4·08
Caustic soda containing 0·30 per cent sodium chloride	3·98

A sample of two per cent. soda solution recently analysed contained 0·20 per cent. of sodium chloride. Cotton yarns also very frequently contain chlorides.

Effect of sodium sulphate.

		Percentage loss.
Blank with cotton and caustic soda		6·75
Caustic soda containing	0·146 per cent. Na_2SO_4 ..	6·33
,, ,,	0·292 ,, ,, ..	6·14
,, ,,	0·338 ,, ,, ..	5·95
,, ,,	0·584 ,, ,, ..	5·85
,, ,,	0·730 ,, ,, ..	5·76

In this case the residual fat and nitrogen were determined with and without the addition of sodium sulphate, and both were found, as was expected, to be greater when sodium sulphate was present.

A test was next made using a solution of pure soda and an exactly equivalent solution of a poor commercial soda containing some sodium chloride (0·29 per cent.) and distinct traces of sulphates. The results were :—

Pure soda	4·72
Impure soda	3·27

Effect of Alumina.

	1	2	3
Blank with cotton and pure soda	5·20	5·58	5·19
Caustic soda containing 0·035 per cent.......	5·15		
,, ,, 0·070 ,, ...	5·09	5·48	4·35
,, ,, 0·140 ,, ...	5·01	5·16	
,, ,, 0·175 ,, ...	4·63		

These results are interesting since they tend to show that very small quantities of alumina are sufficient to inhibit the action of the soda. Alumina is not often found to any great extent in soda, but is a frequent constituent of softened water and cotton itself.

A second set of experiments made with alum gave still more marked results.

Blank with cotton and pure caustic soda	5·00
Caustic soda containing 0·166 per cent. of potash alum	4·88
,, ,, 0·332 ,, ,, ,,	4·25
,, ,, 0·498 ,, ,, ,,	4·06
,, ,, 0·830 ,, ,, ,,	3·90

In this case the fat and nitrogen extracted in the first and fourth tests was determined. The quantities were :—

	Pure soda.	Soda containing 0·49 per cent. alum
Fat extracted	0·227	.... 0·017
Nitrogen	0·036	.... 0·029

Effect of iron.—It is well known that very small quantities of iron are sufficient to cause loss of colour. The following experiment shows that very little is required to inhibit the action of soda. The iron was introduced as ferric chloride.

Blank with cotton and pure soda	5·38
Caustic soda containing 0·0057 of iron	4·74

This quantity of iron is well within that found in some soda lyes.

Effect of Calcuim sulphate.

BlankIwith cottton and pure caustic soda	4·54
Caustic soda containing 0·04 per cent. of calcium sulphate	4·32
,, ,, 0·06 ,, ,, ,,	4·17
,, ,, 0·08 ,, ,, ,,	3·84
,, ,, 0·10 ,, ,, ,,	3·66

Effect of sodium phosphate, $Na_2HPO_4.12H_2O$

Blank with cotton and pure caustic soda	6·37
Caustic soda containing 0·033 per cent. sodium phosphate	4·96
,, ,, 0·066 ,, ,, ,,	4·79
,, ,, 0·099 ,, ,, ,,	4·71

It is interesting to note that sodium phosphate has been recommended as a scouring agent.

Effect of zinc sulphate.—Zinc compounds are often used as antiseptics or for weighting. Their effect is very marked.

Blank with cotton and pure soda	5·20
Caustic soda containing 0·033 per cent. of zinc sulphate	4·99
,, ,, 0·066 ,, ,, ,,	4·86

In conclusion it may be mentioned that in nearly every set of experiments a very distinct difference in colour was noticeable between the cottons boiled with and without the addition of the salts. This was particularly marked in the case of iron, alum, and sodium sulphate. A corresponding but inverse difference was also apparent in the final colour of the lyes. It may be urged that the time of boiling in practice is much longer. This is, of course, true, but the circulation in a laboratory experiment is so complete that 45 minutes corresponds to a much longer time under working conditions, where large masses of goods are to be penetrated. Naturally as the time of boiling increases the results become less divergent, but one may fairly say that, in the absence of neutral salts, the time necessary for a complete boil is considerably shortened.

Experiments are in progress to determine the effect of these neutral salts upon the rate of saponification of fat and the hydrolysis of albuminoids, but are not yet sufficiently advanced for inclusion in this paper.

Yorkshire Section.

Meeting held at Leeds on Monday, December 13th, 1909.

PROF W. M. GARDNER IN THE CHAIR.

THE SYNTHESIS OF A GLAZE, GLASS, OR OTHER COMPLEX SILICATE.

PART I. THE INTERACTION OF LIME AND SILICA (see this Journal, Jan. 31, 1910, pp. 69—74).

THE following curve and diagram were omitted from the above paper, pages 71 and 72, respectively :—

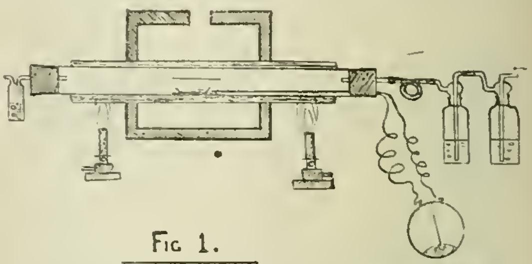
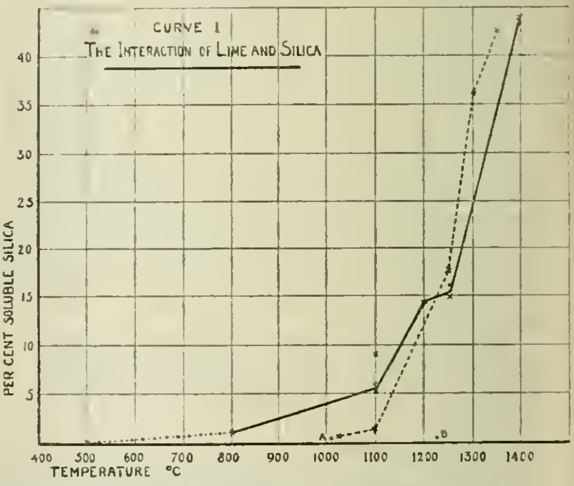


FIG 1.

Apparatas used for decomposing calcium dulphate.



Continuous curve represents silica from mixing $CaCO_3 + SiO_2$.
Dotted curve represents sili a from mixing $CaSO_4 + SiO_2$
"A" = Temp. of decomposition of $CaSO_4 + SiO_2$
"B" = Temp. of decomposition of $CaSO_4$.

Meeting held at Leeds, on Monday, January 17th, 1910.

PROF. W. M. GARDNER IN THE CHAIR.

THE SYNTHESIS OF A GLAZE, GLASS, OR OTHER COMPLEX SILICATE.

PART II. INTERACTION OF LIME WITH SILICA AND WITH ALUMINA.

BY JOHN W. COBB, B.SC.

In a paper read at the last meeting of this section (this Journal, 1910, pp. 69—74), I described and discussed a method of synthesising a complex silicate,

$$Na_2O.CaO.Al_2O_3.10SiO_2,$$

and gave the results obtained from a mixture of lime and silica, when they were present in the simplest ratio of CaO to SiO_2.

The behaviour of lime-silica mixtures in which the proportions of the constituents admitted of the transformation of the whole mass into a decidedly basic or acid silicate, remained for investigation.

Effect of more silica.—The acid mixtures, $CaSO_4+3SiO_2$, and $CaCO_3+3SiO_2$, were tried first; they contained lime and silica in a ratio commonly existing between the definitely basic and acid oxides in glazes and glass. Each mixing was heated in a works furnace. The temperature was raised slowly to 1150° C., and there maintained for about 24 hours, about 144 hours in all. After cooling in the furnace, a portion of the mixture was removed, and the rest put back for another heating. The process was repeated until the analytical results showed interaction ot have reached its limit. The results are given above.

TABLE IIIa.

Lime and Silica.

$CaCO_3+3SiO_2$ (remixed).

Percentage Composition:—

$CaO3SiO_2$ contains $\{CaO=23·7$ per cent. $SiO_2=76·3$ per cent.

Where Heated.	Time (hrs.)	Temp. °C.	Quickly sol. CaO	Quickly sol. SiO_2	Slowly sol. CaO	Slowly sol. SiO_2	SiO_2 sol. in Na_2CO_3.	Total sol. CaO	Total sol. SiO_2	Insol.	$\frac{CaO}{SiO_2}$	Appearance.	Notes.
Works furnace.	24	1150	—	2·1	—	0·6	12·2	—	16·9	62·5	—	slightly coherent	
,,	48	1150	5·7	2·1	16·5	0·9	18·4	22·1	21·5	56·4	1·1	,, ,,	
,,	72	1150	4·8	1·8	16·6	0·8	16·8	21·4	19·4	59·2	1·1	,, ,,	

TABLE IIIb.

Lime and Silica.

$CaCO_3+3SiO_2$ (not remixed).

Where Heated.	Time (hrs.)	Temp. °C.	Quickly sol. CaO	Quickly sol. SiO_2	Slowly sol. CaO	Slowly sol. SiO_2	Total sol. CaO	Total sol. SiO_2	SiO_2 sol. in Na_2CO_3	Insol.	$\frac{CaO}{SiO_2}$	Appearance.	Notes.
Works furnace.	24	1150	12·8	2·1	9·6	0·6	15·9	22·3	18·6		1·3	slightly coherent	
,,	48	1150	9·0	1·3	14·8	0·7	16·3	23·8	18·3		1·4	,, ,,	
,,	72	1150	5·9	2·1	15·8	0·4	16·4	21·7	18·9		1·1	,, ,,	

TABLE IIIc.

Lime and Silica.

$CaSO_4+3SiO_2$ (remixed).

$CaSO_4+3SiO_2$ contains $\{CaO=17·7$ per cent. $So_3=25·3$ per cent. $SiO_2=57·0$ per cent.

$CaO+3SiO_2$ contains $\{CaO=23·73$ per cent. $SiO_2=76·27$ per cent.

Where Heated	Time (hrs.)	Temp. °C.	Quickly sol. CaO.	Quickly sol. SiO_2.	Quickly sol. SO_3.	Slowly sol. CaO.	Slowly sol. SiO_2.	Slowly sol. SO_3.	SiO_2 sol. in Na_2CO_3.	Total sol. CaO.	Total sol. SiO_2.	Total sol. SO_3.	Insol.	$\frac{CaO}{SiO_2}$	Appearance.	Notes.
Works furnace.	24	1050	19·8	3·8	13·2	2·1	—	—	4·3	21·3	8·1	13·2		1·7	Slt. coherent	In this one instance the first heating was at a rather lower temperature.
,,	48	1150	18·6	6·8	5·0	3·7	0·4	0·6	8·5	22·3	15·7	5·6		1·2	,, ,,	
,,	72	1150	16·0	9·0	2·3	6·6	0·8	—	11·1	22·6	20·8	2·3		1·1	,, ,,	
,,	96	1150	18·1	15·7	0·5	4·5	0·7	—	5·7	22·6	22·1	—		1·1	,, ,,	

TABLE IIId.

Lime and Silica.

$CaSO_4+3SiO_2$ (not remixed).

Where Heated.	Time (hrs.)	Temp. °C.	Quickly sol. CaO.	Quickly sol. SiO_2.	Quickly sol. SO_3.	Slowly sol. CaO.	Slowly sol. SiO_2.	Slowly sol. SO_3.	SiO_2 in Na_2CO_3.	Total sol. CaO.	Total sol. SiO_2.	Total sol. SO_3.	Insol.	$\frac{CaO}{SiO_2}$	Appearance.	Notes.
Works furnace.	24	1150	19·0	6·2	9·1	3·1	0·7	—	7·6	22·2	14·5	9·1		1·2	slt. coherent	
,,	48	1150	—	11·2	—	—	0·7	—	9·20	—	20·9	—		—	,, ,,	
,,	72	1150	15·6	11·3	1·9	7·4	0·6	—	7·9	23·0	19·8	1·9		1·2	,, ,,	

The meaning of each heading in these and subsequent tables was given fully in the previous paper.

At the same time an experiment with another object was made. A portion of each mixing was heated in another crucible, and after the first heating, was sieved gently 100 to the inch, and remixed, *i.e.*, the grains were not broken up, but were given fresh points of contact. The remixed portion was heated and mixed again as before, to the limit of interaction.

In further explanation of the way in which Table III was constructed the following figures are given. From the $CaSO_4+3SiO_2$ after twice heating and remixing, a portion was taken for analysis. Two separate 1 gram. lots, A and B, were extracted with normal hydrochloric acid for an hour; this extract contained the "quickly soluble" lime, silica, and sulphuric oxide, as follows:—

Quickly soluble.	$CaSO_4 + 3SiO_2$ [A]	$CaSO_4 + 3SiO_2$ [B]
	per cent.	per cent.
CaO	18·6	18·9
SiO_2	6·8	7·0
SO_3	5·0	5·5

The residue was extracted with normal acid for five days with occasional shaking, and the extract taken as containing the "slowly soluble" lime, silica and sulphuric oxide thus:—

Slowly soluble.	$CaSO_4 + 3SiO_2$ [A]	$CaSO_4 + 3SiO_2$ [B]
CaO	3·7	3·5
SiO_2	0·4	0·5
SO_3	0·6	0·3

The residue from the long extraction was then treated with 100 c.c. hot 5 per cent. solution of sodium carbonate for 15 minutes, and the silica so dissolved determined with the following result:—

SiO_2 soluble in Na_2CO_3	$CaSO_4 + 3SiO_2$ [A]	$CaSO_4 + 3SiO_2$ [B]
$SiO_2 =$	8·5	8·6

A further extraction with 5 per cent. sodium carbonate solution for 15 minutes gave only a slight trace of silica in each case. Totalling the silica lime and sulphuric oxide dissolved gave:—

Total soluble.	$CaSO_4 + 3SiO_2$ [A]	$CaSO_4 + 3SiO_2$ [B]
CaO	15·7	16·0
SiO_2	22·3	22·5
SO_3	5·6	5·8

SO_3 was equivalent to $\frac{5{\cdot}6 \times 56}{80} = 3{\cdot}9$ CaO.

CaO combined with $SiO_2 = 22{\cdot}3 — 3{\cdot}9 = 18{\cdot}4$

Therefore in molecular composition $\frac{CaO}{SiO_2} = \frac{18{\cdot}4}{56} \div \frac{15{\cdot}7}{60}$

Therefore $\frac{CaO}{SiO_2} = 1{\cdot}25.$

A similar calculation gave:— $\frac{CaO}{SiO_2} = 1{\cdot}24$

In such a case either A or B could be taken into Table III; A was actually used. Duplicate analyses of this kind were employed throughout.

Results of prolonged heatings with excess silica.—Examination of Table III led to the conclusion that even with an excess of silica and prolonged heating, lime did not combine with more silica than that of $CaO.SiO_2$. The lime : silica ratio obtained was the same as with the mixing $CaSO_4 + SiO_2$ containing less silica, viz. 1·1 $CaO.SiO_2$. Any trace of reduction would give the slightly higher CaO figure, as would also any imperfection in the extraction of silica.

The formation of a more basic silicate than $CaO.SiO_2$ is indicated as the first step in the inter-action; in time this passes over into $CaO.SiO_2$, but after that takes up no more silica even on prolonged heating. The lime : silica ratio travels from 1·7 to 1·1 and remains there.

The results of the sulphate mixings were confirmed by the carbonate mixings. Assuming that in the presence of so much silica for so long a time, the whole of the lime had gone into combination, the ratio CaO to SiO_2 became calculable, and it was entered in Tables IIIA and IIIB under the heading CaO/SiO_2. Since practically all the lime in the sulphate mixings went into combination the assumption seems quite justifiable. The ratios were 1·3, 1·4, 1·1, 1·1, 1·1, 1·1, in each case 1·1 for the final burn. The fact that a ratio of 1·1 having been obtained, further heating did not in any case lower it, was also taken as indicating that the formula $CaO.SiO_2$ did not represent such a mixture as $2CaO.SiO_2$ + (hypothetical) $CaO.2SiO_2$; as in that case further heating would presumably have altered the proportions of $2CaO.SiO_2$ and $CaO.2SiO_2$, and consequently the lime silica ratio; what was clearly indicated was the ultimate formation of the single compound $CaO.SiO_2$.

Effect of the re-mixing.—Another conclusion from the experiments summarised in Table III is that the remixing, made to give fresh points of contact to the particles, was of no effect in increasing the extent of interaction. In the case of the carbonate mixings there was no trial of the issue, because interaction was practically complete at the end of the first burn, but comparing Tables IIIC and IIID, no increase in the rate of interaction between silica and calcium sulphate could be traced to the remixing, although the conversion of sulphate into silicate was not complete, even at the end of the third burn. No insoluble silicate was formed.

Another interesting point was raised by the appearance of most of the soluble silica, in the form soluble in sodium carbonate, not extracted by normal hydrochloric acid, and a new feature of the results collected for $CaSO_4 + 3SiO_2$ was the appearance of "slowly soluble" matter. This may be intrinsically rather less soluble, but the result is much more probably a time effect, a slow mutual diffusion of soluble and insoluble solids during heating resulting in a slower extraction of the soluble matter afterwards.

Effect of more lime.—The next step was the examination of basic mixings containing more lime. The basic mixtures used were of the formulæ, $3CaCO_3 + SiO_2$, and $3CaSO_4 + SiO_2$. $3CaO.SiO_2$ is usually regarded as an essential constituent in Portland cement.

Mixings were made up from calcium sulphate and quartz sand, heated, remixed (or not remixed as stated) between burnings, and extracted exactly as in the case of the acid mixtures previously used. The results are given in Table IV.

TABLE IVA.

Lime and Silica.

$3CaSO_4 + SiO_2$ (remixed).

$3CaSO_4 + SiO_2$ contains $CaO = 35{\cdot}9$ per cent., $SO_3 = 51{\cdot}3$, $SiO_2 = 12{\cdot}8$

$3CaO + SiO_2$ contains $CaO = 73{\cdot}6$ per cent., $SiO_2 = 26{\cdot}4$ per cent.

Where Heated	Time (hrs.)	Temp. °C.	Quickly Sol.			Slowly Sol.			SiO_2. Sol. in Na_2CO_3	Total Sol.			Insol.	$\frac{CaO.}{SiO_2.}$	Appearance.	Notes.
			CaO.	SiO_2.	SO_3.	CaO.	SiO_2.	SO_3.		CaO	SiO_2.	SO_3.				
Works furnace	24	1150	37·4	2·9	43·1	2·8	0·1	4·4	1·2	40·2	4·2	41·5	8·1	1·8	Very much shrunk and slt. hardened.	
,,	48	1150	37·7	7·1	36·0	—	—	—	trace	42·9	7·2	42·7	7·2	1·9	No further change.	
,,	72	1150	39·4	6·7	34·0	3·9	0·2	7·2	0·3	43·3	7·2	41·2	8·3	2·1	No further change.	

TABLE IVb.

Lime and Silica.

$3CaSO_4+SiO_2$ (not remixed)

Where Heated	Time (hrs.)	Temp. °C.	Quickly sol.			Slowly sol			SiO_2 Sol. in Na_2CO_3	Total sol.			Insol.	$\frac{CaO_2}{SiO_2}$.	Appearance.	Notes.
			CaO.	SiO_2.	SO_3.	CaO.	SiO_2.	SO_3.		CaO.	SiO_2.	SO_3.				
Works furnace	24	1150	38·1	3·3	43·0	2·2	0·1	3·2	1·3	40·4	4·7	46·2	8·7	1·8		
,,	48	1150	37·2	6·8	35·7	4·7	0·2	7·8	0·3	41·9	7·3	42·5	8·3	1·8		
,,	72	1150	39·1	5·0	37·3	4·2	1·8	4·3	trace	43·3	7·7	41·6	—	2·0		

The conclusions drawn from Table IV may be stated thus:—The effect of prolonged heating at a temperature of 1150° C. was the formation of a lime silicate with a ratio CaO/SiO_2 of 1·8 to 2·1. This silicate seemed to be formed on the first heating in small quantity and further heatings only increased the quantity of the same compound. There was no indication of a compound containing more lime than that of 2·1 $CaO.SiO_2$ or approximately $2CaO.SiO_2$; the lime silica ratio did not alter appreciably on prolonging the heating, and, in this respect, the course of the reaction differed from that of the mixings containing an excess of silica.

The remixing between heatings was again of no effect in increasing the rate of combination, as can be seen in Table IV; the figures with and without remixing are throughout in as close agreement as the nature of the experiment allows. Since the amount of combination after the first heating was small (2·9 and 3·3 per cent. soluble silica), the effect of remixing was well tested by the second heating, but the soluble silica values obtained were 7·6 and 7·3 per cent., showing no effect from remixing.

It was pointed out in the previous paper (this Journal, 1910, page 73) that the temperature of decomposition of calcium sulphate by silica was the same, whatever the proportions of the constituents, which supported the view that the same compound was formed at first in each case; this compound seems to be $2CaO.SiO_2$.

TABLE V.

$3\ CaCO_3+SiO_2$.

$3CaCO_3+SiO_2$ contains $\left\{\begin{array}{l}CaO=46{\cdot}7\text{ per cent.}\\SiO_2=16{\cdot}7\text{ per cent.}\end{array}\right.$ $3CaO+SiO_2$ contains $\left\{\begin{array}{l}CaO=73{\cdot}6\text{ per cent.}\\SiO_2=26{\cdot}4\text{ per cent.}\end{array}\right.$

Where Heated,	Time (hrs.)	Temp. °C.	Quickly sol.		Slowly sol.		Total sol.		Insol.	Appearance.	Notes.
			CaO.	SiO_2.	CaO.	SiO_2.	CaO.	SiO_2.*			
		Blank					46·8	0·2			
Works furnace	24	510°				—	47·0	0·6		unchanged	
Muffle	1	800		0·6		—		0·6		,,	Duplicate analysis.
,,	1	800		0·9		—	65·8	0·9		,,	Some CO_2 left.
Works furnace	24	1080						9·2 9·1		shrunk	Duplicate analyses.
Injector furnace	1	1100		4·1		—		4·7 4·1 4·2		,,	
,,	1	1100	71·0	4·8		—	71·0	4·8		,,	
,,	1	1250	71·4	24·6	0·1	—	71·5	24·6		,,	
,,	1	1400	60·1	28·1	0·2	—	60·3	28·1		Fused, fell to powder on cooling.	Contaminated with fire-clay.

* No sodium carbonate extractions for silica were made here; they would have probably given only traces of silica. Cf. Table IV.

The same mixing $3CaSO_4+SiO_2$ was heated at lower temperatures, at 500° C. for 24 hours, then at 800° C. for another 24 hours, and finally at 1080° C. for a further 24 hours. At 500°, the mixing was unchanged in physical character, at 800° just cohering, and at 1080° shrunk and hardening. There was no soluble silica excepting in the 1080° C. sample (2·8 per cent.) confirming previous results, since the calcium sulphate would not be decomposed until a temperature above 1000° C. was reached.

$3CaCO_3+SiO_2$.—To determine the extent of inter-action between lime and silica when the lime was not supplied as the stable compound $CaSO_4$, but as free lime, a mixing was made of the formula $3CaCO_3+SiO_2$. The results are collected in Table V.

From Table V it was evident that the inter-action had just commenced at 800° C., and was slow up to 1100°, where 9·2 soluble silica was obtained after 24 hours heating. At 1250° C. the action was rapid, 24 out of 26 per cent. silica becoming combined in one hour; at that temperature the mixing had shrunk, but with no signs of vitrefaction. Comparing with Table IV it would seem safe to conclude that at 1250° C. there resulted a shrunken, but unvitrified mass, consisting of $2CaO.SiO_2$, mixed with silica. The 1400° C. heating fused, but that was taken as due to some fireclay which fell into it accidentally.

$10CaCO_3+SiO_2$.—Further experiment was made with a mixing containing a large excess of lime, viz.:—$10\ CaCO_3+SiO_2$. The results were similar to the preceding, at 1350° C. all the silica was in soluble combination.

The double oxide mixing of the silicate synthesis, $CaO+10SiO_2$.—The next experiment dealt with $CaO+10SiO_2$, the first dual oxide mixing in the silicate synthesis, and therefore the mixing of most direct importance in this study. Two mixings were made; in the first the lime was supplied as the sulphate, and in the second as carbonate. The experiments were made as before and the results are collected in Tables VIa and VIb.

TABLE VIa.

Lime and Silica.

$CaSO_4 + 10SiO_2$

$CaO + 10SiO_2$ contains { $CaO =$ 8·5 per cent. $SiO_2 =$ 91·5 per cent.

$CaSO_4 + 10SiO_2$ contains $CaO =$ 7·6 per cent. $SiO_2 =$ 81·5 per cent. $SO_3 =$ 10·9 per cent.

Where Heate	Time (hrs.)	Temp.	Quickly sol.			Slowly sol.			SiO_2 Sol. in Na_2CO_3	Total sol.			Insol.	$\frac{CaO.}{SiO_2.}$	Appearance.	Notes.
			CaO.	SiO_2.	SO_3.	CaO.	SiO_2.	SO_3.		CaO.	SiO_2.	SO_3.				
Injector	1	1100	7·6	1·3	6·2	1·5	trace	—	1·3	9·0	2·6	6·2		—	slt. coherent	
,,	1	1200	7·8	5·8	1·5	0·6	—	—	—	8·4	5·8	1·5		1·3	,,	
,,	1	1250	8·4	7·1	—	0·3	—	—	0·3	8·7	7·4	—		1·3	slt. hardened	
,,	1	1300	8·4	8·3	—	—	—	—	0·0	8·4	8·3	—		1·1	hardened no fusion	
,,	1	1350	6·0	1·6	—	*	—	—	6·6	—	8·2	—		—		

*Not finished.

TABLE VIb.

Lime and Silica.

$CaCO_3 + 10SiO_2$

$CaO + 10SiO_2$ contains { $CaO =$ 8·5 per cent. $SiO_2 =$ 91·5 per cent.

$CaCO_3 + 10SiO_2$ contains { $CaO =$ 8·0 per cent. $SiO_2 =$ 85·7 per cent.

Where Heated	Time (hrs.)	Temp. °C.	Quickly sol.		Slowly sol.		SiO_2 Sol. in Na_2CO_3.	Total sol.		Insol.	$\frac{CaO.}{SiO_2.}$	Appearance.	Notes.
			CaO.	SiO_2.	CaO.	SiO_2.		CaO.	SiO_2.				
		Blank	7·8	—	—	—	—	7·8	—				Duplicated.
			7·8	0·1	—	—	—	7·8	0·1				
Works furnace	24	490	7·9	0·1	—	—	*	7·9	0·1			unchanged	
Muffle	1	800	8·2	0·8	—	—	*	8·2	0·8			,,	
Works furnace	24	800	8·1	2·5	—	—	*	8·1	2·5			,,	
Injector	1	1100		2·4	—	—	*	—	2·4			,,	
Works furnace	24	1100		0·5	—	—	*	—	0·5				
Injector	1	1250	8·1	6·3	—	—	*	8·1	6·3			,,	Duplicated.
			8·0	6·5	—	—	*	8·0	6·5			,,	
,,	1	1400	—	5·2	—	0·8	*	—	6·0			hardened, sugary	
Injector	1	1100	6·0	1·4	2·2	—	3·9	8·2	5·3			unchanged.	
,,	1	1200	6·6	3·8	2·0	—	2·4	8·6	6·2			,,	
,,	1	1250	8·1	7·1	—	—	0·4	8·1	7·5			,,	
,,	1	1300	7·6	6·7	trace	—	0·5	7·6	7·2			slt. hardened	
,,	1	1350	5·2	0·3	1·5 †	0·1	7·3	—	7·7			hardened	

*Silica soluble in sodium carbonate solution not determined.
†Not finished.

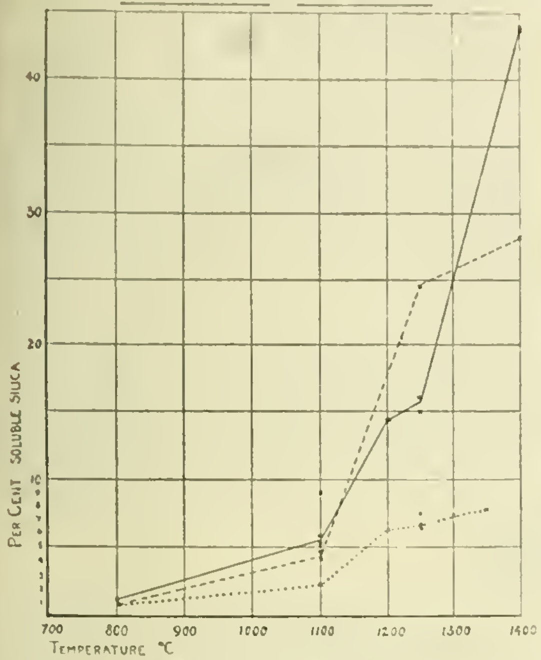
In the first part of Table VIb the silica soluble in sodium carbonate solution was not determined when the mixings were extracted; the silica came out satisfactorily up to 1250° C. in the one hour heatings but at 1400° C., only 0·2 per cent. was shown; with 24 hours' heatings the diminution in soluble silica appeared at 1100° C. These results suggested the necessity for extracting with sodium carbonate to obtain the silica resulting from the decomposition of silicates; it was impossible to suspect insoluble silicates since practically all the lime was soluble. Accordingly, the extraction of the heatings for 15 minutes with 5 per cent. sodium carbonate solution, hot, was instituted.

The second part of Table VIb. shows the results so obtained. They indicated that inter-action commenced very slowly at about 800° C., at 1100° C. was well advanced (5·3 per cent. soluble silica), and that at 1250° C., heated for one hour, the limit was reached with 7·5 per cent. of soluble silica. There was no increase on this amount of silica taken into combination, and the $CaO : SiO_2$ ratio at that limit was 1·15 and 1·13 at 1250° C. and 1300° C. The formation of the compound, $CaO.SiO_2$, was again indicated; no silica beyond that necessary to form $CaO.SiO_2$ was taken into combination. With the carbonate mixing (Table VIa) the highest lime : silica ratio obtained at 1100° C. was 1·3, and the final ratio at 1300° C., 1·1. There was no fusion in either the sulphate or carbonate mixings; the interaction was all but complete at 1250° C. in each case when the mixing was only a little hardened.

Summary for lime-silica mixings.—The results obtained so far seem to justify the following summary of the interaction of lime and silica, under the conditions of experiment. Interaction commences about 800° C.; whatever the proportion of lime and silica, it is probable that $2CaO.SiO_2$ is first formed. On raising the temperature, the inter-action is not always the same. In such a mixture as $3CaO+SiO_2$ the compound $2CaO.SiO_2$ persists. With $CaO+SiO_2$ the compound ultimately formed is $CaO.SiO_2$ throughout the mass. With larger quantities of silica, as are present in $CaO+3SiO_2$ and $CaO+10SiO_2$ the same compound, $CaO.SiO_2$, is formed, the more basic silicate, disappearing as the temperatures rises, is formed. No silicate of lime is produced, which contains more lime than $2CaO.SiO_2$, or more silica than $CaO.SiO_2$, and no insoluble silicate is formed. With large excess of silica, and higher temperatures, some combined lime and silica become slowly soluble, and this may be taken to indicate solid solution in surrounding silica. The inter-action of lime and silica takes place without fusion, and far below the melting point of lime, silica, or the eutectic mixture. Curve II. presents in graphic form some of the principal results obtained from the lime-silica mixings; the percentages of soluble silica are plotted vertically and the temperatures horizontally.

Curve A –

The Interaction of Lime and Silica



——— Silica from mixing $CaO + SiO_2$
- - - - - - - - - Ditto $3CaO + SiO_2$
. . . . Ditto $CaO + 10SiO_2$

LIME AND ALUMINA.

Double oxide mixing; $CaO+Al_2O_3$.—In the silicate synthesis the double oxide mixing was $CaO+Al_2O_3$, and this ratio of lime to alumina was tried first. As in the silica mixings the lime was supplied as carbonate, to trace the temperature and extent of inter-action, and as sulphate to facilitate calculation of the chemical formulæ of any compounds formed. The reaction between alumina and calcium sulphate is not necessarily similar to that between silica and calcium sulphate, because alumina does itself combine with sulphuric oxide to form an aluminium sulphate, and there is the possibility to consider of lime, sulphuric oxide, and alumina coexisting in a molecule in which the alumina does not replace sulphuric oxide.

Temperature of decomposition of aluminium sulphate.—Experiments were therefore made to determine the range of temperature through which alumina and sulphuric oxide remained in stable combination. The dissociation of aluminium sulphate was studied by passing dry air over the sulphate heated in a porcelain tube in the same manner as described in the previous paper (this Journal, 1910, page 72). Traces of acid sulphur vapours came off at 600—620° C., decolourising of the para-nitro-phenol being then very slow, and decided traces at 720° C. Saturation with water vapour at 15° C. did not affect this temperature, but saturation at 60° C.* lowered it to 530—540 C. Dry hydrogen gave results from 270° (very faint) to 330° C. (stronger).

Estimation of the loss of sulphuric oxide, by weighing after heating in porcelain crucibles, as described for calcium sulphate (*loc. cit.*), confirmed 720° C. as the lowest temperature of appreciable loss, and showed the decomposition nearly complete at 800° C.

It was assumed, therefore, that calculations of the CaO/Al_2O_3 ratio might be made with some confidence at the temperatures 1100—1300° C. which were used.

$CaSO_4+Al_2O_3$.—The temperature at which this mixture first evolved acid sulphur gases was determined. The figures obtained were :—with dry air, 1120°, 1130°, 1120°, 1120° C.; and with moist air (saturated at 25° C.), 1080°, 1100°, 1120°, 1125°, 1120°, 1120° C. The interaction between calcium sulphate and alumina was therefore taken as beginning at 1120—1125° C.; the presence of alumina lowered the temperature of decomposition of calcium sulphate by 1225 minus 1120, *i.e.*, 105° C. The presence of silica had been found to lower the decomposition temperature by 220° C. The difference between the two numbers was expected from the more decidedly acidic nature of silica.

The mixtures, $CaCO_3+Al_2O_3$ and $CaSO_4+Al_2O_3$, were heated, and extracted, and the results are collected below in Tables VIIa and VIIb.

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* Air saturated at 60° C. contains 19·6 per cent. water vapour by volume.

TABLE VIIa.

Lime and Alumina.

$CaCO_3 + Al_2O_3$

$CaO + Al_2O_3$ contains {$CaO = 35·4$ per cent. {$Al_2O_3 = 64·6$ per cent.

$CaCO_3 + Al_2O_3$ contains {$CaO = 27·7$ per cent. {$Al_2O_3 = 50·5$ per cent.

Where Heated.	Time (hrs.)	Temp.	Quickly sol.		Slowly sol.		Total sol.		Insol.	Appearance.	Notes.
			CaO.	Al_2O_3.	CaO.	Al_2O_3.	CaO.	Al_2O_3.			
	blank		27·5								No further extraction was made in this and other cases where the slowly soluble columns are left blank.
Muffle furnace	1	500°	27·7	0·3	–					unchanged	
Works furnace	24	500	27·5	0·2						,,	
,,	8	660	27·5	0·3						,,	
,,	8	660	27·3	0·4						,,	
Muffle	1	800	33·0	0·0						,,	
Works furnace	24	850	35·0	0·0						,,	
Injector	1	900		5·8						,,	First sign of interaction.
Works furnace	16	900		4·1						,,	
Injector	1	1100		26·7		2·4		29·1		slt. shrinking	
Works furnace	24	1100		21·6				41·5		,,	SO_3, 3·59 per cent., absorbed from furnace gases.
Injector	1	1100		28·6				42·2		,,	
,,	1	1100	32·2	23·4	2·9	9·9	35·1	33·3	31·6	,,	
Works furnace	24	1150						44·9	18·9	unchanged	Contained 12·4 per cent. SO_3 absorbed from furnace gases.
Injector	1	1250	28·4	32·1	6·9	17·8	35·3	49·9	14·8	slt. coherent	Analyses duplicated throughout.
,,	1	1300	12·8	18·2	23·0	40·8	35·8	59·0	5·2	hardened, not fused.	Analyses duplicated throughout.

From Table VIIA. it was deduced that interaction commenced between 850° C. and 900° C.; the absence of interaction at 800° C. distinguished alumina from silica. At 1100° C. a large proportion of the alumina had become soluble, and at 1300° C. 59·0 out of a total 64·6 per cent.; the insoluble matter remaining was 5·2 per cent., all alumina; it was taken as established that nearly all the alumina at 1300° C. in one hour had gone into combination with lime as a non-resistant aluminate; that no resistant or insoluble aluminate was formed was evident from the recovery of all the lime in the soluble form and was confirmed by the agreement in quantity between the total insoluble matter present (5·2 per cent.) and the difference of total and soluble alumina (5·6 per cent.). The continuous fall in the amount of total insoluble matter (alumina) as the temperature rose was noticeable in this connection, and offered a contrast to results obtained later with a large excess of alumina. Another noticeable feature was that although the conversion of alumina into aluminate had gone so far, nothing like fusion had occurred.

Boudouard found 1400° C. to be the (pyramid) fusing point of the eutectic mixture of lime and alumina.

It was also plain from Table VIIA. that lime was capable of combining with at least that quantity of alumina corresponding with the composition, CaO=35·4 per cent., Al_2O_3=51·0 per cent., approximately $CaO.Al_2O_3$. Assuming all the lime at 1300° C. to have been combined, which is very probable, since nearly all the calcium sulphate in the sulphate mixing was decomposed (*vide* Table VIIB), at that temperature the CaO : Al_2O_3 ratio was 1·1, approximately CaO,Al_2O_3. Owing, presumably, to the weakness of alumina as an acid oxide, the *long-period* heatings contained sulphuric oxide, which had entered the mixing during heating, absorbed from the furnace gases.

From Table VIIB. it was evident that the interaction at 1150—1200° C. was small; previous experiment had shown the inter-action between calcium sulphate and alumina to commence at 1120—1125° C. This temperature is higher than that of commencing inter-action for $CaCO_3+Al_2O_3$ just as the temperature of commencing inter-action for $CaSO_4+SiO_2$ is higher than that for $CaCO_3+SiO_2$, and for the same reason, viz.:—that the force leading to inter-action is differential instead of simple. At 1250° C. the decomposition of the sulphate and formation of soluble aluminate was well advanced, and at 1300° C. had left only four per cent. of soluble matter. Calculation of the molecular lime : alumina ratio, made in the same way as before described, gave at 1250° C. 0·84 and at 1300° C., 0·95. The conclusion was drawn that the heated mass had been nearly all converted into a soluble aluminate of the formula $CaO.Al_2O_3$. No insoluble compound was formed at any stage of the heating, and there was no fusion. It is interesting to note that the molecular ratios of lime to alumina calculated from the slowly soluble portions alone were at 1250° C. 0·83 and for 1300° C., 0·92, nearly the same as when calculated from the total soluble.

TABLE VIIB.

Lime and Alumina.

$CaSO_4+Al_2O_3$

$CaO+Al_2O_3$ contains $\begin{cases} CaO = 35\cdot4 \text{ per cent.} \\ Al_2O_3 = 64\cdot6 \text{ per cent.} \end{cases}$

$CaSO_4+Al_2O_3$ contains $\begin{cases} CaO = 23\cdot5 \text{ per cent.} \\ Al_2O_3 = 42\cdot8 \text{ per cent.} \\ SO_3 = 33\cdot6 \text{ per cent.} \end{cases}$

Where Heated.	Time (hrs.)	Temp. °C.	Quickly sol.			Slowly sol.			Total sol.			Insol.	$\frac{CaO}{Al_2O_3}$.	Appearance	Notes.
			CaO	Al_2O_3	SO_3	CaO	Al_2O_3	SO_3	CaO	Al_2O_3	SO_3				
Injector	1	1150	23·1	1·1	32·6	0·8	2·5	0·5	23·9	3·6	33·1			unchanged	Analyses duplicated throughout.
,,	1	1200	20·5	2·1	28·5	3·3	3·7	2·6	23·8	5·8	31·1			,,	
,,	1	1250	18·1	5·7	22·0	9·2	15·9	2·8	27·3	21·6	24·8		0·84	,,	
,,	1	1300	8·9	13·1	2·5	25·1	41·1	6·3	34·0	53·6	8·8	3·6	0·95	slt. hardened	

TABLE VIIIA.

Lime and Alumina.

$CaCO_3+10Al_2O_3$

$CaO+10Al_2O_3$ contains $\begin{cases} CaO = 5\cdot2 \text{ per cent.} \\ Al_2O_3 = 94\cdot8 \text{ per cent.} \end{cases}$

$CaCO_3+10Al_2O_3$ contains $\begin{cases} CaO = 5\cdot0 \text{ per cent.} \\ Al_2O_3 = 91\cdot9 \text{ per cent.} \end{cases}$

Where Heated.	Time (hrs.)	Temp. °C.	Quickly sol.		Slowly sol.		Total sol.		Insol.	$\frac{CaO}{Al_2O_3}$	Appearance.	Notes.
			CaO	Al_2O_3	CaO	Al_2O_3	CaO	Al_2O_3				
blank			5·1	0·1								
Muffle	1	500	5·1	0·1							unchanged	
Works furnace	24	500	5·2	0·0							,,	
Muffle	1	660	5·3	0·2							,,	
Works furnace	24	660	5·3	0·2							,,	
Muffle	1	800	5·3	0·0	—	—	5·3	0·0	94·7		,,	
,,	1	800	5·1	0·1	—	—	5·1	0·1			,,	
Works furnace	24	850	5·2	0·0	—	—	5·2	0·0			,,	
Muffle	1	900	5·3	5·0							,,	First signs of inter-action.
,,	16	900	5·3	4·8	—	—	5·3	4·8	89·9		,,	
Injector	1	1100	2·7	3·6								
Works furnace	24	1100	4·0	5·1								
Injector	1	1100	4·3	5·6	0·5	2·7	4·8	8·3	86·9	1·0	,,	Lime becoming insoluble.
Works furnace	48	1100	3·4	4·6	1·2	3·7	4·6	8·3	87·1	1·0	,,	
Injector	1	1150	0·5	1·5	3·0	11·4	3·5	12·8	83·7	$\frac{1}{2\cdot0}$	,,	Minimum of insoluble reached.
,,	1	1200	0·3	0·8	1·8	6·6	2·1	7·4	90·5	$\frac{1}{1\cdot9}$	,,	Duplicate analyses.
,,	1	1200	trace	0·5	2·1	8·1	2·1	8·6	89·3		,,	
,,	1	1250	0·4	0·8	2·6	9·8	3·0	10·6	86·4	$\frac{1}{2\cdot0}$	,,	Duplicate analyses.
,,	1	1250	trace	0·6	2·8	10·4	2·8	11·0	86·2	$\frac{1}{2\cdot1}$	,,	
,,	1	1300	0·3	0·8	1·6	5·5	1·9	6·3	91·8	$\frac{1}{1\cdot8}$	,,	
,,	1	1400	0·1	0·2	2·2	8·3	2·3	8·6	89·1	$\frac{1}{2\cdot0}$	slt. hardened	
,,	1	1400	trace	0·2	2·4	8·9	2·4	9·1	88·5	$\frac{1}{2\cdot1}$	,,	

Comparing the results for $CaO+SiO_2$, and $CaO+Al_2O_3$ they were alike in indicating the complete combination of those mixtures into $CaO.SiO_2$ and $CaO.Al_2O_3$. A difference is found in the slower solubility of $CaO.Al_2O_3$; with the silica mixing, practically all the soluble lime was "quickly soluble" (*vide* Table I.); with the alumina mixing as the temperature rose, and more lime became combined as aluminate, it was found, in increasing quantity, as "slowly soluble."

Lime with excess of alumina.—Mixtures were made up, heated, and extracted, of the formulæ, $CaCO_3+10Al_2O_3$, and $CaSO_4+10Al_2O_3$. Table VIIIa. shows the results obtained with the carbonate mixings.

From Table VIIIa it appeared that interaction between lime and alumina commenced between 850° C. and 900° C. with the formation of soluble aluminate. At 1100° C. more alumina had gone into combination and a little of the lime was insoluble. At 1150° C. the total soluble matter, and the amount of soluble alumina, reached its maximum, but one third of the total lime was insoluble; this lime had presumably formed an insoluble aluminate with some of the alumina, and so distinguished the interaction of lime and alumina from that of lime and silica, in which no insoluble compound of lime was formed. At the higher temperatures, no increase in soluble alumina was found, and about half the lime was insoluble.

The molecular ratio, soluble lime/soluble alumina, calculated from 1150—1400° C., gave nearly the same figure throughout, corresponding closely with the formula $CaO.2Al_2O_3$, which was therefore taken as being the soluble compound formed on heating lime with an excess of alumina to those temperatures. An insoluble compound was formed also and persisted, but the mode of examination gave no clue to its formula. It was noticeable that at all temperatures above 1100° C. very little of the lime and alumina was "quickly soluble," indicating that the compound $CaO.2Al_2O_3$ was decomposed but slowly by normal hydrochloric acid, more slowly than $CaO.Al_2O_3$ or the lime-silicates.

Another set of lime-alumina ratios was calculated from the "slowly soluble" matter. These ratios, from 1150° C. upwards, were :— 0·49, 0·52, 0·49, 0·52, confirming the formula, $CaO.2Al_2O_3$, for the "slowly soluble" compound. Again noticeable was the occurrence of considerable interaction between solids, the heated mass being unchanged in appearance up to 1300° C., and only very slightly hardened at the highest temperature tried, 1400° C.

Table VIIIb. shows the results obtained with the sulphate mixings :—

TABLE VIIIb.

Lime and Alumina.

$CaSO_4 + 10Al_2O_3$

$CaO + 10\ Al_2O_3$ contains $\begin{cases} CaO = 5{\cdot}2 \text{ per cent.} \\ Al_2O_3 = 04{\cdot}8 \text{ per cent.} \end{cases}$ $CaSO_4 + 10SiO_2$ contains $\begin{cases} CaO = 4{\cdot}8 \text{ per cent.} \\ Al_2O_3 = 88{\cdot}2 \text{ per cent.} \\ SO_3 = 6{\cdot}0 \text{ per cent.} \end{cases}$

Where Heated	Time (hrs.)	Temp. 0° C.	Quickly sol.			Slowly sol.			Total sol.			Insol.	Appearance.	Remarks.
			CaO.	Al_2O_3	SO_3	CaO.	Al_2O_3	SO_3	CaO	Al_2O_3	SO_3			
Injector	1	1150	2·8	trace	4·0	trace	trace	trace	2·8	trace	4·0	93·2	unchanged	
,,	1	1200	1·7	trace	2·2	trace	0·5	trace	1·7	0·5	2·2	95·6	,,	
,,	1	1250	1·3	trace	trace	0·6	1·2	trace	1·0	1·2	trace	96·9	,,	
,,	1	1300	0·0	trace	trace	0·5	0·9	trace	1·4	0·9	trace	97·8	,,	

Thus it appeared that when calcium sulphate was heated with a large excess of alumina there was at no stage any appreciable amount of soluble alumina obtained, but the lime gradually became insoluble. It seems reasonable to conclude that very little soluble aluminate of lime was formed, but that interaction between calcium sulphate and alumina, which would commence at 1120° C., as before determined, resulted in the direct formation of insoluble lime aluminate. The gradual increase in total insoluble matter was confirmatory; in the corresponding carbonate mixing, it was noted that insoluble lime appeared at 1100° C. (Table VIIIa).

An analysis of the "heating" $CaSO_4+10Al_2O_3$ made at 1250° C., without separation into soluble and insoluble portions, showed it to consist of lime and alumina with only a trace of sulphuric oxide, indicating that the calcium sulphate had been decomposed, again supporting the view that the lime had gone into insoluble combination with the alumina.

TABLE IXa.

Lime and Alumina.

$3CaCO_3 + Al_2O_3$

$3CaCO_3 + Al_2O_3$ contains $\begin{cases} CaO = 41{\cdot}7 \text{ per cent.} \\ Al_2O_3 = 25{\cdot}3 \text{ per cent.} \end{cases}$ $3CaO + Al_2O_3$ contains $\begin{cases} CaO\ \ 62{\cdot}2 \text{ per cent.} \\ Al_2O_3 = 37{\cdot}8 \text{ per cent.} \end{cases}$

Where heated.	Time in hours.	Temp. °C .	Quickly soluble Al_2O_3	Slowly soluble Al_2O_3	Total soluble Al_2O_3	Appearance.	Remarks.
Injector furnace	1	850—900	2·5	—	3·5	unchanged	Interaction just commenced.
,,	1	1150	11·1	2·1	13·2	Slightly coherent	Interaction extensive
,,	1	1250	10·6	3·1	22·7	,,	,, ,,
,,	1	1300	21·0	9·1	30·1	,,	Most of Al_2O_3 combined.
Works furnace	24	1150	8·3	20·0	*a*28·3 *b*29·0 *c*28·0	,,	(*a*) Extracted 25 hours. (*b*) Same extracted 5 days. (*c*) Same extracted 4½ days. A complete analysis of this heating is given below.
,,	48	1150	12·3	28·1	*a*40·4 *b*38·8 *c*38·4		(*a*), (*b*), (*c*), as above. Only a trace was insoluble in normal hydrochloric acid.

All the lime was soluble throughout.

Alumina with an excess of lime.—For this experiment the ratio $3CaO + Al_2O_3$ was chosen. If complete combination occurred, the tri-calcic aluminate claimed as a primary constituent of Portland cement would be formed. The two mixings made corresponded with the formulæ, $3CaCO_3 + Al_2O_3$, and $3CaSO_4 + Al_2O_3$: the results obtained by heating and extracting are collected in Tables IXA and IXB.

From Table IXA. the course of the reaction could be plainly traced from 850° C.—900° C., when it commenced, to 1300° C., when more than three-fourths of the alumina was combined in the short period heatings. The long period heatings were made for one and two complete burns of the works furnace, as previously for lime-silica mixings: the result of interaction for one hour at 1300° C. was about the same as for 24 hours at 1150° C., but less of the alumina was quickly soluble. The result of two burns (48 hours) at 1150° C., was the complete conversion of the alumina into the soluble form indicating combination of all the alumina present to form a soluble aluminate at the temperature 1150° C.

The complete analysis of the mixture heated for one burn of the works furnace (24 hours) was:—lime, 46·5 per cent.; soluble alumina, 29·2; insoluble alumina, 1·6; sulphuric oxide, 22·8; (equivalent to 16·0 per cent. of CaO). In this long-period heating the sulphuric oxide had been absorbed from the furnace gases.

or, if formed, they may have been decomposed. Whatever the reason may be, no evidence of the existence of the more basic aluminates described by others was forthcoming in these experiments.

In Curve III. the results obtained from mixtures of lime and alumina in various proportions are shown graphically. As before, no attempt has been made to construct a continuous curve, even when the results obtained would suggest it. Percentages of alumina rendered soluble are plotted vertically, and temperatures horizontally.

Summary for lime and alumina.—The results from lime and alumina may be summarised thus:—Interaction commenced between 850° C. and 900° C. whatever the proportion of lime to alumina, the temperature being rather higher than with lime and silica. With the proportions $CaO + Al_2O_3$ the inter-action was rapid at 1100° C. and at 1300° C. was nearly complete: a soluble aluminate of the formula $CaO.Al_2O_3$ was the product. When more alumina was present, $CaO.Al_2O_3$ may have been formed up to 1100° C., but above that temperature a more slowly soluble aluminate of the formula $CaO.2Al_2O_3$, and also, commencing at 1100° C. an insoluble aluminate, presumably containing more alumina. As the temperature rose above 1100° C. the soluble aluminate diminished and the insoluble aluminate increased. The formation of an insoluble compound of lime and alumina distinguished alumina from silica.

TABLE IXB.

Lime and Alumina.

$3CaSO_4 + Al_2O_3$.

$3 CaSO_4 + Al_2O_3$ contains $\begin{cases} CaO = 32{\cdot}9 \text{ per cent.} \\ Al_2O_3 = 20{\cdot}0 \text{ per cent.} \\ SO_3 = 47{\cdot}1 \text{ per cent.} \end{cases}$ $3 CaO + Al_2O_3$ contains $\begin{cases} CaO = 62{\cdot}2 \text{ per cent.} \\ Al_2O_3 = 37{\cdot}8 \text{ per cent.} \end{cases}$

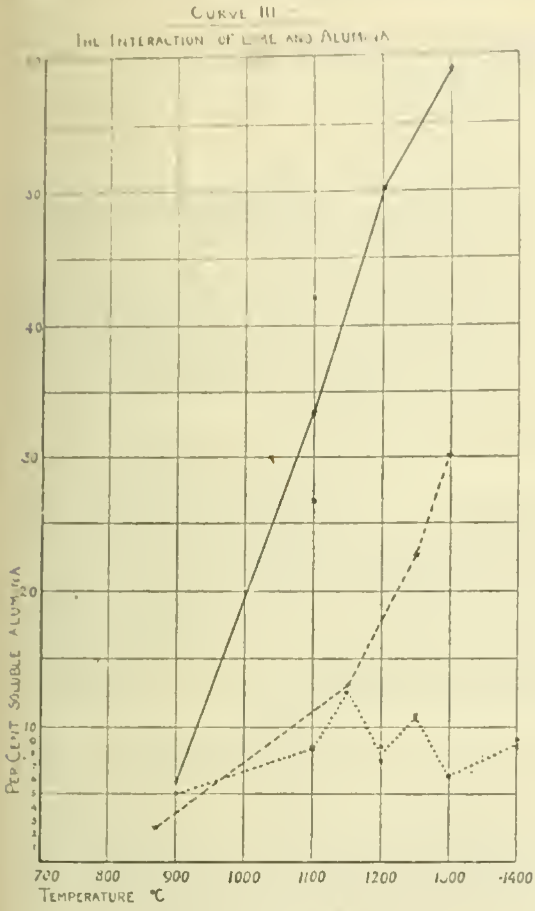
Where Heated	Time (hrs.)	Temp. °C.	Quickly sol.			Slowly sol.			Total sol.			Insol.	CaO. / Al_2O_3	Appearance.	Notes.
			CaO.	Al_2O_3	SO_3.	CaO.	Al_2O_3	SO_3.	CaO.	Al_2O_3	SO_3.				
Injector furnace	1	1150	33·3	2·9	46·1	0·4	0·7	0·5	32·7	3·6	46·6	16·1		Shrunk slightly coherent.	
,,	1	1250	28·3	4·1	38·6	6·0	4·2	5·6	34·3	8·3	44·2	13·2	0·7	,,	
,,	1	1300	26·3	4·0	36·3	8·1	5·9	7·7	34·9	9·9	44·0	11·2	0·8	,,	
Works furnace	24	1150	27·1	2·8	38·5	8·6	10·8	6·2	35·8 36·4	13·6 13·5	44·7	5·9	0·6	Slightly coherent.	
,,	48	1150	23·2	1·7	34·6				36·6 36·5	19·3 18·1	44·2 43·0	0·0 2·4	0·5 0·6	,,	Separate extractions.
,,	72	1150							37·4	20·3	42·6	0·0	0·7	,,	Separate extractions.
,,	72	1150							37·6	21·3	40·6	0·8	0·8		Some of the Al_2O_3 seems to have been lost in the heating.
,,	72	1150							37·62	20·4	40·9	0·7	0·8		Insol. by direct estimation.

From Table IXB. it was evident that, as in previous trials, the interaction commenced at a higher temperature with the sulphate of lime than with the carbonate. The effect of prolonged heating at 1150° C. was marked, 48 hours rendering all the alumina soluble. Heating at 1300° C. for one hour did not cause such extensive combination. No insoluble lime compounds were formed. Calculation of the molecular ratios of soluble lime/alumina gave values from 0·5 to 0·8; no ratio above 1·0 ($CaO.Al_2O_3$) or below 0·5 ($CaO.2Al_2O_3$) was obtained. There was no evidence of the formation of any such basic compound as $3CaO.Al_2O_3$ under these conditions of experiment. It may be held that when all the alumina had entered into combination as $CaO.Al_2O_3$, or as $CaO,2Al_2O_3$, the force tending to decompose calcium sulphate practically disappeared, and the remainder of the calcium sulphate therefore remained undecomposed. Also in the long-period heatings, since the furnace-gases to which the heated material was exposed contained about 0·5 grm. of sulphur per cubic metre, as sulphur oxides, the formation of more basic aluminates may have been prevented

When more lime than in $CaO + Al_2O_3$ was used, the $CaO : Al_2O_3$ ratio was again between 1·0 and 0·5, and no insoluble compound was detected. With the lime alumina mixtures generally, no compound was formed with more lime than $CaO.Al_2O_3$, and no soluble compound with more alumina than $CaO.2Al_2O_3$. The inter-action between lime and alumina occurred without any visible physical change in the heated mass; no chemical inter-action would have been suspected.

The (pyramid) fusion point of the most fusible mixture of lime and alumina is given by Boudouard (J. Iron and Steel Inst., 1905 p. 354) as 1400° C. so that evidence is to hand, apart from that of inspection, that the combination detected had taken place without fusion.

Definite compounds of lime with silica or alumina.—On the question of what definite compounds of lime with silica, and lime with alumina were formed, the results of the preceding experiments indicated: $CaO.SiO_2$, $CaO.Al_2O_3$, $2CaO.SiO_2$ and $CaO.2Al_2O_3$, all decomposable by cold normal hydrochloric acid, and an insoluble compound of lime and alumina presumably containing more alumina than $CaO.2Al_2O_3$. The lime/silica ratio was always between 2·0 and 1·0 and the lime/alumina ratio, in the soluble compounds, was always between 1·0 and 0·5.



———————— Alumina from mixing $CaO + Al_2O_3$
- - - - - - - - Alumina from mixing $3CaO + Al_2O_3$
. . . . Alumina from mixing $CaO + 10Al_2O_3$

These compounds formed at temperatures ranging from 500° C. to 1300° C., when the mixed oxides were heated together in an oxidising atmosphere. Referring to the work of others :—Le Chatelier (Annales des Mines, 1887) prepared $CaO.SiO_2$ and $2CaO.SiO_2$ by heating together lime and silica but failed to prepare $3CaO.SiO_2$ by that means. $Al_2O_3.CaO$, $2Al_2O_3.3CaO$, and $Al_2O_3.3CaO$. are described as prepared by heating together the constituent oxides. Crystal formation seems to have been the criterion of combination used. This research is a classic of silicate chemistry.

Boudouard (J. Iron and Steel Inst., 1905, p. 374) deduced from melting point curves, obtained by experiments on pyrometric pyramids, the existence of $CaO.SiO_2$, $2CaO.SiO_2$, $3CaO.SiO_2$, $CaO.Al_2O_3$, $2CaO.Al_2O_3$, $3CaO.Al_2O_3$.

Day and Shepherd (Amer. J. Sci., Oct. 1906) say "The optical evidence gained by the microscopic study of the crystallized products of mixtures of silicon dioxide and calcium oxide in variable proportions confirms the pyrometric measurements in the following particulars : (1) That silica, calcium meta-silicate, calcium orthosilicate and calcium oxide, are the only compounds in the series." and add "the metasilicate forms solid solutions with silica and with ortho-silicate over limited ranges."

The agreement between these last results and those of the author, obtained by methods and at temperatures so different, points to the stability of the lime-silica compounds concerned, over a long range of temperature.

Jordis and Kanter (Z. angew. Chem., 1903, p. 336) have described the preparation of lime silicates containing more silica than $CaO.SiO_2$ by a wet method, but no constant compositions were obtainable and no formulæ calculable. $CaO.SiO_2$ occurs naturally as Wollastonite and has been prepared artificially by M. Lechartier (Synthèses des Minéraux by Fouqué et Levy, p. 104) by melting a mixture of silica, lime, and an excess of calcium chloride, and washing the product after cooling.

Ebelman, so long ago as 1848 (Synthèses des Minéraux, p. 227) prepared $CaO.Al_2O_3$ (lime spinelle) in large plates by heating to a high temperature, with an excess of boric acid, a mixture of the two oxides.

Clifford Richardson (see this J., 1905, p. 773) mentions as synthesized by himself, mono-, di-, and tri-calcium silicates ; mono-, di-, and tri-calcium aluminates and tri-calcium di-aluminate. He insists on the necessity for extremely fine particles if the tri-silicate or aluminate is to form.

S. B. and W. B. Newberry (this J., 1897, p. 887) state that lime can be combined with silica in the maximum proportion of three molecules to one ; the criterion of chemical combination taken seems to have been the constancy of volume of the product under cold water and steam tests.

No mention seems to have been made of the compound $CaO.2Al_2O_3$ by other investigators, and that may be due to Portland cement having determined the line of research in the direction of basic compounds of lime and alumina ; mixtures containing an excess of alumina have not received so much attention.

The thanks of the author are due to the directors of the Farnley Iron. Co. Ltd., in whose laboratory the experiments have been made and to Mr. C. A. King, M.Sc., his chief assistant, for valuable assistance in experiment and analysis.

Discussion.

Prof. H. R. **Procter** asked if the curves were really continuous, as the diagrams showed the points connected by straight lines. He also inquired if the iron in the sand used in these experiments was in such a form that it could be readily dissolved out.

Mr. J. **Miller** asked if sand or precipitated silica was used in these experiments, as the reaction might go on at a lower temperature if the latter was used.

Mr. B. A. **Burrell** asked whether the temperatures were determined by Seger cones or by a pyrometer, and if by the latter, which was more reliable ? Since the experiments were carried out below the fusion point, was there any physical change observable such as fritting, &c. ?

Mr. J. W. **Cobb**, in reply, said he obtained the curves by connecting points obtained from analytical results, and had not drawn a continuous curve even where it seemed suggested ; many more experiments and analyses would have to be made to admit of accurate plotting ; variation in the curves would no doubt result from secondary reactions, such as the formation of an insoluble aluminate at the higher temperatures (curve 3). He had used the purest quartz sand obtainable (not precipitated silica) for the experiments, since the former was insoluble in normal hydrochloric acid and was used in the glass and ceramic industries. He never used Seger cones for determining high temperatures accurately. These integrated all fusion effects above the point of incipient fusion, and so were invaluable in many works processes, but unreliable for exact temperature measurement, too much depending on the rate of heating. A thermo-couple of platinum and platinum-rhodium was used for determining temperatures in this work. The thermo-couple provided a ready means of improving our knowledge of inorganic chemistry, and that was very necessary, since even with the commonest substances no accurate information could be obtained from books with regard to the temperatures at which reactions commenced, if these temperatures were outside the range of the mercury thermometer. In the tables given, physical changes were noted when they occurred. In some cases no reaction would have been suspected without chemical tests ; a white loose powder was all that was to be seen both before and after the heating.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

PATENTS.

Centrifugal machines. W. A. Macfarlane, Alloa, Scotland. Eng. Pat. 4296, Feb. 22, 1909.

THE claim relates to the method of discharging the contents of centrifugal machines. A series of openings is formed in the bottom of the drum or basket, immediately below the annular space occupied by the separated solid matter. So long as the basket is rotated, the openings are closed by flap-valves which are kept in position by the centrifugal force, but as soon as the rotation is stopped, the valves open and allow the material to be discharged.—W. H. C.

Separators for separating dust and the like from air or other gas or gases; Centrifugal ——. W. Yates and Matthews and Yates, Ltd., Manchester. Eng. Pat. 5735, March 10, 1909.

A SERIES of centrifugal cyclone separators are arranged along each side of a casing of gradually decreasing width, into which the mixture of gas and dust is delivered at the wider end. Owing to the arrangement of the separators, the path of the gas to the tangential inlet of any one of them is not impeded by the position of the separator next in front. The gas enters each separator tangentially, and is discharged, free from dust, through a vertical pipe in the top into a common chamber above. The dust is discharged from the lower end of the conical part of each separator into a common chamber below.—W. H. C.

Filter-presses. J. W. Martin, Manchester. Eng. Pat. 6211, March 16, 1909.

IN order to facilitate the closing and opening of a filter-press, the pressure is applied to the end frame or plate through the medium of one or more spindles which pass loosely through holes bored, parallel to the axis of the press, in the end standard. These spindles bear at one end against the end plate and at the other end against a screw-tightened lever or levers by which the spindles are forced. The levers are hinged, so that on releasing the pressure by a few turns of the screw, the former may be turned back and the spindles quickly removed, to allow the press to be opened out. In some cases the screw exerts the pressure directly on the spindles without the intermediary of a lever.—W. H. C.

Fractional condensation of vapours. S. G. S. Dicker, London. From Oesterreichische Chemische Werke, A.-G. and L. Löwenstein, Vienna. Eng. Pat. 6533, March 18, 1909.

THE mixture of liquids to be fractionally distilled is heated in a suitable vessel and the vapours are passed in succession through a series of condensers. The cooling liquid in any one condenser has a boiling point just below that of the liquid to be condensed in that condenser, but the same or higher than that of the liquid to be condensed in the next condenser. The vapour spaces above the liquid in the still, above the cooling liquid in the condensers, and in the condensing space of the condensers are connected together in such a manner that the pressures are all approximately equal.—W. H. C.

Mixing machines for malting, blending of grains, cement and other purposes. C. H. Griffiths, London. Eng. Pat. 7420, March 27, 1909.

THE materials to be mixed are fed into a hopper placed over a vat or bin. From the bottom of the hopper the mixture is discharged into a hollow arm provided with several openings in its under side, and with an internal conveyor screw or blade. The arm is slowly rotated and the mixture discharged from the openings into the vat or bin in an even layer.—W. H. C.

Bone-black kiln. B. Eba, North Warren, Pa. U.S. Pat. 940,520, Nov. 16, 1909.

THE claim is for improvements in the bone-black kiln described in U.S. Pat. 796,303 of 1905 (this J., 1905, 980). The upper end and lower sections of the vertical retorts are connected by vertical coupling pieces, and the cooling chambers into which the treated material is discharged from the retorts, are connected below to a common discharge chamber having separate discharge openings corresponding to, but out of alignment with the openings of the cooling chambers. The treated bone-black is removed transversely to these outlets by a reciprocating rake or push-plate.—W. H. C.

Channel-kiln. G. E. Oehrn, Hafverösund, Sweden, Assignor to American Gröndal Kjellin Co., New York. U.S. Pat. 948,243, Feb. 1, 1910.

THE claim is for a channel kiln having a combustion chamber, communicating with a cooling chamber, through which the material to be treated is caused to pass. Gas is supplied to a combustion port in the upper part of the combustion chamber, the flame being directed downwards upon the material under treatment. The gas conduit is so shaped that the current of gas is more or less broken, and arrives at the burner as an eddying stream. Air for supporting combustion is caused to circulate through conduits in the casing surrounding the cooling chamber, in order that the latter may be cooled and the air preheated. The air current is divided, one portion being directed vertically downward and the other horizontally on either side of the gas-port. Each current of air can be separately controlled, so that the angle at which the flame strikes downward can be varied.—W. H. C.

Drying apparatus. D. Hurley, Providence, R.I., and J. E. O'Shea, New York. U.S. Pat. 946,843, Jan. 18, 1910.

THE claim is for a drying chamber having a series of superposed, hollow, steam-heated drying shelves resting freely, to allow for expansion, on ledges formed on the sides of the chamber.—W. H. C.

Determining rate of flow of steam and other gases and vapours; Method and apparatus for ——. C. C. Thomas, Madison, Wis. U.S. Pat. 946,886, Jan. 18, 1910.

THE current of steam or other gas, if wet, is first dried by passing it through a chamber in which an electric resistance is fixed. Sufficient current is passed through the resistance to heat the current of gas to such a temperature that any moisture is evaporated. The current of dry gas is then passed over a second resistance arranged to impart a known amount of heat to the current of gas in a definite interval of time. The amount of heat so imparted is measured by the amount of current employed, and by observing the temperature of the gas before and after its passage over the resistance, the volume of gas passing is calculated, being inversely proportional to the rise in temperature.—W. H. C.

Pulverising, spreading, and mixing fluids ; Apparatus for ——. Pages, Camus, et Cie., and P. Bardy, Paris. Eng. Pat. 1781, Jan. 25, 1909. Under Int. Conv., Jan. 27, 1908.

See Fr. Pat. 396,476 of 1908 ; this J., 1909, 591.—T. F. B.

Ether and alcohol ; Process and apparatus for recovering —— *in various industries.* C. Crepello-Fontaine, La Madeleine-lez-Lille, France. Eng. Pat. 2400, Feb. 1, 1909.

See Fr. Pat. 396,664 of 1908, and Addition thereto ; this J., 1909, 597.—T. F. B.

Drying air by refrigeration ; Apparatus for ——. J. Gayley, New York. Eng. Pat. 13,551, June 9, 1909.

See Fr. Pat. 404,060 of 1909 ; this J., 1910, 95.—T. F. B.

Separating particles of liquid [from] gases and vapours ; Apparatus for ——. M. Steger. Bochum, Germany. Eng. Pat. 14,544, June 21, 1909.

See U.S. Pat. 940,947 of 1909 ; this J., 1910, 12.—T. F. B.

Filter-press. B. Berkovits, Budafok, Austria-Hungary. U.S. Pat. 947,883, Feb. 1, 1910.

See Fr. Par. 378,312 of 1907 ; this J., 1907, 1129.—T. F. B.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Shale-dust and coal-dust tests at Broxburn. R. McLaren and W. Clark. Trans. Mining Inst. of Scotland, 1910, 32, 74—85.

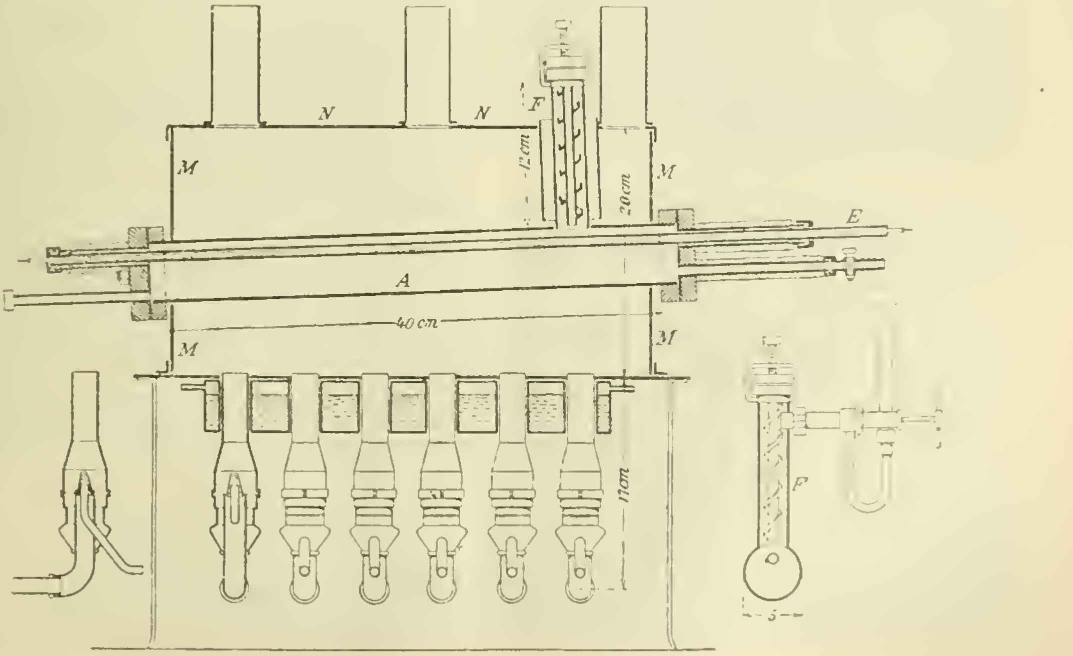
The authors describe a series of experiments carried out with oil-shale dust and shale-mine dust. They find that the shale-dust would not be a source of danger in mines, even if it were present in considerable quantities, since it is not ignited in the presence of a fire-damp explosion, but rather tends to diminish the flame produced. Further experiments showed that it is possible to destroy the power of coal-dust to propagate an explosion, by adding to it an equal quantity of a non-inflammable dust, and it is recommended that dust from spent shale, large waste heaps of which occur in Scotland, be used for the purpose, this dust being of low specific gravity, and hence mixing readily with coal dust. (See also this J., 1909, 692, 871, 1024, 1224.)—A. S.

Retort furnaces ; Working of ——. R. Geipert. J. Gasbeleucht., 1910, 53, 82—83.

In furnaces heated by gas generated in a producer forming part of the furnace, it is usual to regulate the draught and the secondary air supply in order to maintain a constant temperature in the retort chamber. The author points out that this leads to alteration in the composition of the flue-gases. The variations in the temperature are caused by the varying resistance of the fuel column in the producer to the passage of gas. A constant temperature can be maintained by opening the damper below the producer grate as the resistance in the producer increases, and *vice versa*. In this way the chimney-damper and the inlet for secondary air when once set need not be altered. The presence of carbon monoxide in the flue gases can be detected by the formation of a blue flame when hot air from the regenerators is admitted to the flue. The air-inlet beneath the producer grate should be closed until this blue flame disappears. In this way, the temperature can be kept constant, and the amount of carbon dioxide in the flue-gases can be kept as high as 18 per cent.—A. T. L.

Gas-oil and oil-gas. H. Hempel. J. Gasbeleucht., 1910, 53, 53—58, 77—82, 101—105, 137—141, 155—165.

The practical testing of oils used in the manufacture of oil-gas and carburetted water-gas is usually carried out by gasifying a laboratory sample of the oil in Wernecke's apparatus (Lunge : Chem.-techn. Unters.-Meth., Vol. iii., p. 45). The author finds that this apparatus does not give constant results for the same oil, whilst the results indicate a greater yield of gas than is obtained in the works, the candle-power and calorific value being correspondingly lower. The defects of the apparatus are that the temperature



of the retort is not uniform, overheating occurs locally, and the oil is not subjected to the required temperature for a sufficient time. A new apparatus was devised to obviate these defects. This apparatus comprises an inclined retort-tube, A (see Fig.), of iron, 40 cm long and 5 cm. diameter, with a fall of 3 cm. The retort-tube is mounted in an oven, M, which is heavily lagged with asbestos and has a removable cover, N. The retort is heated by a series of blow-pipe burners supplied with air at a pressure of 30 cm. of water. To prevent lighting-back, the upper parts of the burner-tubes are surrounded by a water-vessel as shown, and a gauze-screen is fitted in each burner-tube. A tube, E, in the retort contains a porcelain capillary enclosing a thermo-couple for indicating the temperature. The oil is introduced from a dropping funnel into a siphon tube opening into a vertical branch, F, of the retort-tube. This inlet branch is coated with asbestos and is provided with a helical channel down which the oil flows. The oil is vaporised gradually and completely in this tube, F, before it enters the retort. The apparatus is particularly suited for working at temperatures between 800° and 1000° C. Separate tests with the same oil did not vary more than 1 per cent. as regards the yield of gas, the candle-power, and the calorific value. A number of tests were made with shale-oil, tar-oil obtained from brown coal, and petroleums of German origin and from Galicia, Roumania, and Borneo. All of these gave satisfactory results when gasified at suitable temperatures, the greatest difference in the yield of gas amounting to 20 per cent., and the most suitable temperature varying from 745° C. to 790° C. In all cases, the yield of gas was greater, but the candle-power and calorific value lower, at higher temperatures, the gas containing a smaller percentage of olefines and higher percentages of hydrogen and of saturated hydrocarbons. Within the range of temperature used (711° to 832° C.) the product of the yield of gas and the gross calorific value was fairly constant, and it is suggested that the results of gasification-tests should be expressed in terms of this product for the purpose of comparing the value of different oils. The value of this product is not affected by a variation of 25 per cent. in the rate at which oil is run into the retort. The experiments also confirm the view that the value of an oil for gasification depends upon the percentage of hydrogen in the oil, but no numerical relation was found. When a current of nitrogen or of carbon monoxide was passed through the retort during the gasification of an oil, the yield of gas and its calorific power were unaltered, but the percentage of olefines in the gas was increased and also the candle-power. When a current of hydrogen was used, the yield of gas was reduced by 15 per cent. of the total volume, and there was a large increase in the calorific power, whilst the amounts of tar and of coke produced were lower. The amounts of olefines and paraffins in the gas were much greater than in a mixture of oil-gas obtained separately and mixed with the same amount of hydrogen.—A. T. L.

Petroleum, Russian; Destructive distillation of ——. K. W. Charitschkoff. Chem. Rev. Fett- u. Harz-Ind. 1910, **17**, 33.

SAMPLES of the residues left after the distillation of Baku and Grosny oils at 270° C. were subjected to the cracking process, with the following results: Grosny oil, 1st fraction, boiling up to 150° C., 2·6 per cent. (Baku oil corresponding fraction 1·95 per cent.); 2nd fraction, boiling at 150°—270° C., 16·3 per cent. (23·05 per cent.): residuum, 80·6 per cent., sp. gr. 0·9179, flashing point 140° C., viscosity (Engler) 2·4 (74 per cent., sp. gr. 0·900, flashing point 127° C., viscosity 3·2). The residuum in both cases was very fluid and resembled solar oil. The distillates are considered suitable for use as gas oils and solar oils, and also for thinning heavy, viscous residues that are unsuitable for fuel purposes owing to their high content of asphaltum and their physical properties. Coke could be obtained as a by-product of the cracking process.—C. S.

Naphtha industry of Baku in 1909. Board of Trade J., Feb. 24, 1910. [T.R.]

THE production of naphtha at Baku in 1909 is estimated at 490.000.000 pouds, as compared with 467,310,000 pouds in 1908 and 476,470,000 pouds in 1907. This increase in production was due to more intensive work, in spite of a decreased productivity of the sub-artesian wells. It is estimated that 53,000 fathoms of boring were made in 1909, as compared with 56,871 fathoms in 1908 and 61,253 fathoms in 1907. By far the greater amount of this boring was in deepening wells already begun. The production of naphtha in Binagadi increased, and was expected to amount for the whole year to 8,000,000 pouds. In the nine months January—September, over 1,000,000 pouds of naphtha were obtained in Surachany, where the production of natural gas increased while that of white naphtha fell off. The production of naphtha in the island of Swataja was expected to amount for the whole year to 1,500,000 pouds. Of 80 naphtha refineries, 27 were in operation in 1909. In the first nine months of the year, 242,200,000 pouds of crude naphtha were refined, an increase of 900,000 pouds as compared with the first nine months of 1908. The exports of naphtha products from Batoum and Novorossisk amounted in the first nine months of 1908 to 30,000,000 pouds, and in the corresponding period of 1909 to 31,000,000 pouds; the total exports for 1909 are estimated at 42,000,000 pouds. While the exports from Novorossisk have increased, those from Batoum have fallen. According to a statement by the Statistical Bureau of the Baku Naphtha Industry, the production of naphtha in 1910 is estimated at 470,000,000 pouds. (1,000 pouds = about 16 tons.)

Pitch and asphaltum; Composition and constitution of ——. K. Charitschkoff. Chem.-Zeit., 1910, **34**, 142.

A LARGE number of natural pitches and asphaltums contain nitrogen, and they may be regarded as salt-like compounds of highly complex acids with complex nitrogenous bases. This view is supported by the facts that the polynaphthenic acids prepared by the author (this J., 1909, 303, 974), resinify very readily when heated, yielding asphaltum-like products; whilst when heated with aniline or pyridine, or other organic bases, they give brittle, pitch-like substances of high melting-point.—A. S.

PATENTS.

Coal; Method of treating and handling —— *preparatory to coking.* W. G. Patterson, Pittsburg, Pa. U.S. Pat. 948,074, Feb. 1, 1910.

THE coal is washed with a large excess of water, the whole being run into a tank where the coal and sludge settle together. The coal and sludge are removed together, and sluiced with clear water in a tank, the water being allowed to percolate through the coal, thus depositing the sludge throughout the mass; the coal is then removed from the top.—A. T. L.

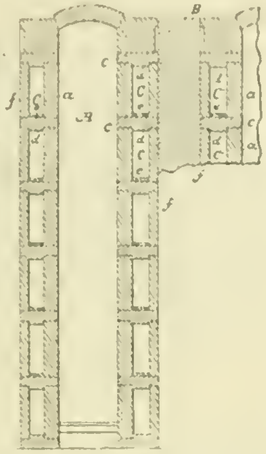
Spirit and hydrocarbons; Process for the preparation of a mixture of —— *stable in the cold, for explosion engines.* Verein der Spiritusfabrikanten in Deutschland. Ger. Pat. 217,201, Nov. 21, 1906. Addition to Ger. Pat. 216,699, Nov. 11, 1906.

THE benzene used in the process described in the main patent (this J., 1910, 144), is replaced partly or wholly by its homologues, especially toluene and xylene, or mixtures of the two such as are present in solvent naphtha and the tar-oil distillates obtained as described in Ger. Pat. 153,585.—A. S.

Gas-discharging device for retort coke-ovens. W. H. Allen, jun., Grosse Ile, Mich., Assignor to Semet-Solvay Co., Syracuse, N.Y. U.S. Pat. 947,522, Jan. 25, 1910.

THE claim is for a gas-discharge pipe provided with a valve and valve-seat. In the outlet end of the pipe, a horizontal spraying-nozzle is fixed, by which liquid can be sprayed into the gas and upon the valve-seat.—W. H. C.

Coke-oven construction. W. H. Blauvelt, Assignor to Semet-Solvay Co., Syracuse, N.Y. U.S. Pat. 947,524, Jan. 25, 1910.



The horizontal flues, C, of the oven, A, are formed of refractory tiles, *a*, *f*, with partition-tiles, *c*, having projections, *d*, serving as distance pieces at the upper part of the flue, and tiles, *e*, resting upon the upper surface of the partition-tiles, *c*, and serving as distance pieces for the lower part of the flue. The partition-tiles, *c*, serve to transmit any lateral pressure which may occur in the oven to the solid, reinforcing, division-walls, B. —W. H. C.

Heating-flues for retort coke-ovens; System of ——. W. H. Blauvelt, Assignor to Semet-Solvay Co., Syracuse, N.Y. U.S. Pat. 947,525, Jan. 25, 1910.

In coke-ovens having horizontal flues, the heating gas is supplied to the upper flue of each series, this flue being connected to two or more flues below, arranged in parallel, and these latter connected in turn to other groups of flues also arranged in parallel. Gas is also supplied at various points to each series of flues, which owing to the arrangement described, possess a gas-carrying capacity which increases from the inlet to the outlet end.—W. H. C.

Gas retorts. R. Dempster and Sons, Ltd., J. W. Broadhead, and H. J. Toogood, Elland, Yorks. Eng. Pat. 1484, Jan. 21, 1909.

In vertical retorts of the type in which the gas outlet is in or near the bottom mouth-piece, a layer of tar may be formed below the heated zone and on the surface of the coke which is fed into the mouth-piece before charging the retort with coal. In order that this layer of tar may not obstruct the passage of gas to the outlet, a pipe, open at both ends, is provided, projecting up into the retort to a point above the layer of tar, and this pipe is arranged so that it may be withdrawn from the retort before discharging. The pipe may be pivoted to the bottom lid of the mouth-piece and supported in its raised position, before charging, by a prop, or it may be arranged to be withdrawn into the gas-outlet pipe.—A. T. L.

Gas-producers. T. W. S. Hutchins, Stockton-on-Tees. Eng. Pat. 3918, Feb. 17, 1909.

In a gas-producer of the kind described in Eng. Pat. 22,974 of 1905 (this J., 1906, 974), the helix of fibrous material surrounding the vertical gas-outlet pipe is replaced by a number of metal collars, which form water-troughs around the gas-outlet pipe, the water overflowing from each trough to the one below it. These collars may be in two halves clamped together so as to be easily removable for cleaning. The producer is rectangular in plan, and is fitted with a grate of inverted V-shape, the base of the grate forming a water-trough which acts as an auxiliary vaporiser. Clinkering doors are provided at each side of the grate. The charging hopper is at the side of the producer, and a baffle-plate is arranged in the producer chamber between the charging orifice and the gas-outlet. The producer is designed with the object of economising space and is intended for use on board ship.—A. T. L.

Gas-producers. F. Tigges, Linden, Hanover. Eng. Pat. 18,123, Aug. 5, 1909. Under Int. Conv., Aug. 6, 1908.

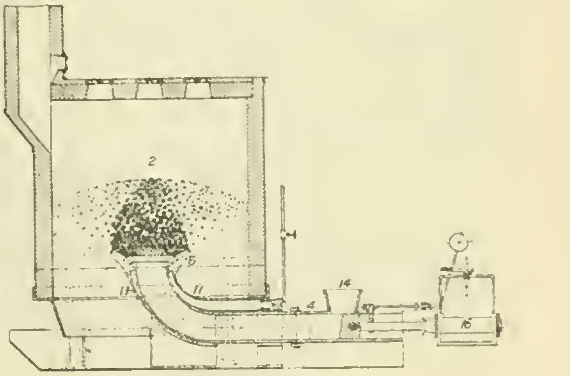
The patent relates to producers of the down-draught type in which the blast is admitted through a chamber or passage surrounding the charging shoot. The charging shoot is a vertical pipe arranged centrally in the upper part of the producer. The blast-chamber is formed by a larger pipe concentric with the charging shoot and of smaller cross-section than the producer chamber. This larger pipe extends farther down into the producer than the charging shoot, so that the fuel falling from the latter at first spreads only over the area of the blast-chamber. In this way the action of the blast over the area of the fuel column is more uniform.—A. T. L.

Gas-producer. T. Clouston, Vancouver, B.C. U.S. Pat. 946,820, Jan. 18, 1910.

The producer is divided by a partition-grate into a closed air-chamber below and a generator-chamber above. Fuel is charged through a hopper having an extension piece which projects through the top of the producer into the generator-chamber. Air is blown into the generator-chamber from the air-chamber through tuyères which project vertically upward into the fuel bed. The gas generated is withdrawn from the centre of the generator-chamber, at about half its height, by a stand-pipe projecting upwards from the centre of the grate and provided near the top with lateral intake ports. The gas passes down this pipe which is situated in the hottest zone of the generator and extends through the grate into the air-chamber below. The gas pipe is coiled within the air-chamber for the purpose of cooling the gas and heating the air, and it passes out of the air-chamber through the axis of the air-inlet pipe. Any volatile hydrocarbons given off in the upper part of the generator-chamber are withdrawn by a separate pipe.—W. H. C.

Gas-producer. J. C. and J. A. Swindell, Pittsburg, Pa. U.S. Pat. 947,065, Jan. 18, 1910.

The fuel is fed into the hopper, 14, and is forced by the plunger, 16, through the pipe, 4, and is discharged through the funnel-shaped mouth, 6, into the centre of the generator-chamber, 2. Air and steam are injected through the annular pipe, 11, and are discharged into the mass of fuel just below and around the fuel discharge. The producer has a water-sealed ash-pit and has no other opening for the entrance of air other than the annular one described.—W. H. C.



Gas-producer. J. Reuleaux, Wilkinsburg, Pa., Assignor to A. Laughlin, Sewickley, Pa. U.S. Pat. 948,249, Feb. 1, 1910.

The producer comprises a fixed body mounted over a rotating water-trough of annular form, which surrounds a fixed conical grate and forms a seal for a metal shell or ash-hopper depending from the lower part of the producer body. The fuel-bed is agitated by a number of water-cooled arms carried by the rotating water-trough and extending parallel to the grate, at different heights, as far as the axis of the producer, the inner ends of these arms being turned downwards and passing through the centre of the grate.—A. T. L.

Gas purification ; Oxide support for ——. J. C. Wright, Stratford, Essex. Eng. Pat. 11,058, May 10, 1909.

The support or grid, which can be used with existing purifiers, consists of a series of wooden bars or battens fitting loosely at each end in slots formed in bearers which rest on the existing T-iron bars of the purifier.—A. T. L.

Manufacture of lime and [fuel] gas. U.S. Pat. 948,045. *See* VII.

Calorimeter. U.S. Pat. 947,418. *See* XXIII.

Erratum.

This Journal, Jan. 15, 1910, page 12, col. 2, line 29 from top. Insert patentee's name: "A. J. Boult. London. From W. H. Bradley, Chicago, U.S.A."

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Ichthyol from Italian schists. F. Marino-Zucco and J. Tonolli. Gazz. Chim. Ital., 1909, 39, [II], 575—579.

Samples of a schist-like mineral from large deposits in Tuscany had an odour recalling that of ichthyol, and yielded on distillation about 8 to 10 per cent. of a crude oil with the following elementary composition :—Carbon, 69·56 ; hydrogen, 8·73 ; nitrogen, 2·27 ; sulphur, 7·79 ; and oxygen, 11·65 per cent. 10 grms. of the oil treated with concentrated sulphuric acid yielded 12 grms. of ichthyolsulphonic acid, in the form of a dark brown soft viscid paste. Comparative analyses of the ammonium ichthyolate prepared from this acid and of 4 samples of commercial products of different origin gave the following results.

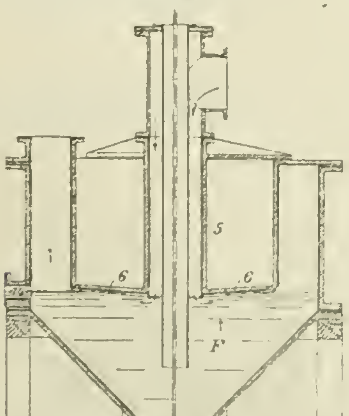
	I.	II.	III.	IV.	Tuscan ammonium ichthyolate.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Ammonia	3·36	4·28	2·48	3·93	1·34
Total sulphur ..	17·68	15·14	13·66	11·95	13·05
(*a*) Sulphur in sulphonic compound........	6·32	8·04	4·66	7·35	2·52
(*b*) Sulphur in sulphides........	11·36	7·10	9·00	4·57	10·53
Ratio between *a* and *b*	1 : 1·79	1 : 0·88	1 : 1·93	1 : 0·62	1 : 4·17

—C. A. M.

Patents.

Saturator for preparing ammonium salts from gases produced in the destructive distillation of coal, brown coal, etc. E. Wagner. Ger. Pat. 216,069, Feb. 19, 1909.

At the lower end of the gas-inlet tube, 5, is fixed an annular disc, 6, which rises slightly from within, towards the outer part. Its lower surface may be ribbed in order to keep the surface of the absorbing liquid constantly circulating. The liquid is kept in contact with the disc, 6, to avoid loss of ammonia, and also to remove the last traces from the gases.—T.F.B.



Mantles for inverted incandescent gas burners ; Forming and hardening ——. Neue Kramerlicht Ges. m.b.H., Charlottenburg, Germany. Eng. Pat. 12,579, May 27, 1909. Under Int. Conv., May 29, 1908.

The mantles are supported in the inverted position by means of a horizontal plate having suitable recesses, and extending along the length of a closed chamber lined with refractory material. The mantles are heated for two minutes by means of a series of inverted blowpipe burners having a vertical reciprocating motion. The products of combustion are drawn off from the chamber through outlets at a higher level than the mantles. A sufficient quantity of air to ensure complete combustion may be admitted through an adjustable orifice in the base of the chamber, or this orifice may be connected to the flue, the air being admitted to the upper part of the chamber. —A. T. L.

Electric arc electrodes and processes of making them. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 2027, Jan. 27, 1909.

The patent relates to arc light electrodes composed of titanium oxide and another metallic oxide or several oxides, as described in Eng. Pats. 26,915 and 26,920 of 1904 (this J., 1905, 190, 269). Owing to the different melting points of the oxides, and their incomplete mixture in the electrodes, the arc changes colour and becomes less luminous after the cathode has been in use for some time. The invention consists in melting the oxides together in a crucible, into a homogeneous mass which is afterwards powdered and formed into electrodes without the use of a binder by filling the powder into iron tubes. A suitable mixture consists of 70 parts of magnetite, 30 parts of titanium oxide, and 5 parts of chromite, with a small quantity of potassium fluoride.—A. T. L.

Arc-light electrode. I. Ladoff, Cleveland, Ohio, Assignor to P. C. Peck, New York. U.S. Pat. 948,926, Feb. 8, 1910.

The upper electrode, or anode, is composed mainly of an alloy of nickel and chromium.—A. T. L.

Incandescent electric lamps ; Manufacture of filaments or coherent conductors of refractory material for ——. The British Thomson-Houston Co., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 4164, Feb. 19, 1909.

The patent is for the use of a solution of agar-agar as binding agent. The agar-agar is finely chopped while dry, and is boiled in water to a smooth liquid containing 3 per cent. of carbonaceous material and 97 per cent. of water. One part of finely divided tungsten, molybdenum, etc., is mixed with 5 parts of the solution, sufficient ammonia having been first added to the liquid to keep the solution alkaline after the mixing. The hot mixture is squirted through a fine capillary cooled by running water, so as to form a gelatinous filament. These filaments are conductive and need not be carbonised. The filaments are shaped, and are then treated with current in an atmosphere of hydrogen and nitrogen, and are finally sintered and shrunk by bringing them to a high temperature.—A. T. L.

Optical pyrometer. Fr. Pat. 405,205. *See* XXIII.

III.—TAR AND TAR PRODUCTS.

Nitro-groups ; Reduction of —— *by hydrogen sulphide.* H. Goldschmidt and H. Larsen. Z. physik. Chem., 1910, 71, 437—512.

From a quantitative study of the reduction of nitro-compounds, the authors draw the following conclusions : (1). In the reduction by hydrosulphides and

hydrogen sulphide, hydroxylamino-compounds form the chief product. (2). The rate of reduction is nearly proportional to the concentration of the hydrosulphide, but increases rather more quickly than the latter. (3). The rate of reduction in a stream of hydrogen sulphide is practically independent of the concentration of the hydrogen sulphide in the solution. (4). The reduction of salts of nitro-bases is a reaction of the first order: addition of electrolytes containing the same ions retards the reaction. (5). Salts of nitro-acids are more quickly reduced in presence of electrolytes containing the same ions. The reaction here also is of the first order. (6). In the reduction of nitro-compounds with sulphides or polysulphides in absence of hydrogen sulphide, amino-compounds are produced. The thiosulphate formed as end-product is due to a secondary reaction. The primary products are hydroxides and higher polysulphides which are converted comparatively slowly into thiosulphate.
—J. C. C.

p-Methoxysalicylaldehyde. P. Friedlaender. Monatsh. Chem., 1909, 30, 897—881.

The compound obtained by Friedlaender and Schuloff (Monatsh. Chem., 1909, 29, 387) by the decomposition of 4-methoxybenzene-2-indolindigo is found to be identical with the *p*-methoxysalicylaldehyde prepared by Tiemann and Parrisius in 1880 (Ber., 13, 2366). The compound is best prepared by gradually adding concentrated sodium carbonate solution to a mixture of resorcinaldehyde and dimethyl sulphate in warm methyl alcohol until an alkaline reaction is obtained. The substance isolated by Goulding and Pelly (this J., 1908, 354) from *Chlorocodon Whiteii* has probably the same constitution.—J. C. C.

Patent.

Trinitrotoluene (1,2·4·6) *; Purification of* ——. V. Vender, Milan, Italy. Eng. Pat. 18,281, Aug. 7, 1909. Under Int. Conv., Aug. 8, 1908.

Crude trinitrotoluene is dissolved in concentrated sulphuric acid by heating to 80°—120° C., and the solution is cooled or diluted to recover the trinitrotoluene, the impurities (dinitrotoluene and resinous matters) remaining dissolved in the acid. The purification may directly follow the nitration, fuming sulphuric acid being added to the nitration-mixture, the excess of nitric acid removed by distillation, and the residual solution cooled, or diluted and cooled.—A. S.

IV.—COLOURING MATTERS AND DYES.

5·7·5′·7′*-Tetrachloroindigo ; Synthesis of* ——. Oberreit. Comptes rend., 1910, 150, 282—283.

The author confirms the constitution of the tetrachloroindigo obtained by Danaila (this J., 1910, 80), which is stated to be identical with that obtained from dichlorophenylglycinecarboxylic acid (Fr. Pat. 315,180 of 1901; this J., 1902, 401), produced by the direct chlorination of phenylglycine-o-carboxylic acid; the dichlorophenylglycinecarboxylic acid being identical with that obtained from 3·5-dichloranthranilic acid (Fr. Pat. 401,506, example 1; this J., 1909, 1120).—A. Sbld.

Indigo; Natural ——. Baron Schrottky de Schrottzynski. Times Eng. Suppl., Feb. 16, 1910.

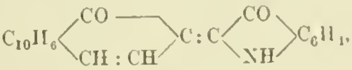
It is stated that, owing to the successful introduction of Java-Natal indigo (a three-year crop), into India, the planter will be able to reduce his cultivation expenses and harvest 50 per cent. more green plant per acre than heretofore, and hence, taking into consideration the better dye-yielding properties of the new variety, and the improvements in manufacture which have raised the output of dye per 100 maunds of green plant from 10 or 14 seers of indigo, as heretofore, to 28 or even 32 seers, at an extra cost which leaves a large margin of profit to the planter, the future cost of the production of natural indigo will be much below that of the synthetic dye.

Indigo, synthetic ; Manufacture of ——. Chem.-Zeit., 1910, 34, 162.

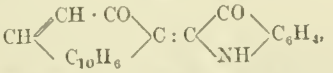
Rahtjen proposes to employ a modification of Sandmeyer's process to manufacture artificial indigo. In the Sandmeyer process (see this J., 1903, 489) diphenylthiourea, prepared from aniline and carbon bisulphide, is converted into hydrocyanocarbodiphenylimide by the action of white lead and potassium cyanide. By treatment with ammonium sulphide, the imide is converted into a thioamide, which yields α-isatinanilide on treatment with concentrated sulphuric acid. This isatinanilide is difficult to handle, but Rahtjen (see Ger. Pat. 204,478, this J., 1909, 86) has found that it readily forms, with sulphurous acid an addition compound, which can be reduced smoothly to indigo. According to Erlenbach a yield of 80 per cent. of the theoretical quantity of indigo is attainable.—A. S.

Indigoid dyestuffs of the anthracene series. A. Bezdzik and P. Friedlaender. Monatsh. Chem., 1909, 30, 871—878.

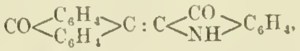
The authors have prepared indigoid dyestuffs by condensing α-and β- anthrols, anthranol, and 1:5- and 1:8-dihydroxyanthracenes with isatinanilide or isatin chloride, usually by warming the ingredients together in acetic anhydride solution. 2-Anthracene-2-indolindigo,



forms bronzy, dark blue needles: with alkaline hydrosulphite it gives an orange-red vat, from which textile fibres are dyed blue. 1-Anthracene-2-indolindigo,

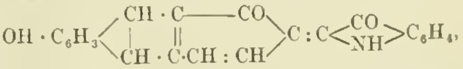


forms coppery, dark blue needles. When warmed with 30 per cent. sodium hydroxide it yields β-anthrol-1-aldehyde. 9-Anthracene-2-indolindolignone,



$$CO{<}{}^{C_6H_4}_{C_6H_4}{>}C:C{<}{}^{CO}_{NH}{>}C_6H_4,$$

prepared from anthranol-isatin, and phosphorus pentachloride in benzene solution, forms brownish red tablets with a metallic lustre. It gives an orange-yellow vat which becomes red on exposure to the air. 5-Hydroxy-2-anthracene-2-indolindigo,



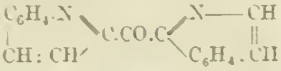
forms dark blue needles and gives an orange-red vat from which textile fibres are dyed in blue-violet shades.
—J. C. C.

Methylene Blue. P. Landauer and H. Weil. Ber., 1910, 43, 198—203.

When Methylene Blue in alcoholic solution is treated with phenylhydrazine at the ordinary temperature, it is reduced to a very pure form of the leuco-compound, which melts at 185° C. This substance is not oxidised in an atmosphere free from acid, even by pure oxygen, and, in strongly alkaline solution, permanganate or hydrogen peroxide has no action on it. With sodium ethoxide it gives a sodium salt (Na attached to N), but it could not be nitrated. The nitro-derivative of the leuco-compound was, however, prepared by the action of phenylhydrazine on Methylene Green: it melts at 146°—147° C.
—J. C. C.

Quinoline Red. E. Vongerichten and L. Krantz. Ber., 1910, 43, 128—130.

By the oxidation of Quinoline Red in hot aqueous solution with potassium bichromate and sulphuric acid, the authors have obtained benzaldehyde and a new base which, when heated with concentrated aqueous potassium hydroxide, furnishes isoquinoline and an acid which is probably quinaldinic acid. On this assumption the base has probably the constitution,



$$\begin{array}{l} C_6H_4.N \diagdown \qquad\qquad\quad N — CH \\ | \qquad\qquad C.CO.C \qquad\quad \| \\ CH:CH \diagup \qquad\qquad \diagdown C_6H_4.CH \end{array}$$

and is of importance in connection with the elucidation of the constitution of the dyestuff. The base melts at 125° C. and yields an oxime.—J. C. C.

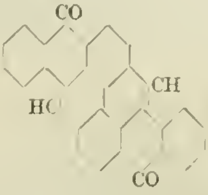
Indanthrene and flavanthrene. XII. The products of the action of nitric acid on flavanthrene and remarks on the elementary analysis of substances rich in carbon and combustible with difficulty. K. Holdermann and R. Scholl. Ber., 1910, **43**, 340—345.

When flavanthrene is boiled for 8 hours with nitric acid, sp. gr. 1·52 (10 parts), and concentrated sulphuric acid (4 parts), at least three different compounds are produced, of which that most sparingly soluble in concentrated nitric acid has been examined. This is a yellow, microcrystalline substance, $C_{28}H_8O_{10}N_6$, which is regarded as dinitrodinitrosodihydroxyflavanthrene. On treatment with hot alkaline hydrosulphite or with ammonium sulphide it yields tetra-aminodihydroxyflavanthrene which is a copper-coloured mass resembling indigo, and with alkaline hydrosulphite gives a vat like flaventhrene; the dyeings on unmordanted cotton turn to black-blue in the air and with dilute hydrochloric acid change to green, which colour however is restored to black-blue on washing. On heating the dyed cotton with bromine water, a pure black colour is produced which does not change under the action of acids. When dinitrodinitrosodihydroxyflavanthrene is boiled with aniline, dianilidodinitrosodihydroxyflavanthrene is formed which gives a bright blue vat on warming with alkaline hydrosulphite, and the dyeings on cotton retain their blue shade on exposure to the air: they are turned green by dilute hydrochloric acid, but are not affected by acetic acid. When *p*-toluidine is substituted for aniline in the above reaction, a blue-black substance is obtained which is insoluble in hot alkaline hydrosulphite.

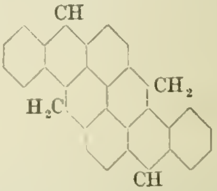
In the analysis of many of these flavanthrene derivatives the figures for carbon come out too low, owing to part of the substance distilling into the copper oxide and the carbon being deposited in the pores of the copper or copper oxide and remaining unburnt even in a stream of oxygen at a red heat. Also in the nitrogen estimations this deposited carbon retains some nitrogen, so that here also the results are too low. In the estimation of carbon the difficulty is overcome by using Dennstedt's method or even by inserting a piece of Dennstedt's platinum contact material between the boat and the copper oxide and heating it to a distinct red heat during the analysis. The nitrogen is also estimated correctly by Dennstedt's method, but as this is rather complicated, the authors insert a boat containing about 1 grm. of potassium chlorate near the magnesite or bicarbonate tube and when the analysis has been carried out as usual, the potassium chlorate is heated and the stream of oxygen continued until the copper spiral begins to blacken. Carbon dioxide is now led through the tube to drive off all nitrogen and it is found that no oxygen proceeds to the nitrometer.—J. C. C.

Pyranthrone, a nitrogen-free methine analogue of flavanthrene and dimethylpyranthrone. R. Scholl. Ber., 1910, **43** 346—356.

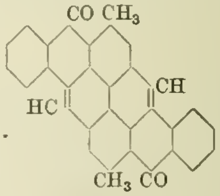
Pyranthrone, which is found in commerce as Indanthrene Gold-orange, has the constitution,



and is prepared by boiling 2 : 2′-dimethyl-1 : 1′-dianthraquinonyl with potassium hydroxide and ethyl alcohol for 2 hours, and oxidising the hydro-compound produced by means of a current of air. The substance forms brown needles and with alkaline hydrosulphite gives a purple vat dyeing cotton in purple-red shades, which on washing in the air become bright orange-red. Probably a diaminopyranthrone is produced by similarly condensing diamino-2 : 2′-dimethyl-1 : 1′-dianthraquinonyl: it gives a vat dyeing cotton in violet shades which turn dark brown in the air. By the bromination of pyranthrone a bromo-derivative is formed which dyes cotton from a violet vat in redder shades than does pyranthrone. On treatment with nitric acid pyranthrone is partly nitrated and oxidised: the product gives violet shades on cotton which become green-blue to gray-blue in the air. Pyranthrone is reduced by hydriodic acid and red phosphorus to pyranthrene.



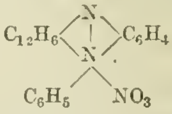
4 : 4′-Dimethylpyranthrone is prepared from 1 : 3-dimethylanthraquinone. With nitric and sulphuric acids this is converted into 4-nitro-1 : 3-dimethylanthraquinone (together with the 2 : 4-dinitro-compound), which on reduction yields the corresponding amino-compound. From this by means of the diazo-reaction, 4-iodo-1 : 3-dimethylanthraquinone is obtained, treated with copper powder, and the resulting 2 : 4 : 2′ : 4′ :-tetramethyl-1 : 1′-dianthraquinonyl is condensed by means of heating to boiling with potassium hydroxide and ethyl alcohol (followed by a current of air, blown through the hot liquid)—to 4 : 4′-dimethylpyranthrone



This substance forms orange-red needles and with alkaline hydrosulphite it gives a purple-red vat dyeing cotton in the same colour, the dyeings becoming golden yellow when exposed to the air and orange-yellow when treated with hot bromine water. On reduction dimethylpyranthrone yields 4 : 4′-dimethylpyranthrene.—J. C. C.

Acenaphthene series; Studies in the ——. F. Ullmann and E. Cassirer. Ber., 1910, **43**, 439—445.

As acenaphthene is now a commercial article the authors have prepared some products (naphthalic acid and naphthostyril) from it, and, from acenaphthenequinone, dyestuffs by condensation with phenylated o-diamines which, however, are weaker than the dyestuffs prepared from phenanthraquinone. When acenaphthene is warmed with 2-aminodiphenylamine and acetic acid, and the diluted aqueous solution treated with a few drops of nitric acid, phenylacenaphthophenazonium nitrate,



$$C_{12}H_6 \begin{array}{c} N \\ | \\ N \end{array} C_6H_4 \qquad \begin{array}{c} \diagup \;\; \diagdown \\ C_6H_5 \quad NO_3 \end{array}$$

crystallises out on cooling. It dyes tannin-mordanted cotton in lemon-yellow shades. The 3-chloro-derivative, prepared from 5-chloro-2-aminodiphenylamine and acenaphthenequinone, dyes tannin-mordanted cotton in greenish-yellow shades. 2-Aminophenylacenaphthophenazonium chloride, obtained by condensing acenaphthenequinone with 2 : 4-diaminodiphenylamine, dyes tannin-mordanted cotton in Bordeaux red shades.—J. C. C.

o-Vanillin and its derivatives. F. A. M. Noelting. Bull. Soc. Ind. Mulhouse, 1909, 79, 401—430.

o-Vanillin (β-metamethoxysalicylic aldehyde, CHO : OH : OCH$_3$ = 1 : 2 : 3) is, in the pure state, a solid which crystallises from water in pale yellow needles. From an acetic acid bath it dyes wool a golden yellow, and silk in rather lighter tones, but in neither case is the shade fast to soap. The influence exerted by various auxochrome groups when introduced into a chromophore is shown with reference to the methoxy, aldazine, and azomethine compounds of salicylic acid, etc., and the shades given by some of these compounds upon "Scheurer mordants" are tabulated. A comprehensive table is also given showing the changes which are brought about in the shade and dyeing properties of a dyestuff (Malachite Green) by the introduction of various radicals in different positions. —F. M.

Azo-coupling; Influence of hydroxyl ions on the ——. G. Heller. J. prakt. Chem., 1910, 81, 184—187.

When diazobenzene chloride (3 mols.) is allowed to act on phenol (1 mol.) in the presence of varying amounts of sodium hydroxide in excess, a mixture of bisbenzeneazophenol and trisbenzeneazophenol is obtained. As the concentration of alkali increases, the amount of bisbenzeneazophenol increases and that of trisbenzeneazophenol diminishes. The diminution of the amount of the latter is much greater than the increase in the former and this is attributed to the formation of readily soluble by-products, probably O-azo-compounds.—J. C. C.

Chemical actions of light. V. Photochemical phenomena in solutions of dyestuffs. F. Weigert. Ber., 1910, 43, 164—172.

Solutions of Methyl Violet, Malachite Green and ammonium salts of Uranine, Erythrosine G, Erythrosine J, and Phloxine were shaken in an atmosphere of nitrogen at 15° C. while exposed to the rays from a mercury arc lamp. In all cases, except that of Methyl Violet, a considerable diminution of pressure was noticed, which was partly restored when the solutions were placed in the dark. Chemical reactions also probably occur, as Phloxine became much yellower and lost its fluorescence almost entirely. Uranine behaved in the same way, becoming darker. The Erythrosine dyestuffs turned a very little darker and rather bluer. Water was also treated under the same conditions, but no such abnormal absorption of nitrogen took place. The author considers that under the influence of light, condensation-nuclei are formed in the solutions which can thus condense nitrogen in very great concentration on their surface. No difference in the change of colour of Erythrosine G could be observed when it was shaken with air instead of nitrogen. The author points out that other observers have noticed the absorption of oxygen by leuco-bases in considerable excess of that required to oxidise them to the dyestuffs, so that here also a process of physical adsorption probably took place.—J. C. C.

Patents.

Dyestuffs of the anthraquinone series; Manufacture of ——. F. Ullmann, Berlin. Eng. Pat. 12,653, May 28, 1909. Under Int. Conv., Mar. 2, 1909.

By the dehydration of anilido-anthraquinonecarboxylic acids of the general formula, $C_6H_4.CO_2H.NH.R$,(R being an anthraquinone residue), anthraquinoneacridones which are vat dyestuffs are obtained. The elimination of water may be effected by means of sulphuric acid or the carboxylic acids may be converted into the acid chlorides, and these then treated with aluminium chloride. Example: 2·5 parts of α-anilido-anthraquinonecarboxylic acid are covered with 20—30 parts of benzene and treated with 2·2 parts of phosphorus pentachloride, whereby the red anilido-anthraquinonecarboxylic acid chloride is obtained. 3—5 parts of anhydrous aluminium chloride are then added: the mixture becomes hot (hydrogen chloride being evolved in quantity) and the mass becomes coloured first brown and then green. The conversion is soon complete, and the product is mixed with ice water, the benzene distilled off with steam, and the violet-coloured needles of anthraquinoneacridone are collected washed and dried. The product may be recrystallised from aniline; it is insoluble in alcohol and ether and dissolves in sulphuric acid with a red colour. It gives a blue vat from which cotton is dyed in clear violet shades.—F. M.

Azo-dyestuffs for chrome-mordanted wool; Manufacture of new ——. A. G. Bloxam, London. From Actien-Ges. für Anilin-Fabr., Berlin. Eng. Pat. 13,917, June 14, 1909.

The diazo compound of 2 : 5-dichloraniline-4-sulphonic acid is combined with an aromatic ortho-hydroxy-carboxylic acid such as salicylic acid. Full, clear and fast orange to red shades are produced by dyeing in an acetic acid bath and subsequently adding sulphuric acid and potassium bichromate to develop the colour.—H. P. P.

Vat dyestuffs of the anthracene series; Manufacture of orange sulphurised ——. Society of Chemical Industry in Basle, and A. Schaarschmidt, Bâle, Switzerland. Eng. Pat. 20,127, Sept. 2, 1909. Addition to Eng. Pat. 7583, April 6, 1908 (this J., 1908, 1015).

The process for obtaining orange vat-dyestuffs described in the chief patent is modified in that the crude dyestuff produced by melting 2-methylanthraquinone or *omega*-monochloro-2-methylanthraquinone with sulphur at a temperature below 300° C., is treated with concentrated sulphuric acid before the treatment with hypochlorite. Instead of using previously prepared hypochlorite, the dyestuff, which has been treated with sulphuric acid, may be suspended in a solution of common salt and the solution electrolysed.—H. P. P.

Vat dyestuffs; Production of red ——. Badische Anilin und Soda Fabrik. Fourth Addition, dated May 2, 1909. (Under Int Conv., Mar. 11, and April 28, 1909) to Fr. Pat. 365,920, May 4, 1908 (this J., 1906, 979; 1907, 960; 1908, 1015).

New vat dyestuffs of the anthracene series are prepared by condensing halogenated ketones of the general formula, X.R.CO.R′.X, or halogenated diketones of the formula, X.R.CO.CO.R′.X, (where R and R′ signify identical or different, simple or substituted aromatic or aliphatic radicals, and X an atom of a halogen) or halogen derivatives of cyclic α-diketones such as phenanthrenequinone with aminoanthraquinones or their derivatives. The dyestuffs obtained dye cotton from the vat in various shades of red.—J. C. C.

Gallocyanine series; Production of dyestuffs of the ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated May 26, 1909, to Fr. Pat. 396,564, Nov. 20, 1908.

In the first Addition (this J., 1909, 1029) the dyestuff obtained from nitrosodiethylaniline and gallic acid was stated to dissolve in sulphuric acid with a pure red colour; the colour is, however, distinctly violet.—J. C. C.

Azo dyestuffs and process for their production. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 405,178, July 17, 1909. Under Int. Conv., Sept. 1908.

The diazo-derivative of o-sulphanilic acid or its derivatives is combined with 1-amino-8-naphthol-3 : 6-disulphonic acid in acid solution, and a diazo-compound is allowed to act on the resulting monoazo-dyestuff in alkaline solution. As an example the production of a dyestuff dyeing wool in greenish black shades is described, which consists in combining diazotised *p*-nitraniline-*o*-sulphonic acid with the acid mentioned, and acting on the product with diazobenzene.—J. C. C.

Tetrabromoindigo; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 404,430, June 17, 1909. Under Int. Conv., Aug. 1, 1908.

The preparation of tetrabromoindigo is more advantageously carried out if chlorosulphonic acid is substituted for concentrated sulphuric acid in the bromination of indigo. Example: 15 kilos. of bromine are dissolved in 50 kilos. of chlorosulphonic acid, and 5 kilos. of finely divided indigo are added gradually at the ordinary temperature. The pure blue solution is thrown on ice, and the precipitated dyestuff collected, pressed, and dried.—J. C. C.

p-Amino-m-hydroxyazo dyestuffs; Process for preparing new ——. Anilinfarben- und Extraktfabr. vorm. J. R. Geigy. Fr. Pat. 404,535, June 28, 1909. Under Int. Conv., March 26, 1909.

Aminohydroxyazo dyestuffs of the general formula, $R.N_2.C_6H_2(CH_3)(OH).NH_2$, in which R represents the radical of an aromatic sulphonic or carboxylic acid or its substituted derivative, are obtained by combining a diazotised aromatic amino-sulphonic or carboxylic acid with *m*-amino-*p*-cresol in acid or neutral solution, with or without the addition of thiosulphates, thiocyanates, or xanthates, or also by combining the diazo-compounds mentioned with the arylsulphonyl ethers of *m*-amino-*p*-cresol, and subsequently eliminating the arylsulphonyl group.—J. C. C.

o-Hydroxydisazo dyestuffs; Process for preparing chrome ——. Anilinfarben- und Extraktfabr. vorm. J. R. Geigy. Fr. Pat. 404,536, June 28, 1909. Under Int. Conv., Mar. 26, 1909.

The dyestuffs previously described (this J., 1908, 1107) can be obtained by diazotising the *p*-amino-*m*-hydroxyazodyestuffs of the type, $R.N_2.C_6H_2(CH_3)(OH).NH_2$, and combining the resulting diazo-compounds with a suitable component.—J. C. C.

Monoazo dyestuffs especially suitable for preparing lakes; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 217,277, Aug. 14, 1908.

The diazo compounds of di- or trichloro-aniline, or of mono-, di-, or trichloro-anilinesulphonic acids, are combined with 2.5- or 2.6-naphthylaminesulphonic acids or with 2.3.6- or 2.5.7-naphthylaminedisulphonic acids. These dyestuffs form lakes which are bright orange in colour, and are very fast towards light, acids, and lime. —T. F. B.

Disazo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8416, April 7, 1909.

See Fr. Pat. 403,208 of 1909; this J., 1909, 1309.—T. F. B.

Vat dyes of the anthracene series; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9219, April 19, 1909.

See Fr. Pat. 403,259 of 1909; this J., 1909, 1309.—T. F. B.

Wool dye; Red to violet ——. M. Weiler, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 947,876, Feb. 1, 1910.

See Ger. Pat. 216,305 of 1908; this J., 1909, 1309.—T. F. B.

Basic dye; Red ——. W. König, Dresden, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 947,918, Feb. 1, 1910.

See Addition of Nov. 23, 1908, to Fr. Pat. 395,793 of 1908; this J., 1909, 595.—T. F. B.

Mono-azo dyestuffs for chrome-mordanted wool; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 12,456, May 26, 1909. Addition to Eng. Pat. 6727, March 20, 1909.

See Ger. Pat. 216,812 of 1908; this J., 1910, 207.—T. F. B.

Indanthrene monosulphonic acid and process of making same. R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 948,204, Feb. 1, 1910.

See Eng. Pat. 339 of 1909; this J., 1909, 975.—T. F. B.

Halogenated indigo and process of making. P. E. Oberreit, V. Villiger, and P. Nawiasky, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 948,241, Feb. 1, 1910.

See Fr. Pat. 401,506 of 1909; this J., 1909, 1120.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Chardonnet artificial silk; Recovery of ether-alcohol in the manufacture of ——. A. Vajdafy. Vegyészeti Lapok, Budapest, 1909, 4, 103. Chem.-Zeit., 1910, 34, Rep., 75.

A method which is stated to have proved successful since 1906 in a Hungarian artificial silk factory, consists in operating the reels on which the artificial silk is wound by means of a roller on to which water is sprinkled. In this way the solvent is washed out of the wet fibres, the supply of water being so regulated that the liquid flowing off the roller contains about 14 per cent. of ether-alcohol, which is subsequently recovered by distillation.—A. S.

Silk weighted with tin; Changes in —— *due to the action of light.* G. Gianoli. Chem.-Zeit., 1910, 34, 105—106.

Earlier investigations of silk, which had been weighted with tin salt, have shown that those portions which by exposure to light had become tender, reacted with mercuric chloride. It is now shown that this reactivity is not due to the presence of stannous compounds, but rather to decomposition products of the silk, resulting from the effects of oxidation and hydrolysis upon the silk fibroïn. The decomposition products are soluble in water, and include ammonia and other nitrogenous compounds. When exposed to sunlight, in a vacuum or in an atmosphere of an indifferent gas, the fibre retains its elasticity and strength, but these are seriously affected when exposure is carried out in the presence of air or moisture.—F. M.

Wood formation; Colloid-chemical processes during —— *and the physical character of wood and of lignin.* H. Wislicenus and M. Kleinstück. Z. Chem. Ind. Kolloide, 1910, 6, 17—23, 87—94.

The authors find that when wood sap is shaken with cellulose or with fibrous alumina, constituents of the sap are adsorbed. These phenomena were studied in great detail in the case of sap from various sources and at various seasons, and it is concluded that wood substance is formed by adsorption of colloidal substances from the cambial sap by the cellulose which is first formed, and also by the deposition of membranes on its surface formed from colloidal gels. They consider that purely chemical phenomena play a subordinate part in the process. Lignin is regarded as a varying mixture of colloids adsorbed by the cellulosic framework, in a partly reversible and partly irreversible state. The spring sap appears to be a product of the partial reversal of this deposition process, and contains comparatively small amounts of dissolved colloids before the period of foliage development. On the other hand during the period of wood formation, the cambial sap contains large amounts of adsorbable colloids, which decrease in quantity in August when wood formation ceases.—E. F.

Patents.

Silk; Process for weighting —— *by means of a mixture of stannic chloride and zinc salts.* H. Salvaterra. Ger. Pat. 215,702, Jan. 8, 1908. Addition to Ger. Pat. 214,372, Sept. 20, 1907.

Instead of first treating the silk with zinc and tin salts and then with tartaric acid as in the principal patent (this J., 1909, 1194), the whole process is carried out in one operation, the weighting bath consisting of a solution of stannic chloride, zinc sulphate, tartaric acid, and hydrochloric acid.—T. F. B.

Cellulose; Manufacture of ——. E. Mortorud, Tordérød, Norway. U.S. Pat. 947,974, Feb. 1, 1910.

A cellulose digester is provided with a strainer situated some little distance above the bottom, a pipe leading from the strainer to an external pump, and a return-pipe from the pump to the top of the digester, with means for introducing steam into the circulating liquid on its way from the pump to the digester. The type of strainer described consists of an annular channel or chamber cut in the brick lining of the digester, with straining surfaces corresponding with the interior surface of the digester.—J. F. B.

Acetylcellulose; Treatment of —— *for the purpose of enhancing its elasticity and its power of absorption for dyestuffs.* J. Wetter, London. From Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 7743, March 31, 1909.

See Addition of April 5, 1909, to Fr. Pat. 383,636 of 1907; this J., 1909, 1194.—T. F. B.

Wood cellulose; Method of treating —— *for the purpose of producing artificial threads and nitrocellulose.* E. Opfermann, E. Friedemann, and Act.-Ges. f. Maschinenpapier-Fabr., Aschaffenburg, Germany. Eng. Pat. 10,604, May 4, 1909. Under Int. Conv., April 15, 1909.

See Fr. Pat. 402,462 of 1909; this J., 1909, 1270.—T. F. B.

Barrel bodies from paper pulp; Apparatus for making ——. W. H. Decker, Syracuse, U.S.A. Eng. Pat. 15,269, June 30, 1909.

See U.S. Pat. 928,248 of 1909; this J., 1909, 958.—T. F. B.

Disintegrating silica direct from natural silica and silicates. [*Preparation of size.*] Eng. Pat. 1735. *See* VII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Wool; Dyeing of ——. M. Saget. Monit. Scient., 1910, 24, 80—87.

The author supports the theory that wool contains amino, imino, and carboxyl groups, this constitution being required to explain why wool mordanted with tannate of tin loses its affinity for acid dyestuffs. This loss of affinity occurs also when hydroxyl and carboxyl groups are introduced by the dyestuffs, etc., used in producing a reserving effect.—B. N.

Dyestuffs of the "Mikado" class; The printing of ——. A. Liebmann. Sealed Note No. 991, July 15, 1897. Bull. Soc. Ind. Mulhouse, 1909, **79**, 399.

Prints obtained with Mikado dyestuffs by the usual methods of application are not fast to washing, but the drawback is said to be overcome by producing the colour by development upon the fibre. This may be done by printing with *p*-nitro-*o*-toluenesulphonic acid (or its sodium salt) together with caustic soda, and steaming, or the sulphonate may be printed alone, and the goods passed through a hot solution of caustic soda, soured off, rinsed, and dried.—F. M.

Patents.

Printing plates; Process for preparing ——. H. Strecker-Aufermann, Munich, Germany. Eng. Pat. 3699, Feb. 15, 1909.

In the process of preparing grained printing plates for monochrome and polychrome printing by etching with ferric chloride through a chromated fish-glue coating, a solution of gum arabic is incorporated in the chromated fish-glue coating. Whether the etching be done by ferric chloride or by the process described in Eng. Pat. 28,319 of 1906 (see Fr. Pat. 372,291; this J., 1907, 536), the gum arabic causes the coating to resist the etching action until the operation is finished. The gum arabic may be treated with a tanning agent or replaced by other substances, such as resin, which resist the etching. H. P. P.

Calico printing; Production of certain effects in ——. The Calico Printers' Association, Ltd., Manchester, and F. Ashton, Hyde, Cheshire. Eng. Pat. 7538, Mar. 30, 1909.

So-called "bleeding" effects are produced by printing the fabric with a mixture of an alkaline metallic mordant, such as sodium aluminate, and a printing colour prepared with sulphide or vat dyestuffs. The printed fabric is steamed, treated with an acid to cause the aluminium compound to spread beyond the confines of the pattern, then "dunged" immediately and dyed. Instead of the acid treatment a very moist steaming may be given in order partially to spread both the mordant and a weak shade of the colour and at the same time to fix both the mordant and the dye where originally printed.—H. P. P.

Inflammability of textile fabrics; Means for reducing the ——. J. Rylance, Cheadle Hulme. Eng. Pat. 28,056, Dec. 24, 1908.

The goods are impregnated with a solution containing ammonium, aluminium, and manganese sulphates, then squeezed, and dried.—F. M.

Paper and other substances; Decorative treatment of ——. H. C. Mitchell, London. U.S. Pat. 947,973, Feb. 1, 1910.

The process for the decorative treatment of paper and other substances consists in applying colour upon a surface, *e.g.*, of a roller, moving this surface in a bath of liquid or applying liquid thereto in any manner for the purpose of spreading the colour, and then transferring the colour by impression from the prepared surface to the paper or other substance to be decorated.—J. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid; Photochemistry of ——. A. Coehn and H. Becker. Z. physik. Chem., 1910, 70, 88—115.

The authors have studied the formation of sulphur trioxide from sulphur dioxide and oxygen under the influence of the radiation from a quartz mercury lamp. Experiments made with a quartz reaction vessel mounted within a mercury lamp showed that the formation of sulphur trioxide proceeds fairly rapidly even at the ordinary temperature and more rapidly at higher temperatures. The equilibrium is quite distinct from that attained in daylight. With the mixture, $2SO_2 : O_2$, equilibrium is attained with a production of 65 per cent. of sulphur trioxide, and this equilibrium can also be attained starting from sulphur trioxide. At 160° C., with the gases confined in the reaction chamber, equilibrium was attained in 1 hour. In daylight at temperatures below 450°C. the equilibrium condition corresponds to practically 100 per cent. of sulphur trioxide. Again the light-equilibrium (attained on exposure to the radiation from the mercury lamp) is not displaced by rise of temperature up to 800° C., whereas the temperature- or dark-equilibrium (in daylight) is displaced considerably by rise of temperature above 450° C. With a mixture in the proportions, $SO_2 : O_2 = 1 : 13$, for example, at 800° C., the yield of sulphur trioxide is 80 per cent. on exposure to the rays from the mercury lamp, whereas in daylight, the yield is 44 per cent. of sulphur trioxide. The temperature-coefficient of the velocity of the photochemical reaction was found to be 1·2. The authors consider that a technical photochemical process for the production of sulphuric acid is quite feasible, since on using air in place of oxygen, no oxides of nitrogen are formed. Some experiments were made with a special

mercury lamp composed essentially of a quartz tube, 115 cm. long and 1·8 cm. diam. This was enclosed in a tube of opaque. English quartz, 100 cm. long and 5 cm. diam., the annular space between the two serving as reaction-chamber. At 450° C. and with the gaseous mixture passing at the rate of 100–150 c.c. per minute, yields of 67·4, 70·8, 92. and 90 per cent. respectively of sulphur trioxide were obtained, with 0·78, 0·66, 8·7, and 9·3 mols. of oxygen per mol. of sulphur dioxide.
—A. S.

Electrolytic chlorine; Utilisation of —— in the simultaneous production of hydrochloric and sulphuric acids. A. Coppadoro. Gazz. Chim. Ital., 1909, **39**, II, 616—642.

Since the production of bleaching powder is now more than sufficient to supply the demand, the problem of utilising the chlorine obtained in the electrolytic manufacture of soda urgently awaits solution. The process of Askenasy and Mugdan (Eng. Pat. 14,342 of 1903; this J., 1903, 1085) for the production of sulphuric and hydrochloric acids by the interaction of chlorine, sulphur dioxide, and water, gives satisfactory results in practice, and in order to determine the most suitable conditions for working this process, the author has studied the solubility of gaseous hydrochloric acid in mixtures of water and sulphuric acid at different temperatures. The following table gives the results in a condensed form:—

At 17° C.			At 40° C.			At 70° C.		
	In 100 grms. of solution.			In 100 grms. of solution.			In 100 grms. of solution.	
Sp. gr.	HCl	H_2SO_4	Sp. gr.	HCl	H_2SO_4	Sp. gr.	HCl	H_2SO_4
	grms.	grms.		grms.	grms.		grms.	grms.
1·211	42·7	—	1·185	35·6	3·56	1·145	32·7	1·61
1·220	39·9	1·86	1·191	34·8	5·86	1·150	31·1	3·38
1·220	39·2	4·75	1·210	32·4	8·90	1·160	30·5	4·80
1·235	36·9	8·04	1·255	27·6	16·8	1·180	28·9	7·93
1·260	33·2	12·8	1·255	25·9	18·8	1·225	22·8	18·9
1·305	28·5	20·9	1·340	18·5	28·6	1·230	22·3	20·0
1·355	22·6	30·8	1·400	11·5	44·2	1·315	13·2	36·2
1·430	15·0	44·6	1·520	3·35	61·1	1·380	6·99	48·0
1·545	6·26	59·4	1·575	1·17	66·4	1·510	1·56	62·7
1·580	3·25	65·4	1·650	0·17	73·2	1·560	0·54	67·6
1·660	0·62	73·7	1·725	0·081	79·4	1·700	0·05	80·7
1·735	0·11	77·5	1·755	0·032	81·4	1·745	0·035	83·0
1·815	0·068	89·0	1·770	0·029	83·5	1·745	0·032	83·4

Hence at the ordinary temperature, 60 per cent. sulphuric acid can contain not more than 6 per cent. of hydrochloric acid, whilst 80 per cent. acid can only contain about 0·1 per cent.; and at 70° C. the possible amounts of hydrochloric acid in sulphuric acid of these two strengths, are about 1·5 and 0·5 per cent. respectively. In practice it is necesssary to obtain sulphuric acid of a concentration at least equal to that of chamber acid (50° to 55° B.=62·5 to 69·9 per cent.). In working the process to obtain an acid as nearly as possible of 70 per cent. strength, the temperature within the apparatus should, if possible, exceed 70° C. The reaction between the chlorine, sulphur dioxide, and water, develops a considerable amount of heat—

$$SO_2\,(gas)+Cl_2\,(gas)+Aq=H_2SO_4,Aq+2HCl,Aq+816\ cals.$$

In an experiment on a small scale, in which two currents of equal volumes of chlorine and sulphur dioxide were passed into water at the rate of 200 c.c. of the mixed gases per 100 c.c. of water per minute. the temperature reached 95° C., but gradually diminished as the reaction became slower, and eventually, after some days, a solution of sp. gr. 1·570 at 17° C. was obtained. This solution contained 3·69 per cent. of hydrochloric acid and 63·2 per cent. of sulphuric acid. In a corresponding experiment the gases were first saturated at 80° C. with steam in the necessary proportion for the reaction, and were then passed into a large globe. The sulphuric acid formed at the bottom had the sp. gr. 1·52. The gases leaving the globe passed through a tower containing glass through which trickled concentrated hydrochloric acid, and then through a second tower through which water descended. The liquid accumulated at the bottom of the latter had a sp. gr. of 1·165 and contained 31·6 per cent. of hydrochloric acid, and 0·84 per cent. of sulphuric acid. The object of using strong hydrochloric acid in the first tower was to prevent the evaporation of water, otherwise caused by the heat of reaction. In the most successful experiments on a small scale, the proportion of hydrochloric acid in the sulphuric acid was only 0·6 per cent., and in industrial practice would have been much smaller, since, in addition to the heat of reaction, inert gases (oxygen and nitrogen derived from the pyrites) would also help to eliminate the hydrochloric acid. Hydrochloric acid is also a common impurity in sulphuric acid from the leaden chambers. Thus the following proportions of hydrochloric acid were found in the sulphuric acid made at Ravenna:—Acid from the first chamber. (51·2° B.), 0·005 per cent.; acid from the second chamber (46·4° B.), 0·25 per cent.; and acid from the third chamber (42° B.), 0·65 per cent. The hydrochloric acid obtained in the process described above had a strength of 31·6 per cent. and contained 0·84 per cent. of sulphuric acid, whilst in another experiment the liquid contained 26·6 per cent. of hydrochloric acid and 0·28 per cent. of sulphuric acid. In a third experiment the hydrochloric acid contained 0·27 per cent. of free chlorine, due to a relative excess of that gas having been introduced. As regards the economic value of the process, the cost of 100 kilos. of electrolytic chlorine is estimated at about 6·20 lire (49s. 8d. per ton) and that of the sulphur from the pyrites at about 6 lire per 100 kilos. (48s. 1d. per ton). Since 100 kilos. (220·5 lb.) of chlorine and 45 kilos. (99·2 lb.) of sulphur yield 285 kilos. (628·4 lb.) of hydrochloric acid (21° B.), which can be sold for about 15·67 lire (12s. 4d.), and 199 kilos. (438·8 lb.) of sulphuric acid (52° B.), worth 6·57 lire (5s. 2d.), there is a good margin for working expenses and profit. The cost of erecting and working the plant is certainly not greater than the corresponding expenses for separate acid plants, and the suppression of the fuel ordinarily required for the manufacture of hydrochloric acid is an advantage for the new process.—C. A. M.

Soda deposits at Lake Magadi, Central Africa. Oil, Paint, and Drug Rep., Jan. 31, 1910. (See also this J., 1910, 210). [T.R.]

F. Shelford, an English engineer, has discovered large deposits of soda at Lake Magadi, which is the terminal point of the projected railroad of the Uganda Railway, Central Africa. It is generally thought that the deposits are of commercial value, for the East African Syndicate has already granted a concession to M. Samuel and Co. to work the beds. Mr. Shelford describes the lake as follows:—"From the surrounding mountains the lake, which is ten miles long by two or three miles in breadth, looks like an ordinary sheet of water of somewhat reddish hue. On reaching the shores, however, we found that the water was only a few inches deep, and covered a hard surface looking exactly like pink marble. There is an immense deposit of soda, which was bored and found to extend to a considerable depth, thus indicating an area of at least twenty square miles of solid soda. The heat upon the soda lake was very great."

Potash salts: Methods of analysis of the ——. H. Roemer. Chem. News, 1910, **101**, 54—58.

For the estimation of potash, Fresenius's platinic chloride and Wense's and Caspari's perchloric acid methods are in general use in the potash industry. These two methods, here described, were adopted and accepted as international forms by the International Congress of Applied Chemistry at Berlin, 1903. Besides these international methods the zinc-dust method introduced by Feit and Bokemüller, is still much approved of by a few potash works. This method, which does not necessitate the precipitation of sulphuric acid in the analysis of salts containing a sulphate, has been described in detail by Bokemüller.

Special weights.—According to stipulations made by Precht, it is now the practice in both methods to weigh out such quantities of the substances that 1 mgrm. of the weighed precipitate gives 0·1 per cent. of potassium chloride or of potassium sulphate.

These quantities are:—

(1) *For per cent.* KCl.

By platinic chloride—(*a*) 7·640 grms. (25×0·3056=25×2KCl : K_2PtCl_6), or 30·56 grms.

By perchloric acid—(*b*) 13·4525 grms. (25×0·5381=25×2KCl : $2KClO_4$).

(2) *For per cent.* K_2SO_4.

By platinic chloride—(*a*) 8·9275 grms. (25×0·3571=25K_2SO_4 : K_2PtCl_6), or 35·71 grms.

By perchloric acid—(*b*) 15·7218 grms. (25×0·3571=25K_2SO_4 : $2KClO_4$).

Atomic weight of platinum.—The old figure of Berzelius, Pt = 197·2, is the established atomic weight of platinum and factor used in the platinic chloride method, because this figure takes into consideration the fact that the potassium platinic chloride precipitate does not exactly correspond to the formula, K_2PtCl_6, but, according to Dittmar and Arthur, contains less chlorine, and in addition hydrogen and oxygen, which will not go off in the form of water at 160° C. As demonstrated by the classical research of Fresenius, the results obtained by the use of the more exact Seubert atomic weight, Pt=195·0, are too high.

Alcohol.—For washing the potassium platinic chloride precipitate, alcohol of at least 96 per cent. strength should be employed, although in a few methods, as, for example, those used by Müller and Morozwicz, 80 per cent. alcohol is recommended. According to Tietjens the seemingly more correct analyses with 80 per cent. alcohol depend on an equalising of errors; that is, the result which would be given by the traces of impurities left behind by the weaker alcohol is balanced by the result which would be given by traces of the potassium platinic chloride being dissolved by the water in the 80 per cent. alcohol. As found by Precht, one part of potassium platinic chloride at the ordinary temperature is soluble in 37,000 parts of 96 (by weight) per cent. alcohol; on the other hand, one part is soluble in 26,000 parts of 80 per cent. alcohol. Besides, the solubility of the compound calcium and magnesium salts is as great in 96 per cent. alcohol, and that of the sodium salts is essentially greater than in 80 per cent. alcohol. As other experimenters have also offered numerous opinions in favour of 96 per cent. alcohol, its use is strongly recommended. At all events, much importance is to be attached to an absolutely clear platinic chloride solution.

Platinic chloride solution.—The separation of the platinum from the precipitates and the alcohol washings is carried out as follows:—The collected filters are boiled several times with water in order to free them from every trace of their former contents. The solution thus obtained, along with the alcoholic washings, are then poured into a porcelain basin of about 50 cm. diameter and heated on a water-bath, zinc or soda being added for reducing purposes. In the latter case, sodium carbonate or bicarbonate will be added to the boiling liquid, and heating must be continued until the liquid covering the dark deposit of metallic platinum is clear or only faintly yellow. After the liquid has been decanted off, the deposit is boiled with water in order to remove sodium sulphate. If the sodium sulphate is not fully removed by washing with water, on the subsequent treatment with hydrochloric acid, it will react with the barium compounds present to form barium sulphate, which is very slightly soluble in hydrochloric acid. The reduced platinum is washed several times by decantation with hydrochloric acid and water, the liquid being decanted off until it is thoroughly clean: the residue is finally evaporated to dryness on the water-bath, and ignited to remove any organic matter. The finely divided platinum is then placed in a larger porcelain basin, and boiled with concentrated nitric acid, and after the latter is poured off, it is dissolved on the water-bath, pure concentrated hydrochloric acid to the amount of four times the weight of platinium being first added, the mixture heated on water-bath, and at the same time warm nitric acid gradually added (1 of nitric to 4 of hydrochloric acid). When the platinum is wholly dissolved, the solution is concentrated by evaporation until a drop taken on a glass stirring rod crystallises immediately. During the evaporation of the liquid, water and hydrochloric acid have to be added alternately for the removal of nitrous compounds, while the conversion of platinous chloride into platinic must take place in fuming hydrochloric and very little nitric acid. On cooling, the mass assumes a crystalline form ($H_2PtCl_6,6H_2O$), and this is taken up with water; the platinic chloride solution after filtration is diluted until 10 c.c. of the solution contain 1 grm. of platinum. It is advisable to remove such impurities as platinous chloride and nitrous compounds before proceeding with the making up of the solution. This is done by adding a chemically pure 10 to 20 per cent. solution of hydrogen peroxide, and when this is well shaken, it will in a very short time take on the characteristic clear colour. By making use of scrap platinum from the laboratory, traces of iridium may be present; these can be removed by precipitation with ammonium chloride and subsequent reduction. To test the purity of the platinic chloride solution, 7·640 grms. of dry pure potassium chloride are dissolved along with 1·2 grms. of sodium chloride in 500 c.c. of water. If the result shows the theoretical value of 100 the solution is quite pure. (NOTE.—For further treatment see under muriate of potash. An addition of sodium chloride is advisable, because, without the same, impurities in the form of traces of sulphuric acid are overlooked in this test.)

Perchloric acid.—The acid used in the perchloric method with a specific gravity of 1·125=19·57 per cent. $HClO_4$ can be had commercially. It should not give a reaction with barium chloride ($BaSiF_6$); 10 c.c. of the acid should mix with 10 c.c. of 96 per cent. alcohol without causing turbidity.

Filters.—The most serviceable filter for both the platinic chloride and perchloric acid methods for the estimation of potash is the Swedish filter-paper (Munktell) 1 F (9 cm.). It is advisable to hold the filter-paper before the lamplight before use to see that there are no small holes in it. As many otherwise excellent filter-papers on being treated with 96 per cent. alcohol give a gain in weight often amounting to a few mgrms., the filter-paper before drying and weighing should be moistened with 96 per cent. alcohol. When dry, the filter-paper should be weighed between two watch-glasses. The Gooch and Neubauer crucibles are not largely used in the potash industry.

Preparation of the sample.—After the sample of the material of which the analysis is desired, has been well mixed and spread out on a table, small quantities from the spread out mixture are taken and well ground in a mortar until the whole of the sample passes through a sieve with a 1 mm. mesh; pieces which are difficult to grind should on no account be laid aside. This material, filled into a bottle, is now ready to be analysed.

I. MURIATE OF POTASH.

(*a*) *Estimation of potash by the platinic chloride method.*—7·640 grms. of the substance are dissolved in 500 c.c. of distilled water. In the case of salts containing more than 0·5 per cent. of sulphuric anhydride, it is advisable to convert the sulphate into chloride beforehand. 20 c.c. (=0·3056 grm.) of the solution, that is, of the filtrate, are measured into a shallow porcelain basin of about 10 cm. diameter, and after adding 5 to 6 c.c. of the platinic chloride, the solution is evaporated on the water-bath, being at the same time frequently agitated by giving the basin a gentle rotatory movement with the hand. The evaporation can be carried on until dryness, as besides potassium platinic chloride, sodium platinic chloride is the chief salt present, which is more soluble in alcohol in a dry condition than when water is present. The dry residue is now moistened with a few drops of alcohol, and thoroughly disintegrated by rubbing with a glass rod. To this are added 20 c.c. of 96 per cent. alcohol, the contents of the basin being at the same time well stirred. The alcohol is then decanted off into a filter which has been heated at 120° to 130° C. and weighed warm until a constant weight has been reached (which takes about an hour), while care must be taken not to let the first of the decanted liquid touch the edge of the filter. Washing with alcohol is continued until the alcohol passing through the filter is quite colourless, and the residue of a golden-yellow colour containing no orange flecks. It is very advisable to finally wash once or twice with hot alcohol at about 75° C. The precipitate can now be transferred to the filter, where it is washed with warm alcohol. Filtering can be hastened by the use of a moderately strong suction apparatus. When the filter is freed as far as possible of alcohol, it is folded, dried at 120° to 130° C., and weighed warm until constant weighings are found. 1 mgrm. of potassium platinic chloride then corresponds to 0·1 per cent. of potassium chloride.

(*b*) *Perchloric acid.*—13·4525 grms. of the substance, to which 3 to 4 c.c. of a $N/1$ solution of barium chloride containing hydrochloric acid are added, are dissolved in 500 c.c. of water: 20 c.c. of the solution contain 0·5381 grm. of the salt. If the salt contains more than 1 per cent. of sulphuric anhydride it is advantageous to precipitate this at boiling-point. 20 c.c. of the solution with 5 to 6 c.c. of perchloric acid are evaporated in a glass or blue enamelled porcelain basin until the odour of hydrochloric acid has disappeared and fumes of perchloric acid begin to form. The residue is allowed to cool, and then about 20 c.c. of 96 per cent. alcohol are added, which contains about 0·2 per cent. by weight of perchloric acid (= sp. gr. 1·125). The residue is thoroughly disintegrated, and washed several times with alcohol, which is decanted into a filter, treated in the same manner as before. Finally, the precipitate and filter are washed with pure alcohol; as little as possible being used. This is done to remove the perchloric acid, which would otherwise blacken the filter. The filter is then dried (120° to 130° C.), and weighed. 1 mgrm. of potassium perchlorate corresponds to 0·1 per cent. of potassium chloride.

Determination of sodium chloride (by TIETJENS).—12·5 grms. of muriate of potash are added to 25 c.c. of a solution of potassium carbonate (3·6 grms. to the litre)* in a 255 c.c. flask and boiled, and while the solution is kept in motion, absolute alcohol is added to the same. The flask is then cooled, filled up to the 255 c.c. mark, and well shaken for about a minute. To 100 c.c. (=5 grms. of the salt) of the filtered solution in a weighed platinum basin, a few drops of strong hydrochloric acid are added and evaporated to dryness. The residue is ignited and weighed. In this mixture either the potassium chloride can be estimated by the platinic chloride or perchloric acid method, and by taking the difference the amount of sodium chloride can be found, or the amount of chlorine can be determined by titrating with $N/10$ silver nitrate solution, and from this the sodium chloride can be calculated as follows:—The chlorine contained is multiplied by $KCl : Cl = 2{\cdot}10266$ (log.=32277), and from this result the weight of the alkali chloride is deducted. The remainder is now multiplied by $NaCl : (KClNaCl) = 3{\cdot}6310$ (log. 56003); thus the weight of sodium chloride is found.

(c) *Determination of magnesium chloride* (by PRECHT).—1.25 grms. of muriate of potash are put in a 500 c.c. flask containing about 300 c.c. of water and dissolved. To this 10 c.c. of $2N$ caustic potash or soda are added. The solution is then brought up to 500 c.c. and filtered. 50 c.c. of the filtrate are measured out, and with phenolphthalein as an indicator are titrated with $N/10$ hydrochloric acid. The number of c.c. of acid required are subtracted from the ten times increased factor of the caustic (with exactly $2N$ caustic = 20·0); the remainder, now $N/10$ caustic, is multiplied by $4MgCl_2$. $2000 = 0{\cdot}1905$ (in round numbers 0·2). This gives the per cent. of magnesium chloride contained. The presence of calcium compounds in the solution does not affect the result.

2.25 grms. of muriate of potash are dissolved in 160 c.c. of water in a 250 c.c. flask. To this are added 25 c.c. of a $N/10$ solution of calcium sucrate, and after the flask has been well shaken, it is filled up to the 250 c.c. mark. In a short time the voluminous precipitate of magnesium hydroxide can be filtered off, when 50 c.c. of the filtrate are taken, and with phenolphthalein as an indicator are titrated back with $N/10$ hydrochloric acid. The calculation is made in the same way as in case 1. The calcium saccharate solution is prepared in the following way:—450 grms. of quicklime and 450 grms. of sugar are dissolved in 7 litres of water, and well shaken for half-an-hour. After the precipitate has thoroughly settled, which takes from two to three weeks, the solution is filtered, 450 grms. of sugar being added to the filtrate. The solution should be kept in an air-tight bottle.

(*d*) *Determination of sulphuric acid in* 98 *per cent. muriate of potash.*—50 grms. of muriate of potash are dissolved in 500 c.c. of water. To 200 c.c. (20 grms. of the salt) of the filtrate, 1 c.c. of concentrated hydrochloric acid is added, and the solution boiled with an excess of barium chloride. In a few hours the precipitate is filtered through a Gooch crucible filter and washed with hot water, being afterwards ignited and weighed. Besides the gravimetric method a few works recommend Andrew's method, which, as it can be carried out more rapidly, is here described:—50 grms. of the salt are added along with 4 c.c. of concentrated hydrochloric acid to 150 c.c. of hot water in a 200 c.c. flask. To this are added 10 c.c. (for every 0·4 per cent. of sulphuric anhydride which the salt contains) of a $N/2$ solution of barium chloride (61 grms. to the litre), and the solution is then boiled. The same number of c.c. of a corresponding solution of potassium bichromate are now added ($K_2Cr_2O_7 : 8 = 36{\cdot}9$ grms. to the litre), and neutralised with a few drops of caustic alkali or ammonia.* The solution is again gently boiled, then cooled and brought up to 200 c.c., shaken, and filtered to remove the barium sulphate and chromate. 100 c.c. of the filtrate (which now contains an equivalent amount of chromate in place of sulphate) are acidulated with a few drops of concentrated sulphuric acid, and titrated with a solution of ferrous-ammonium sulphate,† $6\,[(NH_4)_2SO_4,FeSO_4,6H_2O] : 80 = 29{\cdot}4$ grms. and a few c.c. of concentrated sulphuric acid to the litre, with potassium ferricyanide‡ as indicator (Turnbull's blue reaction). 1 c.c. of ferrous-ammonium sulphate solution corresponds to 0·002 grm. or 0·008 per cent. of sulphuric anhydride. Titration can also be carried out with potassium iodide and an added solution of sodium thiosulphate. Proceeding from the above given amounts, the potassium bichromate solution is exactly ten times as strong as the ferrous-ammonium sulphate. It is advisable to test the strength of the solutions before making use of them. In these tests one should begin with the former, which should consist of a pure well-dried salt, and in this way and by the help of the Tuppel method, the strength of the ferrous-ammonium sulphate is determined.

(*e*) *Determination of water.*—10 grms. of the salt are placed in a covered platinum crucible and heated over a small flame at a dull red heat for from ten to twenty minutes. The water contained is found by calculating the difference in weight before and after heating. In the case of salts rich in magnesium chloride, the breaking up of the magnesium chloride due to heating is prevented by covering the salt in the crucible with well burnt lime or lead oxide.

II. SULPHATE OF POTASH AND SULPHATE OF POTASH AND MAGNESIA.

Determination of potash. — 1. *As potassium platinic chloride.*—8.9275 grms. of the salt are dissolved by boiling in a 500 c.c. flask in 300 c.c. of water, to which 20 c.c. of concentrated hydrochloric acid have been added. The sulphuric acid is precipitated by adding barium chloride§ drop from a pipette or burette to the boiling solution. To test if the sulphate is all precipitated, add a grain of barium chloride to the solution; if no turbidity results all the sulphate has fallen out. Any excess of barium chloride can be removed by adding a few drops of normal sulphuric acid, otherwise the decomposition of barium platinic chloride through the alcohol will easily cause a higher result. A small excess of sulphuric acid makes little or no difference; only the solution with platinum chloride must not be evaporated beyond a syrupy consistency, otherwise the sulphuric acid, due to concentration, will break up the platinum salt. After precipitation of the sulphate and cooling, the liquid is brought up to 500 c.c., and 20 c.c. (=0·3571 grm. of the salt) of the filtrate are treated with 5 to 6 c.c. of the platinic chloride solution, and further dealt with as before. 1 mgrm. of potassium platinic chloride corresponds to 0·1 per cent. of potassium sulphate. To the amount of potassium sulphate found must be added 0·3 per cent., as the amount of potassium sulphate taken down with the barium sulphate precipitates is not wholly compensated for by the lessened volume of the solution through the presence of the bulky precipitate. In the case of sulphate of potash and magnesia no correction is necessary.

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* In order to precipitate the magnesia and calcium compounds; a greater addition is to be avoided, as the dissolved sodium chloride separates out again very easily.

* $K_2SO_4 + (2BaCl_2 + K_2Cr_2O_7) + 2KOH = BaSO_4 + BaCrO_4 + K_2CrO_4 + 4KCl + H_2O$; thus $1SO_4$ or SO_3 will be given as $1CrO_4$.

† $2K_2CrO_4 + 6FeSO_4 + 10H_2SO_4 = 4KHSO_4 + Cr_2(SO_4)_3 + 3Fe_2(SO_4)_3 + 8H_2O$; 1 Fe gives one-third CrO_4 or $\frac{1}{3}SO_3$. The ferrous ammonium sulphate solution is liable to change; therefore should only be made in quantities of a litre at a time, and kept in a dark bottle.

‡ The potassium ferricyanide used must be quite free from potassium ferrocyanide.

§ 50 c.c. concentrated hydrochloric acid to the litre. Barium chloride often contains salts of potash, therefore should be frequently tested.

2. *As potassium perchlorate.*—15·7218 grms. of the salt are dissolved in about 700 c.c. of water in a litre flask, to which 30 c.c. of hydrochloric acid are added. The further treatment is the same as in the first case, with the difference that a smaller excess of barium chloride can be used, and instead of 20 c.c., 40 c.c. (0·6887 grm. of the salt) of the filtrate are evaporated with 5 to 6 c.c. of perchloric acid. 1 mgrm. of potassium perchlorate corresponds to 0·1 per cent. of potassium sulphate. 0·3 per cent. of potassium sulphate must be added to the estimated result.

III. POTASH MANURE SALTS* AND CRUDE POTASH SALTS.

1. *Determination of potash.*—(*a*) *By potassium platinic chloride.*—According as the precipitated potassium platinic chloride is to represent potassium chloride or potassium sulphate, 30·56 grms. or 35·71 grms. of the salt are dissolved by boiling with water, to which 10 c.c. of hydrochloric acid have been added, in a 500 c.c. flask. After cooling, the solution is brought up to 500 c.c. 50 c.c. of the filtrate are treated with barium chloride in a 200 c.c. flask as in the case of sulphate of potash. To 20 c.c. (=0·3056 grm. or 0·3571 grm. of the salt) of the solution, from which the sulphate has been removed, are added 5 to 6 c.c. of platinic chloride solution. This is evaporated until a syrupy consistency is reached, and analysis continued as before. If the sample is so finely ground that everything passes through a sieve of ½ mm. mesh, it will be sufficient to weigh out 7·640 grms. or 8.9275 grms. of the salt.

(*b*) *By potassium perchlorate.*—In using perchloric acid, barium chloride is added to a 500 c.c. solution of 13·4525 grms., or 15·7218 grms. of the salt, and 20 c.c. (=0·5381 grm. or 0·62887 grm. of the salt) are treated in the usual way with the necessary amount of perchloric acid.

2. *Determination of total magnesia.*—10 grms. of the crude potash salt or kieserite are boiled for not less than an hour in 300 c.c. of water. After cooling, 50 to 60 c.c. of *N*/2 caustic potash, and in the case of salts rich in calcium, 20 c.c. of a solution (1 : 10) of normal potassium oxalate, are added to the solution, which is then brought up to 500 c.c., well shaken, and filtered after being allowed to stand for a quarter of an hour. 50 c.c. are then titrated with *N*/10 acid. The factor of caustic increased ten times (by exactly double normal, that is 20.0) is multiplied by five or six, according to whether 50 or 60 c.c. of the caustic were used. The number of c.c. of acid used is subtracted from the above-mentioned result, and the remainder is multiplied by $MgSO_4 : 200 = 0{\cdot}602$ (roughly 0·6). As the separated magnesium hydroxide is not quite insoluble, 0·2 per cent. has to be added to the result.

3. *Determination of magnesium chloride.*—10 grms. of the finely ground crude salt are placed in a stoppered bottle of 250 c.c. capacity along with 100 c.c. 96 per cent. alcohol, and well shaken for ten minutes. The solution is filtered, and 10 or 20 c.c. of the filtrate are titrated with *N*/10 silver nitrate solution. The salts, which contain over 6 per cent of chlorine, soluble in alcohol, corresponding to 8·06 per cent. of magnesium chloride are assigned to group V. (carnallite salts), those with 6 per cent. and under to group IV. (crude salts which are not carnallite, trade name kainite—hard salt). This is, of course, only a conventional method. Owing to the extraction of magnesium chloride and the water contained in the salts, the volume of alcohol will be increased. It is necessary in exact carnallite analyses to wash the residue in the filter well with alcohol, and bring the solution up to 500 c.c. by adding water, and then by taking a certain volume (about 50 c.c.) to estimate the per cent. of magnesia.

4. *Determination of lime.*—Excess of ammonium chloride is added to the solution, and the lime is precipitated as calcium oxalate, and either weighed as calcium oxide or the calcium oxalate precipitate can be carefully dissolved in dilute sulphuric acid and titrated with potassium permanganate.

5. *Determination of sodium.*—A solution (25 grms. of salt in 100 c.c. of water) is made with boiling water; this is filtered, and after the residue is well washed, the filtrate is brought up to 500 c.c. 200 c.c. (=10 grms. of the salt) of the filtrate are acidulated by adding hydrochloric acid, and after heating, treated with barium chloride in a 500 c.c. flask until the sulphuric acid has been quite removed, but without adding excess of barium chloride. The liquid is brought up to 500 c.c., and 50 c.c. of the solution (=1 grm. of the substance) are evaporated to dryness in order to remove the hydrochloric acid. The magnesium chloride is then removed by treating with oxalic acid and igniting, and the residue is moistened with ammonium carbonate in order to transform the calcium chloride which has been formed into calcium carbonate. The alkali chlorides, which are now freed from magnesia and lime, are weighed, and in the usual manner the potassium chloride is estimated with platinic chloride or perchloric acid. The amount of sodium chloride is calculated by subtracting the amount of potassium chloride from the total weight of alkali chlorides: the result has then to be calculated into the different sodium salts.

Determination of sulphate.—Besides the gravimetric method the following volumetric method by Wildenstein is practised by a few works, and is said to be a much quicker method. 5 grms. of the salt are dissolved in a flask and the solution heated to boiling-point. Neutral *N*/1 barium chloride is then added gradually from a burette to slight excess. (The point at which all the sulphuric acid has separated out can be fairly easily recognised by watching the steam bubbles, which when a sufficient amount of barium chloride has been added become opaque). The slight excess of barium chloride is now removed by titrating with a neutral *N*/2 solution of potassium chromate. This solution is added until the liquid assumes a yellow colour; a single drop in excess will make this colour quite visible. The number of c.c. of barium chloride used (after subtraction of half the number of c.c. of chromate solution used) are multiplied by 0·8, and this gives the per cent. of sulphuric anhydride contained. In the application of this method it is necessary to be convinced of the absence of other acids, such as hydrofluoric, carbonic, sulphurous, thiosulphuric, silicic, boric, and phosphoric acids.

7. *Determination of chlorine.*—The per cent. of chlorine is determined in the usual way, a neutral solution being titrated with silver nitrate, with potassium chromate or sodium arseniate as an indicator.

8. *Determination of insolubles.*—10 grms. of the salt are dissolved by boiling in water and filtered through a weighed filter, which is then washed with warm water, dried at 120° to 130° C., and weighed.

9. *Determination of water.*—As in the case of muriate of potash.

Complete analysis.—25 grms. of the sample are dissolved by boiling for an hour in a beaker containing 300 c.c. of water. The solution is then filtered through a weighed filter into a 500 c.c. flask for the estimation of insoluble matter. After the filter has been washed with warm water, and the filtrate cooled, the flask is filled up to the 500 c.c. mark. 20 c.c. (= 1 grm. of the salt) are taken for both the estimation of lime and sulphuric acid: for the estimation of chlorine 20 c.c. of the solution are taken, diluted to 500 c.c., and 50 c.c. of this solution (= 0·1 grm. of the salt) are titrated. For the determination of magnesia, 200 c.c. of the solution are taken and treated with an excess of 2N caustic soda, and after dilution to 500 c.c. filtered, 50 c.c. of the filtrate (= 1 grm. of the salt) are then titrated.

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* In the case of mixed manures which contain ammonium salts and phosphates, the latter must be removed before the analysis is proceeded with.

For the estimation of potash, either a new solution can be made, or 100 c.c. of the prepared solution can be brought up to 200 c.c. After filtration, 20 c.c. (= 0·5 grm.) of the filtrate are treated with 8 to 9 c.c. of platinic chloride, and the analysis proceeded with in the usual way. The calculations for the complete analysis are reckoned in the following manner:—From the total amount of sulphuric acid, that part corresponding to the amount of lime found is deducted. After the estimation of magnesium chloride soluble in alcohol, the magnesia which is not combined with chlorine is calculated as sulphate, and the sulphate which is not combined with magnesia and lime is calculated as potassium sulphate (for instance, in the case of compositions, like those of glaserite, krugite, langbeinite, leonite, polyhalite, pehoenite, and syngenite). The remainder of the potash (from carnallite, douglasite, hard salt, kainite, and sylvinite) is given as muriate of potash, and the chlorine not combined with potassium and magnesium as sodium chloride. If the potash contained does not meet the whole of the sulphuric acid (after the corresponding amounts for lime and magnesia have been deducted), the remainder of the sulphuric acid is given as sodium sulphate, and any chlorine remaining is reckoned as sodium chloride. (The factors necessary for all calculations are given in the preceding table.) In many cases the water estimation gives an idea of the nature of the crude salts. For instance, hard salts, consisting of sylvine, rock salt, and kieserite, contain up to 5 per cent. water ($1H_2O$—$1MgO$). In kainite, which according to late discoveries has the formula $KCl.MgSO_4.3H_2O$, about 12 per cent. of water ($3H_2O$—$1MgO$) is present, and carnallite, $KCl,MgCl_2,6H_2O$, has even up to 26 per cent. of water ($6H_2O$, $1MgO$). Only it is not to be forgotten that the crude salts supplied in most cases are not chemical combinations but mixtures of different varieties of salts.

Factors for calculation.

Found.	Wanted.	Factor.	Log.
$BaSO_4$	SO_3	0·3430	53529
Cl	KCl	2·1027	32277
Cl_2	$MgCl_2$	1·3430	12805
Cl	$NaCl$	1·6486	21712
CaO	$CaSO_4$	2.4275	38516
$CaSO_4$	CaO	0·41194	61484
,,	$2H_2O$	0·26462	42263
,,	K_2SO_4	1·2800	10718
,,	Na_2SO_4	1·04340	01845
,,	SO_3	0·58806	76942
$4CaSO_4$	$MgSO_4$	0·22104	34448
KCl	Cl	0·4756	67723
,,	$3H_2O$	0·72487	86026
,,	$6H_2O$	1·4497	16129
$2KCl$	K_2O	0·6317	80051
,,	K_2SO_4	1·1687	06769
KCl	$MgCl_2$	1·2774	10631
,,	$MgSO_4$	1·6147	20808
$KClO_4$	KCl	0·5381	73087
$2KClO_4$	K_2O	0·3400	53144
,,	K_2SO_4	0·62887	79856
K_2O	$2KCl$	1·5830	19949
,,	K_2SO_4	1·8500	26718
K_2PtCl_6	$2KCl$	0·3056	48515
,,	K_2O	0·19305	28566
,,	K_2SO_4	0·35714	55284
K_2SO_4	$6H_2O$	0·62026	79257
,,	$2KCl$	0·85610	93251
,,	K_2O	0·5405	73282
,,	$2MgCl_2$	0·0930	03862
,,	$MgSO_4$	0·69081	83936
,,	$2MgSO_4$	1·3816	14039
,,	SO_3	0·45945	66224
$MgCl_2$	Cl_2	0·74465	87195
,,	$6H_2O$	1·1350	05498
,,	KCl	0·78287	89363
,,	MgO	0·42335	62670
$MgCO_3$	MgO	0·47818	67959
MgO	$MgCl_2$	2·3621	37330
,,	$MgCO_3$	2·0913	32041
,,	$MgSO_4$	2·9859	47507
$MgSO_4$	$2CaSO_4$	1310	05346
,,	$1H_2O$	0·14964	17506
,,	$2H_2O$	0·29929	47609
,,	$3H_2O$	0·44893	65218
,,	$4H_2O$	0·59858	77712
,,	$6H_2O$	0·89786	95321
,,	$7H_2O$	1·0475	02016
,,	KCl	0·61933	79192
,,	K_2SO_4	1·4475	16064
,,	MgO	0·33490	52493
,,	Na_2SO_4	1·1801	07191
,,	$3Na_2SO_4$	3·5402	54903
,,	SO_3	0·66510	82288
$Mg_2P_2O_7$	$2MgO$	0·3623	55902
$2MgSO_4$	$5H_2O$	0·37410	57300
,,	K_2SO_4	0·72380	85961
$NaCl$	Cl	0·60657	78288
$2NaCl$	Na_2O	0·5303	72450
Na_2O	$2NaCl$	1·8858	27550
,,	Na_2SO_4	2·2914	36011
Na_2SO_4	SO_3	0·56360	75097
SO_3	$CaSO_4$	1·7005	23058
,,	K_2SO_4	2·1765	33776
,,	$MgSO_4$	1·5035	17712
,,	Na_2SO_4	1·7743	24903

Ammonium chloride and potassium bichromate; The reaction between —— when heated. G. B. Frankforter, V. H. Roehrich and E. V. Manuel. J Amer. Chem. Soc., 1910, **32**, 178—184.

THE reaction taking place when ammonium chloride and potassium bichromate are heated together does not proceed according to the equation usually given, namely, $2NH_4Cl + K_2Cr_2O_7 = Cr_2O_3 + 2KCl + 4H_2O + N_2$. The gas liberated is not pure nitrogen, but contains up to 3·5 per cent. of nitrogen peroxide, and from 3·0 to 50·0 per cent. of nitric oxide. When the mixture is heated to a dull red heat, and especially in the presence of an excess of bichromate, chlorine is liberated; under certain conditions ammonia is set free. Besides chromium sesquioxide, other chromium compounds are formed, such as the dioxide, a hydrated oxide, etc.; in addition, there is formed a small amount (representing about 1 per cent.) of a substance which liberates pure nitrogen when brought into contact with water. This substance appears to be chromyl nitride. The complex nature of the reaction is due, in a very large measure, to the dissociation of the ammonium chloride.—W. P. S.

Calcium salts; Behaviour of slightly soluble —— towards aqueous solutions of ammonium salts, especially of tri-ammonium citrate. A. Rindell. Z. physik. Chem., 1910, **70**, 452—458.

THE solubility of calcium carbonate in aqueous solutions of ammonium chloride, ammonium nitrate, and tri-ammonium citrate at 25° C., is shown in the following table:—

Concentration of ammonium salt, in mgrm.-mols. per litre.	Quantity of calcium dissolved (reckoned as calcium oxide) by:—		
	Ammonium chloride.	Ammonium nitrate.	Tri-ammonium citrate.
	grm	grm.	grms.
1000	0·3799	—	—
500	0·2810	0·2950	3·745
250	0·2089	0·2145	2·229
125	0·1599	0·1556	1·268
62·5	—	0·1122	0·8355

The solubility of calcium carbonate is thus considerably increased by ammonium chloride and ammonium nitrate, and to a much greater extent by ammonium citrate. The increased solubility in the case of the citrate solution is due to the formation of complex compounds. It is evident that calcium cannot be precipitated quantitatively in presence of citrates. Further, calcium cannot be separated quantitatively either as oxalate or carbonate in the presence of other ammonium salts.—A. S.

Citric acid; Calcium salts of ——, and their hydrolytic transformations. A. Parrozzani. Staz. sperim. agrar. ital., **42**, 965—998. Chem. Zentr., 1910, **1**, 514.

Experiments were made with solutions containing 1 mol. of citric acid to ½ mol. of calcium, and of concentrations equivalent to 3·24, 6·57, 10·48, and 66·90 per cent. respectively of monocalcium citrate. From these solutions the calcium salts were separated by: (1), crystallisation; (2), precipitation with alcohol; (3), boiling the solution; and (4), precipitating the filtrate from (3). The compositions of the salts obtained are shown in the following table:—

Concentration of solution.	Salt obtained by :—			
	Method 1.	Method 2.	Method 3.	Method 4.
Per cent.				
3·24	Dicalcium citrate.	Tricalcium citrate.	Tricalcium citrate.	Tricalcium citrate.
6·57	Dicalcium citrate.	Tricalcium citrate.	Tricalcium citrate.	Tricalcium citrate.
10·48	Dicalcium citrate.	Dicalcium citrate.	Tricalcium citrate.	Tricalcium citrate.
66·90	Monocalcium citrate.	Dicalcium citrate.	Tricalcium citrate.	Tricalcium citrate.

The tendency of the mono- and di-calcium salts to suffer hydrolysis, with formation of citric acid and of the di- and tri-calcium salts respectively, increases with the temperature and the dilution of the solution.—A. S.

Sulphides of the alkaline-earths; Method of restoring the phosphorescence of ——. D. Gernez. Comptes rend., 1910, **150**, 295—300.

The phosphorescent properties of the sulphides of barium, strontium, and calcium, which have been lost by exposure to air, are revived by heating strongly in a current of dry hydrogen. The sulphide, in small pieces or powder, is placed in a refractory Bohemian glass tube, tapered at one end, and connected at the other to a large vessel containing pumice stone moistened with sulphuric acid, and thence to the gas-holder; the tube is laid on asbestos in a combustion-furnace. After the air has been expelled by the hydrogen, the tube is gradually heated up to the softening point of the glass and kept at that temperature for 15—20 minutes. The current of gas is now stopped, the narrow end of the tube sealed with the blowpipe, and the contents allowed to cool in an atmosphere of hydrogen. A series of small explosions takes place during the heating; some drops of water condense on the cool parts of the tube, and occasionally a little sulphur is deposited. After cooling, the sulphide is found to have fully regained its phosphorescent power. Heat alone only effects a slight improvement.—A. Seld.

Manganate fusion. P. Askenasy and S. Klonowski. Z. Elektrochem., 1910, **16**, 104—114.

For the electrolytic preparation of potassium permanganate in a state of purity, it is advisable to use potassium manganate free from chlorides, sulphates, or nitrates, the presence of which would impair the passivity of the iron anode (see this J., 1904, 940). For this reason the use of any of the customary oxidising agents in the fusion is detrimental, and the preparation should be made from manganese dioxide and pure potassium hydroxide alone, with a good air supply. Experiments on the dissociation pressure of manganese dioxide, gave results differing somewhat from those of Meyer and Rötgers (this J., 1908, 1017), and it was found that the change from manganese dioxide to sesquioxide is reversible. Manganese dioxide decomposes in ordinary air at about 460° C., and in pure oxygen at 500° C. (under atmospheric pressure). The investigation of the fusion was hindered by the sintering of the mass, which prevents the escape of steam and the approach of the necessary oxygen, but this was to a large extent avoided by powdering after a preliminary heating for from 3 to 5 hours at 200°—250° C. The analysis of the samples was carried out (after cooling in the absence of air) by means of oxalic acid solution, and required rapid and careful manipulation and the use of pure materials free from organic matter. The following facts are deduced from the estimations of the yields: (1). The efficiency improves as the original melt is more finely powdered, and the hydrated peroxide gives better yields than the mineral. (2). The atmosphere should be as dry as possible, and the substitution of oxygen for air is advantageous. (3). The best temperature is about 600° in air and somewhat higher in oxygen, while at 330° C. the minimum yields seem to be obtained. (4). Although the reaction continues slowly for a long time, good practical results can be obtained by heating the well powdered preliminary melt to about 550° C. for an hour or so in a suitable atmosphere. When manganese sesquioxide is used, the variation of the yield of manganate with temperature is just the same (a gradual decrease from 200° to 330° C., followed by a gradual rise up to about 600° C., and then a sudden fall) as with the peroxide. The sudden fall at 600° is due to the decomposition of the manganate, which at this temperature has a dissociation pressure of one-fifth of an atmosphere. The formation of a solid solution of manganate in manganite retards the rate of this decomposition, so that although the amount of manganate decreases rapidly from 600°, there are still appreciable quantities present even after heating to above 900° C.—W. H. P.

Carbon tetrachloride vapour; Action of —— on some minerals. P. Camboulives. Comptes rend., 1910, **150**, 221—223. (See also this J., 1909, 961, 962; 1910, 210.)

The vapour of carbon tetrachloride acts on mineral metallic oxides, transforming them into chlorides, as readily as on artificial products, provided they are sufficiently finely divided. Silica is not attacked, anhydrous silicates are attacked in inverse proportion to their silica content, while hydrated silicates are totally transformed. The separation of the volatile chlorides, and the removal of the insoluble silica from the residue, makes this process of considerable value in mineral analysis, and in the detection of oxide in non-oxide minerals (*e.g.* molybdenite).—W. H. P.

Prussian blue; Coagulation of ——. N. Pappadà. Z. Chem. Ind. Kolloide, 1910, **6**, 83—86.

A colloidal solution of Prussian blue was prepared by dissolving the precipitate obtained from ferric chloride and potassium ferrocyanide in oxalic acid, filtering, and purifying by dialysis; experiments were performed on solutions so obtained containing 0·2, 0·4, 0·5, and 2 per cent. of Prussian blue. In these solutions electrolytes cause immediate coagulation, and the amounts of various solutions which were necessary for this purpose were determined with the following results:—Solutions of undissociated organic substances do not coagulate the Prussian blue. The colloidal Prussian blue has a positive electric charge; the coagulating effect of salts with a monovalent cation increases with the atomic weight of the cation from lithium to caesium. The coagulating action of salts with mono-, di-, and trivalent cations increases with the magnitude of their electric charge. The only differences between colloidal solutions of Prussian blue and silicic acid in these respects are that coagulation is immediate in the former case and gradual in the latter, that silicic acid gelatinises whereas Prussian blue does not, and that hydrogen ions are the strongest coagulating agents for Prussian blue, whereas they promote the colloidal solution of silicic acid.—E. F.

Colloidal manganese dioxide; Formation and properties of ——. E. Deiss. Z. Chem. Ind. Kolloide, 1910, **6**, 69—77.

In general the precipitation of manganese dioxide is usually preceded by the formation of a colloidal solution of that substance. Stable solutions of colloidal manganese dioxide are easily prepared by the reduction of permanganate by suitable reagents, such as arsenious acid, in the absence of electrolytes which cause precipitation. They are also formed when manganous salts are oxidised in the presence of various organic colloids, such as albumin, but colloidal iron and aluminium hydroxides only exercise this action when very small amounts of manganese are present. If a solution of sodium arsenite, prepared by dissolving 9·9 grms. of arsenious oxide and 0·8 grm. of sodium hydroxide in water and diluting to 1 litre, is heated to 80° to 90° C., and mixed with a solution of 6·3 grms. of potassium permanganate in one litre of water, also heated to the same temperature, a colloidal solution of manganese dioxide is formed, which does not precipitate even on boiling. It is impossible to completely remove by dialysis the sodium arsenate which is formed. The solution shows the Tyndall effect and under the ultramicroscope, submicrons in rapid movement are observed. On evaporation on the water-bath a blackish-brown residue is obtained which is insoluble in water, but sometimes on evaporation *in vacuo* without heat over dehydrating agents, a dry residue is obtained which will redissolve in water. According to the author the so-called manganites are merely adsorption complexes of manganese dioxide and bases. Under suitable conditions mirrors of colloidal manganese dioxide can be obtained on glass and other surfaces. The production of colloidal manganese dioxide solutions can be made use of in the determination of manganese in the presence of iron. Colloidal iron hydroxide precipitates large quantities of colloidal manganese dioxide, although it holds smaller quantities in solution.—E. F.

Radium ; Austrian State sale of ——. Z. Allgem. oesterr. Apoth.-Ver., 1910, **48**, 71.

The sale of radium has been entrusted to the "Bergwerksproduktenverschliess-Direktion" in Vienna, under the control of the Austrian Minister for Public Works. The radium is sold in the form of radium-barium chloride of three different grades, the price for each milligram of radium chloride, including the containing cell, being 400 Kronen (£16 13s. 4d.). It is packed in cylindrical cells of 21 mm. diam. and 9 mm. long, formed of nickel-plated brass. On the bottom of the cell a layer of lead is cast, in which is a square depression for the reception of the radium-barium chloride. The cell is closed by a mica plate held in position by the screwed-on upper part of the casing. On the bottom of the casing is an official stamp (an eagle) and the series number. Radium cells sealed with lead, and stamped on the soldered part, are also supplied. The cells are packed in cotton-wool and sheet-lead in a small box, together with a certificate bearing the number of the cell, and the weight and radium-content of the preparation. The boxes are sealed with strips bearing the numbers of the cells, and are despatched by post as registered packets at the cost and risk of the purchaser.—A. S.

Carbon subnitride, C_4N_2. C. Moureu and J. C. Bongrand. Comptes rend., 1910, **150**, 225—227.

By removing two molecules of water from the diamide of acetylene dicarboxylic acid, $CONH_2{\cdot}C \equiv C{\cdot}CONH_2$, a subnitride of carbon (dicyanacetylene or carbon cyanide, $N \equiv C{\cdot}C \equiv C{\cdot}C \equiv N$) is obtained as a crystalline body, of m. pt. 21° and b. pt. 76° C., and having an odour resembling that of cyanogen. It is readily combustible and takes fire spontaneously at 130° C., burning with a purple flame. Its molecular refraction and dispersion are abnormally high, probably on account of the three triple linkages. The high vapour pressure and the phenomenon of spontaneous combustion render analysis and vapour density determinations difficult, but both have been made to agree with the formula, C_4N_2.—W. H. P.

Adsorption of dissolved substances. E. Hägglund. Z. physiol. Chem., 1910, **64**, 294—301.

From theoretical considerations it might be supposed that substances such as sodium and potassium chlorides, which increase the surface tension of water, would show negative adsorption from aqueous solution. The author finds that adsorption of such substances always takes place in a positive sense. The degree of adsorption of magnesium, potassium and sodium chlorides, and of potassium and ammonium bromides from aqueous solution by means of kaolin, charcoal, and glass wool was measured at 33·2° C. and at 37·5° C. The adsorbing materials were carefully purified and dried, and were then shaken with the solutions in a thermostat for times varying from three to five hours. The concentrations of the original solution and of the liquid drawn off after the agitation were determined by titration with silver nitrate solution.—E. F.

Production of a firmly adhering lime diaphragm on the cathode with the help of protective colloids. Müller and Buchner. *See* XI.

Volumetric determination of carbonic acid. Vesterberg. *See* XIXb.

Patents.

Barium oxide ; Manufacture of ——. C. Rollin and Hedworth Barium Co., Ltd., Newcastle-on-Tyne. Eng. Pat. 26,140, of 1909; date of Appl. Dec. 18, 1908.

Pure or practically pure amorphous anhydrous barium hydroxide, in a finely powdered condition, as, for example, that produced in accordance with Eng. Pat. 27,587 of 1908 (this J., 1910, 151), is heated to a high temperature (600°—1000° C.) with a barium compound, such as the peroxide or nitrate, which evolves gas on heating and leaves a residue of barium oxide. The mixture (for instance, 2 parts of barium peroxide to 1 part of anhydrous barium hydroxide) is heated in a muffle-furnace, or other externally heated chamber, the floor of which is preferably composed of, or covered with, barium oxide ; the hydroxide melts, and the oxygen evolved from the peroxide, which does not melt, keeps the mass in a porous condition and facilitates the decomposition of the hydroxide. Very pure and porous barium oxide is thus formed, which is specially suitable for conversion to barium peroxide. Carbon compounds of barium, or mixtures which produce carbonates or any gaseous carbon compound, are not suitable for use in the process.
—F. Sodn.

Ammonia from peat ; Process of producing ——. H. C. Woltereck and The Sulphate of Ammonia Co., Ltd., London. Eng. Pat. 27,905, Dec. 22, 1908.

The use of live steam in the moist-combustion process of producing ammonia from peat (this J., 1904, 1215) is almost or entirely dispensed with in the present invention, by withdrawing a part of the hot gases leaving the last scrubber or acid tower ; these gases, which contain large quantities of steam, are conducted to the furnace or generator, by a suitable insulated pipe entering beneath the zone of reaction, and thus mix with the air introduced and greatly facilitate the maintenance of the temperature of reaction within the desired limits. The relative quantities of air and gas are regulated by valves.—F. Sodn.

Ammoniacal and other liquids ; Stills for distilling ——. W. Andrews, Pye Bridge, Derby. Eng. Pat. 3477, Feb. 12, 1909.

The still is designed to give as long a contact time as possible, and secure thorough agitation of the liquor to be distilled. To this end, the plates, both of the primary and secondary stills, are provided with channels into which dip baffle-plates, serrated at their lower edges. The liquor is made to enter the liming chamber near the bottom, where it comes into immediate contact with the steam and lime, which ensures all being uniformly mixed before entering the secondary still, and the steam inlet is so arranged that the liquid near the outlet valve is agitated, and choking at this point is prevented. The whole of the channels and baffle-plates can be readily cleaned by taking down one side of the still.—F. Sodn.

Calcium carbide; Treatment of —— [to prepare it in blocks]. C. C. Wakefield, London. Eng. Pat. 1424, Jan. 20, 1909.

Crushed calcium carbide, preferably heated to a temperature just below the ignition point of sulphur, is incorporated with heated sulphur or, better, with a hot mixture of sulphur and sugar (for instance, 2 parts of flowers of sulphur to 1 part of cheap refuse sugar), and the mixture is then formed into blocks. A suitable proportion of binding material is 1 part to every 10 parts by weight of the carbide, and, for making the blocks, a cylindrical mould placed upon a plate is preferred, a very high pressure being exerted on the die by means of a press. The cake is taken out of the mould and dipped, whilst still warm, into mazoot (petroleum residue) or "blue oil," or other suitable oil, and, after being allowed to drain, is dried.—F. Sodn.

Silica direct from natural silica and natural silicates; Method of disintegrating ——. [Preparation of size.] O. R. H. Schmidt, London. Eng. Pat. 1735, Jan. 25, 1909.

The invention relates to the disintegration of silica direct from natural silica and from natural silicates by the action of alumina. The silica or silicate may be mixed with alumina, which has been precipitated from alum solution by means of alkali, or the alumina may be precipitated in the presence of the silica or silicate, the latter course being preferred. The quantity of alumina to be used and the time of action depend on individual requirements, but the process may be quickly carried out as follows:—The very finely powdered silica is added to a solution of alum, and the mixture is well agitated for about 10 minutes; ammonia (sp. gr. 0·880) is then added, in the proportion of one-third the weight of alum used, the vessel is closed, and the mass is further agitated for half an hour; 1 part of alum is sufficient for 2 parts of silica, though more may be used. The silicates are more easily disintegrated; for example, by thoroughly mixing china clay in a 5 per cent. solution of alum for about 15 minutes, and then introducing ammonia in the proportion stated, and agitating for 10 minutes, the vessel being closed, a very serviceable size is obtained. Natural silica may also be disintegrated by the action of the alumina contained in natural silicates, the mixture being agitated with water for half-an-hour.—F. Sodn.

Aluminium nitride; Process for the production of ——. O. Serpek, Niedermorschweiler, Germany. Eng. Pat. 7507, Mar. 29, 1909.

A mixture of alumina or aluminous compounds and carbon is heated in an atmosphere containing nitrogen, at a temperature (not exceeding 2000° C.), at which, in an atmosphere free from nitrogen, alumina would not be reduced to aluminium or aluminium carbide: almost pure nitride is formed, with an average nitrogen content of about 30 per cent.—F. Sodn.

Lime and [fuel] gas; Manufacture of ——. G. G. Floyd, Kirkwood, Mo. U.S. Pat. 948,045, Feb. 1, 1910.

A mineral carbonate is decomposed by heat in a retort, and the gas evolved is made to pass directly through an incandescent mass of carbonaceous material which is continuously fed into the retort, as consumed, and is in close proximity to the carbonate, though not in contact with it. The preliminary heating of the carbonaceous material is effected by utilising the heat of the fuel gas thus produced.—F. Sodn.

Salts of pyrophosphoric acid; Process of and apparatus for converting the salts of tribasic phosphoric acid into ——. E. Giana, Vercelli, Italy. Eng. Pat. 2109, Jan. 28, 1909. Under Int. Conv., June 30, 1908.

See Fr. Pat. 398,792 of 1909; this J., 1909, 1054.—T. F. B.

Sodium hydrosulphite; Manufacture of stable —— and of mixtures containing the same. J. Y. Johnson, London: From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 2521, Feb. 2, 1909.

See Fr. Pat. 400,174 of 1909; this J., 1909, 1034.
—T. F. B.

Compounds of oxygen and nitrogen; Production of —— by electrical means. P. Bunet, Paris, and A. Badin, Salindres, France. Eng. Pat. 16,221, July 12, 1909. Under Int. Conv., Aug. 17, 1908.

See Fr. Pat. 402,012 of 1908; this J., 1909, 1198.—T. F. B.

Nitrous gases; Process of utilising ——. K. Birkeland, Christiania. U.S. Pat. 948,158, Feb. 1, 1910.

See Eng. Pat. 25,632 of 1907; this J., 1908, 749.—T. F. B.

Nitrous gases; Method of absorbing dilute ——. B. F. Halvorsen, Assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania. U.S. Pat. 948,726, Feb. 8, 1910.

See Fr. Pat. 380,190 of 1907; this J., 1907, 1280.—T. F. B.

Nitrogen and carbonic acid from combustion gases; Process of extracting ——. R. Riedel, Schöneberg, Germany. Eng. Pat. 20,631, Sept. 9, 1909. Under Int. Conv., Sept. 9, 1908.

See Fr. Pat. 404,690 of 1909; this J., 1910, 212.—T. F. B.

Silicides; Manufacture of metallic ——. G. Strauss, Assignor to Cie. Gén. d'Electro-Chimie de Bozel, Paris. U.S. Pat. 948,190, Feb. 1, 1910.

See Fr. Pat. 388,730 of 1908; this J., 1908, 948.—T. F. B.

Saturator for preparing ammonium salts. Ger. Pat. 216,069. *See* IIb.

VIII.—GLASS; CERAMICS.

Glass; The cause of the colour displayed by cloudy [devitrified] ——. H. Fleissner. Sprechsaal, 1910, **43**, 63—64.

A piece of ordinary bottle-glass, which was colourless in its transparent parts, contained cloudy portions, which appeared yellow to reddish-yellow by transmitted light, and blue by reflected light. The cloudiness was due to partial devitrification, *i.e.*, the production of more or less opaque crystalline particles, and the author explains the colour effects produced in the same way as Tyndall (Light, Second Edition, 1895, 163) explained the colour of the sky and of certain glacier waters.—O. R.

Fluorspar porcelain. E. Berdel. Sprechsaal, 1910, **43**, 75—78.

Fluorspar exerts an influence on bodies that cannot be obtained with other compounds of calcium. Its low melting-point (cone 09) and the evolution of silicon tetrafluoride have a mechanical effect, while the fact that some fluorine can always be detected in the fired ware shows that it has also a chemical influence. In a reducing atmosphere, there is a copious evolution of gas according to the equation: $SiF_4+4H_2=SiH_4+4HF$. The author proceeds to review the literature of the subject. Binns (Trans. Amer. Ceram. Soc., 1900, 2, 194) attempted to substitute fluorspar for felspar in a body, but found that the fluorspar brought the points of vitrification and complete fusion too near together, and also that the resulting body, though transparent, was porous. The author attributes this and similar failures to the introduction of too much fluorspar. He then gives the figures for fluorspar porcelains fired at cones 2, 4—6, and 7—9, from which he obtained successful results.

	Fired at cone.	Clay-substance.	Quartz.	Felspar.	Fluorspar.
		per cent.	per cent.	per cent.	per cent.
A	2	28	2·5	63·5	6
B	2	30	3	60·5	6·5
C	2	28	2·5	65·5	4
D	4—6	38·5	1·5	54·0	6
E	4—6	30	10	55	5
F	7—9	35	18	45	2
G	7—9	46	21	27	6

Of the glazes of which the molecular formulæ are given below, Nos. 1—4 are suitable for the porcelains A, B, and C, No. 5 for D and E, and No. 6 for F and G. Nos. 1 and 2 are lead glazes, while 3 and 4 have their lime introduced as fluorspar.

	K_2O	BaO	PbO	CaO	MgO	Na_2O	Al_2O_3	SiO_2	B_2O_3	F_2
1	0·1	0·2	0·7	—	—	—	0·15	1·5	—	—
2	—	—	0·7	0·3	—	—	0·4	2·3	0·1	—
	0·2	0·25	—	0·35	0·20	—	0·2	1·5	—	0·35
	0·25	0·25	—	0·5	—	—	0·3	3·0	—	0·5
5	0·25	—	—	0·5	—	0·25	0·4	2·8	0·5	—
6	0·2	—	—	0·6	0·2	—	0·4	3·8	—	—

—H. H. S.

Influence of composition of glass on pharmaceutical preparations. Lesure. *See* XX.

PATENTS.

Melting furnaces [for glass, metals, etc.]; Gas-fired ——. C. Deselle, Paris. Eng. Pat. 5549, March 8, 1909.

THE patent relates to furnaces of the type described in Fr. Pat. 369,384 of 1906 (this J., 1907, 95), in which a central pillar raised above the hearth of the furnace, has a gas-supply passage provided with openings through which the gas passes into the flame-space, and in which air-inlet channels lead into the flame-space. The improvements consist in: (1), the provision of outlets for the products of combustion, communicating on the one hand with the flame-space, and on the other hand with a collector disposed above the openings leading from the central passage to the flame-space, and under the smoke-box; (2), the combination of air and gas outlets at the upper part of the central pillar, above the hearth; and (3), the combination of convenient openings in the upper part of the central pillar, in the smoke-box, and at the base of the outer pillars supporting the crown of the furnace, thereby allowing the insertion of a rod for cleaning pruposes.—A. S.

Bricks, tiles, pottery, and the like purposes; Kilns employed in the manufacture of ——. E. Thomas, Sutton, Surrey. Eng. Pat. 1319, Jan. 19, 1909.

CIRCULAR, down-draught kilns are provided with a number of fire-places of the usual type, in which the heated gases pass into chambers and escape into the kiln over the top of the wall of the chambers, and also with a number of supplementary fire-places, in which the heated gases pass into chambers and escape into the kiln through perforations in the wall of the chambers, in order to heat the lower portions of the kiln. The heated gases are drawn down through annular central openings in the floor of the kiln, into the highest of three layers constructed in the sole of the kiln. The horizontal space of this top layer is honeycombed with radially arranged brickwork, and annular flues. After passing through these, the heated gases are drawn towards the circumference of the kiln, down the outside of a floor which separates the top from the two lower layers. The second layer consists of concentric circles of brickwork provided with radial flues, and rests directly upon the third layer, which consists of radial lines of brickwork provided with circular flues. After traversing these two lower layers, the gases pass through a central opening into one or more waste flues, which communicate with a circumferential flue. From this they pass to the chimney through an outlet flue, the mouth of which is raised above the floor line of the circumferential flue. —W. C. H.

Shales; Treatment of —— *[for ceramic purposes].* M. Royley, Manchester. Eng. Pat. 1858, Jan. 26, 1909.

WHEN certain shales, of later geological age than the carboniferous shales, are burnt in heaps containing large lumps, as is usual with carboniferous shales, the alumina is rendered to a large extent insoluble in mineral acids, by reason of the high temperature. According to the present patent, such shale is burnt in open heaps, after a preliminary crushing so as to pass a screen of 1—1½ inch mesh; the rate of combustion is thus reduced. An air-flue, about 3 in. wide and made of loose ordinary bricks, is preferably laid along the bottom of each bed or heap, and the combustion is started by igniting wood or other fuel placed on top of the flue; the crushed shale is then gradually added, as combustion proceeds, so as to form the heap, which may be 14 feet wide at the bottom, 4 feet at the top, and 4 feet deep. The supply of air is regulated by closing or partially closing either end of the flue, and wind shields, which may take the form of permanent walls forming sides to the beds, may also be employed. Several beds may be arranged in parallel, the walls being common; or, if there be no walls, the space between adjacent beds may be filled in with the prepared shale and the combustion allowed to spread from bed to bed.—F. SODN.

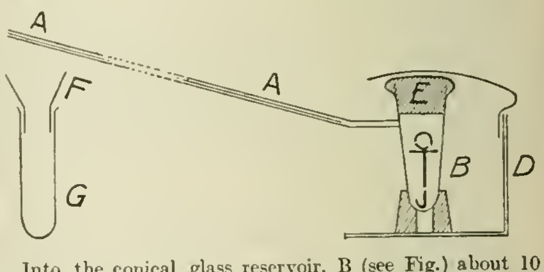
Pottery or ceramic transfer pictures; Printing ink or colour for ——. J. Kasseker, Altwasser, Germany. Eng. Pat. 23,852, Oct. 18, 1909.

THE linseed oil used as the main ingredient of the binding medium in the printing ink or colours for ceramic transfer pictures is saturated to the greatest possible extent with minium or other suitable lead compounds by long boiling. —W. C. H.

IX.—BUILDING MATERIALS.

Plaster of Paris; Apparatus for testing ——. J. H. van't Hoff. Z. physik. Chem., 1910, **70**, 146—152.

DURING the setting of plaster of Paris there is a contraction in volume. The dilatometer has been modified in form so as to adapt it to the technical measurement of this change.



Into the conical glass reservoir, B (see Fig.) about 10 grms. of plaster are introduced through the funnel, F, from the weighing tube, G. The reservoir, B, is smeared inside with vaseline to facilitate the withdrawal of the plaster cast after setting and for the same purpose, a bent wire is inserted in the powder. A is a thick-walled capillary tube attached to B, the intermediate short glass tube being packed with cotton wool to prevent plaster passing into the capillary The reservoir is filled with water saturated with calcium hydroxide and closed with a cork, E, which is kept in position by a spring, D. The water is thus forced to the end of the capillary which is wiped ready for use and a millimetre scale attached. Experiments with the artificial "half-hydrate" of calcium sulphate, $2CaSO_4,H_2O$, showed an immediate steady contraction in volume

reaching its maximum rate in about one hour. The total contraction amounted to 0·042 c.c. per gram of half-hydrate, and the time required for half change was about 68 minutes at 19° C. With commercial plaster of Paris more irregular results were obtained, but the time required for change to take place with the maximum velocity, corresponding to the period of half change, was about 41 minutes.
—E. F. A.

Flooring-plaster. O. Frey. Tonind.-Zeit., 1910, 34, 170—172.

Flooring-plaster is obtained by calcining gypsum at a red heat, the burning being usually accomplished in continuous, vertical, shaft kilns. The amount of coal used is on the average from 7 to 9 per cent. of the weight of raw gypsum. To prevent any reduction of calcium sulphate to sulphide, a plentiful air supply must be maintained. Well-burnt flooring-plaster clinker should be chalky in appearance, should be covered all over with a red film of ferric oxide, and should feel velvety like talc. Overburnt clinker is rough to handle, cracked, and shows signs of incipient fusion. It sets and hardens very poorly. Underburnt clinker shows the original crystalline structure of gypsum and is only partially reddened with ferric oxide. It sets quickly and acquires only a low degree of hardness. The setting of well-burnt flooring-plaster begins in from 1 to 7 hours and is complete in about 20 to 30 hours. The hydration is very slow and goes on for months. The strength of the set plaster depends greatly on the amount of water used. With 22 per cent. of water a specimen attained a tensile strength of 21 kilos. per sq. cm. in eight days, whereas the strength of a similar specimen "run" with 50 per cent. of water, did not exceed 4 kilos. per sq. cm. even after a much longer period. Flooring-plaster can advantageously be mixed with sand, almost like Portland cement, and the author concludes that it is capable of wide application as: (1), Decorative material when mixed with sand, in which case its strength approaches that of cement mortar, the mixture being weather-resisting to a high degree; (2), mortar for building purposes; (3), concrete for floors; (4), basis for the manufacture of artificial stone. It is inapplicable only when exposed continuously to the action of water or moisture.
—O. R.

Emulsions [*Tar-oil* —— *for impregnating wood*]. Wa. Ostwald. Z. Chem. Ind. Kolloide, 1910, 6, 103—109.

The author shows that within limits comprising 55·72 per cent. of all possible mixtures of two mutually insoluble liquids, two different kinds of emulsions are theoretically possible, according as the one or the other liquid forms the dispersed phase, the other forming a continuous phase. If the amount of the dispersed constituent in an emulsion of either kind is gradually increased, a "critical point" is reached eventually at which the spherules of the dispersed phase must theoretically touch, and a stable emulsion of that character is then no longer possible. There is a "critical interval" between the two critical points in which the two kinds of emulsions are possible, as stated above. By first rinsing the sides of the vessel with the liquid which is to form the continuous phase, an emulsion of either type can be obtained, by stirring, within the critical interval. The experiments were performed with mixtures of tar-oil and water and of benzene and water; those emulsions in which the oil formed the continuous phase were very much less stable than the others; whichever kind of emulsion is formed, that constituent which has formed the continuous phase eventually separates to form a secondary emulsion containing a small portion of the previously dispersed phase in suspension, whereas the other constituent always separates to form a perfectly clear liquid. The phenomena are important as it is always the continuous phase which adheres to objects, such as wood to be impregnated, which are immersed in the emulsion.—E. F.

Corrosion of reinforced steel [*in concrete*]. Matthews. *See* X.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

German iron industry; Foreign trade of the ——. Stahl u. Eisen, 1910, 30, 274—276.

The exports of iron and iron goods from Germany and from Great Britain for 1909 are compared in the following table, the figures representing metric tons.

	Germany.	Great Britain.
Pig iron	471,045	1,160,022
Scrap iron	174,288	165,204
Partly manufactured iron	474,854	3,074
Rolling mill products ...	2,315,242	2,501,942
Iron goods	608,962	620,514
Total iron and iron goods	4,044,391	4,450,756
Machinery	331,194	630,398
Totals	4,375,585	5,081,154

The German exports exceeded those of 1908 by 6·8 per cent., the greatest increase being in pig-iron, the exports of which rose from 257,849 to 471,045 metric tons. The exports of partly manufactured iron and of machinery were less than in 1908. The imports were less in all branches. Owing to the wider adoption of the Martin process in Germany in recent years, the trade in scrap iron has become of considerable importance, the imports of scrap iron in 1909 (184,729 metric tons) representing 38 per cent. of the total imports of iron. The distribution of the German exports of iron during the past ten years is shown in the following table, the figures representing units of 1000 metric tons.

The exports to German colonies have steadily increased and now amount to 44.800 metric tons, of which 42,539 tons represent materials for railways.

	Belgium.	Denmark.	France.	Great Britain.	Italy.	Holland.	Austria-Hungary.	Russia.	Switzerland.	Spain.	British India.	China and Japan.	Brazil and Argentine.	United States.
1900	172	51	85	166	71	176	65	109	180	20	35	64	[illegible]	10
1901	305	59	85	466	74	280	76	97	145	15	93	84	105	22
1902	403	77	77	817	135	413	53	70	187	16	74	89	86	312
1903	453	84	76	836	130	366	61	59	189	17	97	92	111	295
1904	378	87	93	544	124	307	43	50	222	15	75	87	127	40
1905	507	100	99	723	147	336	70	50	226	13	90	122	209	59
1906	550	85	57	561	203	249	44	35	212	6	72	86	182	18
1907	409	104	83	439	287	315	97	55	276	15	101	149	387	37
1908	366	77	83	544	293	374	258	59	235	11	140	217	266	11
1909	536	93	132	596	302	364	154	42	248	19	102	178	303	31

A. S.

Steel; Corrosion of re-inforced ——. E. R. Matthews. Mining World, 1909, 223. J. Chem., Met., and Min. Soc., S. Africa, 1909, **10**, 228.

A series of 21 experiments was made to ascertain to what extent steel imbedded in concrete was subject to corrosion. It was found that an entire coating of cement grout was an effectual safeguard against corrosion, but that this coating should be quite dry before the steel is imbedded in the concrete. If, however, a non-porous aggregate is used for the concrete, the separate coating may be omitted. Porous materials such as coke breeze or slag, should not be used in work that will be exposed to air and water, the best materials being broken stone or brick; river sand should not be used for reinforced concrete that is required to be watertight. Rusty steel was found to rapidly brighten when imbedded in concrete, whether exposed to air or water. The author considers that linseed oil, turpentine, or probably any coating other than cement or lime, would rather tend to facilitate than retard corrosion.—F. R.

Iron-carbon system; Influence of antimony and tin on the ——. P. Goerens and K. Ellingen. Metallurgie, 1910, **7**, 72—79.

Using Swedish cast-iron containing 3·60 per cent. of carbon, 0·15 of silicon, 0·2 of manganese, 0·008 of sulphur, and 0·02 of phosphorus, alloys were prepared containing from 5·83 per cent. of antimony, with 3·12 of carbon, to 59·32 per cent. of antimony with 0·30 of carbon, and also alloys containing from 4·28 per cent. of tin with 3·76 of carbon to 11·10 per cent. of tin with 2·73 of carbon. Cooling curves were taken of all the alloys, and freezing-point diagrams constructed of the iron-antimony-carbon and of the iron-tin-carbon systems. These show that both systems belong to the ternary group of iron-carbon alloys, with the formation of a ternary eutectic which in the case of antimony solidifies at a temperature of 950° C. The pearlite point is unchanged. Microscopical examination showed the presence of pearlite and cementite, with antimonide and stannide respectively. These latter become light grey by prolonged etching with picric acid, and remain several stages behind the cementite during heat-tinting. Cooling curves, with the freezing-point diagrams, and six microphotograms illustrate the paper.—A. H. C.

Ferro-silicon. R. Taussig. Times Eng. Suppl., Feb. 16, 1910.

With reference to statements in the Local Government Report on ferro-silicon (this J., 1910, 154) the writer states that in furnaces of large power, *i.e.*, those consuming more than 4000 e.h.p. per furnace unit, technically pure ferro-silicon is now produced containing quite insignificant amounts of phosphides and arsenides. The best proof as to quality of any ferro-silicon is its stability in the atmosphere. If it does not decompose on storing in moist air, it is absolutely harmless for the workmen; neither explosive or poisonous in any way. It is stated that, various grades of ferro-silicon have been put on the market which have never yet shown these disadvantages, either at the works, where hundreds of tons are stored for months at a time; in transport, which in the cases mentioned is practically all done by ship; or at the consumers' works. Again, it is just in these works that those grades are more particularly produced which contain on the average 50 per cent. of silicon, and which it is proposed in the report to shut out of the market. In the manufacture of ferro-silicon (quite irrespective of its silicon content), in large furnaces, the impurities (phosphorus and arsenic) on smelting go into the slag; hence a refining of the ferro-silicon takes place in the furnace itself, while in the ordinarily-used small furnaces this refining does not take place.

Gold production of the world. Engineering, Feb., 11, 1910. [T.R.]

The value of the production of gold throughout the world last year was £91,513,456, as compared with £88,686,905 in 1908. The Transvaal contributed a value of £30,380,000 last year, as compared with £29,163,803 in 1908; the United States £19,300,000, as compared with £18,912,000*l*; and Australia, £14,396,156, as compared with £14,662,934. It will be seen that the production increased last year in the Transvaal and the United States, but that it was barely maintained in Australia. The value of the world's gold production for the ten years ending with 1910, inclusive, was as annexed:—

Year.	Value. £	Year.	Value. £
1900	51,765,940	1905......	75,682,211
1901	52,175,486	1906......	81,110,204
1902	59,762,499	1907......	82,258,891
1903	65,895,081	1908......	88,686,905
1904	69,817,659	1909......	91,513,456

Precious metals from [cyanide] solutions; Rotary extractor for ——. W. D'Arcy Lloyd and E. T. Rand. J. Chem., Met., and Min. Soc., S. Africa, 1909, **10**, 201—204.

The extractor consists essentially of a light steel rectangular tank divided by vertical plates into three compartments, each of which is provided with a conical bottom, opening by means of valves into settling tanks. A hollow rotatable shaft passes horizontally through the tank and its partitions, and a cylindrical cage is fitted in each compartment, concentrically about the shaft. The cages are radially divided, by means of perforated plates, into 16 independent sections, in which the zinc shavings or clippings are placed, the solution having access to the cages through perforations in the shaft and at the periphery of the cages. The auriferous cyanide solution flows, under a steady head, into the hollow rotating shaft, where an obstruction, at the end of the first outer compartment, causes it to pass out, through 1-in. perforations in the shaft, into the first cage of zinc, escaping at the periphery into the compartment and thence, through the bottom valve, into the settling tank. It then passes up a pipe into the second compartment and through the second zinc cage back into the shaft and along to the third compartment, where it passes out again through the last zinc cage into the settling tank, the overflow going to the solution sump. All gold slime, loosened from the zinc, passes into the settling tanks and may be removed without stopping the apparatus. The shaft and attached cages of zinc are rotated at a speed of 1 to 1½ revolutions per minute, about one h.p. being required for a plant precipitating 250 tons of solution per day. Coarse zinc shavings or clippings are recommended in place of the usual fine shavings, partly on account of the smaller loss from attrition and also, as the cages are capable of containing over ten times the weight of zinc clippings, as compared with the usual filiform zinc, the time and labour of charging is correspondingly decreased. Adherent gold is almost completely removed, with a practically negligible loss of zinc, by rotating the cage sections in a drum, containing a 5 per cent. acid bath, for 15 minutes and subsequently thoroughly washing with water. The chief advantages claimed for the mechanical extractor are that the gold slimes are readily accessible without stopping the precipitation, the clean-up is rapid and cleanly, and the constant rotation prevents "fouling" of the zinc. —F. R.

Gold and silver; Determination of —— *in the dry way.* R. Grund. Oesterr. Zeits. Berg- u. Hüttenw., 1909, **57**, 681—683, 697—700. Chem. Zentr., 1910, **1**, 569—570.

Loss of silver in dry assays. A comparison of machine-pressed magnesite cupels with hand-stamped or pressed bone-ash cupels showed that the loss of silver due to absorption is smallest with the magnesite cupels and greatest with hand-stamped bone-ash cupels.

Determination of gold. In the author's opinion, where a large number of gold assays has to be carried out in a relatively short time with materials of very low assay-value, the crucible method is to be preferred to the ordinary concentration process.—A. S.

Bronzes; Corrosion of —— in solutions of electrolytes. F. Giolitti and O. Ceccarelli. Gazz. Chim. Ital., 1909, **39**, II., 557—575.

Referring to the results of Curry (this J., 1906, 1104), the authors point out that in many of his experiments the pieces of bronze were subjected to conditions of heating such as would seldom occur in practice. Moreover in Curry's method of treatment, all variations in the concentration of the various solid solutions in the alloys were practically eliminated, whereas the phenomena of corrosion as met with in practice are to be attributed to such differences of concentration from one part to another in a given bronze. In the authors' experiments bronzes containing less than 10 per cent. of tin were fused and annealed at different temperatures or sharply cooled rapidly or slowly. The structure was then examined under the microscope, and weighed cylinders of the metal (about 3 mm. in diameter and 15 to 20 mm. in length) were cleaned and immersed in 80 c.c. of $N/10$ hydrochloric acid containing 2 per cent. of ferric chloride for a given time, after which the loss in weight was determined. From the results obtained, which are given in detail, the authors have arrived at the following conclusions:—(1) Two bronzes of similar composition which have been subjected to different thermal conditions, may differ widely as regards the amount of resistance they offer to corrosive agents. Such differences in behaviour correspond to differences in structure readily recognisable under the microscope. (2) Other conditions being equal, the simultaneous presence in a given bronze of the two solid solutions, α and β, (*cf.* this J., *loc. cit.*), and especially of the segregation products of the latter, accelerates the corrosive action. In the case of bronzes containing a little over 7 per cent. of tin, the velocity of the corrosion increases with the rise in the proportion of the solid solution, β, whether this larger proportion be due to a difference in the composition of the alloys, or to different thermal treatment affecting the speed of solidification. (3) When the ratio between the quantity of solution, α, and solution, β, (or their segregation products), remains constant, the velocity of the corrosion increases as the differences between the concentration of the individual crystals towards the nucleus and that of the crystals towards the edge become more pronounced. Hence, since such differences of concentration in an alloy can be recognised and approximately estimated by means of the microscope, it is obvious that a simple microscopical examination of the structure of a given bronze may afford data upon which to base a conclusion as to the resistance it will offer to corrosion.—C. A. M.

Metals; Meta-stability of the common ——. E. Cohen and K. Inouye. Z. physik. Chem., 1910, **71**, 301—311.

The meta-stable condition of metals which have been subjected to mechanical treatment (see this J., 1910, 94) may be the cause of many failures met with in practice and hitherto unexplained. The failures of tin-plate have already been referred to (see this J., 1908, 1116; 1909, 1139). Another case brought to the authors' notice was the following. Reservoirs for petroleum lamps made by stamping from sheet brass containing 62·5 per cent. of copper and 37·5 per cent. of zinc, frequently exhibited intense corrosion after a shorter or longer period, cracks or holes being produced. The corroded portion was of the same chemical composition as the other parts, but, under the microscope, showed a structure similar to that of etched brass (this J., 1910, 94), whereas the uncorroded metal had the structure of ordinary freshly rolled brass. Evidently re-crystallisation, *i.e.*, the conversion of the meta-stable into the stable modification, had caused complete disintegration of the metal. It is stated that failures of the brass reservoirs had been more frequent in recent years than previously. The authors attribute this to a difference in the method of manufacture. In the earlier period the stamping of the reservoirs was performed by pressure applied gradually, whereas in more recent times, the reservoirs were produced by merely two manipulations under the press. In this latter case the metal is evidently strained more severely, and hence the tendency to revert to a more stable condition is stronger. Further instances mentioned in which failures may have been due to this "forcing-" or "strain-disease," are the corrosion of a brass door-handle and of the lead cover of a sulphuric acid chamber.—A. S.

Lead and tin; Hardness of alloys of ——. D. Stenquist. Z. physik. Chem., 1910, **70**, 536—538.

The hardness of the alloys of lead and tin was determined by Brinell's method, a steel ball of 1 cm. diam. being pressed into the test-piece by a pressure of 200 kilos. The results (expressed as kilos. per sq. mm. of area of impression) were as follow:—

Percentage of tin	0	0·52	1·53	2·38	2·83	3.40
Hardness........	3·6	4·9	5·7	5·9	6·2	7·3
Percentage of tin	19·4	25·4	52·2	83	89·8	99·9
Hardness........	12·8	14·9	18·0	14·1	12·5	9·1

—A. S.

Titanium; Metallic ——. L. Weiss and H. Kaiser. Z. anorg. Chem., 1910, **65**, 345—402.

The authors have re-investigated the preparation of elementary titanium and have compared their results with the literature on the subject, and their specimens with commercial specimens. The raw material (rutile) was converted directly into potassium titanofluoride by fusing with potassium hydrogen fluoride, and the product was freed from iron and aluminium by crystallisation from dilute hydrofluoric acid. The crystals thus obtained have no water of crystallisation and dissolve in 9·4 parts of water at 98° C. The titanofluoride was converted into amorphous titanium by fusing with sodium. Two specimens were examined, one produced by a single fusion and subsequent extraction with water, the other being the result of a double reduction, and lixiviation with absolute alcohol. The first product had a percentage of titanium varying from 68 to 76 and its sp. gr. at 19° C. was 3·392. The second one contained 85·65 per cent. of titanium, 3·27 of iron, 2·67 of hydrogen, 0·42 of carbon, and 7·99 of oxygen (by difference), and had the sp. gr. 3·988. The purer body was darker in colour, and possessed a higher electrical conductivity than the other. Also it did not decompose boiling water, a point on which the authors differ from most previous observers. Amorphous titanium is only completely soluble in hydrofluoric acid, though it is slightly attacked by hydrochloric and sulphuric (not nitric) acids. It burns in air giving beautiful sparks, though the dioxide can only be quantitatively obtained with oxygen at high pressures. A commercial specimen which had to be freed from soluble organic (12 per cent.) and inorganic (6 per cent.) impurities by washing first with alcohol and ether and then with water, gave a residue, the conductivity of which was superior to that of the authors' product, but its analysis showed a wider range of impurity (titanium, 82·44; aluminium, 1·45; iron, 3·15; hydrogen, 2·12; carbon, 1·99; silicon, 0·94; and oxygen (by difference), 7·91 per cent.). It combined with nitrogen (most readily at 1250° C.) appearing to form the nitride, TiN. By reducing the titanofluoride with aluminium, the authors obtained, after removing the excess of aluminium with hydrochloric acid and washing away amorphous impurities with water, a crystalline aluminide (titanium, 53·72; aluminium, 45·17; silicon, 1·31 per cent.) of sp. gr. 3·348, which corresponds to the compound, Al_3Ti_2, obtained by Wöhler (Ann. Chem. Pharm., **113**, 248) of sp. gr. 3·3. An attempt to repeat the experiments of Manchot and Richter (this J., 1908, 24), who describe an aluminide, Al_3Ti (of sp. gr. 5·5) gave a body containing 51·71 per cent. of titanium, 44·08 of aluminium, and 2·55 of silicon, with the sp. gr. 3·448, and no evidence for the existence of the compound, Al_3Ti, could be obtained. The aluminide is a silver-white crystalline body harder than glass. It is unattacked by alkalis. Wöhler's statement that the compound is soluble in concentrated hydrochloric acid is incorrect. It is only slowly attacked by warm *aqua regia*, but is readily soluble in hydrofluoric acid. When powdered it is combustible, but the crystals when heated oxidise superficially. Molten titanium was prepared both from the aluminide and from the amorphous body by electrical fusion of a compact rod which was produced by hydraulic compression of about 70,000 atmospheres. A vacuum furnace was used, with a current of 15·20 amps., and an E.M.F. of 65 volts. Higher current-strengths were necessary in the case of the aluminide in order to volatilise the aluminium. The metal thus obtained is a very hard substance, completely insoluble in hydrochloric or sulphuric acid. When two pieces are struck together, sparks are produced. Combination with nitrogen takes place readily at red heat, with quantitative formation of the nitride, TiN. The product from the amorphous metal contained 97·41 per cent. of titanium, 1·56 of hydrogen, and 0·30 of carbon, whilst that from the aluminide still contained about 3 per cent. of aluminium. The densities at 19° C. were 5·174 and 5·048 respectively, while the specific heat of the purer sample was 0·1418. The heat of combustion in the powdered state gave: $Ti + O_2 = TiO_2 + 97{\cdot}772$ Cals. M. pt. = 2200°—2400° C.

Analytical methods.—The analyses of all samples can be carried out by first heating a weighed quantity of metal in a platinum crucible to convert it as far as possible into oxide. It is then fused with ten times its weight of potassium hydrogen sulphate. The melt is digested with dilute sulphuric acid and filtered. The residue (if any) consists of silica, with traces of titanium dioxide, and its weight must be checked by treatment with hydrofluoric acid. In the filtrate iron can be estimated separately after neutralising, by precipitation with hydrogen sulphide in the presence of ammonium tartrate, and subsequently converting the quickly filtered sulphide to ferric oxide. Iron and titanium are then estimated together in another sample by direct precipitation with ammonia, and the titanium determined by difference. In the presence of aluminium the process is more complicated and the method of Gooch is very unreliable owing to the uncertain acetic acid concentration. It may be modified by precipitating iron, aluminium, and titanium together, washing the precipitate and then warming some time with 15 per cent. (by volume) acetic acid. This dissolves the iron and the aluminium, but leaves the titanium. It is better however to fuse the oxides after the removal of silica with a mixture of soda and borax in equal parts. After digesting the melt for 24 hours with cold water, the titanium and the iron are in the residue, and aluminium can be determined quantitatively in the filtrate. A separate determination of iron being made, titanium is determined by difference from the sum of iron and titanium oxides. Titanium may be determined volumetrically by the method of Newton (this J., 1908, 248), and also colorimetrically with hydrogen peroxide —W. H. P.

Metals and metallic compounds; Heat-capacities of ——. H. Schimpff. Z. physik. Chem., 1910, **71**, 257—300.

THE author has determined the heat capacities of 15 metals and 29 binary metallic compounds for the three temperature intervals, 17°—100° C., 17° to —79° and 17° to —190°C. The composition of the different specimens is given, and also full details of the method of investigation. The results are given in tables and curves. In the case of the compounds, the values calculated according to Kopp's law agreed with the observed values within the limits of experimental error (2 per cent.) in nearly half of the determinations; in the remainder the difference amounted roughly to 4 per cent. It was noted that the values for magnesium compounds were always smaller, and for antimony compounds, nearly always larger than the calculated values.—A. S.

Red lead; Physico-chemical and technical studies on ——, III. J. Milbauer. Chem.-Zeit., 1910, **34**, 138—140. (See also this J., 1909, 612, 1049.)

THE author has shown that the most favourable temperature for the production of red lead from lead oxide in an atmosphere of oxygen is 470° C. He has now studied the behaviour of red-lead at higher temperatures in oxygen, air, and carbon dioxide, and in a vacuum. It was found that decomposition begins at 470° C. and at this and higher temperatures proceeds until a condition of equilibrium is attained in at the most three hours. In three hours the red lead is completely decomposed at 600° C. in oxygen, at 565° C. in air, at 550° C. in carbon dioxide, and at 530° C. in a vacuum. A study of the behaviour of lead dioxide on heating at different temperatures *in vacuo* gave the following results, the figures representing the percentage of peroxide-oxygen in the products obtained after heating at the temperatures stated, whilst the colours of the products are given in brackets:—Pure lead dioxide, 6·69; at 100° C., 6·65 (grey); 200°, 6·53 (grey); 310°, 5·04 (olive-brown); 370°, 3·50 (light brown); 400°, 2·64 (light brown); 435°, 2·18 (red); 455°, 2·18 (red); 485°, 1·72 (red); 505°, 0·67 (yellowish-brown); 535°, 0·07 (yellowish-brown); and 550° C., O (yellowish brown). —A. S.

Nitrogen thermometer; The —— from zinc to palladium. A. L. Day and R. B. Sosman; *with an investigation of the metals.* E. T. Allen. Amer. J. Sci., 1910, 29. 93—161.

THE investigation is a continuation of the work of Day and Clement [Amer. J. Sci., (4), 1908, 24, 405—463] and was undertaken with the object of extending the gas scale to 1600°, the limit of the Reichsanstalt scale hitherto employed being about 1100°. The work consisted, first, in selecting certain thermometric points (usually the melting-points of metals) and determining their reproducibility; second, in measuring the true temperature on the nitrogen scale at, or close by, each of these fixed points; third, in transferring these known temperatures, by means of thermo-elements, over to the fixed points in question, the transference being necessary as the thermometer bulb could not be placed directly into melting or solidifying substances at high temperatures. To avoid contamination of the thermo-elements (by iridium) the original platin-iridium bulb was replaced by one of platin-rhodium (80 per cent. of platinum and 20 per cent. of rhodium), with satisfactory results. Having proved that the discrepancies in the gas scale temperatures of the usual fixed points, as given by various observers, are mainly due to systematic errors inherent to the apparatus and methods employed, special attention was directed to their elimination or correction. For instance, greater uniformity in the temperature of the gas in the bulb was obtained by the re-arrangement of the heating and radiating devices; and, in the transference of the higher temperatures (above 1100°) by the thermo-elements, the wires of the latter were periodically removed from the furnace and tested for homogeneity, any contaminated portions being cut off. All the melting points of metal, except those of palladium, were made in an upright furnace in which the atmosphere about the melting metal could be perfectly controlled, the containing-vessel (crucible) being placed within the constant temperature zone, which was located by preliminary experiment. The metals, etc., employed were specially selected, as regards purity or constancy of composition, to satisfy requirements comprising exact reproducibility of temperature in repeated determinations, independence of particular experimental arrangements (such as the shape of the furnace or the rate of heating), and convenience and safety of manipulation. Analyses (by E. T. Allen) of the metals used are given, together with the methods employed in their examination. With regard to interpolation between the thermo-element values of the fixed points, the authors find that, within the limits of experimental error, their observations satisfy the following equations:—

Cadmium to copper:—

$$E\ (\text{microvolts}) = -302 + 8{\cdot}2356t + 0{\cdot}0016393t^2$$

Copper to palladium:—

$$E\ (\text{microvolts}) = -1941 + 11{\cdot}1746t + 0{\cdot}00032161t^2$$

Cadmium to palladium:—

$$E(\text{microvolts}) = --169{\cdot} + 7{\cdot}57t + 0{\cdot}002648t^2 - 0{\cdot}0000004724t^3$$

The extension of thermo-element values, obtained below 1100°, into the region above that temperature—as in the existing practice of extrapolation—leads to very erroneous results. The melting temperatures of the metals, etc., used as fixed points, and the conditions under which the determinations were made, are shown in the following table, together with the generally accepted Reichsanstalt scale :—

Substance.	Point.	Atmosphere.	Crucible.	Temperature.	Reichsanstalt scale.
Zinc	Melting and freezing	Air	Graphite	418·2° + 0·3	419·0°
Antimony	do.	Carbon monoxide	do.	629·2 + 0·5	630·6
Silver..............	do.	do.	do.	960·0 + 0·7	961·5
Gold	do.	do.	do.	1062·4 + 0·8	1064·0
Copper	do.	do.	do.	1082·6 + 0·8	1084·1
Diopside (pure)	Melting	Air	Platinum	1391·2 + 1·5	—
Nickel	Melting and freezing	Hydrogen and nitrogen	Magnesia and magnesium aluminate	1452·3 + 2·0	—
Cobalt	do.	do.	Magnesia	1489·8 + 2·0	—
Palladium	do.	Air	Pure magnesia	1549·2 + 2·0	1575·*
Anorthite (pure) ...	Melting	do.	Platinum	1549·5 + 2·0	—
In addition, the following temperatures were incidentally obtained :—					
Cadmium	Melting and freezing	Air	Graphite	320·0 + 0·3	321·7
Aluminium	Freezing	Carbon monoxide	do.	658·0 + 0·6	657·
Platinum	Melting	Air		1755·	—

* Holborn and Valentiner, Ann. d. Phys., (4), 1907, 22,1.

—W. E. F.

ERRATUM.

THIS J., Feb. 15, 1910, page 158, col. 1, title of second abstract, *for* "this J., 1905, 132," *read* "this J., 1905, 1302."

PATENTS.

Steel scrap ; Method of utilising ——. J. P. W. Beckman, Parnassus, Pa. U.S. Pat. 947,031, Jan. 18, 1910.

SCRAP rich in silicon or other metalloid is preheated in a furnace to a temperature below its fusing point. Molten iron or steel is then poured on to the scrap in order to melt it and preserve in the resulting steel the metalloid content of the scrap.—O. F. H.

Iron ores ; Process of reducing ——. C. B. Morgan, Oakland, Cal. U.S. Pat. 947,448, Jan. 25, 1910.

THE molten ore charge is poured on to a bed of liquefiable carbonaceous substance, such as asphaltum, which, intermingling with the melted charge, facilitates the separation of the metal.—W. E. F. P.

Steel. J. W. Evans, Belleville, Ontario, Canada. U.S. Pat. 948,166, Feb. 1, 1910.

CLAIM is made for a steel containing 92 per cent. (or more) of iron, 1 per cent. (or less) of carbon, 3 per cent. (or less) of titanium, 2 per cent. (or less) of vanadium, and 3 per cent. (or less) of nickel.—W. E. F. P.

Fine gold ; Process of, and apparatus for, recovering ——. J. H. Alling, San Francisco, Cal. U.S. Pats. 947,957 and 947,958, Feb. 1, 1910.

THE precious metal is recovered, as amalgam, by subjecting the gold-bearing material—in admixture with a solution of a mercury salt—to the action of an electric current, during its flow through the apparatus. The upper electrode or anode is continuously coated with mercury by suitable means, the cathode consisting of a pocket adapted to contain mercury at a uniform level. The application of this principle to sluice-boxes is also claimed.—W. E. F. P.

Auriferous black sands, mattes and other similar metalliferous materials ; Treatment of —— *to recover the metals contained in them.* C. F. Siegert. Fr. Pat. 404,754, July 5, 1909.

THE material is roasted at a dull red heat, and while at this temperature dropped into a solution of sodium chloride and ammonium chloride. The ore and solution are thoroughly mixed by agitation and the whole heated until nearly all the water is evaporated. Sulphuric acid is then added and diluted with water, and after allowing to stand for a sufficient length of time, say, twelve hours, the solution is leached out, the residue washed, and the gold recovered from it by amalgamation.—O. F. H.

Copper or copper-alloy ; Protection and decoration of ——. S. O. Cowper-Coles, London. Eng. Pat. 27,683, Dec. 19, 1908.

THE copper or copper-alloys are coated with a firmly-adherent film of cuprous oxide by heating them to redness in an atmosphere of carbon dioxide, or in a partial vacuum (or an inert gas) containing sufficient oxygen for the purpose ; or by heating them to bright redness in air, and plunging into cold water. For decorative purposes, a stopping-off composition is applied to the metal, in any design or pattern, after which the above treatment may be given ; or the exposed surfaces may then be treated by electro-deposition, or by the Sherardising or Cowperising process.—W. E. F. P.

Brass dust ; Method of manufacturing ——. A Sang, St. Cloud, France. U.S. Pat. 946,738, Jan. 18, 1910.

COPPER dust is precipitated from a solution of copper sulphate by the addition of zinc dust, and is filtered off and dried. It is then mixed with zinc dust and heated to a moderate temperature.—O. F. H.

Aluminium alloys ; Manufacture of ——. E. J. Seville de St. Laurent, E. W. Lancaster, H. T. McNeale, and J. W. Collins, London. Eng. Pat. 1339, Jan. 19, 1909.

THE patent relates to the production of homogeneous alloys of aluminium and lead containing from 5 to 50 per cent. of the latter metal. These alloys are stated to be malleable, ductile, capable of taking a high polish, and very resistant to corrosion. They also possess good electrical conductivity. Crucibles lined with a paste containing carbon, alumina, and lead oxide are employed in the process, the moulds used being also similarly coated. In the simplest method of manufacture, the aluminium is melted, and allowed to cool, after which oxide of lead and powdered carbon are added. The temperature being then raised until the aluminium melts, the oxide of lead is reduced by the carbon; a further quantity of lead may be added in metallic form, if desired, the molten mixture being thoroughly stirred, in any case, before the final pouring into the mould. The metals may also be melted, or prepared, in separate crucibles and brought together under suitable conditions.—W. E. F. P.

Aluminium; Antifriction alloy of —— suitable for parts of machinery. R. Esnault-Pelterie. Fr. Pat. 405,157, July 16, 1909.

THE alloy consists of 80—90 per cent. of aluminium, 5—10 per cent. of silver or other precious metal, and 5—15 per cent. of metals of the iron group such as cobalt, chromium, nickel, and manganese.—O. F. H.

Solders for metals and alloys. G. Bryant, London, and C. H. Ivinson, Ilford. Eng. Pat. 1403, Jan. 20, 1909.

THE solders or their constituent metals are melted, and dropped, in a finely-divided condition, into a solution of phosphorus or sulphur in oil, floating on an aqueous solution of substances, *e.g.*, zinc chloride, ammonium chloride, etc., which have a fluxing action, or a cleaning or refining action, or cause a physical or other change in the metal. The solder is afterwards re-melted. For example, a molten tin-lead solder may be dropped into phosphorated oil (85 of oil to 15 of phosphorus) floating on a solution of 1 part of zinc chloride in 99 parts of water, or of 1 part of zinc chloride and 5 parts of potassium cyanide in 94 parts of water. It is stated that the treated alloy, after being re-melted, will solder more effectively than before treatment.—A. S.

Metals and alloys; Treatment of —— for various useful purposes. G. Bryant, London, and C. H. Ivinson, Ilford. Eng. Pat. 1404, Jan. 20, 1909.

METALS or alloys melting at a comparatively low temperature, *e.g.*, below 1100° C., are melted, and dropped, in a finely-divided condition, into a solution or solutions containing reagents which produce physical and chemical changes in, or exert a purifying action on, the metals, which are subsequently re-melted. For example, molten zinc may be dropped into phosphorated oil (15 of phosphorus to 85 of oil) floating on the surface of a solution of 5 parts of potassium bichromate and 1 part of zinc chloride in 94 parts of water, or a solution of 3 parts of potassium cyanide and 1½ parts of ammonium chloride in 95½ parts of water. It is stated that zinc thus treated is very fluid when remelted, and alloys almost instantaneously with molten copper, producing extremely tough brasses free from oxide.—A. S.

Concentrators or apparatus for separating or grading metals, ores and other substances in wet recovery processes. G. L. Whitcombe, Johannesburg, and A. K. Cox, London. Eng. Pat. 1756, Jan. 25, 1909.

THE invention relates to an apparatus of the kind described in Eng. Pat. 13,366 of 1908, (this J., 1909, 28, 1140), in which a horizontal turbine or motor wheel, actuated by the introduction, under pressure, of the material in the form of thin pulp, effects a separation of the lighter from the heavier components; the former are carried up and discharged by a screw conveyor attached to the shaft of the motor wheel, while the latter fall through slits in the base of the apparatus and are eventually discharged by means of pipes. In the improved form, external means are provided for the independent rotation of the motor wheel and the screw conveyor, so that each portion of the apparatus may be adjusted to the speed most suitable for the treatment of the material.—W. E. F. P.

Metalliferous ores or compounds; Treatment of —— by wet processes. H. L. Sulman and H. T. Durant, London. Eng. Pat. 1882, Jan. 26, 1909.

THE patent relates to the treatment of ores in a "Brown" agitator (see Eng. Pat. 18,922 of 1904; this J., 1905, 973), which consists of a tank provided with a central vertical pipe, open at both ends, by means of which circulation of the contents of the tank is effected. Zinc ores are treated by introducing them, together with water, into the agitator, and passing sulphurous acid gas or solution up the central pipe to produce circulation of the mixture and effect solution of the zinc. From the zinc bisulphite solution thus obtained, zinc monosulphite may be precipitated in a similar agitator by passing steam up the central pipe, with or without maintaining a reduced pressure in the apparatus. Also, zinc or copper ores may be treated by passing ammonia gas or solution up the central pipe.
—A. S.

Fumes from zinc-retorts; Means for treating ——. H. E. Howard and G. Hadley, Halesowen. Eng. Pat. 4563, Feb. 24, 1909.

THE apparatus consists of a carbon filter for attachment to the open end of the zinc condenser. The filter is composed of two conical pipes, one within the other, the annular space between them being packed with small broken coke. The larger end of the inner pipe is luted, externally, to the condenser, and, the opposite end of the outer pipe being closed, the fume passes through the inner pipe, and back through the layer of coke before being finally discharged into the air—W. E. F. P.

Copper and copper nickel ores; Treatment of pyritic ——. J. T. Carrick and B. S. Pattison, Johannesburg. Eng. Pat. 13,849, June 12, 1909.

THE crushed ore is digested with excess of hydrochloric acid in order to dissolve the iron and nickel, leaving a porous residue of gangue and cuprous sulphide. If the raw ore contain higher sulphides of the metals, it is partially desulphurised by heating at a low temperature, before being digested with the acid. The residue containing cuprous sulphide is treated with water and sulphuric acid, and agitated with compressed air, and the resulting copper sulphate solution treated by known methods. The residue is conveyed to a dump which is, from time to time, sprinkled with dilute sulphuric acid, in order to recover any copper left therein. The iron and nickel solution produced in the first stage of the process, is rendered strongly ammoniacal, and air is blown through it until the whole of the iron is precipitated. From the solution the nickel is precipitated by means of lime.—A. S.

Nickel and copper; Process of recovering ——, from ores and mattes. A. Chalas, Philadelphia, Pa. U.S. Pat. 947,791, Feb. 1, 1910.

NICKEL-COPPER anodes are produced (by smelting the ore) and then dissolved electrolytically in a diaphragm cell containing a solution of an alkali chloride. The copper is continuously precipitated from the anodic nickel-copper solution by circulation through a filter containing a quantity of the mixed nickel and copper hydroxides from a previous operation. The anodic solution, thus purified, is mixed with the cathodic alkali solution, the resulting precipitate of nickel hydroxide being separated by a second filter. For continuous working, an auxiliary diaphragm cell is provided, in which other nickel-copper anodes are similarly dissolved, the anodic nickel-copper solution being added to the corresponding cathodic liquid in order to produce mixed hydroxides of the metals; this precipitate is separated by a third filter, which is used to replace the first when the latter is filled with copper hydroxide.—W. E. F. P.

Scruff and dross; Reduction of ——. R. S. Wile, Assignor to American Sheet and Tin Plate Co., Pittsburg, Pa. U.S. Pat. 947,723, Jan. 25, 1910.

THE scruff and dross are fed, either alone or in admixture with carbon, into an electric furnace containing a fused neutral bath of non-oxidisable material, the latter having a lower specific gravity than the metal to be recovered, and constituting a high-resistance conductor. A layer of carbon is maintained on the surface of the bath, and provision is made for the condensation and recovery of volatile metals.—W. E. F. P.

Smelting-furnace. J. S. Loder, Assignor to Loder Smelter and Refiner Co., Reno, Nev. U.S. Pat. 948,098, Feb. 1. 1910.

The lower tapering portion of a vertical smelting furnace is water-jacketed, and terminates in an bulge extending inwards. Below the bulge is a closed combustion-chamber, adapted for either solid or gaseous fuel in conjunction with a blast, and provided with a suitable floor for the reception of the molten metal.—W. E. F. P.

Arsenical ores and compounds ; Metallurgical and chemical treatment of ——. The Dewey Ore Reduction Corporation. Fr. Pat. 401,675, May 25, 1909.

Arsenical ores, such as those of the Cobalt District of Canada, are roasted at a very low temperature, which never exceeds 600° C. Part of the arsenic is recovered from the fumes as arsenious oxide, and the remainder, left as metallic arseniates in the roasted ore, is recovered by treatment with a strong solution of caustic soda as soluble sodium arseniate, while the silver, cobalt, and nickel are recovered from the residue by usual means. It is claimed that by this treatment the loss of silver by volatilisation in the fumes is almost entirely avoided. —O. F. H.

Metals from their ores ; Process for the extraction of ——. J. B. de Alzugaray. Fr. Pat. 405,030, July 12, 1909.

The finely divided ores in the unroasted condition are treated with hydrochloric acid or acid chlorides in the presence of an oxidising agent, and the residues with a solvent containing cyanides.—O. F. H.

Slags ; Process for obtaining easily soluble —— in the manufacture of metals by alumino-thermic methods. J. Büchel. Fr. Pat. 405,131, July 16, 1909.

A soluble slag consisting of aluminates of alkali or alkaline-earth metals is obtained by using with the reducing agent a considerable percentage of alkali metal in the form, for example, of an alloy with the aluminium, and pouring the resulting fluid slag on to compounds of alkali or alkaline-earth metals.—O. F. H.

Zinc blende and other metalliferous constituents from ore concentrates and slimes ; Separation of —— by flotation or granulation. E. J. Horwood, Broken Hill, N.S.W. Eng. Pat. 1789, Jan. 25, 1909.

See Fr. Pat. 399,272 of 1909 ; this J., 1909, 942.—T. F. B.

Ore-roasting furnaces ; Rabbles for ——. E. Bracq-Laurent, Lens, and R. Moritz, Wasquehal, France. Eng. Pat. 1791, Jan. 25, 1909. Under Int. Conv., June 3, 1908.

See Fr. Pat. 390,838 of 1908 ; this J., 1908, 1111.—T. F. B.

Copper from its ores and alloys ; Process for the extraction of ——. Soc. Française Electrolytique, Paris. Eng. Pat. 4574, Feb. 24, 1909. Under Int. Conv., Feb. 25, 1908.

See Fr. Pat. 397,483 of 1908 ; this J., 1909, 801.—T. F. B.

Copper and copper-nickel ores ; Treatment of pyritic ——. J. T. Carrick, Johannesburg. U.S. Pat. 947,789, Feb. 1 1910.

See Eng. Pat. 13,849 of 1909 ; preceding.—T. F. B.

Magnesium alloys. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 6993, March 23, 1909.

See Fr. Pat. 401,648 of 1909 ; this J., 1909, 1142.—T. F. B.

Arsenide ores and compounds ; Treatment of ——. F. P. Dewey, Washington, U.S.A. Eng. Pat. 11,073, May 10, 1909.

See Fr. Pat. 404,675 of 1909 ; preceding.—T. F. B.

Aluminium alloys. Soc. Anon. "Le Ferro-Nickel," Paris. Eng. Pat. 18,198, Aug. 6, 1909. Under Int. Conv., Aug. 29, 1908.

See Fr. Pat. 402,450 of 1908 ; this J., 1909, 1205.—T. F. B.

Tantalum ; Purifying ——. E. Weintraub, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 947,983, Feb. 1, 1910.

See Eng. Pat. 24,234 of 1906 ; this J., 1907, 1205.—T. F. B.

Antimony ores ; Process of treating ——. H. L. Herrenschmidt, Paris. U.S. Pat. 948,545, Feb. 8, 1910.

See Fr. Pat. 386,107 of 1907 ; this J., 1908, 756.—T. F. B.

Tin from tin-plate waste ; Apparatus for extracting ——. H. Brandenburg, Kempen on Rhine, Germany. U.S. Pat. 948,679, Feb. 8, 1910.

See Fr. Pat. 386,781 of 1908 ; this J., 1908, 813.—T. F. B.

Ores ; Treatment of —— for the extraction of metals therefrom. H. Rosalt, Paris. U.S. Pat. 948,827, Feb. 8, 1910.

See Fr. Pat. 381,642 of 1906 ; this J., 1908, 231.—T. F. B.

Gas-fired melting furnaces [for glass, metals, etc.]. Eng. Pat. 5549. See VIII.

XI.—ELECTRO-CHEMISTRY.

Diaphragms ; Porous ——, employed in electrolysis. M. Bourgerel. Monit. Scient., 1910, **24**, 73—79.

Bodies, such as ceramic ware, silicates, etc., are not recommended for the construction of diaphragms, in the electrolysis of such substances as sodium chloride, as there is produced on the wall of the diaphragm, in the anode compartment, a secondary negative pole, which, by its action on the diaphragm, results in the formation of sodium silicoaluminate. This is transformed, by the action of chlorine, into an insoluble substance, which is immediately hardened, owing to the rise of temperature resulting from the resistance offered to the passage of the current. Diaphragms constructed of certain cements are recommended as being less costly and more easily constructed. Various porous bodies of this nature, not attacked by caustic soda, may thus be advantageously used.—B. N.

Lime diaphragm ; Production of a firmly adhering ——, on the cathode with the help of protective colloids. E. Müller and M. Buchner. Z. Elektrochem., 1910, **16**, 93—96. (See also this J., 1898, 666, 769 ; 1899, 273, 830.)

The diaphragm which plays so important a part in preventing cathodic reduction in the electrolytic preparation of hypochlorites is generally composed of lime produced by adding a small quantity of calcium chloride to the electrolyte. Under ordinary circumstances the protection rapidly disappears, owing to the poor adherence of the diaphragm to the electrode. Better results are obtained with rough (platinised platinum or carbon) electrodes, but even under these circumstances the reduction amounts to upwards of 10 per cent. The addition of a protective colloid (gelatin, starch, gum arabic or egg-albumin) in small quantity (10 c.c. of 1 per cent. solution of colloid to 160 c.c. of 20 per cent. sodium chloride solution with 5 c.c. of a molar solution of calcium chloride) preserves the structure of the diaphragm and brings the reduction to a minimum. It is also found that calcium hydroxide is better than calcium chloride as a source of lime, since the use of chloride leaves the solution acid, and the diaphragm is not durable in the presence of hypochlorous acid. Wheat starch is superior to gelatin as protective colloid, because the latter gives rise to excessive frothing. The deposit is formed on a carbon cathode as a hard porous crust which is sufficiently strong to be used again in a pure

sodium chloride solution without any addition of calcium salts. Similar protection from cathodic reduction is afforded by adding lime and starch in the electrolysis of alkali bromides and nitrates. In the electrolytic preparation of chlorates, where it is necessary to acidify during the electrolysis, the lime diaphragm is useless, and potassium chromate is necessary (see this J., 1901, 257).
—W. H. P.

Cupric solutions ; Electrolysis of ——. O. Dony-Hénault. Bull. Soc. Chim. Belg., 1910, **24**, 56—83.

The theory of the formation of cuprous sulphate and cuprous oxide during the electrolysis of solutions containing copper, and the reactions of the copper voltameter are discussed, with special reference to the theory of electrolytic reduction (Foerster, Abel, and others, this J., 1909, 208) and that of secondary chemical action (Meyer, this J., 1908, 863). The application of Faraday's law to the quantitative formation of cuprous oxide at the anode shows that at ordinary temperatures, and below about 50 C., that is, at temperatures usually obtaining in the electrolysis of copper salts, the second hypothesis applies, but that electrolytic reduction appears to be the dominant factor at temperatures approaching the boiling point. Luther's method of estimating the cuprous salt by means of permanganate has been compared with that of finding the weight of metal precipitated by displacing the equilibrium, $Cu_2SO_4 \rightarrow Cu + CuSO_4$; the simultaneous application of the two methods leads, in the case of acid solutions, to concordant results, but, with neutral solutions, part of the cuprous oxide is apparently redissolved by the cupric salt ; the "supersaturation" of a solution in cuprous ions, suggested by by Foerster, has been experimentally verified. The order of magnitude found for the equilibrium constant, $\overset{++}{Cu} / (\overset{+}{Cu})^2$, is in agreement with the value given by Luther (this J., 1901, 1119) ; Bodländer's value is incorrect.
—F. Sodn.

Electro-catalysis. D. Alexejew. J. Russ. Phys.-Chem. Ges., 1909, **41**, 1155—1160. Chem. Zentr., 1910, **1**, 403—404.

Electrolytic reduction and oxidation processes may be influenced catalytically either by substances dissolved in the electrolyte, or by the material of the electrodes. The author has studied the electrolytic oxidation of ammonia at a lead peroxide anode in the electrolysis of ammonium sulphate solutions. He found that the ammonia is oxidised to nitrogen and nitrous oxide. Nitric oxide, nitrogen peroxide, nitrite-ions, and nitrate-ions could not be detected. It is suggested that the ammonia is first oxidised by the electrolytic oxygen to hydroxylamine and hyponitrous acid, and that these compounds are further oxidised to nitrogen and nitrous oxide at the anode. In acid solutions the formation of nitrous oxide preponderates, whereas in alkaline solutions, only nitrogen is evolved. Direct experiments showed that solid lead peroxide is capable of decomposing dilute solutions of hydroxylamine, with production of nitrogen and nitrous oxide.—A. S.

Silver ; Note on the electro-chemical equivalent of ——. F. Laporte and P. de la Gorce. Comptes rend., 1910, **150**, 278—280.

Differences between the determinations of this equivalent by different workers are found to be due to very slight impurities in the silver nitrate used. After successive improvements in the purification of the salt, the authors obtained as a mean of many experiments, at the Laboratoire central d'Electricité, 1·11829 mgrm. of silver per coulomb, adopting British units, (compared with 1·11827 obtained by the British National Physical Laboratory).—A. Sbld.

Utilisation of electrolytic chlorine for production of hydrochloric and sulphuric acids. Coppadoro. See VII.

Electrochemical preparation of chloroform. Wäser. *See* XX.

Patents.

Insulating material ; Electric ——. The British Thomson Houston Co., Ltd., London. From General Electric Co., Schenectady, New York, U.S.A. Eng. Pat. 2127, Jan. 28, 1909.

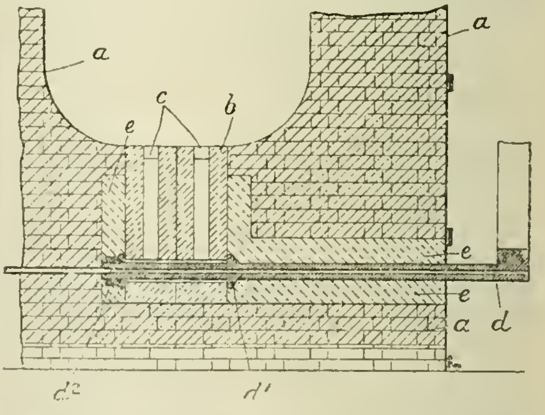
An alkaline-earth hydroxide, such as calcium hydroxide, is mixed with silica, with or without the addition of fibrous material, such as asbestos. The mixture is pressed into the desired shape, and subjected to the action of steam under pressure, the hydroxide being used in excess of the amount required to form a hydrous calcium silicate. The body thus formed may be easily machined, but becomes harder with age. It may be impregnated with rosin oil, linseed oil, stearic acid, etc., and converted into a waterproof material, the free hydroxide combining with the constituents of the oils, acids, etc., to form relatively stable compounds.—B. N.

Electrodes ; Positive —— *for secondary electrical elements with alkaline electrolyte.* Nya Ackumulator Aktiebolaget Jungner, and A. T. K. Estelle, Fliseryd, Sweden. Eng. Pat. 8195, April 5, 1909.

Thirteen parts by weight of nickel hydroxide, "preferably an anhydrohydrate of a high nickel oxide," are mixed with three parts by weight of a conductive substance, such as finely granulated natural graphite. The mixture is compressed, ground, sifted, and formed into bricks after the addition of two parts by weight of cadmium oxide, the latter being previously prepared by subjecting metallic cadmium, as an anode, to electrolysis in an alkaline electrolyte. Finely powdered metallic cadmium may be mixed with the nickel hydroxide and the graphite instead of the oxide, and the mixture is then introduced into suitable perforated sheet metal pockets. The electrode thus formed is subjected, as an anode, to electrolysis in an alkaline solution, the metallic cadmium being thus converted into the oxide.—B. N.

Electrodes ; Electric furnace ——. C. Bingham, London. Eng. Pat. 14,858, June 26, 1909.

The bottom of the furnace, *a*, is fitted with a number of carbon electrodes, *b*, in each of which are formed vertical holes, *c*, communicating with horizontal holes near to the bottom. The tubes, *d*, secured in the horizontal holes by flanges, *d'*, and nuts and washers, *d*², are connected to the bus-bars of the electricity supply system. Both the electrodes and the tubes, *d*, are embedded in broken carbon, *e*. Molten metal is poured into the holes, *c*, so as to form cores in the latter, and flowing round the metal parts of the tubes, *d*, makes good electrical contact between the latter and the carbon electrodes.—B. N.



Electrode. J. W. Stubbs, Assignor to The General Electrolytic Parent Co., Ltd., Middlewich, England. U.S. Pat. 947,358, Jan. 25, 1910.

The electrode consists of two separated, straight, metal conductor-bars, with cross-bars of carbon placed at intervals between them. The carbon bars are spaced apart

by distance pieces, placed on each side of each carbon bar between the conductor-bars, and cast metallic connections are arranged between the conductor and carbon bars.
—B. N.

Battery; Storage ——. W. M. Jackson, Assignor to W. Ferguson, New York. U.S. Pat. 947,238, Jan. 25, 1910.

The battery comprises a vessel containing a fluid electrode, such as mercury, an acid electrolyte, and a second electrode, consisting of an alloy of lead, antimony and bismuth, not decomposable by the electrolyte, made in the form of a frame with receptacles, the latter containing lead peroxide as active material. B. N.

Furnace; Electric ——. J. H. Reid, Newark, N.J. U.S. Pat. 947,849, Feb. 1, 1910.

A quenching tank is arranged below the electrodes, so as to receive the material from the same, and below the surface of the liquid in the tank is arranged an inclined "foraminous" shaker-plate. A current is created on the surface of the liquid over the plate, with the object of carrying off the lighter constituents of the material.—B. N.

Filaments for electric incandescence lamps. Eng. Pat. 4164. *See* IIb.

Arc-light electrode. U.S. Pat. 948,926. *See* IIb.

XII.—FATS; OILS; WAXES.

African palm oil industry; Investigations in connection with the ——. Bull. Imp. Inst., 1910, **7**, 357—394.

The more important results are given of systematic investigations which have been made in British West Africa with respect to: (1) the areas occupied by the oil palm in West Africa which are at present being worked for palm oil and palm kernels; (2) the relative values of the several varieties of oil-palm; (3) the distribution of the different varieties: and (4) the extent to which machinery is being used for the extraction of palm oil and kernels. It is shown that in spite of the crude and wasteful native methods of exploitation, there is an abundant supply of palm-fruits, whilst large areas of oil-palm forest still exist almost untouched. The oil and kernels are extracted mainly by native methods, the machinery now available having been adopted only on a very small scale. Of the several varieties of oil-palm, those yielding thin-shelled nuts give higher yields of oil and kernels than those yielding thick-shelled nuts. For the future development of the industry, the two most promising directions appear to be the more extensive introduction of machinery and the selection of oil-palms giving high yields of oil and kernels.
—A. S.

Fats; Hydrolysis of —— *by means of pancreatic juice. I. and II.* E. F. Terroine. Biochem. Zeits., 1910, **23**, 404—428; 429—462.

The author's experiments, described in detail, show that the hydrolysis of triglycerides by means of pancreatic juice is not affected by the addition of mono- or diglycerides. On the other hand, the products formed in the hydrolysis of a triglyceride (diglycerides, monoglycerides, fatty acids) are progressively more resistant to the further action of the pancreatic juice. The addition of fatty acids (oleic acid) and of soap (sodium oleate) to an oil has a strong restrictive influence upon the hydrolysis, whilst glycerol accelerates the hydrolytic process, especially when the oil has not previously been emulsified. This influence of glycerol is to be attributed to its making the mixtures more homogeneous. This is proved by the facts that it has little or no accelerating influence upon the hydrolysis of dissolved fats, natural emulsions, and solid fats, and that an addition of any viscous substance (*e.g.*, gum tragacanth, gum arabic, egg albumin, sucrose) to a mixture of oil and pancreatic juice causes a similar pronounced acceleration of the hydrolysis. As regards the influence of temperature upon the speed of the reaction, it was found that at 54° C., the hydrolysis was practically nil. At 0° C. hydrolysis was still perceptible, whilst the optimum temperature was 40° C. The hydrolysis of an oil is more affected by alterations in the temperature than is the hydrolysis of ethyl butyrate, or of triacetin. Pancreatic juice is completely deprived of its lipolytic power by being heated for 10 minutes at 65° C., whilst its activity is reduced by 10 minutes' heating at 45° C. The sensitiveness of the enzyme to heat is increased by the presence of bile salts. Under these conditions the lipase is, as a rule, completely destroyed after exposure for 30 minutes to a temperature of 45° C. Pancreatic juice still possesses considerable lipolytic activity after being neutralised. In an acid medium its activity decreases and finally disappears, and the influence of strongly dissociated hydrochloric acid is more rapid than is that of weakly dissociated acetic acid. The optimum concentration for alkali is approximately *N*/150. Hence it is possible that the pancreatic juice is most active lipolytically when it has been partially neutralised by the chyme. The optimum concentration of the alkali is that which promotes the action of the enzyme, and is independent of the physical condition of the substance undergoing hydrolysis. The influence of electrolytes can only be recognised in the case of such compounds as do not alter the reaction of the medium (*i.e.*, the solutions of which are neutral). All salts behave in a similar way, accelerating the enzymic action when present in certain concentrations, and retarding it when present in other concentrations. They differ, however, in the strength of their optimum concentrations. In certain chemical series (fluoride, chloride, bromide, iodide) a regular decrease in the optimum concentration accompanies the decrease in molecular weight. The stimulative influence of bile salts upon the hydrolysis appears to be due to their direct action upon the enzyme. When pancreatic secretion is rendered proteolytically active by the addition of kinase, its lipolytic action rapidly decreases. But in the presence of coagulated egg albumin, the pancreatic secretion containing kinase can follow its normal proteolytic course, and its lipolytic activity is then retained practically intact. (See also this J., 1903, 67, 1094; 1904, 1152; 1909, 149.)—C. A. M.

Ostrich fat; Composition of ——. J. Vamvakas. Ann. Chim. analyt., 1910, **15**, 64—65.

The author has examined a sample of ostrich fat from Bengazie, Barbary, where the natives attribute antirheumatic properties to it. The fat, which is prepared from the bones and fatty portions of the bird, separated into two layers at 28° C. The upper layer of yellow oil had the following characters: sp. gr. at 15° C., 0·9255; critical temperature of solution in alcohol, 70° C.; Maumené test, 48° C.; m.pt., 8° C.; solidifying pt., 2° C.; m. pt. of fatty acids, 49° C.; solidifying pt. of fatty acids, 35·5° C.; oleorefractometer reading, + 23°; Reichert-Meissl value, 7·6; saponification value, 211; Hehner value, 90·37; iodine value (Hübl), 71·12. The lower layer of white fat melted at 45° C., solidified at 31° C., and gave a reading of +30° in the oleorefractometer.—A. S.

Triformin, the simplest fat. P. van Romburgh. Z. physik. Chem., 1910, **70**, 459—461.

By heating glycerol repeatedly with excess of 100 per cent. formic acid, distilling off the excess after each operation, a liquid rich in triformin can be easily obtained. After prolonged cooling of such a liquid in liquefied ammonia, a minute crystal was produced in the viscous mass, and then on gradually warming to 0° C., and stirring with a glass rod, the mass solidified to a crystalline magma. The crystals were separated at 0° C. and after purifying, were obtained in a colourless condition. The pure triformin, thus prepared, melts at 18° C., has the sp. gr. 1·320 at 18° C., and $n_D^{18} = 1·4412$. It can be distilled rapidly without decomposition at atmospheric pressure (b.pt., 266° C. at 762 mm.), but decomposes when heated gradually. It is saponified only slowly by cold water, in which it is practically insoluble: it dissolves in warm water, and can be partly recovered by quickly cooling the solution; on heating the solution it is rapidly hydrolysed. It is readily decomposed by ammonia and aliphatic amines, with formation of formamide or substituted formamides.—A. S.

Myrica wax from Mexico. Olsson-Seffer. Bull. Imp Inst., 1910, 7, 410—411.

The fruits of *Myrica jalapensis*, a tree covering considerable areas in Vera Cruz, Mexico, are covered with a greenish-white layer of wax. The wax, after being refined, has the following characters:—M.pt., 43·2° C.; sp. gr. at 99° C., 0·8763; saponification value, 214·5; iodine value, 2·38; acid value, 4·07. It is thus very similar to Cape-berry wax (see this J., 1907, 263). It is suitable for the manufacture of candles and soap, and it is stated that a small factory, capable of producing about 500 lb. of the wax per day, is now being erected in Mexico.

Candelilla wax from Mexico. Olsson-Seffer. Bull. Imp. Inst. 1910, 7, 410.

"Candelilla wax" (this J., 1909, 717), which occurs as an excretion covering all parts, except the roots, of *Euphorbia antisyphilitica*, has also been examined. It has the following characters:—M.pt. 77·4° C.; sp. gr. at 15° C., 0·9473; saponification value, 104·11; iodine value, 5·23; acid value, 0·03. The wax should be suitable as a substitute for carnaüba wax, and it is stated that its production on a commercial scale in Mexico has been undertaken.—A. S.

Soap solutions; Electrical conductivity of ——. J. W. McBain and M. Taylor. Ber., 1910, 43, 321—322.

The authors' preliminary experiments upon the electrical conductivity of mixtures of palmitic acid and sodium hydroxide have given results which show that, contrary to the views of Krafft (this J., 1896, 601; 1899, 691), normal soaps in concentrated solution are not colloids. In their opinion it is probable that insoluble acid sodium palmitate is the only colloid present in most soap solutions. —C. A. M.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Red lead; physico-chemical and technical studies on —. Milbauer. See X.

Coagulation of Prussian blue. Pappadà. *See* VII.

The finely divided material is carried from the mill by a current of air into a chamber in which is placed a baffle-plate. The coarse particles strike against this plate and are returned to the mill, whilst the fine dust is driven by a fan into a second chamber and thence to a third. In these two latter chambers the fine particles of dust settle and fall through openings at the bottom into suitable receptacles. The air leaves the last chamber through an opening covered with sacking, which retains the remainder of the fine dust.—W. P. S.

Wood; Bath for extracting products from ——. F. Pope, Mount Pleasant, Ga., Assignor to Southern Manufacturing Co., Pittsburg, Pa., U.S. Pat. 947,420, Jan. 25, 1910.

The bath is prepared by mixing together washed wood tar, 80 parts, soft pitch, 10 parts, and pine oil, 10 parts. —W. P. S.

Turpentine-still. B. Hart, Jacksonville, Fla. U.S. Pat. 947,662, Jan. 25, 1910.

The still is provided with a cylindrical strainer which is inserted through a neck or opening at the top; this strainer is supported at its upper end by means of a hook-shaped flange situated at the lower part of the neck. A steam pipe passes down the centre of the strainer, and both strainer and steam pipe may be removed from the still when necessary.—W. P. S.

Linoleum: Manufacture of ——. W. D. and D. L. Snow, Philadelphia, Pa. U. S. Pat. 948,189, Feb. 1, 1910.

A mixture is claimed consisting of oxidised linseed oil, 100 parts; magnesia, 85 parts; and asbestos, 15 parts by weight; kauri gum, rosin, wood-flour, and colouring matter being also added.—W. P. S.

Monoazo dyestuffs especially suitable for preparing lakes. Ger. Pat. 217,277. See IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber exports from Brazil. Board of Trade J., Feb. 10, 1910. [T.R.]

H.M. Consul at Pará has forwarded the following statistics of the exports of rubber, *viá* Pará, during the year 1909:—

	Fine.	Medium.	Coarse.	Caucho.	Total.
	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.
To the United States, from—					
Pará	4,153,518	651,617	4,134,359	715,729	9,655,223
Manaos	5,356,652	1,149,302	1,734,648	1,897,507	10,138,109
Itacoatiara	3,777	2,166	3,877	1,867	11,687
Iquitos	22,798	1,423	8,552	72,920	105,693
Total	9,536,745	1,804,508	5,881,436	2,688,023	19,910,712
To Europe, from—					
Pará	5,277,492	575,743	1,869,178	1,950,409	9,672,822
Manaos	3,672,077	719,842	725,064	2,240,318	7,357,301
Itacoatiara	71,132	10,896	53,298	13,258	148,584
Iquitos	795,933	127,421	325,724	1,401,763	2,650,841
Total	9,816,634	1,433,902	2,973,264	5,605,748	19,829,548
Grand total	19,353,379	3,238,410	8,854,700	8,293,771	39,740,260

Patents.

Printing and lithographic inks; Manufacture of —— [*utilisation of powdered coal, carbon, etc.*]. R. C. Child and J. Johnston, London. Eng. Pat. 8532, April 8, 1909.

A black pigment, suitable for use in printing and lithographic inks, is prepared by grinding coal, jet, shale, retort carbon, or the like, in a centrifugal disc disintegrator.

The total exports of rubber, *viá* Pará in 1908, amounted to 37,686,487 kilos., and in 1907 to 37,514,152 kilos.

Rubber; New Mexican sources of ——. P. Olsson-Seffer. Gummi-Zeit., 1910, 24, 594.

During the last five years a number of hitherto unknown rubber trees and shrubs have been discovered. From some of these plants higher yields can be obtained than from Guayule. Special attention has been devoted to the

Plumeria species—*P. mexicana*, *P. rubra*, and *P. acutifolia*—which occur over wide areas in several parts of Central and Southern Mexico. The latex of these trees is white and creamy, and flows most freely in November, December, and January. The rubber content may be as high as 24 per cent.; 1 lb. 3 oz. of rubber was obtained per tree by the ordinary methods of tapping. *Euphorbia calyculata* ("Vara Leche" or "Chupire") yields large quantities of a very white latex, containing about 21 per cent. of rubber. *Jatropha urens* is very common in the South of Mexico; the product is described as a pseudo-rubber, exhibiting properties of gutta-percha or balata as well as those of rubber.—E. W. L.

Rubber biscuits; Discoloration of ——. T. Petsch. India Rubber J., 1910, **39**, 180.

Bacteria and yeasts appear to be the chief organisms concerned in the "spotting" of rubber biscuits; no effect which can be attributed to the growth of moulds on the rubber has, up to the present, been observed. The organisms must be assumed to be introduced into the latex or the coagulated rubber either by the wind or by the water supply. It is therefore important to adequately sterilise all collecting cups and other vessels periodically, by means of boiling water, and to examine the water supply.—E. W. L.

Rubber; Hard-vulcanised ——. [*Ebonite.*] G. Hübener. Gummi-Zeit., 1910, **24**, 627—629. (See also this J., 1909, 1321.)

Four samples of a rubber mixing containing 30 per cent. of pure rubber, estimated by Budde's bromine method, were vulcanised for (1), seven, (2), eight and a half, (3), nine, and (4), ten hours respectively, under otherwise similar conditions. The vulcanised samples were then submitted to analysis by the method described by the author (this J., 1909, 251, 1321). The following table gives the results obtained:—

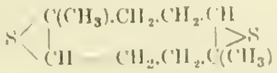
Sample No.	1	2	3	4
	p. cent.	p. cent.	p. cent.	p. cent.
Sulphur of vulcanisation .	3·57	5·01	5·01	4·87
Rubber (from sulphur of vulcanisation)	7·58	10·64	10·64	10·38
Rubber (from combined bromine)	22·95	15·81	15·47	13·94
Total rubber	30·53	26·48	26·11	24·29

Thus with more than 7 hours vulcanisation, the percentage of rubber shown by this method of analysis and calculation becomes considerably lower than that originally present in the mixing, and shown in the sample No. 1.

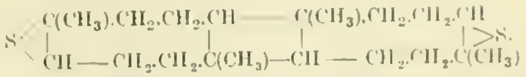
In order to distinguish between the "free" rubber, the "monosulphide," and the "disulphide," the tetrabromide of the "free" rubber was separated from the bromide precipitate by extraction with carbon bisulphide, and the percentages of "monosulphide" and "disulphide" rubber estimated in the manner already described (this J., 1909, 251). This process yielded, in the case of samples 1 and 2, the following results:—

	No. 1.	No. 2.
	per cent.	per cent.
Free rubber	15·05	8·79
"Monosulphide" rubber (calc. from Br)	7·90	7·14
"Monosulphide" rubber (calc. from S)	7·58	7·14
"Disulphide" rubber	nil.	3·51
Total rubber	30·53	26·58
Free sulphur	20·87	19·43
Sulphur in "monosulphide" ..	3·57	3·36
Sulphur in "disulphide"	——	1·65
Total sulphur	24·44	24·44
Total sulphur of vulcanisation	3·57	5·01

The great decrease in the percentage of "free" rubber in the sample No. 2 can best be explained by the supposition that the "disulphide" of rubber is not, as hitherto assumed:—



but:—



On this supposition only can the apparent decrease in the percentage of rubber be explained, and calculating on this assumption, sample No. 2 gives 7·02 (= 2 × 3·51) per cent. of "disulphide" rubber, bringing the total rubber-content up to 26·58 + 3·51 = 30·09 per cent.

These figures are confirmed by others obtained with the same mixing, vulcanised under similar conditions, but consisting of materials having a different origin.

Values for the tensile strength and critical bending stress of the four samples are given. One sample which was vulcanised for 8½ hours, (as was No. 2) showed on analysis no "disulphide" rubber; yet its physical properties were quite similar to those of No. 2. The difference in the progress of vulcanisation in this instance is attributed to differences in the chemical behaviour of the raw rubber, and in the character and method of preparation of the sulphur employed.—E. W. L.

XV.—LEATHER; BONE; HORN; GLUE.

Oil in egg-yolk; Commercial analysis of —— *by means of different solvents.* J. Gordon Parker and M. Paul. Collegium, 1910, 53—57.

The authors give the results obtained in the estimation of oil in preserved egg-yolk by means of different solvents, particularly petroleum ether, chloroform, and carbon tetrachloride. The proportion of phosphorus and nitrogen in the extracted oil was found to be the same in each case, which shows that solution or partial solution of lecithin was not the source of the discordancy of the results obtained. The higher percentage of oil found, using chloroform and carbon tetrachloride, was explained by the solution of moist unsaponifiable products (chiefly soaps of a but slightly alkaline nature) in the yolk by these solvents. Petroleum ether (b. pt. 74°—76° C.) is recommended as the solvent giving results most nearly borne out in practical work.—D. J. L.

Patents.

Leather; Process for the treatment of ——. A. McLennan, London. Eng. Pat. 9870, April 26, 1909.

The process is specially applicable to chrome- and alum-tanned leather. The leather is, in the first place, fat-liquored in the usual manner, dried on frames, and buffed on the flesh side, in order to raise the fibre. It is then treated with a solution of 4 parts of sulphur in 1 part of carbon bisulphide to which is added a solution capable of dissolving fats. A mixture suitable for that purpose consists of ether, benzol, naphtha, benzine (petroleum spirit), paraffin oil and rectified spirit of turpentine. After treatment with this solution, the leather is dried by heat and while still warm, treated with a solution consisting of rubber dissolved in benzine. The goods are heated to 80°—100° F. in this solution, and the period of treatment may extend from 2—5 days, according to the nature of the leather. The leather is next treated in a second bath, consisting of a similar but more concentrated rubber solution, with the addition of sulphur, carbon bisulphide, ether, benzol, naphtha, benzine, and sulphur chloride. As a final treatment the leather is drummed for 12—24 hours in a solution of rubber in benzine with the addition of sulphur chloride. In order to remove surplus rubber, the leather is scraped, and rubbed with a cloth dipped in benzine.—D. J. L.

Tanning; Process of ——. J. M. Brown, Austin, Ark. U.S. Pat. 947,433, Jan. 25, 1910.

Powdered alum is rubbed on the flesh side of hides which have been rendered soft and absorbent, and the hides are rolled and allowed to stand for a sufficient length of time to permit the alum to act. The hides are then immersed in an ooze consisting of *Terra Japonica* (catechu) and water, washed, worked, and oiled.—W. P. S.

Tanning drums. C. J. Glasel, Düren, Germany. Eng. Pat. 7207, March 25, 1909.

See Fr. Pat. 400,940 of 1909; this J., 1909, 1263.—T. F. B.

Filling or stuffing material [from gelatin]; Manufacture of ——. R. J. Caldwell, New Southgate, and F. Pfleumer, London. U.S. Pat. 948,845, Feb. 8, 1910.

See Eng. Pat. 11,300 of 1909: this J., 1909, 1052.—T. F. B.

XVI.—SOILS; FERTILISERS.

Boron; The use of —— *as a catalytic fertiliser.* H. Agulhon. Comptes rend., 1910, **150**, 288—291.

Small quantities of boron (as boric acid) added to culture media or natural soils are found to be beneficial to the higher plants, resulting in an increase in the weight of dry material formed. For maize, rape, and turnips the best proportion was found to be 3 grms. of boric acid per sq. m. of soil; the increase in dry weight in these cases (compared with plants grown under the same conditions without the addition) being 50, 21, and 32 per cent. respectively. For oats and peas this amount of boron is excessive. When the most suitable proportion is used, there is no increase in the percentage of ash nor of the boron contained in it; but with larger doses both are increased and also the amount of moisture in the plant. In agricultural value boron resembles manganese (see this J., 1906, 83). —A. Sbld.

Methods of analysis of potash salts. Roemer. *See* VII.

Patents.

Fertility of land and the growth of crops; Method of, and means for, increasing the ——. T. V. Riordan, London. Eng. Pat. 4051, Feb. 19, 1909.

From 10 to 15 cwt. of powdered lime and from 1 to 1·5 cwt. of coal ashes are spread over the land or drilled in by means of a machine. Over the land thus treated are stretched insulated wires in parallel rows about 80 yards apart and from 6 to 15 ft. above the surface of the land. Wires of finer gauge, about 15 yds. apart, cross the first set of wires. This arrangement of insulated wires is connected by a single wire to an electric generator which supplies positive electricity of high potential, say 100,000 volts or more. The discharge from the wires acts on the atmosphere with the production of "nitrous and nitric oxides," which in the presence of "moisture in the air form nitrous and nitric acid," these being absorbed by the lime and alkaline coal ashes, to form calcium nitrate. The calcium nitrate thus formed, manures the soil.—W.P.S.

XVII.—SUGARS; STARCHES; GUMS.

Sugar factory; Investigation of the Hyros-Rak process in the Schafstaedt ——. A. Herzfeld. Deutsche Zuckerind., 1910, **35**, 157—168.

Two Hyros-Rak batteries (cp. Fr. Pat. 318,451, this J., 1902, 1462; U.S. Pat. 755,546, this J., 1904, 449) are in use at Schafstaedt. Each battery is divided into five diffusers by the compressed mass of slices in the constricted end of each conical vessel. The first diffuser comprises a mashing-in zone, a heating zone, and a zone from which the diffusion juice is finally removed. The fresh slices are mashed in with the juice from the second diffuser, the juice is withdrawn from the heating zone, and, after being heated to a temperature of 80°—90° C., it is returned to the same zone, the temperature of the slices being raised thereby to 70°—75°C. The slices pass through the battery in about 25 minutes. The water introduced into the fifth diffuser is at a temperature of about 60°C.; the top of the diffuser is provided with an adjustable cone, and the slices which leave the battery are expressed to a greater or less degree, according to the position of this cone. The exhausted slices are not subsequently dried. The author gives an account of a week's investigation of the work at the Schafstaedt factory. The results of the investigation are essentially as follows:—The problem of keeping the slices continuously in motion during the extraction of the juice is satisfactorily solved in the Hyros-Rak process. The battery forms a closed system, in the working of which, neither juice nor solid material can be lost. There is no diffusion waste water, and the water expressed from the exhausted slices by the cone at the end of the battery, flows back automatically into the battery. For the working of the battery, it is important that the slices should be kept at temperatures of 65° to (at most) 80°C. If the temperature is kept within proper limits, and the slices are of good quality, the diffusion juice leaving the battery differs from ordinary diffusion juice in that it possesses a somewhat higher content of coagulable substances, whilst the pressed slices contain a very high proportion of dry substance (*e.g.*, 18·94 per cent.), and 1—2 per cent. of sugar. The author considers that it would be advisable to dry the pressed slices. Owing to the fact that the remainder of the plant in the Schafstaedt factory was not large enough to allow of working up the diffusion juice as rapidly as it was obtained from the batteries, it was necessary to stop the battery work from time to time; had it not been necessary to do this, the battery work would have been still more efficient. The resumption of the diffusion work does not present any difficulty.—L. E.

Sugar; Note on the spontaneous crystallisation of —— *in supersaturated solutions.* G. Fouquet. Comptes rend., 1910, **150**, 280—282.

In the author's experiments test tubes fitted with an interior spiral of brass wire, were filled with the solutions and kept for 30 minutes in a glycerin bath heated above the point of saturation; then placed in a bath of hot water which was allowed to cool gradually, the spiral being turned constantly. The temperature was noted at the moment of crystallisation, the exact point being easily observed. Supersaturated solutions of sugar crystallise, with agitation by mechanical friction, at a definite temperature for the particular concentration; a curve of these factors (called the curve of supersolubility) is practically parallel to the solubility-curve. The excess of sugar at the moment of crystallisation remains almost constant. Above that temperature crystallisation only takes place on the addition of some already formed crystals. Experiments in progress indicate that impurities also follow the curve of supersolubility. The author's results with aqueous solutions of pure sugar are given in the following table:—

Sugar per 100 grms. of:		Temperature of:		Sugar per 100 grms. of water in the saturated solution at the temperature of crystallisation.	Sugar in excess per 100 grms. of water at the moment of crystallisation.
Solution.	Water.	Saturatn.	Crystn.		
		°C.	°C.		
78·7	369·4	81·5	31	221·3	148·1
79·8	395·0	86·5	44·2	247·0	148·0
80·8	420·8	91	54·4	271·6	149·2
82·4	468·1	97·5	69·5	318·7	149·4
83·	488·2	100·	75·	339·8	148·3
84·8	557·9		88·5	406·9	150·3
85·1	571·1		92·	428·8	142·3

—A. Sbld.

Carbohydrates ; Phosphoric acid esters of . I. Sucrose-phosphoric acid. C. Neuberg and H. Pollak. Biochem. Zeits., 1710, **23**, 515—517.

On adding a mixture of 77 grms. of phosphorus oxychloride with 250 c.c. of anhydrous chloroform (free from alcohol) to an ice-cold solution of 180 grms. of sucrose in 21 c.c. of water containing in suspension 115 grms. of freshly-ignited calcium oxide, the following reaction takes place :

$$2C_{12}H_{22}O_{11}+2POCl_3+5CaO= \\ 3CaCl_2+H_2O+2C_{12}H_{21}O_{10}O.PO_3Ca.$$

The formation of the monophosphoric acid ester of sucrose requires from three to four hours, and the mixture must be constantly shaken. It is then diluted to twice its volume with water and allowed to stand for some hours, after which it is filtered. The filtrate is treated with carbon dioxide to precipitate the calcium oxide, and the liquid again filtered and evaporated *in vacuo*. The concentrated solution is now added drop by drop to about five times its volume of absolute alcohol. The mixture of calcium chloride and calcium sucrose-phosphate thus precipitated is repeatedly dissolved in water and poured into alcohol to remove the former salt, and finally pure calcium sucrose-phosphate is obtained, the yield being about one-third of the weight of sucrose taken. It contains two molecules of water, at 90°C., and is a fine white powder which is stable in the air and readily soluble in water. The solution gives no precipitate with salts of silver, copper or other heavy metals, but is precipitated to a considerable extent by lead acetate and ammonia. Sucrose-phosphoric acid gives no precipitate with magnesia mixture or with ammonium molybdate, unless it has been previously heated with dilute mineral acid. When hydrolysed with hydrochloric or sulphuric acid it becomes dark owing to the formation of humic compounds. This coloration is prevented by the addition of a few drops of nitric acid. The ester does not reduce Fehling's solution, and is quite unfermentable, but when decomposed with hydrochloric acid, the solution, when neutralised with sodium hydroxide, becomes fermentable.
—C. A. M.

Honey ; The enzymes occurring in ——. A. Auzinger. Z. Unters. Nahr. Genussm., 1910, **19**, 65—83.

Methods are given for detecting the presence, or absence, of such enzymes as catalase, diastase, oxydase, peroxydase, and reductase, in honey, and it is shown that the information obtained on applying the tests to a sample is of use in judging the genuineness of the honey. Honey which has not been heated above 50° C. during its preparation contains catalase, which is capable of liberating oxygen from hydrogen peroxide when a solution of the honey is treated with this reagent, an appreciable volume of the gas being formed after the mixture has been kept at the ordinary temperature for about 24 hours. The water employed for diluting the honey must have been recently boiled and cooled. Whilst the liberation of oxygen in this test does not definitely show that the honey is genuine, as the sample under examination might be a mixture, the absence of an enzyme which acts on hydrogen peroxide is a reason for suspicion. Diastase may be detected by mixing the honey with 1 per cent. starch solution and keeping the mixture at a temperature of 45°C. for one hour. Iodine solution is then added, and, if diastase be absent, a deep blue coloration will be obtained ; should diastase be present, all the starch is hydrolysed, and the colour of the solution will be yellow. In almost every case where a blue coloration was obtained, it was noticed that the colour soon faded. The *p*-phenylenediamine hydrogen peroxide test for peroxydase does not differentiate ordinary honey from heated honey as both give a reaction, but in the case of natural honey the coloration soon fades, whilst that yielded by heated honey is fairly permanent. Invert sugar gives a red-brown coloration with this test.
—W. P. S.

Patents.

Syrups ; Apparatus for treating in the manufacture of confectionery. E. Shaw, Dartford Heath, Kent. Eng. Pat. 20,766, Oct. 2, 1908.

The syrup is forced through an externally heated tube or series of tubes. Each tube contains a worm extending nearly, but not quite, to the inner surface of the tube, and the area of the spiral passage thus formed, is increased from tube to tube, either by increasing the diameters of the successive tubes, or by increasing the pitch of the worms or spirals in successive tubes, or by both methods. The syrup is forced through the tubes by a pump driven by means of a lever which is moved by a motor a certain definite amount at each stroke. The lever is connected to the pump through a lost motion device capable of regulation, one end of the lever extending between two nuts on right and left hand screwed portions of the pump plunger or a rod connected thereto. The syrup is discharged from the last tube of the series into a chamber wherein separation of the steam from the boiled product is effected. The boiled product is delivered from the chamber by a hollow plunger actuated by steam, the supply and exhaust of which are controlled by a valve operated mechanically. The plunger is guided on a piston formed in one with, or fixed to, a fixed piston rod formed with passages for the supply and exhaust of steam to and from cylindrical spaces within the plunger above and below the piston. The plunger is fitted with a tubular sleeve that surrounds the piston rod, this rod being formed with small holes communicating with the steam passages in such positions that steam therefrom passes into the space between the piston and the sleeve, and thus prevents liquid remaining on the metal surface of the piston rod.—L. E.

Sugar juices, and the like ; Process for the decolorisation of —— by electrolytic reduction. S. Kugler. Ger. Pat. 217,461, Dec. 19, 1907.

The patent relates to the decolorisation of sugar juice, etc., by electrolytic reduction, the cathode being placed in the juice and the anode in an alkaline electrolyte separated from the juice by a diaphragm. The electrolytic cells are arranged in frames similar to those of a filter-press, each frame being provided with inlet and outlet channels for the juice and for the alkaline electrolyte, these channels communicating with inlet and outlet mains for the juice and for the electrolyte respectively.—A. S.

Bone-black kiln. U.S. Pat. 940,520. *See* I.

XVIII.—FERMENTATION INDUSTRIES.

Oxydases from vegetable extracts ; Method for rapid preparation of ——. A. Bach. Ber., 1910, **43**, 362—363.

The purification of active enzyme preparations from certain fresh plant juices is a laborious process on account of the presence of slimy bodies which can only be removed by repeatedly precipitating with alcohol, drying, and redissolving in water. The author has found that the addition of 5—10 per cent. of magnesium sulphate to the liquid so modifies the condition of these bodies that they may be completely precipitated by a relatively small proportion of alcohol, and the various active constituents may then be separated from the filtrate by fractional precipitation with alcohol. For instance, 400 c.c. of juice from *Russula delica* were treated with 20 grms. of magnesium sulphate and 200 c.c. of alcohol. After standing for 15 minutes in a freezing mixture, a black flocculent precipitate was formed which was readily filtered off with the aid of the pump, giving a perfectly clear filtrate for the subsequent fractionation. The oxydases were obtained in the form of precipitates, together with crystals of magnesium sulphate, on the further addition of alcohol in stages, corresponding with the presence of 48, 56, 70, 75, and 78 per cent. of alcohol respectively in the liquid. The first, black precipitate and the last crystalline fraction were practically free from oxydases, the main quantities of which were concentrated in the fourth and fifth fractions. The latter was particularly rich in tyrosinase, whilst the phenolase was mainly present in the earlier fractions. The whole operation of fractionation can be completed in 3—4 hours and only requires 3—4 volumes of alcohol, equal to the quantity which is necessary for the first precipitation by the older method. The various fractions may be purified from the magnesium sulphate by dialysis in running water. The author has also used this method with advantage for the preparation of ferments from extracts of the white beet and certain animal organs. —J. F. B.

Oxydase action; The theory of ——. I. Oxydases free from manganese and iron. A. Bach. Ber., 1910, **43**, 364—366.

IN recent years, facts have been observed which are not in accordance with Bertrand's theory that the action of oxydase ferments is dependent on the presence of small quantities of manganese in the active preparations. In several cases active oxydase preparations have been obtained which have not contained a trace of manganese, but so far, it has scarcely been possible to prepare oxydases free from the closely allied metal, iron. By the improved method of purification described in the preceding abstract, the author has now succeeded in freeing his oxydase preparations completely from both manganese and iron. The experiments were carried out on a juice obtained from a mixture of the two fungi, *Lactarius vellereus* and *Russula delica*. The most active fractions obtained by the method described were free from manganese but contained iron. These fractions were united and again split up into three fractions with alcohol at 50, 70, and 75 per cent. concentrations respectively. The last of these was the most active: it yielded 36·9 per cent. of perfectly white ash, which showed not the slightest reaction for iron with ferrocyanide: the second fraction showed a faint but distinct reaction. Thus it is concluded that neither manganese nor iron is an essential constituent of an active oxydase, and that the author's peroxide theory is established. On the other hand, it is not contended that metallic compounds are incapable of contributing materially to the ultimate effect of oxydasic action, but their influence is confined to the further modification of the primary products and is only indirectly favourable (see next abstract).—J. F. B.

Oxydase action; The theory of ——. II. Influence of metallic salts on the further modification of the products. A. Bach. Ber., 1910, **43**, 366—370.

THE oxidation of tyrosine by tyrosinase takes place in two stages, the first product being red and the second black. In the case of oxydases poor in manganese, the transition from the red to the black is very slow, but it may be accelerated by the addition of certain metallic salts. Among these metallic accelerators the author finds salts of aluminium to be the most active. If a few drops of a 1 per cent. solution of aluminium sulphate be added to a solution of tyrosine which has been oxidised to the red stage by tyrosinase, the red product rapidly passes over into the black. Yet aluminium sulphate has no action on the original tyrosine, either alone or in presence of hydrogen peroxide or of peroxydase. Aluminium salts have a similar action on the primary yellow oxidation product of pyrogallol, in whatever manner this product may have been formed, but it has no accelerating influence during the first phase of the oxidation of pyrogallol. Other metallic salts have a similar but weaker action, but in the further oxidation of the primary oxidation product of quinol manganese salts are more active than those of aluminium. This secondary influence of metallic salts is attributed to the disturbance of the equilibrium which tends to be established between the primary oxidising agent and the substratum by the formation of the first oxidation product. The oxydasic oxidation of phenols consists of a catalytic acceleration of ordinary atmospheric oxidation, and takes place in two phases. An oxydase is composed of an active system of oxygenase and peroxydase, the oxygenase combining with atmospheric oxygen and producing a peroxide, whilst the peroxydase transfers the active oxygen of the peroxide to the substratum. In such a system, the oxygenase may be replaced by a peroxide or by a readily oxidisable substance equivalent to a peroxide (ether, aldehyde, terpenes), whilst the peroxydase may be replaced by a metallic salt. This general rule does not apply to tyrosinase. Tyrosine cannot be oxidised to the red stage by hydrogen peroxide or other peroxide-equivalent; tyrosinase appears to contain a specific oxygenase which alone can form with atmosphere oxygen the peroxide body capable of oxidising tyrosine to the red stage. Further, the action of metallic salts of accelerating the change of the red body into the black is not possessed by ordinary peroxydase. The catalytic system, tyrosinase = specific oxygenase + metallic salt, is therefore not an interchangeable one on the lines indicated above in the case of the phenoloxydases. Similar restrictions seem to apply also to alcohol-oxydase and the purine-oxydases. —J. F. B.

Cellase; New observations on the individuality of ——. G. Bertrand and M. Holderer. Comptes rend., 1910, **150**, 220—232. (See also this J., 1910, 102.)

THE authors have established the existence in *Aspergillus niger*, and also in almonds, apricot kernels, and barley grains, of a specific enzyme which resolves cellose into two molecules of dextrose. A comparison of the filtering properties of cellase in different media (see Holderer, this J., 1910, 103) with those of emulsin under similar conditions, shows that the two enzymes are quite distinct. Further, cellase cannot be identical with trehalase, for an extract of apricot kernels brings about the fission of cellose, but is without action on trehalose.—W. H. P.

Malt enzymes; Influence of the reaction of the medium on the filtration of some ——. M. Holderer. Comptes rend., 1910, **150**, 285—287.

THE author previously found that when a maceration of *Aspergillus niger* is made neutral to phenolphthalein, its sucrase passes entirely through porcelain filters, but when made neutral to methyl orange, the sucrase is completely retained by the filter; also that the same rule applied to emulsin, cellase, and maltase. This is now found to be equally the case with enzymes of malt, amylase, dextrinase, and peroxydase, and would appear therefore to be a general law; but experience is needed with those enzymes which, under the influence of the electric current, pass to the cathode. This question is being studied further.—A. SELD.

Original gravity of beer; Calculation of the ——. F. Schönfeld. Woch. f. Brau., 1910, **27**, 57—63.

IN the calculation of the original gravity of beer, the data of Balling are generally accepted, although literature contains many evidences of their being only approximately correct. The author has revised the subject, bringing data obtained from the analysis of nineteen 12 per cent. worts fermented with medium and highly attenuative bottom-yeasts. From these he finds the quotient of fermentation is 1·243 as against 1·232 given by Balling for worts of about 12 per cent. Taking the formula,

$$p\left(\frac{n-m}{q-l}\right)+n$$

where $p=$ original gravity, $n=$ residual gravity in the beer, $m=$ apparent gravity in the beer, and q is the quotient as given above, the new value of q gives for the 19 beers an average original extract of 12·08 instead of 12·38 given by Balling's figure. The real value was 12·07. Taking the other formula in use, $p=\left(\frac{2{\cdot}0665A+n}{100+1{\cdot}0665A}\right)100$, where $A=$ alcohol per cent., and $n=$ residual extract per cent., the original gravity becomes 12·17 or 0·1 per cent. higher than the truth. It is shown that in the calculation of this formula, the allowance made for extract removed by yeast multiplication is not in accordance with practical conditions and the formula has to be modified to $p=\frac{2{\cdot}0145A+n}{1{\cdot}0145A+100}100$. With this formula the extract is calculated to be 12·02 per cent., or 0·05 too low. The author regards the loss of alcohol during fermentation as negligible at the temperature and in the dilutions in which it occurs during bottom fermentation.—R. L. S.

Wine ; Action of the ultra-violet rays on fermenting ——. Maurain and Warcollier. Comptes rend., 1910, **150**, 343—344.

The authors have previously found that the fermentation of cider is arrested by exposure, in thin layers, to the ultra-violet rays from a mercury vapour lamp of quartz (this J., 1909, 900). When white sparkling wine (ready for clearing) in layers of 0·25 mm. thickness, between a plate of quartz, 5 mm. thick, and a glass plate, is exposed to the rays (the quartz plate being placed about 4 cm. from the lamp), fermentation is always arrested in about 10 seconds, though never in less than 5 seconds. In layers of 1·7 mm., sterilisation is always effected in about a minute, but never in less than 30 seconds. White wine is, therefore, much more readily sterilised than cider, owing, it is stated, to its greater transparency to the rays.—A. Sbld.

Phosphoric acid esters of carbohydrates. I. Sucrose-phosphoric acid. Neuberg and Pollak. *See* XVII.

Patents.

Air [in breweries] : Apparatus and materials for purifying ——. L. B. Lilley, Douglas, Isle of Man. Eng. Pat. 2514, Feb. 2, 1909.

The apparatus is essentially a filter for purifying the air in breweries and other places where pure air is required. It consists of a cylindrical tower provided with numerous transverse perforated partitions. The latter are only perforated for a part of their width and are so arranged that the perforations are not opposite one another, the air being thus caused to take a circuitous course through the tower. Layers of cotton wool are placed between the lower partitions, whilst the upper partitions, as well as the sides of the tower, are coated with coal tar which has been oxygenated. The air is blown by means of a fan into the bottom of the tower and leaves the latter at the top. Doors are provided at one side of the tower, so that the partition plates and filtering materials may be renewed. —W. P. S.

Fermentation, clarification, and drawing off apparatus for effervescing liquids under constant gas pressure. E. Charmat, Paris. Eng. Pat. 2202, Jan. 29, 1909. Under Int. Conv., Feb. 1, 1908.

See U.S. Pat. 927,944 of 1909 ; this J., 1909, 901.—T.F.B.

XIXa—FOODS.

Milk ; Reactions due to the colloidal state of unboiled ——. F. Bordas and Touplain. Comptes rend., 1910, **150**, 341—343.

The decomposition of hydrogen peroxide by unboiled milk is stated to be a catalytic phenomenon caused by the colloidal nature of milk. To prove this, milk was heated at 85° C., until it no longer gave any coloration with the usual reagents, then it was forced in a very fine jet, by a pressure of 300 atmospheres, against an agate plate, to reduce the casein to such fineness that it kept in suspension again, and finally it was heated to 110° C. Milk, thus treated, decomposed hydrogen peroxide and gave a blue colour with Storch's reagent, which cannot be ascribed to peroxidising enzymes in the milk. Oxalate and lactate of iron and colloidal clay (prepared by Schloesing's method) are also stated to decompose hydrogen peroxide and to give all the colour reactions ascribed to the enzymes of unboiled milk.—A. Sbld.

Egg albumin ; Composition of the products of alkaline hydrolysis of crystallised ——. N. Gupta. Monatsh. Chem., 1909, **30**, 767—771.

The three substances isolated by Skraup and Hummelberger (this J., 1909, 436) from egg albumin by alkaline hydrolysis have been again prepared by the author from crystallised material and their composition, compared with that of albumin, is shown in the following table :—

	Albumin.	Protalbinic acid.	Lysalbinic acid.	Lysalbinpeptone.
Carbon	52·71	55·4	52·9	46·2
Hydrogen	7·20	7·2	7·0	6·6
Nitrogen	15·30	14·3	14·9	10·3
Sulphur	1·46	2·4	1·2	11·9

—J. C. C.

Ripening [of fruits] ; Stimulation of premature —— *by chemical means.* A. E. Vinson. J. Amer. Chem. Soc., 1910, **32**, 208—212.

Artificial ripening of persimmons, dates and other fruits has been practiced for many years, dates being covered with cloths moistened with vinegar for this purpose, and the author gives the results of numerous experiments in which the ripening effect on dates of a large number of substances has been observed. The dates were subjected to atmospheres containing volatile substances and to actual contact with solutions of salts, acids, etc. From the results obtained it is concluded that the apparent stimulation of ripening effected by many of the chemicals employed depends solely on the killing of the protoplasm. Broadly speaking, any substance which will penetrate the cuticle and kill or stimulate the protoplasm, thereby releasing the previously insoluble intracellular enzymes without rendering them inactive, will bring about ripening, provided the fruits have reached a certain necessary degree of maturity. The effect of stimulation by heat becomes plainly manifest only after the lapse of several days, whilst ripening by chemicals is effected in about 12 hours. If dates are heated sufficiently to destroy protoplasm (from 60° to 75°C.) but not enzymes, the ripening phenomena will follow quite completely, whilst at higher temperatures all ripening ceases. Artificially ripened dates do not sour so readily as the fruit which has ripened on the tree, and from this point of view the subject has considerable commercial importance.—W. P. S.

Ferments occurring in honey. Auzinger. *See* XVII.

Patents.

Flour [from maize] for making bread or the like and process for producing the same. L. H. Rittman, London. From C. Herendeen, Chicago, U.S.A. Eng. Pat. 1444, Jan. 20, 1909.

Maize grains are heated by means of steam until the starch cells burst, and are then passed between cold rollers so as to obtain a flaked product. The latter is dried thoroughly and ground. The flour thus obtained is added in varying proportions to wheat flours, it being claimed that the bread made from these mixtures retains its moisture and freshness longer than does bread made from plain wheat flour.—W. P. S.

Baking powders ; Manufacture of ——. G. W. Johnson, London. From Chemische Fabrik vorm. Goldenberg, Geromont und Co., Winkel-on-the-Rhine, Germany. Eng. Pat. 9682, April 23, 1909.

Ammonium acid tartrate, or anhydrous sodium acid tartrate, or a mixture of the two is employed as the acid ingredient of the baking powder.—W. P. S.

Caffeine-free coffee. R. Hübner, Assignor to F. Schwyzer, New York. U.S. Pat. 947,577, Jan. 25, 1910.

Coffee beans are spread out in shallow layers and subjected to the action of water at a temperature of 15°C. until partial germination has taken place ; the beans are then washed with water at a higher temperature so as to remove the greater portion of the caffeine and the other soluble constituents.—W. P. S.

XIXB—WATER PURIFICATION ; SANITATION.

Carbonic acid [in water, etc.]; Volumetric method for the determination of ——. A. Vesterberg. Z. physik. Chem., 1910, **70**, 551—568.

The author has found that carbonic acid can be determined simply and rapidly by a reversal of Winkler's well-known method for the determination of alkali hydroxide in presence of alkali carbonate. The method consists essentially in decomposing the carbonate with acid, absorbing the carbonate in excess of standardised baryta water containing barium chloride, and titrating the excess of baryta with hydrochloric acid in presence of phenolphthalein. It is advantageous to effect the absorption of the carbon dioxide *in vacuo*. The decomposition flask is provided with a tap-funnel and is connected with a glass bottle containing the solution of barium hydroxide and barium chloride, the bottle being in turn connected with a suction pump. A current of air free from carbon dioxide is first drawn through the apparatus, which is afterwards evacuated. Then, after closing the connection with the pump, the requisite quantity of acid is introduced into the decomposition flask containing the carbonate, and the carbon dioxide evolved driven over by gently boiling the contents of the flask. The tap on the inlet-tube of the absorption-bottle is then closed, the decomposition flask is disconnected, and after the baryta solution has been allowed to stand until it commences to clear, it is titrated with hydrochloric acid. Determinations with different samples of distilled water, the baryta and barium chloride solution being added directly to the water, showed that this frequently contains considerable quantities of dissolved carbon dioxide. The application of the titration method to the determination of the "free and half-bound carbonic acid" in water is described. The baryta and barium chloride solutions are added directly to the water, and in order to obtain a sharp end-point in the subsequent titration, a considerable quantity of cane sugar is dissolved in the barium chloride solution. Without this precaution the precipitated magnesium hydroxide is soon converted into a relatively inactive form, which reacts only slowly with the hydrochloric acid in the subsequent titration. It is also pointed out that the method in which the water is boiled to decompose calcium and magnesium bicarbonates, and then after filtering, the "permanent" hardness determined, is inaccurate, since calcium and magnesium carbonates are appreciably soluble in water. By boiling the water with calcium chloride, however, the calcium carbonate is precipitated quantitatively, and the magnesium carbonate is converted into calcium carbonate. Hence, by filtering, dissolving the precipitate in excess of hydrochloric acid, boiling to expel carbon dioxide, and then titrating the excess of acid with baryta in presence of phenolphthalein, the "carbonate hardness" of a water can readily be determined.—A. S.

Disinfection by the gases formed in the incomplete combustion of straw. A. Trillat. Comptes rend., 1910, **150**, 339—341.

The author has previously shown that the smoke of ordinary fuels and from burning saccharine substances contains formaldehyde in addition to various polyphenols, etc., and that burning sugar can be utilised as a simple disinfectant (this J., 1904, 744; 1905, 453, 901). The gases from burning straw are found to contain more or less polymerised formaldehyde in quantity varying from 200 mgrms. to 2 grms. per kilo. of straw, according to the conditions observed. The best disinfecting results are obtained by placing dry and damp layers of straw alternately. An experiment made by burning 18 kilos. of straw in a room of 140 cb. m. content (during which the temperature of the space rose to 35° C.), showed that *Bacillus coli* and the diphtheria bacillus were destroyed after contact with the smoke for 12 hours. For more resistant germs, the fumigating must be repeated. This is recommended as a simple mode of disinfecting sewers, tunnels, stables, etc.—A. Sbld.

Patent.

Water; Apparatus for the purification of ——. J. P. Lajoie, Taverny, France. U.S. Pat. 948,785, Feb. 8, 1910.

See Fr. Pat. 383,266 of 1907: this J., 1908, 351.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Angostura alkaloids. J. Tröger and O. Müller. Arch. Pharm., 1910, **248**, 1—22.

By treating the ethereal extract of Angostura bark with dilute acetic acid, the following alkaloids were isolated:—cusparine, galipine, and a base melting at 233° C. After exhausting the ethereal extract with acetic acid, it was shaken out with dilute sulphuric acid, when cuspareine, m. pt. 54°—55° C., was obtained. Galipine, which contains three methoxyl groups, was oxidised by means of potassium bichromate and sulphuric acid. It yielded veratric and anisic acids, together with small quantities of an amine, and an acid containing nitrogen, which melted at 241°—247° C. When galipine sulphate was oxidised in a neutral solution with permanganate, traces of veratric acid were found, also an acid, $C_8H_7NO_6$, melting at 244°—246° C., and an acid containing nitrogen melting at 262°—264° C. Galipidine, when subjected to oxidation with potassium bichromate and sulphuric acid, yielded two aromatic acids, one of which was possibly veratric acid, a base melting at 138° C., a liquid smelling like pyridine, and formic acid.—F. Shdn.

Corydalis solida; Alkaloids of ——. G. Heyl. Apoth.-Zeit., 1910, **25**, 36—37.

O. Haars (this J., 1905, 634) has previously isolated bulbocapnine from the herbaceous portion of the plant. The tubers, which do not appear to have been examined previously, are now shown to contain protopine m. pt. 207° C., also two other alkaloids, one melting at 145° C. and the other at 132°—133° C.—J. O. B.

Hordenine, an alkaloid from barley; Synthesis of —— and (a)-p-hydroxyphenylethylamine. K. W. Rosenmund. Ber., 1910, **43**, 306—313.

p-Methoxyphenylethylamine (see this J., 1910, 108) when methylated with the calculated quantity of methyl iodide, yields a mixture of primary, secondary, tertiary, and quarternary bases, the last-named preponderating. If the liquid portion of the reaction-product, consisting of the primary, secondary and tertiary bases, be heated with acetic anhydride, the two first-named are acetylated and can then be readily separated from the tertiary base. The latter, which is the methyl ether of hordenine, can be converted into the alkaloid by heating with hydriodic acid. The synthesis whilst only giving poor yields of hordenine itself, is very suitable for the preparation of derivatives of hordenine, especially hordenine iodomethylate, which can be obtained almost quantitatively from *p*-methoxyphenylethylamine, and should possess a physiological action similar to that of adrenaline. Whereas (β)-*p*-methoxyphenylethylamine, $CH_3O.C_6H_4.CH_2.CH_2.NH_2$, when heated with hydriodic acid is smoothly de-methylated, (*a*)-*p*-methoxyphenylethylamine, $CH_3O.C_6H_4.CH(NH_2).CH_3$, yields a mixture of products, from which however a small quantity of a crystalline base, m. pt. 120°—121° C., probably the (*a*)-*p*-hydroxy-compound, was isolated.—A. S.

Alkaloid in the seeds of Lunaria biennis; Presence of an ——. E. Hairs. Bull. Acad. roy. Belg., Classe des sci., 1909, 1042—1048. Chem. Zentr., 1910, **1**, 456.

The seeds were freed from fat by extraction with petroleum spirit, and then extracted with boiling alcohol. From the extract, about 1 per cent. of a crystalline alkaloid was isolated in white needles, melting at about 220° C. It is almost insoluble in water, but easily soluble in acids and in chloroform.—A. S.

Solanaceæ; Influence of culture on the yield of alkaloids from some ——. J. Chevalier. Comptes rend., 1910, **150**, 344—346.

Medicinal plants, cultivated commercially, are stated to be poorer in active principles than those gathered wild, and this is found to be due to the want of rational culture. In the cultivation of belladonna, the use of phosphatic and potash manures added very little to the yield of alkaloid, but nitrogenous manures and especially a mixture of nitrates and ordinary manure gave very good results: the yield of total alkaloid increased from 0·366 grm. to 0·676—0·756 grm. per 100 grms. of dried leaves. Similar results were obtained with henbane and *Datura Stramonium* (a variety with thornless capsules): the former yielded 0·286 grm. of total alkaloid per 100 grms. of dried leaves, compared with 0·070—0·180 grm., and the latter gave 0·200 grm. in place of 0·100—0·125 grm. The soils used in the experiments were fairly permeable, rather rich in lime (3·22—4·80 per cent.), and contained 0·07 per cent. of phosphoric acid.—A. Sbld.

Hydrocyanic acid in Sambucus nigra. C. Ravenna and M. Tonegutti. Staz. sperim. agrar. ital., **42**. 855—879. Chem. Zentr., 1910, **1**, 544—545.

The authors state that the enzyme which decomposes the glucoside, sambunigrin, in the common elder, is not soluble in water. The hydrocyanic acid is contained in the plant in the form of the glucoside and is present in larger quantities than has hitherto been believed. The portions richest in hydrocyanic acid are the stalks. (See also this J., 1905, 857, 939, 1123.)—A. S.

Gentian root; Effect of drying on the composition of ——. Preparation of gentiopicrin. E. Bourquelot and M. Bridel. J. Pharm. Chim., 1910, **1**, 156—162.

For pharmaceutical purposes, gentian root is dried for 8 or 10 days, then put in vessels, when a certain amount of heating takes place, accompanied by fermentation. The authors have compared the amounts of reducing sugars produced by the action of emulsin and invertase on extracts of samples of gentian root dried as above, and of samples dried entirely in the air or at 35° C. They find that a much larger proportion of reducing sugar is obtained from air-dried gentian than from the official gentian powder. In order to obtain the best yield of gentiopicrin, air-dried gentian root should be used. The root can be extracted in a Soxhlet apparatus with ethyl acetate. Or the root may be extracted with hot alcohol, the alcohol distilled off, and the residue extracted with boiling ethyl acetate containing a little water. A yield of 3·5 per cent. was obtained in this way. Gentiopicrin has $[\alpha]_D = 196{\cdot}3°$.—F. Shdn.

Arbutin and methylarbutin; Characters of ——. E. Bourquelot and A. Fichtenholz. J. Pharm. Chim., 1910, **1**, 62—66, 104—109.

Arbutin has probably never been obtained pure; it has always been contaminated with methylarbutin. When it is hydrolysed, the quinol formed, as well as the dextrose, exercise a reducing action on Fehling's solution. The equivalents of copper precipitated by given weights of quinol have now been determined, and are found to increase with the concentration of the solution. Methylquinol, the corresponding product of hydrolysis of methylarbutin does not reduce Fehling's solution. Arbutin solutions give, as indicated by Schiff, a fine blue colour reaction with very dilute ferric chloride reagent. Methylarbutin gives no colour, but its product of hydrolysis, methylquinol, does. Arbutin gives a fine blue tint with Jungmann's reagent (1 grm. of sodium phosphomolybdate dissolved in 10 c.c. of strong hydrochloric acid, and 20 c.c. of water). To a solution of arbutin 6 to 8 drops of this are added, followed by the same quantity of ammonia solution. Methylarbutin does not react with this reagent but methylquinol does. When arbutin is submitted to the action of emulsin, the liquid, after the second day, becomes pink, and gradually darker, until it is yellowish-brown. Under similar conditions, the product of hydrolysis of methylarbutin by emulsin, provided it be pure, will remain colourless for a month. If to the two emulsin fermentation liquids, a few drops of the oxydase ferment of *Russula delica* be added, before the arbutin has begun to change colour, a pink to deep brown-red colour appears in the arbutin solution in a few hours, whereas the methylarbutin solution, will be only greyish-white to chamois-coloured after 48 hours. Hydrolysis of methylarbutin with emulsin proceeds much more rapidly than with arbutin. By comparing the weight of copper precipitated by the products of hydrolysis of mixtures of arbutin and methylarbutin with the observed optical deviations before and after fermentation with emulsin, an approximation of the quantities of the two glucosides present may be calculated.—J. O. B.

Essential oils of the Pharmacopœia. C. A. Hill and J. C. Umney. Pharm. J., 1910, **84**, 177—181.

The authors having examined a number of essential oils during recent years, have drawn monographs of certain oils with a view to their inclusion in the next Pharmacopœia. The authors consider that the proportion of medicinal or odorous constituent in essential oils should be defined where possible. The following quantitative determinations are proposed:—Cineol in cajuput and eucalyptus oils; phenols in clove, pimento, and thyme oils; esters in lavender and pine oils; alcohols in peppermint, rosemary, and santal oils; citral in lemon oil; allyl *iso*thiocyanate in oil of mustard. Cinnamic aldehyde should be determined by the neutral sulphite method in place of the acid sulphite method. It is suggested that the oil of *Pinus sibirica* should be substituted for that of *Pinus pumilio*. The two important points to be borne in mind in drawing up a monograph are: (1), that the oil should possess the maximum therapeutic value; and (2), that normal and natural distillates should be included. Monographs of oils from the following sources are given:—Dill, anise, chamomile, cajuput, caraway, cloves, cinnamon, copaiba, coriander, cubebs, eucalyptus, juniper, lavender, lemon, peppermint, spearmint, nutmeg, pimento, pine (from fresh leaves of *Pinus sibirica*), rose, rosemary, sandal wood, and mustard (volatile oil of mustard), and rectified oil of turpentine. The inclusion of the following oils is under the consideration of the General Medical Council, and the authors' monographs are given:—Orange, gaultheria, sweet birch, fennel, and thyme. Descriptions of proposed saponification and acetylation processes are also given.—F. Shdn.

Sandalwood; Characters of essential oil of East Indian ——. Stafford Allen and Sons, Ltd., Chem. and Drugg., 1910, **76**, 293.

A table is given showing the physical characters of over 170 samples of sandalwood oil distilled during the past two years and nine months. The following are the highest and lowest figures thus recorded:—Sp. gr. at 15° C., 0·9733 to 0·9799; solubility in 70 per cent. alcohol, at 15° C.; 1 : 4 to 1 ; 14 : $\alpha_D = -13{\cdot}32°$ to $-20{\cdot}85°$ in a 100 mm. tube.—J. O. B.

Pine-needle oils from Colorado; Four ——. J. Swenholt. Midland Drugg. and Pharm. Rev., 1909. **43**, 611—612. Chem. Zentr., 1910, **1**, 441.

The oils were prepared by distilling the twigs with superheated steam, twice cohobating the aqueous distillate, after neutralising with sodium carbonate, extracting the oils with hexane, and distilling off the solvent at a temperature below 80° C. The oils had the following characters:—*Pinus Murrayana* (lodge pole pine) oil: saponification value, 51·87, corresponding to about 18 per cent. of esters ($C_{10}H_{17}OC_2H_3O$). *Picea Engelmanni* (Engelmann spruce) oil: distinct camphor-like odour, sp. gr. 0·8950, $\alpha_D = +1°56'$ in a 50 mm. tube, saponification value, 24·15, corresponding to about 8·5 per cent. of bornyl acetate. *Pinus edulis* oil: sp. gr. 0·8653, $\alpha_D = -3°37'$ in a 50 mm. tube, saponification value, 17·55, corresponding to about 6 per cent. of esters ($C_{10}H_{17}OC_2H_3O$). *Pinus flexilis* oil faint camphor-like odour, sp. gr. 0·8670, $a_D = +4°0'$, saponification value, 43·14, corresponding to about 15 per cent. of bornyl acetate. The watery portion of the distillate from *Picea Engelmanni* contained a mixture of fatty acids with 5—6 carbon atoms, whilst that from *Pinus edulis* contained also acids of higher molecular weight.—A. S.

Linalol; Determination of [and other alcohols] —— in essential oils by acetylation. P. Jeancard and C. Satie. Amer. Drugg., 1910, 56, 42.

The determination of linalol, by the ordinary method of acetylating, invariably gives too low results. The following modification of the method, diluting the oil with xylene, is found to be more accurate. One part of the oil, one part of acetic anhydride, and five parts of xylene are heated together to boiling. The acetylated product is washed, four times in succession, with sodium carbonate solution. Two grms. of the (dry) acetylated oil are then weighed off and saponified in the usual manner, to determine the acetyl value, which will refer to one-sixth part of the amount weighed. Oil of rosewood containing about 90 per cent. of linalol gives from 70 to 91 per cent. by this method. By the ordinary method of direct acetylation, not more than 45 to 52 per cent. can be obtained from the same oil.—J. O. B.

Essential oils; Constituents of ——. Tetrahydrosantalene. F. W. Semmler. Ber. 1910, 43, 445—448.

Santalene was dissolved in methyl alcohol and the solution well cooled. It was then saturated with hydrogen chloride. In this way santalene dihydrochloride, $C_{15}H_{26}Cl_2$, was obtained. It boils at 140°—142° C. at 0·55 mm., has the sp. gr. 1·076 at 20° C., and $n_D = 1·4976$. It readily loses hydrogen chloride. When reduced with sodium in alcohol, a mixture of hydrocarbons is obtained. After treatment with ozone and distilling with steam, tetrahydrosantalene, $C_{15}H_{28}$, was produced. This substance boils at 116°—118° C. at 9 mm., and has the sp. gr. 0·864 at 20° C., $n_D = 1·4676$, and $a_D = +7°30'$ in a 100 mm. tube. The hydrocarbon is saturated.—F. Shdn.

New remedies. [Local anæsthetics]. A. Einhorn, E. Uhlfelder, K. Fiedler, and C. Ladisch. Annalen, 1910, 371, 125—179.

It has been long known that esters of benzoic acid can produce more or less local anæsthesia. The authors have endeavoured to produce derivatives of benzoic acid esters which are soluble, sterilisable, and free from poisonous or irritating action. The introduction of a sulphonic acid grouping, or a free carboxyl grouping, destroys the anæsthetic action. *p*-Aminobenzoic acid diethylamino ethyl ester (novocaine) can be produced by several reactions. When *p*-nitrobenzoylchloride acts upon ethylenechlorhydrin, an ester is formed, melting at 56°C. This can be reduced and allowed to act upon diethylamine, with the formation of novocaine. A number of monoacid salts are described which are readily soluble in water. The monohydrochloride, m. pt. 156° C., and the mononitrate, m. pt. 100°—101° C., both yield an aqueous solution with a neutral reaction. The piperidoethyl ester of *p*-aminobenzoic acid can be obtained by allowing the chloro-ethyl ester of *p*-nitrobenzoic acid to act upon pyridine and reducing the product. When pure it melts at 90°C. The monohydrochloride dissolves in water giving a neutral solution and melts at 213° C. A further series of benzoic acid esters are described under the head of alkamine esters of *p*-aminobenzoic acid. These compounds are less useful pharmacologically than novocaine. In most cases *p*-nitrobenzoyl chloride was allowed to act upon the hydroxyl derivative of the base, and the product reduced. The following have been prepared and are described. *p*-Aminobenzoyldimethylaminoethanol, m. pt. 121° C.; monohydrochloride, m. pt. 185°—186° C. *p*-Aminobenzoyldiisopropylaminoethanol, m. pt. 48° C.; monohydrochloride, m. pt. 195° C. *p*-Aminobenzoyldiisobutylaminoethanol, m. pt. 84°—85° C., monohydrochloride, m. pt. 195°—196° C. *p*-Aminobenzoyldiisoamylaminoethanol, m. pt. 44°—45° C.; monohydrochloride, m. pt. 154° C. The above hydrochlorides dissolve in water forming a neutral solution. *p*-Aminobenzoyldiethylaminomethylethylmethylcarbinol melts at 121° C. The corresponding derivative of tetraethyldiaminopropanol melts at 50° C., and its dihydrochloride at 222°C. *p*-Aminobenzoyldipiperidopropanol melts at 137·5° C., and the dihydrochloride at 261° C. Di-*p*-aminobenzoyldiethylaminopropanediol melts at 132°C., and the monohydrochloride at 185° C. Mono-*p*-aminobenzoylpiperidopropanediol melts at 91° C., and the monohydrochloride at 206° C. Di-*p*-aminobenzoylpiperidopropanediol melts at 127°C., and the monohydrochloride at 210·5°C. Some derivatives of *m.p*-diaminobenzoic acid ester have been prepared and are described. When organic acids act upon *m.p*-diaminobenzoic acid ester, *μ*-alkylated derivatives of benzimidazolcarboxylic acid ester are produced. With chloracetylchloride, on the other hand, the dichloracetyl compounds are obtained. Dibenzoyl-*m.p*-diaminobenzoic acid methyl ester melts at 231° C. Di-piperido-glycyl-*m.p.*-diaminobenzoic acid methyl ester melts at 108° C. *m*-Amino-*p*-piperidoglycyl-*m*-aminobenzoic acid ethyl ester melts at 103° C., and the hydrochloride at 204° C. The monohydrochloride of *m.p*-diaminobenzoic acid diethylaminoethyl ester melts at 163°C., and yields a neutral solution with water. The *p*-dimethylamino derivative corresponding to the latter gives a hydrochloride melting at 164° C.; and the hydriodide of the *m.p*-tetramethyl derivative melts at 109°—110°C. (See also this J., 1908, 713).—F. Shdn.

Allo- and isocinnamic acids; Transformations of ——. C. Liebermann and H. Trucksäss. Ber., 1910, 43, 411—414.

Further experiments have been made on the crystallisation of allo- and isocinnamic acids from light petroleum (this J., 1910, 111). The light petroleum used was carefully rectified, and boiled between 30° and 40° C. The hot solution of the acid was transferred to a specially constructed tube, a portion of the solvent boiled off, and the tube sealed. It was then cooled in ice or a freezing mixture, when crystals separated. In ten experiments allocinnamic acid was dissolved in the light petroleum. On opening the tubes, the crystals in two of them were found to be allocinnamic acid, in two others the crystals appeared to be those of the acid melting at 42° C., but on filtering off they melted at 68° C. The crystals in the remaining six all melted at 42° C. In four experiments solutions of cinnamic acid melting at 58° C. were placed in the tubes. Two of them yielded allocinnamic acid owing to "infection," the remaining two gave the acid melting at 42° C. The results point to the pre-existence of the acid melting at 42° C. in light petroleum solution, and to the fact that the three acids are polymorphous.
—F. Shdn.

Cinnamic acid of storax and synthetic cinnamic acid; Difference between ——. C. N. Riiber and V. M. Goldschmidt. Ber., 1910, 43, 453—462.

According to E. Erlenmeyer jun., synthetic cinnamic acid produced by the Perkin reaction consists of equal quantities of two components, the cinnamic acid of storax, and an isomeride described as heterocinnamic acid (this J., 1909, 959). The acid from storax melts at 134°—135° C., the synthetic acid at 132°—133° C., and heterocinnamic acid at 130°—131° C. The crystals of the acid from storax are large and well-defined; measurements were made which agree with those observed by Fock (Ber., 1906, 39, 1578). The crystals of the synthetic variety are smaller, and not nearly so well defined, they have, moreover, a silky appearance. If a crystal of the acid from storax is suspended in a saturated ethereal solution of the synthetic acid, growth takes place on certain edges only. The authors have found that these variations in the properties of cinnamic acid are due to the presence of about 1 per cent. of an impurity. A large quantity of the ethyl ester of cinnamic acid was fractionated in a vacuum. The highest-boiling fractions on hydrolysis yielded an acid containing chlorine, which on analysis proved to be monochlorocinnamic acid. It was also found that when cinnamic acid from storax was mixed with about 1 per cent. of either *o-* or *p*-chlorocinnamic acid, or *o*-nitrocinnamic acid, a product was obtained which resembled the synthetic acid.—F. Shdn.

Citronella oil in Ceylon. Chem. and Drug., Feb. 26, 1910. [T.R.]

The exports of citronella oil from Ceylon during 1909 showed an increase of 236,119 lb., being 1,512,084 lb. against 1,276,965 lb. in 1908. The leading destinations were: United Kingdom, 780,049 lb.; the United States, 446,874 lb.; Germany, 172,302 lb.; Australia, 45,411 lb.; and France, 42,201 lb. The increase last year is attributed to new producing districts opened up in the South of Ceylon. Although this country still figures as the principal consumer of citronella oil, important quantities credited to England are destined for shipment to Germany and the U.S.A. *viâ* London. The largely increased exports would seem to suggest that, although adulteration is rampant, the oil does not lose any of its popularity. As the adulteration question has become so acute, it is now stated that both consumers and importers are seriously considering the advisability of altering the terms of sale, and selling only pure citronella oil guaranteed to contain a definite amount of geraniol and citronellal. It is well-known that the Ceylon oil in drums is always adulterated down to pass Schimmel's test, but it is stated that during the past month or so some Ceylon shipments have proved of a very inferior character, and have failed to pass Schimmel's test, the consequence being that buyers have refused to accept delivery of such tenders, and in other instances heavy allowances have been made. These allowances have, of course, called a protest from Ceylon shippers, whilst on this side a movement is on foot with a view to place the citronella-oil business on an entirely new basis as regards quality—*i.e.*, in future pure oil only will be accepted against arrival contracts.

Netherlands ; Import duties on certain alcoholic products. Board of Trade J., Feb. 10, 1910. [T.R.]

A Dutch Royal Decree, dated the 13th January, fixes the import duties on certain products prepared with alcohol, as follows:—

Substance.	Rate of Duty.		
		florins.	cents.
Chloral hydrate	Kilo.	2	00
Sulphuric ether	,,	3	40
Chloroform	,,	2	35
Acetic ether	,,	1	90
Collodion	,,	3	00
Spiritus nitri dulcis	,,	2	05
All other similar substances prepared from or with alcohol	,,	2	25

Chloroform ; Electrochemical preparation of ——. B. Wāser. Chem.-Zeit., 1910, **34**, 141—142.

The methods which have been proposed for the electrolytic preparation of chloroform by the electrolysis of aqueous-alcoholic solutions of alkali chlorides give low yields. Somewhat better results are obtained with a calcium chloride solution (see this J., 1907, 100), but the chlorine liberated at the anode is not completely fixed by the calcium hydroxide produced in the cathode compartment, and oxidises the alcohol to aldehyde. If calcium oxide or hydroxide be added to overcome this difficulty, a deposit of calcium hydroxide soon forms on the cathode, or on the diaphragm if one be used, increasing the resistance of the bath, and at times even preventing the passage of current. Since barium hydroxide is more soluble than the calcium compound, the author has made experiments with it, using as anode liquid a solution containing 80 grms. of crystallised barium hydroxide, $Ba(OH)_2,8H_2O$, 1 grm. of barium chloride, $BaCl_2,2H_2O$, and 300 c.c. of water; and as cathode liquid, 30 c.c. of hydrochloric acid, of sp. gr. 1·19, contained in a cell of porous porcelain. Platinum electrodes were used, with a current of 8 volts and 2 amperes. The temperature of the bath at the beginning was 50° C.; after half an hour, alcohol (30 c.c.) was slowly added to the anode liquid, and the temperature raised gradually to 70° C. The main quantity of the alcohol was added only towards the end. The cathode liquid must be periodically renewed during the electrolysis. 30 c.c. of alcohol yielded 0·6 grm. of chloroform. The current-density has comparatively little influence on the yield, the best results being, however, obtained with about 4 amperes per 100 sq. cm. at the anode and 10 ampères at the cathode. A current-yield of about 35 per cent. was obtained. With acetone instead of alcohol, lower yields were always obtained, whether the electrolyte consisted of barium chloride, calcium chloride, or alkali chloride (compare this J., 1904, 621).—A. S.

Ether ; Drying of moist ——. E. v. Siebenrock. Monatsh Chem., 1909, **30**, 759—766.

Anhydrous sodium sulphate has lately been much recommended for use in drying moist ether, and the author has made a quantitative examination of its drying qualities as compared with those of anhydrous calcium chloride, potassium carbonate, magnesium sulphate, sylvine, potassium chloride, calcium sulphate, and carnallite. It is found that both calcium chloride and potassium carbonate are good drying agents, and that sodium sulphate dries ether only gradually. When the ether contains easily saponifiable impurities, sodium sulphate may advantageously be replaced by carnallite or magnesium sulphate.—J. C. C.

Glass ; Influence of the composition of —— *on pharmaceutical preparations.* Lesure. J. Pharm Chim., 1910 **1**, 66—71, 119—126.

For solutions of easily hydrolysable substances, such as cocaine salts, only vessels composed of neutral glass should be employed; that is, such as give no indication of alkalinity with Poulenc's alizarin sulphonate reagent when heated with water for 20 minutes, in an autoclave at 120° C. Such are the best Jena glass of Shott and Genossen, Appert's Serax, and Ehrenfeld's Cologne glass. For solutions of salts which form precipitates with time, such as phosphates and arsenates, only non-calcareous glass must be used. The makes above mentioned, and that of Legras, are types of these. They have a base of alumina, zinc, and magnesia. For more stable salts, such as sodium cacodylate, methyl-arsinate, strychnine salts, and mercurials, glass which does not exceed a faint degree of alkalinity may be used. This, however, must not exceed the equivalent of 5 c.c. of *N*/100 of sodium hydroxide solution for every 100 c.c. of capacity, after exposure for 30 minutes in an autoclave at 120° C. For solutions of iodides, chlorides, and bromides, all glass containing lead must be avoided. In vessels made of neutral glasses, such as those mentioned above, nearly all medicinal chemicals can be sterilised by heating in an autoclave at 120° C., without undergoing decomposition.
J. O. B.

Ichthyol from Italian schists. Marino-Zuco and Tonelli. *See* II.b.

Fractionating device. Hahn. *See* XXIII.

Patents.

Compound for use in medicine and pharmacy. M. Ransome, Altrincham. Eng. Pat. 6114, March 15, 1909.

A compound which is said to destroy all harmful germs in the system, without affecting harmless bacterial life, is prepared by mixing together sodium sulphocarbolate, sucrose, maltose, and lactose, with or without application of heat.—T. F. B.

Esters of diglycollic acid and preparation of same. L. Ach, Mannheim, Assignor to C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. U.S. Pat. 948,084, Feb. 1, 1910.

Aryl esters of diglycollic acid, $(RO.CO.CH_2)_2O$, are obtained by the action of a dihalogen derivative of diglycollic acid on a phenyl compound (phenol) in presence of a substance which will combine with the halogen acid liberated: the mixture is cooled during the reaction. The new esters are sparingly soluble in water and dilute acids, and are saponified when heated with aqueous alkali solutions.—T. F. B.

1-p-Dialkylaminophenyl-2-alkyl-3-oxymethyl-5-pyrazolones; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pats. 217,557 and 217,558, April 28, 1909.

(1). 1-*p*-Aminophenyl-2-alkyl-3-oxymethyl-5-pyrazolones can be converted into the 1-*p*-dialkylamino derivatives either by treatment with chloroacetic acid to introduce two acetic acid residues into the amino-group, and then eliminating carbon dioxide from these by heating; or by first treating with hydrocyanic acid and formaldehyde to form the cyanomethyl derivative, then introducing one acetyl group by means of chloroacetic acid, and finally saponifying. (2). 1-*p*-Aminophenyl-2,4-dialkyl-3-oxymethyl-5-pyrazolones are converted into the corresponding 1-*p*-dialkylamino compounds by methylation. In the 4-position, the alkyl group may be replaced by hydrogen or other substituents. (See also Eng. Pat. 4128 of 1909; this J., 1909, 854.)—T. F. B.

Betula alba; Process for preparing compounds easily soluble in water from the leaves of ——. G. R. Grasser and K. Purkert. Ger. Pat. 217,559, Nov. 27, 1907.

Birch leaves are extracted with alcohol, the alcoholic extract is heated with alkali hydroxide, the solution is saturated with dry carbon dioxide, and decomposed by water: the insoluble substance precipitated is filtered off, the filtrate is concentrated and precipitated by means of dilute mineral acids, and the two acids, $C_{41}H_{70}O_7$ and $C_{38}H_{69}O_3$ (resinotannol), filtered off and separated by conversion into their tri- and di-alkali salts respectively by means of alcoholic alkali hydroxide solution. The acid, $C_{41}H_{70}O_7$, or $C_{33}H_{65}O_2.C_6H_2(OH)(COOH)_2$, is obtained in the form of its tri-alkali salt, and can be employed as a diuretic.—T. F. B.

Beta-methyltetramethylenediamine; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,206, May 24, 1909.

See Ger. Pat. 216,808 of 1908: this J., 1910, 234.—T. F. B.

Medicaments [containing quinotannic acid and iron]; Process of preparing ——. A. Meyer, Mülhausen, Germany. U.S. Pat. 948,930, Feb. 8, 1910.

See Fr. Pat. 404,938 of 1909: this J., 1910, 234.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic action of a charred wood surface and of some liquids. D. Isitani. Physik. Zeits., 1909, 10, 1003—1005. Chem. Zentr., 1910, 1, 500.

Whilst wood at the ordinary temperature produces scarcely any effect on a photographic plate in seven days, charred wood in the same period gives a very distinct image. It is best to have a layer of air of a few tenths of a millimetre between the wood and the plate. The powder scraped off the charred surface of the wood is active, but ordinary wood charcoal is inactive. The active substance appears to be in the intermediate layer between char and wood. The action is exercised through paper, but not through glass and metal foil; it is augmented by a thin layer of aluminium powder. If water or alcohol be placed on the active charred surface, the effect is no longer produced. The action is increased by glycerin and ammonia, and diminished by potassium hydroxide solution. —A. S.

Patents.

Sensitised paper. H. Caster, Düren, Germany. Eng. Pat. 883, Jan. 13, 1909.

Pure, sensitised paper is reinforced by a fabric, and raw paper is applied to the back of the fabric in such a manner that the binding medium will pass through the pores of the paper and form a surface suitable for receiving writing or printing. (Reference is directed in pursuance of Sect. 7, Sub.-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 2057 of 1906, this J., 1906, 867.)—T. F. B.

Chemical substances used in photography; Preparation and packeting of ——. T. O. Kent, and Oppenheimer, Son, and Co., Ltd., London. Eng. Pat. 6652, March 19, 1909.

The various components of photographic solutions are compressed into tablets, the substances which react together being separated from one another by layers of inert material; for example, in preparing developing tablets, the organic reducing agent may be separated from the alkali by means of a layer of sodium sulphite.—T. F. B.

Photographic emulsions. W. J. Wilson, Watford. Eng. Pat. 10,284, April 30, 1909.

It is stated that improved results are obtained by adding a soluble tungstate or molybdate or both, to emulsions containing silver phosphate. In an example, the following proportions of constituents of the emulsion are given:—Gelatin, 60 grms.; sodium phosphate, 17·5 grms.; citric acid, 1·5 grms.; silver nitrate, 25 grms.; sodium tungstate, 7 grms.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Nitroglycerin explosives factories; Special rules for the prevention of accidents in ——. Chem. Ind., 1909, 32, 797—805.

The German Imperial Insurance Office gave its consent on November 3, 1909, to the special rules relating to nitroglycerin factories which had been drafted by the German Industrial Association. These rules become operative on May, 1, 1910. In the main these regulations are very similar to those in force in Great Britain. The following points of difference may be noted. Protecting mounds have to be 1 m. wide on top and 1 m. higher than the eaves of the building, and there must be a distance of 1 m. between the base of the mound and the base of the building. Tunnels in mounds are to be constructed of brick or concrete, and shelters against falling *débris* must be provided outside each mound. All windows must either be glazed with wire netting glass, or a fine wire mesh, or perforated metal sheet placed against them to prevent broken glass falling into the building. The walls and floors of magazines must be of concrete, and the outside door of the double doors must be of oak, 5 cm. thick. Nitrators and separators, in the nitroglycerin buildings, must be provided with reserve agitating apparatus consisting of cylinders of compressed nitrogen or carbon dioxide. The temperature of nitration must not be allowed to rise above 30° C. The drowning tanks must contain an amount of water at least 5 times that of the acid mixture to be dealt with, and must be provided with water inlet at the bottom, air agitating pipes, and an overflow. In the event of drowning a charge, an alarm must be given. When danger buildings have to be lit from outside by oil, only rape oil is allowed to be used. All radiators and heating pipes in buildings must be so painted that dust deposited on them may be readily detected. Chimneys under 20 m. in height must be provided with spark catchers. The temperature of waste acids, containing nitroglycerin, must not be below 10° C., and all acid must be denitrated the same day as it comes from the after-separator. Collodion cotton may be dried at temperatures up to 50° C., and it may only be transported in soft leather bags or boxes of dark-coloured fibre, or wood, without any nails or metal fittings of any kind. Within a distance of 3 m. from any danger building, where work is being carried on, not more than 10 workpeople may be employed in repairs or other work. During a thunderstorm the electric wiring of each danger building has to be disconnected from the main circuit. The buildings for nitroglycerin and explosives must be grouped together. The following table gives the maximum amount of explosives allowed in the various buildings, their minimum distance from each other, and the maximum number of workpeople allowed in each building, exclusive of service waiters.

Shale-dust and coal-dust tests at Broxburn. McLaren and Clark. *See* IIa.

Patents.

Explosives. H. F. Easton, St. Keyne, Cornwall. Eng. Pat. 18,551, Aug. 11, 1909.

Explosives for blasting purposes consisting of or containing a mixture of barium nitrate, trinitrotoluene, and aluminium powder. The amount of trinitrotoluene should not be less than 20 per cent., nor more than 33 per cent., of the weight of barium nitrate; and the amount of aluminium should not be more than 20 per cent. of the total. Where the explosive may be subject to the action of water, the trinitrotoluene is partly replaced by dinitrotoluene, and a small quantity of wax is added, together with some potassium chlorate to counteract the sluggishness produced by the wax.—A. S.

Explosive. A. Mikolajczak, Kastrop, Germany, Assignor to F. Schniewind, New York. U.S. Pat. 918,790, Feb. 8, 1910.

See Fr. Pat. 341,911 of 1904; this J., 1904, 914.—F. F. B.

Purification of trinitrotoluene. Eng. Pat. 18,281. *See* III.

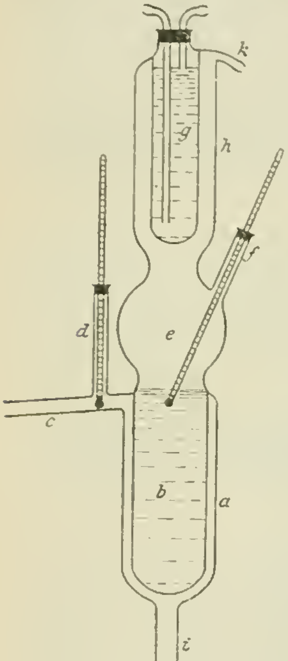
Building.	Distance from centres of buildings (metres.)		Maximum quantity of explosives (kilos.).	Number of workpeople.
1. Nitrating house	25		600	
	40		1200	2
	50		2000	
2. Separating house	The same as		nitrating house.	1
3. Wash and filter house	25		1200	
	40		2400	2
	50		4000	
4. Nitroglycerin magazine	30		4000	2
5. After-separator, washwater house and denitrator	Several groups may use one.		No accumulation of explosive allowed.	2
6. Mixing house for kieselguhr-dynamite	25		600	
7. Incorporating houses for explosives containing over 25 per cent. of nitroglycerin (horizontal shaft in mixer)	40		1200	2
8. Do. do. do. (Vertical shaft in mixer)	50		2000	
9. Incorporating house for explosives containing 4 to 5 per cent. of nitroglycerin	25		600	2
	40		1200	4
	50		2000	
10. Expense magazines	25		600	
	40		1200	2
	50		2000	
11. Cartridge huts for high percentage nitroglycerin explosives	12		50	2
	15		75	
12. Cartridge huts for low percentage nitroglycerin explosives	15		200	4
13. Packing houses	30		No accumulation of explosive allowed.	6
	Between each other.	From packing house.		
14. Magazines	15	40	5000	—
	40	150	30,000	
15. Collodion-cotton drying stoves	45		—	2

—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Fractionating device : A new ——. A. Hahn. Ber., 1910, **43**, 419—423.

The principle of the apparatus consists in passing the vapours from the liquid being distilled through a space kept at a constant temperature equal to, or preferably 2°—3° below, that of the lower-boiling constituent of the liquid. The device is shown in the figure. The annular space between *a* and *b*, which is very narrow (1—1·5 mm.) is kept at the desired temperature by placing a liquid of suitable boiling point in *b*. The vapours from *b* are condensed by the condenser, g. The space, *h*, communicates through *k*, either with the atmosphere or with a pump. The vapours from the distillation flask rise through *i*, into the annular space between *a* and *b*; the higher-boiling constituent is condensed, whilst the lower-boiling constituent gradually passes over through *c* to the condenser. It is stated that using in *b* either a mixture of methyl alcohol and water boiling at 76° C. at atmospheric pressure, or pure water under diminished pressure, 96 per cent. alcohol can be obtained directly and quantitatively from alcohol of 45 per cent. strength. Good separations have also been obtained in the cases of mixtures of ether and alcohol, methyl and ethyl alcohols, and methylethyl ketone (b. pt. 81° C.) and diacetyl (b. pt. 87° C.).—A. S.



Zinc and lead ; New volumetric methods of determining ——. E. Rupp. Chem.-Zeit., 1910, **34**, 121.

The author has investigated the application of potassium cyanide in the volumetric determination of lead and zinc. The estimation of zinc is similar to that of silver by Liebig's method, and depends on the formation of the soluble double cyanide, $K_2Zn(CN)_4$, which is decomposed immediately by excess of zinc ions, producing insoluble zinc cyanide: $K_2Zn(CN)_4 + Zn^{\cdot\cdot} = 2Zn(CN)_2 + {}_2K^{\cdot}$. The end point is rendered much more definite by the presence of a small quantity of any ammonium salt (except the acetate). 10 or 20 c.c. of *N*/2 potassium cyanide are titrated with a 0·2—0·8 per cent. solution of the zinc salt (free from acid) till a permanent cloudiness remains after shaking. 1 c.c. of *N*/2 potassium cyanide = 0·008171 grm. of zinc. Lead cyanide is not soluble in excess of alkali cyanide, but it is readily soluble in acids. On adding excess of potassium cyanide to a lead solution, and filtering, the excess of potassium cyanide can be titrated with hydrochloric acid and methyl orange. 20 or 25 c.c. of *N*/2 alkali cyanide are treated with a known volume of lead salt solution (free from acid) in a 100 c.c. flask. After making up to the mark, allowing to stand for ten minutes, and filtering, the cyanide is titrated in 50 or 75 c.c. of the filtrate by means of *N*/4 or *N*/2 acid. The cyanide solutions are standardised by pure salts of lead or zinc, though the purest samples may be standardised simply by hydrochloric acid with methyl orange.—W. H. P.

Osmium, its analytical determination, its oxides, and its chlorides. O. Ruff and F. Bornemann. Z. anorg. Chem., 1910, **65**, 429—456.

The general gravimetric method of estimating osmium is by reduction in a current of hydrogen, with a hot copper spiral to prevent the carrying over of osmium tetroxide. This method is not applicable to some of the osmium halides, and it is not very convenient for solutions. The method of Paal and Amberger (Ber., 1907, **40**, 1378) is then applied. This depends on reduction of the osmium compound by means of alcohol, formaldehyde or hydrazine to insoluble osmium dioxide. The precipitate thus obtained is always partly colloidal and passes readily through the filter. This difficulty can be avoided by producing in the filtrate a barium sulphate precipitate, which carries down the colloidal suspended oxide. It is found however that if the original solution is made exactly neutral after precipitation, and warmed for some time on the water-bath before filtering, the osmium dioxide is completely precipitated, and can be easily filtered off and weighed, after careful drying in a current of carbon dioxide. The volumetric method of Klobbie (Chem. Centr., 1898, **11**, 65) is applied to solutions of osmium tetroxide which is distilled from a mixture of the original substance with sulphuric and chromic acids in a current of oxygen. The osmium tetroxide is absorbed in alkali, carefully neutralised in the cold, treated with excess of potassium iodide, and titrated with thiosulphate, using starch as an outside indicator. The colour of the osmium solution being very dark, the end point is not very sharp. One molecule of osmium tetroxide liberates four atoms of iodine. Another volumetric method consists in oxidising the original substance to osmium tetroxide by means of potassium permanganate in sulphuric acid or 40 per cent. hydrofluoric acid solution. The permanganate method however is chiefly useful as affording evidence of the state of oxidation of a previously-determined percentage of osmium.—W. H. P.

Products of the action of nitric acid on flavanthrene, and remarks on the elementary analysis of substances rich in carbon and combustible with difficulty. Holdermann and Scholl. *See* IV.

Methods of analysis of potash salts. Roemer. *See* VII.

Behaviour of slightly soluble calcium salts towards aqueous solutions of ammonium salts, especially of tri-ammonium citrate. Rindell. *See* VII.

Metallic titanium. Weiss and Kaiser. *See* X.

Determining gold and silver in the dry way. Grund. *See* X.

Analysis of oil in egg-yolk by means of different solvents Gordon Parker and Paul. *See* XV.

Volumetric determination of carbonic acid. Vesterberg. *See* XIXb.

Determination of linalol [and other alcohols] in essential oils by acetylation. Jeancard and Satie. *See* XX.

Patents.

Calorimeter. S. W. Parr, Urbana, Ill. U.S. Pat. 947,418, Jan. 25, 1910.

The apparatus consists of a pair of vessels which are connected with a reservoir containing a liquid, means being provided for insuring that the two vessels shall receive the same volume of liquid. A burner is fitted to each vessel and the change of temperature of the liquid in the vessels is ascertained by thermometers fitted in the same. The heating vessels have similar diameters, and means are provided so that one vessel may be adjusted relatively to the other to compensate for variation in size. —W. P. S.

Optical pyrometer for measuring the temperature of distant bodies, such as that of the stars. C. Féry. Fr. Pat. 405,205, July 19, 1909.

The apparatus consists of a telescope in which a mirror is fixed at an angle of 45°; the light proceeding from a distant incandescent object is observed through the centre of the mirror, this portion not being silvered, and is compared with a portion of the spectrum of the light from a standard lamp. The light from this lamp passes through a prism and a lens placed in a tube at right-angles to the telescope, so that a portion of the spectrum is received on the mirror. The intensity of the light coming from the lamp is regulated by a shutter, and any desired portions of the spectrum are thrown and re-combined on the mirror by means of a movable shutter and lens, so that the tint of the light proceeding from the incandescent object under examination may be matched.—W. P. S.

Calorific value of solid fuel; Method of and apparatus for measuring the ——. M. Mehler, Aachen, and G. Lohmann, Gross-Lichterfelde, Germany. Eng. Pat. 12,652, May 28, 1909.

See Fr. Pat. 403,413 of 1909; this J., 1910, 11.—T. F. B.

Trade Report.

German chemical industry in 1909. Board of Trade J., Feb. 3, 1910. [T. R.]

The "Frankfurter Zeitung" of 8th January states that the German chemical industry in 1909 showed on the whole an unmistakable improvement as compared with the previous year. Business with the United States, British India, Japan, and European and Asiatic Turkey was brisker, and although exports to these countries were not so great as in the years preceding the depression, there was a distinct advance as against 1907 and 1908; trade with China remained poor. The chemical industry, and especially the aniline dye branch, suffered greatly from the American crisis, but appears now to be improving; it has, however, been injured by the tariff changes that have recently been made in several countries. The trade with the United Kingdom increased considerably. The prices of raw materials for many chemical products rose very considerably in 1909, while the prices of the finished products did not keep pace with them. The exports of tar dyes and of explosives decreased greatly, but business was comparatively good in glycerin, with higher prices, and in medicinal preparations. As regards aniline dyes and dyeing materials, the demand for fast colours was greater in 1909 than in the previous year. The price of sulphur black was raised some 10 to 15 per cent. by an agreement arrived at between manufacturers of the article in February, 1909, but even now the margin of profit is narrow.

Books Received.

The Industrial Laboratory. Published by the Industrial Laboratory in the Department of Agriculture and Commerce of the Japanese Imperial Government.

This book describes the history, organisation, and equipment of the Japanese Industrial Laboratory, and also contains an appendix consisting of the following papers contributed to the College of Engineering, Tokyo Imperial University:—"Japanese lacquer," by K. Miyama (this J., 1908, 456). "Drying of Japanese lacquer at a high temperature," by K. Miyama (this J., 1909, 318). "A new unsaturated fatty acid in Japanese sardine oil," by M. Tsujimoto (this J., 1906, 818). "Occurrence of clupanodonic acid in herring and whale oils," by M. Tsujimoto (this J., 1906, 819). "The composition of chrysalis oil," by M. Tsujimoto (this J., 1908, 455). "A few Japanese vegetable oils," by M. Tsujimoto (this J., 1908, 454). "Occurrence of clupanodonic acid in dab and green turtle oils," by M. Tsujimoto (this J., 1909, 316). "The cause of the odours of oils and fats, especially of marine animal oils," by M. Tsujimoto (this J., 1909, 316). "The resinous substances deposited from the mixed fatty acids of marine animal oils on keeping," by M. Tsujimoto (this J., 1909, 316). "The oxidised fatty acids of marine animal oils," by M. Tsujimoto (this J., 1909, 317).

Bulletin of the Imperial Institute. Vol. VII. No. 4. Price 1s.

This issue of the Bulletin contains the results of investigations in connection with the African palm oil industry (see page 00), articles on recent developments in the Seychelles, and on the occurrence, preparation and uses of vanadium: also notes on the International congress of tropical agriculture and colonial development to be held at Brussels in May next, on vegetable waxes from Mexico (see page 00), &c.

Technologie et Analyse Chimiques des Huiles, Graisses et Cires. Par le Dr. J. Lewkowitsch, M.A. Traduit du manuscrit spécialement rédigé pour cette édition par l'Auteur, par Emile Bontoux. Tome III. H. Dunot et E. Pinat, Editeurs, 49, Quai des Grands-Augustins. Paris. 1910. Price 17 fr. 50. Boards, 19 fr. Complete work (3 vols.) paper, 65 fr. Bds. 69 fr.

This volume III. completes the French edition. It not only represents an entirely new translation of vol. III. of the 4th English edition which appeared in the spring of 1909 (see this J., 1909, 494—495), but it has also been brought fully up to date by the incorporation of work published between that date and this. It has also been further completed by the inclusion of numerous statistics especially relating to France, which have been added by the translator. The text completes 1946 pages of subject-matter for the entire work, with 92 illustrations, this present volume containing 522 pages, 54 of which relate to matter in the appendix. The work concludes with a copious index of subjects.

Paper Technology. An Elementary Manual on the Manufacture, Physical Qualities, and Chemical Constituents of Paper and of Papermaking Fibres. By R. W. Sindall (Technical advisor to the Government of India, &c.) Chas. Griffin and Co., Limited, Exeter Street, Strand, London. 1910. Price 12s. 6d. net. Second Edition. Revised.

See this Journal, 1906, 1178, where the notice of the first edition appears. In the present edition, besides several additions to the first, the statistics are brought up to date, and the questions on "Paper Manufacture" have been extended by the inclusion of examination papers issued since 1906. The trade customs of certain countries have also been inserted. The glossary of definitions of the various papers, with brief notes as to origin and use, has been revised, and additions made.

Handbuch der Soda-Industrie und ihrer Nebenzweige, von Dr. Georg Lunge. Vorm. Professor der tech. Chemie am eidgen. Polytechnikum in Zürich. Dritte umgearbeitete Auflage. Dritter Band. Verlagsbuchhandlung von Friedr. Vieweg & Sohn. Brauwschweig. 1909. Price M 24.

8vo volume, containing 623 pages of subject-matter, with 185 illustrations and three on separate sheets. There are also indexes of names and subjects. This third edition of the third volume follows the corresponding volume of the second edition after a lapse of thirteen years, and is brought up to date by the introduction of much new matter, and the omission of some old. The leading subjects are: I. The ammonia soda processes. II. Various other soda processes. III. the chlorine industry and products, and IV. Some appendix additions to volumes I. and II. Under these heads, the various patented processes are all described, together with other proposed improvements.

THE JOURNAL OF THE INSTITUTE OF METALS. Volume II. Edited by G. Shaw Scott, M.Sc. Published by the Institute of Metals, Caxton House, Westminster, London, S.W. 1909. Price £1 1s. 0d.

THE Journal is issued twice annually. It is an 8vo volume, and the present volume II. contains 328 pages of subject matter, 1 page of statistics, and 1 page of Bibliographic notes. The book concludes with an alphabetical index of names and subjects. There are numerous illustrations and diagrams. The subject-matter is sub-divided, and arranged as follows:—SECTION I., Minutes of proceedings. SECTION II., Abstracts of papers relating to the non-ferrous metals and the industries connected therewith. ORES AND MINERALS—(i) Occurrence. (ii) Mining. (iii), Mechanical preparation. (iv) Metallurgical preparation. EXTRACTION OF METALS. —(i) Aluminium. (ii) Copper. (iii.) Gold. (iv) Lead. (v.) Rare Metals. (vi) Silver. (vii) Zinc. ELECTRIC FURNACES, PROPERTIES OF METALS AND ALLOYS. CHEMICAL ANALYSIS, TESTING, AND TEMPERATURE MEASUREMENT. The first 287 pages of the Journal consist of a record of the papers read at the autumn meeting of the Institute, with the discussions.

New Books.*

Adam, Jean: Le Palmier à huile. Habitat. Conditions de végétation. Culture. Produits. Commerce. Conservation des palmeraies. Amélioration de la production. Considérations économiques. In-8 avec photographies, fig. et cartes. Paris, Challamel. 1910. 9 fr.

Adams, W.: Ja. Hints on amalgamation and the general care of gold mills; a reference book of actual gold-mill practice. 3d. ed., rev. and enl. San Francisco, Mining and Scientific Press. 1910. c. 121 p. il. 12°, $2.

Adressbuch der deutschen Gummi-, Guttapercha- u. Asbest-Industrie nebst verwandter Geschäftszweige, wie Kabel-, Celluloid- u. Linoleum-Industrie. Mit e. alphabet. Firmen-Register nebst Bezugsquellen-Liste u. Inseraten-Verzeichnis. 8. Ausg. 1910. (v. 66, 464 u. 37 S.) 8°. Berlin, Union, Zweigniederlassg. Cloth M. 5.

Berthier, A.: L'Éclairage industriel. In-4 avec. 323 fig. Dunod et Pinat. 7 fr. 50. Bibliothèque de "La Technique moderne." Paris, 1910.

Biondi, L. e *Righini*, E.: Il pino da pinoli: coltura-prodotti-industrie. (Memoria premiata alla Reale Accademia economico-agraria dei georgofili di Firenze in seguito al concorso bandito 1907). Milano, 16°, pagine XII, 142. U. Hoepli. 1910. Lire 2.50.

Braun, Irene: Batik. Anleitung zur Wachsfärbekunst. (32 u. 8 S. m. Abbildgn.) gr. 8°. Stuttgart. 1909. Hamburg. F. W. Thaden. M. 1.80.

Friese, Dr.-Ing. Walth.: Tabellen zur Ermittelung der freien Säure (Gesamtsäure) sowie der flüchtigen u. nicht flüchtigen Säuren im Wein. Nach den amtl. Anweisgn. zur chem. Untersuchg. desselben, berechnet u. zusammengestellt. (18 S.) gr. 8°. Dresden, v. Zahn & Jaensch 1910. Cloth back. M. 1.50.

Germer, Prof. Herm.: Mörteluntersuchungen. 2. Tle. (77 S. m. Abbildgn. u. 44 Taf. m. IV. S. Text.) Lex. 8°. Berlin, Verlag der Tonindustrie-Zeitung 1910. Cloth M. 6.

Gmelin u. Kraut's Handbuch der anorganischen Chemie. Hrsg. v. Prof. C. Friedheim u. nach dessen Tode v. Dr. Frz. Peters. 7. gänzlich umgearb. Aufl. gr. 8°. Heidelberg, Carl Winter.

I. Bd., 2. Abtlg. Ditz, Dr. Hugo: Fluor, Chlor, Brom, Jod. Die kristallograph. Angaben v. Dr. H. Steinmetz. (XXX, 441 S.) 1909, M. 18 —; half mor. M. 21.

V. Bd., 1. Abtlg. Gutbier, Dr. A.: Nickel u. Verbindungen- Roth, Dr. W.: Kobalt u. Verbindungen (ausser den Kobaltiaken); Gutbier, Dr. A.: Die Nachträge; Pfeiffer, Dr. P.; Kobaltiake [Kobaltamine]; Peters, Dr. Frz.: Kupfer u. Verbindungen.—Die kristallograph. Angaben v. Dr. H. Steinmetz. (LXXXIII, 1595 S.) 1909, M. 63—; half mor. M. 66.

Industrie die chemische, auf dem Weltmarkt Ein alphabet. Verzeichnis der hauptsächlichsten Chemikalien Drogen, Farbwaren, Vegetabilien, Rohmaterialien, chem. Apparate u. Bedarfsartikel, die f. den Weltmarkt in Frage kommen, m. Angabe ihrer besten Bezugsquellen in allen Ländern. Hrsg. vom Verlag f. chem. Industrie, Berlin. 1. Jahrg. 1910. (VII, XXX, 158 S.) gr. 8°. Berlin, Verlag f. chem. Industrie. M. 5.

Kirchner, Otto: Die kaustische u. kohlensaure Verseifung in der modernen Seifenindustrie. Die Haushaltungsseife. Hrsg. unter Mitwirkg. v. Drs. Bela Lach u. C. Stiepel. (viii., 157 S. m. 52 Abbildgn). 8°. Wien. A. Hartleben. 1910. M. 4; cloth M. 4·80.

Kusserow, Dr. R.: Mitteilungen f. Brennerei u. Presshefefabrikation. Nebst. Anh.: Adressbuch der Lieferanten f. das Brennereigewerbe. Nr. 34. Dezbr. 1909. (32 S.) kl. 8°. Sachsenhausen (Mark, Chausseestr. 8). Selbstverlag. 50 Pf.

Mannheim, Dr. E.: Toxikologische Chemie. (150 S. m. 6 Abbildgn.) Leipzig. Small 8vo. 1910. Cloth. 80 Pf.

Mettrier, M.: L'Industrie houillère du département du Nord. In-4 avec figures et 1 carte en couleurs. Dunod et Pinat. Paris, 1910. 6 fr.

Meyer, Julius. L'importanza che ha la dottrina della velocità di reazione nei processi chimici, per la chimica applicata. Pavia, 8°. 1910. Lire 2.

Michel, Karl, u. *Michel*, Otto. Betriebs-Kontrolle f. Brauerei u. Mälzerei. 3. wesentlich verb. u. verm. Aufl. (III, 512 S. m. Fig.) gr. 8°. Mannheim, (J. Bensheimer's Verl.) 1910. Cloth, M. 7.50.

Ottavi. E. e *Marescalchi*, A. L'uva e le sue nuove utilizzazioni: mosti concentrati, sciroppi, conserve, vini senz'alcool. Casale Monferrato, 16° fig., p. xi, 234. 1910. Lire 3.

Pearson, Henry C.: Gummireifen u. alles darauf Bezügliche. Pneumatikreifen, Vollgummireifen, Luftreifen, Kombinationen verschiedener Systeme f. Automobile, Omnibusse, Fahrräder u. Fuhrwerke aller Art. Bearb. v. Dr. Rud. Ditmar. Ubers. v. R. Challamel. (XVI, 224 S. m. 316 Abbildgn.) gr. 8°. Wien, A. Hartleben. 1910. M. 8. Cloth M. 10.

Schmidt, Dr. Ernst: Ausführliches Lehrbuch der pharmazeutischen Chemie. II. Bd. Organische Chemie. 1. Abtlg. Organische Verbindgn. m. offener Kohlenstoffkette. Mit 95 eingedr. Abbildgn. 5. verm. Aufl. (XV., 1020 S.) gr. 8°. Braunschweig, F. Vieweg & Sohn. 1910. M. 23. Cloth M. 25.50.

Uebersicht üb. die Jahresberichte der öffentlichen Anstalten zur technischen Untersuchung v. Nahrungs. u. Genussmitteln im Deutschen Reich f. d. J. 1906. Bearb. im kaiserl. Gesundheitsamt. (VIII, 328 u. 44 S.) Lex. 8°. Berlin. J. Springer. 1909. M. 6.60.

Vade mecum f. Drogisten 1910. Hrsg. vom "Drogenhändler." (188 S.) 8°. Berlin, A. L. Hermann. M. 2.

Wadsworth, Marshman E.: Crystallography; an elementary manual for the laboratory: with 6 tables, 25 plates, and 612 figures. Phil., John Joseph McVey, 1909 [1910] c. 16+20+299 p. O. cl. $3 net.

Zeitschrift f. Sauerstoff- u. Stickstoff-Industrie u. damit zusammenhängende Gebiete: Grossgasindustrie, Kältetechnik, autogene Schweissg., Sauerstoffbeleuchtg., Stickstoffdünger-Fabrikation u. Anwendgn. in der Landwirtschaft. Hrsg. u. Red.; Rud. Mewes. 2. Jahrg. 1910. 12 Hefte. (1. Heft. 28 S. m. Abbildgn.) 31,5×23,5 cm. Leipzig, H. A. L. Degener. M. 12 per annum. Single parts M. 1.50.

Zetzsche, Frz.: Mikrophotographischer Atlas der industriellen Faserstoffe. (12 Taf. m. IV. S. Text.) gr. 8°. Kötzschenbroda-Dresden, H. F. A. Thalwitzer, 1910. M. 1.50.

* Dissertations.

[Prices vary, ranging from two to three shillings.]

Barten, E.: Notwendigkeit, Erfolge u. Ziele d. technischen Unfallverhütung. Berlin. Charlottenburg. 1909. 101 S. m. Tab. u. Taf. 8°.

Bossel, G. N.: Zur Kenntniss der o-Amidosalicylsäure. Dresden. 1909. 45 S. 8°.

Eichel, C.: Ueber das Verhalten des Stickstoffs gegen Silicide. Dresden. 1909. 74 S. m. 1 Taf., 7 Fig. u. 8 Kurv. 8°.

Grewe, G.: Ueber die quantitative Bestimmung der Ameisensäure u. die Vergärung der Ameisensäure durch drei roten Farbstoffbildende Bakterienarten. Heidelberg. 1909. 227 S. 8°.

Harster, R.: Vergleichende Untersuchungen über die Ermittelung des Wirkungswertes einer salzsauren Zinnchlorürlösung unter Anwendung verschiedener Urprüfungssubstanzen. München (Techn. Hochsch.). 1909. 77 S. 8°.

Hevesy, G. v.: Ueber die schmelzelektrolytische Abscheidung der Alkalimetalle aus Aetzalkalien und die Löslichkeit dieser Metalle in der Schmelze. Freiburg. 1909. 29 S. 8°.

Heyden, P.: Ueber den Einfluss, den die Konzentration der Kalilauge auf die quantitative Analyse des Glykogenes ausübt. Giessen. 1909. 38 S. 8°.

Horak, F.: Die Dissoziation des Kohlenoxychlorids. Berlin. 1909. 47 S m. 3 Fig. 8°.

Horn, G.: Einfluss der Fäulnis auf die Zerstörung des Cyankaliums. Giessen. 1909. 40 S. 8°.

Kayser, E.: Ueber die neutralen Kohlenwasserstoffe des Imprägnieröls. München (Techn. Hochsch.). 1909. 70 S. m. 2 Fig. u. 27 Kurv. 8°.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the books and dissertations in the foregoing list can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT: MACHINERY.

APPLICATIONS.

3690. Crossley and Atkinson. Raising and forcing liquids. Feb. 15.

4329. Dondey and Testro. High-pressure filter. [Australian Appl., March 6, 1909.]* Feb. 21.

4363. Bone, Wilson, and McCourt. Apparatus for transferring heat from gases to liquids or gases. Feb. 22.

4525. Candy and Candy. Filters. Feb. 23.

4621. Burstall. *See under* II.

4789. Summers. *See under* XIII.

COMPLETE SPECIFICATIONS ACCEPTED.

1001 (1909). Jones. *See under* XXIII.

1045 (1909). Burt. Filters. March 2.

4623 (1909). Boothroyd, Ltd., and Woolliscroft. Apparatus for mixing emulsions, etc., March 2.

5931 (1909). Lévy. Separation of gaseous mixtures into their constituents. March 2.

8958 (1909). Moscicki. Bringing liquids into intimate contact with gases or vapours. March 2.

17,246 (1909). Boult (Blair Engineering Co.). Regenerative furnaces. March 2.

21,737 (1909). Kestner. Apparatus for raising liquids by compressed air. Feb. 23.

II.—FUEL: GAS: MINERAL OILS, AND WAXES: DESTRUCTIVE DISTILLATION: HEATING: LIGHTING.

APPLICATIONS.

3610. Westinghouse Metallfaden Gluhlampenfabrik. Manufacture of tungsten filaments for electric lamps. [Austrian Appl., Feb. 15, 1909.]* Feb. 14.

3619. Parker. Gas producers. Feb. 14.

4069. Hiby. Coke ovens.* Feb. 18.

4098. Urbain, Feige, and Seal. Method of illuminating based on the action of the electric current on radiferous phosphorescent sulphides.* Feb. 18.

4124, 4125, and 4126. Hall-Brown. Gas producers. Feb. 19.

4372. Duff, and Gas Power and By-Products Co. *See under* VII.

4473. Fabry. *See under* VII.

4482. Leach, Lang, and Fawcett, Preston, and Co. Manufacture of heating gas. Feb. 23.

4543. Davis. Gas washers. [Addition to No. 2113 of 1909.]* Feb. 23.

4613. Sadler and others. Apparatus used in purifying gas. Feb. 24.

4621. Burstall. Means for extracting tar and other impurities from gases. Feb. 24.

4890. Kros. Coke furnaces.* Feb. 26.

Complete Specifications Accepted.

3326 (1909). Jabs. Gas producers. Feb. 23.

4311 (1909). Southey, and Dudbridge Iron Works, Ltd. Apparatus for generating gas and vapour. Feb. 23.

4361 (1909). Ernst. Production of incandescent light by Dowson gas, generator gas, etc. Feb. 23.

4524 (1909). Crossley and Rigby. Gas producers. March 2.

5093 (1909). Robin. Manufacture of incandescent gas mantles. March 2.

6556 (1909). Muller and Bonnet. Manufacture of incandescent gas mantles. Feb. 23.

9405 (1909). Baglin. Coke ovens. Feb. 23.

15,206 (1909). Weidl. Horizontal coke oven. Feb. 23.

21,374 (1909). Gebr. Siemens und Co. Electrodes for arc lamps. March 2.

III.—TAR AND TAR PRODUCTS.

Applications.

3752. Bedford and Williams. Catalytic reduction of organic substances. [Comprised in No. 17,017 of 1909.] Feb. 15.

4337. Rosculet. Process of solidifying liquid hydrocarbons.* Feb. 21.

4540. Newton (Bayer und Co.). Manufacture of diphenylene dioxide. Feb. 23.

4701. Flurscheim. Nitro derivatives of aniline. Feb. 24.

4898. Newton (Bayer und Co.). Manufacture of halogen substituted anthraquinones. Feb. 26.

Complete Specifications Accepted.

6991 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of substituted phenylglycine-*o*-carboxylic acid compounds. March 2.

30,480 (1909). Ullmann. Manufacture of anthraquinone derivatives. March 2.

IV.—COLOURING MATTERS AND DYES.

Applications.

3601. Newton (Bayer und Co.). Manufacture of a new leuco derivative of the gallocyanine series. Feb. 14.

4536 and 4537. Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. Feb. 23.

Complete Specifications Accepted.

7821 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. March 2.

9888 and 13,323 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture and employment of anthracene colouring matters. March 2.

12,207 (1909). Newton (Bayer und Co.). Manufacture of dyestuffs of the gallocyanine series. Feb. 23.

15,089 (1909). Imray (Meister, Lucius, und Brüning). Manufacture of a black monoazo dyestuff. Feb. 23.

15,403 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of substantive disazo dyestuffs. March 2.

2627 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of brown sulphurised dyestuffs. March 2.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

3559. Knoll und Co. Manufacture of films from acetylcellulose. [Ger. Appl., Feb. 16, 1909.]* Feb. 14.

3829. Weertz and Scheidhauer. Apparatus for making artificial threads. Feb. 16.

3830. Weertz and Scheidhauer. Manufacture of cellulose solution and artificial silk. Feb. 16.

4067. Bloxam (Curtius und Co.). Dyeing and sizing paper.* Feb. 18.

4086. Metzeler und Co., and others. Manufacture of waterproof lustrous fabrics for balloons, etc.* Feb. 18.

4455. Browne. *See under* XIV.

4557. Meunier. Treatment of wool, silk, hair, etc., to increase their resistance to water, heat, and chemicals.* Feb. 23.

4671. Ledanois. Making silk net waterproof.* Feb. 24.

Complete Specifications Accepted.

7206 (1909). Green. Manufacture or treatment of paper. March 2.

7650 (1909). Calico Printers' Assoc., Ashton, and Costobadie. Production of ornamental effects on textile fabrics. March 2.

13,772 (1909). Lavergne. Manufacture of waterproof fabrics. March 2.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

3757. Stark. Treatment of vegetable fibres known as cotton silks. Feb. 15.

4067. Bloxam (Curtius und Co.). *See under* V.

4222. Hilton. Dyeing and like machines. Feb. 21.

Complete Specifications Accepted.

5734 (1909). Marshall. Apparatus for dyeing or similarly treating textile material on bobbins, etc. March 2.

11,355 (1909). Newton (Bayer und Co.). Production of green shades on cotton fibre. March 2.

16,285 (1909). Brierley and Melling. Dye-jigs, cisterns, tanks, vats, etc. Feb. 23.

21,624 (1909). Kemp. Dyeing and washing machines. Feb. 23.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

3842. Sulphates, Ltd., Thwaites, and Ralph. Treating liquors containing metallic compounds to obtain iron, zinc, and cobalt compounds. Feb. 16.

4112. General Electrolytic Parent Co., Ltd., Connor, and Hargreaves. Manufacture of chlorate of soda. Feb. 19.

4288. Simpson and Oviatt. *See under* X.

4372. Duff, and Gas Power and By-Products Co. Recovery of ammonia from gas-producer gas.* Feb. 22.

4376. Szirmay and Arany. *See under* XX.

4428. Loke. *See under* X.

4473. Fabry. Recovery of ammonium sulphate direct from coke oven or retort gas. Feb. 23.

4684. Norris. Manufacture of alkaline formates.* Feb. 24.

Complete Specifications Accepted.

3436 (1909). Barnett. Calcium carbide cartridges. Feb. 23.

3939 (1909). Vautin. Treatment of natural nitrates. Feb. 23.

4167 (1909). Thwaites and Ralph. *See under* X.

10,465 (1909). Johnson (Badische Anilin und Soda Fabrik). Absorption of oxides of nitrogen. Feb. 23.

10,867 (1909). Johnson (Badische Anilin und Soda Fabrik). Production of commercially pure nitrates. March 2.

14,725 (1909). Nauton, De Marsac, and Tesse. Alkaline solvents. Feb. 23.

17,216 (1909). Soc. l'Air Liquide. Liquefying air and separating it into its constituents. Feb. 23.

19,755 (1909). Chem. Werke vorm. Dr. H. Byk, and Schmidt. Manufacture of borates containing active oxygen. March 2.

22,316 (1909). Soc. l'Air Liquide. Separation of rare gases from the atmosphere. Feb. 23.

23,419 (1909). Eschellmann, Harmuth, and Ges. der Tentelew'schen Chem. Fabr. Apparatus for making sulphuric anhydride by the contact process. Feb. 23.

26,878 (1909). Mines de Manganèse de Las Cabesses. Manufacture of suboxides of manganese intended to be used as a stimulant manure. March 2.

VIII.—GLASS ; CERAMICS.

Applications.

4054. Smith. Method of staining glass. Feb. 18.

4316 and 4317. Baillie. Glass furnaces. Feb. 21.

Complete Specifications Accepted.

364 (1909). Bousfield and others. *See under* IX.

IX.—BUILDING MATERIALS.

Applications.

3740. Hartmann and Schwerdtner. Method of preserving wood.* Feb. 15.

3960. Berner. Manufacture of artificial stone.* Feb. 17.

4358. Holden. Manufacture of Portland and other cements. Feb. 22.

Complete Specification Accepted.

364 (1909). Bousfield, Schulte, and Metal Finishers, Ltd. Manufacture of tiles, bricks, pottery, etc. March 2.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

3592. Gutensohn. Treatment of material containing zinc. Feb. 14.

3715. Haultain and Moffatt. Reducing metallic oxide ores.* Feb. 15.

3739. Härdén. Metallurgical furnaces.* Feb. 15.

3819. Mathesius. Reduction of metallic oxides.* Feb. 16.

3965. Gadomsky. Extraction of copper from ore and slags.* Feb. 17.

3981. British Thomson-Houston Co. (General Electric Co.). Treatment of metals of the chromium group.* Feb. 17.

4011. Mackenzie. Treatment of friable or sand-like ores. Feb. 18.

4064. King's Norton Metal Co., and others. Removing copper or its alloys from steel, iron, or other surfaces. Feb. 18.

4288. Simpson and Oviatt. Reduction of metallic oxides. Feb. 21.

4428. Loke. Production of concentrates of titanic oxides combined or mixed with iron oxides. Feb. 22.

4466. Eldred. Platinum-clad metals.* Feb. 23.

4553. Murex Magnetic Co., Ltd., and Lockwood. Treatment of ores and the like. Feb. 23.

4692. Warren. Apparatus for granulating blast furnace slag.* Feb. 24.

4745. Hopkins. Condenser for zinc smelting furnaces. Feb. 25.

Complete Specifications Accepted.

26,852 (1908). Minerals Separation, Ltd. (Higgins). Concentration of ores. Feb. 23.

4167 (1909). Thwaites and Ralph. Separating copper and other metals from liquors obtained in wet metallurgical processes. Feb. 23.

4471 (1909). Hemingway. Recovering lead and zinc from compounds containing these metals. March 2.

4914 (1909). Rouse. Agglomerating or briquetting copper ore concentrates preparatory to smelting. March 2.

6461 (1909). Osborn and Carnegie. Apparatus for extracting sulphur dioxide and other gases from cupolas, etc. March 2.

6821 (1909). Reid. Reducing iron or other ores and refining the metal obtained. March 2.

12,198 (1909). Huntington. Separating volatile from non-volatile metals or metalliferous substances. Feb. 23.

24,631 (1909). Sanna. Utilising the spongy zinc obtained electrolytically. March 2.

XI.—ELECTRO-CHEMISTRY.

Applications.

3733. Marseille and Gouin. Manufacture of alkaline accumulator electrodes. [Fr. Appl., March 8, 1909.]* Feb. 15.

3833. British Thomson-Houston Co. (General Electric Co.). Material suitable for insulating, etc.* Feb. 16.

4226. Irwin and Stubbs. Electrolysis. Feb. 21.

4452 and 4453. Browne. *See under* XIX.

4645. Gorham. Resuscitating negative plates of secondary batteries and assisting in their formation. Feb. 24.

Complete Specification Accepted.

18,433 (1909). Levi. *See under* XVI.

XII.—FATS ; OILS ; WAXES.

Applications.

3591. Patent Borax Co., Ltd., and Bradford. Soaps and other saponaceous compounds, detergents, bleaching compounds, etc.* Feb. 4.

3613. Wendler. *See under* XXIII.

3752. Bedford and Williams. *See under* III.

4661. Simpson. Extraction of vegetable and other oils and fats or essences. Feb. 24.

4852. Hargreaves. Manufacture of soap. Feb. 26.

Complete Specification Accepted.

16,665 (1909). Genthe. Thickening linseed and similar oils. March 2.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Applications.

3649. Farup. Manufacture of colouring matters from titaniferous iron minerals. [Norw. Appl., Feb. 15, 1909.]* Feb. 14.

4789. Summers. Apparatus for drying white lead colour powders, etc. Feb. 25.

Complete Specifications Accepted.

4040 (1909). Jagenburg. Production of printing ink and oil paints. Feb. 23.

11,525 (1909). Pope. Manufacture of white lead. Feb. 23.

XIV.—INDIA-RUBBER : GUTTA-PERCHA.

Applications.

3587. Silberrad. Manufacture of products useful in the rubber industry. Feb. 14.

3932. Barnes. Manufacture of rubber, etc. Feb. 17.

4001. Silberrad. *See under* XX.

4080. Plinatus. Manufacture of a caoutchouc-like substance. Feb. 18.

4189. Matthews and Strange. Synthetic manufacture of caoutchouc. Feb. 19.

4455. Browne. Cleaning, scouring, bleaching, or degumming rubber, wool, cotton, etc. Feb. 22.

4572. Mattthews and Strange. Synthetic manufacture of caoutchouc. Feb. 23.

4620. Matthews and Strange. Manufacture of caoutchouc. Feb. 24.

4904. Zu Aichlburg. Manufacture of caoutchouc-like mass. [Austria Appl., March 6, 1909.]* Feb. 26.

XV.—LEATHER; BONE; HORN; GLUE.

Complete Specifications Accepted.

8960 (1909). Johnson (Chem. Fabr. Elektro). Manufacture of compositions for use in dressing leather. Feb. 23.

14,516 (1909). Redlich and Wladika. Treatment of quebracho extracts. Feb. 23.

16,440 (1909). Nitritfabrik. Manufacture of tannin extracts. Feb. 23.

XVI.—SOILS; FERTILISERS.

Application.

4091. Wade. *See under* XIX.

Complete Specifications Accepted.

18,433 (1909). Levi. Electrochemical prodrction of phosphatic fertilisers. Feb. 23.

26,868 (1909). Mines de Manganèse de Las Cabesses. *See under* VII.

XVII.—SUGAR; STARCH; GUM; &c.

Application.

4855. Kestner. Sugar-crystallising processes. [Belg. Appl., Feb. 26, 1909.]* Feb. 26.

Complete Specification Accepted.

25,121 (1909). Flick. Manufacture of soluble starch. Feb. 23.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

3574. Justice (Schneible Co.). Manufacture of fermented liquors.* Feb. 14.

4177. Overbeck. Obtaining alcohol from distillers' wort.* Feb. 19.

4800. Nance. Manufacture of fermented beverages containing low percentages of alcohol. Feb. 25.

XIX.—FOODS: WATER PURIFICATION; SANITATION.

Applications.

3604. Mosnier. Preservation of maize, rice, etc.* Feb. 14.

3613. Wendler. *See under* XXIII.

3673. Levin. Manufacture or treatment of flour. Feb. 15.

3969. Richardson. Purifying or clarifying water.* Feb. 17.

4091. Wade. Apparatus for filtering sewage and obtaining manure.* Feb. 18.

4289. Goslar. Preparation of a foodstuff from blood. Feb. 21.

4330. Stener. Purifying apparatus for liquids.* Feb. 21.

4452. Browne. Removing or rendering innocuous foreign matter or impurities in certain materials by electricity. Feb. 22.

4453. Browne. Softening and purifying water by electricity. Feb. 22.

4454. Browne. Disinfecting, decolorising, or deodorising liquids. Feb. 22.

4538. Newton (Bayer und Co.). Production of an alimentary substance. Feb. 23.

4642. Belhommet. Preserving the yolk of eggs.* Feb. 24.

Complete Specifications Accepted.

22,140 (1908). Grossmann. Desiccating sewage sludge. March 2.

767 (1909). Morse. Digesters and similar apparatus for treating garbage. Feb. 23.

8041 (1909). Willman. Process of pasteurising milk. Feb. 23.

8296 (1909). Candy. Purification of water. March 2.

20,179 (1909). Schilling, and Ges. f. Abwässerklärung. Separation of light or floating substances from effluents. March 2.

25,341 (1909). Edme, Ltd., and Lovell. Malt composition for use as food. March 2.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

3752. Bedford and Williams. *See under* III.

4001. Silberrad. Manufacture of isoprene. Feb. 18.

4376. Szirmay and Arany. Preparation of chemically pure lithium sodium citrate. [Hungarian Appl., Feb. 22, 1909.]* Feb. 22.

4539. Newton (Bayer und Co.). Manufacture of santalol compounds. Feb. 23.

4661. Simpson. *See under* XII.

Complete Specification Accepted.

25,675 (1909). Wassermann. Substances for the local immunisation of diseased tissues. Feb. 23.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

4208. Dawson, Finlay, and Thames Colour Plate, Ltd. Colour screens for colour photography. Feb. 19.

4209. Dawson, Finlay, and Thames Colour Plate, Ltd. Colour photography. Feb. 19.

4912. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Manufacture of polychrome screens for colour photography. [Addition to No. 29,273 of 1909. Fr. Appl., Feb. 27, 1909.]* Feb. 26.

Complete Specification Accepted.

7518 (1909). Cunningham. Treatment of photographic prints. March 2.

XXII.—EXPLOSIVES; MATCHES.

Applications.

3907. Flurscheim. Manufacture of priming compositions, charges, and shells for torpedoes. Feb. 17.

4700. Flurscheim. Explosive compositions. Feb. 24.

XXIII.—ANALYTICAL PROCESSES.

Application.

3613. Wendler. Determination of fat in milk and other dairy products.* Feb. 14.

Complete Specifications Accepted.

4011 (1909). Jones. Scale for comparing or converting strengths of solutions. Feb. 23.

16,536 (1909). Hillmer. Apparatus for determining the specific gravity of liquids. March 2.

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Birmingham Section.

Meeting held at Birmingham University, on Thursday, December 9th, 1909.

HENRY L. HEATHCOTE, B.SC., IN THE CHAIR.

RAPID ELECTRO-ANALYSIS WITH STATIONARY ELECTRODES.

BY T. SLATER PRICE, D.SC., PH.D., F.I.C., AND T. C. HUMPHREYS.

In March, 1909, J. T. Stoddard published the results of an investigation on the rapid electro-analysis of cadmium, copper, nickel, silver and zinc, using stationary electrodes (Journ. Amer. Chem. Soc., 1909, **31**, 385; this J., page 375). The first set of experiments dealt with the use of a cylindrical gauze cathode (3 cm. long and 3 cm. in diameter) surrounding a cylindrical foil anode (2.5 cm. long and 0.8 c.m. in diameter); the agitation of the electrolyte was produced simply by the heating effects and vigorous gas evolution caused by the strong currents employed. The following solutions were used, the amount of the electrolyte being about 50 c.c. in each case.

1. Cadmium nitrate with just enough potassium cyanide to give a clear solution.
2. Copper sulphate with 7 or 8 drops of concentrated nitric acid. The solution was heated to about 60°.
3. Nickel sulphate with 1·5 grms. of ammonium sulphate and 12 to 15 c.c. of concentrated ammonia.
4. Silver nitrate with the least possible excess of potassium cyanide. The solution was heated nearly to boiling.
5. Zinc sulphate with an excess of sodium hydroxide; or with sodium hydroxide to partial solution of the precipitate and then just enough potassium cyanide to give a clear solution. The solution was heated.

The strong currents employed often heated the solution to boiling.

The following table gives the times necessary for the complete deposition of given weights of the various metals, and also the strength of current used. The current density per sq. dcm. is obtained in each case by dividing the given current by 0·4.

Metal.	Approx. weight in grams.	Current Ampères.	Time in mins.
Cadmium	0·42	5	15
Copper	0·5	6	10
Copper	0·5	8	8
Nickel	0·34	6	8
Nickel	0·49	6	12
Nickel	0·6	6	16
Silver	0·25	1—1·5	10
Silver	0·5	1	17
Zinc (NaOH)	0·5	4	15
Zinc (NaOH)	0·4	8	10
Zinc (KCN)..........	0·5	6	30

Another table is also given, showing that the results of different experiments on the same solution are in agreement with each other; for example, two determinations of copper in 25 c.c. of a given solution gave 0·4944 and 0·4943 grm. of copper respectively. The author then draws the conclusion that the results are quantitative. In no case, however, as pointed out by one of us in Science Abstracts, 1909, No. 757, p. 264, does the author give the actual weight of the metal taken, so that the accuracy of the experiments cannot be ascertained from his results. It has been pointed out repeatedly (compare Price and Humphreys, this Journ., 1909, **28**, 117) that the accuracy of an electrolytic method cannot be ascertained by simply making a number of different determinations, taking the same volume of salt solution in each case, and comparing the weights of metal deposited. In each case it is necessary for the investigator to satisfy himself that all the metal has been deposited, and that the weight of the deposit is in agreement with the weight of metal actually taken.

Frary (Trans. Amer. Electrochem. Soc., 1909, **15**, 495), in a discussion on a paper by Palmer and Palmer on rapid electrochemical analysis, referred to Stoddard's work and made a somewhat similar criticism to the above; he also pointed out the necessity of Stoddard's results being checked by several independent workers. We had already commenced work on the subject before Frary's criticism was published; it is the results of this work which we venture to bring before the society.

Our method of procedure was as follows:—In each case the amount of metal in a given volume of solution was determined electrolytically, using a rotating cathode, by a method which was known to give quantitative results. The analysis was then carried out exactly as described by Stoddard, and the results compared with those obtained with the rotating electrode. Since the fixed cathode (45 mm. long and 32 mm. in diameter, with 4 meshes to the sq. mm.) and anode (44 mm. long and 22 mm. in diameter) used by us had not exactly the same dimensions as the electrodes used by Stoddard—and we did not deem it advisable to incur the expense of fresh electrodes—we not only electrolysed for the times given in Stoddard's paper, but also for longer times.

The results are given in the following table. The voltages are not given, since they have little significance (compare Price and Humphreys, *loc. cit.*). The volume of solution was in each case 70—80 c.c. Also, after the electrolysis was completed, the whole of the electrolyte and washings was tested to see if all the metal had been deposited. The results of these tests are given in the last column. The pipettes used to measure the solution had been carefully calibrated.

The figures printed in thick type give the times used by Stoddard in his experiments (see table p. 2), and which he stated were sufficient for complete deposition.

The electrolytes used in each case were as follows:—

Salt used.	Electrolyte added.	
	Rotating electrode.	Stationary electrodes.
Copper sulphate.	1 cc. conc. HNO_3.	6 drops (= ½ cc.) conc. HNO_3.
Nickel ammonium sulphate.	1·5 gms. ammoniam sulphate. 5 cc. conc. ammonia.	1·5 gms. ammonium sulphate. 12 cc. conc. ammonia.
Silver nitrate.	10 cc. conc. nitric acid. 15 cc. conc. ammonia.	Potassium cyanide in slight excess.
Cadmium sulphate.	1·5 gms. sodium hydroxide. 0·5 gm. potassium cyanide.	Potassium cyanide till solution just cleared.
Zinc sulphate.	2 gms. sodium sulphate. 1 gm. sodium acetate. 2 drops glacial acetic acid. or 3 gms. ammonium sulphate. 3·5 cc. conc. ammonia.	Sodium hydroxide to partial solution of the precipitate and then potassium cyanide till clear.

Metal.	Volume of solution taken in cc.	Cathode used.	Temp.	Amps.	Time in mins.	Weight of deposit grams.	Remarks.
Copper....	25	Rotating	Cold	4	25	0·5085	Good deposits. All down.
	25	,,	,,	4	30	0·5085	
	25	Fixed	Hot (60°)	6	10	0·5054	Good deposits, but not all deposited.
	25	,,	,,	6	10	0·5066	
	25	Rotating	Cold	3	25	0·4896	Good deposits. All down.
	25	,,	,,	3	25	0·4897	
	25	Fixed	Hot (60°)	5	20	0·4902	Deposit slightly spongy in one part.
	25	,,	,,	5	20	0·4904	Deposit fairly good, but showed a tendency to become spongy.
Nickel .	25	Rotating	Cold	2	20	0·2758	Good deposits. All down.
	25	,,	,,	2	30	0·2757	
	25	Fixed	,,	6	8	0·2745	Good deposits. Not all down.
	25	,,	,,	6	8	0·2725	
	25	Rotating	Cold	2	30	0·2546	Good deposit. All down.
	25	Fixed	,,	6	20	0·2543	Fine white deposits. All down. No frothing during electrolysis.
	25	,,	,,	6	20	0·2544	
Silver .	25	Rotating	Boiling	2	30	0·3352	Deposits good. All down.
	25	,,	,,	2	25	0·3349	
	25	Fixed	,,	1·5	17	0·3343	Deposits good.
	25	,,	,,	1·5	17	0·3341	
	25	Rotating	Boiling	2	20	0·3217	Good deposits. All down.
	25	Fixed	,,	1·5	15	0·3211	
	25	,,	,,	1·5	15	0·3213	
	25	Rotating	Boiling	2	30	0·2542	Good deposits. All down.
	25	,,	,,	2	30	0·2541	
	25	Fixed	,,	1·5	17	0·2528	Firm white deposits. All down.
	25	,,	,,	1·5	17	0·2529	
	25	,,	,,	1·5	30	0·2526	
	25*	,,	,,	2	—	—	Very spongy deposit. Not weighed.
	25*	,,	,,	1	—	—	Spongy deposit. Not weighed.

* In these two cases the electrolyte used contained 10 cc. conc. nitric acid and 15 cc. of conc. ammonia.

Metal.	Volume of solution taken in cc.	Cathode used.	Temp.	Amps.	Time in mins.	Weight of deposit in grams.	Remarks.
Cadmium	10	Rotating	Cold	2	30	0·2002	Good deposits. All down. Weight of Cd. in 25 cc.=0·5005 gram.
	10	,,	,,	2	30	0·2003	
	25	Fixed	,,	5	15	0·4970	Good deposits, but not all down.
	25	,,	,,	5	15	0·4941	
	25	,,	,,	5	15	0·4985	
	25	,,	,,	5	15	0·4940	
	10	Rotating	Cold	2	30	0·1783	Firm white deposits. All down. Weight of Cd. per 25 cc. =0·4456 gram.
	10	,,	,,	2	30	0·1782	
	25	Fixed	,,	5	30	0·4457	Very good deposits. All down.
	25	,,	,,	5	30	0·4456	
Zinc	10	Rotating (silvered)	Cold	1–2	30	0·2037	Good deposits. All down. Weight of Zn per 25 cc.=0·5090 gram.
	10	,,	,,	1–2	30	0·2035	
	25	Fixed	Hot	6	30	0·5055	Good Deposit. Not all down.
	25	,,	,,	6	30	0·4412	Not down.
	25	,,	,,	6	30	0·4146	Deposit began to redissolve.
	10*	Rotating (silvered)	Cold	1	25	0·2030	All down. Good deposits. Weight of Zn per 25 cc.=0·5075 gram.
	10*	,,	,,	1	25	0·2029	
	25*	Fixed	,,	6	30	0·5076	Good deposits. All down.
	25*	,,	,,	6	30	0·5075	

* The solution was not the same as that used in the previous set of five experiments.

In considering these results it should be borne in mind that our electrodes were not exactly the same size as those used by Stoddard. They were a little larger, and consequently the current density would be a little less; this should favour the formation of a good deposit. A satisfactory electrolytic method should, however, admit of a variation in the size of the electrodes between certain limits which are not necessarily very close together.

It should further be remembered that when it was found that the times mentioned by Stoddard were not long enough for complete deposition, we have not endeavoured to find the *least* time necessary for a quantitative result to be obtained, for reasons which we have given in a previous paper (*loc. cit.*).

Copper.—10 minutes were not sufficient for the complete deposition of 0·5 grm. of copper. Quantitative results were obtained after 20 minutes, but the deposits showed a slight tendency to become spongy.

Nickel.—0·27 grm. of nickel could not be completely deposited in 8 minutes. The results were quantitative after 20 minutes, and the deposits satisfactory in every way.

Silver.—The results obtained with the fixed electrodes were always slightly low, notwithstanding that the test on the electrolyte and washings showed that all the silver had been deposited. Similar results for a cyanide electrolyte, using a rotating anode, have been obtained by Fischer and Boddaert (Zeitsch. für Elektrochem. 1904, **10**, 945) and Sand (Trans. Chem. Soc., 1907, **91**, 387. This J., 1907, 190). The low results were not due to the weight of silver obtained with the rotating electrode being high, since the weights agreed to within 0.1–0.2 mgm. with the weight of silver actually taken.

Further experiments showed that the electrolyte which gave satisfactory results with the rotating electrode could not be used with the fixed electrodes, since the deposit was spongy and quite unweighable, even when a current of 1 ampère only was used.

Cadmium.—15 minutes were not sufficient for the complete deposition of 0·49 grm. of cadmium. Very good results were obtained after 30 minutes.

Zinc.—The experiments described in this paper were really undertaken because we were surprised at the good results obtained by Stoddard in the electrolytic estimation of zinc, this metal being, as we have pointed out elsewhere, (*loc. cit.*) one of the least satisfactory to determine electrolytically. Our results are in accordance with those of Stoddard, except in so far as the temperature is concerned. If the electrolysis is started with cold solutions the results are satisfactory, but if the solution is subjected to a preliminary heating the zinc is not all deposited, and in one experiment it began to dissolve off the electrode. This agrees with the results obtained by one of us (Price, Trans. Faraday Soc., 1907, **3**, 88. This J., 1907, 345) in the determination of zinc with rotating electrodes.

In the light of our experience we are of opinion that for rapid electro-analysis stationary electrodes* are not so reliable and satisfactory as rotating electrodes. In the case of silver they do not give accurate results, and one never feels quite certain of the result when zinc is being deposited. One great disadvantage is that a tap-funnel cannot be used to hold the electrolyte, owing to some of the latter remaining in the neck of the funnel and escaping electrolysis. This necessitates the use of a beaker, with subsequent siphoning off of the electrolyte, which, in comparison with the funnel method, is a somewhat clumsy method of procedure. Nor is it a neat method of doing things to lower the beaker away from the electrodes while they are being washed, since this necessitates the preliminary removal of the tripod and gauze on which the beaker has been standing. Experiments are being made in this laboratory, however, by means of which it is hoped to adapt a tap-funnel for use with stationary electrodes.

Stoddard also carried out experiments with a mercury cathode and stationary anode. We have not repeated his results, since for ordinary work a mercury cathode is not manipulated as conveniently as a platinum one.

Discussion.

The Chairman said that he remembered reading Stoddard's results when first published, and viewing them with suspicion because he had been accustomed to give stationary electrodes a much longer time. The difference between the older process and the American one was that in the latter a high temperature was used. The effect of that was enormously to increase the size of any bubbles which were evolved during electrolysis. This was, of course, due to the steam diffusing into the little bubbles so that they exerted a powerful brushing effect on the deposit. The difficulty still met with was that sometimes copper and other metals came down in the form of powder. An investigation into the causes of this would be a real boon to many.

Mr. E. A. Lewis asked how the impurity in the electrolyte affected the character of the deposit. In the case of copper, for example, how would it come down if the electrolyte contained arsenic, or, in another instance, a relatively large amount of iron. It was possible with the stationary electrode, by varying the conditions, to get a good deposit even in the presence of impurity. Could the same be done with this rapid method?

Professor T. Turner asked whether the copper solution was hot or cold?

Dr. Price: About 60°.

Dr. Slater Price, in replying on the discussion, said his object in bringing the paper before the Section was because matters which appeared in foreign journals often escaped the attention of some chemists; and because he wanted to make known the tests they were making. He did not think that the method of rotating electrodes was going to be driven out at present. The new method was neither so reliable nor convenient. Mr. Lewis was still sceptical with respect to rotating electrodes; but he would find that more could be done with them than by stationary electrodes, especially with respect to copper. By rotating electrodes one could deposit the copper more quickly, and thus obtain the results with greater rapidity. Practically all that could be achieved with stationary electrodes could be achieved with rotating electrodes. In nitric acid solution arsenic did not come down with copper with the rotary electrodes.

London Section.

Meeting held at Burlington House, on Monday, March 7th
1910.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE RATIONAL ANALYSIS OF CLAYS.

BY WALTER C. HANCOCK, B.A., F.I.C.

The ultimate analysis of a clay gives the percentages of the acidic and basic oxides, but does not indicate how these are combined in the form of the various minerals present. The amounts of silica, alumina, and combined water are a rough measure of the amount of "clay" present in the sample. The fusibility depends to a large extent upon the sum of the fluxes (the oxides of titanium, iron, calcium, magnesium, and the alkali metals), provided in the case of a fireclay there is not a large excess of silica, which at high temperatures acts as a flux. The colour to which the clay will burn may be judged by the amount of iron, though the red colour due to iron oxide is modified by the presence of calcium compounds. Clays with a large amount of combined water tend to crack during burning, and have a high shrinkage, and those with a large amount of organic matter require slow firing. Beyond these points the ultimate analysis is not much guide in the manufacture of clay goods, and the rational analysis aims at the quantitative separation of the components of a clay into three mineral species, clay substance, quartz, and felspar, which are the main ingredients of most "body" mixtures. Thus, when one clay has to be substituted for another, the potter can calculate from such an analysis what alterations are necessary in the mixture in order that the body may retain certain physical properties. It also gives an insight into some of the physical properties of the clay itself, such as plasticity, shrinkage, fusibility, texture, etc. Clays are mixtures of quartz grains, fragments of unweathered minerals, and the product of the weathering of certain minerals, the "clay substance," which is mainly hydrated aluminium silicate. Quantitatively, the most important minerals are clay substance, quartz, felspar, and mica; others, such as pyrites, calcite, rutile, hornblende, garnet, etc., are only present in small quantities, and are left out of account in the rational analysis.

In 1835 Forchammer, in an investigation of the constitution of clay and its formation from felspar, adopted sulphuric acid as a solvent for clay. In 1844, Brongniart refers to the process as the "rational analysis," and regarded it mainly as a method of isolating "kaolin" (argile kaolinique) from "normal kaolins." In 1852 it was used by Fresenius in his examination of the clays of Nassau, and in the early seventies by Bischof in his work on the relation between chemical constitution and refractoriness. It was, however, Seger who developed the process to its present state, and pointed out that the portion insoluble in sulphuric acid, in many cases did not consist only of silica, but contained appreciable quantities of felspar, the amount of which could easily be determined by a slight extension of the process. Briefly, the process consists in decomposing the clay with sulphuric acid with the formation of aluminium sulphate and the liberation of silica, in a form in which it can be easily dissolved. The insoluble portion consists of quartz and felspar, and the amount of the latter is calculated from the alumina or alkali content. The accuracy of the results depends largely on the details of the process, the ratio of the amounts of reagents used to the quantity of clay taken, the strength of the reagents, and the methods of heating.

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* We think that the results would be somewhat better if the foil anode were replaced by one made of gauze.

Acid treatment.—With proper precautions the clay substance is completely decomposed by strong sulphuric acid, the quartz is not attacked, the felspar is only slightly affected so that the error from this cause can be neglected, but the mica is very largely dissolved. For 5 grams of clay, dried at 100° C., the following amounts of acid and water have been suggested :—

		Water	Acid.
C. Bischof	1884	150 c.c.	25 c.c.
H. Seger	1893	100 to 150 c.c.	50 c.c.
H. Hecht	1895	300	50
C. Bischof	1899	150	50
A. Sabeck	1902	100	50
E. Berdel	1903	200	100
G. Lunge	1908	100	50

The heating is generally effected by placing the dish directly over a flame, and arranging that 4 to 4½ hours elapse before the acid fumes strongly. Care is required, especially with silicious clays, on account of the "bumping" of the liquid. Some experimenters recommend heating on a water bath for 10 hours, and then on a sand bath till the acid fumes.

Alkali treatment.—The silica liberated by acid from the clay substance is dissolved by sodium hydrate, or carbonate, or both. Koerner has suggested its removal by digesting the mass on a water bath for 5 minutes with ½ per cent. hydrofluoric acid. Sabeck recommends 2 per cent. caustic soda; Lunge and Millberg, digestion with 5 per cent. caustic soda on a water bath, and Berdel 400 c.c. of a 6 to 7 per cent. caustic soda, and heating nearly to boiling. Jackson and Rich found that warming with 5 per cent. caustic soda dissolved appreciable amounts of felspar, and these and similar experiments of Seger were made on apparently unweathered crystals of felspar, which presumably would be more resistant than particles still left in plastic clays which have resulted from the decomposition of older rocks.

For the determination of the felspar in the residue it was formerly considered enough to estimate the alumina, but Lindhorst suggested that the alkali content would be better, and this is now generally used. The amount of alumina often exceeds that required for the felspar, calculated from the alkali, probably due to the presence of other aluminous minerals.

Probably one of the most convenient and accurate processes for the rational analysis is that described in Lunge's "Methods of Technical Analysis," which seems to embody most of the recommendations from these and other sources.

This process was recently used in making the rational analyses of a number of clays of which ultimate analyses were also available. The alkalis were determined by the Lawrence Smith method, and in many cases the portions dissolved by sulphuric acid, and the insoluble residues were analysed for the silica and alumina contents.

The following table gives the ultimate analyses of a series of five fireclays (to the first decimal place).

	94	95	96	97	98
Silica	59·0	53·1	52·0	54·9	46·4
Alumina	25·4	30·5	30·3	29·0	37·1
Combined water	9·4	11·1	10·6	10·2	12·5
Potassium oxide	·2	·3	·6	·2	·2
Difference	6·0	5·0	6·5	5·7	3·8
	100·0	100·0	100·0	100·0	100·0

From these figures the felspar was calculated from the percentage of alkali, according to the formula for orthoclase, $K_2O.Al_2O_3.6SiO_2$. The clay substance ($2SiO_2.Al_2O_3.2H_2O$) can be calculated either from the combined water, or from the alumina less the alumina required for the felspar. Only in No. 98 is there enough alumina to satisfy all the combined water as clay substance and the alkali as felspar. On the other hand, if calculated on the alumina, less the alumina in the felspar, there is in Nos. 94 to 97 an excess of combined water, due probably to the presence of other hydrated minerals such as mica.

The following table shows the results of the rational analyses compared with the calculated amounts of clay substance, quartz, and felspar.

	Clay sub.		Quartz.		Felspar.	
	Found.	Calc.	Found.	Calc.	Found.	Calc.
94	66·2	63·3	31·1	28·8	2·2	1·2
95	82·2	76·0	15·5	16·5	2·2	2·0
96	85·4	74·7	13·4	14·9	1·2	3·7
97	79·9	72·7	19·7	20·2	·37	1·2
98	92·5	92·8	7·1	2·3	·4	1·4

The residues were :—

	K_2O.	SiO_2.	Al_2O_3.	In felspar.		Free silica.
				SiO_2.	Al_2O_3.	
94	·4	31·7	1·3	1·7	·5	30·0
95	·4	15·5	1·9	1·45	·4	14·0
96	·2	13·9	·6	·75	·22	13·2
97	·06	18·43	1·9	·22	·07	18·21
98	·06	5·98	1·45	·25	·07	5·73

The following table shows: 1, The amount of clay substance found; 2, the silica; and 3, the alumina found; and 4, the combined water (calculated) in the clay substance; 5, the totals of these three; 6, the combined water found in the ultimate analysis, and at the bottom the proportions of silica to alumina to combined water, which theoretically should be as 100 : 80 : 30.

	94	95	96	97	98
1.	66·2	82·2	85·4	79·9	92·5
2.	26·7	36·3	37·1	35·3	40·1
3.	32·4	36·0	36·7	34·4	40·0
4.	9·2	11·4	11·9	11·1	12·9
5.	68·3	83·7	85·7	80·8	93·0
6.	9·4	11·1	10·66	10·2	12·2
Silica	100	100	100	100	100
Alumina	122	99	109	97	100
Water	34	31	32	31	32

From these results it appears that the soluble portion agrees fairly well with the formula, $2SiO_2.Al_2O_3.2H_2O$, if the amount of ferric oxide is allowed for, and that in certain cases the calculated amount of clay substance approximates to the amount found, provided that the oxides of iron, calcium, magnesium, etc., are relatively insignificant. The analysis of the residues serves as a check on the completeness of the decomposition of the clay, and shows whether the aluminium sulphate and liberated silica had been properly removed. The total silica in the residue, minus the silica in the felspar, should be equal to the quartz found. As seen from the table, the alumina is, in this series, in excess of that required for the felspar, calculated from the alkali.

The results already quoted were obtained on a series of 5 fireclays, and the following table shows that the calculated results may be entirely different from the actual amounts of clay substance, quartz and felspar found in a rational analysis.

	Clay subs.		Quartz.		Felspar.	
	Found.	Calc.	Found.	Calc.	Found.	Calc.
86	84·5	48·2	14·7	29·5	·8	16·1
87	56·8	38·9	41·9	39·1	1·4	16·2
88	57·7	39·3	40·4	36·8	1·9	18·0
89	71·9	68·4	24·7	7·4	3·4	19·6
90	88·7	79·5	10·5	2·6	·8	13·0
91	85·3	85·9	15·2	3·1	1·5	8·6
109	57·4	37·5	48·1	17·9	1·5	10·4

The sum of the calculated amounts of clay substance, quartz, and felspar is not 100, because the oxides of titanium, iron, calcium, etc., are not reckoned in, but their sum in this series is less than 4 per cent. At present there are not enough data to draw any definite conclusions from these comparisons. It must always be borne in mind that with very plastic, fine grained clays the component minerals are so small in grain that they may be easily attacked by reagents. This would account for the high values found for the clay substance. The felspar is the least satisfactory of the calculations. It would appear that either the felspar is very seriously attacked in the process, or that much of the alkali is present, not as felspar, but as some other mineral.

Discussion.

Mr. **John W. Cobb** wrote: I have not used the ordinary "rational" analysis of clays much, because the few trials I made of it years ago were unsatisfactory. Some limitations have been indicated by Langenbeck in his "Chemistry of Pottery." The ordinary treatment with alkali is too drastic, since it is certain to dissolve some free silica, even quartz, unless the grains are coarse. Lunge showed this, and my own trials were confirmatory, leading to 15 minutes' treatment with 5 per cent. Na_2CO_3 solution, hot, as a method for separating gelatinous silica from quartz; stronger solutions dissolved fine quartz. For some practical purposes, however, it is only the coarse quartz which counts in action, and in such cases the treatment with stronger alkali may be preferable, although chemically less distinctive. Generally speaking, my experience suggests that for works guidance, neither the "complete percentage," nor the "rational" analysis of a clay can be trusted without special modifications in application and interpretation, which vary with the use to which the clay is to be put, and that a variety of "rational" analyses will be forced upon the understanding chemist. For purposes of classification and of reporting clay analyses, in general terms without consideration of usefulness in specific directions, such as fall to the lot of a geological survey, a generally approved method is desirable and the working out, improving, and critical examination of such a method eminently useful.

Dr. **J. W. Mellor** (Hon. Secretary English Ceramic Society) said it was very important in dealing with clays, compounding mixtures, etc., to have some definite idea how they were going to behave. At present one had to depend mainly on the method of trial and failure; and this became very laborious in dealing with a large number of clays. The rational analysis was intended to furnish data, which enable the process of trial and failure to be abbreviated. Mr. Hancock had added to the series of comparisons most of which indicated that the method was not reliable for clays in general, although, it might give very fair results with clays of one particular type.

Some ball clays contained very considerable amounts of carbon, three or four per cent. might be taken as an average. Had Mr. Hancock drawn any distinction in his calculations between the carbon as such, and clay substance? Sabeck added nitric acid with his sulphuric acid to get rid of carbon: but supposing that the result were successful, it was not fair to make comparisons with clay substance containing unknown amounts of carbonaceous matters.

He inquired if Mr. Hancock had detected felspar in either the ball or the washed china clay he had examined, possibly also the stoneware clay? He inferred that Mr. Hancock had found something which he called "felspar," and calculated how much of this imaginary substance ought to be present in his clays; and placed figures before them to show that the two determinations do not agree. It would be interesting to find what would be done with some of the nepheline clays, which contain nepheline in place of felspar. This mineral would come out in the rational analysis as "clay substance." In dry Cornish stone, he did not know what grounds there were for assuming the white powder to be $Al_2O_3.SiO_2.2H_2O$. Some of this substance was present, but it was mixed with another hydrated alumino-silicate with a different loss on ignition.

The results of the rational analysis were quite incompatible with the ultimate analysis. The latter was fairly accurate, the former was not. There was, therefore, only one possible conclusion.

He was not sure he agreed with the author's plan of calculating felspar by a determination of the alkalies in his first residue. He saw no advantage over the alumina method, and certainly the residue would want some washing to get rid of the soda occluded during the removal of clay substance.

Mr. **Blount** said clay substance proper was not an entity. Kaolinite, he supposed, existed, but it had very little to do with real clay. The same thing probably held true with felspar. Calculations had been made as to the amount of felspar in clay from the percentage of soda or alumina in the residue obtained after decomposition of the clay by some particular method, *e.g.*, by sulphuric acid of a certain strength, with the result that the figures were incompatible. One should try to derive from those rather discouraging facts a more rational method of analysis. A method was wanted, partly physical and partly chemical, by which one could make a proximate analysis of mineral bodies. Mr. Hancock had done considerable service in shewing that the customary methods by which these things were calculated, instead of using purely analytical methods, were liable to error. He (the speaker) suggested a course which might, perhaps, be better. Let a mixture be made of the minerals identified by mineralogists in clays, and be treated in such a manner as to make proximate analyses of them. In that way, he thought, they would soon know a great deal more about the matter than they did at present.

Mr. **H. M. Ridge** said the author referred especially to orthoclase felspar; but he did not know whether he based any of his calculations on other varieties of felspar, which were of common occurrence. He suggested that possibly if the author took the trouble to find out approximately—it was not possible to do it accurately—what was the original source of the clay, the original variety of stone or rock from which the clay was derived before decomposition, he might find that only a small portion had been derived from rock which had contained the bulk of its felspar of the orthoclase variety. That might lead to some further interesting results, and also the composition of the different varieties of felspar might throw light upon the result obtained in the rational analysis of clays.

Mr. **Beadle** asked if the author had traced any relation between the percentage of clay substance and the plasticity of the clay. He remembered that at one time different percentages of organic matter were purposely added to china clay, in the form of dissolved cellulose, until it reached a plasticity equal to that of ordinary clay. An addition of two per cent. would impart sufficient plasticity to a non-plastic clay to enable it to be worked. The nature and extent of the organic matter in clay might, therefore, in a large measure, account for its plastic character.

Mr. C. G. Cresswell referred to Acheson's work (see this Journal, 1910, 246). Acheson had succeeded in finding organic solutions which would impart plasticity to clay. It seemed quite possible that many other bodies were rendered to a certain degree plastic by the addition of organic matter; for instance, in his own neighbourhood there was Thanet sand, very fine, and possessing distinct plasticity; and firebricks were being made near Epsom with this sand, which was locally called clay. It was almost certain that this plasticity was due mainly to the organic matter associated with the sand. Acheson used a tannin solution for deflocculating graphite. There were huge quantities of mica flowing down certain Cornish streams deflocculated by organic matter; and, many years ago, he (the speaker) had had the task of endeavouring to flocculate it. He found it could be done with certain salt solutions, thus shedding light on Dr. Angus Smith's observations on the flocculating effect of calcium chloride on sewage. One of the finest flocculators for these slimy waters was lime; and the addition of about a half a grain per gallon was enough.

Mr. W. F. Reid asked if the clays, the analyses of which had been shown, were all taken in the natural state, and whether the sand was included in them as found. The necessity of separating the coarser sand from that percentage of quartz, which might be in almost as fine a state of sub-division as the clay substance itself, was required in analysis for technical purposes.

Dr. Feilmann referred to Rohland's work, wherein methods for the approximate analyses of clay were described. The finely divided clay was distributed on a slide and stained with fuchsine. The portions which conferred plasticity on the material, being colloidal, were stained; a micro-photograph was taken and the dark stained portions were cut out, and weighed, and a figure was obtained which Rohland stated gave a numerical measure of the plasticity of the particular material. This was possibly important from a ceramic point of view. In another paper, the plasticity of clays was ascribed to the percentage of colloidal substances present, which might be of very various character, even zinc silicate, and no aluminium silicate at all which possessed plastic properties. It seemed that all such substances tended to hydrolyse in the presence of water and become slimy. Substances in that state would be readily affected and dissolved by the sulphuric acid treatment.

Mr. J. Allan Howe said that many of the clays of which the author had been illustrating the analyses had been examined by him for the Museum of Practical Geology, the samples being collected with a view to having them examined in several ways. The Museum desired to have a few samples of well-known clays of which they could show not only the ultimate analyses, but also the rational analyses and several other physical tests, so that the results of all the tests could be compared. Very few analyses of clays in Britain had been treated in that way, and he thought it would be useful for various purposes. He had considered these rational analyses necessary, although he quite agreed with Dr. Mellor when he said that they really seemed to be of no use whatever. As far as he could observe, no one really used the rational analysis in order to find out what a clay was going to do. In all cases when a man started an area of new clay he wanted to find out how it would behave. When practical tests had been made the ultimate analysis helped to explain little differences, which arose in the treatment of the clay, what were the real difficulties in the way of the practical worker. It seemed that the rational analysis as it stood now was practically of no use, but a simple and conveniently short way of stating the qualities of a clay by one test or another if it could be found, would be very useful; and he looked forward to every improvement that could be suggested for help in dealing with the difficult problem of deciding what should be done with clays of various kinds.

Mr. Hancock, in reply, said that the analysis of the soluble and insoluble portions had been made, and the comparisons between the results of the rational and ultimate analyses had been given, as an attempt to follow the individual constituents of the clays through the process, and to trace what connection there was between the two methods. Mr. Cobb had referred to Langenbeck's statement that the felspar was very seriously attacked, but it must be remembered that Seger had pointed out that under suitable conditions he had found that only 2·24 per cent. was dissolved, and this had been confirmed by Jackson and Rich. Dr. Mellor had drawn attention to the omission of any mention of organic matter in these clays, but it had been impossible to deal with all the details. Calcium carbonate was generally removed by treating the clay with hydrochloric acid, and organic matter by treating with nitric acid. The largest amount of organic matter in any of the clays mentioned in the paper was less than two per cent., and in the others it was considerably less. Of course, the felspar could be calculated from the alkali content of the clay, but many of the slides had shown that the results entirely disagreed with the amounts found in a rational analysis. The removal of the alkali from the residue was made easier in some processes in which the residue was treated finally with hydrochloric acid before being ignited and weighed. But if any alkali from the reagents were left in the filter paper, this would lead to a high result for the felspar, whereas most of the results had shown that the felspar found was considerably less than that calculated from the alkali content of the ultimate analysis. Undoubtedly the rational analysis was useful as a method of rapidly sorting out a number of clays, even if the results were not sufficiently trustworthy for other purposes. Mr. Blount's suggestion that the effect of reagents on mineral mixtures of known composition should be tried, was valuable, the only difficulty was that such mixtures would be more or less definite in composition, whereas the minerals in clays which had resulted from the decomposition of older rocks, had probably been very considerably altered in physical condition if not in chemical composition. The felspar had been calculated as orthoclase, because the bulk of the alkali, according to the ultimate analysis, was potash. It was probably impossible to trace the kind of rock from which these clays had been derived, and many had come from districts in the South of England, where the geological question was by no means settled. In reply to Mr. Reid, he said the clays had been analysed as they were found, without the removal of any of the sand.

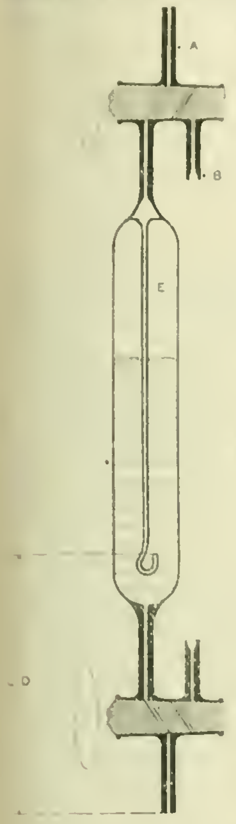
A NEW GAS SAMPLING TUBE.

BY G. NEVILL HUNTLY, B.SC., F.I.C.

In a boiler trial it is required to take an average sample of the flue gases extending over the whole trial. For this purpose a rapid stream of gas is drawn by suitable means from the flue through a wide tube, and the latter tapped by the laboratory sample tube. Assuming that the gas in the main tube represents the average of the flue gas, the following conditions must be satisfied by the laboratory sample.

1. Since mercury is used as the confining fluid, the tube sample must necessarily be small.
2. The gas must be drawn into the sample tube at a uniform rate per hour.
3. The gas in the dead space between the main tube and the sample tube must be eliminated.
4. The gas in the sampling tube must not be allowed to diffuse back into the main tube, or to be drawn back into the main current by sudden changes of pressure.

The usual pattern of tube, with single stopcocks at each end, does not fulfil conditions 2, 3 or 4. The replacement of the single stopcocks by double ones, described by Haldane, eliminates the dead space difficulty, and much facilitates the transference of the gas in the laboratory. Stead's gas sampler, which is much used, allows the dead space to be cleared when starting to take the sample, but not on transference of the gas. Back diffusion is supposed to be prevented by the small U at the top; in the four that I have used this has not worked, the mercury in the U being carried over with the first bubbles of gas. Possibly these tubes were not constructed according to the original design. The rate at which the gas is drawn in is not constant, and frequent regulation of the drip tap is essential if this condition is to be even approximately fulfilled.



The tube figured satisfies conditions 2, 3, and 4. The gas is drawn in at A. The dead space is cleared by sucking at B. The rate at which gas is drawn in is fixed by the tap and the distance CD, and the latter can be increased by joining on a glass tube with rubber to D. It is obvious that the gas cannot be sucked back or diffuse back. It has been found by trial that the rate at which the gas is drawn in is constant throughout within 1 per cent. A slight inclination of the tube from the vertical gives a sensitive fine adjustment.

(The tube shown was made by C. L. Müller, 6, Orange Street W.C.)

THE VALUE OF THE "NON-TANS" IN TANNING MATERIALS.

BY DR. J. GORDON PARKER.

The question of the value of the non-tans in an extract or tanning material has never, to my knowledge, been satisfactorily settled, and has become more acute of late years owing to the introduction of closed autoclaves for the extraction of the wood in the manufacture of extracts, instead of the use of open extraction vats. This has resulted in the manufacture of what are commonly called "pressure extracts," *i.e.*, extracts which are manufactured by extracting the material from which they are made under pressure of one or two atmospheres. It is claimed that the more thorough the extraction which is given the greater is the yield of soluble substances obtained from the wood. The temperature at which the extraction takes place is higher owing to the increased pressure. While this results in a greater yield of soluble substances, it is a well established fact that extraction under pressure and at high temperatures decomposes a certain amount of tannic acid. The object of this investigation was, therefore, to find out, and if possible establish on practical scientific lines, which was the more valuable to the tanner, an extract made by open extraction containing a low percentage of non-tans, or an extract made from the same material by the aid of closed autoclaves or pressure vats containing a lower percentage of tanning and a much higher percentage of non-tanning substances. The two extracts chosen are two well known French extracts which are both largely sold in the English market at practically the same price, and the samples with which the experiments were carried out gave the following analyses, which were carried out by both methods of analysis, *viz.*, the present International method and the now obsolete filter-bell method:

	Extract A.		Extract B.	
	Present interna-tional method.	Old filter bell method.	Present Interna-tional method.	Old filter bell method.
	per cent.	per cent.	per cent.	per cent.
Tannin	30·1	31·3	27·0	29·4
Non-tannins	8·9	7·7	13·6	11·2
Insoluble	0·6	0·6	0·8	0·8
Water	60·4	60·4	58·6	58·6
	100·0	100·0	100·0	100·0

Extract "A" represents a well-known pure French chestnut extract extracted on the open batteries of vats afterwards decolorised by blood and concentrated. Extract "B" represents a similar extract made from the same wood but extracted in closed autoclaves under pressure, and afterwards decolorised by blood.

Before passing to the practical part of the work, the above analyses are well worthy of study. With extract "A" the difference in non-tans is only 1·2, but in extract "B" the difference between the two methods is 2·4. One of the chief reasons why the old filter-bell method of analysis was condemned by the I.A.L.T.C. was the fact that by the filter-bell process part of the non-tans were retained by surface attraction and were reported as tannins (*vide* Comm. Report* and Procter and Blockey† and, therefore, the purer the extract the less the difference should be between the two methods of analysis.‡ It should be noted that the difference in extract "B" is double the difference in extract "A." In passing, it is undoubtedly the reason why the manufacturers of pressure extracts so strongly protested against the introduction of the new method, and even now will only give a guarantee when it is insisted upon.

The practical tests were divided into four series. The first consisted of taking 12 butts cut from English market hides, the average green weight of which was 74 lb.; these butts were divided into four parts, and two parts from each butt used in each extract. This procedure was adopted throughout the series. In the first series, the butts were tanned in a mixed liquor made from oak bark, myrabolams and gambier for the first 12 days, after which the marked pieces were separated and the further tanning carried out in handlers. These handler pits were made up with the extracts, in the one case "A," and in the second case "B." The goods were handled in these pits daily for five weeks, 2 lb. of extract being added each day; they then passed on to layers, which were made up by taking half the handler liquor and strengthening with these specific extracts; the first layer was made to a strength of 65° Bk., and in order to duplicate as far as possible the conditions of the tanning, for every 24 butts 64 lb. of cup valonea was dusted in between the butts to keep them apart. At the end of the fortnight, the goods were taken out and given a second layer in the same liquor, after the strength had been raised to 75 Bk., and were left in this for three weeks. At the end of this period a new liquor was made from the leaches consisting of bark, valonea, and myrabolams of 40 Bk. Exactly equal portions of this liquor were put into each pit, and the strength raised from 40 to 85 Bk. by the addition of the specific extract. The butts were put down again, dusted with the same quantity of valonea, and left for four weeks. This makes a total of 16 weeks in the tan yard. The goods were now taken out, allowed to drip for three days, scoured by hand, oiled, rolled, and dried; no vatting, bleaching, or other similar treatment was given, the leather being finished and dried in the natural way. An analysis of the finished leather, gave the following results:—

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* Collegium, 1907. 253-261.
† This Journal, 1903. xxii. 482-484
‡ Collegium, 1907. 41-56.

	"A.	B."
Hide substance	36·2	37·3
Tanning matters	49·2	48·3
Mineral ash	0·6	0·4
Moisture	14·0	14·0
	100·0	100·0
Tanning figure	136·0	128·5

On the resulting leather being weighed and calculated back on to the pelt weight, these trials gave for "A" extract 72·1 per cent. of leather calculated on the limed pelt weight, and for "B" extract exactly 70 per cent.

The second series of experiments was carried out in a slightly different manner. The quantity and quality of pelt taken was the same, and the butts were passed through a series of suspender pits containing a mixed liquor for the same period, *viz.*, 12 days, and were afterwards put through handler pits made up exactly as in the first series. The pack was divided into two as before, and instead of the extract being weighed in, it was measured in, in such a way as to keep the liquors in the two sets of pits exactly the same strength of tan as given by analysis. The handlers commenced with an analytical strength of 5 per cent. of tannin; this was gradually increased, until at the end of four weeks the strength of the liquor was 7 per cent. of tan by analysis. The goods were handled in this liquor daily, and each pack treated in the same manner. After a month the goods went through three layers, but these layers were made up by taking a leach liquor containing about 4 per cent. of tan, and making this up with the extract to 8 per cent. of tannin for the first layer, 10 per cent. of tannin for the second layer, and 12 per cent. of tannin for the third. The total time of tannage was 17 weeks. The two packs were removed from the pits, allowed to drip, scoured and finished exactly as the first series. The yield in leather calculated on the limed weight was for extract "A" 73·6, and for extract "B" 71·8. This result indicated that the non-tans contained in "B" extract had not played any very important part, as on referring to the original analysis, it will be seen that, made up on the analytical strength, the density of "B" liquors must have been materially higher than "A" liquors. As a matter of fact, the last layer containing 12 per cent. of tan registered for "A" liquor 91° Bk, for "B" liquor 107° Bk.

Having now at my disposal old liquors mellowed from use in the previous series, containing in the one case "A" extract, and in the second "B," it was thought that results could be obtained similar to the results in ordinary tan yard working. Again, as in the first two series, the same number of butts were taken, divided, and tanned in two sets of suspenders of equal strength, but separately, one set containing mellow liquor, containing "A" extract, the other blended with "B." After passing through these suspenders for 12 days (they were strengthened each day), the goods were then put in the handlers, which were made from the layer liquors of the previous test. After four weeks in the handlers, these goods then went into the old layer liquors which had been used for the previous experiment, after which a perfectly new liquor was made with fresh leach liquor raised to 80° Bk. with each of the two extracts. The goods were dusted as before with valonea cup, left in the second layer for three weeks, the layer being afterwards strengthened to 90° Bk. with more extract and left for five weeks. The subsequent shed work, drying, rolling, etc., was the same. The yields of leather calculated on the limed weight, were for series "A" 73·8, series "B" 71·6. The appearance of the finished leather from these three series of experiments was then compared. Leaving aside the question of colour, series "A" were in each case firmer and more solid than "B." The leather was, if anything, thicker and plumper. The leather tanned in the "B" series had a distinctly mellow feel, and would have been too soft for the English market. A comparison of the physical quality of the leather was then made. The following is the mean of six tests from six separate pieces of each:—

Series "A."

Loss on washing	19·6
Water penetration test	196 hours.
Water absorption test	⅞ inch.

Series "B."

Loss on washing	21·3
Water penetration test	143 hours.
Water absorption test	⅞ inch.

The above series of experiments appears to prove that as regards actual tanning of leather, better results are obtained both for weight and firmness with an extract containing a low percentage of non-tans, or at least one may certainly claim that in the above work the higher percentage of non-tans have not in any way contributed either to weight or firmness, as in each of the three separate experiments, extract "A" gave better results than "B." It has, however, been claimed that one of the chief advantages of an extract containing a high percentage of non-tans lies in its use as a vatting or retanning agent. In order to test this, 24 butts were now taken, four from each of the three experiments with "A" extract, and four from each of the experiments with "B." These 24 butts were now again divided into two parcels, so that an equal number of "A" butts and "B" butts were in each pack. The whole 24 were now wet back in a weak tan liquor until thoroughly wet through; this lasted three days, after which they were allowed to drip over night. The weights of these butts were carefully noted in the dry state before wetting. Two vats were now prepared, each made up to 100° Bk. with the two extracts. The basis of each liquor was an ordinary clear liquor from the leach of 45° Bk., and sufficient extract was added to raise the strength to 100° Bk. in the one vat with "A" extract, and in the other vat with "B" extract. The temperature of the vats was now brought to 110° F. and the butts handled in, each set being kept separate. They were handled twice the first day, next morning raised, and the strength of the liquor raised to 110° Bk. with their respective extracts, the temperature was again raised to 110° F. and the goods replaced. The third day the strength was raised a further 10° by the addition of the extract, the temperature raised to 115° F. and the goods replaced. At the end of four days the butts were removed, allowed to drip for four hours, and afterwards rapidly rinsed through a cool sumac liquor; they were now allowed to drip overnight, wiped over on the flesh and grain, oiled, and dried slowly in a cool dark room; when in suitable condition, they were hand pinned, oiled, rolled, and finished in the usual manner. The leather was then dried and weighed. All these processes were carefully carried out at the same time and under the same conditions, so as to make the work absolutely comparable. The resulting gain in weight was as follows:—

Pack "A" gained 4·2 per cent. Pack "B" gained 4·4 per cent., or a gain of 2/10 per cent. in favour of the extract with the higher percentage of non-tans. This vatted leather was now tested to ascertain the amount of soluble matter which could be removed on washing and also as resistance to water:—

The following are the results in triplicate:—

Series "A."

Loss on washing	21·8 per cent.
Water penetration test	166 hours.
Water absorption test	⅞ inch.

Series "B."

Loss on washing	22·1 per cent.
Water penetration test	130 hours.
Water absorption test	⅞ inch.

These tests again point to the fact that a high percentage of non-tans in the tanning materials is conducive to water absorption, and does not tend to the production of a leather of a high water-resisting character. This undoubtedly seriously mitigates against the slight advantage in weight which is obtained in the vatting of the samples with "B" extract.

The above experiments were carried out on a full commercial scale; altogether 48 full size butts were used, each butt being cut into four pieces in order that they could be tanned in the pits which were at our disposal, these being 2 feet 6 inches cube. The resulting tanned leather, therefore, weighed over half a ton, and in each case the general principles and processes of tanning as carried out in this country on a large scale in the tannery, were duplicated as far as possible.

It is also interesting to note that the extract "A" in each case penetrated more rapidly than "B," the goods being struck through in the handlers in from seven to nine days sooner than the corresponding pieces in the handlers made with "B" extract. This also means considerable advantage to the tanner.

The above work, had time permitted, would have been extended, and might with advantage have been extended in the direction of further analysis of the liquors at various stages and of the products formed by fermentation, etc., in the pits. This would have necessitated a larger amount of labour than was at the time possible. Several analyses were, however, carried out of the waste liquors, and the development and acidity formed carefully noted, but in no case was there any material difference. On the three tests the acidity of the liquors was measured each day and kept uniform throughout. The hinder liquors from "B" extract always contained correspondingly higher percentages of non-tans, as was only to be expected.

While not claiming that the above work conclusively proves that the non-tans are useless as regards actual formation of leather, it indicates that a high percentage of non-tans in an extract is of no advantage. As it had been noticed that leather always appeared to tan quicker and strike through more rapidly in the extract containing the lower percentage of non-tans than in extract "B"; it was thought desirable to carry out a comparative series of tests on the speed of tanning and to ascertain whether or not the non-tans retard the penetration of the tannin. To this end, a portion of a carefully delimed butt was cut up into a number of small pieces, each 4 inches square. A number of these pieces, chosen as far as possible of equal weight and substance, were then treated in the following manner:—

The pieces were thoroughly washed in distilled water in rotating glass churns, the water was then poured off, the pieces of pelt scudded and freed as far as possible from excess of moisture, and then divided into four sets, each of four pieces, marked—1 to 4, and four pieces of each mark were placed into rotating glass churns with a litre of distilled water and churned for 10 minutes, after which to churn 1*a* was added 20 grams per litre of extract A, to churn 1*b*, 20 grams of extract B; churn 2*a*, 20 grams of extract A plus 20 of glucose; to churn 2*b*, 20 grams of extract B plus 20 grams of glucose. These churns were then slowly rotated by means of an electric motor, for about 15 minutes in each hour; at the end of six hours a further 20 grams of the specific extract was added to each churn, a further 20 grams after 24 hours, 50 grams after 48 hours, 100 grams 24 hours later, and a further 100 grams at the end of the fourth day. The tannage was then continued for a further two days, making a total of six days. The remaining two sets of pieces were suspended on glass rods in liquors made in the same manner so as to tan slowly, imitating as far as possible the usual commercial process in the tannery; commencing with a liquor of 10 grams per litre, this was strengthened by the addition of 10 grams per day for 14 days, the pelt being handled up, and the liquors well stirred three times a day. From each set of leathers pieces were taken for analysis, and after rinsing through water were subsequently dried, and the percentage of nitrogen estimated by Kjeldahl's method. The results in the following table give the tanning figure, which expresses the number of units of tan combined with 100 parts of dried hide substance.

	After 24 hours.	After 48 hours.	After 72 hours.	After 96 hours.	After 6 days
1 A.	42	70	94	103	131
1 B.	41	69	91	104	126
2 A.	43	68	90	102	126
2 B	42	67	88	100	120

Still tannage.

	After 24 hours.	After 48 hours.	After 72 hours.	After 6 days.	After 8 days.	After 10 days.	After 14 days.
A.	26	50	71	89	101	109	113
B.	27	49	70	86	97	103	108

The above figures confirm in a striking manner the work done by Stiasny (Collegium 1909, 385, p. 395), who showed that the higher the percentage of non-tans present in a tan liquor, the slower the penetration into the pelt.

The above work indicates that the high value placed in some quarters on the "non-tans" of a tanning extract is extremely problematic. It is the intention of the author to carry this work further by means of standard solutions of tanning material containing various percentages of non-tannins of varying constitution.

The author desires to express his thanks to Mr. Van Gijn and others for their assistance in checking many of the "Kjeldahl" and other results.

THE COMPLETE ANALYSIS OF LEATHER.

A Common Mistake in the Determination of the Degree of Tannage.

DR. J. GORDON PARKER AND M. PAUL.

Contribution from the Leathersellers' Company Technical College, London, S.E.

Much information valuable to the practical tanner can be obtained from a full and detailed analysis of vegetable tanned leathers, and the method devised by Von Schroeder and published in 1898 (after his death) by Bartel* is universally used by chemists. The method is so well known that only a brief summary is necessary. The leather to be analysed is cut into thin shavings or powdered by means of a rasping machine. From one portion the actual moisture and the mineral ash are determined. Another portion is extracted with petroleum ether for the estimation of the percentage of oil, after which the water-soluble matter, including the uncombined tannins, are washed out by percolation with warm water; finally, the percentage of nitrogen is determined on a third sample by Kjeldahl's method, from which is calculated the percentage of hide substance present in the leather. These various figures can be obtained with great accuracy.

Assuming that a sample of leather gives the following results:—Moisture, 16·5 per cent.; mineral ash, 0·95; fat, 1·00; soluble matter, 18·6; hide substance, 36·6. Von Schroeder calculates in the following manner, admitting as leather substance everything contained in the leather excepting moisture, ash, fat, and soluble matters, *i.e.*, the amount of pure leather is found by subtracting the total of the previous figures from 100. In the above sample the total of moisture, ash, fat, and soluble matter is 37·05 per cent.; the leather substance would, therefore, be 100 − 37·05 = 62·95. As the hide substance has already been ascertained, the tannin combined can be ascertained by difference, and would be, in this case, 26·35 per cent.

The ratio $\frac{\text{tannin combined}}{\text{hide substance}} = \frac{26{\cdot}35}{36{\cdot}6} = 71{\cdot}9$ per cent. is called by Von Schroeder the "Durchgerbungszahl," or "degree of tannage." The knowledge of this ratio is of great value as a means of ascertaining the quality of the leather, but obviously this number alone is of no great value for ascertaining the commercial value of a sample of leather unless the physical properties of the leather, such as penetration of water, tensile strength, flexibility of grain, etc., are also obtained; however, it indicates the "degree of tannage," and to the currier or dresser of leather, whether the leather is likely to be capable of good yield in dressing, the possibility of retannage, and also whether the tanning process has been more or less rational.

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*Bartel, Ding. Polyt. J., 1898, 305, p. 65; this J., 1898, 17, 164-166.

The appearance of a section of the leather shows the penetration of the tannin; if, however, a section of leather shows an apparently complete penetration, and at the same time gives a low tanning figure, it can generally be concluded that the tannage has been hastened by some mechanical means, such as drumming or similar accelerating process, and indicates that the fibres of the leather have simply been coloured, and that the tannin has not completely penetrated and united with the fibres of the hide. The importance of this tanning factor is therefore admitted, and its determination for commercial purposes has become general.

The object of this paper is to draw attention to an error in Von Schroeder's method of calculating this figure. The error is contained both in his first paper, published before his death, and in his posthumous papers, published by his colleague, Bartel.[*] We cannot find that this error has been noted, except by Procter;[†] other publications and books dealing with the analysis of leather, simply quote the method, giving the details of how the analysis should be carried out, without indicating the error to which we refer. This is not on the whole surprising, as since this work was done by Von Schroeder, practically no investigations of this nature have been published, with the one exception of Ronchèse's work,[‡] in which he describes his method for the determination of nitrogeoous substances by direct titration in the presence of formaldehyde, instead of by distilling off the nitrogen as ammonia.

The error occurs in the calculation in the following manner:—The mineral ash is determined by incinerating a portion of the original leather. This gives the total amount of ashes from mineral matter, insoluble and soluble, including lime, magoesia, alumina, iron, silica, and salts of potassium and sodium. In the extraction of the water-soluble matter, some of this mineral matter, *i.e.*, the soluble portion, including calcium, sodium, potassium, and magnesium salts of inorganic and organic acids, is washed out and calculated as water-soluble matter, existing generally as anhydrous mineral salts and also occasionally as salts containing some water of crystallisation. Thus, part of what has been accounted for in the mineral ash is also reckoned in with the soluble matter. Now, in the calculation of the leather substance the sum of the four percentages, moisture, fat, mineral ash, and soluble matter, is subtracted from 100. Therefore that portion of ash derived from mineral matter soluble in water has been subtracted twice, and the percentage of leather substance is too low by this amount. By incinerating the dry leather, after extraction of the water soluble matter, the amount of ash derived from the insoluble mineral matter is obtained and by incinerating the water soluble matter the amount of ash derived from soluble mineral matter is obtained.

In the case of the analysis referred to above, the ash consists as follows:—

	per cent
Ash from soluble mineral matters	0·82
Ash from insoluble mineral matters	0·13
	0·95

Consequently, Von Schroeder's calculation of the percentage of leather is too low by 0·82 per cent. This alters the "degree of tannage" from 71·9 to 74 per cent., a difference of 2·1 per cent.

In the leather, there only exists after washing, in addition to the leather substance itself, the insoluble mineral matters; therefore, by burning the leather residue after the extraction with water, the amouot of ash derived from this insoluble matter is obtained. It is almost correct to calculate the pure leather substance as equal to the dry leather residue, *minus* the insoluble ash. As a matter of fact, the actual amount of insoluble mineral matters in the dry leather residue is slightly higher than the amount of insoluble ash obtained by incineration, because by incineration, the calcium carbonate and other salts are partially decomposed, but this error is very small; for example, the error on the sample in question containing 0·13 per cent. of insoluble ash is only 0·02 to 0·04 per cent. This error is magnified when the mineral ash is calculated on a sample of the original material, not only because the amount is greater, but also because greater dissociation occurs in the soluble mineral matters, *e.g.*, Epsom salts, or other easily dissociated salts. Moreover, the amount of ashes obtained is very variable with the temperature of incineration depending upon whether an ordinary Bunsen flame or muffle furnace or a blow pipe is used.

It is therefore incorrect to estimate the amount of leather substance as the difference between 100 and the sum of four factors including the mineral ash. For this reason, and also because the ash derived from soluble mineral matter is deducted twice in the above method of calculating the leather substance, we prefer to determine the amount of the leather substance, for the calculation of such an important factor as the "tanning figure," by weighing the dry leather residue, after extraction of the soluble matter, and subtracting from this weight the weight of ash derived from the insoluble mineral matters. This obviates the unsatisfactory method of determining it by the difference between 100 and the sum of four separate factors.

The amount of water included as mineral matter in the water soluble does not affect the result, because the water of crystallisation is included as moisture, and the water of constitution is the same in the original leather after drying, as in the dry soluble matter, since the drying is done at the same temperature.

From the above reasoning it is clear that all the figures published by Von Schroeder are too low by the amount of mineral ash derived from the soluble matter. Curiously enough, he has estimated this ash from soluble matter, and given it in a separate column.

We have, therefore, repeated his calculations, making the necessary correction, and find that the "degree of tannage" is higher by 0·5 per cent. to 2·4 per cent. It may be suggested that the error is so small that the correction makes a difference which in practical work could be neglected, as in the leathers analysed by Von Schroeder the percentage of mineral ash is small, averaging 0·74. This argument would have held good for the tannage of 20 years ago, but under modern conditions the method of tanning leather has undergone a great change, and whereas the average mineral ash of a leather generally did not exceed ½ per cent., nowadays, with the use of extracts, chemically decolourised and bleached by aid of bisulphites and other salts, the mineral ash of which extracts varies from 1·5 to 4 per cent., and in isolated cases, even 6 per cent., the percentage of ash in the leather tanned by these agents may rise considerably above ½ per cent. Evidently it is impossible to say that leather tanned with these extracts, and containing 1·4—1·6, or even 2 per cent. of ash, is adulterated, and the error which in Von Schroeder's tables does not exceed 1 per cent. is multiplied six or seven times if a modern leather be worked out under the same conditions.

To illustrate this, we have analysed a number of leathers typical of the various tannages produced at the present time; in these tables, we indicate the tanning figure according to Von Schroeder's method of calculation; and in the corresponding column the exact figure obtained by weighing the dry leather residue after the soluble matter has been washed out and deducting from this the quantity of insoluble ash, for estimating the amount of the pure dry leather; in this manner it is possible to check one's results so that they agree within 0·1 per cent. Where the duplicates differ from 100 by more than plus or minus 0·1 it proves an error in one of the other three determinations, either in the moisture, fat, or dry soluble matter, or it may be the use of too high a temperature in the drying of the residue, indicating the presence of catechol-tans which are liable to split up giving off water of combination.

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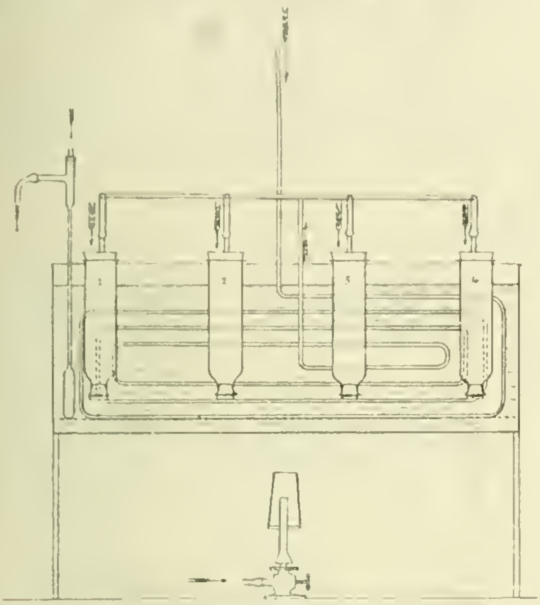
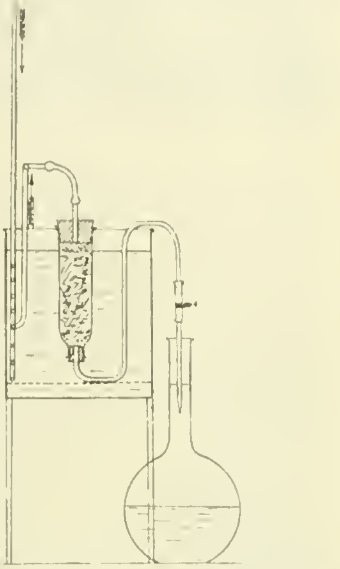
[*] Ding. Polyt. Journal, 1897, No. 305, pages 65, etc.

[†] Leather Industries Laboratory Book, page 356.

[‡] Bull. Soc. Chim., 1909.

We also venture to point out another matter in connection with this analysis. We consider that it is absolutely necessary in estimating such an important factor as the leather substance that the weight of the resulting dry leather should be ascertained after washing directly; but in order to carry this out, it necessitates a departure from Von Schroeder's method, as his extractor or percolator can no longer be used. The use of Procter's extractor is also unsuitable. The authors have, therefore, devised an apparatus which enables this to be easily carried out. The apparatus consists of a water bath fitted with a thermo-regulator. The weighed quantity of leather is placed in an inverted Procter's filter bell or small glass vessel. The ends of the filter bell are plugged with cotton wool, which must be previously tanned and washed, or glass wool may be used. The filter bell is then connected by a serpentine glass tube, which passes three or four times immersed in the water bath, with a reservoir filled with distilled water. The flow of water can be regulated by a small clamp. As the cold water comes down from the reservoir it must pass four times the length of the water bath before coming in contact with the leather; it thus reaches the temperature of the water bath before it reaches the leather. The first portion of the liquor which comes over contains most of the tannin matters, sugars, and those mineral matters which diffuse easily, the more difficultly soluble tannins coming afterwards gradually. It is well known that, theoretically, one can continue washing leather for ever, as a certain amount of decomposition is always taking place, but practically, we have found that by extracting 20 grams of leather with a litre of water at a temperature of 55 to 60° C., for 24 hours, the last portion of the water which percolates through gives no precipitate with a solution of





COMPLETE ANALYSIS OF LEATHERS.

Comparison between Von Schroeder's Calculation and Exact Method.

Table I.

Tanned leathers without extract.

Class of Leather.		Moisture.	Ashes.		Fat.	Sol. matter.	Pure leather subst.	Total.	Leather substance.		Degree of tannage T.C./H.S. %	Difference.
			Total.	From insol. mineral matter.					Hide subst.	Tannin comb.		
1. English Sole	S	17·08	0·59		0·84	20·0	61·49	100·0	35·37	26·12	73·8	
	e	17·08		0·29	0·84	20·0	61·77	99·98	35·37	26·40	74·6	0·8
2. English Sole	S	16·8	0·72		0·92	18·4	63·16	100·0	34·9	28·26	80·9	
	e	16·8		0·21	0·92	18·4	63·60	99·93	34·9	28·70	82·2	1·3
3. Pure Hemlock, U.S.A.	S	17·06	0·74		0·89	17·4	63·91	100·0	38·50	25·41	66·0	
	e	17·06		0·27	0·89	17·4	64·32	99·94	38·50	25·82	67·0	1·0
4. Venezuela Sole	S	18·02	0·63		0·38	5·45	75·52	100·0	48·05	27·47	57·1	
	e	18·02		0·11	0·38	5·45	76·07	100·03	48·05	28·02	58·3	1·2
5. Californian Oak	S	16·72	0·81		1·05	16·50	64·92	100·0	33·3	31·62	94·6	
	e	16·72		0·19	1·05	16·50	65·45	99·91	33·3	32·15	96·5	1·9
6. West of England	S	17·22	0·86		1·09	20·20	60·63	100·0	35·0	25·63	73·2	
	e	17·22		0·12	1·09	20·20	61·32	99·95	35·0	26·32	75·2	2·0
7. Oak Sole	S	17·31	0·46		0·73	19·70	61·80	100·0	36·4	25·4	69·7	
	e	17·31		0·05	0·73	19·70	62·20	99·99	36·4	25·8	70·8	1·1
8. Oak Sole	S	17·51	0·48		0·91	19·05	62·05	100·0	36·9	25·15	68·1	
	e	17·51		0·09	0·91	19·05	62·53	100·09	36·9	25·63	69·4	1·3
9. French pure Oak	S	18·08	0·76		0·11	7·28	73·77	100·0	42·6	31·17	73·1	
	e	18·08		0·07	0·11	7·28	74·33	99·87	42·6	31·73	74·4	1·3
10. French pure Oak	S	18·6	0·58		0·42	7·04	73·36	100·0	43·2	30·16	69·8	
	e	18·6		0·04	0·42	7·04	73·82	99·92	43·2	30·62	70·9	1·1
11. Canadian Hemlock	S	16·52	0·88		2·06	15·1	65·44	10·0	33·6	31·84	94·7	
	e	16·52		0·13	2·06	15·1	66·30	100·11	33·6	32·7	97·3	2·6
Average	S	17·35	0·68		0·85	15·10	66·00	100·	37·98	28·02	73·7	
	e	17·35		0·14	0·85	15·10	66·51	99·97	37·98	28·53	75·1	1·4

gelatin and salt, and only the faintest colouration with iron. With the apparatus here described, it is perfectly safe to leave this going over night: the reservoir, however, must contain slightly less than the requisite quantity of water so that the final percolation may be finished under observation the following morning. We find that a safe temperature for an extraction of leather is from 50 to 55° C., but if the leather be well tanned, the temperature may be raised to 60° C.; but a temperature of 65° C. must never be exceeded. With under-tanned leather or leather tanned in a drum, by which process the combination of leather and hide fibre is not complete, the temperature must not exceed 55° C. If, after commencing the extraction of a sample of leather at 60°, a precipitate is obtained in the percolate instead of a clear solution, it indicates under-tanned leather, and a fresh sample must then be taken and the temperature reduced. Realising that owing to dissociation of hide substance and tannin, absolutely exact figures can never be obtained, we therefore suggest that for all practical purposes comparable figures can be obtained by following the above method, viz., 20 grams of leather, one litre of water, extraction 24 hours at a

TABLE II.

Mixed tannage.

	Class of Leather.		Moisture.	Ashes.		Fat.	Sol. matter.	Pure leather subst.	Total.	Leather substance.		Degree of tannage T.C./H.S. %	Difference.
				Total.	From insol. mineral matter.					Hide subst.	Tannin comb.		
12.	English Sole	S	15·6	1·02		0·8	16·6	65·98	100·0	35·6	30·38	85·3	
		e	15·6		0·18	0·8	16·6	66·7	99·88	35·6	31·10	87·3	2·0
13.	English Sole	S	16·52	0·99		1·10	18·2	63·19	100·0	34·7	28·49	82·1	
		e	16·52		0·23	1·10	18·2	63·90	99·95	34·7	29·2	84·1	2·0
14.	English Sole	S	16·8	0·85		0·9	18·85	62·6	100·0	36·1	26·50	73·4	
		e	16·8		0·17	0·9	18·85	62·6	99·92	36·1	27·10	75·0	1·6
15.	French Sole	S	15·8	1·4		1·4	18·1	63·3	100·0	36·0	27·3	75·8	
		e	15·8		0·12	1·4	18·1	64·48	99·90	36·0	28·48	79·1	3·3
16.	French Sole	S	16·45	1·62		1·1	17·8	63·03	100·0	35·6	27·43	77·0	
		e	16·45		0·14	1·1	17·8	64·5	99·99	35·6	28·9	88·1	4·1
17.	French Sole	S	16·34	1·31		0·95	17·5	63·9	100·0	39·2	24·70	63·0	
		e	16·34		0·12	0·95	17·5	65·0	99·91	39·2	25·80	65·8	2·8
18.	French Upper	S	16·1	1·20		2·8	18·7	61·20	100·0	36·8	24·4	66·3	
		e	16·1		0·21	2·8	18·7	62·1	99·91	36·8	25·3	68·7	2·4
19.	German Split	S	17·02	1·18		0	19·0	62·8	100·0	40·9	21·9	53·5	
		e	17·02		0·18	0	19·0	63·8	100·0	40·9	22·9	55·9	2·4
20.	German Split	S	16·0	1·45		0	22·2	60·35	100·0	40·6	19·75	48·6	
		e	16·0		0·25	0	22·2	61·5	99·95	40·6	20·9	51·4	2·8
21.	English Upper	S	12·65	1·03		34·21	3·82	48·29	100·0	30·3	17·99	59·3	
		e	12·65		0·12	34·21	3·82	49·14	99·94	30·3	18·84	62·2	2·9
22.	Spanish Sole	S	14·9	1·50		2·4	13·6	67·6	100·0	40·2	27·4	68·1	
		e	14·9		0·17	2·4	13·6	68·8	99·87	40·2	28·6	71·1	3·0
23.	Italian Sole	S	16·0	1·7		1·35	19·75	61·20	100·0	37·8	23·4	61·9	
		e	16·0		0·2	1·35	19·75	62·60	99·90	37·8	24·8	65·6	3·7
24.	English Sole retanned	S	16·40	2·1		1·3	18·90	61·0	100·0	35·05	25·95	74·0	
		e	16·40		0·14	1·3	18·90	63·2	99·94	35·05	28·15	80·3	6·3
25.	American Mixed	S	16·87	0·89		0·91	13·6	67·73	100·0	37·1	30·63	82·5	
		e	16·87		0·16	0·91	13·6	68·45	99·99	37·1	31·35	84·5	2·0
26.	South African Sole	S	18·27	1·61		1·21	15·2	63·71	100·0	38·2	25·51	66·7	
		e	18·27		0·07	1·21	15·2	65·32	99·97	38·2	27·12	70·9	4·2
27.	English Drum tanned	S	16·04	1·24		1·71	23·95	57·06	100·0	35·84	21·22	59·2	
		e	16·04		0·18	1·71	23·95	58·12	100·00	35·84	22·28	62·1	2·9
28.	Spanish Sole	S	18·26	1·16		0·18	11·75	68·65	100·0	40·55	28·10	69·2	
		e	18·26		0·14	0·18	11·75	69·56	99·89	40·55	29·01	71·5	2·3
29.	English Sole	S	14·12	0·94		0·81	22·92	61·21	100·0	37·3	23·91	64·1	
		S	14·12		0·15	0·81	22·92	61·95	99·95	37·3	24·65	66·0	1·9
	Average	S	16·12	1·305		2·95	17·24	62·37	100·0	37·10	25·27	68·1	
		e	16·12		0·162	2·95	17·24	63·46	99·94	37·10	26·36	71·0	2·9

TABLE III.

Adulterated leathers.

	Class of Leather.		Moisture.	Ashes.		Fat	Sol. matter.	Pure leather subst.	Total.	Leather substance.		Degree of tannage T.C./H.S. %.	Difference.
				Total.	From insol. mineral matter.					Hide subst.	Tannin comb.		
30.	German Sole	S	17·6	2·2		1·60	22·3	56·30	100·0	34·4	21·9	63·6	
		e	17·6		0·18	1·60	22·3	58·2	99·88	34·4	23·8	69.1	5·5
31.	German Upper	S	15·50	2·07		2·81	28·4	51·22	100·0	30·8	20·42	66 3	
		e	15·50		0·25	2·81	28·4	53·0	99·96	30·8	22·2	72·0	5·7
32.	Belgian Sole	S	16·78	2·6		1·90	20·52	58·20	100·0	34·2	24·0	70·1	
		e	16·78		0·19	1·90	20·52	60·5	99·89	34·2	26·3	61·8	6·7
33.	Italian Sole	S	17·1	1·91		1·8	21·4	57·79	100·0	35·6	22·19	62·3	
		e	17·1		0·17	1·8	21.4	59·5	99·97	35·6	23·9	67·1	4·8
34.	American Sole	S	17·6	3·2		1·6	22·6	55·0	100·0	33·3	21·7	65·1	
		e	17·6		0·28	1·6	22·6	58·0	100·08	33·3	24·7	74·1	9·0
35.	English Sole	S	17·86	4·82		1·37	16·90	59·05	100·0	43·3	15·75	36·3	
		e	17·86		0·15	1·37	16·90	53·75	100·03	43·3	20·45	47·2	10·9
36.	Belgian Sole	S	17·9	4·95		1·2	23·8	52·15	100·0	33·8	18·35	54·2	
		e	17·9		0·21	1·2	23·8	56·83	99·94	33·8	23·03	68·1	13·9
	Average	S	17·19	3·10		1·75	22·27	55·67	100·0	35·06	20·61	58·7	
		e	17·19		0·20	1·75	22·27	58·64	99·95	35·06	23·48	66·9	8·2

regular temperature of 55° C. It will then be found that in the last portion of the percolate, less than one part in 10,000 of tannin is present.

In the first of the above tables are cases of pure vegetable tanned leathers, in the tannage of which little or no extract has been used. In the second table, the leathers have been tanned with a mixture of various tanning materials from different countries, together with extracts in varying quantities. In the third table, various samples of commercial adulterated leather, at present on the market, are dealt with. It will be noticed that all of these are adulterated with different common adulterants. As will be seen by glancing at table I., the difference in results by the two methods of calculation ,Von Schroeder's and this modified one, is comparatively small. but for the other leathers, the error is enormous, and from this it will be seen that chemists reporting the "degree of tannage" to their clients by Von Schroeder's formula, without the correction, even for non-adulterated leather, show the "degree of tannage" as being considerably lower than is actually the case, and the report, therefore, is liable to be misleading.

The authors do not claim any novelty in this work, but merely wish to establish a more accurate method for ascertaining a figure for the "degree of tannage" of leather, which is of extreme value to the tanner and buyer of leather, as it enables him to judge the quality of the leather and also to check the process of tanning in the tan-yard.

Manchester Section.

Meeting held at Manchester, on Friday, January 14th, 1910.

MR. R. H. CLAYTON IN THE CHAIR.

THE ANALYSIS OF FERROCYANIDES.

BY F. W. SKIRROW, M.SC., Ph.D.

In a recent paper before the Society of Public Analysts, H. G. Colman has given an account of the various methods in use for the estimation of ferrocyanides in spent oxide of iron and other cyaniferous masses (Analyst, 1908, 261: this J., 1908, 806), and he there outlines the three principal classes of method as follows:—(1) Titration with metallic salt solutions. (2) Determination of the iron. (3) Determination of the hydrocyanic acid.

The author has had occasion to subject the first and third of these methods to a careful examination, and the conclusions arrived at, some of which are not in accord with those of previous workers, are given in the following paper.

Determination of the hydrocyanic acid.—This method, which depends on the conversion of the ferrocyanide to mercuric cyanide, was first proposed by Rose and Finkener (Zeits. anal. Chem., 1862, **1**, 299), and further developed by Feld (J. Gasbeleucht., 1903, **47**, 565)[*] It is carried out as follows:—0·3 to 0·5 grm. of the soluble ferrocyanide is placed in a flask and diluted to 100—150 c.c. with the addition of 10 c.c. of normal caustic soda. This is boiled and 15 c.c. 3*N*[†] magnesium chloride dropped slowly in with continual shaking in order to get a milky precipitate of magnesium hydrate. This is then boiled again and 100 c.c. of boiling *N*/10 mercuric chloride added and the boiling continued for 5 to 15 minutes. The flask is then connected to a condenser dipping into a receiver containing 25 c.c. *N* caustic soda. 30 c.c. of 4*N* sulphuric acid is run from a stoppered funnel into the flask and the contents distilled for 20—30 minutes when the whole of the hydrocyanic acid is obtained in the receiver. The distillate is then titrated with *N*/10 silver nitrate solution after addition of a little potassium iodide.

The following precautions are emphasized by Feld:—(1) The ferrocyanide, even if "guaranteed chemically pure," should be boiled for five minutes with the caustic soda to convert any traces of insoluble compounds into soluble ferrocyanide. (2) The magnesium chloride should be added very slowly with continual shaking, to ensure the magnesium hydroxide being very finely divided—neglect of this precaution making possible an error of as much as 2 per cent. (3) The mercuric chloride should be always added boiling to the boiling solution. (4) The molecular ratio between the mercuric chloride and the magnesium chloride which is not precipitated by the caustic soda should be 1 : 3 or 4.

In order to test the method as so described, trial analyses were first carried out on solutions of pure potassium and sodium ferrocyanide which had been carefully recrystallized. Solutions were accordingly made up containing 4 grms. of potassium ferrocyanide per litre. 100 c.c. of this solution was treated exactly as described, with the precautions indicated by Feld, and it was found that the yield of hydrocyanic acid obtained was only from 94—97 per cent. of that theoretically obtainable from the ferrocyanide employed, two consecutive experiments under apparently identical conditions often differing by as much as 2—3 per cent. Similar results were obtained with other samples of recrystallized potassium ferrocyanide and also with sodium ferrocyanide. In many cases the solutions in the distilling flask were again diluted and distilled, with or without the addition of more acid, but in no case was any trace of hydrocyanic acid evolved on the second distillation, nor was any indication ever obtained of blue or green colouration in the residue left in the distilling flask. Experiments on varying the amounts of the several reagents had only a negative result.

It was noticed in the preceding experiments that a distinct odour of hydrocyanic acid was developed in every case on adding the magnesium chloride to the alkaline solution—the magnesium chloride being of course very much in excess of the caustic soda. In one experiment, to 100 c.c. of the ferrocyanide solution was added 25 c.c. of *N* caustic soda followed by a solution of 0·2 grm. of ferrous sulphate crystals in the cold. This would convert any cyanide present into ferrocyanide. The test was then carried out as before. On adding the magnesium chloride solution, hydrocyanic acid was still evolved and the final yield of hydrocyanic acid was 95·5 per cent.

Loss of hydrocyanic acid on boiling with magnesium chloride.—100 c.c. of the potassium ferrocyanide solution was treated with 25 c.c. of *N* caustic soda. This was boiled in the distillation apparatus and 20 c.c. of 3*N* magnesium chloride slowly added from the stoppered funnel, the flask being meanwhile shaken and any hydrocyanic acid evolved collected in the receiver. The boiling was continued for 10 minutes. The solution in the distilling flask was again diluted and distilled again into a fresh receiver for 10 minutes. 100 c.c. of the mercuric chloride solution was then added boiling, and the solution again distilled into a fresh receiver. Finally the solution was again diluted and distilled with 30 c.c. 4*N* sulphuric acid. The following were the results obtained:—

	Hydrocyanic acid evolved. Per cent.
First boiling with magnesium chloride	1·05
Second ditto	0·35
Boiling with mercuric chloride....................	0·00
Distillation with sulphuric acid	94·72
Total	96·1

Thus it appears that though this loss may account for some of the fluctuations in the percentage found, yet it does not account for the whole loss in the estimation. In no single case did the yield of hydrocyanic acid approach that quoted by Feld, who in four consecutive experiments with pure ferrocyanide obtained the following yields:—100·2 per cent., 100·2 per cent., 100·3 per cent., 100·2 per cent.

Experiments starting from potassium cyanide.—In order to eliminate any possible errors due to impurity in the ferrocyanide used, a series of experiments were carried out starting from potassium cyanide, a solution of which was freshly made up and its strength ascertained exactly by titration with silver nitrate and also by titration with silver nitrate after distillation with $3N$ magnesium chloride solution as in Feld's method for the estimation of cyanide. The two methods gave results agreeing to 0·2 per cent.

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[*] See also Carpenter and Linder (41st Annual Report on Alkali works, 1904, 34); also Mayer and Hempel (J. Gasbeleucht., 1908, 426).

[†] In this paper, as in Feld's, "*N*" is used to denote "Molecular Normal."

25 c.c. of this solution was treated with 50 c.c. of N caustic soda and with a solution of 0·7 grm. of ferrous sulphate crystals. This was allowed to stand with frequent shaking in the cold for 1 hour and was then treated as in the ferrocyanide test. The magnesium chloride was added very slowly on the distillation apparatus and any hydrocyanic acid evolved collected in the receiver. Yields obtained, 96·3 per cent. and 97·0 per cent.

Distillation of potassium cyanide with magnesium chloride.—25 c.c. potassium cyanide solution distilled direct with 3 c.c. $3N$ magnesium chloride for $\frac{1}{4}$ hour conditions of collecting being the same as in the ferrocyanide test. Yield, 99·8 per cent.

Distillation of potassium cyanide with sulphuric acid.—25 c.c. of potassium cyanide solution diluted with 150 c.c. water and distilled with 30 c.c. of $4N$ sulphuric acid, dilution and conditions of collecting being the same as in the ferrocyanide test. Yield, 99·9 per cent.

It is thus evident that at this dilution the sulphuric acid does not attack the hydrocyanic acid. It must be noted however that in the ferrocyanide test the hydrocyanic acid is present as mercuric cyanide and this would probably decompose more slowly and be still present when the acid was becoming somewhat more concentrated.

Distillation of mercuric cyanide with sulphuric acid.—It was found, in accordance with Feld, that the hydrocyanic acid could not be distilled off with sulphuric acid in absence of chlorides. 25 c.c. of the potassium cyanide solution was treated with 100 c.c. of the $N/10$ mercuric chloride solution in order to obtain mercuric cyanide. 25 c.c. of $3N$ magnesium chloride was added and the solution distilled with $4N$ sulphuric acid. The following results were obtained:—

Acid used.	Yield of hydrocyanic acid.	Remarks.
	per cent.	
30 c.c.	93·4	Distilled for $\frac{1}{2}$ hour.
15 c.c.	98·8	Distilled more slowly.
10 c.c.	99·8	Distilled very slowly for 1 hour.
10 c.c.	99·4	Distilled very slowly for 1 hour.

Thus on distilling mercuric cyanide with sulphuric acid a much better yield of hydrocyanic acid is obtained if the solution be distilled slowly and the concentration of the acid be kept low.

This represents the maximum yield of hydrocyanic acid which may be expected in the ferrocyanide test if the ferrocyanide is converted quantitatively to mercuric cyanide and if the other products of decomposition of the ferrocyanide have no effect on the yield on distilling mercuric cyanide with sulphuric acid.

Influence of the other products of decomposition of the ferrocyanide.—25 c.c. of the potassium cyanide solution was treated with 100 c.c. of the mercuric chloride solution followed by 25 c.c. of the magnesium chloride solution. This was placed in the distillation apparatus and boiled. A mixture of 50 c.c. of N caustic soda and a solution of 0·7 grm. of ferrous sulphate crystals was then dropped slowly in. Thus we have the theoretical amount of mercuric cyanide and in addition the other products obtained at this stage. In one experiment the magnesium chloride and ferrous sulphate were mixed and the caustic soda added and the iron oxidized with just sufficient mercuric chloride before adding to the mercuric cyanide solution, the result being the same as before.

The mixtures were then distilled slowly for 1 hour with 16·5 c.c. of $4N$ sulphuric acid. Yields of hydrocyanic acid obtained:—98·0 per cent.; 98·5 per cent.; 98·4 per cent.; 98·5 per cent.; mean, 98·35 per cent. We thus have about 1·2 per cent. lower yield due to this cause.

Distillation after conversion to ferrocyanide.—These experiments were carried out with the same quantities as above, the only difference being that the reagents were added in such a way as to first form ferrocyanide which was then decomposed again to mercuric cyanide. Yields obtained:—97·5 per cent.; 97·5 per cent.; 98·4 per cent.; 97·9 per cent.; 98·1 per cent.; 97·2 per cent.; mean 97·77 per cent. Thus we have a less yield of hydrocyanic acid if the reagents are added in such a way as to form ferrocyanide than if added so as to give mercuric cyanide direct, which points to some loss of hydrocyanic acid on the conversion of ferrocyanide to mercuric cyanide.

Estimation of ferrocyanides by titration with zinc sulphate.—Preliminary experiments were carried out on this method on the lines indicated by Colman (*loc. cit.*), who points out the considerable influence of the nature and amount of the alkali sulphate present on titration, and shows that in standardization of the zinc sulphate solution against pure ferrocyanide an amount of alkali sulphate should be added equal to the amount which would be present in the titration of an actual sample. He shows that in titrating, say, sodium ferrocyanide, the same result can be obtained as in titrating potassium ferrocyanide if a sufficient amount of potassium sulphate be added to the solution. The strengths of solution employed by Colman were 4,584 grms. sodium ferrocyanide per litre and equivalent strengths of the potassium and calcium salts, and 11·51 grms. of zinc sulphate per litre. This method of analysis has been used by the author for a long time, using much more concentrated solutions than the above, *viz.*, 50 grms. of sodium ferrocyanide per litre and equivalent solutions of the potassium and calcium salt, and 46·5 grms. of zinc sulphate per litre. At this concentration the end point is much more sharply defined and the behaviour in presence of alkali sulphate shows certain important differences from the behaviour in weaker solutions.

Experiments on potassium ferrocyanide.—The potassium ferrocyanide used in these experiments had been carefully recrystallized. The titrations were carried out as follows:—25 c.c. of the potassium ferrocyanide solution was measured into a porcelain basin and was diluted with 50 c.c. of 10 per cent. potassium sulphate solution or of water as the case might be. This was acidified with 2 c.c. of dilute sulphuric acid (1 : 2). The zinc sulphate solution was run slowly into this and the end point determined by placing a band of 50 per cent. ferric chloride on a small square of Schleicher and Schull special reaction paper No. 601. This was then dipped into the solution until the liquid just soaked up to the ferric chloride. The end point was taken when a blue band was just not formed in 2 minutes. It was found to usually develop in $2\frac{1}{2}$—3 minutes.

In the preliminary experiments it was found that the reaction ceased fairly quickly in absence of sulphate, but that in presence of sulphate the reaction was much slower. The end point in all cases was quite sharp and easy to determine.

Absence of sulphate.—Zinc sulphate required, 23·79 c.c. On allowing the solution to stand for one hour no stronger development of blue took place on making the paper test and no further amount of zinc was required.

Presence of sulphate.—25 c.c. of potassium ferrocyanide solution + 50 c.c. 10 per cent. potassium sulphate + 2 c.c. dilute acid. It was found that in this case much less zinc sulphate was required at first. Thus, on running in 23 c.c. of zinc sulphate and stirring for 2 minutes, no trace of blue was shown on making the paper test. It was found, however, that on allowing the mixture to stand for $\frac{1}{4}$ to $\frac{1}{2}$ hour and then making a paper test a strong blue line was at once developed, and on continuing the titration the amount of zinc required was 23·79 c.c., thus being exactly the same as in absence of sulphate. On allowing the mixture to stand further for 1 hour and again making the paper test, no further trace of blue was developed, thus indicating that the mixture is now in equilibrium.

It thus seems certain that in presence of alkali sulphate the first precipitate to come down is one in which some of the zinc is replaced by the alkali metal, but that on standing this precipitate splits up again and gives soluble alkali ferrocyanide and a precipitate containing more zinc than the original one. Miller and Danziger (J. Amer. Chem. Soc. 1902, **24**, 823) have previously noted the fact that when a zinc ferrocyanide precipitate is left in contact with the solution from which it has been precipitated, the precipitate changes in composition in such a way that the proportion of zinc increases. The process is not, however, complete in acid solution, as the amount of zinc used is still smaller than would be the case if the precipitate were zinc ferrocyanide. It is, however, seen that, at the concentration of solutions employed, the end result is the same in presence or in absence of additional alkali sulphate, and the composition of the precipitate in presence of 5 grms. extra of potassium sulphate the same as when only the potassium of the ferrocyanide is present, provided that in presence of sulphate the necessary time be allowed for the change in the precipitate to take place.

Experiments on calcium ferrocyanide.—In this case, owing to the uncertainty as to the exact composition of the crystallized salt, the solution was made up and its strength first ascertained by conversion to the potassium salt. The solution was then made equivalent to the solutions of the potassium and sodium salt used.

Absence of sulphate.—25 c.c. + 50 c.c. water + 2 c.c. acid required 24·11 c.c., 24·18 c.c., 24·16 c.c., 24·12 c.c. of zinc sulphate solution.

Presence of sodium sulphate.—(5 grms.) 25 c.c. calcium ferrocyanide solution + 50 c.c. 10 per cent. sodium sulphate + 2 c.c. acid required 24·23 c.c., 24·21 c.c., 24.23 c.c. of zinc suphate solution.

Experiments on sodium ferrocyanide.

Absence of sulphate.—25 c.c of sodium ferrocyanide solution + 50 c.c. water + 2 c.c. acid required 24·04 c.c., 24·05 c.c., 24·06 c.c., 24·03 c.c. of zinc sulphate solution. In each case the end point was quite sharp and on standing for 1 hour longer no further zinc was required.

Presence of potassium sulphate.—25 c.c. of sodium ferrocyanide solution + 50 c.c. of 10 per cent. potassium sulphate solution + 2 c.c. of acid required 23·83 c.c. and 23·88 c.c. of zinc sulphate solution. In this case also it was necessary to allow the mixture to stand for ¼ to ½ an hour before finishing the titration. 23 c.c. of the zinc sulphate was run in and the paper test made after 2 minutes when no sign of blue was obtained. After standing for ¼ hour, however, a paper test gave an immediate blue line. The result in presence of potassium sulphate is much more nearly equal to the titration of potassium ferrocyanide, being, however, slightly higher.

Presence of sodium sulphate.—25 c.c. of sodium ferrocyanide solution + 50 c.c. of 10 per cent. sodium sulphate solution + 2 c.c. of acid required 24·11 c.c., 24·15 c.c., and 24·13 c.c. of zinc sulphate solution, the solution being allowed to stand ¼ to ½ hour before completing the titration. Thus the result in presence of sodium sulphate is practically the same as in absence of sulphate.

Influence of impurities.—25 c.c. of the sodium ferrocyanide solution was taken and to this was added 50 c.c. of a solution containing 1 grm. each of sodium sulphite, thiosulphate, and sulphide. The solution was neutralized with sulphuric acid and 2 c.c. of the dilute sulphuric acid added.

	Zinc sulphate required.
In presence of above impurities	24·02 c.c.
In absence of impurities	24·04 c.c.

Thus the presence of sulphite, sulphide, and thiosulphate is without influence on the accuracy of the test.

Correction to be applied when the amount of ferrocyanide present differs from that present when the zinc solution is standardized.—In all cases 25 c.c. of the sodium ferrocyanide solution was taken and 50 c.c. of the 10 per cent. sodium sulphate solution added. To this 2 c.c. of the dilute acid was added, thus bringing the total volume up to 77 c.c. The ferrocyanide solutions were made up of varying strength, the strength of the first solution being that used in standardizing. The results are given in the following table:—

Sodium ferrocyanide present.	Zinc sulphate solution theory from standardization.	Found.	Correction.
grms.	c.c.	c.c.	c.c.
1·2500.	24·09	24·09	0·00
0·5000.	9·64	9·47	0·17
0·3125	6·02	5·80	0·22
0·1563.	3·01	2·76	0·25
0·0625.	1·20	0·93	0·27

If the corrections above be plotted on a curve against the volume of zinc sulphate actually used it will be found that the points lie very close to a straight line. If then it is necessary to titrate solutions of any strength within the above limits, provided the titration be always made in the same volume of liquid (77 c.c.) and with approximately 5 grms. of sodium sulphate and 2 c.c. of 1 in 3 sulphuric acid present the amount of zinc sulphate actually used can be corrected from this curve and the amount of ferrocyanide present calculated. It must be remembered that the more dilute the ferrocyanide solution which is being titrated the more care must be taken to have the standard amount of sodium sulphate present.

Experiments in weaker solutions.—We have seen that in solutions of the concentrations before mentioned the amount of zinc sulphate required for precipitation of a given amount of alkali ferrocyanide was practically independent of the amount of the sulphate of the same alkali metal present if time be given for the precipitate to come into equilibrium with the nearly completed precipitated solution.

Experiments were then tried to test the effect of standing on titrating when using the weaker solutions which had been in general use previously. The following solutions were used:—11·51 grms. of zinc sulphate per litre; 4·584 grms. of sodium ferrocyanide per litre.

Titration in absence of sulphate.—50 c.c. of sodium ferrocyanide solution + 50 c.c. of water + 2 c.c. of dilute acid:—Required: (*a*) 17·65 c.c.; (*b*) 17·63 c.c. of zinc sulphate.

Titration in presence of sulphate.—50 c.c. of sodium ferrocyanide solution + 50 c.c. of 10 per cent. sodium sulphate + 2 c.c. of acid. In this case as before it was found that if say 16 c.c. of zinc sulphate was run in and the paper test made at once no trace of the blue band would be obtained. On standing for a quarter of an hour, however, an immediate blue band was obtained. But it was found that on completing the titration the amount of zinc sulphate required was not the same as in absence of sulphate. The amount required was (*a*) 16·7 c.c.; (*b*) 16·7 c.c. One of the above titrations was allowed to stand for 19 hours, without any further change in the amount of zinc sulphate required. This difference caused by the presence of sulphate makes the method less easily applicable for general use than the method using the stronger solutions.

The separation of ferrocyanide from carbonyl ferrocyanide.—The method adopted for this purpose was the precipitation of the ferrocyanide by alcohol. A study was first made of the precipitation of pure sodium ferrocyanide and the following procedure finally adopted:—An amount of the ferrocyanide solution which would require a suitable amount of the zinc sulphate for titration was measured into a small beaker and was treated with 10 c.c. of *N* caustic soda and five times its volume of methylated spirits. This was allowed to stand overnight and was then filtered through a small quantitative filter with a hardened cone under a slight vacuum. The precipitate was washed with absolute alcohol or methylated spirits and was drained for half-an-hour on the pump. The filter paper and precipitate was transferred to the titrating basin, the beaker in which the precipitation was carried out was rinsed twice with 25 c.c. of the 10 per cent. sodium sulphate solution and once with 25 c.c. of water.

The liquid was neutralized and 2 c.c. of the dilute acid added. Thus we have the dilution required and the necessary amount of sulphate and acid for the titration which is carried out as previously described. It was found that the precipitation by methylated spirits was much more regular and accurate in presence of caustic soda. It was further found that although with pure ferrocyanide the precipitation was sufficiently good on standing for one hour, with solutions from spent oxide of iron it was necessary to stand overnight. The drying of the precipitate in the steam oven was tried but some decomposition of the ferrocyanide always took place on doing so. The presence of the filter paper had no effect on the titration. More accurate results were obtained if the precipitate was washed finally with absolute alcohol before draining.

The following results were obtained using absolute alcohol as the washing liquid :—

Direct titration without precipitation required 24·06 c.c. of zinc sulphate.

Caustic soda present.	Zinc sulphate required.
grms.	c.c.
0·28	24·07
3·00	24·08
6·00	24·08
0·04 grm. of iron carbonyl ferrocyanide dissolved in alkali and filtered and the filtrate added to the ferrocyanide before precipitation with alcohol.	24·05

Experiments on spent oxides of iron.—For these experiments a large batch of spent oxide was extracted with carbon bisulphide and was then dried, ground, and thoroughly mixed. 25 grms. of this material was ground repeatedly with 50 c.c. of 20 per cent. caustic soda for several hours. It was then made up to a known volume *plus* an allowance for the volume of the oxide. It was found, however, that the error introduced by this allowance was so considerable as to render some other method desirable. The following method was adopted :—The alkaline solution of the oxide was filtered through a small Buchner filter on the pump and was washed out with water using the minimum quantity of water for each wash. till the total volume of filtrate was about 500 c.c. The oxide residue was reserved for further examination. The filtrate was then made up to a known volume and a portion treated to separate the ferrocyanide from the carbonyl ferrocyanide as previously described. It was found that on acidifying the solution before titrating. a bluish precipitate was thrown down and that on making the paper test for the end point a green band developed above the blue. This green band persisted for two or three tenths of a c.c. after the blue band had disappeared, and rendered the end point more difficult to determine. On titrating till the green band disappeared and again adding a drop or two of pure ferrocyanide. the green again made its appearance. Attempts were made to get rid of the iron in the alkaline solution. which caused the blue precipitate. on acidifying. and eventually the most satisfactory method was found to be by boiling the solution when a precipitate of ferric hydrate was thrown down. On filtering this off and acidifying. no precipitation of blue now takes place and on making the paper test the green band is only very faint and disappears simultaneously with the blue. The iron possibly exists in the alkaline solution as colloidal ferric hydrate which is precipitated on boiling. This iron is thrown down along with the ferrocyanide when the unboiled solution is precipitated by alcohol and again goes into solution when the ferrocyanide is redissolved in water.

In the following experiment the alkaline solution filtered off from a weighed quantity of oxide which had been extracted with carbon bisulphide was precipitated by methylated spirits and the precipitate filtered off and dissolved in water to a known volume. (1) 25 c.c. was titrated direct with zinc sulphate with the addition of 50 c.c. of 10 per cent. sodium sulphate and 2 c.c. of dilute acid. (2) 25 c.c. was boiled down to small bulk, filtered and washed out and the filtrate concentrated again to 25 c.c. This was then titrated with the addition of 50 c.c. of 10 per cent. sodium sulphate and 2 c.c. of acid.

	Zinc sulphate required.
	c.c.
Direct titration	14·28
Titration after boiling	14·52
,, ,,	14·51

It will be seen that neglect of this precaution would make results by this method about 1·7 per cent. low on the ferrocyanide present.

Examination of the oxide residue.– The oxide after washing the alkaline solution out as described was further examined to see what amount of ferrocyanide was left in. It was found that no ferrocyanide could be extracted with water, but that a certain amount of insoluble ferrocyanide was contained, and further that this could not be completely extracted by further treatment with caustic soda. This insoluble ferrocyanide was probably present as calcium iron double salt and in order to extract this. the oxide residue was treated with hot concentrated hydrochloric acid and filtered. After washing, the residue was again ground and allowed to stand with caustic soda. This was filtered and washed out and the filtrate boiled and treated as before, being finally concentrated to 75 c.c. and titrated in presence of sodium sulphate and 2 c.c. acid. The amount of zinc sulphate used in titrating was corrected from the curve as previously described. The following figures show the ferrocyanide indicated by the main titration, and the amount afterwards extracted by hydrochloric acid followed by caustic soda.

	Sodium ferrocyanide. per cent.
Main titration	32·52
Further extracted by hydrochloric acid and caustic soda	0·2

the latter thus being 0·6 per cent. on the total ferrocyanide.

It may be noted that portions of the same average sample of such an extracted oxide were given to different people to analyse independently by a method drawn up on the lines described and the results obtained in no case differed by more than three or four in the second decimal place.

Summary.—(1) In the Feld method for the estimation of ferrocyanides some loss of hydrocyanic acid takes place on boiling the ferrocyanide solutions with caustic soda and excess of magnesium chloride under the conditions of the test.

A 99·5 per cent. yield of hydrocyanic acid may be obtained on distilling mercuric cyanide with sulphuric acid in presence of chloride, if the concentration of the sulphuric acid be not allowed to become too great. If this distillation however be carried out in presence of the other products of the decomposition of the ferrocyanide which are present in the test a less yield than the above is obtained. Furthermore it seems probable that under the conditions of the test ferrocyanide is not completely converted to mercuric cyanide. (2) In the zinc sulphate method for the estimation of ferrocyanide. it is advantageous to use more concentrated solutions of ferrocyanide and of zinc sulphate than those generally adopted. With the more concentrated solutions a sharper end point is obtained and the effect of the presence of excess of alkali sulphate is minimized—the end result in presence of excess of the sulphate of the alkali metal in question being the same as in absence of excess of the sulphate if the precipitated solution be allowed to stand for a quarter—half-an-hour before completing the titration. It is thus unnecessary to so finely regulate the amount of sulphate present, provided we are dealing with the ferrocyanide and sulphate of the same alkali metal. This has been shown both in the titration of the potassium salt and of the sodium salt. In the titration of sodium ferrocyanide it is better to use a zinc sulphate which has been standardized against pure sodium ferrocyanide, though results of comparative accuracy can be obtained using a solution which has been standardized against potassium ferrocyanide provided that sufficient potassium sulphate be added and the solution allowed to stand.

(3) In the separation of ferrocyanide from carbonyl ferrocyanide by alcohol, the greater accuracy of the method in presence of caustic soda is indicated and the advantage of washing the precipitate finally with absolute alcohol.

draining and titrating direct in presence of the filter paper pointed out.

(4) In estimating the ferrocyanide in the residues obtained after extraction of spent oxide or iron with carbon bisulphide it is shown that a higher result is obtained if the alkaline solution be boiled and filtered before proceeding with the estimation. On boiling, some dissolved iron is precipitated which would otherwise cause precipitation of ferrocyanide on acidification. Lastly, caustic soda does not extract the whole of the blue from oxide, there being some varying residue of blue which is difficultly soluble in caustic soda and is probably in the form of the calcium-iron double salt.

Discussion.

The **Chairman** said the principal point in the paper was that in the estimation of ferrocyanides on a large scale, that was in working up spent oxide of iron and other cyaniferous residues, certain losses occurred. He had known the Feld method to be used in gas works for estimating the cyanogen in the muds and raw products obtained by washing gas. It was unexpected both to Dr. Skirrow and himself to find certain discrepancies had crept in. He noticed that Dr. Colman had not mentioned them in his paper. The method for the decomposition of ferrocyanides into mercuric cyanide and then into hydrocyanic acid was interesting in that it had been used on a commercial scale. To his mind the zinc test was the most useful for cyanide works inasmuch as it could be used in the presence of impurities like sulphides and thiosulphates which would make the application of the copper test impossible. The sulphate of the alkaline metal had no effect if the solution were allowed to stand, and, that of course, was a point to remember in dealing with solutions that required titrating with zinc. There was also the influence of dilution. In experimenting on a large scale a difference of one per cent. was important in comparing a yield of say 80 or 90 per cent. with another yield of a similar amount. In the final results there would be a 10 per cent. difference, in the loss or gain which, of course, was a very big item.

Mr. J. H. **Hoseason** enquired if Dr. Skirrow had further investigated the loss of the hydrocyanic acid in the first process. It seemed to him quite possible to break up the ferrocyanogen complex. It was possible for the hydrogen and cyanogen ions to take the other direction and be hydrolised.

Mr. J. E. **Southcombe** said he had formed a similar idea to Mr. Hoseason with regard to the hydrolysis of the ferrocyanide. He believed it was possible during processes of hydrolysis for a great change to take place and cyanate to form. Cyanic acid was not volatile in steam, and, of course, that would account for the loss.

Dr. F. W. **Skirrow**, in reply, said the one thing that had been brought out in Colman's work was the impossibility of titrating a solution of ferrocyanide either with copper or zinc; without reference to the alkali metal present. That was standardizing with the ferrocyanide of one alkali metal and titrating the ferrocyanide of another. It was clearly impossible to obtain accurate results in that way. He had not tried experiments with the copper salt. The advantage of being able to titrate in the presence of sulphites, sulphides, and thiosulphates, and so on, was so great that it had led him to confine himself to the zinc test. He had not gone into the question of the loss of the hydrocyanic acid, but he thought that hydrolysis would account for a great deal of it.

Scottish Section.

Meeting held at Glasgow, on Tuesday, January 18th, 1910.

MR. D. J. PLAYFAIR IN THE CHAIR.

THE FUNCTIONS OF STARCH IN THE MANUFACTURE OF PAPER.

BY JOHN TRAQUAIR.

In the manufacture of paper the most important factors in determining the quality of the finished products are :—(1) The fibres, (2) the sizing agents. An unsized or waterleaf paper of even the finest quality is relatively soft and absorbent. It is also deficient in strength and cannot resist handling or mechanical wear and tear. The object of paper-sizing is to diminish the capillarity by cementing together single fibres, and at the present day two methods are in use, viz. :—engine-sizing and tub-sizing. Engine-sizing means resin-alum-sizing, and for the specific ink and water resisting quality specially required in writing, printing, and wrapping papers, we are practically limited to rosin. It is not my intention to discuss this type of sizing at all, but papermakers know that it is the result of a complex process, influenced by quite a number of factors, and is not merely the simple process of adding substances of water resisting quality, which property they confer on the paper.

The other method (tub-sizing as it is called) deals with the finished sheet, and is a simpler process, colloid substances in solution, chiefly gelatin, being used. In this case the paper in the web or sheet is run through the colloid solution at a suitable temperature and concentration. The amount of size absorbed is regulated by the time of immersion, the nip or pressure on the squeezing rollers, viscosity of the size, and other factors. The paper is then dried at as low a temperature as possible by various methods. The colloid taken up by the paper coats the fibres, fills the interstices of the web with a structureless film, reduces the capillarity of the fibres, and the porosity of the paper.

This is the original method of sizing, and is at present universally used in high class papers for writing purposes.

Starch was the first paper-sizing agent, and it has been shown by Wiesner "Microscopical Examination of Paper," Vienna, 1887, that the European papers of the 8th to 14th century are exclusively starch sized, no rosin, gelatin, or tragacanth being present. A number of these papers can be written on with ink at the present day and are in excellent preservation. The art of sizing paper with starch seems to have disappeared from Europe in the 14th century and was replaced by animal sizing, and it is evident that the problem for the papermaker of to-day is to rediscover the lost art and apply it to modern conditions.

Regarding Asiatic papers, Wiesner in his "Eastern Turkestan (Chinese) Papers," Vienna, 1902, mentions a joint examination with Professor Karabacek of El Faijum papers with the following results :—(1) All the Faijum papers are sized with starch ; other sizing agents such as rosin, gelatin, tragacanth, etc., could not be identified. (2) The majority can be written upon with ordinary ink to-day, after a lapse of 800 to 1000 years. (3) Unchanged wheat starch granules are frequently found along with incrustations of starch paste, gluten residues, and other constituents of flour, proving that in sizing there were used mixtures of raw and boiled starch, or half boiled starch. The presence of the gluten residues, etc., indicate that the purification of the starch was imperfect, or that an addition of flour was made in the sizing.

Karabacek "New Sources of Paper History," Vienna, 1888, gives extracts from an Arabian work dated 11th to 12th century, and entitled "The Scribes Assistant, or the Intellectual man's Equipment," as follows :—1. "Now take the best sort of the finest and whitest flour and wheat starch, both purified. Soften and bruise the flour and wheat starch separately in cold water till no lumps remain. Pour on boiling water and stir, etc. Apply to paper by rubbing in, and dry in the air, etc." 2. Describes preparation of a solution of rice starch in which the paper is immersed, then dried and glazed. 3. Similar method to 2. in a manuscript 1701, but rice starch solution is spread on with a piece of linen cloth. The paper so treated is not distinguishable from genuine Bagdad paper. The ancient papyrus, according to Pliny, was treated with a plant sap to keep off moths and worms, and a starch paste prepared from fine flour with hot water and vinegar was used to join together the strips of which papyrus is composed. Pliny does not state how the sizing was done, but it is evident that hard sizing was not aimed at, as he says that polished or glazed paper does not absorb ink properly.

"Matthias Koops, Historical Account of substances used to describe events, etc.," 1801, states that :—"They (the Romans) sized papyrus in a similar method as we do rag paper, but they made their size of the finest flour which was stirred in boiling water with a few drops of vinegar and some leaven, and then filtered. It was after the first size beaten with a hammer ; sized the second time, pressed and then smoothed." In Chinese and Japanese paper, rice flour is added to the pulp to fill up the pores and impart additional whiteness to the paper. These, however, are not hard sized ; in fact, are frequently not sized at all.

In modern times the use of starch in papermaking is intimately related with the introduction and use of various vegetable fibres. Cotton and linen fibres were the earliest papermaking materials, and still produce the best paper, for in the raw state they exist as nearly pure cellulose, and therefore require little chemical treatment. The introduction of the Fourdrinier machine in 1803, and its subsequent improvements, was the means of putting papermaking in the way of achieving its present industrial importance.

The increased means of production stimulated the demand, and in fifty years, the paper made in the United Kingdom had increased from 11,000 tons (1800) to 63,000 tons (1850). As rags were almost exclusively the raw material used, a famine in rags threatened, and the search for new fibres began in earnest. In 1852 "esparto" was successfully introduced, and in a few years its use had far outgrown rags as a raw material. The repeal of the paper duty in 1860 and the introduction of chemical wood pulp in 1878 marked further periods in the progress of an industry whose growth has been one of phenomenal rapidity. In other fifty years the production of paper had multiplied itself ten times, the paper manufactured in the United Kingdom being 650,000 tons in 1900. At the present day, the consumption of the variety of products which can be classed as paper has reached such a figure and is increasing steadily at a rate which threatens destruction to the forests of the World.* This is so obvious that several of our large British paper consuming firms have within the last two or three years secured large forest areas, notably in Newfoundland with a view of ensuring for themselves future supplies of the chief raw material for their newspapers and other publications. Doubtless the ingenuity of our chemists will increase the number and sources of suitable papermaking fibres, and meet the increased demand in the future as in the past.

But to return to my subject, I said the use of starch was intimately connected with the introduction of the various vegetable fibres. The main facts are as follows :—It was found impossible to make a paper from esparto equal to a rag paper, and starch came into use as a necessary sizing and stiffening agent. It was about this time that the manufacture of starch on a large scale was started in this country, and the use of starch especially in Esparto E.S. writings and printings, grew to large proportions. In many cases the starch was used with little discrimination, and an entire lack of knowledge of how to get the best results from it.

After the introduction of chemical wood pulp, the use of starch steadily declined, the reason being that the hydrating capacity of this cellulose is at a maximum, and in use it added a wetness to the pulp, and a consequent hardness and rattle to the finished paper. Thus by combining esparto and well beaten chemical wood pulp a variety of results could be obtained, results in many cases very similar to those obtained by the use of starch, but there were other reasons for the decrease in the use of starch, among which we may mention (1) The gradual realisation by the papermakers that their methods of using starch involved a large loss. (2) Increasing competition and a consequent decreasing profit enforcing economy and thereby curtailing the use of starch. Not only so, but where starch requires to be used, the papermakers who formerly only used the finest starch now use cheaper qualities.

We now come to consider the function of starch in papermaking at the present day, and hope to throw some light on the history of its use as briefly summarised in the preceding paragraph.

J. Hübner states (Cantor Lectures, 1903) "that it is quite safe to count it (starch) among the loading materials." This is news to starch makers if not to most papermakers, and I am afraid its price precludes its use for this purpose except in some special high class papers. The papermaker as a rule does not look upon starch as a loading or even a strength giver, but rather as a hardener and binder, influencing the feel, rattle, and retention of loadings. Starch may be added to the paper, either during its manufacture or as a final process. In the first case, it is added to the pulp in the beater, and is known as engine-sizing, and in the second case, it is applied as a surface size by a modification of the usual tub-sizing process.

The first method is the one in general use, and the starch performs various functions according to the class of paper in which it is used, the following being the principal classes :—

1. *Rosin size.*—A solution of starch is generally used to dilute down the rosin size before adding to the beater. The extent of dilution has a considerable effect on the efficiency of the size, and the presence of starch prevents precipitation of rosin on dilution and lessens the danger of having undissolved particles of sufficient dimensions to cause rosin specks on the paper. The starch colloid also assists in the distribution of the precipitated rosin compounds.

2. *Starch* is also used in special papers, such as cheque papers, where it is part of the test. (See Eng. Patent No. 748, Menzies and Bevan, 1891) as an example.

3. *E. S. Writings.*—Starch finds a much larger use in this class of paper, and in Scotland where the finest esparto E. S. writings are made, the use of starch cannot be dispensed with.

We have stated that the function of rosin-size is to add a water or ink-resisting quality to the paper, but it contributes little to the closing or compacting of the sheet. This effect is best and most commonly obtained by starch, but is, of course, also obtained by using other colloids, such as gelatin, casein, viscose, etc. The effect of adding a quantity of swollen or partly swollen starch to the pulp is the coating of the fibres with gelatinous starch hydrate. This adds a wetness or increased capacity for holding water, and as the water is longer retained in the passage of the pulp over the wire, the thorough interlacing of the fibre by the "shake" is assured. Under the action of the press rolls the interlocking of the fibres is favoured by the presence of a gelatinous substance which may be regarded as a kind of cement, and in the final drying the shrinkage of the now thoroughly swollen gelatinous starch, which accompanies dehydration considerably helps the process of compacting the sheet. It is this effect which justifies the use of starch, and although it can be obtained by prolonged beating and consequent hydration of the cellulose it is more economically obtained by starch.

4. *Imitation art.*—This is a class of paper which has come greatly into use within recent years, as it enables the printer to get very fair results with process block work on a paper which costs little more than an ordinary printing. It is therefore extensively used for magazines, catalogues, and periodicals, where the illustrations are not of first importance. In this class of paper, starch is used as a clay carrier, that is, its function is to fix the abnormally large proportion of china clay which is necessarily present in this paper. The finest imitation art paper is made in Scotland from esparto, and is loaded with from 25 to 35 per cent. of china clay, and as a final process is treated on the water doctor calendar where the sheet is alternately damped on the surface and hot calendared under heavy pressure.

The method of making paper depends on arranging the fibres in different planes, so that the surface consists of tiny hills and valleys, and calendaring consists in simply crushing down the hills into the hollows, so as to bring the whole surface into one plane. This is greatly facilitated by the alternate surface wetting and hot calendaring which also gives a polish to the paper.

Methods of using starch. Owing to the recent advance in the price of all starching materials, the time is most opportune for again considering the method of using starch in paper-making. At present it is added to the beater, and may be either raw, semi-swollen, boiled, or mixtures of these. The literature on the subject is very meagre, and the only scientific work on starch in its relation to paper is that by Alfred Lutz, Papier-Zeit., 1908, 33 (This Journal, 1908, page 466). Unfortunately, this work was all done on the experimental scale, which rather discounts its value, but it shows the extent of loss in using starch under various conditions, and the experiments, although necessarily, carried out on hand-made papers, are strictly comparative. The amount of starch retained by the paper is found to depend mainly on the state in which it is added, although the nature of the starch and the condition of the pulp have minor influences.

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* See Appendix (Census of Production, Table II, 1907) at end.

In one series of experiments, 10 per cent. of starch was added to well beaten wood pulp, the yields being as follows:—

	Starch retained.		
	Potato.	Wheat.	Rice.
(a.) *Raw.*	per cent. 73·6	per cent. 71·7	per cent. 53·4
(b.) *Boiled.*	46·2	58·3	58·9

These results are very striking. In the raw starch experiments the per centage retained by the paper corresponds with the dimensions of the starch granule, and in the boiled starch experiments, to the fact that potato starch is relatively more soluble in boiling water. The extremely small granuled rice contains a much larger proportion of insoluble amylose which precipitates out on adding to cold water, the potato starch containing comparatively more soluble amylose. The increase in strength of the paper due to the addition of starch is proportional to the quantity taken up, and is fairly constant with different kinds of starch.

In order to determine the influence of starch on the retention of loading, a further series of experiments were done in which 5 per cent. starch calculated on the fibre was boiled to a paste with china clay and added to the pulp, comparative tests being done against pulp similarly loaded, but without starch.

	Clay retained.	
	Plain.	With starch.
Pulp with 5 per cent. rosin and 15 per cent. china clay ...	11·0	12·3
Pulp unsized with 50 per cent. clay	28·8	31·5

The additional quantity of loading retained by the starch does not compensate for extra cost, but without starch the paper was limp, and would have caused trouble on printing owing to dusting. This is prevented by the starch which imparted a feel and rattle to the paper. It was also found that the tensile strength and stretch of the paper was increased by 25 per cent.

On this question of retention of loading, the following facts from working scale experiments may be of interest. The clay was mixed with sufficient water and 10 per cent. of starch, and in one case the mixture was heated to fully 80° C., that is, the starch was thoroughly swollen. In the second case, the starch-clay mixture was heated to 45—50° C., that is, the starch was not swollen, although a slight thickening took place. Equal quantities of these mixings were used in the same proportion of pulp, and worked separately on the papermaking machine. Average samples of the waste waters were examined for ash, which was also determined in the finished paper.

As a result, it was found that the waste water contained a larger quantity of suspended matter, and the paper a smaller percentage of ash when the starch had been thoroughly swollen, and that less suspended matter was contained in the waste water and a larger proportion of ash in the paper when the starch had only been heated to under 50° C. Several experiments gave in every case similar results, there being on an average at least 25 per cent. more clay in the total solids from waste water in the case of swollen starch than with the unswollen experiments.

It is evident from the figures which have been quoted, that the best results are obtained by adding starch to the beater in a semi-swollen condition, that is, the starch should retain its natural granule form, being only slightly swollen and rendered plastic by the action of warm water. In this form the granules adhere easily between the fibres, stop up the pores, and at the same time bind the loading material. The raw starch does not adhere so readily, while starch paste, being practically a solution, is readily sucked or pressed through the pores between the fibres together with any particles of clay which may have settled in the latter. The swelling of the plastic starch granules is completed on the drying cylinder, and the maximum value possible by this method of using starch is obtained. In every case, however, it is evident that a loss of starch occurs, and I question if even under the best condition and a closed system of working, it is less than 33 per cent. of the starch used.

In the case of thoroughly swollen starch, we know it is much larger, although the full starching value is obtained for that proportion which is retained by the paper. In the case of raw or semi-swollen starch the drying cylinders are relied on to complete the swelling, but as the temperature of these is lowest at the wet end, the paper may be so dry by the time the temperature has been raised above the swelling point of the starch, that there is not sufficient moisture left to properly complete the swelling. This is very evident if a paper which has been engine sized with raw starch is carefully examined by the microscope. The paper should be torn so as to partially split it, then soaked in weak iodine solution to stain the starch and examined by say a 1 in. objective with reflected light. The starch granules on the surface will be swollen and diffused, but in the interior they are only slightly swollen and may retain their form so that the nature of the starch used can be easily identified. It is like ironing a collar too dry. It will lack stiffness owing to insufficient water being present to swell the starch granules. In this connection it might be worth mentioning that the modern, and by far the most economical laundry method of starching, is to use a thin boiling starch in which the collars are sized, then dried at a high temperature, damped, and ironed; the advantage being that every ounce of the starching or stiffening value of the starch used is obtained.

Now, the question occurred to me some years ago, why should similar methods of using starch not be applied in papermaking. This, of course, is reverting to the tub-sizing method, but after all, it is admitted on every hand that it is the best method of papersizing. The matter was discussed with a few papermakers and after many delays a paper making machine was altered to allow of these ideas being tested on a practical scale. A tub sizing trough was placed above the smoothers, and over this were several sparred cylinders, round which the sized paper travelled before being led on to the final drying cylinders.

I do not claim that this application was novel, but the idea was advanced with some appreciation of the difficulties to be overcome, and the knowledge that the first essential was to have a suitable starch product. The ideal product should yield a thin slightly viscous solution at 1½ to 2 lbs. per gallon, and give a tough flexible film on drying, as insoluble and unaffected by water as possible. Further, it must be produced at a price little above the equivalent of the starch ordinarily used.

The thin boiling maize and wheat starches now so extensively used in the large power laundries were first introduced and manufactured in America, and in Scotland at the Glenfield Starch Works, so that their properties and uses were quite familiar. Unfortunately, they are not quite suitable, as the solution at even 1 lb. per gallon sets on cooling, and when used hot "skins" easily and causes trouble unless a number of precautions are taken.

I have found that the starch esters, commercially known as "Feculose," (see this Journal, 1909, page 288), fulfil the conditions as to fluidity, permanency of solution, and filming power. The film, however, is not insoluble, but the solution when treated with 2 to 3 per cent. of formaline and dried, gradually becomes practically insoluble, and much less water absorbent. These observations are still in the experimental stage, but similar results can be obtained by other means.

The end in view is the production of an improved printing surface, but the use of Feculose for tub-sizing, as usually understood may be dealt with first.

Tub-sized papers.—The makers of tub-sized paper have always viewed with suspicion any starch product which has been offered as a substitute for gelatin. The fact seems to have been entirely overlooked that the earliest papers were exclusively starch sized, and as far as sizing and durability are concerned are still unsurpassed.

All efforts to substitute a pure vegetable size for gelatin have ended in failure, and this fact has established the use of gelatin so firmly that tub-sizing has come to mean animal tub-sizing, and is frequently guaranteed as such. The advantage of feculose over animal size is that it can be dried at a high temperature and therefore more quickly, and the elaborate air-drying methods at present in vogue (and necessary where gelatin is used) can be largely dispensed with. No starch product, however, has the ink resisting power of gelatin, but this can be easily obviated by adding a little rosin-size to the feculose solution, and then just sufficient sulphate of alumina to decompose it. From 1—5 per cent. of rosin size may be used, and this gives the ink resisting quality. The feculose solution is distinctly colloidal in character, and does not penetrate the paper so readily as animal size. Comparative tests have shown that when used alone without alum the paper takes up the same amount of size from a 6 per cent. solution of gelatin as from a 12 per cent. solution of feculose at 90° F. Experiments run under these conditions on a papermaking machine where the half dried paper was run through the tub-sizing box, then over three-sparred cylinders, followed by ordinary cylinders and calendars, which dried and finished the paper in one operation, gave excellent results, the paper being in every way equal to that obtained by sizing with gelatin.

The fact that feculose does not give the tannic acid reaction has led to its use in conjunction with gelatin. This has opened quite a new field, and feculose is now in regular use in several works for tub-sizing paper. So far, its use has been confined to the cheaper class of machine made tub-sized papers; the makers of the higher class tub-sized papers being naturally very conservative. Feculose shows a 30 to 40 per cent. economy over gelatin, but in works where the gelatin is extracted directly, the difference is less.

A typical sizing bath is two parts 12½ per cent. solution of feculose, and one part 6¼ per cent. solution of gelatin with just sufficient alum to give the required viscosity to the size. It has been found that feculose gives the paper a distinct quality, improving the handle by making it more pliable, and the writing quality by making the surface less hard and ink repellent.

E. S. writings.—Feculose is also used to improve engine sized writing, where the paper (which has been fully rosin-sized in the beater) when more than half dry is run through a weak solution of feculose and dried on the papermaking machine. The paper is tightly squeezed, so that little size is taken up, and it is endeavoured to keep this size as much as possible on the surface. This imparts the handle and writing quality of a tub-sized paper to an ordinary engine-sized writing, and leads to new outlets for this class of paper.

Printings.—In papers of this class the production of a good printing surface is the ultimate criterion of success. Feculose and china clay have been used in weak solution on the water doctor calender with very promising results, but the conditions are rather difficult to adjust, and this use is at present in the experimental stage. Where the paper is tub-sized in feculose and colour, the conditions are more easily controlled, and encouraging results are obtained, the important point being that the loading is put where it is most required, viz., on the surface of the paper. Of course, under ordinary working conditions, you are limited to a very light coat, but the result is an improved printing surface and the full value of every ounce of sizing material used is obtained on the paper. The china clay can be replaced by other colours, such as blanc fixe, or satin white, with superior results, and as this paper has received what we might term a preliminary coating a much lighter final coat would be required if used as an enamelling paper. This opens a wide field of possibility, as the coating methods could be simplified, and the speed of coating greatly accelerated. The problem before papermakers to-day is the production of a printing surface which will take a process block at a price as near that of ordinary printings as possible. I feel sure the solution will be found on the lines I have indicated, but our experiments have not reached such a stage as to warrant a definite statement, although I will deal further with this under papercoating, where positive results have been obtained.

Papercoating.—This is a distinct branch of the paper trade, and in fact, forms a separate industry. The function of size, in this case, is to fix the mineral coating to the surface of the paper.

Few can have failed to notice within the last decade the enormous growth in numbers and circulation of illustrated papers. The better class periodicals have cultivated a popular taste for good illustrations and now no book or magazine is acceptable without them.

The development of modern printing paper is closely associated with the introduction of the photo-mechanical processes of illustrating. The application of photography and the designers' art to commercial purposes in the numerous monthly, weekly, and even daily papers, not to mention the numberless advertising pamphlets, catalogues, etc., has created a large and ever increasing demand for a cheap paper to give the most effective printing results. The wood engraving, the copper etching, the collotype, the lithograph, and the half tone process block, have each marked a stage in the advancement of the printer's art, and each required some special characteristics in the paper to obtain the best results. In the modern half tone block and three colour process work, a paper having a smooth surface is essential if a picture showing a sufficient amount of detail is to be produced. This smoothness of surface in the case of imitation art is secured by loading the paper heavily with china clay and water-finishing on hot calenders, but if one will compare a picture printed from the same block on imitation art and on ordinary art enamel, it is evident why the former is called "imitation" art enamel. The picture in the former is very much inferior in depth and clearness, in fact, has a grey appearance.

It must be pointed out that the degree of surface smoothness should only be sufficient to take the maximum of detail possible in a process block, and the ideal position is arrived at when a paper with a surface just sufficiently perfect to take the maximum of detail possible is produced.

It must be confessed that the heavy highly polished art enamel which has been produced in response to the insistent, but often unreasonable demand, for something cheap, is not really paper. It is generally a sheet of poor vegetable fibres sandwiched between two coats of mineral matter which frequently amount to 50 per cent. of the whole.

The coating performs two functions: In the first place it fills up and levels the unevenness of the paper, and secondly it provides a printing surface. This is an important point and one that is generally overlooked by many paper manufacturers. It is the printing surface which is the essential condition. An imitation art enamel may have a perfectly smooth surface, and still give printing results very much inferior to a third or fourth class coated paper. The reason being, that the surface has no ink affinity: that is, it has no power of absorbing the ink from the block in the fraction of a second in which they are in contact: in fact, the surface is ink resistant, instead of being ink absorbent. The ideal coating for paper would be a solution of cellulose, but up to the present, although a number of attempts have been made, these have not proved successful. The manufacture of art enamel has been dealt with in a paper read before this Society by R. W. Sindall (see this J., 1905, page 770).

and I propose to contino my remarks to amplifying various points which were only briefly dealt with in his paper, and to deal specially with the application of starch, notably the starch ester or acetate teculose.

At first papercoating was all done by hand, the earliest machines being of the flat type, with round spreading brushes, which had a circular motion. In the early eighties the German cylinder machine was introduced with jigger brushes, and this has remained the standard type until the present day, although with a number of minor improvements. Some of the large art enamel firms have double coaters, but these are not completely successful, as the trouble of adjusting them scarcely compensates for the increased speed of production.

The paper used varies considerably, the best being pure esparto paper, then mixtures of esparto with chemcial wood pulp in various proportions. In the cheaper qualities, mechanical wood pulp is used in increasing proportion. The pulp should be free beaten, and the paper as free from wire mark as possible, and little more than half rosin-sized. For good class chromos, it is essential that good quality body paper be used as this has a greater influence on the printing results than is generally credited. The colours used are of some interest.

(1). *Satin white.*—More of this colour is used than any other, as it possesses a maximum covering power combined with a high lustre. It is made by precipitating sulphate of alumina with excess of lime in fairly strong solution, thoroughly milling the precipitate, washing and filter pressing. The finished product therefore consists of a gelatinous alumina hydrate precipitate, calcium sulphate and excess of lime. I annex typical analysis which show the composition of commercial satin white as used in paper coating. It should contain not more than 10 per cent. free lime.

Comparative covering powers show the following results. Method—Paint out on glass to equal density, the same weight of colour with one and a half times its weight of water.

	Area covered calc. to dry colour.	Price of pulp colour.	Average moisture.	Calc. price of dry colour.
		per ton.	per cent.	per ton.
Satin white	100	£4 10–£6	65—73	£13 10–£18
Blanc fixe	50	£5 10–£7	25—30	£7—£9
China clay......	35	£1 10–£2 5	5	£1 10–£2 5

Typical satin white.

	per cent.
Moisture	66—70
$Al_2(OH)_6$..................................	7—9
$Ca(OH)_2$	6—8
$CaSO_4$	13—17
Alkaline salts..................................	4—6

A mode of comparative analysis might be mentioned. This may be termed Mechanical Anaylsis and consists in washing with water a weighed quantity of the satin white on a filter for several hours to remove sulphate and hydrate of lime. The insoluble consisting of alumina hydrate and the insoluble portion of the lime salts, this being examined for presence of china clay.

Results for 8 samples of at least 6 different makes.

	1	2	3	4	5	6	7	8
Moisture .	64·3	67·3	70·2	70·2	66·5	73·7	70·4	66·9
Soluble extract	12·9	16·1	13·2	14·4	17·81	9·9	10·1	14·31
Insoluble residue ..	22·8	16·6	16·6	15·4	15·65	16·4	19·5	18·7

(2) *Blanc fixe.*—This is the next most important pigment, and is simply barium sulphate obtained by precipitating commercial barium chloride with sodium sulphate. It is usually sold as a white paste containing 25 to 30 per cent. moisture. An inferior blanc fixe obtained as a by-product in the manufacture of hydrogen peroxide is also on the market.

(3) *China clay.*—This is the well known mineral, and for paper coating good qualities are used. Cleanness and good colour being essential.

Sizing material used :—(1) *Glue.*—The largest proportion of the paper coated in Britain is sized with glue, and for this purpose a good quality hide glue is essential. Special qualities are made for papercoating, and at least, 95 per cent. is continental.

(2) *Casein.*—This sizing material is a milk product obtained by precipitating separated milk with acid, washing, purifying, and then drying and grinding. A great deal more has been written on casein than on glue, or any adhesive substance, but the subject still presents difficulties with reference to the preparation of solutions, and mixture with other bodies, especially colouring matters. Casein was introduced as a size for papercoating in Britain in the year 1897, and made very little progress at first, as the the method of making a solution was different from that employed with glue, which up to that time had been exclusively used for papercoating. However, the great economy effected, led some of the more enterprising papercoaters to take the matter up and solve the difficulties connected with its application with very satisfactory results. Casein is characterised by giving a very brilliant finish with satin white, and as the coat can be easily rendered absolutely insoluble by the use of formalin, it is particularly suitable for box enamels, and similar classes of paper. It also gives good results for process block printing in black and colours. On the Continent and in America, casein is used to a much larger extent than in Britain, and is undoubtedly unsurpassed for special classes of paper for decorative purposes. For some years the price of casein ranged from £20 to £25 per ton, but the price gradually began to rise owing to the use of the product in other industries and a general recognition that as a milk product it had a higher value if turned into cheese. In 1908 it had risen to over £30 per ton, while to-day its value is fully £40 per ton. At this price, its use as a size for paper coating is limited to the special class for paper for which it is peculiarly suitable.

(3). *Starch products.*—The fact that weight for weight starch has an equal, if not greater, sizing value than gelatin suggested its use in paper coating, and many attempts have been made from time to time to substitute a starch product for glue. The problem was to get a starch product which would yield a sufficiently fluid solution to make down the colour to a cream and still retain the original sizing power of the starch. Ordinary soluble starch was first tried in conjunction with gelatin, but many troubles were experienced, and it is questionable whether the economy is very real. At any rate, the use of soluble starch in this way is strictly limited. Soluble starch with 5 per cent. borax gives a solution which can be used for papercoating, but its sizing value is low.

It is recognised that unless a solution of the sizing material dries to a continuous film on glass, it is not suitable for papercoating If it dries to a brittle mass, as is the case with ordinary soluble starch alone, or with borax, it will not give a continuous surface on paper. The broken surface will lead to considerable trouble in finishing, and will be absolutely fatal to the attainment of first class printing results. This has been my own experience, and is confirmed by the few firms who have experimented to any extent with soluble starch.

It is, however, possible to obtain a starch product capable of yielding a continuous film on glass and paper, and in 1900 a French soluble starch was introduced which fulfilled theso conditions. This was manufactured by Brueder's process (see English Patent 17,650 August 16th, 1898, C. Brueder), and is an oxidised starch produced by the action of alkaline hypochlorites. Preliminary experiments gave encouraging results but subsequent tests on a manufacturing scale were not so successful, with the consequence that the prejudice which already existed against all starch products was further strengthened. It was found that a reaction took place between the alkaline satin white and the starch product, as the colour when freshly made up was all right, but in an hour or so the starch size became watery and lost its sizing power. Several attempts have been made to get a suitable starch product by an alkaline breakdown, but so far without success, as owing to the treatment necessary to obtain sufficient fluidity the colour of the product is rendered unsuitable.

In 1901 I took up the problem, and confess to have spent seven years in solving it. In the first place, all the starch products on the market were examined as to their suitability, but without success, and my work was concentrated on the starch esters which at that time were simply in the laboratory stage. These esters have several ideal properties, fluidity, permanency of solution, good colour, and excellent sizing and spreading power, but in spite of this, for several years it looked as if the problem was to remain unsolved. Fortunately, I was in the position of having a papercoating work at my disposal, and was thus enabled to do experiments on a practical scale, in addition to laboratory work, and this fortunate combination must in some degree account for my ultimate success.

The various qualities of feculose (commercial starch esters) were tested as to their suitability. The main difficluties experienced were:—

(1) The setting of the feculose colour.

(2) Troubles on coating, grease spots, etc.

It was demanded that feculose size should be neutral, and remelt easily like gelatine, should it "set" or jelly on standing. The action of neutralising agents, such as borax, zinc oxide, magnesia, etc., were investigated, the result being that the neutralised feculose was of little merit as it set more quickly, and could not be remelted easily. The thickening action of borax, alumina and its salts was noted, but these reactions do not improve its papercoating quality. The usual remedies for spotting, such as the addition of a little oleine to the colour were tried, also other agents whose efficacy is a superstition among colour mixers, but these had only a harmful effect. Mixtures of feculose and other sizing agents were also investigated.

Feculose and casein do not mix, but feculose and glue can be used together, although the results did not justify the continuation of experiments in this direction. Owing to the successful application of mixtures of gelatin and feculose for tub-sizing, the matter was reopened at a later date. The best method is first to mix the colour with the proportion of feculose size and then add the glue size to complete the mixing. This development was thoroughly tested on a working scale, but the results were disappointing. The colour is apt to be frothy, and while fair results are obtained with light coats, heavier coats show pin holes and other imperfections. In mixtures of colloids with such distinct origin and properties as gelatin and feculose, separation occurs on standing, and until some knowledge of the constitution of those bodies is obtained, we can only hope to experiment on crudely empirical lines. Towards the end of 1905 a much cheaper type of feculose was tried, and while this gave excellent results with neutral colours (such as blanc fixe and china clay) it was a failure with satin white. A neutral or acid satin white was made and tested, the only point of interest being that with this colour a perfectly dull finish was obtained. The whole question finally resolved itself into the production of a starch product which would be unaffected by alkali, as far as its sizing properties are concerned.

All the types of feculose which had so far been tested reacted with alkali, the solution becoming thin and watery, except in one instance, which gave me a hint as to the direction in which a solution of the problem was to be found. After careful experiment, it was evident that any oxidised starch was acted on by alkali, and this was confirmed by some published work at that time. This cleared the way for further investigations, but it had taken four years to reach this point, although the work during these years had not been valueless. A new type of feculose was evolved to meet the requirements. The conversion is carried sufficiently far to give a product which yields a thin solution with four or five parts water, and keeps permanently fluid for several days. The product as discharged from the converter contains about 4 per cent. free acetic acid and 6 per cent. combined acetic acid, and in order to make it a marketable article the free acid has to be removed. At first this was neutralised by the addition of various alkalies, but very much better results were obtained from a washed product. At present it is sent out in three forms: (1) As it comes from the converter, in which case, the papercoater prepares the feculose by washing by decantation, and then boiling as usual. (2) Hydrous feculose. This is the washed, but undried product, and is sent out in barrels in the pulp form containing 50 per cent. moisture. We find it keeps perfectly, and in this form it is prepared for use with a minimum of trouble. (3) The washed and dried variety. Feculose has now been used in such quantity that we can positively affirm that it meets all the requrements of a papercoating size. It is prepared for use by boiling, by any convenient method, with four or five times its weight of water. In mixing with the colour, if the chemical composition of feculose is borne in mind, no difficulties will arise. It is a partial starch acetate, containing 5 or 6 per cent. combined acetic acid, which on hydration produces an enormous effect on the starch complex for reasons which are as yet obscure. With neutral or acid colours, no reaction takes place, but with alkaline colours such as satin white, the starch acetate is slowly decomposed with regeneration of an insoluble starch hydrate. As heat accelerates all chemical reactions it is best to cool the feculose solution before mixing with the satin white, this retards the thickening which takes place, and the colour liquefies easily on warming up should it become rather thick.

It is this reaction which accounts for the excellent working properties of the feculose colour as it sets on the paper when spread out and exposed to the drying temperature, in which respect it is the direct opposite of animal size.

The feculose colour can be used right away as it comes from the mixer: is never frothy in working; can be dried at a higher temperature than glue, and therefore saves considerable time. Papercoating is a process of details, and it is quite impossible in this paper to deal with anything other than a few of the more important features.

Comparisons:—When compared against the finest hide glue, 15 to 20 per cent. more feculose is required to give an equally hard sized surface, the figure for the best quality casein being very similar.

Finishing:—Under equal conditions with satin white the finish is practically the same as that obtained with glue, but not so bright as with casein. It must be recognised however that in using starch products the usual laundry methods of obtaining a high finish, must to a certain extent be adopted, *i.e.*, calender the slightly damped surface with a hot calender, and heavy pressure.

Printing:—The feculose surface has an unique ink affinity with the remarkable property of quickly taking up the ink from the stone or block, enabling it to give under comparative conditions printing results unequalled for density and solidity of colour. This quality of the feculose paper has to be recognised, and it sometimes suffers from the defects of its good qualities. This ink affinity can be modified to any extent by the addition of a little rosin size to the colour.

Owing to feculose being a starch product, it can be dried at a high temperature without its sizing power being affected, or the size drying into the paper as occurs with glue, and this property opens a wide field of possibility for the simplification of the present drying process, which is universally some type of festooning.

With the view of simplifying the present process a series of experiments were done some years ago. The paper was coated on an ordinary surfacing machine with the size alone at different concentrations, and then with varying proportions of (1) china clay, (2) Blanc fixe, and (3) satin white. The results were interesting. The size alone gave imperfect prints, the surface, although smooth, was absolutely ink resistant, and the ink took several days to dry. With china clay, better results were obtained, and still better with blanc fixe, in every case, the printing results improved with the increase of mineral matter, up to, of course, the fixing limits of the size. With satin white, however, the best results were obtained, the difference being very marked with light coats. The satin white surface had the highest finish, and the peculiar ink affinity, the whole series demonstrating in a very striking manner that it is the surface with the proper ink attraction that gives the best results under ordinary printing conditions

This has been pursued further, and it has been demonstrated that a paper with a coat of only 7½ grammes per square metre (3 lb. per ream D.C. 480s.) will give printing results equal to an ordinary chromo with a coating of 30 to 40 grammes per square metre (12 to 16 lb. per ream D.C. 480s.). The paper used need not cost any more than an ordinary enamelling, but is preferably surface sized on the papermaking machine with feculose alone, or an admixture with some china clay to fill up and harden the surface. With coats of under 10 grammes per square metre, the paper can be treated at the full machine width, and dried over cylinders at a high speed, the production by this method being enormously greater than by the usual festooning process, where you are limited to 30 ins. or 40 ins. width. The process is still in embryo, but the results up to date have demonstrated its possibilities (see English Patent No. 16,327, 1908. S. Milne). This paper has the merit of durability, as it is mainly fibre, and does not show fully 60 per cent. ash, as is the case with many art enamels.

STATISTICS.

The papercoating industry is distributed very evenly between England and Scotland, there being seven firms in each country who are papermakers and coaters. It does not follow that the paper used for coating is their own manufacture, as in several cases a large proportion of the enamelling paper is bought from other firms who make a speciality of this class. These 14 firms control 80 one-sided coating machines, and of these 60 will run 24 hours per day. There are also eight double-coating machines in regular use, which equal 16 ordinary coating machines. There are 10 firms of papercoaters who are not paper manufacturers, controlling 70 surfacing machines and about 10 board coating machines. These all run 10 hours per day, and turn out a variety of work. There are also one or two large printing firms who have a papercoating department.

There are produced in Britain about 20,000 reams of art enamel per week, and 15,000 reams of chromo and other coated papers. This requires fully 50 tons per week of sizing material, which at present, is mainly glue of Continental origin.

Finally, there is one striking fact regarding this industry which impresses anyone who has had the opportunity of intimately studying the general conditions—viz., the absolute lack of any scientific control.

This militates against the introduction of improved methods, stifles experimental work, and frequently leads to other excrescences of which the least said the better.

In conclusion I have to thank several friends in the paper trade for their criticisms and suggestions, and particularly Messrs. Wm. Wotherspoon & Co., Glenfield Starch Works, Paisley, for permission to publish the foregoing paper.

APPENDIX.

(*Census of Production*, 1907.)

TABLE I.—OUTPUT.

Note.—The figures in this Table are given to the nearest thousand in each case. Amounts lower than five hundred are not shown.

—	England and Wales and Ireland.	Scotland.	United Kingdom.
	Quantity.		
Paper :—	Cwts.	Cwts.	Cwts.
Paper for Writing and Drawing and for Envelopes	1,145,000	1,340,000	2,485,000
Paper for Printing and for Posters, &c.	7,661,000	1,060,000	8,721,000
Packing and Wrapping Paper, Biscaps, &c.	3,024,000	613,000	3,637,000
Printed and Coated Papers (not Hangings)	315,000	366,000	681,000
Pasteboard, Cardboard and Millboard	749,000	144,000	893,000
Other Sorts	424,000	140,000	564,000
Paper Bags	551,000	159,000	710,000
			17,691,000
All other Products	Recorded by value only.		
			Tons. =884,550

TABLE I—*continued*.

—	England and Wales. and Ireland.	Scotland.	United Kingdom.
	Value.		
Paper :—	£	£	£
Paper for Writing and Drawing and for Envelopes	1,591,000	1,494,000	3,085,000
Paper for Printing and for Posters, &c.	4,703,000	887,000	5,590,000
Packing and Wrapping Paper, Biscaps, &c.	1,570,000	373,000	1,943,000
Printed and Coated Papers (not Hangings)	389,000	457,000	846,000
Pasteboard, Cardboard, and Millboard	455,000	110,000	565,000
Other Sorts	538,000	162,000	700,000
Paper Bags	391,000	96,000	487,000
All other Products	92,000	20,000	112,000
Total Value	9,729,000	3,599,000	13,328,000
Total Value for England and Wales	9,554,000	—	—
Total Value for Ireland	175,000	—	—

TABLE II.—COST OF MATERIALS USED, SHOWN IN RELATION TO THE VALUE OF OUTPUT.

Note.—The figures in this Table are given to the nearest thousand in each case.

—	England and Wales and Ireland.	Scotland.	United Kingdom.
I. Cost of Materials used	£ 6,411,000	£ 2,405,000	£ 8,816,000
II. Value of Output	9,729,000	3,599,000	13,328,000
III. Value of Output *less* Cost of Materials used	3,318,000	1,194,000	4,512,000

Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, February 21st, 1910.

LORD ALLERTON IN THE CHAIR.

PROBLEMS OF THE LEATHER INDUSTRY.

BY PROF. H. R. PROCTER.

Though the technology of leather manufacture is one of the most ancient, and has been highly developed by the accumulated experience of ages, it is as yet less influenced by scientific knowledge than many other industries. This is less due to any special ignorance or unwillingness of tanners than to the extraordinary difficulties of the problems it presents, and the risk and costliness of experiment. Much has, however, been accomplished in recent years towards clearing up the prevailing darkness, and this has been hastened by the introduction of new tanning agents, such as chrome salts and aldehydes, which are so far removed from the older methods as to render much of the previous experience valueless, and to compel the adoption of new methods and a study of their underlying principles.

The skins of animals naturally presented themselves to our forefathers as valuable for clothing and other purposes ; but, wet, they were subject to rapid and offensive decay, while, dried, they became hard and horny, and therefore ill adapted to most uses. To retain softness while preserving the skins by drying was the first problem which presented itself, and it was solved in a variety of ways in pre-historic times, rather, probably, by accident than by any reasoned experiment. Thus skins which were oiled and stretched while drying remained soft and flexible, and became resistant to moisture and decay. Wood smoke, which must always have been present during drying in primitive dwellings, was found to assist this preservation, and certain barks and fruits, possibly first used as dyes, had a still more marked effect. Alum, which in some countries is a natural efflorescence from shales containing alumina and pyrites, was possibly first applied as a substitute for salt, the preservative qualities of which had long been known. The hair, first loosened accidentally by putrefaction, was more conveniently removed by liming, and improvements in dyeing and finishing were gradually introduced, so that even in ancient Egypt the "Art and Mystery" of the tanner had reached a high stage of development in detail, though the principles then, and almost to the present date, were those of the primitive savage; and even during the past century the improvements consisted rather in the substitution of machinery for hand-labour than in any more radical departure from earlier ideas.

While discussing the problems of the trade as they present themselves to-day, it will be well, as I am addressing myself, not only to the specialist but to the general chemist, to give some slight sketch of the methods of the present. While the earliest users of the skin probably aimed at retaining the hair and wool, these are no longer needed for most of the purposes to which leather is now applied, and the first stages of the modern process are usually devoted to their removal. In a few cases, and especially in the removal of wool from sheepskins, where the wool is of more value than the pelt, the primitive method of putrefaction is still employed, though under better conditions, the skins being hung in rooms of carefully regulated dampness and temperature, and the progress of the operation being closely watched. Wool and hair, though apparently growing from the true skin (*corium*) are really the product of a thin outer layer of cellular tissue (*epidermis*) which not only covers the entire surface, but surrounds and forms a sheath to the hair-bulb. The soft and growing cells of the layer are readily disintegrated by putrefaction, and thus the hair is loosened. While the skin itself is composed of white fibres of collagen, a material which passes at once into gelatine on heating with water, the epidermis and hair consists of keratin, which is nearly related to coagulated albumen. Thus the effect of chemical reagents on the two layers differs widely. While the gelatinous fibre is merely swollen and split into finer filaments by the action of alkalis, the epidermis is softened and ultimately dissolved. Lime is generally used for this purpose, not merely on account of its cheapness, but because its limited solubility allows it to be added in excess without forming a dangerously concentrated solution, while, as it is consumed by the hide it is instantly replaced from the undissolved portion. Practically the process is conducted in pits in which the hides or skins are laid in milk of lime, from which they are withdrawn at intervals of one or two days, and the liquor is mixed, and if necessary more lime is added before they are replaced. One to three weeks is required for the operation, according to the character of the hides or skins, and the purpose for which they are intended. Suspension and mechanical agitation in the lime liquor hastens the process by insuring rapid renewal of the saturated solution, but is more frequently used on the Continent than in England.

Though lime is the agent principally used, its action is frequently quickened by the addition of sodium sulphide, or occasionally of other alkaline salts. The action of soluble sulphydrates is peculiar and completely different from that of hydrates, swelling the *corium* very little, and dissolving the keratin structures rapidly. It has, however, been shown by Stiasny* that in complete absence of hydroxyl ions, this solvent action does not take place, and the most favourable condition is when SH and OH ions are present in equal concentration. This condition is fulfilled when sodium sulphide is dissolved in water, of which it takes up one equivalent, forming an equi-molecular solution of sodium hydroxide and sulphydrate; but much smaller proportions of sulphydrate materially quicken the liming process, while retaining the value of the hair, which is completely pulped and destroyed in concentrated solutions. Fresh lime solutions are practically sterile, but as they get charged with dissolved organic matters they become capable of supporting a variety of bacterial life, though from the presence of excess of lime, their alkalinity except from ammonia remains unaltered. While sterile limes have little solvent but powerful plumping effect on the hide fibre, the bacteria or their products increase the former and lessen the latter, and at the same time increase the solvent action on the epidermis and consequently hasten the unhairing. Thus it is an axiom in sole-leather tanning, where the utmost weight and solidity is desired together with plumpness, to use new rather than old limes, but as absolutely new limes unhair very slowly, if at all, it is usual to begin the process in liquors which have already been used for one or two packs, finishing in a quite fresh lime. In the case of skins and dressing leathers, where some solution of the interfibrillary substance is desired, advantage is usually taken of the somewhat more solvent effect of older limes. The theory of the process is by no means completely elucidated, and till this is done, complete chemical control is impossible, as the effect of the various constituents is not fully known. Even the determination of the valuable dissolved hide-substance is difficult since it is as yet impossible to distinguish the epidermis-products from those of the corium.

On the completion of the liming process the hair is removed mechanically either by hand with a blunt two-handled knife, or by machine, or sometimes where it has been treated with sulphides, by mere friction in a revolving drum. The fat and loose cellular tissue is also pared or scraped from the flesh side, and, in the case of sole leather, the hide is "rounded" into butts and offal, which are tanned separately.

Before actual tannage, it is necessary to remove the lime, of which the skin retains perhaps 3 per cent. of its wet weight, and which would cause discoloration and destroy tannin, or at least neutralise their acidity if introduced into the liquors. In the case of sole leather it is desired to retain the hide in plump condition, and in earlier times it was frequently taken to the liquors after only a slight washing with water, which removes but little of the absorbed lime, as alkalis are obstinately retained by hide-substance, possibly in a state of chemical combination, which is slowly hydrolysed. At present, even in sole leather tannage, a part at least of the lime is usually removed by acid treatment, as with the tanning materials now in use, and especially with extracts and rapid tannage, but little acid is produced by fermentation. The use of acids for deliming is not, however, so simple as at first sight might be supposed, since the affinity of hide for acids is not less than for alkalis, and the swelling which they produce has an even more injurious effect on the leather since it is not neutralised by the liquors, which themselves must have an acid reaction. It is therefore essential, if strong acids are used, that there should be no excess beyond that needed for neutralising the lime, since acid is absorbed by the hide to saturation even from very dilute solutions. With weak acids the operation is easier, as their feeble hydrion concentration prevents excessive swelling, owing to the hydrolysis of the acid compound with the hide, and so weak an acid as boric acid can be used in large excess without injurious results, while acetic, lactic, and even formic acid require much less precaution than the stronger mineral acids.

In the case of the lighter leathers used for the upper part of boots and other purposes where softness and pliability are required, it is essential that the tannage should be begun with the skin in an absolutely unswollen condition, and hence, while even the strong mineral acids in great dilution are frequently employed to remove the greater part of the lime, the process is usually completed by one or other of the fermentation processes which have been used from immemorial time. The simplest of these is the bran drench, for which bran is infused in warm water and allowed to ferment with the production of lactic and acetic acids from glucoses formed by the action of an unorganised ferment, cerealin, which is present in the bran, on the starch which it contains. The glucoses are then fermented by bacteria, which are always present in the vats, and of which the action is inhibited by a small excess of acidity, so that the process is really a simple acid "pulling down," in which so long as only the right bacteria are present, the acidity is automatically self-regulating. At the same time, considerable quantities of hydrogen and carbon dioxide are evolved, which cause the skins to float in the liquor.[*] Unfortunately, it is impossible to work under accurate bacterial conditions, and putrefactive and butryric bacteria are always present which may get the upper hand with disastrous effects. This risk can only be lessened by careful attention to temperature and the other conditions, such as the amount of glucose, the acidity and the age of the liquors which favour the development of the right organisms; and the provision when necessary of a plentiful supply of ferment organisms from a sound working drench. Frequent cleansing of the vessels with hot water and the maintenance of a constant temperature of about 70° Fah. are useful precautions. Putrefactive bacteria will not thrive so long as the drench remains acid, and the greatest danger arises from organisms which form butyric acid, which by its powerful and solvent swelling action may completely destroy skins in a few hours.

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* Gerber, 1906, this J. (Abst.), 1907, p. 25.

Though from its simplicity I have first mentioned the "drenching process," it is rarely used alone, but generally only to complete the removal of lime after "puering" or "bating," which are fermentative methods of quite a different character, in liquids containing nitrogenous matters and usually alkaline in reaction.

The chemical effects caused by bacterial fermentations, are due not merely to direct changes produced inside the organisms, but even more generally to the action of the digestive ferments or zymases which they secrete into the liquid. These unorganised ferments, like the pepsin of our own stomachs, are not living things, but have the power of causing chemical change in the substances they act on, without themselves being destroyed. They are in fact catalytic agents.

The "bate" is a fermenting infusion of pigeon- or hen-dung, and is usually employed for the heavier dressing leathers, while the "puer," similarly made with dog-dung, is employed for the finer and thinner skins used for light shoes, glove leathers, and moroccos. Though these differ both in effect and mode of use, they depend on the common principle of making use of nitrogenous and largely anærobic fermentation and its products; but in the two cases the active organisms differ, and it is uncertain whether, in either case, they are really derived from the intestinal bacteria or are accidental and extraneous ferments, for the growth of which the diluted excrement forms a suitable medium. The case of puer has been very fully investigated by J. T. Wood,[†] and also by Popp and Becker. Wood found that the filtered bacterium-free puer liquor had considerable puering effect, and that the presence of actual living organisms was not essential. Even after boiling, which not only destroyed life, but coagulated the zymases present, this effect, though greatly diminished, was not entirely absent; and he traced what remained to the salts of amines and the amino-acids formed by the decomposition of the skin. On substituting phenylamine hydrochloride for the natural amine salts, and adding zymases precipitated by alcohol from the puer liquor, satisfactory puering was obtained in the absence of life, but of course at a cost too high for technical use. Practically, Wood, in conjunction with Popp and Becker, produced the puer-substitute "erodin," which consists of a culture-medium of peptonised gelatinous tissue, with a special mixed culture of selected bacteria, capable of attacking the keratin-structures but not of liquefying gelatine; and this has been largely and successfully employed in some branches of leather manufacture, though in others, and especially in the manufacture of chrome-kid, it has not taken the place of the natural product. While it is much safer and more certain in its action than the latter, from the definite character of the ferments employed, and sentimentally less digusting, it is practically not less odorous than the original, which no doubt dervies its name from an old French verb, *puer*, which still survives in the participle *puant*, stinking; and it is a little more complicated in use. It has been suggested that the special action of excrement was caused by the excess of digestive ferments which it contained. Wood pointed out that this could not be due to pepsin, which only acts in acid solution, but that the pancreatic ferment trypsin possessed many of the required qualities, acting in alkaline solution, and not merely dissolving albuminoids, but emulsifying fats; and on experiment he found that it actually had marked puering properties, though the fact that it is itself an excellent nutriment for bacteria renders it highly improbable that any can exist unchanged in the dog-dung, which is always allowed to undergo a fermentation of some weeks before use. The idea has, however, been developed by Röhm and Haas in Germany, who have produzed an artificial puer under the name of "Oropon," containing pancreas-products and ammonium chloride, which acts at once on the skin without previous fermentation, and which both experimentally and practically gives very promising results, while at the same time it effectively removes lime and renders drenching unnecessary.

It cannot, however, yet be said that the problem of puering has received its definite chemical solution. The properties required are not merely that of removing lime, which is only imperfectly accomplished by puering unless supplemented by drenching, but of removal of fat by emulsification, and solution of the cellular epidermis-structures still remaining in the skin. Some solution of the hide fibre itself, or at least of the interfibrillary substance, is also usually required in order to soften the leather, but this must be controllable and very moderate in amount.

The puer liquor is always used warm (80°—90° F.), and its action is very rapid, thin skins being completely reduced within the hour. This rapid action renders it quite unsuitable for the thicker sorts of leather, of which the surfaces would be digested and dissolved before the centre was properly penetrated, and hence recourse is had to the milder action of the "bate," made with bird-dung and used cold for four or five days. Not only is the medium here much less nitrogenous, but the bacteria are quite different, apparently rosary-like chains of small spherical cells (*streptococcus*), which thrive at low temperatures, while the puer bacteria require nearly blood-heat for their development. It is also pointed out by Wood that bird-dung contains the urinary constituents which in animals are separately secreted. Less scientific study has been devoted to the bating than to the puering process, but there is no doubt that a bate-substitute on the same lines as erodin could be made by the selection of suitable bacteria and an appropriate culture-medium. There is, however, no reason that all the necessary effects, both of puering and bating, should not ultimately be attained by purely chemical treatment without the risk and uncertainty which must always attach to bacterial and ferment action.

The actual conversion of the prepared skin into leather is not less rich in unsolved problems than the processes which have preceded it. At the point which we have reached we have the more or less purified gelatigenous fibrous structure before us, really an organised jelly, still readily capable of destructive putrefaction, and becoming on drying a translucent horny sheet. We may fairly ask what is the general character of the change into an imputrescible and pliable dry material which we can bring about by agents so different in chemical character as chrome salts, vegetable tannins, and aldehydes? In general terms the question was answered by Knapp in 1858,[*] though his answer only suggests further inquiries as to the actual change. Knapp in effect tells us that the raw skin consists of water-swollen gelatinous fibres, which on mere drying adhere and contract into an almost homogeneous horny mass, and that the essence of tanning is so to treat these fibres that they dry and contract without adhering, and that they are rendered incapable of absorbing water and again becoming adhesive. In the main the explanation which he gives of the change is the somewhat crude one that the fibres become superficially coated with the tanning substance, and so isolated and waterproof. The supposition is in no case very convincing, and is incapable of direct proof or actual observation of the protecting layer, in the case of formaldehyde is obviously untenable, and with regard to chrome is improbable from the minimal quantities of chrome hydrate which suffice to effect the change. No less difficulties meet the still earlier hypothesis of Sir Humphry Davy that the leather is a direct chemical compound of the nature of a salt between the gelatine and the vegetable tannin; among which may be cited the very variable composition, not only of actual leather, but of the directly precipitated tanno-gelatine. In the light of modern knowledge it seems safest to conclude that in the various methods many different causes—chemical, physical, and mechanical—are at work to produce the isolation and non-absorbence of the gelatinous fibres; and that it is not necessary to assume unity of cause because of apparent similarities in the final result. Thus Knapp was able to produce a white leather (which however returned to the pelt state on soaking in water), by mere dehydration of the skin with alcohol, which first isolated the fibres by replacing the water between them, and then dehydrated them so that they were no longer capable of adhesion. By the employment of alcohol containing a trace of stearic acid in solution, the isolated fibres were mechanically coated with a minute quantity of this substance, by which the pliability of the leather and its resistance to water were greatly increased. A somewhat more complex instance of leather production is afforded by the "pickling" process, in which the raw prepared skin is first slightly swollen by sulphuric acid, usually with addition of salt to control the swelling, and then treated with saturated common salt solution, in which it becomes thin, white, and imputrescible, and if dried forms a very perfect white leather, which is permanent so long as it remains dry. This case has been very fully investigated by the writer, who has brought strong evidence to show that the hide-fibre, which is amphoteric (or at the same time acid and basic from the presence both of amino- and carboxyl-groups), actually forms a chemical compound with the acid, which is semipermeable to the salt and is dehydrated by its osmotic pressure.

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[*] Compare Wood, this J. 1890, p. 27; 1893, p. 422; 1897, p. 510; Brit. Ass. Rep., 1893, p. 723.

[†] This J., 1894, p. 218; 1895, p. 449; 1898, pp. 856, 1010; 1899, pp. 117, 990.

[*] "Natur und Wesen der Gerberei," Braunschweig, 1858.

From this process it is an easy step to the alum and chrome tannages. Both aluminium and chromium are weak bases, the salts of which have a strongly acid reaction in consequence of their partial hydrolysis on solution in water into free acid and a basic salt. In presence of the hide-fibre the free acid is absorbed and fixed, and the hydrolysis is carried so far that the basic salt becomes colloidal and insoluble in water, and in this state forms a coating or possibly an adsorptive or chemical compound with the fibre, which is also dehydrated by the addition of salt, and thus prevented from swelling or adhesion. In the modern single-bath basic chrome process, the hydrolysis of the normal chrome salt is already carried in the liquor as far as possible without the precipitation of an insoluble basic salt, so that the fixation of small quantities of acid by the hide causes also the fixation of comparatively large quantities of basic chrome salt, and the residual acid is removed and the chrome salt rendered still more basic and insoluble by subsequent washing and the treatment with borax or some other alkaline salt, generally known as "neutralisation." Exactly in what condition the chrome exists in the hide, whether as oxide, hydrate, or very basic salt, is as yet not definitely determined, but though the quantity of acid can be reduced almost indefinitely in the leather without injuring its quality, an actually alkaline condition at once renders it horny and apparently undertanned. The two-bath method of chrome tannage only differs from that just described in that the basic salt, instead of being ready formed in the liquor, is produced in the skin itself by the reduction of chromic acid with thiosulphate. Whether the tanning effect of chrome, which is shared in degree with iron, alumina, and other metals forming basic salts, is due to the absorption and coating of the fibre with colloidal chrome oxide in an insoluble irreversible condition, or to some more intimate sort of combination is yet unknown.

Tannage with aldedydes, and especially with formaldehyde, seems still more definitely one of chemical change. Aldehydes have peculiar powers of uniting with a great variety of substances to form new compounds, often insoluble; but apart from this, it is difficult to see how a volatile substance like formaldehyde can form a resistant coating on fibres which prevents their adhesion and renders them waterproof and imputrescible by mechanical means, especially when present only in the very minute quantity which is necessary to complete an aldehyde tannage; and the conclusion is almost irresistible that at least the surfaces of the fibres are so altered by the action of the aldehyde as to become themselves insoluble and non adhesive. The suggestion that in a practical aldehyde tannage the surfaces only are affected is somewhat supported by the facts that over-tannage renders the whole fibre brittle and tender, and that even with very small quantities of aldehyde this effect will ultimately occur, unless means are taken to destroy all surplus and uncombined formaldehyde (usually by its reaction with ammonia), as soon as the tannage is completed.

The ordinary oil tannage or "chamoising" of "wash leather" and buff leather has been a puzzle to chemists. For wash leather the "lining" or inner split of sheepskins, after suitable preparation to free it from excess of lime, is "stocked" or beaten with fish oil till the water is replaced by oil, which is then allowed to oxidise by spontaneous heating in piles after exposure to air. Only oils with more than one pair of unsaturated bonds are capable of producing this effect, and though marine oils are invariably employed in practice, it has been shown by Fahrion * that similar effects may be produced by linseed, or even in a lesser degree by rape oil, and it is known that the latter is employed in the manufacture of the Japanese white leather, so much used for brace tabs. The most obvious explanation of the chamoising process would be that of the mechanical coating of the fibres by the varnish-like products of oxidised oils, but this is apparently excluded by the fact that oil leathers can be, and habitually are, washed without injury with alkaline solutions, in which these oil products are freely soluble, and by which they are readily removed from vegetable fibres. It is pretty clear that the union of the leather-fibre with the oil, whether physical or chemical, must be more intimate than that of a mere surface-coating; and Fahrion (*loc. cit.*) has shown that by saponification a portion of oil can be extracted from the leather which cannot be removed by any solvent. The present writer at one time suggested the theory that the oil tannage was actually an aldehyde one, produced by the acryl aldehyde which is freely evolved from the glycerine during the heating process; but this idea, though perhaps partially correct, seems to be negatived as a complete explanation by Fahrion's observation that the fatty acids themselves are capable of producing oil-tannage, since in this case acryl aldehyde is of course absent, but aldehydes arise from the oxidation and breaking up of the acid-chain itself, and it is quite possible that these combine chemically with the hide-fibre.

Though the use of vegetable tannins is even yet probably the most important means of leather production, the actual nature of its action is still a subject of dispute. The advance of colloidal chemistry has proved that many apparent solutions are really only extremely fine emulsions or suspensions in which the presence of separate particles can actually be shown by means of the ultramicroscope, though no defined line can be drawn between actual solutions like that of sugar in water, and obvious suspensions like butter-fat in milk or clay in turbid water. In all these cases of colloidal suspension it is known that the particles possess electrical charges somewhat similar to those of the ions in electrolytic solution, and that if these charges are removed or neutralised, the suspension immediately settles. These charges, like those of the ions, may be positive or negative as compared to the liquid, and if a suspension with + particles be mixed with another with − particles, the two neutralise each other, and are precipitated together in a way which closely resembles the formation of a chemical compound, such as barium sulphate, by the union of $+\mathrm{Ba}''$ with $-(\mathrm{SO}_4)''$.

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* "Ueber die Vorgänge bei Lederbildung." Zeits. Angew. Chem., 1909, Hefte 43-45.

It is known that gelatine and tannin both form solutions containing ultramicroscopic particles, which in the gelatine-solution are + and in the tannin −, and it is now generally believed that their mutual precipitation is a colloidal and not a truly chemical (ionic) reaction, though it must be remarked that the progress of scientific thought at present tends to break down any clear line of demarcation between the two ideas. Whether chemical or not, the actual precipitate is not definitely quantitative, and there seems no limit to the extent to which tannin can be removed from it by washing with hot water.* On the other hand, Knapp's view that the action is confined to a mere surface-coating of the fibres is not supported by any clear evidence, but it is quite probable that the action is at first a surface one, even if it ultimately extends throughout the fibres. When a solid is brought into a solution (either ionic or colloidal) in which the solid and the dissolved bodies have relatively opposite electric potentials, the dissolved body is attracted by the solid and becomes concentrated on its surface, and this surface-condensation (known as adsorption) in some cases leads ultimately to true chemical action or close physical union which renders the combination permanent and irreversible. In ordinary cases, the surface of a solid is so limited in relation to the surrounding liquid that the quantity fixed is relatively a small one, but where the surface is almost infinitely extended by the division of the solid into a fine emulsion or suspension, or by a porous or fibrous structure, it may be very considerable. This latter, it may be pointed out, is the condition of the hide with regard to the tanning liquor or any other solution from which adsorption can take place, and it is obvious that the splitting up of comparatively coarse fibres into microscopic fibrils which is caused by liming must be of great importance, not only as regards rapidity of tannage, but in respect of the weight of tanning substance adsorbed and ultimately fixed. As a matter of experience, unswollen hide always gives a thin and hungry leather, and though in this respect swelling by acids may take the place of that by lime, it remains an axiom that in some stage of the process the fibres must be split up, if well tanned and satisfactory leather is to result. A point of importance with regard to adsorption, at least so long as it remains reversible, is that the amount adsorbed bears a definite relation to the concentration of the solution; so that, regarded as an adsorption process, the heaviest tannage will be given by the strongest liquors, a statement also in accord with practical experience.

Before adsorption can take place on the internal surfaces of the skin, the tanning solution must reach them, and this, in the ordinary method of laying in liquor, it can only do by diffusion through the outer portions. While all crystalloid or "true" solutions diffuse with comparative rapidity, colloidal solutions, and tannin solutions among the rest, diffuse extremely slowly, an obvious explanation of the well-known fact that while alum or (not too basic) chrome solutions will penetrate the thickest hide in a few hours or at most a few days, vegetable tanning solutions may take months to produce a similar effect. Diffusion can only occur from a more to a less concentrated solution, and tannage must cease when the concentration inside the hide is equal to that without, and hence the axiom that the strength of tanning liquors must be constantly increased as the tannage proceeds. The further rule that it must be begun in weak liquors is partly a corollary of the first, but also depends on the fact that much time must be allowed for diffusion if the effect is to be uniform, and not to result in too rapid tannage of the surface before the interior is penetrated, since the tanned surface is more or less impermeable to further passage of tannin.

It may be asked whether it is not possible to employ physical or mechanical means to hasten the diffusion and shorten the very considerable time required for tanning the heavier leathers. Diffusion is quickened by heat, but this can only be employed to a limited extent, though it undoubtedly hastens tanning. Some years ago electricity was largely boomed as an effective means, but any hastening of the process which was observed was shown to be due much more to mechanical motion than to the current employed. It is, however, possible that electricity may ultimately have some practical value, and the process of Mr. L. A. Groth, in particular, is not entirely without scientific basis. He suspended the hides in pits between two electrodes connected with an alternating current generator. This arrangement gets over the troubles arising from the electrolysis of salts contained in the liquor, the products of which would destroy tannins, though these are probably not themselves electrolytes. It can be shown that when an electric current is passed through a porous diaphragm, it also causes flow of the liquid in one or the other direction according to the positive or negative charge of the diaphragm in relation to the liquid, an effect known as electric cataphoresis; and some experiments by S. Rideal (this J., 1891, p. 942) seemed to show increase of absorption during the time the current was passed. It is, however, doubtful whether under such conditions the current would go through or round the hides, and still more so whether the gain of rapidity, if any, would be of sufficient commercial value to pay for the increased cost. One of the electric processes was carried out in closed rotating drums, and it was observed that either with or without current extremely rapid tanning was effected, even thick hides being completely tanned through in three or four days. This observation has been the basis of several successful processes of quick tannage, which are carried out in drums with concentrated liquors, but without electricity.

One of the most important questions in modern vegetable tannage, and also the most puzzling, is that of the influence of acids on the process. In sole leather tannage a considerable acidity of the tanning liquors is essential to the production of a firm and plump leather, for which a swollen pelt is necessary, and even in dressing leather a distinct acid reaction is required, since the hide is usually brought in in an alkaline condition, and alkaline liquors do not tan. The natural acids are principally derived from the fermentation of sugars contained in the tanning materials; but the modern process is carried out with concentrated materials, and is so comparatively rapid that little fermentation occurs, and artificial acidification is often required. From a research now being carried out by one of my students, it seems that small traces of acid at first slow the absorption of tannin, but a minimum is soon reached, after which additional quantities increase absorption. Apparently the acid contained in swollen pelt is partially but not entirely displaced by tannin as the tannage progresses. In the ordinary process of sole leather tannage, the butts (trimmed hides) are first suspended in weak and nearly exhausted liquors of sufficient acidity to remove any traces of lime, and to replace the previous alkaline swelling by an acid one. These liquors are gradually strengthened in tannin, and usually also in acid, by moving the goods forward through a series of pits through which liquors are circulated in the reverse direction; and the suspension generally lasts about ten days, though it may be longer. During this short period, and in spite of the weak liquors, at least 25 per cent. of the total tannage is accomplished, since the green goods take up tannins with great avidity. Great care is required to secure the complete removal of lime and a uniform swelling without irregular contraction or "drawing of the grain," which would result from too astringent liquors, and the colour which is here set has generally a determining influence on that of the finished goods. The use of old and used liquors is not only prescribed at this stage from reasons of economy, but because their previous use has removed the more astringent tannins, leaving only those of lesser affinity for the hide, together with neutral salts and other non-tanning bodies which conduce to a milder action. If it becomes necessary to add fresh tanning materials at this stage, naturally mild materials, such as gambier and myrobalans, are selected.

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* J. T. Wood, this J., 1908, p. 384.

The tannins are broadly divided chemically into derivatives of the dihydric phenol catechol, and those of the trihydric phenol pyrogallol. Each of these classes contains at least several individuals differing in practical character and constitution, and probably in some cases by the added presence of other phenols as, for instance, phloroglucol in the molecule. It is by no means certain that any tannins are really acids, though they combine with alkalis, possibly on account of lactone or phenolic structure. One principal cause of the practical differences of tannins in use depends on the extent and character of the solid products to which they give rise on slow decomposition in the liquors; most catechol tannins yielding more or less of insoluble "reds" or phlobaphenes, while many pyrogallol tannins are associated with some body which deposits pale yellow and very insoluble ellagic acid. While these solid products play an important part in the later stages of the process in giving weight and solidity, they are not desirable in the earlier or true tanning stage; and one reason for using old liquors is that most of these insolubles are already deposited.

After the suspension, the goods are laid flat in liquors of gradually increasing strength, in which at first they are moved daily, but finally are brought into much stronger liquors with intermediate layers of solid tanning material. Of these they receive three or four of a duration increasing from one to three or four weeks, the final liquor being often a gravity as high as 1·100 (100° Bkr.), and largely composed of oakwood and other extracts concentrated in the vacuum pan. These liquors not only ensure the absolutely saturated tannage of the leather, but materially add to its weight by the solid contents of the liquor mechanically absorbed and finally dried into the leather. Before this last stage of the process, the actual tannage may be assumed to be nearly complete, and what goes on is mainly the mechanical coating of the fibres and the filling of their interstices with insoluble reds and ellagic acid in accordance with Knapp's ideas. This is not merely profitable to the tanner in the sense of gain of weight, but increases the durability and water-resistance of the leather.

The principles of dressing leather tannage do not differ from what has just been described, but the goods are brought into the tanyard in an unswollen condition, and the liquors are so low in acidity as to avoid swelling. The deposition of solid matter is also much less, owing to the weaker and generally older liquors employed, the different selection of materials, and the shorter duration of the process.

Such is a brief sketch of a few of the more important problems presented by the industry. Many points have been entirely neglected, and I have thought it best to devote the limited time at my disposal to matters of salient interest in the general theory, leaving it to others to deal with the more detailed and practical questions of actual manufacture.

DISCUSSION.

Mr. J. T. **Wood** said the bacteria in the pigeon-dung bate were quite different to those in the dog-dung, and worked at a lower temperature. The bacterium he used in erodin was a variety of *Coli*, which grew best at blood heat. Some device was necessary in the paddles to maintain the temperature, but it was difficult to get people to use new methods which involved expense. Pigeon-dung bate contained a *streptococcus*, which did not produce the same kind of enzymes as the bacteria in the dog-dung bate. He did not like to let this opportunity pass without acknowledging how much he, personally, was indebted to the help and encouragement he had received from Professor Procter, and the same remark applied to the younger men who had studied under him.

Dr. J. **Gordon Parker** referred to the present difficulty due to the high price of raw hides and skins. He emphasised the importance of the proper preparation of the pelt in lime, as on this the final production of good leather mainly depended. Many questions in liming were not clearly understood, and he would welcome deeper information on them. It was known, however, that bacteria produced very important results. In de-liming much care was necessary or trouble resulted. There was a great change in vegetable tannins, and pelt might be lost by allowing goods to slop about in weak tan liquors. "Erodin" had been used on a much larger scale and with greater success on the Continent than in England. This was probably due to the care taken abroad, in keeping the chambers where it was used quite clean, and thus preventing the access of other bacteria, and consequent confusion in the fermentation processes. With regard to chrome tanning, he believed that more attention must be paid to scientific principles than hitherto, and the advice of men like Prof. Procter should be sought if success was to be obtained, since the slightest changes in the method of treatment gave very great differences in results. He felt that it would now be necessary to follow the progress of colloidal chemistry much more closely since it was opening up new views in the theory of vegetable tanning. Research was now of great value, and more attention should be given to unsolved problems.

Prof. H. R. **Procter** showed several samples illustrating the process, and among others a sample of Foerderer's kid, 17 years old, showing that chrome leather does not change appreciably on long keeping.

Lord **Allerton** said he had always believed that good leather was made before the hides and skins went into the tan liquor at all. It was of paramount importance to have the goods in the right "condition" before proceeding from one stage of the process to another. To obtain this "condition," careful preparation of the goods was necessary in each stage. For instance, in the case of sole leather, it made all the difference in the result if the leather before rolling was in exactly the right "condition." He did not think sufficient attention was at present given to this point. It must be remembered that different kinds of hides required different treatment in the preliminary processes. For example, East India kips are imported in varying conditions, and different treatment was necessary with regard to arsenic cured hides, brined, salted, and dry salted cures, each requiring different treatment. He might mention at this point, that there had been in recent years a great change for the worse in the cure of brined and dry salted hides from India. Years ago, he used to tan a good many Dutch skins, salted calf skins, some lots of which showed a great deal of salt stain. He had thought that this might be due to the use of salt containing a percentage of iron. It was, he thought, generally recognised that the salt stain in calf skins increased with the length of time which they were kept in the salt. The same may be said of the hides from India, which came as dry salted hides, and he wondered if in India, salt, or salt mixed with earth containing iron, was being used. Last year and this, a great many hides were seriously deteriorated owing to this salt stain, especially Myapore and Dacca cures. Many of the hides were difficult to soften and difficult to unhair, and after liming were very much swollen, and contained a great deal of scurf and dirt which was very difficult to remove, and it would generally be recognised that if the dirt and scurf could not be removed, good leather could never be obtained. He wondered whether some method of curing could be found which would avoid these disastrous results. He had been told, and hoped, that this was within the bounds of practical chemistry—that the hides could be cured without salt, and so avoid the difficulties which at present existed. The question is one of great importance, when it is remembered that at least seven millions of hides are annually exported from India. That the mischief was preventable was plain from the fact that the dry salted hides came from practically one district in India, and that from the other districts the hides did not suffer from this salt stain.

THE SYNTHESIS OF A GLAZE, GLASS, OR OTHER COMPLEX SILICATE.

Part III. The Interaction of Solid Oxides.

BY JOHN W. COBB, B.S.C.

The mode of formation of silicates and slags has been the subject of both speculation and investigation, and laws have been laid down.

Seger, from the ceramic standpoint (Collected Writings, p. 491) says : " To effect chemical combination the contact must be complete. Hence two solid substances will not produce chemical compounds unless a liquid is present that will dissolve one or both of them. Hence in a clay or glaze, until one of the natural compounds present has reached its fusion point, and thus by its intermediation is able to produce further chemical reaction, an increase of fusing components by chemical action cannot take place."

This is a "common sense" view, but too narrow. Spring's experiments (Bull. Soc. Chim., **44**, 166) showed that very high pressures could effect the combination of certain solid substances, although recently doubt has been cast upon his results as having been obtained by using imperfectly dried material. The inter-diffusion of solid metals has been proved by Roberts-Austen to take place slowly, merely by contact. But in the study of the interaction of such substances as normal metallic oxides, silica and alumina heated together under atmospheric pressure, Seger's hypothesis has been generally accepted, and since the velocity of interaction is often enormously increased by fusion, the supposition that interaction begins with fusion is a fairly safe working rule in many cases.

This fundamental assumption is stretched by some modern metallurgists. Howe, in his " Laboratory Text-Book for Metallurgy," gives an exercise on the temperature of formation of silicates in which this temperature is "determined" by heating Seger cones of the materials until they bend and touch.

H. O. Hofmann, writing on the formation temperature of certain silicates in fusion, makes the same tacit assumption, although the title really evades the difficulty. (Trans. Amer. Inst. Min. Eng., 1899).

Of course, in one sense, a silicate slag can only be said to form physically as a slag when it fuses, but chemically the formation point of the silicate is not necessarily the same, for even on the assumption quoted in connection with Seger, the fusion of the most easily fusible constituent or mixture of constituents is sufficient to determine interaction before general fusion occurs.

The most specific statements on this point have been made recently by Boudouard (J. Iron and Steel Inst., 1905, No. 1, p. 334) who worked on the fusion of lime-alumina-silica compounds. This important paper is quoted (this J., 1905, 1144) by Turner as "a memoir of reference which will doubtless be consulted by all future workers in this direction." The fusion temperatures of Boudouard are not melting points in the scientific sense, but determinations by Seger cones, essentially determinations of the temperature at which a certain degree of fluidity is obtained as indicated by a standard degree of deformation occurring under the influence of gravity. The practical value of the determinations, and of the diagrams summarising the results is great. To quote, however, from under the head of conclusions what bears on the matter in hand :—" With regard to the difference existing between the temperature of formation of a slag and its fusion it is, according to my observations on the di-calcium silicate and on the aluminate of calcium Al_2O_3,1·8CaO equally permissible to regard it as no greater than the amount which would fall within the permissible limits of possible error."

These references to Seger, Howe, Hofmann, and Boudouard exemplify current published opinion on the made of formation of silicates ; such work as that of Vogt, Doelter, and Miers on the constitution of fused silicates using the evidence of crystallisation from " melts " has only an indirect application.

The author believes that one thing plain from the experiments described in this account of his work is that the formation of these compounds often commences at temperatures very much below the fusing point of the compounds formed. Fortunately, mixtures resembling those of Boudouard, viz. : $2CaO+SiO_2$ and $CaO+Al_2O_3$, were studied (this J., 1910, pp. 71 and 255) $CaO+SiO_2$ was unchanged in appearance at 800° C., but a little of the silica present was soluble ; at 1100° there was a barely appreciable hardening, but 5 to 14 per cent. soluble silica was extracted ; indicating extensive formation of non-resistant silicate of lime. There was extensive formation of a lime silicate at a temperature far below the melting point of $CaO.SiO_2$ or any mixture of lime and silica. In this case combination preceded fusion, and it cannot be said that the temperature of formation was that of fusion. The slight hardening taking place in this instance as in others might be taken to indicate the formation of another non-resistant silicate of lime more fusible than $CaO.SiO_2$, which had formed, fused, and cemented the rest, if it were not that Boudouard has himself determined the cone fusion points of lime silica mixtures, and has shown the most fusible mixture to be very nearly $CaO+SiO_2$, with a cone fusion point of 1400—1420° C.

It would appear from all the experiments described in Part I. of this study reasonable to suppose that the formation of the compound, $CaO.SiO_2$, commenced much below the point of fusion, and that the process continued as the temperature was raised until the fusion of the $CaO.SiO_2$ containing a certain amount of enmeshed uncombined unfused matter, caused the bending of the pyramid. The point indicated would be near the melting point similarly determined of the pure compound, $CaO.SiO_2$, but presumably a little higher. Heating after fusion would quickly ensure complete combination, and if followed by cooling and a remelting, the second melting would take place at the true (cone) melting point of $CaO.SiO_2$, rather lower than the first melting point determined.

The behaviour of $CaO.Al_2O_3$ described in Part II. (this J., 1910, 255) was equally convincing. Not until 1100° C. did the mixture become slightly coherent, and it then gave 29 to 42 per cent. of soluble alumina, indicating the extensive formation of a non-resistant calcium aluminate.

The cone fusing point of the most fusible mixture of lime and alumina is given by Boudouard as 1400° C., for $2CaO.Al_2O_3$, so that here again is evidence, apart from that of inspection, that the combination had taken place without fusion.

A danger in laying down any law connecting the formation point of complex silicates with their melting points is that often they have no true melting points. This has been shown by Allen and Day, in their work on " Isomorphism and Thermal Properties of Felspar," (Amer. J. Sci., 1905, **19**, 93), and by Turner for a slag (this J., 1905, 1144).

When a solid changes to a liquid through a stage of semi-liquidity, as do most complex silicates, no sudden heat absorption takes place, permanent super-cooling may occur, and no true melting point can be fixed. An attempt to determine the precise melting point of pitch or any non-crystallising substance fails ; in an experiment made by the author hard pitch in the form of a Seger pyramid, and apparently quite brittle, bent slowly at the temperature of the air, and at the end of a month the point touched the base plane.

Clifford Richardson (see this J., 1905, 733) claimed that silica, alumina, and lime diffused at a temperature below the melting point of the resultant clinker to form a Portland cement ; this view is opposed to that of Boudouard, but in complete agreement with that of the author.

Summary. It appears therefore :—

(1) That the author's experiments seem to disprove completely Boudouard's generalisation that the temperature of formation of a slag and its cone fusion point are practically identical.

(2) That fusion is not necessary for the interaction of the constituents of a silicate or aluminate mixture ; such interaction may proceed far without fusion, even to completeness.

(3) That the mode of interaction indicates that at the higher temperatures, from about 800° C. upwards, contact of the solid particles of a loose powder is rendered, by the rise in temperature, an effective molecular contact, allowing

the strongly selective force of chemical affinity to dominate the beginning and continuance of the interaction.

The Theory of Solid Reactions.

When the number of molecules in a particle, and the complete change in the grouping necessitated by chemical combination is considered, these "solid reactions" constitute striking evidence of the change induced in the internal constitution of a solid by heat long before it shows any signs of melting; only a high degree of freedom in molecular motion could effect such an extensive interchange of partners. As to what mental picture can be formed of such interaction, the following is suggested:—Consider the effect of cooling a substance like warm but solid naphthalene which has a considerable vapour pressure below its melting point. The cooling involves in the first place the gradual diminution of vapour pressure, *i.e.*, from the kinetic stand point, the gradual slowing down of the molecules, until they are prevented by the gravitational attraction of the solid particles from making any more free excursions into space; each solid particle surrounds itself with an atmosphere of its own substance, a halo or film of comparatively free-moving molecules. In this state the naphthalene has no vapour pressure and is perfectly stable. As cooling continues the quasi-vaporous film on each solid particle becomes normally solid like the rest of the mass. The stages of cooling are vapour, quasi-vaporous film, and normal solid. These stages can be regarded as necessarily occurring around any cooling solid particle which has a vapour tension below its melting point, and the same stages as necessarily occurring in reverse order on heating; when the vapour pressure ceases during cooling to be measurable, there is a close resemblance to the ordinary solid, but the quasi-vaporous films of neighbouring particles may be in effective molecular contact and if the particles are different in kind chemical action can come into play in a way which is hardly conceivable with a normal solid. The effect of heat in bringing about chemical action between solid particles generally may be similarly regarded. On this view, under the influence of heat, the surface of each solid particle passes from the state of normal solid to that of quasi-vaporous film. The meeting of the films of neighbouring particles allows fairly effective molecular contact and fairly rapid chemical reaction follows in accordance with the chemical affinities brought into play. The creation of such a film by heat facilitates interaction; moistening the surfaces or applying pressure, or both, would tend in the same direction. The assumption involved is that a solid particle, heated to a temperature below its melting point, and below the temperature at which it exerts a vapour pressure, may become surrounded by a quasi-vaporous film of its own material, which facilitates effective molecular contact with a neighbouring particle

Obituary.

JAMES CAMPBELL BROWN.

Prof. J. Campbell Brown, D.Sc., Grant Professor of Chemistry in Liverpool University and Public Analyst for Lancashire, was the son of Mr. George Brown of the Alum and Ammonia Co. of Bow, London. He was educated at Aberdeen University and the Royal School of Mines. In 1864 he became teaching assistant in the chemical department of Aberdeen University, and in 1867 Lecturer on Experimental Science and Toxicology in the Liverpool Royal Infirmary School of Medicine. He took a prominent part in the foundation of Liverpool University College, was one of the founders of the Society of Chemical Industry, and was Chairman of the Liverpool Section from 1886 to 1888.

In 1874 he published a report on the chemistry of tea cultivation in India and the distribution of theine, and devised a fertiliser which has greatly increased the yield of Indian tea. He died at the age of 67 on March 14th.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Electro-chemical action and boiler corrosion. C. F. Burgess. Engineering, 1910, 251—252.

The author has made some experiments by means of an experimental boiler provided with an insulated flue-tube, and with means for measuring any minute electric currents that might be produced. On introducing water at the ordinary temperature, the current between the shell and the flue-tube momentarily rose and then slowly dropped until after four hours it was only one-tenth of its former value. As the temperature rose the current also rose, and, just before the steam pressure reached 100lb. per sq. in., became a maximum. After this it again decreased, and on removing the source of heat, made a slight jump and then rapidly fell nearly to zero. Variations in pressure had no effect on the electrolytic action, and when substances were added to the water the effect on the conductivity of the water was very noticeable. Tests under conditions similar to those obtaining in practice showed that the current was smaller after each cooling than during the previous run. After the flue and shell had been short-circuited for 40 hours, it was found that their polarity had become reversed, but became normal again in about three hours, giving, however, a smaller current. The corrosion effects on the flue were found to be similar to those obtained on locomotive boiler tubes.—J. W. H.

Patents.

Steam for power and heat, for distillation purposes, and the like; Utilisation of ——. H. L. P. Boot, Tunbridge Wells. Eng. Pat. 1996, Jan. 27, 1909.

The invention relates to means for the use of turbines in industrial work, the exhaust steam being utilised for heating, distilling, or further power production.—J. W. H.

Centrifugal drying machines or hydro-extractors. H. C. Longsdon and J. R. Bottomley, Keighley. Eng. Pat. 4183, Feb. 20, 1909.

A cover is claimed for that type of centrifugal machine in which the cage is suspended and driven by a vertical shaft. The cover fits on to the upper surface of the receptacle containing the cage, and is provided with an additional door covering the slot which is made to accommodate the vertical shaft. The cover is provided with a double hinge, so that on lifting up the additional door, it may slide some distance before being lifted clear of the receptacle. At the outer end of the slot a handle or stop-piece is fixed, which, on coming into contact with the shaft, prevents further movement of the cover.—J. W. H.

eparator ; Centrifugal — —. H. M. Goodman, Louisville, Ky. U.S. Pats. 949,226 and 949,227, Feb. 15, 1910.

'HE claim is for a centrifugal separating machine including rotatable chamber having a fixed end and an end that ay be opened, closed by a removable cover, so as to etain the separated material within the chamber. The aterial to be treated is introduced through a pipe in he fixed end, and the separated liquid is withdrawn hrough another pipe so arranged in the fixed end, that hilst the latter pipe cannot act as a siphon, it neverthe-ss permits liquid to escape from the chamber. —W. H. C.

)rying air. J. Gayley, New York. Eng. Pat. 13.555, June 9, 1909.

'HE air is cooled in stages by passing it through a series f vessels provided with coils through which cooled brine s circulated. In the first vessel, the coils in which have a arger surface than those in the succeeding vessel, the air s only cooled down to a point at which moisture is separated s liquid. In the next vessel the coils have a smaller urface and the brine is colder, the remaining moisture n the air being deposited as frost.—W. H. C.

)ryer. W. R. Macklind, Mineral Point, Mo. U.S. Pat. 949,487, Feb. 15, 1910.

'HE material to be dried is carried through a chamber rovided with a suitable heater, on an endless band omposed of metal ribbons which pass over a pair of drums, ne at each end of the chamber. A hood, divided into ompartments, is arranged over the chamber, and a current f air, which is passed over the material, is so regulated hat it is strongest where the material contains most noisture.—W. H. C.

'nflammable liquids [*collodion*] ; *Storage of* ——. Maschinenbau-Ges. Martini und Huncke, Berlin. Eng. Pat. 19,692, Aug 27, 1909. Under Int. Conv., Dec. 28, 1908.

NFLAMMABLE liquids are stored in sealed containers in n atmosphere of inert gas, a supply of which is contained n a receptacle under pressure, and utilised for forcing the quid from the reservoir when required. In the case of iquids containing a substance in solution, *e.g.*, collodion, t has been found that when the pressure of gas is released, portion of the solvent escapes with the gas in the form of apour, and the dissolved substance may be precipitated. 'he present invention provides for the insertion of a small ank, containing the same solvent liquid, between the gas-eservoir and the receptacle in which the solution is stored. 'he gas is thus forced to pass through the tank and become aturated with the vapour of the solvent before coming n contact with the solution.—J. F. B.

'vaporating apparatus ; Multiple-effect ——. S. M. Lillie, Philadelphia. U.S. Pat. 948,376, Feb. 8, 1910.

'HE vessels forming a multiple-effect evaporating plant re arranged horizontally and parallel to each other, o that the vapour end of each vessel is adjacent to the team ends of the vessels on either side of it. The pipes onnecting the steam and vapour ends of adjacent vessels re provided with valves which can be controlled inde-endently and simultaneously.—J. W. H.

'as-furnace ; Regenerative ——. G. H. Benjamin, New York. U.S. Pat. 948,538, Feb. 8. 1910

'HE furnace is provided with two sets of regenerators or gas and air, and two sets of burners at different levels. 'leans are provided for forcing the gas and air through he regenerators to the burners under pressure.— J. W. H.

'iltering, washing, and drying ; Apparatus for ——. J. Bebbington, Runcorn, Assigner to T. T. Mathieson. Tattenhall. U.S. Pat. 949.724, Feb. 15, 1910.

'EE Eng. Pat. 23.221 of 1907 ; this J., 1908, 562.—T. F. B.

'iquids and gases ; Apparatus for effecting intimate contact between ——. Kirkham, Hulett, and Chandler, Ltd., Fr. Pat. 405,601, July 30, 1909. Under Int. Conv., Aug. 28, 1908

SEE Eng. Pat. 18,129 of 1908 ; this J., 1909, 873.—T. F. B.

Reverberatory furnaces for calcining hydrated oxides of iron. Eng. Pat. 5619. *See* VII.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Gasoline and alcohol [*Denatured*] *tests on internal-combustion engines.* R. M. Strong. U.S. Geol. Surv., Bull. 392, pp. 38.

SOME 2000 tests were made with gasoline and alcohol as fuels, in a number of engines and under different working conditions. The calorific value per unit weight of the denatured alcohol was about 0·6 of that of the gasoline used, the specific gravity of the gasoline being 0·71—0·73. The calorific values of equal volumes of the explosive mixtures of alcohol vapour or of gasoline vapour with the theoretical quantity of air for complete combustion were equal. An engine designed and adjusted to use alcohol to the best advantage will give 30 per cent. more power than a gasoline engine having the same cylinder diameter, stroke, and speed, and when the two engines work at the most economical load the fuel-consumptions are 0·7 lb. of alcohol and 0·59 lb. of gasoline, per B.H.P. per hour, respectively, and the thermal efficiencies 39 per cent. for the alcohol engine, and 26 per cent. for the gasoline engine. The compression pressures were 180 lb. per sq. in. in the alcohol engine, and 70 lb. per sq. in. in the gasoline engine. If alcohol is used in a gasoline engine without changing the compression pressure, under the best working conditions the power of the engine is increased about 10 per cent., and the thermal efficiency is slightly greater, the fuel consumption being 0·98 lb. of alcohol, as compared with 0·59 lb. of gasoline per B.H.P. per hour. The consumption of either fuel is greatly increased if the engine is not worked under the best conditions, especially as regards time of ignition, and adjustment of fuel supply to the carburettor. The consumption per B.H.P. per hour is also greater at reduced loads, the most economical load being 80 per cent. of the maximum. In adapting a gasoline engine to work with alcohol, it is not advisable to increase the compression pressure, because of the resulting increase in the maximum pressure, but the fuel ways in the carburettor should be enlarged. The chief difficulty found with engines so adapted is in starting cold, and it is necessary to increase the throttling at the spraying nozzle when starting. Alcohol mixed with from 10 to 50 per cent. of water can be used in engines suitably equipped. The amount of pure alcohol consumed is increased and the maximum power of the engine decreased with increasing dilution, but 80 per cent. alcohol would be more economical than 90 per cent. alcohol if the cost were 15 per cent. less. The storage and handling of denatured alcohol is attended with less risk than in the case of gasoline. The exhaust of an alcohol engine is cleaner and less obnoxious than the exhaust of a gasoline engine.—A. T. L.

Mineral oils ; Exports of —— *from the United States.* Oil, Paint, and Drug Rep., Feb. 21, 1910. [T. R.]

THE following figures show the exports of various mineral oils and paraffin wax from the United States during the years 1907, 1908, and 1909 :—

	1907.	1908.	1909.
Crude oil ......(galls.)	120,300,549	149,190,017	186,305,442
Illuminating oils (galls.)	905,924,296	1,129,004,8[illegible]	1,046,401,072
Naphtha ......(galls.)	34,625,525	43,889,844	68,758,675
Lubricating oils (galls.)	152,028,855	147,769,024	161,639,609
Residuum......(galls.)	75,774,754	77,551,68[illegible]	107,998,575
Paraffin wax......(lb.)	207,504,494	141,067,470	181,327,568

The total values of the above products were, 1907, $101,592,512 1908, $115,738,093 ; 1909, $111,445,214.

Roumanian petroleum industry in 1909. Oil, Paint, and Drug Rep., March 7, 1910. [T. R.]

While in 1908 the total production of petroleum in Roumania was 1,150,000 tons, with an excess of only 20,000 tons over the previous year, the production of 1909 was approximately 1,300,000 tons. This result is owing to the development of the Trintea oil field, which proved to be one of the rich oil districts in Roumania. The wells of Moreni and Campina have also contributed to a large extent to the increase of crude oil production in 1909.

During 1909, Roumania had in the average 730 productive drilling wells and 520 productive hand wells.

The new law passed in 1909 for the granting of concessions of the government oil lands, which will shortly be offered by public auction, will doubtless contribute to a considerable increase of production.

While in regard to production the year 1909 was a satisfactory one, it was not so as regards the sale of products. On account of the strong competition between the Americans and the concerns who control the Galician products contending for the European oil markets, the prices for export dropped, rendering import very difficult. Therefore the total exports show a decrease of 40,653 tons, as compared with the previous year. The export of petroleum products amounted in 1909 to 420,051 tons, as against 460,704 tons in 1908. The following is the home consumption during the financial year 1908—1909 (April 1, 1908, to March 31, 1909, old style) :—

	Taxed.	Denatured.
	Tons.	Tons.
Refined oil	39,239	—
Naphtha	720	9,178
Mineral oil	6,405	6,852

	Consumption.	Burnt in refineries.
	Tons.	Tons.
Residuals (fuel oil)	344,393	113,257

Mineral oils ; Heat of vaporisation of ——. E. Graefe. Petroleum, 1910, 5, 569—571.

On the basis of values obtained with lignite-tar oils, the author has determined the heat of vaporisation of various petroleum fractions, with the following results : light crude oil, 86·0 cals. ; heavy crude oil, 68·7 cals. ; gas oil, 69·2 cals. ; vaseline oil, 63·3 cals. ; heavy vaseline oil, 53·8 cals. ; cleaning oil, 66·5 cals. These figures, though merely approximate, are considered to indicate the practical importance of a good preliminary heating of the oils in the refining process, the amount of heat required to raise the temperature to boiling point being often greater than that for vaporisation.—C. S.

Naphthenes ; Formation of ——. *IV. Formation of naphthenes from olefines and from artificial lubricating oil, and synthesis of the latter.* C. Engler and O. Routala. Ber., 1910, **43**, 388—397.

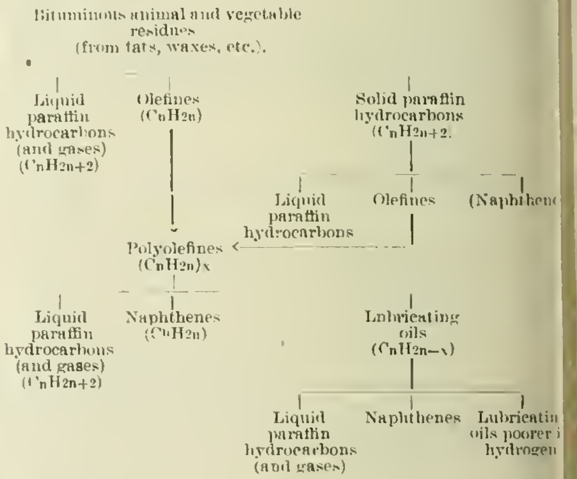
See this J., 1910, 10. The artificial lubricating oil produced by heating amylene under pressure and by treating amylene with aluminium chloride, is accompanied in the latter case by little or no naphthenes, whereas by the first method, comparatively large quantities of naphthenes are formed. The artificial lubricating oil is similar in properties and composition to the lubricating oils obtained by the distillation of natural petroleum. The results of the authors' further experiments lead them to believe that the formation of naphthenes from olefines in many cases does not take place directly, but that the primary products of the transformation are polyolefines, which decompose into paraffin hydrocarbons and naphthenes on the one hand, and lubricating oils on the other. At a low temperature, as for example in presence of aluminium chloride, only small quantities of naphthenes are formed, but larger quantities are produced at higher temperatures. The authors agree with Nastjukoff's view that lubricating oils consist chiefly of saturated and unsaturated cyclic hydrocarbons.—A. S.

Naphthenes ; Formation of ——. *V. Products obtained by heating a cylinder oil under pressure.* C. Engler and B. Halmai. Ber., 1910, **43**, 397—405.

Experiments with a viscous cylinder oil from Baku petroleum showed that when heated under pressure, this behaved in an exactly similar manner to the artificial lubricating oil obtained from amylene, yielding a mixture, of which the lower-boiling fractions consisted entirely of paraffin hydrocarbons ; the intermediate fractions contained proportions of naphthenes increasing with the boiling points of the fractions ; and the highest-boiling portion consisted of lubricating oil.—A. S.

Naphthenes ; Formation of ——. *VI. Conclusions as to the possible mode of formation of petroleum, and its optical activity.* C. Engler. Ber., 1910, **43**, 405—411.

The author suggests the following scheme as representing processes occurring in the formation of petroleum, and discusses its bearing on the characters of the different kinds of petroleum.


Bituminous animal and vegetable residues (from fats, waxes, etc.).
Liquid paraffin hydrocarbons (and gases) (C_nH_{2n+2})
Olefines (C_nH_{2n})
Solid paraffin hydrocarbons (C_nH_{2n+2}.
Liquid paraffin hydrocarbons
Olefines
(Naphthene
Polyolefines (C_nH_{2n})x
Liquid paraffin hydrocarbons (and gases) (C_nH_{2n+2})
Naphthenes (C_nH_{2n})
Lubricating oils (C_nH_{2n-x})
Liquid paraffin hydrocarbons (and gases)
Naphthenes
Lubricatin oils poorer i hydrogen

With regard to the optical activity of natural petroleum, this presents no objection to the above scheme, since when the product obtained by heating under pressure an optically active (+12° in a 200 mm. tube) cylinder oil (see preceding abstract) was fractionated, the fractions distilling above 180° C. were found to be strongly dextrorotatory, *i.e.*, the optical activity was not destroyed by heating for many hours at 400° C., a temperature much higher than that likely to obtain in the natural formation of petroleum.—A. S.

Paraffin wax ; Manufacture of ——. R. Zaleziecki. Petroleum, 1910, 5, 636—637.

A process by which the use of hydraulic presses is avoided is now in operation at Mähr.-Schönberg. The paraffin distillate obtained from the crude oil, is cooled to 10° or 15° C. and pumped through filter-presses. The semi-solid mass is taken by a conveyor running beneath the press and delivered into a machine which works it into a pulp. The pulp is delivered by a pump into a special tube-press, comprising perforated tubes lined with filter-cloth, the press being heated by steam. The crude paraffin wax remaining in the press is afterwards melted out. The process gives a satisfactory yield and the product is of excellent quality. The cost is less than with hydraulic presses, since less labour is required and the preliminary treatment in filter-presses need not be so complete.

—A. T. L.

Patents.

Fuel; Process of treating ——. [*Compressing coke.*] A. G. Maul, Assignor to Anthracoke Co., New York. U.S. Pat. 949,326, Feb. 15, 1910.

For the manufacture of compressed coke, a body of fuel is placed in a closed retort provided with a valve for the escape of volatile constituents and a movable wall (piston) for compressing the product. Heat is applied to the retort, and the movable wall is advanced against the fuel to an extent proportional to the reduction of its mass by distillation. When the whole of the volatile matters have been eliminated, the wall is further advanced so as to compress the coke.—J. F. B.

Gas producers. A. Jabs, Zürich. Eng. Pat. 3326, Feb. 10, 1909.

The producer is of the type in which the fuel is dried and partially distilled before entering the producer chamber. The fuel is charged into a vertical shaft, having louvre-like walls, arranged within a heating chamber above the producer chamber. This chamber is heated by the passage through it of a portion of the producer gas generated in the producer chamber, the main quantity of producer gas escaping by a separate outlet, and the amount of gas passing through the heating chamber is regulated so that the temperature of distillation is not much above 100° C. in order to prevent decomposition of the by-products. The heating chamber is provided with baffles so that the heating gases pass laterally through the fuel column alternately in opposite directions.

—A. T. L.

Gas producers for the use of sawdust, wood shavings, and similar fuels. K. I. Crossley and T. Rigby, Manchester. Eng. Pat. 4742, Feb. 26, 1909.

In order to maintain a close and uniformly dense bed of fuel in the producer, when the fuel is light compared with coal, a weight is allowed to rest upon the top of the fuel column in a vertical storage bell. This bell is preferably of a considerable height compared with the depth of the fire. The charging hopper is at one side of the storage bell and the weight is withdrawn above the charging orifice during charging. The position of the weight may be used to indicate the level of the fuel in the storage bell.—A. T. L.

Gas-retort furnace. R. M. Brooke, West Vale, Assignor to R. Dempster and Sons, Ltd., Elland. U.S. Pat. 949,674, Feb. 15, 1910.

See Eng. Pat. 16,405 of 1908; this J., 1909, 647.—T. F. B.

Mineral oils; Method of treating ——. The Oil Refining Improvements Co., Ltd. Fr. Pat. 405,315, July 22, 1909. Under Int. Conv., Aug. 6, 1908.

See Eng. Pat. 16,617 of 1908; this J., 1909, 1081.—T. F. B.

Saturators for making sulphate of ammonia. Eng. Pat. 3036. *See* VII.

Apparatus for purifying blast-furnace gas. U.S. Pat. 948,664. *See* X.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Wood charcoal; The properties and chemical composition of ——. P. Klason and A. Bergh. Arkiv Kem., Min., Geol., 1909, **3**, 1—53. Chem.-Zeit., 1910, **34**, Rep., 107—108.

The authors' results may be summarised as follows:—1. The average composition of wood charcoal from carbonising ovens is carbon, 81; hydrogen, 4; oxygen, etc., 15 per cent. 2. The average composition of charcoal from heaps is carbon, 90; hydrogen, 2·5; oxygen, etc., 7·5 per cent. 3. At temperatures up to 250° C., oven charcoal is more sensitive towards oxygen than charcoal produced in heaps. At 100° C. it takes up 15 per cent. of its weight of this gas. Between 300° and 600° C., the prevailing temperature of the heaps, the rate of burning of charcoal in air is so great that under the conditions in which the gases normally circulate, it is scarcely possible for atmospheric oxygen to find its way into the carbonising zone of the heaps. 4. The catalytic combustion of charcoal is the result of two separate processes resulting on the one hand, in the combination of oxygen with carbon to form "oxidised" charcoal, and on the other the splitting-off of carbon dioxide and water, perhaps also of carbon dioxide and methane, from this "oxidised" charcoal. 5. The state of equilibrium between carbon monoxide and carbon dioxide in the heaps changes in that with increasing temperature the reaction approaches to $C+CO_2=2CO$, the reverse taking place with a falling temperature. 6. Combustion of gaseous or liquid products of distillation does not take place in the heaps to any noticeable extent. Owing to the catalytic action of carbon monoxide and atmospheric oxygen on the charcoal, mentioned above, the formation of tar is much less than is the case where wood is carbonised in ovens or retorts. 7. Explosive gas mixtures can only be produced in the uncarbonised parts of the heaps. An explosion is not conceivable, except possibly where a severe gust of wind interferes with the draught, causing a back-fire. 8. The influence of carbon dioxide and steam begins, appreciably, between 400° and 500° C. 9. A curve representing the yield of charcoal is of hyperbolic form. An asymptotic curve is obtained below 200° C. and over 500° C. if the temperatures are taken as abscissæ and the corresponding yield of charcoal as ordinates. 10. Reckoning from dry wood the yield of charcoal is 40 per cent. at 400° C. and 30 per cent. at 500° C.—J. A.

Temperature work of the Bureau of Standards. C. W. Waidner. J. Ind. Eng. Chem., 1910, **2**, 49—63.

The author reviews the work which has been done at the United States Bureau of Standards (see this J., 1904, 842) on thermometry, pyrometry and heat measurements.

Optical pyrometry (reprint No. 11).—A comparison of the different forms of optical pyrometers (see this J., 1905, 320). The intensity of the radiation, both monochromatic and total, from different substances at a given temperature differs very greatly, and hence optical pyrometers are calibrated in terms of the radiation from a so-called "black body," *i.e.*, a body which will absorb all radiation, both visible and invisible, incident on it, and will therefore radiate rays of every colour and wave-length. Since, as Kirchoff has shown, the radiation from a closed chamber, the opaque walls of which are at a uniform temperature, is the same as that from a "black body," the optical pyrometers will give the true temperatures of bodies heated in closed furnaces, the walls of which are at a temperature not greatly different from that of the body, but in other cases will give the equivalent "black body" temperature, which will differ from the true temperature in proportion as the radiation of the body of which the temperature is being measured differs from the radiation of a "black body." In the case of fused baths and enclosed spaces, the true temperatures may be obtained directly by placing a porcelain or iron tube closed at one end in the bath or space, and observing the radiation from the open end of the tube. Experiments with different pyrometers showed that platinum is a very selective radiator, the difference between the true temperature and the "black body" temperature being least when the latter is measured with blue light, and greatest when measured with red light. At the instant of melting, for example, the "black body" temperature of platinum measured with red, green, and blue light, was found to be 1541°, 1577°, and 1612° C. respectively, the true melting point being over 1750° C. With pyrometers, such as the Wanner pyrometer, in which polarised light is used, errors may be introduced owing to the light emitted by the heated body being partially polarised, but these can be avoided by viewing the heated surface normally or by taking the mean of four readings of the pyrometer in positions at right angles to one another. Total radiation pyrometers give low results in presence of water vapour, carbon monoxide, and carbon dioxide, owing to the strong absorption by these gases of the longer waves of the spectrum; in presence of dense fumes, very low results may be obtained.

Temperature of the arc (reprint No. 8).—A number of determinations with the Le Chatelier, Wanner, and Holborn-Kurlbaum optical pyrometers, using both red and green light, gave 3700° as the absolute "black body" temperature of the hottest portion of the positive crater of the electric arc between carbon electrodes. Contrary to the results of Violle and other workers, it was found that an increase of current caused a rise in the temperature of the crater. With electrodes of Acheson graphite, the temperature was about 40° higher than with carbon electrodes.

Radiation from and the melting points of palladium and platinum (reprint No. 55) (see this J., 1907, 1140).—Low results are given at temperatures above 1200° C. by the temperature scale defined by platinum thermo-couples calibrated at the freezing points of zinc, antimony, and copper, and an extrapolation of the equation, $e=a+bt+ct^2$, where e is the E.M.F. of the couple when the hot junction is at the temperature, t, and the cold junction is at 0° C., a, b, and c being constants. The difference between the thermo-electric and optical scales is as follows:

Temperature on thermo-electric scale	1200°	1300°	1400°	1500°	1600°	1700°
Difference	0°	2°	6°	14°	25°	43°

Calorimetric resistance thermometers (reprint No. 68).—A description of platinum resistance thermometers which have been constructed for the purpose of measuring small differences of temperature (2° or 3°) such as are met with in calorimetric determinations, to within 2 or 3 parts in 10,000, and yet having so small a time lag that when plunged into an ice or steam bath, they assume the temperature of the bath to within 0·001° C. in a few seconds.

Specific heats of [calcium chloride] brines (reprint No. 135).—The specific heats of calcium chloride brines such as are used in the refrigeration industries were determined with a constant flow calorimeter and with a Dewar vacuum flask calorimeter. The results with brines prepared from "chemically pure" calcium chloride are shown in the following table:—

Temp.	Specific heats of brines of sp. gr.		
	1·140	1·200	1·260
° C.			
− 25	—	—	0·647
− 20	—	0·695	0·651
− 15	0·764	0·700	0·654
− 10	0·768	0·705	0·657
− 5	0·772	0·709	0·660
0	0·775	0·712	0·663
+ 5	0·778	0·715	0·666
+10	0·781	0·719	0·670
+15	0·784	0·722	0·673
+20	0·787	0·725	0·676

For interpolation between the values in the table, the formula, $\delta=2\cdot6654-3\cdot0169\sigma+1\cdot3515\sigma^2$, may be used, where δ is the density and σ is the mean of the given and interpolated specific heats. Tests with four commercial brines, one of which contained over 30 per cent. of magnesium chloride, showed that at 0° C. the results were only from 0·2 per cent. higher to 0·4 per cent. lower than those given in the table, whilst at lower temperatures the values agreed within 0·2 per cent.

Other matters dealt with are:—Radiation from platinum at high temperatures (reprint No. 24); melting points of the iron group elements by a new radiation method (reprint No. 62) (see this J., 1907, 1140); estimation of the temperature of copper by means of optical pyrometers (reprint No. 121) (see this J., 1910, 215); preliminary measurements on temperature and selective radiation of incandescent lamps (reprint No. 40); heat treatment of high temperature mercurial thermometers (reprint No. 32) (compare this J., 1894, 61; 1901, 899); standard scale of temperature in the interval 0° to 100° C. (reprint No. 69); testing of clinical thermometers (reprint No. 13); transition temperature of sodium sulphate; standardised heat samples; thermodynamic scale of temperature (reprint No. 57); action of the Hampson liquefier (reprint No. 123) (compare this J., 1898, 411); methods of obtaining cooling curves (reprint No. 99); platinum resistance thermometry at high temperatures (reprint No. 124), (see this J., 1910, 205).—A. S.

Contaminations of denatured spirit. Mohr. *See* XVIII.

Patents.

Vertical retorts for the destructive distillation of coal. T. Parker, Wednesfield, Staffs. Eng. Pat. 3003, Feb. 8, 1909.

The patent relates to retorts of the kind described in Eng. Pat. 14,169 of 1908 (this J. 1909, 879), in which a battery of vertical tubes is cast in one piece, the tubes being open at the top to a common gas-outlet or charging chamber. The invention consists in providing apertures in the walls of adjacent tubes near the lower end, so that if some of the retorts are blocked at the upper part by caked coal, the gas may escape through these orifices into the retorts which are not blocked.—A. T. L.

Incandescent light; Production of —— by means of Dowson gas, generator gas, and the like. E. U. G. Ernst, Copenhagen. Eng. Pat. 4361, Feb. 22, 1909. Under Int. Conv., March 12, 1908.

The temperature of the flame is raised above the minimum temperature of light emission for the mantle, by preheating the air or the gas, or a mixture of these.—A. T. L.

Incandescent gas mantles. J. L. Muller, Sannois, and J. Bonnet, Paris. Eng. Pat. 6556, Mar. 18, 1909. Under Int. Conv., Mar. 20, 1908.

The patent relates to machines of the kind described in Eng. Pat. 24,218 of 1901 (this J., 1902, 461), in which the mantles previously soaked in solutions of suitable salts are supported from an endless chain which runs horizontally through the machine, stopping periodically while the mantles are subjected in different parts of the machine to the various processes required to complete their manufacture. There are ten stopping positions, at which the following operations are carried out:—attaching the mantle to its support, singeing or burning away the fabric at the upper portion of the mantle, singeing at the bottom of the mantle, incineration in three successive stages, calcining and burning the head of the mantle, cutting the mantle to any desired length, dipping the mantle in collodion, and finally drying the finished mantle. The principal features of the machine are the provision of stop gear, by which the period of stoppage can be regulated at will, and of means by which the rods for supporting the mantles are transferred at the front end of the machine from the upper to the lower length of the endless chain, and at the back end of the machine from the lower to the upper length, whilst the guides which are supported within the mantles during the processes of singeing and incineration, are removed from within the mantles and transferred from the lower to the upper length of the chain at the point where the mantles are dipped in collodion.—A. T. L.

Incandescent electric lamps; Manufacturing metal filaments for ——. The Westinghouse Metal Filament Lamp Co., Ltd., London. From A. Lederer, Vienna. Eng. Pat. 6936, Mar. 23, 1909.

The patent is for the process of decarbonising tungsten or other metal filaments by heating them to 1200° or 1300° C. in pure dry hydrogen. At this temperature, carbon and hydrogen combine directly to form methane (Bone and Jerdan, Trans. Chem. Soc., 1897, 41). The hydrogen may be obtained from dilute sulphuric acid and zinc, or from caustic potash and aluminium, and is purified by passing it through a tube containing copper at red heat, and afterwards through concentrated sulphuric acid and over phosphorus pentoxide. Raw filaments containing 2·5 per cent. of carbon lose 2·3 per cent. of carbon at 1000° C., and after heating at 1300° C., the amount of carbon is reduced to 0·01 per cent.—A. T. L.

Tungsten for the manufacture of electric incandescence lamp-filaments; Production of pure —. Bergmann-Elektricitäts-Werke Akt.-Ges. Fr. Pat. 405,323, July 22, 1909. Under Int. Conv., April 20, 1909.

Tungstic acid is mixed with zinc dust in the proportion of 4 parts to 5 parts of the latter, and the mixture is heated in a closed vessel through which a current of lighting gas is passed, the temperature being regulated so that the tungsten is gradually reduced. The heating is continued for a short time after the production of vapours of zinc oxide has ceased. Finally, the product is extracted with hydrochloric acid in order to remove the zinc oxide. The metallic tungsten is obtained in a very finely divided state. —A. T. L.

Electric incandescence lamps; Treatment of metallic [tungsten] filaments for ——. Bergmann-Elektricitäts-Werke Akt.-Ges. Fr. Pats. 405,324 and 405,325, July 22, 1909. Under Int. Conv., April 20, 1909.

(1) A filament containing only tungsten and oxides of tungsten is obtained in known manner from tungstic acid and a binding agent, the squirted filament being carbonised and then treated so as to eliminate the carbon. The filaments so obtained are then heated electrically in a vessel of about 2 litres capacity, through which a current of hydrogen is passed at the rate of about 10 litres per hour. (2) In order to remove the last traces of carbon from tungsten filaments, they are heated to incandescence in a vessel through which is passed a current of lighting gas containing a small percentage of carbon dioxide.—A. T. L.

[Electric] incandescence lamps; Process for fixing metallic filaments to the leading-in wires of ——. Bergmann-Elektricitäts Werke Akt.-Ges. Fr. Pat. 405,326, July 22, 1909. Under Int. Conv., Jan. 22, 1909.

The connections between the filaments and the leading-in wires are made by fusing on to the junction a metal, such as copper different from that forming the leading-in wires, the metal being one that will undergo less disintegration at the cathode than silver, in order that the lamp bulb may not be blackened during use by disintegration of the metal. The powdered metal is made into a paste with a suitable volatile liquid and the junctions between the filament and the leading-in wires are coated with this paste. An arc is then formed between two electrodes placed at either side of the junction, in order to melt the metal and form the joint. One of these electrodes may be a copper wire. During this operation the filament and lamp-head are mounted in a bell through which a current of cold non-oxidising gas is passed to protect the filament.—A. T. L.

Incandescent bodies for gas-lights; Manufacture of ——. M. von Unruh, Charlottenburg, Germany. U. S. Pat. 949,010, Feb. 15, 1910.

See Fr. Pat. 393,587 of 1908; this J., 1909, 132.—T. F. B.

Filaments suitable for the mantles of incandescent gas lamps; Manufacture of ——. R. Laigle, Paris. Eng. Pat. 17,771, July 30, 1909. Under Int. Conv., Aug. 1, 1908.

See Addition of Aug. 1, 1908, to Fr. Pat. 382,749 of 1907; this J., 1909, 1188.—T. F. B.

Metallic [pyrophoric] alloys. Eng. Pat. 16,210. *See* X.

Metallic compounds; Manufacture of highly pyrophoric ——. Fr. Pat. 405,021. *See* X.

III.—TAR AND TAR PRODUCTS.

Creosote; Examination of ——. A manuscript presented to the U.S. Forest Service by W. F. Sherfessee, Bureau of Forestry, Manila, Philippines. T. H. Davis. Oil, Paint, and Drug Reporter, Feb. 14, 1910.

The importance of the more extensive preservation of timber in the United States is urged, and as creosote may be regarded as the best material for this purpose, a study was made of the characters of a number of samples of commercial creosotes and analogous materials. For a full investigation of a commercial creosote, the following tests are adopted:—(1) Specific gravity at 60° C., with a hydrometer. (2) Colour and appearance by both reflected and transmitted light. (3) Absorption spot—six drops are allowed to fall on white blotting paper: tar, dirt, free carbon, etc., separate at the centre of the spot. (4) Tar acids, determined by shaking 25 c.c. with 50 c.c. of caustic soda of sp. gr. 1·1; the increase of volume of the alkali multiplied by 4 gives the approximate percentage of tar acids. (5) Viscosity, by noting the relative times required for 50 c.c. each of the sample and of water to run out from a pipette. (6) and (7) Loss by evaporation on exposing 10 c.c. on a 3-in. watch glass for 24, 48, and 72 hours at the ordinary temperature and for 4 and 6 hours at 90° C. (8) Naphthalene content, by cooling to 30° F. the fraction distilling between 200° and 250° C. (9) Flash point by the open cup method. (10) Distillation test with 100 c.c. in a side-tube fractionating flask connected to a glass tube, 24 in. long, serving as an air condenser. The flask rests upon an asbestos board having a 2-inch hole with serrated edges, and is enclosed in an asbestos box covered at the top by an asbestos plate, having a hole for the thermometer. The oil is distilled at the rate of 2—3 drops per second throughout, and the thermometer is fixed so that at the commencement it just touches the surface of the oil. Fractions are collected up to 200° C., 200°—220° C., 220°—250° C., 250°—270° C., and 270°—300° C. For ordinary commercial control, it would probably be sufficient to determine the specific gravity, tar acids, and naphthalene, and examine the absorption spot. Results obtained with a number of commercial samples are shown in the following table:—

No.	Sp. gr. at 60° F.	Viscosity (water=1)	Tar acids.	Distillation test.					
				Up to 200° C.	200°—220° C.	220°—250° C.	250°—270° C.	270°—300° C.	Residue.
			per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
1	1·019	—	12	14	21	33	12	8	12
2	1·025	—	12	11	20	37	8	12	12
3	0·975	—	—	0	9	26	16	21	28
4	1·036	1·154	11·5	8	10	28	10	13	21
5	1·000	1·635	—	17	17	21	9	13	23
6	1·035	1·179	16	7	38	31	9	10	5
7	1·071	1·501	10	1	9	29	15	15	31
8	1·020	1·099	11	7	24	43	10	10	6
9	1·067	1·648	—	3	8	21	16	15	37
10	1·018	1·166	—	7	13	26	16	17	31
11	0·986	1·487	—	0	16	34	16	17	17
12	1·037	1·203	11	11	19	29	11	9	21
13	1·042	—	30 (?)	6	8	10	8	9	59
14	0·971	—	25	0	6	35	20	20	19
15	1·033	—	20	11	41	26	8	3	11
16	1·058	1·115	6	5	15	29	13	13	25
17	0·995	1·385	18	2	7	32	17	21	21
18	1·016	1·095	0	8	9	20	17	20	26

The samples are described as follows:—No. 1. Domestic commercial creosote distilled from a mixture of coal tar and water-gas tar. No. 2. The same (refined). No. 3. Commercial creosote with some odour of wood creosote. Nos. 4, 8 and 12. Commercial creosote, domestic. Nos. 5 and 9. Commercial creosote, domestic, fictitious. No. 6. Belgian creosote as imported into America. No. 7. English creosote as imported into America. Nos. 10 and 14. Commercial creosote. No. 11. Scotch creosote as imported into America. No. 13. Wood creosote. No. 15. Scotch creosote, special, imported for disinfectants. No. 16. English creosote guaranteed pure coal tar product. No. 17. Blast-furnace creosote, English. No. 18. Dead oil from water-gas tar.

Creosote to be used for the manufacture of disinfectants should be free from fine carbon, tarry matter, naphthalene, and water, and should contain at least 10 per cent. of tar acids. For the manufacture of wood stains, it should have a specific gravity between 1·020 and 1·040, a minimum naphthalene content, and contain at least 10 per cent. of tar acids. It is not possible to draw up a general specification for creosote to be used for impregnating timber, as widely differing views are held by consumers in regard to the constituents to which the preservative action is mainly due. For the impregnation of timber, the combined vacuum and pressure process of Bethell is the one most generally favoured, but recent experiments on a large scale by the U.S. Forest Service have shown that efficient penetration can be obtained by a soaking process under proper conditions. If an open tank be used, this must be covered as far as practicable and the creosote must be free from light oils, in order to minimise the loss by evaporation at the high temperature required. This loss can be almost entirely eliminated by using closed tanks as recommended by the U.S. Forest Service. It is estimated that not more than 30 per cent. of the creosote required in the United States for the impregnation of timber can be furnished by American distillers direct from coal tar. Coal-tar creosote has a specific gravity between 1·020 and 1·040. Of other products, blast-furnace creosote is generally of low specific gravity, practically free from light oils, of low naphthalene-content, and comparatively rich in tar acids. Coke-oven creosote is of high specific gravity, poor in tar acids, and contains considerable quantities of naphthalene and anthracene oils. Scotch creosote is usually of low specific gravity, of very low naphthalene-content, contains a fair percentage of tar acids, but also contains readily volatilised constituents and paraffin derivatives. Belgian creosote has a normal specific gravity, a rather high percentage of tar acids, and contains considerable quantities of hydrocarbons distilling below 220° C.; it evaporates almost completely when exposed to the air for six hours at 90° C. "Dead oil" from water-gas tar closely resembles coal-tar creosote, except that it is almost entirely free from tar acids.—A. S.

Xylenes, nitrotoluenes, and toluidines; The freezing of mixtures of isomeric ——. H. W. Fischer. Z. Elektrochem., 1910, 15, 161.

COMMERCIAL nitrotoluene (38 per cent. of the para-, 60 of the ortho-, and 2 of the meta-derivative) deposits crystals on cooling below 0° C., and an apparent cryohydric point is reached at – 18° C. On filtering off the crystals on a cold filter, it is found that pure *p*-nitrotoluene m.pt. 54°), has separated. The temperature falls slowly from – 18° C., the solution becoming richer in *m*-nitrotoluene. This, with the proximity of – 18° C. to -10°·5 (the m.pt. of *o*-nitrotoluene) shows that practically all the *p*-derivative has separated. A mixture of toluidines on fractional crystallisation yields a pasty mass consisting of solid *p*-toluidine suspended in a mixture of *o*- and *m*-toluidine saturated with *p*-toluidine. No cryohydric point could be observed down to – 50°. *o*- and *m*-toluidines are probably bodies which give (like glycerol) vitreous solids. The xylenes on cooling in liquid air and then filtering rapidly, can be made to yield a residue melting at about + 5° C., consisting therefore mainly of *p*-xylene. The m. pt. of *o*-xylene is about – 25° C., and of *m*-xylene about —50° C.—W. H. P.

Refractive indices of mixtures of methyl alcohol and water. Doroszewski and Dworzanczyk. See XX.

PATENTS.

Dianthraquinonylphenylenediamines; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 215,294, July 26, 1907. Addition to Ger. Pat. 175,069, Jan. 10, 1905.

BY the action of di-halogen derivatives of benzene on aminoanthraquinones, halogenarylidoanthraquinones are produced; when these are treated with aminoanthraquinones, the remaining halogen is replaced, with formation of dianthraquinonylphenylenediamines. These may also be prepared by prolonging the action of the aminoanthraquinones on the dihalogen-benzenes, or by raising the temperature, until both halogens are replaced.
—T. F. B.

Halogenanthraquinonesulphonic acids; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 217,552, Sept. 30, 1908.

HALOGEN derivatives of anthraquinone are converted into their sulphonic acids by treating them with the sulphonating agent until the products are soluble in water, and then stopping the reaction (compare Fr. Pat. 385,358 of 1907; this J., 1908, 557).—T. F. B.

Anthraquinone derivatives containing nitrogen and sulphur; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 217,688, Dec. 2, 1908. Addition to Ger. Pat. 216,306, Nov. 18, 1908 (see this J., 1910, 14).

WHEN anthraquinone-α-thiocyanate or its derivatives are treated with ammonia, anthrathiazoles are formed, with elimination of hydrocyanic acid.—T. F. B.

Aminoaldehydes; Process for preparing ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 217,385, Feb. 4, 1908.

AMINO-ALDEHYDES may be prepared by the reduction of aminocarboxylic esters, preferably in the form of their salts, by means of nascent hydrogen. Aminocarboxylic acids substituted in the amino group, or containing more acid groups, can be similarly reduced. The preparation of aminoacetaldehyde and of hydroxyphenylaminopropionaldehyde is described in detail.—T. F. B.

Anthracene compounds; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,930, May 20, 1909.

SEE Fr. Pat. 403,205 of 1909; this J., 1909, 1309.—T. F. B.

Trinitrotoluene (1.2.4.6); Process for the purification of ——. V. Vender. Fr. Pat. 405,812, Aug. 7, 1909. Under Int. Conv., Aug. 8, 1908.

SEE Eng. Pat. 18,281 of 1909; this J., 1910, 265.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

PATENTS.

Pentabromindigo; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 3019, Feb. 8, 1909. Addition to Eng. Pat. 13,789, June 29, 1908 (see Fr. Pat. 392,638 of 1908; this J., 1909, 17).

PENTABROMINDIGO may be obtained by bromination in presence of sulphuric acid, as described in the principal patent (*loc. cit.*), but without using excess of bromine. The concentrated sulphuric acid may be replaced by chlorosulphonic acid or fuming sulphuric acid, with or without excess of bromine. Example: 42 parts of

dibromindigo, obtained by brominating indigo, are gradually added to a cooled mixture of 420 parts of 98 per cent. sulphuric acid and 48 to 50 parts of bromine; the mass is stirred for a short time and then heated to 50°—60° C. for 10—12 hours. The product is poured into a bisulphite solution and ice, filtered, and dried. The product is identical with that produced by the principal patent.
—T. F. B.

Dehydroindigo, its homologues and substitution products; Process for preparing compounds soluble in water from ——. L. Kalb. Ger. Pat. 217,477, Dec. 29, 1908.

Compounds of dehydroindigo with bisulphites, such as $C_{16}H_8N_2O_2$, $2NaHSO_3$, are obtained (1) by treating dehydroindigo or its homologues or derivatives with aqueous solutions of bisulphites, or (2) by treating with aqueous or aqueous-alcoholic solutions of sulphites or bisulphites the salts obtained from dehydroindigo and anhydrous acids. The products are of value in dyeing and printing (see also this J., 1909, 1192).—T. F. B.

Leuco-compounds of dyestuffs containing sulphur; Process for preparing ——. Kalle und Co. Ger. Pat. 217,556, June 6, 1908. Addition to Ger. Pat. 213,714, March 29, 1908 (see this J., 1909, 1083).

3-Oxy-(1)-thionaphthene is condensed with dioxindole derivatives of the general type,

$$\text{Alkyl.O.}C_6H_3{<}\begin{matrix}CH(OH)\\NH\end{matrix}{>}CO,$$

preferably in presence of alkali carbonates. The products are leuco-compounds of brown to yellow dyestuffs.
—T. F. B.

Anthracene series; Process for preparing vat dyestuffs of the ——. Badische Anilin und Soda Fabrik. Ger. Pat. 217,570, March 16, 1909. Addition to Ger. Pat. 177,574, Oct. 10, 1905.

Halogen derivatives of benzanthrones are treated with alkali hydroxides or alcoholates, and the products are then halogenated. The dyestuffs obtained in this way from monohalogen-benzanthrones and chlorine, dye red shades, and the corresponding bromine derivatives, bluish violet shades.—T. F. B.

Triphenylmethane dyestuffs; Process for preparing acid chrome ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 217,571, Dec. 18, 1908.

Aldehydo-hydroxybenzoic acids, or aldehydo-hydroxy carboxylic, sulphonic, or sulpho-carboxylic acids of the naphthalene series, are condensed with phenols or their derivatives which do not contain a carboxylic group, and the leuco compounds thus formed are oxidised to dyestuffs, which give orange to red dyeings (compare Ger. Pats. 216,305 and 216,924; this J., 1909, 1309, and 1910, 207). T. F. B.

Sulphonic acids of aromatic aminoazo compounds; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 217,935, Oct. 24, 1908.

Diazo compounds of aromatic sulphonic acids are treated with arylsulphanilides, and the resulting arylsulphaminoazo compounds are converted into aromatic aminoazosulphonic acids by splitting off the arylsulpho group.
—T. F. B.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4767, Feb. 26, 1909.

See U.S. Pats. 933,446, 933,447, 933,448, and 933,562 of 1909; this J., 1909, 1082.—T. F. B.

Disazo dye. C. Heidenreich, Vohwinkel. Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 944,328, Dec. 28, 1909.

See Fr. Pat. 405,178 of 1908; this J., 1910, 267.—T. F. B.

Sulphur [sulphide] colouring matter; Manufacture of a black ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 15,625, July 5, 1909.

See U.S. Pat. 935,009 of 1909; this J., 1909, 1190.
—T. F. B.

[Anthracene] dyestuffs; Process for producing new ——, *and the products thereof.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 405,760, Aug. 5, 1909. Under Int. Conv., Sept. 30, 1908.

See Ger. Pat. 213,501 of 1908; this J., 1909, 1082.—T. F. B.

Thioindigo dye; Process of making a ——. E. Münch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 949,592, Feb. 15, 1910.

See Ger. Pat. 205,324 of 1907; this J., 1909, 134.—T. F. B.

Azo dye for chromed wool and process of making same. H. Oster, Charlottenburg. Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 949,633, Feb. 15, 1910.

See Eng. Pat. 13,917 of 1909; this J., 1910, 267.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Wood pulp and paper mills; Water-consumption in Swedish ——. T. Carlson. Kemi och Bergsvetenskap, 1910, [1]: through Wochenbl. Papierfab., 1910, **41**, 551—552.

The author has collected statistics relating to the amount of water consumed, and the losses of fibre in the effluents at several Swedish mills. In the grinding of mechanical pulp, one mill had 400 cub. m. of effluent water, and another had 300 cub. m., per ton of dry pulp, the losses of fibre in suspension being 56 kilos. and 54·3 kilos. respectively. In ten sulphate (soda) wood pulp mills, the consumption of water ranged from 122 to 360 cub. m. per ton of dry pulp, and one of the largest mills recorded a loss of about 22 kilos. of suspended fibres per ton. Of 30 sulphite pulp mills, 5 showed a water-consumption of 180—250 cub. m. per ton, 22 showed 300—350 cub. m., and 3 others used larger quantities, up to 450 cub. m. per ton. In the sulphite mills the losses of fibre in the effluents amounted to 2—3 per cent. in the manufacture of unbleached pulps, and 4 per cent. in the manufacture of bleached pulps. The concentration of the pulp on the paper machines ranged from 0·33 to 1 per cent., equivalent to 100—350 cub. m. of water, not including the spraying water, per ton of paper. In the manufacture of "news" paper the author found a loss of 11·3—14·8 per cent. of fibre; with sulphite pulp papers, a loss of 3·7—6·4 per cent., and with rag papers, 2 per cent. He concludes that in all pulp and paper mills, some form of plant for the recovery of the waste fibres from the water may be profitably installed.—J. F. B.

Sulphite wood pulp digestion process; Irregularities in the ——. P. Klason. Wochenbl. für Papierfab., 1910, **41**, 464—468, 541—546.

According to the author's investigations, dry spruce wood has approximately the following composition: cellulose, 53; other carbohydrates, 13; lignin, 29; proteins, 1; resin, oil, fat, and ash, 4 per cent. Lignin, like cellulose, is probably not a definite molecular compound, but in its chemical reactions it may be regarded as a condensed derivative of coniferyl and hydroxyconiferyl alcohols, $4C_{10}$ groups being condensed to form the C_{40} aggregate which is the simplest term of the lignin molecule (see this J., 1908, 1080). In the bisulphite process the reacting groups are the four hydroxypropylene chains of the coniferyl derivatives. Two of these combine with calcium bisulphite to form the stable calcium lignosulphonate of the waste lyes. The other two are capable of combining with calcium bisulphite in excess, but the compound is extremely unstable; one of these appears to contain a free carbonyl group, probably in the alternative aldehydic form of the hydroxypropylene chain. From the above data it may be calculated that 1 kilo. of wood is capable of combining, at a maximum, with 105·6 grms. of sulphur dioxide and 45 grms. of calcium oxide. In practice, less than three-fourths of the above amounts are used, but the minimum quantity of lime necessary to saturate the lignosulphonic acid at the end of the digestion is 22·5 grms., corresponding to the stable lignosulphonate mentioned above. If the quantity of lime available for this purpose sinks below 22·5 grms. per kilo. of wood, the digestion is a failure: the unsaturated groups of the lignin become resinified by the action of the free lignosulphonic acid, and the pulp is "overboiled" and charred. The chief cause of this state of things is the production of sulphuric acid, which fixes the lime in the form of calcium sulphate, and removes it from the sphere of action. In some cases the whole of the lime may be thus eliminated and free sulphuric acid may actually exist, with disastrous results. The production of sulphuric acid may be expressed by the equation: $3SO_2=2SO_3+S$. This is a reversible process, but the presence of the lime, by removing the sulphuric acid as it is formed, favours the decomposition in the direction indicated in the equation. One of the chief factors in producing this decomposition is an excessive temperature; anything over 150° C. is dangerous. A low ratio of free to total sulphur dioxide is also dangerous; this ratio should be about 70 per cent., and if it is lower, great care must be exercised with regard to the temperature. A freshly prepared bisulphite lye may be heated alone at 135° C for 15 hours with a loss of not more than 2 per cent. of the sulphur dioxide, but a lye which has been kept for a long time may become completely resolved into sulphuric acid and sulphur on heating. There are, no doubt, intermediate stages in the reaction illustrated above, dithionic, trithionic and thiosulphuric acids representing stages in the decomposition. Theoretically, the presence of a trace of free sulphur is capable of inducing total decomposition of the lye catalytically through these stages on heating. Practically there is an equilibrium in the process, and it has been found that, at 135° C., 250 mgrms. of sulphur may be present per litre of lye, without inducing decomposition through the formation of thiosulphuric acid. This margin of safety is seldom exceeded if the gases be properly washed before absorption, but it should be a rule that no visible traces of free sulphur should ever be permitted in the fresh lye; the latter will not dissolve more than 3 mgrms. of sulphur per litre at the ordinary temperature. The author has found that selenium is 500 times more powerful than sulphur as a catalytic agent in the production of sulphuric acid from sulphurous acid. If the lye be heated at 135° C. for 15 hours with 0·6 mgrm. of selenium per litre, the whole of the lime is precipitated as calcium sulphate, and free sulphuric acid exists in excess, whilst serious destruction of the lye may result from much smaller quantities of selenium. Certain grades of pyrites contain 0·035 per cent. of selenium, and if only 2·4 per cent. of this quantity gets through into the lyes, their efficiency may be destroyed. The selenium probably comes forward from the roasting furnaces in the elementary state in the form of dust. Rapid roasting and high temperatures favour its passage with the gases, and it appears to condense on the particles of zinc oxide which are present in the furnace dust. Its perfect elimination by washing is extremely difficult, and the absorption of the gases is better conducted in towers than in chambers, in the case of pyrites containing selenium, since much of the dust passes up the towers with the exhausted gases. The catalytic action of tellurium has also been investigated and found to be only one-tenth as powerful as that of sulphur.—J. F. B.

Volumetric determination of selenium. Klason. *See* XXIII.

Viscometer for comparing hot pastes. Cappenberg. *See* XVII.

Patents.

Textile fabrics having electrical and other properties. H. P. Pearson, London. Eng. Pat. 4677, Feb. 25, 1909.

Unshrinkable wool fabrics claimed to be more durable than those chlorinated in the piece are manufactured by mixing chlorinated wool fibres with untreated wool fibres. In an example, 3 parts of chlorinated "top" are mixed with 2 parts of untreated "top," and yarn is spun from the mixture. It is stated that electricity is produced in the wearing of such fabrics by friction between the chlorinated and untreated fibres.—H. P. P.

Ramie; Manufacture of batting and yarn of ——. P. Birkenstock, L'Arbresle, France. U.S. Pat. 949,643, Feb. 15, 1910.

The raw decorticated ramie is treated in a sodium carbonate solution, washed, boiled in a caustic soda solution containing sodium sulphoricinate, soured, and again washed. After drying, the material is cut to the length desired for the fibres, and passed on to the opening machine. The resulting fibres are treated in a caustic soda solution, soured, washed, and dried; after which they go through the processes of spreading, carding, and spinning.—H. P. P.

Cork; Process of treating ——. W. and T. Ross, Glasgow. Eng. Pat. 5646, March 9, 1909.

Cork, in an undivided mass, is subjected to heat and pressure conjointly, sufficient only to solidify it without destroying its resilience. The pieces of cork are roughly shaped to the desired form of the finished article, the volume of the original being, however, three or four times greater than those of the compressed product. The cork is then forced into a mould under a pressure of 200—300 lb. per sq. in., and the mould is heated externally at a temperature of 150°—220° F. When cold, the cork is both solid and resilient, and suitable to be worked with tools. If desired, the compression of the cork may be effected gradually in successive moulds of decreasing size.—J. F. B.

Paper pulp; Towers for bleaching ——. J. White and F. Gray, Edinburgh. Eng. Pat. 29,553, Dec. 17, 1909.

In the ordinary type of bleaching tower, the pulp is withdrawn from the bottom and discharged over the top of the tower by means of a pump. In the present invention, the splashing and waste of power involved by that method are obviated by connecting two towers together at the bottom, by means of a pipe in which the pump is situated. Half of the contents of the first tower are then transferred to the second by gravity alone, whilst the remainder is transferred by the pump against a pressure which never amounts to that corresponding to the total height of the tower. In another type of tower, when it is desired to circulate the pulp in the first tower before transferring it to the second, the towers are divided axially by a partition into two compartments. A multiple-way cock is fitted at the bottom of each tower, and a by-pass in each pump connection between two consecutive towers. According to the position of the cock, it is possible either to transfer the pulp from one tower to another, or to circulate it from one side of the vertical partition to the other in the same tower.—J. F. B.

Alkaline pulping liquors; Process of treating spent ——. W. J. Hough, Toledo, Ohio. U.S. Pat. 949,324, Feb. 15, 1910.

Spent alkaline pulping liquors are treated with an acid, *e.g.*, sulphuric acid, to precipitate the resinous and ligneous matters contained in the solution.—J. F. B.

Fibrous and cellular material; Method of indurating ——. L. H. Baekeland, Yonkers, N.Y. U.S. Pat. 949,671, Feb. 15, 1910.

See Fr. Pat. 386,628 of 1908; this J., 1908, 686.—T. F. B.

Fibres from solutions; Apparatus for making ——. W. A. E. Crombie. Fr. Pat. 405,782, Aug. 6, 1909.

See Eng. Pat. 16,557 of 1908; this J., 1909, 978.—T. F. B.

Cellulosic film; Application of the —— to the manufacture of new embossed articles. J. E. Brandenberger. Fr. Pat. 405,429, Nov. 14, 1908.

See Eng. Pat. 24,809 of 1908; this J., 1909, 851.—T. F. B.

Cellulosic film; Application of the —— to the manufacture of articles suitable for binding, morocco dressing, paper tapestry, etc. J. E. Brandenberger. Fr. Pat. 405,430. Nov. 14, 1908.

See Eng. Pat. 24,811 of 1908; this J., 1910, 17.—T. F. B.

Storage of inflammable liquids [collodion]. Eng. Pat. 19,692. *See* I.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Tannin; The fixation of —— upon cotton by means of tartar emetic. A. Sanin. Z. Farben-Ind., 1909, **8**, 343—346; 1910, **9**, 2—4, 17—20, 49—54.

I. *Influence exerted by common salt upon tartar emetic and upon the tannin-antimony salt.*—It has long been known that the solubility of tartar emetic in water is increased by an addition of common salt, and it is here shown that this increased solubility is not due to the formation of an addition compound, but is caused by double decomposition resulting in the production of potassium chloride and sodium-antimony tartrate, which is easily soluble in water. A similar effect is produced by the addition of other sodium salts or of ammonium compounds. Dilute solutions of tannin are not precipitated by dilute solutions of tartar emetic, but with more concentrated solutions a precipitate of antimony tannate is obtained. The precipitation is quantitative in the presence of common salt. Based upon this observation, a reagent is mentioned which has no effect upon gallic acid and other non-tannin impurities of commercial tannins; it is prepared by dissolving 20 grms. of sodium chloride, 20 grms. of tartar emetic, 40 grms. of sodium acetate, and 5 grms. of acid sodium tartrate in 100 c.c. of water. With this solution the presence of tannin in a solution containing only 0·004 grm. of 80 per cent. tannin per litre of water, may be detected. In fixing the tannin mordant upon cotton materials, the formation of acid potassium tartrate has a prejudicial effect upon the levelness, and the author thinks that an addition of common salt (instead of chalk), to the fixing bath, would be of advantage in ensuring a regular and complete fixation of the mordant.

II. *The composition of the precipitates obtained with tannin and tartar emetic.*—Previous investigations upon this subject are reviewed. The experiments were repeated and it is shown by analysis of the products obtained, that the composition of the tannin-antimony compound varies with the concentration of the antimony solution and the conditions of precipitation. A solution of the above reagent, containing 20 grms. of tartar emetic per 100 c.c. of water, added to a 2 per cent. tannin solution, gives a precipitate which, dried at 100° C., has the composition, $C_{14}H_9O_9.SbO$. Solutions of the same strengths, warmed to 80°—90° C. yield a precipitate which has the composition, $(C_{14}H_9O_9,SbO)_2,Sb.OH$. Using a tannin solution of the above strength, but a tartar emetic solution containing but 2 grms. of the salt per 100 c.c., the precipitate obtained possessed the composition, $(C_{14}H_9O_9)_2,Sb.OH$. The first mentioned compound is apparently the most stable.

III. *The composition of the tannin-antimony salt, produced upon the fibre by the usual method of mordanting.*—The author draws attention to the wide variations in the proportions of tartar emetic to tannin which have been recommended in practice. A sample of mordanted cotton was extracted with tartaric acid and the solution was neutralised with sodium carbonate. The percipitate obtained, possessed approximately the formula, $(C_{14}H_9O_9)_2,Sb.OH$. This result is in agreement with those obtained by immersing samples of cotton, impregnated with known weights of tannin, in tartar emetic baths of known strength, and determining the residual tartar emetic by titration. The conclusion is therefore drawn that in mordanting, on the padding machine for instance, the weight of tartar emetic required is one-half that of the tannin, which is in agreement with the quantities usually taken in practice.

IV. *The influence of various conditions upon the completeness of the fixation of tannin upon cotton by means of tartar emetic.*—Although in practice the most suitable proportions of tannin and tartar emetic have been almost universally employed, there has been a great deal of uncertainty as to the degree of fixation of the tannin, and the amount of tannin which, owing to imperfect fixation, is wasted. Data are here given showing the effect of (*a*) time, (*b*) concentration of the tartar emetic bath, and (*c*) addition of salt to the fixing bath. It is shown that the reaction between tannin and tartar emetic is not instantaneous and complete, but that the maximum degree of fixation is obtained by an immersion of about 40 minutes duration in the tartar emetic solution. A longer period of immersion apparently increases the proportion of unfixed tannin from 6·8 to 15 per cent. The stronger the solution of tartar emetic, the more complete is the degree of fixation of the tannin, and the shorter is the time required for the fixation to reach the maximum. As regards the addition of common salt to the fixing bath, the opinion already expressed, that such an addition would tend to increase the degree of fixation of the tannin is justified by the results obtained. It is also shown that the use of salt permits of the concentration of the tartar emetic bath being diminished, and that the time of immersion to ensure complete fixation is shortened. The addition of salt (say 50 grms. per litre) may be recommended not only when mordanting is carried out in "long" baths, but also where "short" baths or padding methods are employed.—F. M.

Textile fibres; Affinity of —— for insoluble colouring matters. L. Vignon. Comptes rend., 1910, **150**, 472—474.

The author has previously shown that precipitated lead chromate suspended in water, dyes silk, wool, and cotton equally well, and that the fibres retain a certain quantity after repeated washings (this J., 1909, 651). Similar results have been obtained with freshly prepared moist Prussian blue, using it (calculated dry) in the proportions of 1 per 4000, 2 per 100, and 5 per 100 of the weight of the fibres, both at the ordinary temperature and at 90° C. After 30 minutes the skeins were washed with cold water; 12 successive washings were needed to remove the unfixed blue in the case of the largest proportions. Freshly precipitated copper sulphide gave similar results. Fine lampblack easily gave deep grey shades. Artificial colouring matters, soluble in alcohol and insoluble in water, obtained in a very finely divided state by pouring 20 c.c. of alcohol containing 0·05 grm. of colour (Lyons Blue, Induline, Scarlet, Rhodamine, &c.) into 500 c.c. of water, dyed skeins of the different fibres nearly equally. It should be noted that in time and on heating, the colour is coagulated and the dyeing power reduced. Microscopical examination of the dyed fibres showed that the mineral pigments and lampblack were fixed superficially in minute granules, whilst those dyed with the finely divided organic colours were uniformly dyed and no isolated particles could be noticed even with very high powers. Fibres were dyed with insoluble β-naptholazobenzene formed in the bath, both at the moment of its formation and after 4 days; under the microscope the first set appeared evenly dyed, but the latter showed small granules. The fixation of insoluble colours is only a phase of the fixation of all extremely finely divided substances, insoluble in the liquid forming the bath, the essential factors being the state of division and the condition of the surface of the fibre. It is a molecular attraction in a physical sense.—A. Sbld.

Viscometer for comparing hot pastes. Cappenberg. *See* XVII.

Patents.

Tubes used in ring spinning and cop dyeing. T. Halliwell, Eccles. Eng. Pat. 19,249, Aug. 21, 1909.

The tube is made of perforated sheet metal and of an outside diameter suitable for spinning "twist" or "weft" as may be required. In either case, the tube stands clear of the spindle at all points except at the two ends. If the tube is for "twist" yarns, it fits the usual spindle cone at its lower end and at its upper end is provided with a short bush which fits the spindle. If the tube is for weft yarns, both its upper and lower ends are provided with bushes which fit the spindle. In each case the lower end of the tube has an outside ferrule. When transferred from the ring spindle to the hollow perforated cop dyeing spindle, the tube fits the spindle at the top and bottom and leaves a cavity between spindle and tube equal in length to the length of the cop. During the dyeing operation, the liquor passes up the spindle, through its perforations into the cavity, and thence through the perforations in the tube into all parts of the cop.—P. F. C.

Tendering of cotton, linen or mixed goods dyed with sulphide colours; Preventing ——. G. F. Holden, Middleton, and P. Maguire, Manchester. Eng. Pat. 3087, Feb. 9, 1909.

The dyed goods are first impregnated with tannic acid or other tannin material and are afterwards treated with a suitable salt of an alkaline-earth metal.—P. F. C.

Dyeings on wool; Process for chroming ——. G. Ulrich. Ger. Pat. 217,236, June 14, 1908.

A mixture of lactic and formic acids may be used in the chroming of dyed wool. The goods may be dyed with an acid mordant dyestuff in presence of 0·5 to 3 per cent. of formic acid; when the bath is cool, the requisite quantities of bichromate and lactic acid are added, preferably with a further quantity of formic acid, and the dyestuff is fixed by boiling. The goods may also be dyed in presence of an ammonium salt; formic acid is then added, to completely exhaust the dyebath, and the dyestuff is fixed as described above.—T. F. B.

Printed yarns for tapestry weaving; Treatment of ——. J. Crossley and Sons, Ltd., Halifax, and A. Herz, Hipperholme, Yorks. Eng. Pat. 7521, Mar. 29, 1909.

Instead of steaming the printed yarns on drums, whereby the hanks become uneven in length, and thus cause inconvenience in the weaving, the hanks are laid around adjustable pins or pegs in a frame and steamed in that position. H. P. P.

Printing on cotton or other fabrics. J. F. Scott, Manchester. Eng. Pat. 22,343, Oct. 1, 1909.

To prevent fabrics shrinking, stretching or creeping during printing, they are run on a base of paper or other non-stretchable material having a surface broken up so as to cause the fabric to adhere to it. This surface is produced either by means of a specially manufactured paper or by coating ordinary paper first with a non-adhesive, impermeable varnish and afterwards printing on an adhesive gum or varnish in a broken pattern.—H. P. P.

Goffering effects stable towards ironing and moisture on yarns, fabrics, etc., by means of proteins; Process for producing ——. E. A. F. Düring. Ger. Pat. 217,679, March 22, 1908. Addition to Ger. Pat. 206,901, May 4, 1907 (see Fr. Pat. 387,567; this J., 1908, 854).

The fibres or fabrics are impregnated with the protein at a temperature at which no coagulation takes place; they are then dried, calendered hot, and the protein coagulated either by steaming or by chemical treatment. By drying the fabrics before calendering, the clogging of the calender rolls is avoided.—T. F. B.

Fabrics; Treatment of ——. A. Huillard, Paris. Eng. Pat. 8331, April 6, 1909.

See Fr. Pat. 401,690 of 1909; this J., 1909, 1122.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid; Concentration of —— in Gaillard towers. Recke. Chem.-Zeit., 1910, **34**, 173—175, 182—184.

It is stated that the Gaillard process for the concentration of sulphuric acid (see Fr. Pat. 367,376; this J., 1906, 1146), has been widely adopted during the past few years, 100 installations being now in operation. In this process the acid is concentrated by direct contact, in the form of spray, with hot gases from a generator fed with coke, the acid and gases flowing in opposite directions. The plant consists essentially of a gas-generator, a concentrating tower constructed of volvic lava, a lead recuperating tower, coke-boxes and a centrifugal fan. The gas from the generator, which is fed with dry coke free from particles of incompletely carbonised coal, is ignited and the hot products of combustion pass upwards through the concentrating tower, then to the bottom of the recuperating tower, up through the latter, thence to the coke-boxes, and are finally delivered by the fan to the chimney. The acid to be concentrated is fed in at the top of the towers, being atomised by forcing it through jets by means of compressed air. The coke-boxes serve to remove the last traces of acid mist from the gases. The acid condensed in the coke-boxes may be supplied to the towers, but it is better to utilise it for other purposes, or return it to the Glover tower of the sulphuric acid plant. The process is stated to be specially applicable to the concentration of very impure chamber acid, and with suitable modifications, to the regeneration of the waste acid from petroleum refining. The total cost of an installation is as follows:—Generator, £44; concentrating tower, £1018; recuperating tower, £80; coke-box, £165; fan, £48; compressor for raising acid, etc., £113; connecting pipes, earthenware and lead, £32; total, £1500. In working the process, the cost of labour is about 5·3d. for 1 ton of 97—98 per cent. acid, 4·7d. for 1 ton of 95—96 per cent. acid, 2·9d. for 1 ton of 93—94 per cent. acid, and 1·2d. for 1 ton of 60 per cent. acid, the corresponding figures for power consumption (for moving the gases and acid) being 0·5—0·6, 0·4—0·5, 0·3—0·4, and 0·1—0·2 horse power. Starting with chamber acid of 54° B., an installation is capable of furnishing, according to Gaillard, 4000—6000 kilos. of 97—98 per cent. acid, 8000—10,000 kilos. of 92—93 per cent. acid, or 30,000 kilos. of acid of 60° B. in 24 hours, with a coke consumption of 20—25, 8—12, and 3—6 per cent. respectively of the weight of concentrated acid. The results shown in the following table have been obtained in practice:—

For acid of the concentration :—

	97–98 per cent. monohydrate.			95–96 per cent. monohydrate.		93-94 per cent. monohydrate.		60° B.
Temperature of gases in °C. :								
At inlet to concentrating tower	850	650	810	760	—	610	—	740
,, outlet from ,, ,, ..	200	207	192	178	173	165	164	108
,, inlet to recuperating tower ..	186	194	180	168	163	156	156	103
,, outlet from ,, ,, ..	134	135	131	122	116	113	112	85
,, inlet to fan	61	62	58	55	54	52	—	12
Suction or pressure in mm. of water column :—								
Inlet to concentrating tower ..	27 –	30 –	22 –	24	26 –	21 –	31 –	17 –
Outlet from recuperating tower ..	24 —	25 –	19 –	21 -	19 —	18 —	27 —	14 -
Inlet to fan	39 —	48 –	43 –	45 —	35 –	43 -	48 —	40 —
Outlet from fan	1·5 +	2·5 +	2·1 +	1·8 +	1·1 +	2·0 +	2·3 +	1·0 +
Concentration and temperature of acid :	°B. °C.	°B. °C.	°B. °C.	B. °C.	B. °C.	B. °C.	B. °C.	B. °C.
Delivered from concentrating tower	66·0 26	65·5 30	65·4 31	65·4 31	65·3 30	65·2 27	65·2 26	60·1 20
,, ,, recuperating tower	56·6 102	53·0 98	51·5 91	49·6 84	47·5 85	46·5 79	46·4 80	— —*
Supplied to both towers	50·4 30	52·5 21	51·0 26	5 ·6 33	50·0 22	49·8 32	49·3 29	51·7 28
Condensed in coke-box I ..	50·4 —	52·7 —	49·4 —	47·3 —	46·0 —	45·0 —	— —	— —
,, ,, II.. ..	25·2 —	41·6 —	35·3 —	32·8 —	32·5 —	25·1 —	— —	— —
,, ,, III ..	4·1 —	16·2 —	16.8 —	14·5 —	15·0 —	5·5 –	— —	— —
Production in 24 hours, in kilos.	9700	6300	7500	8100	9000	12,000	13,600	30,500
Concentration of acid attained	97·3-97·6	97·5-97·9	97·2-97·4	96·0-96·3	95·0-95·2	94·0-94·1	93·1-93·3	60·1 B.
Coke consumption in 24 hours in kilos.	1400	1400	1500	1500	1400	1500	1600	1200
,, ,, in per cent. of concentrated acid..................	14·4	22·2	20	18·5	15·6	12·5	11·0	3·9

* In this case no acid was supplied to the recuperating tower : the acid condensed therein ranged from 45·5—56° B.

A. S.

Sulphurous acid ; Preservation of —— by means of glycerin. E. J. Brown. Pharm. J., 1910, **84**, 244.

SULPHUROUS acid containing 3·8 per cent. of sulphur dioxide to which 5 per cent. of glycerin was added, was kept in a stoppered bottle, three-quarters filled, and occasionally opened : at the end of a year it was found to contain 3·1 per cent., the same acid kept under the same conditions, but without the addition, contained only 1·5 per cent. In the analysis of sulphurous acid and sulphites, by the addition of a little glycerin to the liquid, direct titration with iodine can be substituted, with equally accurate results, for the usual method of adding the liquid to excess of standard iodine and titrating back with thiosulphate.
—A. SBLD.

Citric acid ; Pusch's test for the purity of ——. J. B. Hill. Pharm. J., 1910, **84**, 245—247.

THE following simplified and rapid mode of procedure is recommended :—0·5 grm. of the sample and of pure citric acid are placed in separate test-tubes (6 in. × ⅝ in.) and 5 c.c. of sulphuric acid added to each. The tubes are placed simultaneously in an ordinary Bunsen flame ; at the end of 30 seconds they are withdrawn and examined. The results obtained with acids of different degrees of purity are as follows :—

Pure acid .... = Lemon-yellow solution.
5·0 per cent. of tartaric acid = Black, sulphur dioxide abundant.
1·0 do. do. = Deep brown-black, sulphur dioxide evident.
0·5 do. do. = Deep red-brown.
0·25 do. do. = Red-brown.
0·1 do. do. = Reddish-brown.
0·01 do. do. = Brownish-yellow.

With careful manipulation and sixty seconds heating, 0·0001 per cent. of tartaric acid is said to be easily detected ; even 0·00001 per cent. gave a distinctly deeper tint, in good light, than the control tube. The test is also applicable to citrates, 1 per cent. of tartrate being easily detected. The above method is also applicable for the detection of sugar in citric acid ; the reactions obtained are :—

1 per cent. of sugar .... = Cherry-red, sulphur dioxide distinct.
0·1 do. .... = Sherry colour, sulphur dioxide evident.
0·01 do. .... = Yellowish-red, sulphur dioxide perceptible.
0·001 do. .... = Reddish-yellow.
0·0001 do. .... = Reddish-yellow.

It was also found that 0·5 per cent. of sugar could be detected, in tartaric acid, by the coloration after an hour's contact with cold sulphuric acid ; by heating for 10 seconds in the flame the control tube remained practically unaffected, with 1 per cent. of sugar a red solution was obtained, and with 0·5 a red-brown ring.—A. SBLD.

Iodine in salt minerals ; Occurrence of ——. E. Erdmann. Z. angew. Chem., 1910, **23**, 342—347.

THE proportion of iodine present in the salt minerals of Germany is found to be very much less than that in salt obtained by the evaporation of sea-water, and kainite from Kalusz, a mineral believed to have been deposited directly from sea-water, is found to contain 0·9 mgrm. of iodine per kilo., which is more than twenty times as much as in sylvine, the German salt mineral richest in iodine. As an explanation, it is suggested that during the formation of the German deposits, iodine compounds were largely decomposed, and the iodine lost. For the detection and estimation of iodine in these minerals, 1—20 kilos. of material was fractionally crystallised, and the iodine, thus concentrated in the final mother-liquor, was precipitated (before the other halogens) by adding a little silver nitrate ; the silver iodide was decomposed by treating with sodium sulphide solution, the silver sulphide filtered off, and the excess of sodium sulphide oxidised in the filtrate by hydrogen peroxide ; excess of this reagent was then destroyed by boiling, any iodate present was reduced, and the iodine finally estimated colorimetrically by adding sodium nitrite and carbon bisulphide, or, in the case of a sufficient quantity being present, by weighing as palladous iodide. 1/100 mgrm. of iodine per kilo. can be detected by this method, using 10 kilos. of material. Carnallite is found to be free from iodine, and its absence is attributed to the fact that iodo-carnallite does not form mixed crystals with carnallite.—F. SODN.

Manganates ; Formation of —— at high temperatures. O. Sackur. Ber., 1910, **43**, 381—388.

WHEN manganese oxides are fused with alkali carbonates or hydroxides and atmospheric oxygen allowed to act upon them, there is formed, when the alkali-compound is in excess, the alkali-salt of a manganese compound, in which the valency of the manganese lies between 4 and 6. There is first formed a compound, $Mn_5O_{12}.5M_2O$. Further oxidation then occurs, the final result being a compound having the formula, $Mn_5O_{13}.5K_2O$, in the case of the potassium salt, and $Mn_2O_5.2Na_2O$ in the case of the sodium salt. These salts are decomposed by water, with formation of manganate or permanganate and manganese dioxide.
—J. T. D.

Alkali mangani-manganates. V. Auger. Comptes rend., 1910, **150**, 470—472.

THE author has previously established the existence of mangani-manganates, having the general formula, $Mn_2O_5.2M''O.M''(OH)_2$, and prepared the barium salt (this J., 1904, 328). Sodium mangani-manganate is obtained by heating 10 grms. of potassium permanganate with 100 grms. of sodium hydroxide, moistened with 20 c.c. of water in a silver crucible to 220—260° C., until the evolution of oxygen has ceased: after cooling, the mass is ground, washed in the cold with a solution of sodium hydroxide of 40° B., to remove excess of alkali, and then dried on a porous plate. On analysis the ratio of manganese to available oxygen agreed closely with the theoretical value, but estimations of the sodium differed. The water of crystallisation was estimated in a product which contained an excess of soda: the result corresponded to $Mn_2O_5,3{\cdot}5Na_2O,8H_2O$. The salt crystallises in microscopically small flattened prisms of a beautiful bluish-green colour; on exposure to air it becomes brownish, and it is instantly hydroylsed by water, hydrated manganese dioxide being formed; it dissolves in sodium hydroxide (30 per cent. solution) with a greenish-blue colour. The melt obtained on fusing a manganese oxide with a nitrate or chlorate and an excess of soda never contains an oxide higher than Mn_2O_5. Lithium mangani-manganate is easily formed, and it is only very slowly decomposed by water. The author claims priority over Sackur (see preceding abstract) and agrees with him that when permanganate is heated in presence of potash, the decomposition is arrested at the oxide, Mn_5O_{13}.—A. SELD.

Potassium permanganate; Electrolytic production of —— from potassium manganate solutions. P. Askenasy and S. Klonowski. Z. Elektrochem., 1910, **16**, 170—176.

To secure a good yield and a pure product in the electrolysis of potassium manganate, it is necessary as far as possible to avoid cathodic reduction, and to prevent the manganese dioxide (which is produced by the reduction) from finding its way into the permanganate. It is possible to achieve this without the use of a diaphragm by a suitable choice of cathodic current density, avoiding the high values which would prevent the dioxide from adhering to the electrode, and the very low ones which would favour reduction. Stirring, and the use of platinum instead of (passive) iron for the anode do not produce any large improvements in the process, which is outlined as follows:—The product of the manganate fusion (this J., 1910, 275) receives its final heating to 500° C. in a current of air with continuous grinding, till 1 grm. of the material contains at least 0·7 grm. of manganate. This is added while still warm to caustic potash solution to produce an electrolyte which will contain 85 grms. of manganate and 50 grms. of potash per litre. After filtering through asbestos, the filtrate is electrolysed and the residue (manganese dioxide) is used for the manufacture of more manganate. The cell consists of an iron vessel serving as anode, with an iron cathode, the temperature being kept about 60° C.: the E.M.F. about 2·8 volts: current density at the cathode, 0·85 amps. per sq. cm., and at the anode about one-tenth as great. The distance between the electrodes is 15 to 20 mm. Under these circumstances 100 grms. of manganate with 20 ampère-hours (150 per cent. of theoretical) is about two-thirds converted into permanganate. One kilo. of permanganate requires about 0·7 kilowatt-hour. After electrolysis the hot solution is allowed to cool, and the crystals separated in a centrifuge. They are washed with a little dilute caustic potash and then with a little water, and if required absolutely free from dioxide, they are crystallised, after filtration through asbestos. The mother-liquor is concentrated *in vacuo*, the salts which separate (mostly manganate with a little permanganate) being used in another electrolysis, while the alkali (after causticising if necessary) is used either for another electrolysis or for the preparation of more manganate.—W. H. P.

Cupri-compounds; citrates, tartrates, acetates. S. U. Pickering. Chem. Soc. Proc., 1910, **26**, 17—18.

THE constitution suggested for the cupric carbonates (see this J., 1909, 793) has been confirmed by a study of the citrates, of which eleven have been isolated or recognised. They are derived from the potassiocupric citrate, $(C_6H_5O_7)_2K_4Cu$, the copper becoming electronegative by union with two carbons, and also quadrivalent. The β-salt contains $M^IOHOC{\cdot}Cu^{IV}O{\cdot}CO_2$ (in which case it is alkaline), or $Cu^{II}O_2C{\cdot}Cu^{IV}O{\cdot}CO_2$, resulting from the union of potassium hydroxide or cupric oxide with the double citrate. More potash converts the $:Cu^{IV}O$ into $:Cu^{IV}OHOK$, the substance becoming violet, oxidising dextrose and combining with cellulose. This is the λ-salt. The a-salt is produced from the double salt and an alkaline carbonate, the elements of potassiocupric carbonate becoming added to the former. The double salt dissolves to form a β-cupri-salt with $(HO)_2C{\cdot}Cu^V O{\cdot}CO_2$: this obviates having to regard the former as a molecular compound. A similar explanation applies to the acetates. Hydroxides of the alkali metals with copper tartrate first form a neutral β-cupritartrate, containing $(HO)_2C{\cdot}Cu^{IV}O{\cdot}CO_2$, and also a $:Cu^{IV}O$ group between each pair of CHOH groups. Excess of alkali converts these into the $:Cu^{IV}OHOK$ groups of the λ-salt. All λ-salts decompose, giving cupric or cuprous oxides: a λ-cupridextrose, with a $:Cu^{IV}OHOK$ group between each pair of carbons, would explain the proportion of copper reduced by dextrose.

Basic salts; Constitution of ——. S. U. Pickering. Chem. Soc. Proc., 1910, **26**, 19.

ADDITIONAL evidence of the individuality of the five basic salts formed by the action of lime on copper sulphate is given, and it is shown that whilst the lower members are true basic salts, the higher members contain electronegative copper, and show all the properties of cupri-compounds; they also contain calcium oxide and calcium sulphate. The extreme members of the series are simply cuprates of calcium. A simple scheme is suggested which seems to give a full explanation of the constitution and various properties of the compounds. Iron appears to form analogous compounds, namely, ferrates, with the metal in the electronegative condition.

Dithionates produced in the decomposition of silver sulphite and of its double salts; Separation and purification of ——. H. Baubigny. Comptes rend., 1910, **150**, 466—467.

Potassium dithionate.—This is obtained more easily from silver sulphite (the sodium salt is more easily prepared from the double sulphite of silver and sodium). 6—8 grms. of silver sulphite are suspended in 200—250 c.c. of warm water in a flask and brought gently to the boiling point. The reaction is completed in an hour at most. To the cold solution a little phenolphthalein is added, the silver oxide remaining in solution is precipitated by a slight excess of potash and then the sulphuric and sulphurous acids by barium hydroxide solution: the excess of barium is removed by carbonic acid, the liquid being heated finally to destroy bicarbonate. The filtrate is evaporated on the water bath to the crystallising point, the syrupy liquid decanted, the dried salt recrystallised from boiling water and washed with weak alcohol. It is neutral to indicators. Another crop of crystals is obtained by adding an equal volume of alcohol to the concentrated mother liquor, and washing the crystals with weak alcohol. If barium hydroxide is substituted for potash in precipitating the silver, and the excess of barium removed as above, the filtrate on evaporation yields pure crystals of barium dithionate. *Sodium dithionate.*—Solutions of 9 grms. of silver sulphite and 20 grms. of crystallised sodium sulphite are mixed, and the mixture heated to 100° C. The liquid is decanted after 30 minutes, barium nitrate cautiously added to precipitate sulphuric and sulphurous acids, and the slight excess of barium removed by sodium carbonate. The filtrate is neutralised exactly with nitric acid (using methyl orange as an indicator) and evaporated on the water-bath to the crystallising point; the crystalline mass is separated and washed with a mixture of equal volumes of water and alcohol. Another crop is obtained

by adding the alcoholic washings to the mother liquor. From the united lots of crystals, after two recrystallisations and washings, the pure salt, $Na_2S_2O_6$ H_2O, is obtained.
A. Sbld

Dimercuriammonium bromides. H. Gaudechon. Comptes rend., 1910, **150**, 467—470.

Solutions of various concentrations representing the reaction, $2HgBr_2 + 4NH_3$ in presence of water, were kept in closed flasks in the dark at 8°—10° C., and frequently agitated. In the higher concentrations ammonium bromide was added to increase the solubility of the mercuric bromide. After an interval of 21—45 days, needed to establish an equilibrium, the precipitates and solutions were analysed; in all cases free ammonia was found, indicating a limited reaction. The precipitates were separated from the mother-liquors on porous porcelain and dried at 15° C. over baryta; three distinct phases of the reaction were established. The existence of three definite compounds is believed to be established, viz.:—$(NHg_2Br)_4.HgBr_2$; $NHg_2Br.NH_4Br$; and $NHg_2Br.3NH_4Br$, the percentage composition of the last, however, differs a little from calculated amounts, due either to loss of ammonium bromide on drying, or to the reaction not having attained a state of equilibrium. (*See* Rây, Chem. Soc. Trans., 1902, **81**, 650.)—A. Sbld.

Salts in non-aqueous solutions; Reactions of ——. A. Naumann. Ber., 1910, **43**, 313—321 (see also this J., 1909, 1195).

The following compounds are soluble (those marked * with difficulty or sparingly) in ethyl acetate:—Ammonium thiocyanate*; bismuth chloride; cadmium chloride*, iodide, nitrate; calcium bromide, iodide, nitrate; chromium trioxide*; cobaltous bromide*, chloride*, nitrate*; cuprous bromide, chloride*; cupric chloride*; ferrous chloride; ferric thiocyanate; lithium bromide*, chloride*, fluoride*, iodide*, nitrate*; magnesium chloride; mercuric bromide, chloride, iodide, nitrate*; potassium manganate, mercuric iodide; silver sulphate*; stannous chloride; stannic chloride; zinc chloride*. The following are insoluble:—Aluminium chloride, fluoride, nitrate, phosphate, silicate, sulphate; ammonium bromide, carbonate, chloride, iodide, sulphate; barium bromide, chlorate, chloride, fluoride, nitrate, nitrite, sulphate; bismuth nitrate, sulphide; cadmium bromide, carbonate, sulphate, sulphide; calcium carbonate, chloride, fluoride, nitrite, phosphate, silicate, sulphate; chromium carbonate (basic), chloride, fluoride, phosphate, sulphate; cobaltous sulphate; cupric carbonate, cyanide, fluoride, nitrate, sulphate, sulphide; ferrous sulphate, sulphide; ferric chloride, sulphate; lead bromide, chloride, fluoride, iodide, nitrate, phosphate, sulphate; lithium carbonate, metaborate, sulphate; magnesium bromide, carbonate, sulphate; manganous carbonate, chloride, silicate, sulphate; mercurous bromide, chloride; mercuric chromate, cyanide, sulphate, sulphide; nickel chloride, nitrate, phosphate, sulphate; potassium bicarbonate, bromate, bromide, carbonate, chlorate, chloride, cobalticyanide, cyanide, ferricyanide, ferrocyanide, iodate, iodide, nitrate, nitrite, perchlorate, perantimonate, sulphate, thiocyanate; silver arsenite, bromide, carbonate, chloride, cyanide, iodate, metaborate, nitrate, nitrite, oxide, phosphate, sulphate, thiocyanate; sodium bicarbonate, bromate, bromide, carbonate, chlorate, chloride, iodide, metaborate, nitrate, nitrite, sulphate, sulphite, tetraborate; stannous sulphide; stannic sulphide; zinc bromide, carbonate, cyanide, nitrate, sulphate.

Ammonia: if ethyl acetate be saturated with ammonia and then hydrogen sulphide be passed through, white plates of ammonium hydrosulphide are formed, and the liquid slowly becomes yellow through formation of polysulphides; if the gases be passed through in the reverse order, needles instead of plates are formed. *Mercuric chloride:* the solution at 18° C. contains 1 grm. in 2·05 grms. of solvent. Hydrogen sulphide precipitates the white double salt, $HgCl_2,2HgS$. Ammonia precipitates the compound, $HgCl_2,2NH_3$. Ammonia and hydrogen sulphide together precipitate a blackish-grey substance, which on boiling with water yields mercuric sulphide. The molecular weight of mercuric chloride in the solvent is 262·1. *Mercuric bromide:* the solution at 18° C. contains 1 grm. in 7·66 grms. of the solvent. Its behaviour with ammonia and hydrogen sulphide is generally similar to that of the solution of the chloride. *Mercuric iodide:* the solution contains 1 grm. in 68·03 grms. of solvent. It behaves with hydrogen sulphide like the other halides, but ammonia precipitates no ammonia-compound. *Potassium-mercuric iodide:* neither ammonia nor hydrogen sulphide produces a precipitate. Both together form a black precipitate containing mercury and sulphur. *Cadmium iodide:* the solution at 18° C. contains 1 grm. in 54·3 grms. of solvent. Hydrogen sulphide does not precipitate the cadmium completely; the white or yellowish precipitate has the composition corresponding to the formula, $CdI_2,2CdS$. Ammonia precipitates the whole of the cadmium as the compound, $CdI_2,2NH_3$. Both together precipitate cadmium sulphide. Mercuric chloride or bismuth chloride produces a white precipitate of cadmium chloride. *Stannous chloride:* the solution at 18° C. contains 1 grm. in 22·4 grms. of solvent. Hydrogen sulphide precipitates stannous sulphide. Ammonia after long saturation with the gas produces a precipitate of the compound, $SnCl_2,2NH_3$. Mercuric chloride precipitates mercurous chloride, which is not reduced to metallic mercury. *Antimony trichloride:* the solution at 18° C. contains 1 grm. in 16·97 grms. of solvent. Hydrogen sulphide gives no precipitate. Ammonia produces a white precipitate of $SbCl_3,3NH_3$. *Bismuth trichloride:* the solution at 18° C. contains 1 grm. in 60·36 grms. of solvent. Hydrogen sulphide precipitates the bismuth completely as trisulphide. Ammonia precipitates the compound, $BiCl_3,2NH_3$.—J. T. D.

Alumina formed by the oxidation of aluminium-amalgam in air; Note on ——. P. R. Jourdain. Comptes rend., 1910, **150**, 391—394.

The very light fibrous mass of alumina, obtained by the spontaneous oxidation of aluminium-amalgam on exposure to air has been stated to be a hydrate with 5 mols. of water. Analysis of six specimens prepared by the author gave as a mean of concordant results:—water, 46·5; mercury, 3·5; and alumina (by difference), 50·0 per cent. The formula, $Al_2O_3, 5H_2O$, requires 46·9 per cent. of water. The substance was found to lose moisture in air dried by sulphuric acid and gained in weight on exposure to air saturated with moisture. When heated in air, at 100° C., a constant weight was not obtained after several days. After heating for one day at 15° C., in the air, the residue contained 46 per cent. of water; after eight days at 60° C., in the air, 35 per cent.; after ten days *in vacuo* at 110° C., 22 per cent.; and after 14 hours at 200° C., *in vacuo*, 9 per cent. It cannot therefore be regarded as a definite hydrate. It can be used for polishing very hard metals, such as hardened steel.—A. Sbld.

Natural zirconium oxide. E. Wedekind. Ber., 1910, **43**, 290—297.

Large quantities of natural zirconium dioxide are found in the Minaes Geraes district of Brazil and the material is cheaper than zircon ($ZrSiO_4$), which was until recently the main source of zirconium compounds. The author investigated three qualities of the natural zirconium dioxide, namely (1), black, glassy, kidney-shaped pieces; (2), broken, stony fragments; and (3), pebbles. The gassy variety has an olive green or brownish surface and breaks under the hammer into wedge-shaped pieces; between these a brownish-yellow powdery mass occurs which can be mechanically removed and contains all the iron. After its removal the residue contains almost 98 per cent. of zirconium dioxide; the black colour is probably due to titanium. The specific gravity of this product is 5·41. The compositions of the various products are :—

	Glassy variety		Glassy variety mechanically freed from iron.	Broken fragments.		Pebbles.
ZrO_2	94·12	93·43	97·97	88·40	88·19	74·48
TiO_2	0·98	1·59	1·2	3·12	3·07	1·35
Fe_2O_3	3·22	4·00	—	4·07	4·07	10·26
SiO_2(free)	0·43	0·5	1·72	2·50	2·26	14·08
Silicate	1·95		0·1	3·39	3·37	
	100·73	99·52	100·99	101·48	100·96	100·17

Commercial products, ground mixtures of the above varieties, showed on analysis

Loss on ignition.	ZrO_2	TiO_2	Fe_2O_3	SiO_2(free).	Silicate.	Total.
0·8	68·93	0·6	3·59	12·22	14·08	100·17
0·8	68·72	0·61	3·35	11·28	15·64	100·39

The iron and titanium are partially removed by repeated boiling with moderately concentrated hydrochloric or sulphuric acid. If the residue is treated several times with hydrofluoric and sulphuric acids and again ignited, a product is obtained which is pure enough for many purposes. For analysis it is most convenient to fuse with sodium bisulphate in platinum vessels. To completely remove iron for preparative and other purposes, the acid aqueous extract of the mineral is neutralised with ammonia till just turbid, and powdered ammonium carbonate added till no more of the original precipitate is redissolved. A further equal quantity of ammonium carbonate is then added and the whole warmed until iron is precipitated and no yellow coloration is caused in the filtered and acidified liquid with hydrogen peroxide. After cooling, the liquid is filtered, acidified with sulphuric acid, carbon dioxide removed by warming and stirring, and the zirconium hydroxide precipitated with excess of ammonia. It is washed by decantation and converted into the dioxide or salts. The ores contain much occluded gas, consisting of carbon dioxide, nitrogen, hydrogen, oxygen, helium, and traces of argon; 100 grms. of the crude broken ore evolved 221·96 c.c. of carbon dioxide and nitrogen; 76·28 c.c. of hydrogen; 17·95 c.c. of oxygen, and 1·41 c.c. of helium. The ores are very slightly radio-active. (See also this J., 1908, 449, 1151.)
—E. F.

Plumboniobite; The earths of ——. O. Hauser. Ber., 1910, **43**, 417—419.

As the result of analysis of this mineral by wet methods, the author ascribed to it the formula, $R_2''Nb_2O_7+R'''^{1}(Nb_2O_7)_3$, where R'' = Pb, Fe, UO, and R'''^{1} = Y, Gd, Yb. The smallness of the amount of material available rendered the definite recognition of the earth-metals difficult; and careful spectroscopic examination of the mineral has shown that the earth-metals are chiefly gadolinium, samarium, and yttrium. As the mineral is almost free from the cerium and terbium earths, which are the most difficult to separate from gadolinium and samarium, it ought to form an important source of the two last-mentioned metals.—J. T. D.

Tetraphosphorus heptasulphide, P_4S_7. A. Stock. Ber., 1910, **43**, 414—417.

To prepare this substance, the elements in nearly the required proportions, but with a slight excess of phosphorus (100 of phosphorus to 173 of sulphur), are heated together till reaction sets in, and after the reaction has ended, the product is further heated till distillation occurs. The cooled fusion is extracted with and recrystallised from carbon bisulphide, in which the substance, P_4S_7, is but slightly soluble. The crystals are small faintly yellow prisms, melting at 305°—308°—310° C. with slight decomposition. The boiling-point is 523° C., at which temperature decomposition proceeds much more rapidly. The density of the substance at 17° C. is 2·19. It is much more rapidly decomposed by water than is the sulphide, P_4S_3. (See this J., 1910, 210.)—J. T. D.

Gases; Solubility of —— *in water. Influence of colloids and fine suspensions. Pt. I. Solubility of carbon dioxide and nitrous oxide.* Alex. Findlay and H. J. M. Creighton. Chem. Soc. Proc. 1910, **26**, 44 (see this J., 1909, 750).

Under atmospheric pressure, silicic acid increases the solubility both of carbon dioxide and of nitrous oxide; ferric hydroxide and gelatin increase the solubility of carbon dioxide, but diminish the solubility of nitrous oxide; arsenious sulphide is practically without influence on the solubility of either gas; charcoal and silica increase the solubility of both gases. The other colloidal substances examined, diminish the solubility of both gases. Various types of solubility-pressure curves have been obtained: 1. Where increased solubility is found, then at higher pressures the solubility curve (*a*) remains nearly horizontal, or falls to a flat minimum (carbon dioxide in presence of silicic acid, ferric hydroxide, gelatin); (*b*) rises continuously (carbon dioxide and nitrous oxide in presence of charcoal and silica, and nitrous oxide in presence of silicic acid). 2. Where decreased solubility occurs, then at higher pressures the solubility curve may either rise continuously or generally, fall to a minimum and then rise more or less steeply. The cases under 1 (*a*) are probably best explained on the basis of chemical interaction; those under 1 (*b*) on the basis of "adsorption." The behaviour in the cases under 2 probably depends on the action of two factors, namely, solubility of the gases in a polymerised form in the colloid phase (descending portion of the curve), and "adsorption" (rising portion of the curve).

Polonium; Note on ——. Mme. Curie and A. Debierne. Comptes rend., 1910, **150**, 386—389.

Several tons of uranium residues yielded 2 mgrms. of substance containing 0·1 mgrm. of polonium. Fairly pure helium was isolated from the gases given off by a solution of polonium under a high vacuum in a quartz tube, due to the action of the α-rays emitted by this element. The life of radium is about 5300 times that of polonium (which is reduced to one-half in 140 days). The spectrum is being studied with a view to ascertaining if an inactive element is derived from it, polonium, according to theory, being the last radio-active term in the series of derivatives from radium. The atomic weight was estimated to be about 200.—A. Sbld.

Radium emanation; Influence of —— *on equilibrium in a gaseous system.* F. L. Usher. Chem. Soc. Proc., 1910, **26**, 20—21.

A quantitative study of the pressure changes following the introduction of radium emanation into ammonia and mixtures of nitrogen and hydrogen, coupled with analysis of the resulting mixture of gases, lead to the following conclusions: (1) Ammonia is decomposed rapidly at the ordinary temperature, and solid ammonia less rapidly at −190° C. (2) This decomposition is nearly irreversible, and re-combination of nitrogen and hydrogen was not observed to take place to a greater extent than 0·86 per cent. (3) At the ordinary temperature the decomposition follows approximately the course of a unimolecular homogeneous reaction when correcting factors for the decay of the emanation, and alteration of its efficiency with time, are introduced. (4) The maximum effect observed was the decomposition of 134,300 molecules of ammonia per atom of emanation. The energy required to produce this effect is about one per cent. of the energy actually expended during its production. (5) If the ratio of ammonia to emanation molecules does not exceed 10,000 to 1, the statement that each atom in disintegrating produces the same effect is not strictly true, on account of the waste involved when the system is rich in emanation. (6) All experiments with gases in glass vessels in presence of the emanation are complicated by the fact that gas is driven into the glass, and can only be recovered by heating strongly in a vacuum.

Hydrogen; Reaction of nascent —— in the dry state. A. C. Vournasos. Comptes rend., 1910, **150**, 464—465.

Nascent hydrogen liberated on heating dry sodium formate reacts with several elements which do not combine directly with free hydrogen. *Phosphorus.*—When sodium formate melted at 200° C., is subjected (after displacement of air by hydrogen) to phosphorus vapours obtained by heating this element to 400°—450° C., phosphoretted hydrogen (mixed with phosphorus vapours) is readily formed. This gas is also formed when a mixture of 1 part of red phosphorus and 5 parts of sodium formate (or preferably an equimolecular mixture of sodium formate and hydroxide) is heated in a tubulated retort, after expelling the air by hydrogen, to 400° C., or when a mixture of sodium formate and neutral sodium phosphite (or anhydrous disodium phosphate) is similarly heated. *Sulphur.*—Hydrogen sulphide is obtained in a similar manner, perfectly pure dry gas is readily obtained by heating 1 part of flowers of sulphur with 4 parts of an equimolecular mixture of sodium formate and hydroxide to 400° C., as above. Sodium sulphite is also reduced, with formation of hydrogen sulphide. The sulphides of mercury, lead, and tin similarly treated yield their respective metals and hydrogen sulphide. *Arsenic* and sodium arsenite readily yield arseniuretted hydrogen. Sodium antimonite yields a little stibine. Silicon does not react, but its chloride and sulphide give a little hydrogen silicide. Nitrides yield ammonia; cyanides, hydrocyanic acid; alkali carbides, acetylene, etc.—A. Sbld.

"*Crystallised boron.*" *II.* H. Biltz. Ber., 1910, **43**, 297—306.

The quadratic crystals, previously obtained by Hampe (Annalen, 1876, **183**, 90) and to which he assigned the formula, $C_2Al_3B_{48}$, are much more easily obtained as follows:—50 grms. of boron trioxide, 75 grms. of sulphur, 100 grms. of aluminium "groats" and 2 grms. of soot are mixed and covered in the crucible with a little magnesium powder. This latter is ignited with magnesium ribbon or with paper impregnated with potassium nitrate, and starts the reaction in the mass below. For larger quantities the proportions must be altered: more particularly the proportion of sulphur may then with advantage be reduced. The reguline particles are picked out, repeatedly boiled with water to remove aluminium sulphide, and when they are quite metallic in appearance, concentrated hydrochloric acid is gradually added, and the whole finally warmed to assist solution of metallic aluminium. When the mass is disintegrated, impurities are removed by repeated decantation with water, and the residual crystals are digested with warm dilute hydrochloric acid to remove the last traces of aluminium, which process may take some weeks. Finally the crystals are further washed by decantation with water. From 50 grms. of boron trioxide, about 8 grms. of crystals are so obtained, consisting of 85 per cent. of yellow, quadratic crystals, mixed with black, opaque crystals of AlB_{12}. These can be separated by fractional flotation in a mixture of methylene iodide and benzene, starting with sp. gr. 2·60 and gradually adding more benzene; the yellow, quadratic crystals are slightly heavier than the others. The pure product so obtained has the sp. gr. $2{\cdot}590 \pm 0{\cdot}006$ at 18°/4° C. It is dark brown to metallic grey in colour by reflected, and yellow to brownish yellow by transmitted light. The crystals are quadratic, usually columns with superposed octahedral planes. They are not attacked by hot strong hydrochloric or sulphuric acids, or by a solution of chromic anhydride in strong sulphuric acid. They are slowly attacked by strong, boiling nitric acid. They contain 4·07 per cent. of carbon, 13·38 of aluminium, and 82·1 of boron, corresponding to the formula, $C_2Al_3B_{44}$.—E. F.

The thorium nitrate industry. Times Eng. Suppl., March 3, 1910. [T. R.]

The first thorium factory was started by Welsbach at Atzgersdorf, in Austria, and this factory to-day supplies the thorium nitrate used by the Welsbach and Auer Companies throughout the world, with the exception of the American Welsbach and the German Auer companies. The former company obtain their supplies from scattered deposits in Carolina, and the latter have erected a factory to provide for their own requirements.

For many years past an association of German manufacturers known as the Thorium Convention has dictated prices to the incandescent gas light industry, to which thorium nitrate is a necessity. At the beginning of this industry one kilo. of thorium nitrate cost 2,000 marks but for a number of years past and until quite recently it sold at 26 marks. Apart from the sand which reached the Austrian Welsbach Company, the Convention had a monopoly which could only be broken if the outsiders succeeded in obtaining the sand in large quantities and at competitive prices. The German Auer Company succeeded in acquiring a large quantity of Brazilian sand, and they now manufacture their own requirements at their factory at Weissensee. Other firms followed suit, the sand monopoly was broken for practical purposes, and there are in work at the present time in Europe some half-a-dozen thorium factories, in addition to the Austrian Welsbach factory and to those of the Thorium Convention.

In December last, the Austrian Welsbach Company, finding that the Thorium Convention had set aside an understanding that the Convention should not interfere with the Auer Companies, reduced the price of thorium to 22 marks, and later on, to 16 marks.

The cost of producing 1 kg. of thorium nitrate by the Convention process—which differs materially from the Austrian process—amounts to about 18 marks. From the market price of 16 marks there is deducted 3 per cent. discount and various expenses, and the Austrian Welsbach Company disposed in a few days of about 66,000 kg. of nitrate, being about one-quarter of the world's yearly consumption.

Following the Convention's practice, the majority of such contracts are made with what is known as the "decline clause," entitling the buyer to any lower market price which may be current during the continuance of his contract; the Convention accordingly had to carry out its existing contracts with this decline clause at the same prices and on the same conditions as those offered by the Austrian Welsbach Company. The Convention naturally has to look to the interests of its own customers—the mantle manufacturers—and must supply them at prices which have never ruled before, the penalty being the loss of those customers to the Austrain Welsbach Company. The only course open to the Convention is to come to an understanding with the Austrian Welsbach Company and with the outsiders. Seeing that the Austrian Welsbach Company only held the low market price firm for a week, and have since advanced their figure, and that the Convention has now fixed the price at 19 marks, it would appear that there is some possibility of an understanding. In that event the price of thorium nitrate will again go to the normal figure, as the mantle manufacturers will willingly pay a reasonable price so that they may not be constantly faced with either increases or reductions, which upset all calculations of manufacturing costs and selling prices. At the same time the influence of the Welsbach and Auer Companies, and the inclusion of the outsiders, if such proves possible, should safeguard the consumer against any undue increase in price.

Electrolysis with magnesium cathodes. Schmidt. *See* XI.

Volumetric determination of selenium. Klason. *See* XXIII.

Analysis of calcium carbide with the "decomposition flask." Berl and Jurrissen. *See* XXIII.

PATENTS.

Tin oxide; Process for the production of pure ——. C. A. Jensen, London. From G. Spitz, Brünn, Austria. Eng. Pat. 28,565, Dec. 31, 1908.

TIN-PLATE waste or other material containing tin is heated, under high pressure, with caustic soda or other alkaline solution, with the addition of an oxidising agent, and, from the solution of sodium stannate thus formed, any lead and zinc are precipitated, by means, for instance, of metallic tin and sodium sulphide respectively. The sodium stannate solution, obtained in this or in any other manner, is then treated with carbonic acid, boric acid, or other acids or acid salts. Tin oxide containing 2—3 per cent. of alkali is thereby precipitated; this is washed with water and calcined, after which it is ground, if necessary, and washed with a dilute acid (*e.g.*, 20 kilos. of nitric acid of 36° B. for 100 kilos. of oxide) or with a solution of an ammonium salt, and is then dried. The product is white and contains 99·5—99·9 per cent. of stannic oxide.—F. SODN.

Sulphate of ammonia: Saturators for making ——. G. and N. Wilton, London. Eng. Pat. 3036, Feb. 8, 1909.

THE object of the invention is to provide a large bubbling area in a comparatively small saturator and to arrange for the ready removal of tar, so that ammonium sulphate may be made directly from gas charged with ammonia. The saturator consists of a cylindrical upper chamber, surrounded at its lower edge by an annular gas channel; both are open beneath and dip into the acid solution contained in a settling tank. The gas is caused to bubble through the solution into the upper chamber by passing through apertures or serrations in the cylindrical wall separating the gas channel from the chamber. Any tar which is washed out of the gas floats on the surface of the liquid in the upper chamber and may be drawn off by a pipe provided for the purpose. The settling tank may take the form of an inverted cone, or, if the apparatus be employed for making a saturated solution to be crystallised in another vessel, it may be made with a flat base. The apparatus, which may be constructed of iron lined with lead, is conveniently made in sections which are flanged and jointed together, suitable inlets and outlets for gas, solution, &c., being provided.—F. SODN.

Sulphur from sulphuretted hydrogen and sulphur dioxide; Obtainment and utilisation of ——. W. Feld, Hönningen-on-the-Rhine, Germany. Eng. Pat. 3061, Feb. 8, 1909.

GASES containing sulphuretted hydrogen and sulphur dioxide respectively are treated, either simultaneously or alternately, and at any desired temperature, with a compound of a metal, the sulphide of which is, on the one hand, insoluble and, on the other hand, decomposed by sulphur dioxide, either alone or in the presence of sulphur or air or other oxidising agent, or basic or acid compounds. For this purpose basic or neutral compounds of zinc, manganese, or iron, or their neutral or weak acid salts are suitable; for example, the zinc sulphide formed by the action of sulphuretted hydrogen on a suspension of zinc oxide in water; this is decomposed by treatment with sulphur dioxide, with the liberation of sulphur and formation of soluble thio-salts, and on treating the solution with sulphuretted hydrogen, more sulphur is precipitated and zinc sulphide is re-formed. The process may be carried out in the case of coal gas, by passing the gas through a vertical gas washer containing a number of superposed chambers, in which it is treated with liquor containing zinc thio-salts. From the washer the liquor passes down an absorption tower, situated below, through which sulphur dioxide and air are blown, and then to a tank, in which it is stirred until the zinc sulphide is decomposed; the sulphur is then separated by means of a press, and the liquor is pumped again to the washer. The production of sulphur is, therefore, continuous. Owing to the formation and accumulation of sulphuric acid in the liquor, it is sometimes necessary to add a basic compound or the salt of a weak acid; thus the liquor may be used for the recovery of ammonia from gas, and if much ammonia be present, the formation of sulphuric acid may be increased by boiling the liquor during the treatment with sulphuretted hydrogen or sulphur dioxide or air; the ammonium sulphate is separated and utilised. The metallic compounds may, if preferred, be used in a solid or humid state and the final products separated by extraction with a solvent.—F. SODN.

Gases; Apparatus for use in the liberation of —— from bodies containing the same. F. W. Bartelt, Bristol. Eng. Pat. 3394, Feb. 11, 1909.

THE apparatus described in Eng. Pat. 3395 of 1909 (this J., 1910, 212) is claimed for the preparation of any gas to be obtained by dropping liquid on another substance.
—F. SODN.

Hydrated oxides of iron; Reverberatory furnaces for calcining ——. J. Gill, Pendleton, Lancs. Eng. Pat. 5619, Mar. 9, 1909.

THE furnace is constructed with two or three beds, and the material to be calcined is first heated on the top bed or drying hearth and is then removed to the other beds successively. The fire-grate is arranged with the bars set at an angle of about 30°, and there is an open space of about 10 in. between the lower end of the bars and the back of the grate, so that the clinkers may be pushed into a chamber below, where they drop against another set of bars, preferably water-cooled, and the combustion of any unburnt material is completed; as the fuel slips down the inclined bars, fresh coal falls on the bars from a hopper situated over the fire-hole. A fire-bridge, constructed behind the grate, extends above the bars and forms a combustion chamber, which is supplied with heated air from passages built in the side walls of the grate, whereby immediate and complete combustion of the fuel-gases is effected. Another air passage is continued through the bridge and supplies hot air to the flue beneath the lower bed of the furnace; this flue is intersected by a series of perforated baffle-walls, and in it the hot gases from the grate mix with the heated air. At the further end of this flue a water trough is placed, from which steam rises and is carried, along with the heated gases and air, over the material in the lower chamber and then into the upper chamber. The drying hearth, which may be open or enclosed, is formed by iron plates covering the upper chamber. Any desired temperature may be maintained by manipulating dampers closing the air channels, and thus all shades of oxide, from Turkey red to deep purple, may be produced.—F. SODN.

Sulphur burners. P. H. Grimm, Glencove, N.Y., U.S.A. Eng. Pat. 10,774, May 6, 1909.

THE furnace, which is for the production of sulphur dioxide for fire-extinguishing, fumigating, disinfecting, and other purposes, consists of a combustion chamber suspended in the upper part of a metal jacket, through which water is made to flow; the burning sulphur is preferably contained in a loose tray slightly raised on legs above the floor of the chamber, and air is supplied under pressure. The gas passes out from the furnace and then back through a number of cooling tubes situated in the lower part of the jacket, and, by means of a valved by-pass from the air-supply pipe, any proportion of air may be mixed with the issuing gas. A closed sulphur reservoir penetrates the combustion chamber from above, so that molten sulphur may be supplied as required by manipulating a screw valve. By means of a pipe provided with a valve, the pressure in this reservoir is kept in equilibrium with that in the combustion chamber; by closing the valves, however, the reservoir may be recharged without interrupting the working of the furnace. The supply of air and sulphur are thus under perfect control, and any desired temperature may be maintained, gas of any concentration being produced continuously.
—F. SODN.

Oxygen; Apparatus for making ——. G. von Ach, Newark, N.J. U.S. Pat. 944,473, Dec. 28, 1909.

The apparatus is designed to provide a rapid and simple means of preparing oxygen from the air, and is intended for use in hospitals, &c. The barium oxide or other material is contained in a flattened retort of elliptical section which is heated in a furnace, preferably by gas burners. In the upper part of the furnace is a cylindrical heater, through which the air passes on its way to purifiers containing lime and sodium hydroxide respectively; the purified air is pumped into a reservoir which is fitted with a gauge and outlet pipe, the latter being provided with a pressure regulator. The air passes thence, preferably at a pressure of about 17 lb., through a tube filled with sponges, to retain moisture and oil, into a cylinder containing lime, and from this, through another regulator, to a coil of red-hot pipes in the furnace, and then finally into the retort, which it traverses from end to end. When sufficient oxygen has been absorbed, proper valves are manipulated, and the oxygen is pumped out again and passed to a gasometer or storage tank. The retort may be made of boiler iron, and short flues are inserted from wall to wall, to permit more ready heating; the opposite sides are also joined by tie bolts to prevent collapsing or buckling, and an inlet is provided for the insertion of a pyrometer. Steam may be injected along with the air, if desired.—F. Sodn.

Oxides of nitrogen from the air; Process for producing ——. F. I. du Pont, Assignor to The E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 948,372, Feb. 8, 1910.

The air to be treated is passed through a container which is cooled externally; here it is subjected to the action of an arc extending between electrodes longitudinally with respect to the container and made to rotate, or otherwise move, against the inner surface of the container, which is a non-conductor of electricity, so that the high temperature of the gas is rapidly reduced.—F. Sodn.

Ammonia-condenser. B. Walter, Pittsburg, Pa. U.S. Pat. 948,835, Feb. 8, 1910.

The apparatus consists of a vertical cylinder traversed by a number of vertical cooling pipes which are supplied with water from a common head: a spiral passage of decreasing section is pierced by the pipes, so that, as the gas flows between the pipes, the condensed liquid drains away continuously, and the gas, although constantly diminishing in volume, flows with uniform velocity.—F. Sodn.

Catalytic [agent], and process of making the same. T. J. Wrampelmeier, Berkeley, Cal. U.S. Pat. 948,947, Feb. 8, 1910.

Finely divided pyrites cinder or other suitable material is agglomerated by means of a binding agent capable of reacting therewith, such as sulphuric acid, and the resulting mass is then heated.—F. Sodn.

Silicon carbide; Method for the production of ——. F. J. Tone, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 949,386, Feb. 15, 1910.

A mixture of silica and carbon, substantially free from natural impurities and in such proportions that the silica is in excess of the amount required by the equation, $SiO_2 + 3C = SiC + 2CO$, is heated by electrical means, so as to form crystallised silicon carbide. The operation is prolonged sufficiently to cause the layer of silicon carbide adjacent to the zone of greatest heat to decompose, giving silicon vapour, and this is allowed to react with carbon monoxide to form silicon carbide upon the initially formed crystals, thereby building up transparent crystals of increased size. Interstices for the circulation of gases within the charge may be provided by mixing an excess of "destructible interstitial matter" therewith. F. Sodn.

Nitrogen oxides from atmospheric nitrogen; Process for preparing —— by burning combustibles containing carbon. O. Bender. Fr. Pat. 405,163, July 26, 1909.

See Eng. Pat. 18,203 of 1909; this J., 1910, 211. –T. F. B

Barium compounds [oxide]; Manufacture of ——. C. Rollin, and Hedworth Barium Co., Ltd. Fr. Pat. 405,638, Aug. 2, 1909. Under Int. Conv., Dec. 18, 1908.

See Eng. Pat. 26,140 of 1909; this J., 1910, 276. –T. F. B.

Air; Liquefaction of ——, and the separation of it into its constituents. Soc. l'Air Liquide, Paris. Eng. Pat. 17,216, July 23, 1909. Under Int. Conv., July 24, 1908.

See Fr. Pat. 401,496 of 1908; this J., 1909, 1127.—T. F. B.

Atmosphere; Separation of rare gases from the ——. Soc. l'Air Liquide, Paris. Eng. Pat. 22,316, Sept. 30, 1909. Under Int. Conv., Oct. 3, 1908.

See Fr. Pat. 403,777 of 1908; this J., 1910, 88.—T. F. B.

VIII.—GLASS; CERAMICS.

Plumbiferous glazes and their behaviour with acid liquids. K. Beck, Loewe, and Stegmüller. Arbb. Kais. Gesundh.-Amt., 1910, 33, 203—249.

The authors' results are in general agreement with those of Thorpe (see this J., 1899, 494; 1901, 475, 476, 897). Experiments with lead silicates were made by shaking 2 grms. of the finely-powdered material with 100 c.c. of 4 per cent. acetic acid and 1 per cent. nitric acid respectively in closed flasks for 2 hours, and also for 4 hours, at 25° C. It was found that from mono-silicates the whole of the lead is dissolved by the dilute acids. The proportion of lead dissolved decreases rapidly with increase of the silica-content of the silicate, but even with a high percentage of silica, a small amount of lead is still dissolved by the acids. Tests with boiling 4 per cent. acetic acid gave similar results, except that a larger proportion of lead was dissolved. The amount of lead dissolved is increased by addition of boric acid, borax, and lime, and diminished by addition of alumina to the silicate. Lead glazes are mixtures of different compounds, and by the action of acids, the more easily soluble compounds are removed, leaving behind a practically insoluble residue. The proportion of lead dissolved from fritted glazes varied considerably with the duration of the burning. For example with a mono-silicate glaze, a frit prepared by firing for a short time, gave up the whole of its lead to boiling 4 per cent. acetic acid, whereas from a frit prepared by firing for a longer period, only quite a small quantity of lead was dissolved. Just as in the case of the raw glazes, the fritted glazes containing aluminium proved the most resistant. With regard to the finished glaze on glazed ware, the character of the surface is of importance. Experiments with glazed ware showed that the presence of small quantities of soluble lead compounds cannot be wholly avoided, but these soluble constituents are soon removed by boiling acid liquid several times in the vessels, and the glaze then becomes practically insoluble.

The "softening points" of the different lead silicates and glazes were determined by a method based on the fact that whilst an electric current cannot pass through a mass of fragments of the granulated material, it will pass so soon as the fragments begin to soften and run together. The results obtained were as follow :—

	Mono-silicate: PbO, SiO_2.	Disilicate. PbO, $2SiO_2$.	Trisilicate. PbO, $3SiO_2$	Tetra-silicate. PbO, $4SiO_2$.
Pure	480° C	570° C	620° C	650° C
Containing 5 per cent. borax	450° C	510° C	550° C	590° C
.. 5 per cent. boric acid	460° C	540° C	600° C	—
.. 2½ per cent. lime	520° C	590° C	—	—
.. 2½ ,, alumina	535° C	600° C	630° C	—
.. 5 ,, alumina	595 C	660° C	700° C	

A. S.

Lead-glazed pottery and vitrifiable pigments; Remarks on the [German] regulations for the examination of ——. W. Funk. Z. anal. Chem., 1910, **49**, 137—142.

The German regulations for the examination of lead-glazed utensils and of pottery decorated with enamels containing lead prescribe that no lead must pass into solution when the article is boiled for 30 minutes with a solution containing 4 per cent. by weight of acetic acid. The author points out that, owing to the complete or partial substitution of other metals for lead in modern glazes, it is important to confirm the actual presence of soluble lead by tests other than the hydrogen sulphide reaction. Copper, bismuth, zinc, cobalt, nickel, and iron are employed in glazes and in pigments used for decorating pottery and all but zinc yield dark colorations when their acetic acid solution is treated with hydrogen sulphide; in the case of zinc, however, the zinc sulphide formed may render invisible a coloration produced by any lead which may be present. The addition of hydrochloric acid in definite, but not too great, quantity to the solution before treatment with hydrogen sulphide is recommended for the purpose of preventing these metals, with the exception of copper and bismuth, yielding a coloration. Should a coloration still be obtained, it is necessary to ascertain, by means of well-known reactions, whether such coloration is due to lead or to copper or bismuth before deciding that the article under examination actually contains lead.—W. P. S.

Patent.

Ceramic marble. A. Baker, Blandford, Dorset. Eng. Pat. 24,919, Oct. 29, 1909.

The invention relates to the treatment of certain clay such as is found in the neighbourhood of Wareham, Dorset, which contains a large proportion of iron oxide and has hitherto been discarded as useless. The clay is allowed to absorb moisture, until sufficiently plastic to be worked by hand, and any gritty particles are removed, special care being taken not to disintegrate the mass or disturb its natural veining. Pieces of the required shape and size are subjected to gradual pressure in a press, in such a manner as to ensure that no cracks are formed, and the material is then cut into slabs. After moulding or other suitable manipulation, the articles are gradually dried to the desired extent, any cracks being filled, and are then fired at a temperature of 800°—1000° F., according to the tint required. Ceramic marble is thus produced which is capable of taking a high polish, and is said to be harder than any natural marble.—F. Sodn.

IX.—BUILDING MATERIALS.

Firebricks at high temperatures; Testing crushing strength of ——. M. Gary. Mitt. Kgl. Materialprüfungsamt, 1910, **28**, 23—40.

Cylinders of 5 cm. radius and 5 cm. in height were bored out of the material to be tested by means of a diamond drill, and their crushing strengths were determined, first in the cold, and then at high temperatures. The relation between the crushing strength of such a cylinder and that of a mass of ordinary brick shape was also determined. To determine the crushing strength at high temperatures, a cylinder, bored to admit the terminals of a Le Chatélier pyrometer, was first heated in an electric furnace, and the relation between the electrical conditions and the temperature produced was observed. The cylinder was then disposed between the vertical poles of the electric furnace and mounted between two cylindrical blocks of porcelain. The lower of these blocks rested on the bottom plate of a crushing press, the upper block being placed underneath and in contact with the plunger of the press. Suitable provision was made for the proper insulation of the porcelain cylinders, to prevent loss of heat and injury to the press. It was found that with a single heating to 1200° C., good firebricks showed an increased resistance to crushing strain. The action of repeated heating above 1000° C., both gradual and sudden, remains to be studied.—O. R.

Plaster; The conversion of unduly quick-setting into slow-setting ——. O. Frey. Tonind.-Zeit., 1910, **34**, 242—243.

Too great a proportion of calcium sulphate semi-hydrate causes plaster to set too quickly. This can be remedied, either by recalcining the plaster, or by adding to it a suitable quantity of flooring-plaster, preferably by the latter method.—O. R.

Examination of creosote. Davis. *See* III.

Patents.

Bricks, tiles, slabs, and the like; Manufacture of —— from slate waste. G. J. de Villartay, Paramé, France. Eng. Pat. 20,479, Sept. 1909.

Slate waste, reduced to a more or less fine powder or gravel, is very thoroughly mixed, whilst dry, with cement, as a rule in the proportion, 3 : 1, and then a quantity of water, sufficient to amalgamate the whole, say 100 litres for a quantity of material adapted to make 600 bricks, is slowly added, the mass being constantly stirred. The paste is rammed into suitable moulds, *e.g.*, by the repeated fall of a "monkey" of 150—200 kilos. in weight, and, after removing from the mould, the mass is placed in a drying apparatus for about 10 days and is then immersed in water for about 24 hours; it is finally exposed to the air for a month or six weeks. The articles produced are said to be very strong and not to deteriorate on exposure to sea air.—F. Sodn.

Stones or paving; Manufacture of artificial —— for paving roads, paths, etc. H. Flentje. Fr. Pat. 405,657, Aug. 2, 1909.

See Eng. Pat. 18,102 of 1909; this J., 1910, 27.—T. F. B.

Cement, ores and the like; Process and apparatus for treating —— in the rotary furnace. G. von Landgraf, Leipzig, Germany. Eng. Pat. 9229, April 19, 1909.

See Addition of April 15, 1909, to Fr. Pat. 390,316 of 1908; this J., 1909, 1200.—T. F. B.

Cement; Process and apparatus for making ——. Pine Street Patents Co. Fr. Pat. 405,462, July 26, 1909.

See U.S. Pats. 929,144 and 929,145 of 1909; this J., 1909, 940.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Rolled-iron; Investigation of —— at different stages of manufacture. H. Meissner and H. Felser. Stahl u. Eisen, 1910, **30**, 287—290.

The chemical composition of open-hearth and puddled iron was not found to alter during the manufacture of tubes, nor of Thomas or Martin steel for bar iron. The slag, however, was reduced by 75 per cent. by the rough rolls, owing to it being then comparatively fluid. After cutting up, reheating and rolling, 23 per cent. of that remaining was removed, but no further alteration took place during the subsequent stages to the final shape. The finished tubes on leaving the rolls contained 0·47 per cent. of slag. Microscopical examination of rolled bars showed that the ferrite grains became smaller as the rolling proceeded, being however larger on the outside than in the middle of the bar. Tables of the mechanical tests, with the curves showing the alteration during the various stages are given.—A. H. C.

Electric steel refining. Times Eng. Suppl., March 2, 1910.

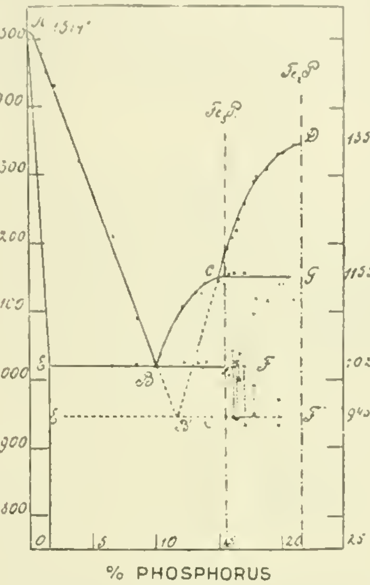
The Héroult electric steel furnace has been recently adopted by the Skinningrove Iron Company for the refining of steel for the manufacture of rails. Three Héroult furnaces are now nearly erected in Sheffield for the manufacture of tool-steel. Their advantages for the production of steel of a quality equal to that of crucible steel, are widely recognised on the Continent. But the adaptation of the Héroult furnace to the refining of lower classes of steel offers a far wider field of operations. By the adoption of the Héroult method of treatment the value of ores low in sulphur and phosphorus will diminish, and vast deposits of cheaper ore will immediately become available for the manufacture of the highest class of steel, whilst the capacity of existing open-hearth and Bessemer plants will be largely increased. By the use of cheaper raw material and the increased output of existing oxidising furnaces the cost of electric refining may be counterbalanced. The Bessemer process will probably receive a new lease of life in working conjointly with the electric furnace. Many specifications now involve open-hearth rails, and even if the Bessemer process be used, the reserves of suitable ore are and will be continually decreasing, whilst the price is consequently rising. Two alternatives remain—to abandon the Bessemer plant and replace it by open-hearth furnaces, or to work the Bessemer in conjunction with the Héroult furnace. In the case of the United States Steel Corporation, where this condition existed, the latter course was adopted. In England it is probable that the same procedure will be followed, notably on the West Coast; and at steel works on the North-Eastern Coast a furnace now being constructed will be used to refine about 200—250 tons of steel per day from a Talbot furnace, the capacity of which will be much increased, since the removal of the sulphur by a preliminary process will be rendered unnecessary and, together with complete deoxidation, will be ensured by the subsequent refining process.

Phosphorus retained with ferric chloride in the ether separation; Determination of ——. R. J. Wysor. J. Ind. Eng. Chem., 1910, 2, 45—47.

The author has examined the method for the separation or iron from other metals based on the solubility of ferric chloride in ether (see Rothe, this J., 1892, 940; Blair, this J., 1908, 902), his experiments being made with a view to ascertain the behaviour of small quantities of phosphorus. Determinations were carried out with mixtures of iron ores of different phosphorus-content and in some cases with addition of known quantities of a solution of diammonium-hydrogen phosphate in hydrochloric acid. It was found that in all cases a certain proportion (ranging from 12·2 to 37·7 per cent. of the total, under the experimental conditions) of the phosphorus remained with the ferric chloride in the ether solution. Under fixed conditions the percentage of phosphorus thus retained is fairly constant. In the methods of the United States Steel Corporation for the commercial sampling and analysis of iron ores, a correction of the weight of the mixed oxides of aluminium, iron, and phosphorus, should be made for the amount of phosphorus retained by the ethereal solution of ferric chloride.—A. S.

Phosphorus compounds of iron. N. Konstantinow. J. Russ. Phys.-Chem. Ges., 1909, 41, 1220–1240. Chem. Zentr., 1910, 1, 601–603.

The author has subjected the alloys of iron and phosphorus to thermal examination. His results differ considerably



from those of Saklatwalla (this J., 1908, 570). The alloys were prepared by fusion in a magnesia crucible in a "kryptol" furnace, and the temperatures were measured by means of Kurnakow's registering pyrometer. The equilibrium-diagram of the alloys containing up to 21 pe cent. of phosphorus is shown in the figure. The branch, A B, corresponds with the separation of solid solutions of the phosphide, Fe_3P in iron; B C to the separation of the phosphide, Fe_3P; and C D to the separation of the phosphide, Fe_2P. The limiting concentration of the mixed crystals is 1·7 per cent. of phosphorus, and the corresponding alloys show a coarsely crystalline structure. The eutectic point, B, lies at 1020° C., and 10 per cent. of phosphorus. The point, C (1155° C. and 15·5 per cent. of phosphorus) represents the transformation-temperature of the phosphide, Fe_3P. The point D, at 1350° C. and 21·4 per cent. of phosphorus, represents the melting point of the phosphide, Fe_2P. In the case of alloys containing from 15·60 to 21·0 per cent. of phosphorus, supercooling phenomena frequently make their appearance on cooling the fused products, which then begin to solidify only at about 945° C., the melting point of the metastable eutectic, B^1, yielding a eutectic mixture $Fe_2P+FeP_{0-3\cdot12}$. But simultaneously, separation of the other phosphide, Fe_3P begins; the temperature rises suddenly to about 1200° C., and the whole mass is converted into the stable eutectic mixture, $Fe_3P+FeP_{0-3\cdot12}$. The author's results, both thermal and micrographic, are in complete agreement with those of Stead (this J., 1900, 1019).—A. S.

Ferro-silicon; Poisonous gases evolved from —— by the action of moist air. P. Lebeau. Metallurgie, 1910, 7, 113—115.

Most of the accidents due to poisoning by the gases evolved from ferro-silicon are in connection with that prepared in the electric furnace, and containing 50 per cent. of silicon and which also spontaneously disintegrates (see this J., 1910, 154). The gases evolved by the action of water on the alloys containing from 50 to 90 per cent. of silicon have been analysed. By means of liquid air the arseniuretted hydrogen and the phosphoretted hydrogen were separated from the hydrogen itself, and on evaporation were passed through a hot tube in which all the arseniuretted hydrogen was decomposed, the unchanged phosphoretted hydrogen being then passed into a solution of copper sulphate. One sample of the alloy containing 50 per cent. of silicon evolved gases containing 56 per cent. of hydrogen, 41·3 of phosphoretted hydrogen, and 2·43 of arseniuretted hydrogen. From a similar sample 375 litres of gas per short ton were evolved. An alloy containing 90 per cent. of silicon yielded 80 litres of gas per short ton, containing 92·1 per cent. of hydrogen, 7·8 of phosphoretted hydrogen, and no arseniuretted hydrogen.—A. H. C.

Ferrosilicons; Determination of silicon in high-percentage ——. G. Preuss. Z. angew. Chem., 1910, **23**, 301.

The author has investigated a process for the determination of silicon in ferrosilicon, which is based on the action of pure potassium hydroxide at a high temperature. The fusion may be made in two ways: (*a*) a mixture of 10 grms. of sodium and potassium carbonates, 0·5 grm. of sodium peroxide, and 0·5 grm. of finely powdered ferrosilicon is heated in a platinum crucible; (*b*) 0·5 grm. of ferrosilicon is covered with potassium hydroxide broken up into small pieces, and heated in a nickel crucible of about 100 c.c. capacity. The alkali must be free from silica, and the crucible is heated with the lid on, gently at first for 20 minutes, so as to avoid decrepitation, and then vigorously until decomposition is complete. The melt is dissolved in hot water, acidified, and evaporated to dryness; the evaporation with acid is repeated and the silica is collected and weighed. Both methods give concordant results. The process is equally applicable to silicon carbide. For the analysis of ferrosilicons containing only 10 per cent. of silicon, the following method is recommended:—0·5 grm. of the sample is heated in a beaker at about 100° C., with 10 grms. of potassium chlorate and 100 c.c. of concentrated hydrochloric acid for an hour; the solution is transferred to a dish and evaporated to dryness. Although the silica is perfectly white, its amount is always from 0·5 to 1·5 per cent. too high: it must therefore be fused with fusion mixture and evaporated twice with acid before it is ready for weighing.—J. F. B.

Sulphide ores [gold]; Treatment of —— in Victoria. S. Radcliff and J. Drevermann. Trans. Australasian Inst. Min. Eng., 1909, **13**, 132—137.

The authors have carried out experiments with a sample of low-grade auriferous concentrates of the composition shown in the following table:—

Size of sieve.	Percentage of ore passing through.	Assay value, gold.	"Insoluble."	Iron.	Sulphur.	Arsenic.
		oz.	per cent.	per cent.	per cent.	per cent.
Original ore	—	2·6	44·9	23·1	16·0	9·0
On 30-mesh	3·7	—	—	—	—	—
,, 60-mesh	57·0	1·9	53·3	21·2	16·2	8·0
,, 80-mesh	5·7	1·15	—	—	—	—
,, 120 mesh	20·4	1·6	—	—	—	—
,, 150-mesh	5·7	1·7	42·8	26·8	19·6	9·4
Through 150-mesh	7·4	4·8	34·1	29·9	23·8	12·3

By means of a Richards tubular classifier, in which the material is subjected to the action of an ascending current of water, the velocity of which can be accurately regulated, the finest fraction was further classified into a light and a heavy portion; the former contained 9 per cent. of arsenic and 7 oz. of gold, and the latter, 25 per cent. of arsenic, and 5 oz. of gold per ton. The ore is free from zinc and tellurium. On roasting there is a loss of from 10 to 15 per cent. of the gold by volatilisation. Laboratory tests showed that by treating the raw ore with bromo-cyanide solution, an extraction of 85 per cent. could be effected, with a moderate consumption of cyanide, the next best treatment consisting of roasting and chlorination, giving an extraction of 75 per cent. on the roasted ore. A test on the large scale with 5 tons of the ore gave an extraction of 81 per cent. with bromocyanide solution, and this method appears to offer distinct advantages over the methods now generally used in Victoria, in which the main portion of the yield is obtained by roasting and chlorination.
—A. S.

Bullion and assay values; Standardisation of ——. Report of the Sectional Committee of the Institution of Mining and Metallurgy, Dec. 15, 1909.

The following proposals are recommended for adoption. (1) Assay reports shall state the exact condition of the sample as to dryness when assayed. (2) Assay values of gold and silver ores and products shall be represented in pennyweights and decimals or in ounces and decimals, and not in oz., dwts. and grains. They shall be expressed in terms of fine gold and fine silver respectively, not as "bullion." (3) Assay values of alluvials shall be reported in grains and decimals of a grain of "fine" gold, or in pence (at 2d. per grain of "fine" gold), or cents per cubic yard. It is recommended that, in the absence of specific information, one cubic yard of ordinary alluvial, excluding boulders, be taken as equivalent to 3,000 lb. (1½ short tons). (4) In reporting assay values of cyanide and other solutions, the results shall be given in parts by weight in a stated volume of the solution. (In the case of cyanide solutions, the use of the "fluid ton of 32 cubic feet" is recommended. It closely approximates to 2,000 lb. and is in common use.) (5) When it is necessary to state or estimate the money value of an ore, etc., (other than of gold), it shall be accompanied by the assay value, and the basis on which the former has been calculated from the latter shall be stated. (6) Laboratory sifting tests shall be made with the I.M.M. Standard sieves, or, when other sieves are used, the widths of the apertures shall be stated. (See also this J., 1907, 1240.)

Copper ores; Electric smelting of —— and of the intermediate products of the copper furnace. W. Wolkow. Metallurgie, 1910, **7**, 99—102.

A silicious copper sulphide containing 8·2 per cent. of copper and 54·8 of silica was smelted in an electric furnace, hammer-scale being added to make the slag more fusible. Very little sulphur dioxide was evolved, and a matte was obtained containing from 61 to 73·9 per cent. of copper. The slag contained 0·15 per cent. of copper. This result was obtained by using only twelve kilos. (26·4 lb.) of the ore and on a large scale the cost would be considerably less than that found with this small quantity. Finely powdered ore can be used without being previously made into briquettes, and it is not necessary to add a large quantity of flux to the mineral. There is very little loss by dusting, or by volatilisation at the high temperature, and the slag contains less copper than that usually obtained from the blast-furnace. A metal containing 96 per cent. of copper with a slag containing 0·6 per cent. of copper was obtained by similarly smelting the mixture of sulphides and oxides resulting on roasting the matte. The process is distinctly suitable where cheap electrical power is obtainable.—A. H. C.

Alloys of copper, aluminium, and manganese; Properties of some ——. *Ninth report to the Alloys Research Committee.* (*With an appendix on the corrosion of alloys of copper and aluminium when exposed to the sea.*) W. Rosenhain and F. C. A. H. Lantsberry. Inst. of Mech. Engineers, Jan. 21, 1910. [Advance proof.]

The investigation was confined mainly to the alloys promising to be of technical value. The test alloys were prepared from electrolytic copper of 99·81 per cent. purity aluminium of 99·67 per cent. purity, and manganese of 95·41 per cent. purity, but subsequent tests showed that results not appreciably different could be obtained by using a cuproferromanganese prepared from commercial 80 per cent. ferromanganese as the source of manganese for the alloys rich in copper, and ferromanganese direct in the case of the alloys rich in aluminium. *Alloys rich in copper.*—Preliminary tests on twenty-two alloys containing up to 10 per cent. of manganese and up to 11 per cent. of aluminium showed that the effect of small quantities of manganese on the binary alloys of copper and aluminium (see this J., 1907, 153, 206) is to raise the yield point and ultimate strength, without diminishing the ductility; larger additions of manganese render the alloys brittle. Further tests on nine selected alloys containing from 0·5 to 5 per cent. of manganese, showed that three of these were sufficiently promising to warrant full investigation. These three alloys contained respectively:—No. 2, 10 per cent. of aluminium and 1 per cent. of manganese; No. 3, 10 per cent. of aluminium and 2 per cent. of manganese; and No. 6, 9 per cent. of aluminium and 3 per cent. of manganese. Tensile tests of these alloys gave the following results:—

Condition.	No. 2. Yield point.	No. 2. Ultimate stress.	No. 2. Elongation on 2 ins.	No. 2. Reduction of area.	No. 3. Yield point.	No. 3. Ultimate stress.	No. 3. Elongation on 2 ins.	No. 3. Reduction of area.	No. 6. Yield point.	No. 6. Ultimate stress.	No. 6. Elongation on 2 ins.	No. 6. Reduction of area.
	tons per sq. in.	tons per sq. in.	per cent.	per cent.	tons per sq. in.	tons per sq. in.	per cent.	per cent.	tons per sq. in.	tons per sq. in.	per cent.	per cent.
Sand casting	14·00	35·76	22·5	—	13·20	34·44	24	—	10·80	31·60	24*	—
Chill casting	16·00	39·90	25	—	16·80	37·00	25	—	14·80	34·40	26	—
1½ in. rolled bars	17·12	38·08	26·5	32·4	18·20	40·40	35	31·3	18·04	38·64	43·5	46
¾ in. rolled bars	25·04	42·84	22·5	33·6	21·40	40·72	29	32	20·00	40·00	39	43·6
¾ in. cold-drawn bars	42·00	50·04	16	—	40·88	52·08	10	—	38·92	44·00	22	40·8

* The specimen broke outside the gauge-marks, so that the recorded elongation is exclusive of the local extension at the fracture.

The effect of either annealing or quenching the alloys at temperatures near 550° C. was not very marked, although alloys Nos. 2 and 3 were injured by annealing and only partially restored to their original condition by quenching. Sand-cast specimens of alloy No. 6 were somewhat improved by annealing at 550° C. At temperatures above 800° C., annealing seriously injured all three alloys, and quenching produced a relatively hard and brittle material of high tensile strength but very little ductility. The hardness of cold-drawn bars due to the cold-working began to disappear after the alloys had been exposed to a temperature of 550° C. The elastic limits of the three alloys were:—No. 2, 8 tons; No. 3, 9 tons; and No. 6, 12 tons per sq. inch, the elastic modulus ranging from $13·6\times10^6$lb. for No. 2 to $14·9\times10^6$lb. for No. 6; the modulus was not appreciably affected by cold-drawing, although the elastic limit was raised considerably. At high temperatures the alloys behaved in tensile tests in a similar manner to the binary copper-aluminium alloy with 10 per cent. of aluminium, but probably would be better than the latter after prolonged exposure to moderately high temperatures (300° C.). Under alternating stress, the three alloys gave almost identical results, the safe maximum stress being about 25 tons per sq. in. for a rate of reversal of 1000 per minute. The alloys gave better results than the corresponding binary copper-aluminium alloy in the single-blow impact test, and better results than Swedish Bessemer steel in the repeated bending-impact test. Although capable of being easily machined and taking a high polish, they proved considerably more resistant to rolling abrasion than tool steel. Laboratory tests in fresh and sea water showed that in fresh water the ternary alloys are more resistant than the binary copper-aluminium alloys, but in sea water, alloy No. 2 loses nearly as much as naval brass, whereas No. 6 is not corroded at all. In constitution the ternary alloys closely resemble the binary copper-aluminium alloys, consisting of either a single solid solution (the *a*-body) or of two phases, in each of which manganese exists in the form of a solid solution.

Alloys rich in aluminium.—The usefulness of alloys at this end of the series is limited by the formation of the hard brittle compound, Al_3Mn. Of 8 alloys containing less than 4 per cent. of either copper or manganese, two were selected for full examination, containing respectively: No. 10, 2 per cent. each of copper and manganese, and No. 11, 3 per cent. of copper and 1 per cent. of manganese. The results with these alloys were not markedly superior to those obtained with the corresponding binary copper-aluminium alloys, except in the case of chill castings, in which form alloy No. 11 had an ultimate strength of 12 tons per sq. inch, with an elongation of 13.5 per cent. on 2 inches. The casting temperature has an important influence on the strength of the ternary alloys. For example a chill casting poured at a mean temperature of 680° C. had a tensile strength of 11·6 tons per sq. inch, with an elongation of 8 per cent., whilst the same metal poured at a temperature of 750° C., had a tensile strength of less than 6 tons per sq. inch and an elongation of only 2 per cent. on 2 inches. The specific gravities of the two alloys in different forms range from 2·71 to 2·80 for No. 10 and 2·67 to 2·79 for No. 11. In the light ternary alloys, three phases have been observed: a solid solution which is nearly pure aluminium containing some copper but practically no manganese, the compound, $CuAl_2$, and the compound, Al_3Mn. Each of these phases forms an eutectic mixture with aluminium. The ternary eutectic which is present in most of the alloys solidifies at 522° C. The two alloys, No. 10 and No. 11 were more resistant to the action of fresh and sea water than pure aluminium, and somewhat better than the corresponding binary copper-aluminium alloys. A series of five binary aluminium-manganese alloys containing respectively 1, 2·5, 5, 7·5, and 10 per cent. of manganese was distinctly inferior to pure aluminium with respect to resistance to corrosion by nitric and sulphuric acids of 10 per cent. and 50 per cent. concentration..

Corrosion tests of copper-aluminium alloys in the sea.—Specimens of binary copper-aluminium alloys (*loc. cit.*) containing respectively 1·06, 3·01, 5·00, 7·50, and 9·90 per cent. of aluminium, and of naval brass and Muntz metal were exposed to the sea at Portsmouth, both alone and bolted to plates of mild steel; the alloys were exposed altogether for a period of 639 days, being examined at intervals. The results obtained were in general agreement with those obtained in laboratory tests (see this J., 1907, 152), except that naval brass alone was found to be superior to Muntz metal. The alloy contained 1·06 per cent. of aluminium was less resistant than naval brass, but the other copper-aluminium alloys were distinctly superior to the latter. In contact with mild steel the four alloys poorest in aluminium showed a gain in weight even after being scraped with a piece of blunt copper. The alloy containing 9·90 per cent. of aluminium showed a slight loss; naval brass in contact with mild steel lost more than Muntz metal. In general it may be stated, however, that in contact with mild steel, all of the alloys are practically unaffected. In all cases the rate of corrosion showed a slight falling off after the first year of exposure. The paper is accompanied by 16 plates containing 92 photomicrographs.—A. S.

Zinc amalgams. E. Cohen and K. Inouye. Z. physik. Chem., 1910, **71**, 625—635.

THE authors have repeated the work of Kerp and Böttger (this J., 1900, 1022), and fail to confirm the observation that the solubility of zinc in mercury reaches a maximum at 81·5° C.; working under improved conditions, they find a regularly increasing series of values for the weight of zinc dissolved by 100 grms. of mercury, as shown below:—

Temp., C.°	Zinc, grms.	Temp. C.°	Zinc., grms.
0·3	1·39	64·75	4·47
19·9	2·03	80·1	5·66
30·0	2·45	89·5	6·50
39·95	2·95	94·8	7·04
50·0	3·49	99·6	7·57

The temperatures at which crystallisation commences were also determined for these amalgams; the results do not agree with those obtained by Puschin (this J., 1903, 423).—F. Sodn.

Alloys; A new method of preparation of ——. K. Friedrich. Metallurgie, 1910, **7**, 97—99.

AN alloy was prepared containing 90 per cent. of tin and 10 per cent. of copper, having a eutectic point at 220° C. At this temperature it was plastic and could be kneaded. It was mixed with powdered smalt-glass and highly compressed while at a constant temperature of 220° C. On cooling and polishing, a material having a white ground with blue spangles uniformly distributed through it was obtained. Another alloy containing 98 per cent. of lead and 2 per cent. of antimony was pressed at the eutectic point of 250° C. with 10 per cent. of iron filings, and yielded a much harder lead mixture. It is suggested that this material might be used as a bearing metal. The author discusses the difference between these mixtures and those prepared by Spring on subjecting finely divided metals to a high pressure at the ordinary temperature. Ornamental alloys may be easily prepared by the admixture of enamels and glasses, as well as materials having a high resistance to heat and electricity by utilising oxides and silicates.—A. H. C.

Zirconium; Elementary ——. *I.* E. Wedekind and S. J. Lewis. Annalen, 1910, **371**, 366—387.

AFTER a survey of the literature relating to zirconium, the authors describe methods for the following determinations in samples of the metal: total zirconium, free zirconium, combined oxygen, nitrogen, and carbon. Samples A, B, and C were of the compact form and obtained from manufacturers; they varied in their appearance and fracture. Two samples, D and E, had been prepared in a vacuum electric furnace. Specimen E had been made by the action of magnesium on zirconium-potassium fluoride, specimen F had been made in a similar way, but was in the form of a powder. Some of the granular metal was melted in a completely evacuated tube which was heated in an electric furnace (sample G). The results of the analysis of these samples are given in the table below.

Sample.	Zirconium.			Total. Zr.	O.	N.	C.	Mg.	Fe.	Ca.
	Free.	combined with								
		O.	N.							
A	83·85	11·70	—	95·55	4·14	none	—	—	Trace	—
B	65·14	17·49	8·70 (?)	91·35	6.18	2·02	0·08	0·28	,,	—
C	—	—	—	90·55	—	—	—	—	—	—
D	56·61	25·4	6·67	88·68	8·97	1·55	—	—	Trace	—
E	24·98	53·68	—	78·66	18·95	—	—	—	—	—
F	87·02	8·54	—	96·46	3·02	—	—	—	—	—
G	92·64	2·55	1·24	96·43	0·9	0·29	—	—	0·4	0·07

All the preparations of zirconium when strongly heated evolved ammonia. Upon prolonged heating between 100° and 200° C., there was an increase of weight, due to the absorption of nitrogen, which became replaced by oxygen. A preparation heated for 10 days to 270° C. was found to contain 21·26 per cent. of oxygen. The metal is unaffected by water even at 70° C.; with the halogens, it forms tetrahalides. Sulphur and oxygen readily combine with it on strongly heating. The action of other reagents upon the metal is described. The authors consider that the density of the absolutely pure metal cannot be far from 6·39 at ordinary temperatures. The atomic volume would then be 14·18. The specific heat, after allowing for impurities was, for sample B, 0·0735; sample D, 0·0656; sample G, 0·0683. The powdered metal when compressed will conduct electricity, but soon becomes heated to redness and then takes fire. A cylinder of the compact metal, 0·8 cm. in height and 1·1 cm. diameter, had about the same electrical resistance as a cylinder of brass of the same dimensions. The hardness of specimens A, B and D was 6·5 to 7·0 by the usual scale for minerals. The melting point is about 2350° C.—F. Sodn.

New Zealand; Economic geology of ——. J. M. Bell. Trans. Australasian Inst. Min. Eng., 1909, **13**, 66—86.

THE author gives a brief description of the mineral resources of New Zealand under the following headings:—(1) gold and silver, (2) copper, (3) iron, (4) antimony, (5) mercury, (6) tin, (7) chromite, (8) manganese, (9) scheelite, (10) coal, (11) petroleum, and (12) cements and building stones. Few of the metalliferous deposits are of commercial importance, the only metals mined extensively being gold and silver. Copper, scheelite, and antimony are worked to a small extent. Coal, of which New Zealand contains a relatively large and very varied supply, is worked in almost every part of the Dominion. In 1908 the output of gold was £1,477,012 from quartz mines and £703,250 from alluvial and dredging fields. Of scheelite, 68 tons, valued at £6055, were produced in 1908. The total output of coal was 1,831,009 tons in 1907, and 1,860,975 tons in 1908. It is suggested that the titaniferous iron sands which are found along the western coast of the North Island, and which are remarkably free from phosphorus and sulphur, may become of some commercial importance.—A. S.

Mineral production of Mexico in 1908—9. Board of Trade J., March 3, 1910. [T. R.]

THE value of the mineral production of Mexico in the year ended 30th June, 1909, is estimated to have been as follows:

	£
Gold	4,502,000
Silver	7,711,000
Copper	2,038,000
Lead	640,000
Zinc	105,000
Iron	120,000
Other metals	205,000
Coal	449,000
Mineral oil	280,000
Total	16,041,000

Analysis of sodium amalgam and zinc dust with the "decomposition flask." Berl and Jurrissen. *See* XXIII.

PATENTS.

Sealing, annealing and coating metals. S. O. Cowper-Coles, London, and Metalloids, Ltd., Tipton, Stafford. Eng. Pat. 23,181, Oct. 30, 1908.

The metal to be coated is heated in a closed apparatus, to, or above the annealing temperature, in a reducing atmosphere, consisting of such gases as, Mond, producer, or water gas, Riché wood gas, or the vaporised lower members of the paraffin and alcohol series, such as petrol or rectified spirit. The reducing gas must be in excess and the water vapour, produced by the reduction of the scale to metal, prevented from condensing by maintaining the ends of the apparatus at a temperature of 100° to 150° C. The cleaned metal is subsequently coated with zinc, tin or the like. The gases may be freed from sulphur compounds and unsaturated hydrocarbons by passing them through solutions of copper sulphate or caustic potash, and strong sulphuric acid, but films of sulphide or carbon are not formed if the temperature is about 870° C.—F. R.

Soldering metals. T. Harden, and Amalgaline, Ltd., London. Eng. Pat. 3134, Feb. 9, 1909.

In place of a ribbon of tinfoil, coated with a mixture of stearine, vaseline, and methylated spirits, to form a self-fluxing solder (see Eng. Pat. 20,615 of 1905), an alloy consisting of 75 per cent. of tin and 25 per cent. of a mixture of bismuth, antimony, and zinc, in any relative proportions, is substituted for the tinfoil, and coated as previously described (*loc. cit.*)—F. R.

Electroplating apparatus. C. G. Backus, New York, U.S.A. Eng. Pat. 8734, April 13, 1909. Under Int. Conv., April 13, 1908.

The articles to be plated are contained in a revolving cylinder or drum mounted on a shaft, which is carried by supporting arms, the upper ends of the latter being provided with contact blocks adapted to engage with stationary contact plates fixed to the sides of the tank, and connected with a source of current. The drum is held firmly in position during the electroplating process by the provision of recessed blocks within the tank, which receive the bearings carried by the supporting arms. The drum is rotated by means of an externally mounted driving shaft, and an intermediate driving mechanism, the latter being carried by a pivoted support, whereby it may be swung out of operative relation with the drum and withdrawn from the tank, thus allowing the drum to be also removed. A sliding clutch-member, extending through the driving shaft, is held in engagement with a companion clutch-member connected with the transmission gearing by means of a helical spring, suitable pins on the former clutch engaging in grooves in the driving shaft for completing the driving connection. When the pins are withdrawn from the grooves against the action of the spring, the clutches are separated, and by a turn of the clutch carrying the pins, the latter rest on the end of the driving shaft, thus permanently breaking the driving connection, so that the transmission gearing may be withdrawn from the tank. The drum comprises suitable ends attached to a cylindrical portion, the latter consisting of a number of longitudinal contacting strips, provided with grooves cut in the contacting edges, thus forming a series of openings for the passage of the electrolyte, or the openings may be angular, thus preventing the passage of the small articles within the drum. Several of the longitudinal strips form a door, the latter engaging at one end with a strap on the periphery of one end of the drum, the other end being fastened to the door by a removable thumb-screw. The electrodes, supported by the drum shaft, comprise "longitudinally-extending yokes" carried by separable collars on the drum-shaft, a number of pendant tongues being pivoted on each of the yokes.—B. N.

Metal; Electrolytic separation of ——. E. M. Chance, Philadelphia, and E. Kent, Lansdowne, Pa. U.S. Pat. 948,681, Feb. 8, 1910.

The improvement consists in subjecting to the passage of an electric current, a fused metalliferous anode, and a fused electrolyte, the anion of the latter having a selective affinity for a metallic component or components of the anode, and which tends to form therewith compounds having markedly different heats of formation. The difference of potential across the cell is controlled so as to effect the selective "decomposition of metal." At the cathode are deposited the metals forming compounds with the anion having relatively low heats of formation, while the metal or metals forming compounds with relatively high heats of formation, remain in the electrolyte.—B. N.

Recovering metals from solutions; Electrolytic apparatus for ——. W. A. Hendryx, Denver, Colo. U.S. Pat. 949,016, Feb. 15, 1910.

A tank, provided with a supply of a "chemical ore pulp solution," is connected to a pump, and the latter attached to a revolving depositing-drum. The drum is provided with an inlet and outlet pipe for the solution, and with a filtering device adjacent to the inlet end. Screens are placed at both ends of the drum, which is also provided with an anode and cathode of suitable metal, such as lead, in granulated or shot form, both electrodes being connected to a suitable current generator.—B. N.

Iron or steel sheets, wire or tubing, or small iron articles, such as nails or screws; Method of coating thin —— *with copper or its alloys.* W. G. Clark, Geelong, Australia. Eng. Pat. 13,445, June 8, 1909.

The process is designed for producing a coating of copper on thin sheets, wire, or tubing, or small articles, for which the method described in Eng. Pat. 16,820 of 1908 (this J., 1909, 986) is not suitable. The articles are first cleaned in a pickling bath containing 1 part of sulphuric or other acid to 10 of water, and are then immersed in a solution composed of 1 part of copper sulphate, 2 of sulphuric acid, 1/3 of boric acid, and 18 parts of water, all by volume. After removal from this bath, the articles are dried, coated with a flux of boric acid (and if desired with a metal to alloy with the copper), heated slowly in a furnace to the melting point of copper, plunged into molten or powdered boric acid, and allowed to cool therein.—A. S.

Copper and other metals [*on iron and steel*]; *Method of depositing* ——. A. Sang, Sewickley, Pa. U.S. Pat. 948,662, Feb. 8, 1910.

Powdered copper, or a mixture of powdered copper and zinc, is applied to the surface of the iron or steel to be coated, and heat applied.—F. R.

Coating metals by cementation. A. Sang, Bellevue, Pa. U.S. Pat. 948,663, Feb. 8, 1910.

The article to be coated is completely imbedded in a metallic coating material, with or without admixture with a reducing agent, and the article then electrically heated to the required temperature by passing a current through it, causing it to act as a resistance core.—F. R.

Alloys; Metallic [*pyrophoric*] ——. Kunheim und Co., Berlin. Eng. Pat. 16,210, July 12, 1909. Under Int. Conv., Sept. 23, 1908.

The claim is for pyrophoric alloys composed of (1) the metals of the rare earths, either singly or mixed together, with (2) alkaline-earth or earth metals or aluminium, the proportion of the latter constituent not exceeding 50 per cent. of the total.—A. S.

Metallic compounds; Manufacture of highly pyrophoric —— *of great stability in air.* Kunheim und Co. Fr. Pat. 405,021, July 12, 1909.

The hydrides of the rare earth metals are melted with metals such as magnesium, calcium, and aluminium or their hydrides, and afterwards treated with hydrogen.

Or, the rare earth metals may be alloyed with other metals, such as magnesium, calcium and aluminium, and the alloys so obtained heated to a high temperature in a current of hydrogen.—O. F. H.

Zinc and other analogous furnaces ; Appliance for charging retorts of ——. E. Dor-Delattre, Dorplein-Budel, Holland. Eng. Pat. 17,103, July 22, 1909. Addition to Eng. Pat. 13,822 of 1908 (see this J., 1909, 206).

The apparatus consists of a propellor, or feed-wheel, having radial blades, rotating within a casing, to which is attached a charging tube. In place of a rigid feed-tube, as in the original patent, which caused damage when it fouled the retort, a triple-hinged intermediate coupling-piece is interposed between the tube and the casing, permitting vertical and lateral movement, the tube being retained in position by means of a spring.—F. R.

Zinc ; Process for obtaining —— *from zinciferous materials.* H. Pape, Hamburg-Billwärder, Germany. U.S. Pat. 948,740, Feb. 8, 1910.

A smelting furnace is charged consecutively with small coke, briquettes composed of pulverised zinciferous material with a reducing agent, and finally lumps of zinciferous material. Subsequent similar series of charges are superimposed at predetermined intervals.—F. R.

Tungsten or other hexavalent high fusing point metals ; Process of producing powdered metallic ——. W. Majert, Berlin. U.S. Pat. 946,551, Jan. 18, 1910.

Finely powdered tungstic salts such as sodium paratungstate, are mixed with powdered carbonaceous reducing material, and the mixture heated in a reducing atmosphere to form a mixture of metallic tungsten and a tungstate. The metallic tungsten is then separated from the tungstate. —O. F. H.

Ores ; Apparatus for treating ——. F. E. Hatch, Pellston, Mich. U.S. Pat. 946,727, Jan. 18, 1910.

Sulphide ores are roasted in an inclined, rotating cylinder, heated electrically. The fumes from the roaster are collected and used for the manufacture of acid, with which the roasted ore is subsequently treated. The roasted ore from the roaster and the acid are delivered to a series of leaching vessels attached to an endless belt which passes over two pulleys. The residue in the leaching vessels is thus automatically discharged as the latter pass over the end pulley. —O. F. H.

Ore-pulp ; Apparatus for treating ——. B. MacDonald, Guanajuato, Mexico. U.S. Pat. 948,766, Feb. 8, 1910.

The apparatus for treating ore-pulp with cyanide or other solutions consists of a vertical receiving tank, having a ridge partition extending across the bottom, forming pockets or compartments, the bottom of each of which is connected by a valve casing to a separate pipe delivering into the top of the tank. The heavier portions of the charge, which tend to settle, are continuously transferred to the top of the tank, through the pipes, by means of injector jets extending upwards into the valve casings.—F. R.

Separation of combined minerals ; Process for ——. A. S. Ramage, Newark, N.J., Assignor to Chemical Development Co., Buffalo, N.Y. U.S. Pat. 949,002, Feb. 15, 1910.

Ores containing copper and iron sulphides, with or without zinc sulphide, are roasted at a temperature only sufficient to decompose the iron sulphide, and then treated with a solution of sodium bisulphate and nitric acid, and the remaining sulphides removed by flotation. Zinc, if present, is removed by roasting the copper and zinc sulphides separated by flotation, to a temperature sufficient to decompose the zinc sulphide only, and subsequently dissolving out the zinc.—F. R.

Ores ; Process of nodulising [agglomerating] fine ——. J. Weatherby, jun., New Cumberland, Pa., Assignor to A. J. Dull, Harrisburg, Pa. U.S. Pat. 949,387, Feb. 15, 1910.

The ore is subjected to mechanical agitation and heat, for example in a rotary kiln, at a temperature insufficient to fuse it, and finely-divided carbonaceous combustible material is introduced into the charge of heated ore, in proximity to its point of discharge from the kiln ; the combustible material is thus burnt in contact with the agitated ore, which raises the temperature of the ore particles and effects their agglomeration.—F. Sodn.

Briquettes ; Manufacture of —— *from powdered ores, fines, etc.* Hasper Eisen und Stahlwerk. Fr. Pat. 404,786, July 6, 1909.

The finely divided ores are mixed with the slime or mud from apparatus used for cleaning blast-furnace gases, and, if desired, also with other binding materials.—O. F. H.

Furnace ; Electric ——, *and method of operating the same.* A. L. J. Queneau, Philadelphia, Pa. U.S. Pat. 948,343, Feb. 8, 1910.

The bath of molten metal is provided with a connection, or multiple connection, of molten metal, and through the latter is passed an electric current, or multi-phase current, so proportioned to its cross-section as to develop a series of "disruptions" in the conductor in close proximity to the main body of metal in the bath. The disruptions alternate with a series of "re-establishments" of the connection, caused by the hydrostatic pressure of the bath, and oxidation of the connection is prevented at the place of disruption by providing reducing conditions at this point. A thorough mixture of the metal in the bath is effected by the pulsations, due to the alternate disruptions and re-establishments.—B. N.

Smelting apparatus. E. Fink, Milwaukee, Wis. U.S. Pat. 948,468, Feb. 8, 1910.

A substantially horizontal rotary barrel smelter, having its central diameter greater than that of the ends, and having a tap hole adjacent to the junction of an end and side, is provided with a flue, supported independently, to conduct away the furnace-gases. Fuel is fed into the furnace by means of a nozzle, in a direction opposed to that of the flow of the products of combustion, in order to heat the charge and the wall of the furnace-barrel above the charge.—F. R.

Blast-furnace gas ; Apparatus for purifying ——. H. Savage, Seraing, Belgium. U.S. Pat. 948,664, Feb. 8, 1910.

The apparatus consists of a closed chamber, divided into two main compartments and having a centrifugal fan, rotating in a closed casing, connecting the two. The blades of the fan on the inlet side have a greater diameter than those on the outlet side. A gas intake opens into one compartment, the outlet being in the other. The lower part of the chamber forms a collecting vessel.—F. R.

Copper ; Process of producing electrolytic ——. A. S. Ramage, Newark, N.J., Assignor to Chemical Development Co., Buffalo, N.Y. U.S. Pat. 949,003, Feb. 15, 1910.

Copper ores are reduced to the metallic state, by heating them in a suitable furnace to a low red heat, and passing a mixture of hydrogen and water-gas over them, the residual gases being burnt under, or around, the furnace.—F. R.

Iron from ores ; Method of recovering —— *and preparing iron alloys.* A. S. Ramage, Newark, N.J., Assignor to The Electric Steel Co. of Canada, Welland, Canada. U.S. Pat. 949,004, Feb. 15, 1910.

Iron ore is reduced by means of a mixture of hydrogen and water-gas, to a metallic sponge, substantially free from carbon. Electrolytic iron is then deposited from a suitable solution, using the spongy iron as anode. The hydrogen occluded in the electrolytic iron, is removed by oxidation.—F. R.

Silver-nickel-cobalt-arsenic ores; Treatment [smelting] of ——. C. C. Cito, Irvington, N.J. U.S. Pats. 949,058 and 949,261, Feb. 15, 1910.

(1). Arsenical ores of silver, nickel, and cobalt, free from lead, are smelted with sufficient copper to produce an alloy containing all the silver, nickel, and cobalt and most of the arsenic, the metals being subsequently separated by electrolysis, using a solution of copper sulphate as the electrolyte. (2). The ores are smelted with a percentage of copper, at least equal to that of the arsenic, and not less than two-thirds that of the nickel and cobalt.—F. R.

[Metallurgical] Retort furnace. N. H. Freeman, Boulder, Colo. U.S. Pat. 949,178, Feb. 15, 1910.

The retort consists of a conical vessel heated externally in a furnace and filled with molten metal. It is provided with a cover, and a central hollow shaft passes through a stuffing-box on the latter, and is rotated by suitable gearing from above. The exterior of the shaft is furnished with horizontal discs, spaced apart, and an internal, independently rotated worm or screw is arranged within the hollow shaft. The ore is fed into the top of the central shaft and is forced down into the molten metal by the screw. It emerges from the bottom of the shaft and passes upwards through the molten metal, being compelled to take a zig-zag course by the horizontal discs, which alternately extend to, and fall just short of, the sides of the retort. The discs which extend to the wall of the retort are provided with openings near the centre for the upward passage of the ore, which in the case of the other discs passes between their edges and the side of the vessel. The retort is also provided with a skimmer-blade at the top to remove the ash or scoria and with an overflow spout.—W. H. C.

Furnace; Open-hearth ——. S. E. Meyers, St. Louis, Mo. U.S. Pat. 949,192, Feb. 15, 1910.

The furnace consists of a central smelting basin contained in a housing, the latter having a combined heat and air passage at each side, and a pocket located beneath each passage to separate and catch the slag passing from the furnace-chamber. A carbon chamber is situated at the rear of the slag pocket, to catch the carbon which separates from the slag during its circulation, and a "checker-generator" is located immediately beyond. Valves are provided for regulating the flow of air, and also clean-out doors for the removal of the carbon and sediment.—F. R.

Carburising or case-hardening materials, etc. H. Rodman, Pittsburg, Pa. U.S. Pats. 949,441 to 949,449, and 949,549, Feb. 15, 1910.

(1). Spent carburising material is made fit for use again by adding to it carbonaceous material and soda ash. (2). The deterioration of carburising or case-hardening mixtures composed of a carbonaceous material and an energising substance (*e.g.*, soda ash) is prevented by coating the particles of carbonaceous substance with a viscous hydrocarbon, with which the energising substance is incorporated. (3). A carburising material is produced by mixing together a carbonaceous substance and an energising substance, such as soda ash, and heating the mixture to the fusing point of the latter. (4). A carburising mixture containing coking coal, peat, and lime or soda ash or a mixture of the two. (5). Soft non-coking coal and peat are prepared for use as carburising material by shrinking them by the application of heat. (6). A carburising or case-hardening material containing coke and lime or soda ash or a mixture of the two. (7). A carburising or case-hardening material containing soft coal ("coal of the lignite or peat series"), and lime or soda ash or a mixture of the two. (8). A carburising or case-hardening material is prepared by coking a mixture of coking coal and an energising substance such as soda ash. (9). A carburising or case-hardening material consisting essentially of coke, soda ash, and lime. (10). A carburising or case-hardening material is prepared by coking a mixture of coking coal and limestone.—A. S.

[Cyaniding, etc.] Treatment of sands or the like with liquids. C. E. D. Usher, Assignor to Adam-Usher Process, Ltd., Johannesburg, S. Africa. U.S. Pat. 949,455, Feb. 15, 1910.

A charge of "sands" or other material to be treated, is placed in a tank and the required liquid forcibly injected into the lower part of the charge, through a number of apertures in close proximity to, and extending substantially over the entire area of the bottom of the tank. The clear liquid, collecting at the surface of the agitated material, is drawn off and re-injected at the bottom of the mass.
—F. R.

Iron; Process of refining ——. F. W. Hawkins and G. F. Key, Assignors to The Globe Steel Filtration Process Co., Detroit, Mich. U.S. Pat. 949,474, Feb. 15, 1910.

Most of the oxidisable impurities are removed by atomising the molten metal in an oxidising atmosphere, the remainder being eliminated by a second similar treatment. The non-oxidisable impurities are removed by a subsequent percolation through a filter-bed consisting of comminuted basic material.—F. R.

Iron or steel articles; Process of bluing ——. M. Rees, Follansbee, W. Va., Assignor to W. A. Skinkle, Cleveland, Ohio, and W. Thomas, Pittsburg, Pa. U.S. Pat. 949,500, Feb. 15, 1910.

The iron or steel articles are placed in a closed receptacle, heated to about 650° F., and subjected to the action of "sulphur and carbon gases," together with steam and the heated air already contained in the receptacle. The articles are finally allowed to cool while still enclosed in the receptacle.—F. R.

Iron or steel articles; Method of treating [for tinning or galvanising] ——. H. Howard, Boston, Mass. U.S. Pat. 949,575, Feb. 15, 1910.

The articles to be tinned or galvanised are first treated in an acid pickling bath, to remove scale, and then connected up to form the cathode in an alkaline electrolytic bath.
—F. R.

Steels; Refining of molten —— obtained in furnaces not heated electrically. Soc. Anon. Electrométallurgique (Procédés P. Girod). First Addition, dated June 7, 1909, to Fr. Pat. 402,758, May 6, 1909 (this J., 1909, 1204).

A temperature of about 1100° is adopted instead of 700°—900° C., as the temperature at which deoxidation and release of occluded gases are brought about, and the lowering of the temperature of the bath is accomplished by the addition of cold scrap such as turnings.—O. F. H.

Iron; Process for the protection of —— from atmospheric influences. E. Wasserfuhr. Fr. Pat. 404,847, July 7, 1909.

The iron is sprayed or sprinkled with a liquid consisting of a "fatty substance" dissolved in water.—O. F. H.

Zinc; Process of treating ——. S. Frank, Frankfort on Maine, Germany. Eng. Pat. 14,342, June 18, 1909.

See U.S. Pat. 935,900 of 1909; this J., 1909, 1142.—T. F. B.

Furnace; Electric —— for the reduction of iron and other ores. Aktiebolaget Elektrometall. Fr. Pat. 405,347, July 23, 1909. Under Int. Conv., Aug. 1, 1908.

See Eng. Pat. 17,342 of 1909; this J., 1910, 95.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Electrolysis with magnesium cathodes. F. Schmidt. Elektrochem. Zeits., 1909, 16, 157—160, 189—193, 228—232, 256—265.

The electrolysis of solutions of sodium chloride using platinum anodes and magnesium cathodes, but no diaphragm, has been studied by the author. The gas coming from the cell was collected and analysed from time to time in order to determine the amount of hydrogen which had been used up in reducing the hypochlorite formed to chloride. The contents of the cell were also analysed at intervals, the amount of hypochlorite and chlorate being determined. Magnesium is more readily attacked by a solution of an alkali chloride than by pure water, and as soon as the magnesium cathode is placed in the electrolyte, a deposit of magnesium hydroxide is formed on it ($Mg+2H_2O=Mg(OH)_2+H_2$); this deposit acts as a diaphragm and prevents the hypochlorite coming into direct contact with the cathode, and so being reduced. The result is that there is a quantitative evolution of hydrogen from the cell. The yield of hypochlorite is, however, not quantitative, owing to the secondary formation of chlorate and decomposition of the hypochlorite with the evolution of oxygen. The evolution of hydrogen is quantitative so long as high current-densities are used, and is also independent of the temperature (from 0° to 75° C.). The only influence of high current-density and high temperature is that some of the magnesium hydroxide breaks away from the cathode from time to time, but it is immediately replaced by more of the magnesium dissolving: the result is that there is a slight excess of hydrogen evolved over that which would be obtained simply by the passage of the current. Diminution of the concentration of the solution from 30 to 10 per cent. of sodium chloride resulted only in a slight increase in the amount of chlorate formed and oxygen evolved (decomposition of water). The reducing effect of the hydrogen on the hypochlorite was completely suppressed even with as low a current-density as 0·023 amp. per sq. cm., whereas the addition of chromate to the electrolyte, using platinum electrodes, failed to produce this effect at such low current-densities. Of technical importance is the fact that a higher voltage is necessary for a given current when a magnesium cathode is used than when the electrode is of platinum, because of the increased internal resistance of the magnesium hydroxide surface-layer. As the hypochlorite concentration increases, the chlorate concentration also increases. In prolonged experiments the hypochlorite concentration finally becomes constant, and also the amount of oxygen evolved, 66·6 per cent. of the current then being used up in the formation of chlorate, and the remainder in the evolution of oxygen. The highest hypochlorite concentration obtained was equivalent to 6·16 grms. of active oxygen per litre, whilst Oettel, using a platinum cathode, obtained 5·73 grms. per litre. Taking everything into consideration, the efficiency of the cell with a magnesium cathode is very little better than when a platinum cathode is used. Cathodes of zinc, cadmium, manganese, antimony, Britannia metal, and magnalium were tried in place of magnesium, but in no case was the reduction of the hypochlorite by the evolved hydrogen prevented. Electrolytes of alkali iodides and bromides gave similar results to those obtained with sodium chloride, except that the efficiency was much increased. In one experiment with a magnesium cathode, the yield of iodate from an iodide electrolyte was 98·50 per cent., whereas with a platinum cathode it was only 32·69 per cent. A similar suppression of the hydrogen reduction was obtained in the electrolysis of solutions of sodium nitrite and ammonia, but the action of the magnesium cathode was considerably affected by the presence of heavy metals as impurities in the electrolyte.

Rapid electro-analysis with stationary electrodes. Stoddard. *See* XXIII.

Electro-chemical action and boiler corrosion. Burgess. *See* I.

Electrolytic production of potassium permanganate. Askenasy and Klonowski. *See* VII.

Patents.

Electrolyte for primary batteries; Improved preparation to be employed in making ——. B. E. R. Newlands, London, and R. M. Parkinson, Peterborough. Eng. Pat. 11,926, May 20, 1909.

A dry or solid preparation is made by mixing together 125 c.c. of concentrated sulphuric acid and 200 grms. of sodium bichromate, or near approximations to these proportions, or an equivalent proportion of potassium bichromate may be used instead of the sodium salt. To this mixture, when the battery is to be used, 20 grms. of sodium chloride in solution are added, and water to make the solution up to 1 litre in volume.—B. N.

Accumulators; Regenerating electric ——. J. Friedrich, Cologne, Germany. Eng. Pat. 19,111, Aug. 19, 1909.

Accumulators which show a decrease in capacity, are regenerated by removing the working electrolyte, and charging the cells with a slightly acid aqueous electrolyte to which no solid electrolytic substance has been added. A current of electricity is sent through the cell, first in a direction opposite to that of charging, and afterwards in the normal charging direction. The acid electrolyte is then replaced by the working electrolyte.—B. N.

Secondary battery plate. W. Morrison, Des Moines, Iowa. Assignor to The Westinghouse Storage Battery Co., New York. Re-issue No. 13,083, Feb. 15, 1910, of U.S. Pat. 916,576, March 30, 1909.

The active material comprises lead or lead oxide, sulphuric acid, water, and ammonium sulphate, with an insoluble, inert, "non-setting" sulphate, such as barium sulphate, precipitated from a solution of barium hydroxide or a soluble barium salt.—B. N.

Alkaline storage batteries; Treating cans of ——. T. A. Edison, Orange, N.J. U.S. Pat. 948,542, Feb. 8, 1910.

In order to prevent crystallisation of the alkaline salt on the exterior of the cans or receptacles of alkaline storage batteries, a non-saponifiable oil is applied to the outside, which is then wiped lightly with a cloth, so as to leave only a microscopic film on the exterior of the vessel. —B. N.

Electrode; Storage-battery ——. T. A. Edison, Orange, N.J., Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 948,558, Feb. 8, 1910.

The active mass comprises a compressed agglomeration of relatively large active particles of nickel hydroxide, individually surrounded by flake-like conducting material composed of nickel.—B. N.

Batteries; Rejuvenating storage ——. A. O. Tate, Toronto, Ontario, Canada. U.S. Pats. 949,506 and 949,507, Feb. 15, 1910.

(1) A depleted storage battery cell of the "applied oxide type" is renewed by electrolytically reducing the oxidised faces of the metallic anodes, and their applied oxide, to metallic lead, and simultaneously electrolytically oxidising the spongy metallic lead of the cathodes, until both anodes and cathodes have assumed their normal or original efficiency. (2) The method, which is intended to give increased life to a storage battery plant, consists in cutting out, at stated intervals, a definite percentage of the cells, which have deteriorated through the presence of an abnormal amount of oxide upon the anodes, produced by continuous charging in the same direction, and substituting for these a similar number of cells, which have been previously charged to their normal or original efficiency whilst disconnected. The disconnected cells are then fully charged by a current flowing in a direction

opposite to that utilised in previous charges, until the cells have assumed their normal efficiency. This substitution is successively continued in sequence throughout the entire system of cells.—B. N.

Furnace ; Electric ——. C. A. Weeks, Philadelphia, Pa. U.S. Pat. 949,511, Feb. 15, 1910.

The furnace comprises a hollow body with end walls, and provided with a lining having inturned walls fixed at or near its end portions, so as to form an annular retaining hearth. Means are provided for supporting and revolving the body and inturned walls about a substantially horizontal axis, in order to interchange the roof and hearth. Electrodes are arranged through the inturned walls, projecting axially into the furnace chamber, and a condenser is attached to an opening in one of the side walls.—B. N.

Producing pure tungsten for electric incandescence lamp-filaments. Fr. Pat. 405,323. *See* IIb.

Treating metallic filaments for electric incandescence lamps. Fr. Pats. 405,324 and 405,325. *See* IIb.

Fixing metallic filaments to leading-in wires of [electric] incandescence lamps. Fr. Pat. 405,326. *See* IIb.

Production of silicon carbide. U.S. Pat. 949,386. *See* VII.

XII.—FATS ; OILS ; WAXES.

Fish oils in vegetable oils ; Detection of ——. O. Eisenschiml and H. N. Copthorne. J. Ind. Eng. Chem., 1910, 2, 43—45.

One hundred drops of the oil are dissolved in a mixture of 3 c.c. of chloroform and 3 c.c. of glacial acetic acid, a slight excess of bromine is added, and after about 10 minutes, the test-tube containing the mixture is placed in boiling water. Under these conditions, in the case of linseed and other vegetable oils, any precipitate formed is re-dissolved, whereas in the case of fish oils, the cloudiness is permanent. It is stated that 10 per cent. of fish oil in vegetable oils can be easily detected by this test, and with very little practice, even 5 per cent. can be detected. In the case of boiled oils, it is necessary to first remove the metallic driers. Fish oils which have been heated to 260° C. or above, will not respond to the test. The precipitate may be filtered off and weighed. Experiments with mixtures of different proportions of linseed oil with a sample of menhaden oil, which alone gave 9·1 per cent. of bromine-derivatives insoluble in the mixture of glacial acetic acid and chloroform, showed that the weight of precipitate obtained was directly proportional to the quantity of fish oil present, but owing to the widely different results obtained with fish oils of the same kind but from different sources, the method cannot be used for quantitative purposes.—A. S.

Soap ; Observations on the detergent action of ——. IV. W. Spring. Z. Chem. Ind. Kolloide, 1910, 6, 164—168.

In previous papers (this J., 1909, 430 ; 1910, 99) the author attributed the detergent action of soap solutions to the formation of adsorption compounds between the soap and the "dirt," of an opposite nature to or stronger than those already existing between the "dirt" and the material to be washed. He has extended his observations in the present paper to the reactions taking place between soap and colloidal silica, clay, and cellulose. The silica employed was a precipitated product having the composition, $7SiO_2,3H_2O$. When this was shaken with soap solution, the latter was partially split up into a more basic portion and a more acid portion, and a part of the basic soap was precipitated on the silica, the supernatant liquid containing less ash than the original solution. On the other hand, when the liquid was filtered, the solids of the filtrate contained the more ash, the greater the dilution of the solution of soap. This showed that the soap promoted the passage of the silica through the filter, but that the closing of the pores was more complete the greater the concentration of the soap and the greater the production of the silica and soap adsorption compound. The soap solution was found to carry 37 times more silica through the pores of the filter than pure water. The adsorption compound between silica and basic soap is not very stable ; it is decomposed by shaking two or three times with excess of water. The relation between the concentration of soap solution and the rate of clarification of silica suspensions can be shown by a periodic curve, with minimum points at concentrations of $\frac{1}{2}$ and $\frac{1}{16}$ per cent. of soap. When, solutions of soap are shaken with clay, the adsorption phenomena are far more pronounced than with the materials previously studied. Not only is a larger proportion of the soap precipitated on the clay, but a greater proportion of the latter is held in suspension by the soap left in solution. The suspensions do not settle readily and, when filtered, a large proportion of the clay passes through the filter. A 1 per cent. solution of soap will carry 206 times more clay through a filter than pure water. The phenomena are considerably more pronounced with a hydrated clay than with an ignited clay. As regards the rate of clarification of suspensions of clay in solutions of soap, it was found that solutions containing $\frac{1}{4}$ per cent. of soap and over, settled rapidly and at the same rate ; the rate of sedimentation reached a minimum at a concentration of $\frac{1}{32}$ per cent. of soap, and below this it again increased. The decomposition of soap by cellulose is less pronounced than in the case of the other materials, and is barely perceptible with solutions containing less than 1 per cent. of soap. But it takes place in the sense that the cellulose combines with a basic portion of the soap and the solution contains a more acid soap : thus, in an opposite sense to the decomposition effected by lampblack and red earth. Consequently it follows that these bodies adhere readily to cellulose, but when the combination is treated with a solution of soap, the adhesion is naturally broken.—J. F. B.

Patents.

Oil from palm and other nuts ; Apparatus for extracting ——. J. H. Eglen, Liverpool. From J. B. Esuman-Gwira, Cape Coast, Gold Coast Colony. Eng. Pat., 3357, Feb. 11, 1909.

The apparatus claimed consists essentially of a rotatable casing provided with a hopper and an outlet cock arranged at opposite sides. Through this casing, which may have a lining of perforated metal to facilitate the draining off of the liquid, passes a rotatable shaft (or shafts) carrying stirring arms and projecting beyond the casing, whilst inside, between the rotatable stirring arms, are fixed stationary arms, to assist in detaching the soft oil-containing portions of the nuts. Means are also provided for locking the casing with either the hopper or the outlet cock uppermost, and for the admission of steam to heat the contents of the vessel.—C. A. M.

Washing compound. W. and F. Walker, Ltd., and J. T. Freestone, Liverpool. Eng. Pat. 17,228, July 24, 1909.

An ordinary soap powder is incorporated with a suitable proportion (say 50 per cent.) of magnesium carbonate, preferably in the hydrated form ("magnesia alba").—C. A. M.

Cleansing preparations ; Manufacture of ——. The Firm A. Kobe, Halle a/S, Germany. Eng. Pat. 21,742, Sept. 23, 1909. Under Int. Conv., Nov. 26, 1908.

A preparation capable of removing paints and varnishes from painted surfaces, and of removing dirt, fats, &c., from textile materials or solid surfaces is obtained by extracting mineral oil residues (*e.g.*, the tar or goudron from the distillation of crude petroleum) with methyl or ethyl alcohol, with or without the aid of heat and pressure. The filtered alcoholic extract will contain from 2 to 3 per cent. of active bituminous substances, and may be made into an emulsion with water. In this form it is particularly suitable for washing textiles or for cleansing furniture, oil-painted walls, and the like.—C. A. M.

Oil; Process and apparatus for the immediate recovery of residuary —— from earth which has been previously used for clarifying or bleaching oil, by the use of steam. B. Noltenius, Bremen, Germany. Eng. Pat. 8245. April 6, 1909.

See Fr. Pat. 401,517 of 1909; this J., 1909, 1146.—T. F. B.

Vegetable oils; Method of treating ——. The Oil Refining Improvements Co., Ltd. Fr. Pat. 405,316. July 22, 1909. Under Int. Conv., Nov. 11, 1908.

See Eng. Pat. 24,209 of 1908; this J., 1909, 1081.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Patents.

Printing ink and oil paints; Process for the production of ——. F. G. Jagenburg, Wartofta, Sweden. Eng. Pat. 4040, Feb. 18, 1909. Under Int. Conv., Feb. 19, 1908.

See Fr. Pat. 399,604 of 1909; this J., 1909, 992.—T. F. B.

Reverberatory furnaces for calcining hydrated oxides of iron. Eng. Pat. 5619. *See* VII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc; Determination of —— as tetrabromide. G. Hübener. Gummi-Zeit., 1910, **24**, 740—742.

In certain cases apparently low results for the percentage of caoutchouc in raw rubbers are obtained by Budde's method. The author contends however that the values obtained may really represent the actual amount of caoutchouc hydrocarbon present, and that the higher values obtained by other methods may be erroneous, owing to the presence of non-caoutchouc substances which are difficult to separate. Two samples of raw rubber were examined from this point of view. Sample No. I. was tacky and yielded 6·92 per cent. of resin on extraction with acetone. Sample No. II. was dry and contained 7·84 per cent. of resin. In neither case did the resins yield a bromine derivative which was insoluble in a mixture of alcohol and carbon tetrachloride. 5 grms. of each sample were covered with carbon tetrachloride in a 500 c.c. flask, allowed to stand for 24 hrs., and the volume then made up to 500 c.c. with carbon tetrachloride. The solution was thoroughly shaken, and a 10 c.c. sample was removed, diluted with 50 c.c. of carbon tetrachloride, and mixed with 50 c.c. of Budde's brominating solution. The action of the bromine was allowed to proceed for 15 minutes, when the liquid was diluted with 50 c.c. of alcohol, and allowed to stand until the precipitate had completely settled. The precipitate was collected on a weighed filter, washed first with a mixture of tetrachloride and alcohol (2 : 1), then with alcohol, dried at 60° C., and weighed. Other samples of the original rubber solutions were then taken and the caoutchouc estimated as above. Samples (*b*) were taken after thoroughly shaking up the solutions, but were filtered through asbestos before bromination. Samples (*c*) were taken from the centre of the solutions after the latter had been allowed to stand, so that the insoluble constituents might partially settle out. Samples (*d*) were taken in the same way as samples (*c*), but were filtered before bromination as in the case of (*b*). A fifth sample (*e*) of No. I. was taken in the same way as (*c*), but was filtered through a filter paper before bromination. The following percentages of caoutchouc were found in this way:—

Solution sample.	Rubber sample.	
	No. I.	No. II.
	per cent.	per cent.
(*a*)	89·12	91·26
(*b*)	80·38	88·21
(*c*)	82·73	89·10
(*d*)	78·11	85·94
(*e*)	76·44	—

In order to ascertain whether the low results obtained in (*d*) and (*e*) were due to caoutchouc remaining on the filters, the insoluble constituents which settled out from the solution of sample No. I. were removed and brominated, a relation between the weight of insoluble constituents and that of their bromine derivatives being thus arrived at. An estimate of the amount of insoluble bodies present was thus obtained, and making a correction for this, it was found that the values for caoutchouc so calculated were sensibly in agreement with those of samples (*e*) and (*d*) respectively. By repeated filtration of a solution of a third sample of raw rubber, the author was able to obtain, on precipitation with alcohol, a sample of caoutchouc which showed on analysis by the tetrabromide method, practically 100 per cent. of the hydrocarbon. The original sample of rubber contained only 9·6 per cent. of resin, and the caoutchouc estimated by Budde's method, in a solution which has been filtered and otherwise treated as samples (*d*) in the table was only 83·29 per cent. In the unfiltered solution 85·82 per cent. of caoutchouc was found. Hence in this case it was clearly not sufficient to filter the solution once through asbestos in order to remove the insoluble constituents, whereas repeated filtration did actually remove them. The author concludes that in chemically pure rubber the Budde process, with 15 minutes bromination, gives good results. In the case of raw rubbers the first precaution to be adopted is to filter the solution till clear.—E. W. L.

Patent.

Rubber; Process for the manufacture of spongy ——. E. Poizot, Glos, France. Eng. Pat. 16,663, July 16, 1909. Under Int. Conv., Feb. 12, 1909. Addition to Eng. Pat. 16,540 of 1909; this J., 1910, 225.

Good products may be obtained by treating by the process claimed in the previous patent (see this J., 1909, 1261), a mixture in suitable proportions of "latex" caoutchouc (say 4 kilos.), ordinary pure caoutchouc or gum (say 4 kilos.), old powdered rubber (4 kilos.), sulphur (0·8 kilo.), zinc oxide (2 kilos.), "white factice" (2 kilos.), and volatile alkali, (say 625 c.c. of 3·6 per cent. ammonia solution), the last-named being preferably added to the factice.
—C. A. M.

XV.—LEATHER; BONE; HORN; GLUE.

Liming [hides and skins]; The principles of ——. R. W. Griffith. J. Amer. Leather Chem. Assoc., 1910, 5, 109—129.

The author reviews our present knowledge of the liming process, and gives the results of some original observations. About 5 per cent. of a lime of good quality, calculated on the hide weight, is sufficient for a satisfactory lime-liquor. The "mellowness" of a used lime-liquor may be

artificially produced by the addition of ammonium sulphate. The maximum plumping effect is produced in 8—9 days, after which depletion begins, but the hide will plump again on immersion in cold water. The plumping effect is attributed to the hydroxyl ions, and it is a curious fact that this swelling is not suppressed by salt. The theory of the action of lime as a depilating agent is not yet settled, Procter and Eitner considering the action to be bacteriological, while von Schroeder considers it purely chemical. The loss of hide substance in the limes is exaggerated, as it includes the epidermal matter, which it is the object of liming to remove. Experiments made by the author to determine the influence of previous soaking in water on the solution of the hide substance showed that up to 24 hours this had no influence, but a longer soaking increased the amount of hide substance dissolved by the lime-liquor. The object aimed at in the liming process should be to obtain a layer of particles of lime spread over each hide.
—D. J. L.

Viscometer for comparing hot pastes. Cappenberg. *See* XVII.

Patents.

Leather-board; Method of manufacturing a substitute for ——. W. J. Ostberg. St. Kilda, Australia. Eng. Pat. 22,001, Sept. 27, 1909.

The process consists in reducing leather-waste to pieces of about $\frac{1}{32}$ in. thickness, removing tannin from them by means of bleaching powder solution, and then saturating them with an adhesive composition. Sufficient material to form a sheet is then pressed, partly dried and finally calendered. The product is improved in appearance and also rendered waterproof by applying to both sides a mixture of glue, linseed oil, and boric acid.—D. J. L.

Tannin-containing extracts from vegetable matter, more particularly extracts of mangrove bark; Process for the treatment of ——. H. Daumköhler and H. Schwindt, Bremen, Germany. Eng. Pat. 24,899, Oct. 29, 1909.

Tannin extracts, more particularly mangrove extract, are decolorised by means of "nascent hydroxides of metals" produced by electrolysis in a bath having different metals as anode and cathode, solutions of salts of these metals being also added to the bath. The precipitated hydroxides carry down the colouring matter in the form of a lake, while the nascent hydrogen also has a clarifying effect. Aluminium and zinc are the most suitable metals for the electrodes. A non-electrolytic process consists in adding aluminates of the alkaline-earths, more particularly barium aluminate, to the extract. The precipitated hydroxides, carrying down the colouring matter, are made to settle by adding sulphuric acid or sulphates. The two processes may be combined.—D. J. L.

Leather; Manufacture of compositions for use in dressing ——. G. W. Johnson, London. From Chem. Fabr. Elektro, Biebrich on Rhine, Germany. Eng. Pat. 8960, April 15, 1909.

See Fr. Pat. 402,292 of 1909; this J., 1909, 1212.—T. F. B.

Quebracho extracts; Treatment of —— A. Redlich and J. Wladika, Vienna. Eng. Pat. 14,516, June 21, 1909.

See Fr. Pat. 404,305 of 1909; this J., 1910, 226.—T. F. B.

Tannin extracts; Process for the manufacture of ——. Nitritfabrik Akt.-Ges., Cöpenick, Germany. Eng. Pat. 16,440, July 14, 1909. Under Int. Conv., July 20, 1908.

See Fr. Pat. 405,110 of 1909; this J., 1910, 227.—T. F. B.

Bating skins; Process for ——, *replacing the use of mordants extracted from animal excrements, especially dog dung.* G. Eberle. Fr. Pat. 405,597, July 30, 1909. Under Int. Conv., Nov. 16, 1908, March 17 and June 5, 1909.

See Eng. Pat. 21,202 of 1909; this J., 1910, 226.—T. F. B.

XVI.—SOILS; FERTILISERS.

Micro-organisms; Assimilation of ammonia-, nitrate-, and amide-nitrogen by ——. S. Bierema. Centr. f. Bakt., 1909, 23, 672—726. Biedermann's Zentr., 1910, 39, 126—132.

A large number of experiments have been made with micro-organisms using nitrates, ammonium compounds, amides and amino-acids as sources of nitrogen, and a great variety of substances as the source of carbon. The nutrient fluids contained small quantities of dicalcium phosphate, magnesium sulphate and sodium chloride, and the proportions of combined nitrogen and combined carbon were always 0·3 and 0·4 per cent. respectively. Inoculation was effected by means of earth or from an active culture. The experiments were performed in both deep and shallow vessels. Sodium nitrate acted as a favourable source of nitrogen in presence of most carbon compounds, calcium acetate being least satisfactory. Calcium nitrate proved an even better source of nitrogen, particularly in combination with glycerol, dextrose, and calcium lactate; lactose and calcium acetate were less active, though they gave better results than with sodium nitrate. Ammonium nitrate was far less suitable. Ammonium sulphate favoured the growth of moulds rather than that of bacteria. Ammonium carbonate alone was almost inactive, but it gave good results when used together with sucrose, dextrin, glycerol, lactose, etc. Magnesium-ammonium phosphate, in spite of being sparingly soluble, was an excellent source of nitrogen. Formamide and acetamide were not good media for the development of soil organisms. Carbamide alone was not capable of serving as the source both of nitrogen and carbon, but in conjunction with mannitol, maltose, or dextrose, it was quickly assimilated. Hippuric acid was very active in combination with carbohydrates. Leucine and tyrosine acted as sources of both carbon and nitrogen, as also did asparagine and neutralised aspartic acid, which were readily assimilated when in combination with carbon compounds. Ammonium formate was almost useless; the acetate and especially the butyrate were more readily utilised. Ammonium oxalate and the ammonium salts of succinic, lactic, malic, tartaric, and citric acids were all assimilated when in combination with carbon compounds. Carbon dioxide and methane were unsuitable as sources of carbon, as also were ethyl alcohol and acetone. Mannitol and glycerol were equivalent to the carbohydrates as sources of carbon; starch and cellulose required first to be broken down. The calcium salts of acetic and butyric acids had but little value; those of succinic, malic, and lactic acids, however, were very good and often had a value equal to that of the carbohydrates. Assimilation was in every case most rapid in the shallow vessels. The foregoing conclusions were controlled by quantitative experiments, and in addition some 150 races of bacteria and moulds were isolated in pure culture. The moulds absorbed into their own structure by far the major part of the nitrogenous nutrient, the balance being found in solution as ammonia and nitrate. The various races of micro-organisms showed a great difference in their resistance to sterilisation, the moulds being far less easily decomposed than bacteria.
—E. F. A.

Patents.

Superphosphates; Apparatus for removing —— *from the decomposition chamber.* K. J. Beskow, Helsingborg. U.S. Pat. 949,055, Feb. 15, 1910.

See Eng. Pat. 20,466 of 1907; this J., 1908, 821.—T. F. B.

Fertilisers; Stimulant —— *for agriculture, containing oxides of manganese.* Mines de Manganèse de Las Cabesses. Fr. Pats. 405,694 and 405,696, Nov. 21, 1908.

See Eng. Pat. 26,867 of 1909; this J., 1910, 167.—T. F. B.

XVII.—SUGARS ; STARCHES ; GUMS.

Beetroots ; Determination of invert sugar in ——. J. Urban. Z. Zuckerind. Böhmen, 1910, **34**, 287—297.

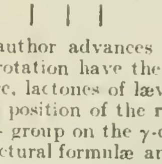
To determine invert sugar in beetroots, the solution obtained by digesting beetroot pulp is clarified with basic lead acetate and 50 c.c. of the solution, freed from lead, treated with Fehling solution according to Herzfeld's method. The 50 c.c. normally represent 13 grms. of pulp, which from 18 per cent. beetroots, contain 2·34 grms. of sucrose. In the calculation of the invert sugar from the weight of copper obtained, the only tables available were those of Herzfeld or Preuss for 10 grms. of sucrose, and that of Baumann for 5 grms. As the above solution contains only about 2·5 grms. of sucrose, it has been usual to add pure sugar to make up the total to 10 grms. This procedure is, however, inconvenient, and the author has prepared a table for use with ordinary Fehling solution, boiling for two minutes, and having 2·5 grms. of sucrose present. The results obtained by means of this table are, however, not quite accurate owing to the varying sugar content of the roots. For this reason and to avoid destruction of sucrose, which occurs with ordinary Fehling solution, the caustic soda has been replaced by an equivalent quantity of sodium carbonate and a table prepared for use with this method, using 2·5 grms. of sucrose and boiling for five minutes. This solution is more sensitive to invert sugar than the former. Cold aqueous digestion must be used in preparing the solutions for invert sugar determinations, since the hot digestion method may destroy 25 per cent. of the invert sugar present.—L. J. DE W.

Colouring matters of the cane ; Action of sulphurous acid on ——. P. de Sornay. Bull. Assoc. Chim. Sucr. Dist., 1910, **27**, 676—681.

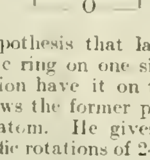
THE author maintains, in agreement with Vivien, Pellet, and others, that sulphurous acid acts on colouring matters similarly to other acids and without becoming converted thereby into sulphuric acid. In sulphited juices the whole of the sulphurous acid may be found, on titrating with iodine, even when the juices have stood a long time. Sulphurous acid prevents the subsequent darkening of juices, and this effect is more important than its decolorising power. Its oxidation on heating takes place more or less rapidly according to the temperature and at the expense of the oxygen of the air, and of easily reducible foreign organic matters present in the sugar.—L. J. DE W.

Sugar lactones ; Relation between the chemical constitution and the optical rotatory power of the ——. C. S. Hudson. U.S. Dep. Agric., Bureau of Chemistry, 1910, Circular No. 49, 1—8.

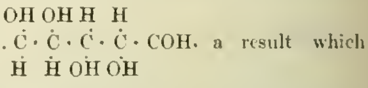
IT is generally agreed that the sugars, the lactones of the corresponding acids, and the glucosides, possess a lactonic ring, but that this ring is absent from the structure of the alcohols and acids corresponding to the sugars. The sugars, the lactones, and the glucosides, are strongly rotatory, whereas the alcohols and acids are feebly rotatory, and it may be assumed, as a first approximation, that the rotations of the lactones are entirely due to the lactonic rings. There are two possible structures for the lactonic ring, viz. :—



and



The author advances the hypothesis that lactones of dextro-rotation have the lactonic ring on one side of the structure, lactones of lævo-rotation have it on the other, and the position of the ring shows the former position of the OH- group on the γ-carbon atom. He gives a list of the structural formulæ and specific rotations of 24 lactones of the monobasic sugar acids, including every such lactone for which the structure and specific rotation have been determined ; in no case is there an exception to the above hypothesis, all the lactones which have the ring "above" the chain being lævo-rotatory, whilst all those which have it "below" are dextro-rotatory. The author's theory may be applied to the determination of the constitution of the monose aldehyde sugars. Thus, the cyanide synthesis or its reverse has shown the steps of the following series : *d*-erythrose → *d*-arabinose → *d*-glucose → *d*-glucoheptose → *d*-gluco-octose. Since *d*-gluco-octonic lactone is dextro-rotatory, its ring must be considered to be below the chain, and therefore the hydrogen atom joined to the γ-carbon atom is above the chain. From this, and similar reasoning based on the optical properties of *d*-arabonic, *d*-gluconic, and *d*-glucoheptonic lactones, the author deduces a configuration for *d*-glucose identical with that chosen by Fischer on chemical data. The steps of the proof moreover, give the structures of *d*-arabinose and *d*-erythrose. The author also confirms Fischer's configurations for *d*-galactose and *d*-mannose, and shows that rhamnose has the configuration,



$$CH_3 . \overset{OH}{\underset{H}{\dot{C}}} \cdot \overset{OH}{\underset{H}{\dot{C}}} \cdot \overset{H}{\underset{OH}{\dot{C}}} \cdot \overset{H}{\underset{OH}{\dot{C}}} \cdot COH,$$

a result which confirms Fischer's work with regard to the configuration around the three carbon atoms next in order to the aldehyde group, and settles the question of the configuration around the carbon atom adjacent to the methyl group ; with regard to this last point, Winther selected the same configuration on the ground that Tate's bacillus attacks rhamnose. The relations above-mentioned corroborate the view that the formation of lactones involves the γ-carbon atom preferably to any other ; the parallelism between the position of the lactonic ring and the direction of rotation of the lactone (a parallelism which would not hold if the ring were considered as formed with any atom other than the γ-carbon atom) seems to show with certainty that the lactonic ring in these monobasic sugar lactones forms on the γ-carbon atom.—L. E.

Pastes [starch, etc.] ; A viscometer for comparing hot ——. H. Cappenberg. Chem.-Zeit., 1910, **34**, 218—220.

THE author has designed a viscometer for starch pastes and other viscous substances, such as liquid glucose, glue, varnishes, etc., in which a spherical weight of standard dimensions is drawn upwards through a column of the paste of fixed height and temperature, the time in seconds occupied in doing this, under the pull of a known load in grams constituting an observation. A series of trials are made with a regularly decreased load, these being tabulated for comparison, it having been found that single observations with a fixed load are useless for this purpose. In comparing starches it was found that pastes containing 5 per cent. of potato starch and 9 per cent. of wheat starch gave co-incident figures, and it may reasonably be assumed that for these samples the thickening powers were in that ratio. It is recommended that only thick pastes or liquids of high viscosity be compared by means of the apparatus, as trials with thinly viscous liquids have given erratic results. —J. A.

PATENTS.

Sugar factories ; Furnaces for usefully disposing of bagasse and molasses from ——. W. P. Thompson, London. From F. J. J. van der Kolk, Neiu Fersana, Java. Eng. Pat. 15,092, June 28, 1909.

The bagasse is burnt under the boiler in a furnace of considerable depth provided with ordinary grates at the bottom. One or more retorts (into the top of which pipes carrying the molasses are led) are arranged across the furnace, the gaseous products of the combustion of the molasses escaping through holes in the tops of the retorts into the flue under the boiler. When a large amount of charcoal or charred molasses has collected in the retorts, it is emptied through hinged or pivoted lids into a second furnace provided with a sliding grate. A large quantity of air is admitted through the grate, and the products of partial or complete combustion pass into the bagasse furnace. The molasses is thus completely burnt, without the escape of any noxious fumes into the atmosphere.—L. E.

Converting apparatus [starch]. C. L. Sovereign and A. W. H. Lenders, Waukegan, Ill. U.S. Pat. 948,485, Feb. 8, 1910.

The apparatus includes a tank for heating the starch, a closed converter (comprising a number of connected vessels) and an expansion chamber. Pipes conduct steam from the expansion chamber, and from each of the converting vessels, to the heating tank. The starch is continuously introduced from the heating tank to the first of the converting vessels; a pressure of steam higher than atmospheric pressure is maintained in these vessels. The converted liquor is continuously introduced into the expansion chamber and withdrawn therefrom.—L. E.

Materials [starch]; Process and apparatus for separating, washing, and concentrating ——. A. W. H. Lenders, Waukegan, Ill. U.S. Pats. 948,512 and 948,513, Feb. 8, 1910.

The apparatus includes a series of receptacles containing agitating devices comprising stationary members and intermediate rotating members. A pipe leads from the bottom of the first receptacle to the upper part of the next, and so on throughout the series. A supply pipe for the material to be treated (ground corn) leads into the first receptacle, and a water-supply pipe leads to the lower part of the last receptacle. A current of water is made to flow through the receptacles in opposition to the force of gravity and at a rate sufficient to float off the starch but not sufficient to overcome the gravity of the bran. The bran is withdrawn and passed through a disintegrating device to the next receptacle and so on, in the direction opposite to that of the flow of water. The receptacles are constructed so as to diminish the velocity of the water in the direction of its flow. The water in each receptacle excepting at the upper part, is churned by the agitating device.—L. E.

Grain [starch]; Process of steeping ——. A. W. H. Lenders, Waukegan, Ill. U.S. Pat. 948,514, Feb. 8, 1910.

This is a process for steeping grain prior to grinding. The grain is confined in a battery of steeping tanks, a steeping liquid, consisting of water and sulphurous acid, being passed through the units of the battery in succession. The units are cut out of the circulatory system in the same order of succession, one by one, the grain in the units thus cut out is drained, washed, and removed, the units are refilled with new grain, and re-connected in the battery. The acid water which is drained off is recharged with sulphurous acid and returned to the circulatory system. —L. E.

XVIII.—FERMENTATION INDUSTRIES.

Beer manufacture; Study of colloidal phenomena in ——. F. Emslander. Z. Chem. Ind. Kolloide, 1910, 6, 156—164.

In previous papers (this J., 1904, 945; 1909, 153) the author has pointed out the importance of the colloidal point of view in the study of beer and its manufacture. It has been calculated that 1 c.c. of wort or beer contains 10^{18} colloidal particles, presenting an aggregate surface of 600 sq. m. Thus, surface-forces and phenomena play a very important part; they may be considered under the heads of liquid-solid, liquid-liquid, and liquid-gaseous phases. Any factor which destroys or reduces the surface tensions promotes coagulation of colloids (chiefly of protein nature) and increases attenuation. These factors have been studied (*loc. cit*) in the investigation of the influence of the surface of the containing vessel both on attenuation and on diastatic action. The liquid-liquid phase is of subordinate importance in brewing, but cases may occur in which the pitch lining of the tuns may exude oil. Beer-scale, itself produced by the coagulation of colloids on the walls of the tuns, has a most favourable influence in preventing further coagulation. The influence of gas bubbles in reducing the surface tensions of the particles and the stability of the colloids is shown by the effects of vibrations during storage or transport; aeration of the wort or beer also promotes coagulation and attenuation. Further, the failure of the vacuum fermentation process may be largely attributed to this influence of the formation of bubbles of gas on the surface tensions of the colloidal particles. On the other hand, beer is largely deprived of its colloids by filtration, but the quality may be partially restored by agitation. Besides the surface phenomena, the factors which influence sol-formation have to be considered, namely peptonisation and solution of the proteins. These processes (*viz.*, those favouring sol-formation) promote stability, and the favourable influence of hydrogen ions, or a certain degree of acidity, falls in this category. The desire for malts poor in protein is on false lines, and a high proportion of proteins in a properly controlled condition constitutes the ideal. Besides the stabilising influence of positive ions there is also that of protective colloids, hop resins, tannin, dextrin, mineral colloids, and alcohol. These act as emulsifying agents increasing the viscosity. The colloidal beer *par excellence* is the Bavarian beer, to which must be added porter. These types are regarded by the author as eminently nutritious, and he proposes a hypothesis, based on their colloidal condition, in explanation of this view. The colloids of the beer are regarded as acting as protective colloids towards other foodstuffs, and experiments on the coagulation of mixtures of milk and beer or black malt worts are cited in support of this hypothesis.—J. F. B.

Benzoic, cinnamic, and salicylic acids; Detection of —— *in wine.* C. von der Heide and F. Jakob. Z. Unters. Nahr. Genussm., 1910, 19, 137—153.

A portion of the wine is acidified with sulphuric acid and extracted with chloroform; after the chloroform solution has been washed with a little water, salicylic acid is tested for by adding 3 c.c. of water and then a few drops of 0·05 per cent. ferric chloride solution. Another portion of the wine is then rendered alkaline, evaporated to a small volume, acidified, and extracted with ether. The ethereal solution is shaken with dilute alkali solution, whereby the organic acids are obtained in aqueous solution in the form of their salts. The solution is heated on a water-bath until all dissolved ether has been expelled, and then, after cooling, is treated with 1 per cent. potassium permanganate solution; the first few drops of permanganate convert any cinnamic acid present into benzaldehyde which may be detected by its odour. As little as 0·01 mgrm. of the acid gives a distinct odour of benzaldehyde. The mixture is next heated on the water-bath and the permanganate solution is added drop by drop until the pink coloration persists for a few minutes; the excess of permanganate is then destroyed by the addition of sulphurous acid, and the acidified solution is extracted with ether. The treatment with permanganate destroys any salicylic acid and organic matter present, converts the benzaldehyde resulting from cinnamic acid into benzoic acid, and leaves the latter acid unchanged. The ethereal solution containing the benzoic acid is evaporated and benzoic acid may be detected in the residue by converting this acid into ammonium diaminobenzoate as described by Robin (this J., 1908, 1171). In order to ascertain whether benzoic acid is present as such in the wine (the process just given detects the presence of both cinnamic acid and benzoic acid), a third portion of the sample is rendered alkaline and evaporated until the alcohol has been removed; the residual solution is acidified, submitted to steam distillation, and the distillate is extracted with ether. The ethereal solution is then evaporated, and the residue is tested for benzoic acid as described.

The authors have also investigated the preserving action of these three acids, and find that fermentation does not take place, in must to which yeast has been added, in the presence of the following quantities of the acids:—benzoic acid, 0·15 to 0·25; salicylic acid, 0·10 to 0·25; and cinnamic acid, 0·05 to 0·15 grm. per litre.—W. P. S.

Cider; Cold storage of apple ——. H. C. Gore. U.S. Dep. Agric., Bureau of Chemistry. 1910, Circular No. 48, 1—13.

THE author gives the results of experiments on the cold storage of apple ciders prepared from 9 varieties of apples, viz., Tolman. Winesap, Yellow Newtown, Ralls, Gilpin, Baldwin, Golden Russet, Roxbury Russet, and Kentucky Red. The first six of these varieties are more typical of the usual American cider apples than the last three. All the decayed parts were removed from each lot of apples before grinding. The juices were cooled (in some cases to below 0° C.), then stored at 0° C. and examined from time to time. The ciders prepared from the first six of the above-mentioned varieties, remained without noticeable fermentation for 36—57 days, and had not fermented sufficiently to be considered as becoming "hard" or "sour" until they had been stored for 90—119 days. As regards the other ciders, 83 days elapsed before noticeable fermentation set in, and 125 days before they had fermented enough to be considered as becoming "hard" or "sour." The ciders (with the exception ot the Tolman) suffered no deterioration, but rather had improved in flavour during storage.—L. E.

Whisky; Distillation of ——. A. B. Adams. J. Ind. Eng. Chem., 1910, **2**, 34—42.

Two kinds of stills are used for the first distillation in the United States, namely, the three-chambered still in Maryland and Pennsylvania, and the ten- or twelve-chambered continuous still in Tennessee and Kentucky. In the case of the three-chambered still, after a "run," the slop or spent beer (wash) from the bottom chamber is drawn off, the contents of the middle and top chambers are run into the bottom and middle chambers respectively, and the top chamber is charged with fresh wash. The contents of the "doubler"—a copper cylinder connected to the still—are run into the middle chamber of the still, and the doubler is re-charged with the combined "heads" and "tails" from the previous "run." The still is heated by live steam, and the vapours after passing through the "doubler" are condensed. The "first runnings" or "heads" are collected in the "low wines" tank, the middle portion in the "high wines" tank, and the last runnings or "tails" in the "low wines" tank. The "high wines" are re-distilled the following day in a pot still for whisky, the "heads" and "tails" from this distillation being added to the wash, whilst the "lees water" is run to waste. In the case of the continuous still, the distillate from the first distillation is re-distilled in a pot still, and frequently the "heads" or "foreshots" are left in the finished product. Samples representative of a day's working by both processes were collected and analysed, the Allen-Marquardt method being used for the determination of the higher alcohols. The results are given in the form of tables and curves, and from a discussion of their significance, the author concludes that the following facts may be regarded as established. (1) In both processes practically all of the higher alcohols ("fusel oil") are found in the finished whisky, only slight traces being eliminated in the spent wash and "lees water." (2) During the distillation certain chemical changes occur in the acids, as is shown by the difference in the amount eliminated from the wash and that found in the distillates; in the esters, as is shown by the loss in the second distillation; and in the aldehydes. The finished whisky is almost neutral. (3) Furfural is produced during the distillation in the three-chambered still, but not in the continuous still. When, however, the whisky obtained by the latter process is stored in a charred wooden cask, furfural is produced. (4) The substances which produce the unpleasant odours frequently observed in the "tails" and "lees water" are not due to "fusel oil." (See also Allen, this J., 1891, 305, 519; and Schidrowitz, this J., 1902, 814; 1905, 585; 1906, 1900.)—A. S.

Spirit, denatured; Contaminations of —— *and their remedy.* O. Mohr. Z. Spiritusind., 1910, **33**, 53—54.

DENATURED spirit is frequently contaminated by substances that impair its usefulness, especially for burning in lamps, by choking the pores of the wick and charring the latter. The amount of residue left by spirit when evaporated should not exceed 0·1 grm. per litre after being dried for an hour at 105° C., though this quantity is frequently exceeded considerably. Of the contaminating impurities, oils (chiefly mineral oil), when present in any quantity can be detected by the turbidity ensuing on dilution with water, petroleum being also detected by its smell under these conditions; whilst fats impart the property of dissolving copper, the spirit acquiring a green tinge. Acetic acid causes the spirit to corrode metals (lamp containers, etc.), and being volatile, cannot be determined by evaporation, distillation and titration being necessary. Resins also lead to the corrosion of metal lamp fittings, etc., owing to their acid character. Sugar is a frequent impurity and chokes the lamp wick and produces charring. It may be detected by the polarimeter and by Fehling solution (with or without previous inversion). The source of many of these impurities is traceable to the casks in which the spirit has been transported and stored. Wooden casks are lined with gelatin to prevent the spirit from dissolving out tannin, etc., from the wood; but the gelatin is soluble to some extent in spirit, though this defect may be obviated by the use of chromated gelatin, rendered insoluble by exposure to the light of an electric lamp. Rusty iron should not be allowed to come in contact with denatured spirit, since it darkens the colour of the denaturing agents. It is desirable to introduce regulations for preventing the storage of lamp spirit in vessels liable to produce contamination, or to ensure that retailers are supplied solely with bottled spirit.—C. S.

Poisoning due to spirits, and the detection of amyl alcohol (fusel oil) in spirituous liquors. H. Holländer. Münch. med. Wochenschr., 1910, **57**, 82—83. Chem. Zentr., 1910, **1**, 671.

FOR the detection of amyl alcohol in spirituous liquors, 25 c.c. are treated with 1 c.c. of $N/1$ potassium hydroxide solution, and distilled. 5 c.c. of the distillate are boiled for 1 minute with 5 c.c. of concentrated acetic acid, and then a drop of phenylhydrazine is added. The clear solution is again boiled and then cooled, and concentrated hydrochloric acid introduced so as to form a lower layer. If the liquor contained amyl alcohol, a green ring is formed at the zone of contact of the two layers, the coloration being due to a green colouring matter produced by the action of hydrochloric acid on acetylamylphenylhydrazine.—A. S.

Gasoline and alcohol tests on internal-combustion motors. Strong. *See* IIA.

PATENTS.

Beer; Process of producing a pale, chill-proof ——. F. H. Wagemann, Des Moines, Iowa. U.S. Pat. 949,011, Feb. 15, 1910.

THE process of producing a pale, chill-proof beer consists in dividing the wort into two parts, boiling the first portion with a small percentage of hops, settling, and filtering the liquid before delivering to the fermentation tun. The second portion is treated in a similar manner, but the filtered wort is boiled with the principal quantity of hops in the wort copper, strained, and filtered before it is mixed with the first portion. A variation of the process consists in running both portions of the wort separately, after boiling with a small proportion of hops and clarifying, through a second filter inlaid with fresh hops; the other parts of the process being the same as described.—J. F. B.

Brewing process. R. Kubessa, Kalk, Germany. U.S. Pat. 949,581, Feb. 15, 1910.

SEE Addition of July 13, 1906, to Fr. Pat. 333,939 of 1903; this J., 1907, 29.—T. F. B.

XIXA.—FOODS.

Cocoa; Determination of husk in ——. A. Goske. Z. Unters. Nahr. Genussm., 1910, 19, 151—158.

THE following method, based upon the difference between the sp. gr. of cocoa husk and that of ordinary cocoa powder, is described for the determination of added husk in ordinary cocoa:—One grm. of the dry, fat-free cocoa is mixed in a stoppered tube with 20 c.c. of a calcium chloride solution prepared by dissolving 107·1 grms. of calcium chloride in 100 c.c. of water (this solution should have a sp. gr. of 1·535 at 30° C.). The stopper of the tube is then removed, the mixture is heated to boiling for two minutes and while still hot submitted to centrifugal action for 6 minutes. The liquid portion is now removed, and the almost solid sediment is collected on a weighed filter, washed with hot water until free from chlorine, dried at 100° C., and weighed. From the weight of the sediment of husk obtained, the excess quantity of the latter present in the original cocoa is calculated. For this purpose, it may be taken that cocoa husk itself yields 38·7 per cent. of sediment, and the amount of fat in the cocoa must also be taken into consideration. The figure, 38·7, was the highest result obtained on the examination of a number of samples of cocoa husk, the average result being 24·5 per cent. From the final result obtained, a deduction of 6 per cent. is made, this being the quantity of husk yielded by ordinary commercial cocoas. For example, 1 grm. of dry, fat-free cocoa yielded 0·0618 grm. of sediment, or, using the figure 38·7, 0·16 grm. of husk. As the cocoa contained 18·4 per cent. of fat, this is equivalent to 13 per cent. of husk in the original sample. Deducting 6 per cent., the sample, therefore, contained 7 per cent. of added husk.—W. P. S.

Cocoa; The addition of potassium carbonate to ——. Bordas. Ann. Falsific., 1910, 3, 61—70.

WHILST French manufacturers in general do not add alkali salts to cocoa for the purpose of producing so-called soluble cocoa, the importation into France of foreign cocoa so treated has of late years reached very large proportions, and the author discusses the question whether the sale of such cocoa should, or should not, be prohibited, and whether, if permitted, the quantity of added alkali should not be regulated by law. Natural cocoa-mass contains from 2·46 to 3·05 per cent. of potash (K_2O), calculated on the dry, fat-free substance, whilst samples of soluble cocoa examined contained from 4·82 to 6·41 per cent. As regards the effect on health, there is considerable conflict of opinion as to the possible action of the added potash, but it seems that there is no direct evidence of injury to health provided that the cocoa does not contain an excessive quantity of potassium salts. Belgium, Italy, and Switzerland, however, prohibit the sale of cocoa containing more than 3 per cent. of alkali carbonate, and in Roumania the limit is fixed at 2 per cent. The United States prohibits the sale of cocoa containing any added alkali and the same regulation obtains in Austria. The author considers that the term "soluble-cocoa" is a misnomer, the darker colour of an infusion of "soluble-cocoa" as compared with that of ordinary cocoa being due to a greater proportion of colouring matter passing into solution. Whilst a smaller quantity of "soluble-cocoa" than of ordinary cocoa is required to colour a given volume of water to the same depth of tint, an apparent advantage to the consumer thus accruing, he is, at the same time, buying potassium carbonate and water at the price of cocoa, "soluble-cocoa" containing, on the average, about 2 per cent. more moisture than ordinary cocoa powder.—W. P. S.

Apple pulp and apple jellies; Analysis of ——. A. C. Chauvin. Monit. Scient., 1910, 24, 163—165.

THE author has carried out a number of experiments with apple pulps and apple jellies containing known amounts of added cane sugar, dextrose, and dextrin, with the object of ascertaining whether the quantities of sugars added could be determined after the mixtures had been boiled, or whether the boiling produced changes, such as the saccharification of the dextrin, which would interfere with the analysis. It was found that the organic acids present converted a portion of the dextrin into a reducing sugar; the quantity of the latter present corresponded with from 3·80 to 7·84 per cent. of dextrose. Consequently, it may be erroneously concluded that dextrose is present in a sample when such is not actually the case.—W. P. S.

PATENTS.

Milk; Process for preserving ——, *with a view to its use in the liquid state without the addition of any preservative.* G. Kunick, London. Eng. Pat. 2682, Feb. 4, 1909.

FRESH milk is skimmed in the usual way. The cream or milk fat is freed from water, melted and purified, and placed in casks in which it gets hard and can be kept for a long time without the addition of any preservative. The skimmed milk is treated by any well-known method giving a white, dry powder in which the casein and albumin have not undergone any important modification owing to the heat to which they have been exposed; this powder also, can be kept for a very long time if well packed. At the place of consumption, the powder is made into an emulsion with water, *e.g.*, by pouring it slowly into about ten times the quantity of hot water, the water being kept in motion throughout the operation. The milk fat, or other suitable fat, is added to the emulsion (about 33 parts of fat per 100 parts of powder) which is kept in motion all the time, the fat and other substances then being incorporated by mechanical means so as to form a permanent suspension; the best temperature for incorporation is between 50° and 60° C.—L. E.

Milk; Process of pasteurising ——. J. Willmann, Shelton, Conn., U.S.A. Eng. Pat. 8041, April 3, 1909. Under Int. Conv., May 25, 1908.

SEE U.S. Pat. 913,600 of 1909; this J., 1909, 379.—T. F. B.

Cottonseed oil and food compositions containing it; Impts. in ——. J. H. Filbert. Fr. Pat. 405,558, July 29, 1909.

SEE U.S. Pats. 929,845 and 930,286 of 1909; this J., 1909, 999.—T. F. B.

XIXB.—WATER PURIFICATION; SANITATION.

Potable waters; Note on the controlling of the sterilisation of —— *by means of the fluorescent substances present.* F. Dienert. Comptes rend., 1910, 150, 487—488.

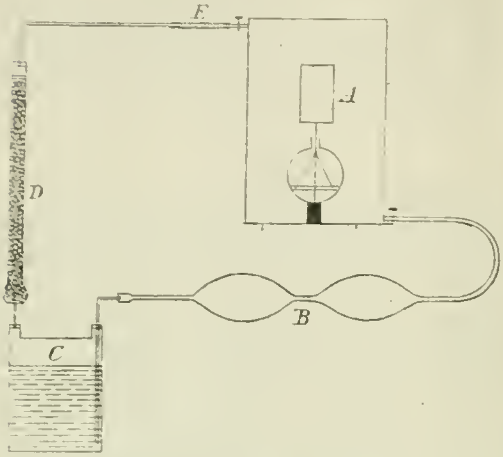
THE fluorescent organic bodies present in surface waters are destroyed by oxidation. A comparison of the fluorescent images, given by pencils of strong reddish-blue rays traversing the samples of water, is proposed as a rapid means of controlling the working of installations for sterilising water supplies by ozone. A few minutes, it is stated, suffice for a test.—A. SELD.

Radioactivity of mineral springs; Determination and calculation of the ——. F. Henrich. Z. angew. Chem., 1910, 23, 340—342.

THE radioactivity of a sample of water may be readily determined by the circulation method, using an Elster-Geitel electroscope and arranging the apparatus as in the figure. A is the electroscope, B a pressure ball, C a Woulff's bottle, of 1·25—1·5 litres capacity, D a long tube filled with calcium chloride, and E a glass or metal tube filled with fine wire. An experiment is first carried out using distilled water in C, to ascertain the air-leakage, and a determination is then made with the water to be tested; from this result is deducted the "induced" activity, which is obtained by a third experiment, filling the bell of the electroscope with air from the room; in each case the position of the leaves is noted at the end of 60 minutes. The activity in a litre of water (e_x), reckoned in volts, is given by the expression,

$$\frac{Me'+ae'-Me-ae+v0{\cdot}23e',}{v}$$

where M is the effective volume of the bell, a the volume of air in the rest of the system, v the volume of water, e the activity in a litre of air before circulation, and e' the activity after circulation. The activity, in Mache units, is then, $1000\,\frac{e_x k}{300\times3600}$, k being the capacity of the electroscope.—F. Sodn.



Radioactive waters in Saxony. C. Schiffner and M. Weidig. Z. angew. Chem., 1910, **23**, 364.

The authors' investigations show that in the mining districts of Saxony, where uranium minerals occur, waters possessed of considerable radioactivity (0·2—72·6 Mache units) are found, and that the activity depends, as a rule, on the amount of uranium present in the vicinity. In many instances, however, water of marked activity has been found, in the absence of deposits containing uranium. —F. Sodn.

Radioactive waters; Artificial ——. J. Landin. Industritidningen Norden, 1909, **37**, 411. Chem.-Zeit., 1910, **34**, Rep., 102.

The radioactivity of natural waters is mostly very low. The most active natural water yet discovered is that from an old Roman well on the island of Ischia; this water has an activity of 30,800 units (volts discharged per hour per litre of water). The activities of other natural waters is as follows:—Water from Joachimsthal, 14,000 units; Grabenbäcker spring, Ganteri, 12,000—13,000; Büttel spring, Baden-Baden, 9000—10,000; Patriks spring, Porla, Sweden, 800; and Hög springs, Mederi, Sweden, 500—600 units. Waters of much stronger radioactivity can be prepared artificially, *e.g.*, by immersing an insoluble radium preparation in the water. For baths, water should have an activity of 200,000 units, and for pump-rooms, an activity of 10,000 units. In Sweden such waters are now placed on the market in specially constructed bottles by the "Radioaktiva vatten" of Stockholm.—A. S.

Examination of creosote. **Davis.** ***See* III.**

Patents.

Water purification. J. C. Thresh, Chelmsford. Eng. Pat. 3023, Feb. 8, 1909.

Water, free or practically free from suspended organic matter other than bacteria, etc., is treated with a small quantity of active chlorine (ordinarily not exceeding the equivalent, per 1,000,000 parts of water, of 2 parts of active chlorine, and, it may be, frequently less) in the form say, of a solution of calcium hypochlorite. After the lapse of, say half an hour, the water is treated with metallic iron, *e.g.*, iron turnings, filings, or clean scrap iron, the latter combining with the unused chlorine, and being converted into an oxidised form that can be removed by filtration or sedimentation.—L. E.

Insecticide. G. Oddo, Pavia, Italy. U.S. Pat. 948,739, Feb. 8, 1910.

Copper ore, roasted and ground, is treated with sulphuric acid, first at the ordinary temperature and then at a high temperature, until all the salts are transformed into sulphates. The mass obtained is neutralised with lime, and the precipitate is dried, ground, and sifted; it is claimed as an insecticide powder which is insoluble in water.—F. Sodn.

Water; Process for the purification of ——. E. E. M. Payne and W. H. Staynes. Fr. Pat. 405,367, July 23, 1909. Under Int. Conv., March 23, 1909.

See Eng. Pat. 6935 of 1909; this J., 1909, 1161.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchona bark; The assay of ——. H. Engelhardt and H. W. Jones. Pharm. J., 1910, **84**, 236.

The authors recommend Keller's method, modified by Fromme, together with a titration of the alkaloids; they carry out the assay as follows:—2·5 grms. of fine or moderately coarse powder, are heated in a 200 c.c. flask with 2 c.c. of 25 per cent. hydrochloric acid and 20 c.c. of distilled water for 10 minutes on a steam bath; the flask is allowed to cool, and then 50 grms. of ether and 25 grms. of chloroform are added. The mixture is well shaken, supersaturated with 5 c.c. of caustic potash solution (15 per cent.), and then shaken continuously for 15 minutes; 1·5 grms. of gum tragacanth are now added and the mixture shaken again. After the liquids have separated, 60 grms. (equal to 2 grms. of bark) are filtered, and extracted three times with 1 per cent. hydrochloric acid, using 20, 10, and 10 c.c. respectively. The combined acid solutions are shaken well with 15 c.c. of chloroform, supersaturated with ammonia, and again well shaken. After settling, the chloroform is filtered through a double filter into a tared Erlenmeyer flask of 100 c.c. capacity, the aqueous solution shaken twice more with 10 c.c. of chloroform, the additional chloroform filtered and added to the first. The solvent is then evaporated off and the residue dried at 100° C. to a constant weight. The result is too high, owing to the presence of fatty matter. The residue is therefore dissolved in 10 c.c. of alcohol and 10 c.c. of ether, when 30 c.c. of water are added; the solution is coloured with a few drops of hæmatoxylin solution, and $N/10$ sulphuric acid added with constant shaking until the purple colour has almost changed to yellow; 10 c.c. of water and more acid are now added until a lemon yellow is obtained; then 30 c.c. of water are added, and after vigorous shaking, more acid is added until the lemon-yellow colour persists. Each c.c. of acid corresponds to 0·0309 grm. of total cinchona alkaloids. The relation of the percentages of the four principal alkaloids of the drug is almost constant.—A. Sbld.

Caffeine; Compounds of —— *with pyrogallol and phloroglucinol.* A. J. Ultée. Chem. Weekblad, 1910, **7**, 32—34. Chem. Zentr., 1910, **1**, 519.

Caffeine forms well-defined additive compounds with pyrogallol and phloroglucinol, when equimolecular equivalents, in warm concentrated aqueous solutions, are mixed. *Caffeine-pyrogallol*, $C_8H_{10}O_2N_4.C_6H_6O_3+4H_2O$, forms needle-shaped crystals, m. pt. about 70° C. It is partially dissociated in aqueous solutions and yields up its caffeine when extracted with chloroform. *Caffeine-phloroglucinol*, $C_8H_{10}O_2N_4.C_6H_6O_3+2H_2O$, melts at about 185° C. Caffeine is readily converted into theobromine by shaking a solution of the alkaloid in excess of dilute sodium hydroxide solution with a few drops of dimethyl sulphate, and gently warming.—J. O. B.

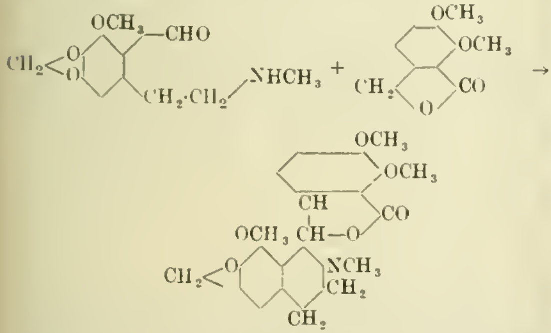
Colchicum corm and seed ; Assay of ——. [*Impurity of "colchicine" as determined in the U.S.P. official method*]. A. R. L. Dohme, H. Engelhardt, and R. Schmidt. Druggists Circular, 1910, 58.

In preparing colchicine on the large scale by a method similar to the assay process of the U.S.P. 1900, the yields obtained have been below those indicated by preliminary analysis of samples, employing the official process. By this, 8 samples of colchicum corms yielded from 0·352 to 0·434 per cent. of "colchicine," and 9 samples of seeds, from 0·480 to 0·796 per cent. This "colchicine" was then purified by Panchaud's method (Schweiz. Woch. Chem. Pharm., 1906, 563), as follows. To the "colchicine" of the assay process, 1 grm. of dry chloroform, followed by 2 grms. of dry ether, and 30 grms. of dry light petroleum spirit were added. The precipitate formed on adding the last was collected, washed with dry petroleum spirit, and dried. The funnel and filter was then placed on the flask, and the precipitate washed back with warm chloroform into the flask ; after thoroughly washing the filter with chloroform, that solvent was driven off and the residue treated again as before, with chloroform and ether, and re-precipitated with light petroleum spirit. After this second precipitation, the colchicine was collected, dried and weighed, making a correction of 2·2 mgrms. for the amount of alkaloid dissolved by the above volumes of liquid. Applying this method to the "colchicine" residue obtained by the official U.S.P. process, that from the corms was found to be only from 35·2 to 48·4 per cent. pure ; and that from the seeds from 58·1 to 75·8 per cent. pure.—J. O. B.

dl-Narcotine (gnoscopine) ; Synthesis of ——. *Preliminary note.* W. H. Perkin, jun., and R. Robinson. Chem. Soc. Proc., 1910, **26,** 46.

During the course of some experiments on the synthesis of the alkaloids, the authors have found that gnoscopine is produced when cotarnine and meconine are boiled in alcoholic solution with potassium carbonate. The synthetical alkaloid melts at 229° C., and this melting point was unaltered by admixture with a specimen of gnoscopine from opium, of the same melting point.

The synthesis takes place according to the scheme :



The authors intend to apply this reaction to the synthesis of hydrastine, and to complete the synthesis of narcotine, narceine, etc., by resolving gnoscopine into its optically active components and by converting the cotarnic acid which has recently been synthesised (Chem. Soc. Trans., 1909, 95, 1977) into cotarnine.

Assamin, the neutral saponin of Assam tea seeds. H. Halberkann. Biochem. Zeits. 1909, **19,** 310—367.

Assamin is a yellowish white, markedly hygroscopic, optically inactive powder, readily decomposed in aqueous solution. It has the formula, $C_{30}H_{46}O_{15}$, and is hydrolysed by 3 per cent. sulphuric acid into galactose, a pentose, and sapogenin, $C_{19}H_{28}O_6$. Assamin acts on the blood as a powerful haemolytic.—J. O. B.

Colocynth ; Constituents of ——. F. B. Power and C. W. Moore. Chem. Soc. Trans., 1910, **97,** 99—110.

The material used in this investigation was the dried, peeled fruit of *Citrullus Colocynthus*, Schrader. The pulp which, when freed from seeds, amounted to 24·4 per cent. of the whole, was extracted with alcohol. The portion of this extract soluble in water was found to contain a new dihydric alcohol, *citrullol*, $C_{22}H_{36}O_2(OH)_2$, m. pt. 285°—290° C., and a feebly basic amorphous alkaloidal substance. The latter has an extremely bitter taste and possesses purgative action. The portion of the alcoholic extract insoluble in water, consisting chiefly of resinous material, contained *a*-elaterin, m. pt. 232 C., $[a]_D = -68·9$ in chloroform. In the same portion of the extract there were also found hentriacontane, and a phytosterol, $C_{27}H_{46}O$, m. pt. 160°—162° C. and optically inactive. The ether and chloroform extracts of the resin, possessed marked purgative propertes even after the removal of the active alkaloidal substances. The seeds were found to contain traces of an alkaloidal substance, a small amount of an enzyme which hydrolyses *β*-glucosides, and 12·72 per cent. of a fatty oil. From the oil there was obtained a small amount of a phytosterol, $C_{20}H_{34}O$, which melted at 158°—160° C. and had $[a]_D = +8·1°$ in chloroform.
—F. Shdn.

Red clover flowers ; Constituents of ——. F. B. Power and A. H. Salway. Chem. Soc. Trans., 1910, **97,** 231—254.

A large amount of red clover flowers (*Trifolium pratense*, Linné) was gathered and dried. The alcoholic extract on steam distillation yielded an essential oil containing furfuraldehyde, which had the sp. gr. 0·9476 at 20°/20° C., and $a_D = +4°$ in a 100 mm. tube. The portion of the alcoholic extract soluble in water contained a large amount of sugar which yielded *d*-phenylglucosazone. In addition the following substances were isolated from it :—salicylic and *p*-coumaric acids ; *iso*rhamnetin ; a number of new phenolic substances : *pratol*, $C_{15}H_8O_2(OH)(OCH_3)$, m. pt. 253° C. ; *pratensol*, $C_{17}H_9O_2(OH)_3$, m. pt. 210° C. ; a *yellow* compound, $C_{16}H_{10}O_7$, m. pt. 280° C. ; a substance, $C_{16}H_7O_3(OH)_3$, m. pt. 225° C. ; a substance, $C_{14}H_{12}O_6$, m. pt. 214° C. ; also the following new glucosides : *trifolin*, $C_{22}H_{22}O_{11}.H_2O$, m. pt. 260° C., which yielded on hydrolysis a yellow colouring matter, *trifolitin*, $C_{16}H_{10}O_6$, m. pt. 275° C., and rhamnose, $C_6H_{12}O_5$; iso*trifolin*, $C_{22}H_{22}O_{11}$, m. pt. 250° C., and a glucoside of quercetin melting at 235° C. The portion of the alcoholic extract insoluble in water consisted chiefly of resinous material. The following substances were obtained from it : myricyl alcohol, heptacosane and hentriacontane ; sitosterol, $C_{27}H_{46}O$, m. pt. 135°—136° C., $[a]_D = -34·4°$ in chloroform ; a new dihydric alcohol, *trifolianol*, $C_{21}H_{34}O_2(OH)_2$, m. pt. 295° C. ; a mixture of fatty acids, chiefly palmitic, stearic, and linolic acids, and a small amount of pratol, $C_{16}H_{12}O_4$, the latter having evidently been in the resin in the form of a glucoside.—F. Shdn.

Hyacinths ; Essential oil of ——. C. J. Enklaar. Chem. Weekblad, 1910, **7,** 1—11. Chem. Zentr., 1910, **1,** 646.

Fresh hyacinth blossoms were extracted with cold benzene, the benzene was distilled off, and the residue treated with dilute alcohol and with petroleum spirit, whereby fatty oil and wax were precipitated. In this way a small quantity (0·01 per cent. of the weight of the blossoms) of an essential oil, still containing traces of fatty matter, was obtained. The vapours of the oil have a strong unpleasant odour when in a concentrated condition, but, when greatly diluted, the odour is quite similar to that of hyacinth blossoms. The oil distils between 90° and 150° C. at 10 mm. pressure, and contains about 50 per cent. of a compound containing oxygen, liquid at the ordinary temperature, b. pt. 92°—94° at 10 mm., 205°—206° C. at 760 mm., sp. gr. 0·907 at 15° C., $n^{16}_{D} = 1·4914$. This compound contains oxygen, probably in an ether-like linkage ; it does not respond to ketone-reactions and behaves as a saturated compound on treatment with permanganate. The oil also contains benzyl alcohol, benzyl benzoate, and a non-nitrogenous fluorescent substance.—A. S.

Rosin spirit; The occurrence of camphene in ——. C. Grimaldi. Chem.-Zeit., 1910, **34**, 220.

The author has examined the distillate from Austrian and American rosin spirit, and has been able by means of the Balbiano reaction (see this J., 1902, 1293; 1903, 1311) to isolate and identify camphene in the fraction distilling up to 170° C., in which it occurs in small quantity.—J. A.

Monoterpenes. Limonene and carvone. E. Deussen and A. Hahn. Ber., 1910, **43**, 519—524.

A quantity of *l*-limonene was converted into the nitrosochloride. This was treated with sodium ethoxide, when *d*-carvoxime (m. pt. 72° C.) was obtained together with an oil. The oil was benzoylated, with the formation of an ester melting at 76°—77° C., and with $[a]_D = -73{\cdot}58°$ in benzene, which is very probably *l*-β-benzoylcarvoxime. On hydrolysis this ester yielded *l*-β-carvoxime, melting at 56°—57° C. A mixture of *d*- and *l*-carvoxime benzoyl ester melted at 55° C., and crystallised from alcohol in quadrangular tablets. The two β-carvoximes are undoubtedly optical isomerides. *d*-Limonene-*a*-nitrolanilide was heated under reduced pressure, with the formation of aniline and *l*-*a*-carvoxime. A similar result was obtained by the distillation under reduced pressure of *d*-limonene-β-nitrolanilide. Either *a*- or β-limonene nitrosochloride when benzoylated can be made to yield *l*-*a*-carvoxime (m. pt. 72°—73° C.). When *l*-*a*-carvoxime is boiled for some time with light petroleum, *i*-carvoxime is formed, which melts at 92°—93° C. *l*-Carvoxime hydrochloride (m. pt. 135°—136° C.), after being boiled in methyl alcohol, becomes inactive and melts at 126° C. The benzoyl and phthalyl esters of *l*-*a*-carvoxime do not change when their solutions are boiled. *L*, *d*-Tetrabromo-*a*-carvoxime benzoyl ester, prepared from *l*-*a*-benzoylcarvoxime, melts at 135°—136° C. and has $[a]_D = +25{\cdot}97°$ in benzene. *R*. *l*-Tetrabromo-*a*-carvoxime benzoyl ester (made from *d*-*a*-benzoylcarvoxime) melts at the same temperature and has $[a]_D = 25{\cdot}51°$ in benzene. Richter's examination of carrot oil is also noticed (see this J., 1909, 1222). The authors consider that both *d*- and *l*-pinene are present in this oil.—F. Shdn.

Cinnamic acids; The absorption spectra of the ——. H. Stobbe. Ber., 1910, **43**, 504—507.

The author has determined the absorption spectra of the three cinnamic acids melting at 42° C., 58° C., and 68° C., and compared the results with the absorption spectrum of ordinary cinnamic acid. The first three acids have exactly the same absorption spectrum. This confirms the theory that these three acids are separate forms of a trimorphous compound.—F. Shdn.

Cinnamic acids; The isomeric ——. III. E. Biilmann. Ber., 1910, **43**, 568—580.

It seems probable that the three cinnamic acids, melting at 42° C., 58° C., and 68° C. respectively, are separate modifications of a trimorphous acid. If the three acids are trimorphous, they should only differ in the solid state, and not in solution. When the acid of m. pt. 68° C., is melted, and cooled in a freezing mixture, the acid melting at 42° C. is formed. If the cooling is done without a freezing mixture, the chance of the formation of an acid of higher melting point is increased. Five capillary tubes containing the acid melting at 58° C. were heated to 62° C. and cooled in ice-water. In each case the acid melting at 42° C. was produced. Solutions of the three acids were made, and the conductivity determined; the value of the dissociation constant was practically the same for each of them, $K \times 10^6$ lying between 138 and 142 (see preceding abstract). Allocinnamic acid reacts readily with mercuric salts to form complex compounds, whereas cinnamic acid does not. Hence allocinnamic acid possesses a maleinoid structure, whilst the structure of cinnamic acid is fumaroid. Allocinnamic acid was dissolved in hot water and treated with a hot solution of mercuric oxide in dilute acetic acid. There was a white micro-crystalline precipitate of the inner salt of an *a*-mercuric-β-phenyl-hydracrylic acid, $C_9H_8O_3Hg$. This is a neutral substance, which dissolves in cold caustic alkalis and in hot sodium carbonate solution. When treated with potassium iodide solution, the liquid becomes alkaline. On heating with hydrochloric acid, mercuric chloride and cinnamic acid are formed. The mercuric compound was dissolved in sodium hydroxide solution and hydrogen sulphide passed in, when β-phenyl-hydracrylic acid, $C_9H_{10}O_3$, m. pt. 91° C., was obtained. The latter yields cinnamic acid when boiled with dilute acids. Maleic acid was treated with mercuric acetate in the same way, the solid product dissolved in alkali and decomposed with hydrogen sulphide, when inactive malic acid was found to have been produced. By similar reactions β-hydroxybutyric acid was produced from crotonic acid.—F. Shdn.

Metastyrene; The true constitution of —— and the polymerisation of styrene by light and heat. H. Stobbe and G. Posnjak. Annalen, 1910, **371**, 259—286.

Metastyrene is formed from styrene by the action of ultra-violet light and heat. "Pure metastyrene" is a white, odourless, amorphous substance which can be easily powdered, and is soluble in aromatic hydrocarbons. It is fully saturated and is indifferent to bromine and permanganate. On account of its colloidal properties its molecular weight cannot be determined by the ebullioscopic method. Preparations formerly described as metastyrene are really solutions of metastyrene in styrene. The progress of the polymerisation can be followed, as the internal friction and hence viscosity of a solution of metastyrene in styrene increases with the amount of the former in solution. The rate of polymerisation is not uniform, and increases after a time. Moreover, the reaction when once started will continue in the dark or without further heating.
—F. Shdn.

Distyrene; The fluid and the solid ——. H. Stobbe and G. Posnjak. Annalen, 1910, **371**, 287—302.

Two hydrocarbons are known by the name distyrene, a fluid distyrene, b. pt. 312° C., and a solid distyrene, m. pt. 124° C. The fluid variety is apparently *a*.γ-diphenyl-*a*. β-butene, $C_6H_5{\cdot}CH : CH.CH(CH_3){\cdot}C_6H_5$. Under the action of bromine it yields distyrenedibromide, m. pt. 102° C. When reduced with hydriodic acid it forms *a*,γ-diphenylbutane, which boils at 295° C. The solid distyrene is *a*.γ-diphenyl-*a*,β-butene. The dibromide, m. pt. 238° C., when reduced with sodium amalgam yields *a*,γ-diphenylbutane, m. pt. 52° C. Acetophenonepinacone was treated with acetyl bromide and then with phosphorus pentabromide. The product was treated with sodium carbonate solution, when an oil separated, which partly solidified. On crystallising from alcohol, silky needles of dibromodimethylstilbene (β,γ-dibromo-β,γ-diphenylbutane) were obtained, which melted at 140°—145° C.
—F. Shdn.

Bismuth tribromophenolate (xeroform); Valuation of, and determination of —— in surgical dressings. C. Kollo. Apoth.-Zeit., 1910, **25**, 99.

Xeroform.—Two grms. are suspended in 25 c.c. of distilled water, 10 c.c. of *N*/1 potassium hydroxide solution are added, and the mixture is warmed on the water-bath, with frequent agitation, until the bismuth oxide is completely precipitated. After cooling, the volume of liquid is adjusted to 100 c.c. Fifty c.c. of the clear liquid are then pipetted off, and titrated with *N*/1 hydrochloric acid, with phenolphthalein indicator. After deducting 5 c.c. for the equivalent of *N*/1 potassium hydroxide present, each remaining c.c. of *N*/1 hydrochloric acid used up is equivalent to 0·331 grm. of tribromophenol. The precipitated bismuth oxide, remaining in the flask, is then collected on a tared filter, dried at 100° C., and weighed. The formula, $Bi(C_6H_2Br_3O)_2OH, Bi_2O_3$, requires about 51 per cent. of bismuth oxide, and 47 per cent. of tribromophenol.

Xeroform gauze. Ten grms. of the material are macerated for some hours, with occasional agitation, in a mixture of 99 parts of acetone and 1 part of 25 per cent. nitric acid. Fifty c.c. of the liquid are then pipetted off into a flask, and the solvent is driven off on the water-bath. The residue, which consists of tribromophenol and bismuth nitrate, is then treated as described above, with the exception that the product of reaction is the hydrated oxide, BiO.OH, and not the trioxide, Bi_2O_3, and that the free nitric acid present must be neutralised before adding the standard alkali. In the xeroform from gauze, the author has been unable to find more than 42 per cent. of tribromophenol, and 48 per cent. of bismuth oxide.
—J. O. B.

Methyl alcohol and water ; Refractive indices of mixtures of ——. A. Doroszewski and S. Dworzanczyk. J. Russ. Phys.-Chem. Ges., 1909, **41**, 951—958. Chem. Zentr., 1910, **1**, 155—156.

The values given in the literature for the refractive index of anhydrous methyl alcohol are stated to be incorrect. The values found by the authors for the pure alcohol and its mixtures with water, using the Zeiss immersion refractometer, are shown in the following table :—

Per cent. of alcohol by weight.	n_D^{15}	$n_D^{17\cdot5}$	Per cent. of alcohol by weight.	n_D^{15}	$n_D^{17\cdot5}$
100	1·33057	1·32957	40·00	1·34308	1·34248
95·00	1·33309	1·33212	35·02	1·34235	1·34180
90·01	1·33545	1·33450	30·02	1·34138	1·34091
85·01	1·33749	1·33657	24·98	1·34022	1·33080
80·00	1·33925	1·33835	20·00	1·33879	1·33844
75·01	1·34067	1·33980	15·01	1·33730	1·33702
69·99	1·34179	1·34094	12·00	1·33644	1·33616
64·99	1·34272	1·34192	10·04	1·33584	1·33559
60·03	1·34327	1·34250	7·04	1·33504	1·33480
54·99	1·34365	1·34290	5·00	1·33453	1·33429
49·98	1·34378	1·34308	2·00	1·33384	1·33362
45·03	1·34359	1·34294	0	1·33339	1·33320

For calculating the specific refractive power the authors found Gladstone's formula, $\frac{n-1}{D}$, most satisfactory.—A. S.

Patents.

Guaiacol compounds ; Manufacture of —— F. Hoffmann-La Roche und Co., E. Barell, and F. Elger, Basle, Switzerland. Eng. Pat. 19,805, Aug. 30, 1909. Addition to Eng. Pat. 24,072, Oct. 5, 1908.

Hexamethylenetetramine-triguaiacol (this J., 1909, 490) may also be prepared by rubbing together dry hexamethylenetetramine with dry guaiacol in the proportion of 1 mol. to 3 mols. Other stable molecular compounds, *viz.*, hexamethylenetetramine mono- and di-guaiacol, may also be produced by the interaction of the two substances in suitable proportions, either in the dry condition or in solution. They are crystalline compounds, soluble in water, and are readily resolved into their components.
—T. F. B.

Anæsthetic ; Local ——. N. Sulzberger, New York. U.S. Pat. 949,134, Feb. 15, 1910.

A local anæsthetic is claimed, consisting of a 10 per cent. solution of cocaïne in a phenol-ester of an organic acid, *e.g.*, phenyl acetate, to which is added a very small proportion of adrenaline.—J. F. B.

Phenol esters chlorinated in the side-chain ; Manufacture of ——, *and of oxybenzyl alcohols, oxybenzaldehydes, and oxybenzoic acids.* F. Raschig, Ludwigshafen on Rhine, Germany. Eng. Pat. 8069, April 3, 1909.

See Fr. Pat. 401,845 of 1909 ; this J., 1909, 1167.—T. F. B.

Alkyl derivatives of the aromatic series [phenols, etc.] ; Process for preparing ——. A. Gerber. Fr. Pat. 405,587, July 30, 1909. Under Int. Conv., July 31, 1908.

See Ger. Pat. 214,783 of 1908 ; this J., 1909, 1223.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

"Carbon" tissues for use in colour photography. E. Clifton, Enfield, and A. E. Wells, London. Eng. Pat. 23,273, Oct. 31, 1908.

During printing of carbon tissues, particularly those containing a blue pigment transparent to white light, there is a tendency to "print through," when the print will not leave its backing. To remedy this, an opaque pigment or dye is added to the transparent pigment, and is dissolved out in the subsequent processes. For example, when using Prussian blue as pigment, manganese dioxide is incorporated with the film, and is subsequently eliminated by means of sulphurous acid.—T. F. B.

Cinematographic film and its process of manufacture. R. W. James, London. From Comp. Générale de Phonographes, Cinematographes, et Appareils de Précision, Paris. Eng. Pat. 14,039, June 15, 1909.

The support of the cinematograph film is emulsified only on the central or working portion, leaving the borders uncoated, which may be perforated or otherwise treated before or after emulsifying. An apparatus is described for coating a film in the above manner.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Nitric esters [guncotton and nitroglycerin] ; The influence of micro-organisms and vegetable matter on the stability of ——. M. Jacqué. Z. ges. Schiess- und Sprengstoffw., 1910, **5**, 81—82.

The author has known instances of blocks of compressed guncotton (containing 15 per cent. of water) showing very marked growths of micro-organisms, but in no case was the nitrogen content or stability of the nitrocellulose affected. Attempts to cultivate the spores of *Aspergillus niger* and *Mycetozoa* in nitroglycerin and ethyl and amyl nitrates were not successful. It is pointed out that the *algæ* and aquatic plants produce organic salts, especially oxalates, during decomposition, and that traces of these organic salts would adversely affect the heat test of guncotton and nitroglycerin. In support of this view the author mentions that in 1907 one of the large dynamite factories in Mexico experienced great difficulty in obtaining heat tests up to their standard of 15 minutes at 76° C. Investigation showed that the cause of the trouble lay in the fact that the water reservoirs and channels had considerable quantities of vegetable growths in them, and when this was cleared away, the heat tests of the guncotton and nitroglycerin returned to their normal figures. (See also this J., 1907, 1295.)—G. W. McD.

Starch nitrate. E. Berl and R. Bütler. Z. ges. Schiess- und Sprengstoffw., 1910, **5**, 82—84.

The authors have investigated the statement made by Hough that a nitrate of starch (16 per cent. of nitrogen) can be obtained by using a mixture of nitric acid and fuming sulphuric acid containing some 2—3 per cent. of free sulphur trioxide (see this J., 1902, 1471 ; 1904, 385 ; 1905, 691).

Ten grms. of starch were injected by means of compressed air into 30 grms. of a cooled acid mixture consisting of equal proportions of nitric acid and sulphuric acid, and with sulphur trioxide in excess. The starch nitrate was stabilised by boiling with a solution of ammonia, and was afterwards washed with water. The following table gives the results obtained with starches of different origins.

Starch.	Nitrogen per cent.	Ignition point. °C.	Relative viscosity (2 per cent. acetone solution).
Maize	13·23	121	1·86
Potato	13·44	120	3·78
Rice	12·86	135	1·60
Soluble	13·35	120	1·35
Potato	13·44	—	2·66
Cellulose nitrate..	13·40	—	1005

The viscosity figures refer to acetone as unity. All the starch nitrates were insoluble in alcohol. In a mixture of ether and alcohol the nitrates prepared from rice and soluble starch were freely soluble, whilst the others were only partially soluble. The normal moisture content of the nitrate prepared from potato starch was 6·57 per cent. A comparison was also made between the nitration of cellulose and potato starch with an acid consisting of sulphuric acid (40·84 per cent.), nitric acid (55·33 per cent.), and sulphur trioxide (3·83 per cent.). The proportion of acid to carbohydrate was 50 to 1. The results obtained for nitrogen content and viscosity in acetone are given in the lower portion of the table. In a 5 per cent. acetone solution the viscosity of cellulose nitrate is about 9000 times greater than that of starch nitrate (see also this J., 1907, 1157, 1255; 1908, 534).—G. W. McD.

Mercuric fulminate. A. Solonina. Z. ges. Schiess- u. Sprengstoffw., 1910, **5**, 41—46, 67—72.

After surveying the literature dealing with the preparation of mercury fulminate, the author gives the results of his own work on the preparation of white fulminate. The grey colour of ordinary fulminate is generally prevented by adding a little copper and hydrochloric acid to the solution of mercury nitrate, before pouring into the alcohol, which is kept cool. The effect of cuprous chloride, cupric nitrate, cupric sulphate, copper only, hydrochloric acid only, sodium chloride, and barium chloride instead of copper and hydrochloric acid shows that the whiteness is caused by the chlorides, but that with hydrochloric acid in the absence of copper, considerable quantities of oxalic acid are formed, which affect the purity and the crystalline nature of the product. Microscopic examination and amalgamation tests showed that carefully prepared grey fulminate (without any additions) contained no mercury globules, though most hastily prepared and all commercial samples contain appreciable quantities. From the author's samples, however, the small traces of metal could easily be removed by placing for a few days in a vacuum desiccator, while in the case of a commercial sample, exposure for a year was not sufficient. The white fulminate is always free from metal. On treatment of either variety with ammonia, potassium cyanide, or pyridine, the fulminate dissolves, leaving a small residue consisting mainly of mercury (about 98 per cent.) but containing some carbon and hydrogen. The source of this is probably the mercurous compounds which are present in the original fulminate. The precipitate thus obtained, which is described in analysis as "metallic" mercury, is really a measure of free mercury and mercurous compounds. Analytical and microscopical examination shows that the best specimens of fulminate are those prepared with addition of cuprous chloride; they generally contain less than 1 per cent. of "metallic" mercury and less than 0·5 per cent. of oxalic acid, while if hydrochloric acid alone be added, as much as 5·76 per cent. of oxalic acid may be observed. The use of cuprous chloride also leads to greatest uniformity and perfection in the size, shape, and transparency of the crystals, which measure about 0·4 mm. by 0·1 mm. For the purification of mercury fulminate, the best method is to dissolve in pyridine and precipitate the filtered solution with excess of water, the pyridine being recovered in large scale operations.

In analysis of the products the author finds it advisable to determine "total" as well as "metallic" mercury. It is necessary to dry (so as to avoid loss of mercury from grey fulminate) in an atmosphere saturated with mercury vapour and to avoid carefully (for the same reason) taking the portion for analysis from the upper layer only of the dried sample. The sample is treated with strong ammonia, the solution filtered, and the precipitate washed with ammonia and water. It is then dried with the same precautions as before and weighed. Total mercury can be estimated as sulphide, or by electrolytic deposition over copper (again with precautions in drying). Oxalic acid is estimated (after removing mercury) as calcium oxalate. Carbon and nitrogen may be estimated by combustion, the substance being mixed with a considerable excess of copper oxide to avoid explosion, and mercury vapour being removed along with water by introducing gold leaf into the calcium chloride tube. For the estimation of mercury fulminate in mixtures it is necessary to determine both the total mercury and the amount (of fulminate) dissolved by ammoniacal acetone.—W. H. P.

Nitrogen in smokeless powders; Gas-volumetric analysis with the "decomposition flask" and the determination of ——. E. Berl and A. W. Jurrissen. Z. angew. Chem., 1910, **23**, 241—248.

The authors describe their apparatus for accurate estimation of the nitric oxide produced by reducing organic nitrates and nitrites with metallic mercury and concentrated sulphuric acid. The principal difficulty in older methods is the irregularity of the action of the concentrated sulphuric acid, in which many gelatinous nitrates are not readily soluble, and which, acting as an oxidising or dehydrating agent, sometimes gives rise to gaseous products other than nitric oxide, thus leading to high results. Sometimes also oxime formation prevents some of the nitrogen from being set free and leads to low results. The "decomposition flask" is a round-bottomed flask of 250—300 c.c. capacity, with a well-fitting ground glass stopper, through which enters the stem of a dropping funnel and from which a tube leads to a three-way tap connected with the pump or a measuring burette in one direction, and with a carbon dioxide reservoir in the other. For easily soluble nitrates or nitrites, the weighed sample is introduced and the flask is freed from air by evacuating, filling with carbon dioxide, and repeating the process several times. Concentrated sulphuric acid is then carefully admitted, and by shaking the flask, the substance is quickly dissolved. On adding one or two c.c. of mercury, the nitric oxide is evolved. When the reaction has ended and the flask is cold, the gas is driven over into a nitrometer by introducing from the dropping funnel air-free concentrated sodium sulphate solution. The nitrometer is filled with mercury, saturated sodium sulphate solution, or 20—30 per cent. caustic potash solution. If caustic potash is not used as measuring liquid, a few c.c. must be introduced to remove any carbon dioxide or sulphur dioxide. After cooling and correcting for temperature, pressure, and solubility of nitric oxide in potash, the calculation can be made in the usual way. If the substance is not readily soluble in sulphuric acid, or if it is desired to estimate the nitrogen in nitro-groups, it is first oxidised *in vacuo* with sulphuric acid and chromic acid with slight warming. This leaves the nitrogen in such a form that it is converted by addition of mercury into nitric oxide. This is collected and measured as before, after absorbing carbon dioxide, but owing to the presence of carbon monoxide, the volume must be checked by absorption with ferrous sulphate solution. Very concentrated solutions of caustic potash must be avoided in absorbing carbon dioxide, since they react with nitric oxide to form the more soluble nitrous oxide. If the sulphuric acid used in the reaction is too dilute (less than 80 per cent.), the values obtained will be too low. The results of actual experiments show the method to be accurate in the case of nitrates of potassium and calcium, cellulose nitrates and (after oxidation) the nitro-derivatives of toluene, phenol, naphthalene, aniline, etc. Urea and diphenylamine gave no nitric oxide, showing that the presence of amino-bodies

does not affect the results. The preliminary oxidation avoids the errors which the presence of bodies like vaseline, camphor, etc., introduces into ordinary determinations.
—W. H. P.

Patent.

Explosives; Buildings for the manufacture and storage of ——. O. Guttmann, London. Eng. Pat. 4094, Feb. 19, 1909.,

The roof of the building is constructed with sheets or plates of expanded metal, coiled wire work, etc., arranged above or below it or both, such covering being capable of resisting the impact of falling bodies or projectiles. The metallic covering may be connected with the earth at intervals, so as to protect the building against lightning.
—C. A. M.

XXIII.—ANALYTICAL PROCESSES.

Electro-analysis; Rapid —— with stationary electrodes. J. T. Stoddard. J. Amer. Chem. Soc., 1909, **31**, 385—390.

Experiments were made with solutions of cadmium nitrate and of silver nitrate in potassium cyanide, of copper sulphate with a small quantity of concentrated nitric acid, of nickel sulphate in ammonium sulphate and ammonia, and of zinc sulphate in excess of caustic soda (sufficient to partly dissolve the precipitate produced) and potassium cyanide. In one set of experiments a mercury cathode was used, and in another, a cathode consisting of a cylinder of "52 mesh" (per inch) platinum gauze (diam., 3 cm.; length, 3 cm.: total surface area, about 40 sq. cm.). It was found that by using strong currents, the metals mentioned could be completely and satisfactorily precipitated with the aid of stationary electrodes in about the same time as that required with rotating electrodes. Some of the results obtained are shown in the following table:—

Volume of solution taken in c.c.	Volume of electrolyte.	Cathode used.	Current.	Time.	Weight of metal found.
	c.c.		amp.	mins.	grm.
$Cd(NO_3)_2$:—					
25......	50	Gauze	5—4·5	15	0·2132
25......	25	Mercury	5—6	10	0·2124
$CuSO_4$:—					
20......	50	Gauze	6	8	0·3955
20......	20	Mercury	4	8	0·3954
$NiSO_4$:—					
25......	50	Gauze	6	12	0·4897
15......	15	Mercury	5·5	10	0·3593
$AgNO_3$.—					
25......	50	Gauze	1	17	0·4957
20......	20	Mercury	8—7·3	6	0·3970
$ZnSO_4(KCN)$:—					
25......	50	Gauze	6	30	0·4991
25......	25	Mercury	6	15	0·4988

—A. S.

Zinc and cyanogen; Volumetric determination of ——. H. Grossmann and L. Hölter. Chem.-Zeit., 1910, **34**, 181—182.

The method for the determination of zinc used by the authors is the same as that described by Rupp (this J., 1910, 300), namely titration with potassium cyanide in neutral solution, in presence of ammonium chloride, but the end of the titration is recognised by the disappearance of a precipitate of silver iodide produced in the solution by the addition of silver nitrate and a few drops of potassium iodide solution.

Cyanides may be determined by direct titration with a standardised solution of nickel sulphate, the end of the reaction being indicated by a turbidity due to the separation of nickel cyanide. The method is applicable in presence of halides and thiocyanates, when Liebig's method of titration with silver nitrate cannot be used.—A. S.

Selenium; Volumetric determination of ——. P. Klason. Wochenbl. Papierfab. 1910, **41**, 545—546.

Littmann (this J., 1906, 694) states that selenium is completely oxidised to selenious acid by evaporation with nitric acid, and that the selenious acid can then be titrated with permanganate. The author finds, however, that more or less selenic acid is produced by the action of nitric acid, and this portion therefore escapes detection by permanganate. The author proposes the following method:—The selenium is oxidised to selenic acid by means of hydrogen peroxide, the excess of peroxide is decomposed, and the selenic acid is heated in a closed bottle in an atmosphere of carbon dioxide in a water-bath with potassium iodide and hydrochloric acid, following the same procedure as in the determination of ferric chloride by means of hydriodic acid. The selenium is thus precipitated in a dense, black form, and the iodine liberated is titrated with thiosulphate. In this way, fractions of a milligram of selenium may be accurately determined. It should be noted that if tellurium be also present, it is estimated as selenium.—J. F. B.

Gas-volumetric analysis with the "decomposition flask," and the determination of nitrogen in smokeless powders. Berl and Jurrissen. *See* XXII.

Calcium carbide, sodium amalgam, and zinc dust; Analysis of —— with the "decomposition flask." E. Berl and A. W. Jurrissen. Z. angew. Chem., 1910, **23**, 248—249.

See preceding abstract, page 374. The analysis of the substances mentioned is carried out by determining the volume of gas liberated on treatment with a suitable reagent. For calcium carbide, water saturated with acetylene is used for decomposing the carbide and for filling the measuring burette. For sodium amalgam, acidified water is used to decompose the sample, and saturated sodium chloride solution for displacing and measuring (carbon dioxide must be removed by a little caustic potash). Zinc dust is treated with hydrochloric acid and a drop of platinum chloride (copper chloride gives low results).—W. H. P.

Combustible liquids; Determination of carbon, hydrogen, and nitrogen, in highly ——. E. Berl. Z. angew. Chem., 1910, **23**, 249—250.

The liquid can be introduced into the tube distributed through a large amount of copper oxide in the following way. A small cylindrical vessel 2 cm. long is made of oxidised copper gauze closed at one end, and of such a diameter that it will easily pass into the tube. Into this is put a layer of coarse and then a layer of fine copper oxide. A drop or two of the liquid is then introduced from a small dropping funnel. Several vessels are thus filled and the weight of liquid used is determined by weighing the funnel before and after these operations. The combustion tube is clamped in a vertical position and the vessels are introduced with a layer of coarse copper oxide between each pair. The tube can then be placed in the furnace and treated in the usual way. This method gives a complete combustion of the liquid, without the separation of any graphitic carbon, which is difficult to burn.—W. H. P.

Boron; Detection of traces of ——, in organisms and in complex mixtures. G. Bertrand and H. Agulhon. Bull. Soc. Chim., 1910, **7**, 90—99.

In nearly all cases it suffices to simply burn off the organic matter, after drying, in a muffle furnace (at most at a dull red heat) to obtain the boron as borate. In exceptional cases (such as oats) the substance must be first soaked with sodium hydroxide solution. The ash is acidified with sulphuric acid, methyl alcohol added, and the boron distilled off as methyl borate; the distillate is received in a few drops of $N/1$ sodium hydroxide and evaporated to dryness on the water-bath. The residue is tested with turmeric and in the flame. A portion is acidified with hydrochloric acid, turmeric paper immersed in it for some time and then dipped into weak ammonia. It is stated that with care a reaction can be distinctly obtained with 0·0005 mgrm. of boron. Potassium chloride diminishes the sensitiveness of the test to 0·02 mgrm., but this can be partly counteracted by a large excess of hydrochloric acid. Sodium chloride exerts much less influence. Sodium hydroxide is therefore preferable for saponifying the methyl borate. A portion of the above residue is moistened with sulphuric acid, made into a paste with fine calcium fluoride and carefully tested on platinum wire with a hydrogen flame; a green flame, giving a spectrum with 3 characteristic fairly broad bands nearly equidistant, can be obtained with care, with 0·0005 mgrm. of boron. Certain ashes relatively rich in boron (such as those from wine) can be tested directly and the distillation with methyl alcohol dispensed with.—A. Sbld.

Liquids; Measurement of the index of refraction of ——, by means of the microscope. L. Decombe. Comptes rend., 1910, **150**, 389—391.

The author's method is based on that of Brewster but is stated to be more accurate. The liquid is introduced between a plano-convex lens (flat side upwards) and a glass plate fixed above a luminous point. The index of refraction is calculated from the angle of displacement of a microscope, corresponding to the refraction of the light caused by the liquid. The instrument is standardised on a liquid of known refractive power. This method only requires a drop of liquid and can be applied to translucent liquids. A refractometer based on these principles is being constructed.—A. Sbld.

Tin and antimony; Separation of ——. L. W. McCay. J. Amer. Chem. Soc., 1909, **31**, 373—381.

By passing hydrogen sulphide into a moderately dilute solution containing free hydrofluoric acid and a large quantity of sodium acetate, antimonious sulphide is precipitated practically completely from antimonious compounds, whereas stannic (and antimonic) compounds remain unaffected. Since the sulphides of antimony and tin obtained in the regular course of analysis, form antimonious and stannic chlorides respectively, when dissolved in concentrated hydrochloric acid, the difference in behaviour mentioned can be used for the separation and determination of the two metals. The method yields accurate results. The results of a few experiments indicate also that tin and antimony can be accurately determined in this way, without addition of sodium acetate to the solution, provided that a moderate amount of free hydrochloric acid be present in addition to hydrofluoric acid.—A. S.

Pusch's test for purity of citric acid. Hill. *See* VII.

Occurrence of iodine in salt minerals. Erdmann. *See* VII.

Examination of lead-glazed pottery and vitrifiable pigments. Funk. *See* VIII.

Determination of phosphorus retained with ferric chloride in the ether separation. Wysor. *See* X.

Determining silicon in high-percentage ferrosilicons. Preuss. *See* X.

Standardisation of bullion and assay values. *See* X.

Detecting fish oils in vegetable oils. Eisenschiml and Copthorne. *See* XII.

Determination of caoutchouc as tetrabromide. Hübener. *See* XIV.

Determining invert sugar in beetroots. Urban. *See* XVII.

Detecting benzoic, cinnamic, and salicylic acids in wine. Von der Heide and Jakob. *See* XVIII.

Detecting amyl alcohol (fusel oil) in spirituous liquors. Holländer. *See* XVIII.

Determination of husk in cocoa. Goske. *See* XIXa.

Assay of cinchona bark. Engelhardt and Jones. *See* XX.

Assay of colchicum corm and seed. Dohme and others. *See* XX.

Valuation of bismuth tribromophenolate (xeroform) and its determination in surgical dressings. Kollo. *See* XX.

Mercuric fulminate. Solonina. *See* XXII.

Trade Report.

United States imports and exports of chemicals and allied substances in 1908 *and* 1909. Oil, Paint, and Drug Rep., Feb. 7, 1910.

Imports.

	1908.	1909.
Acids[1] ....free	—	$254,608
Alizarin and alizarin colours ....lb.	$3,157,306	$3,876,921
Ammonia, suphate of, free[2] .... lb.	—	39,730,041
Ammonia, sulphate of, dut. ....lb.	76,475,104	46,099,293
Aniline salts ....lb.	5,197,089	6,307,226
Argols or wine lees ....lb.	25,260,796	29,758,834
Arsenic[1] ....lb.	—	2,752,584
Asphaltum and bitumen, crude tons	131,862	132,807
Bark, cinchona or other quinine, lb.	3,368,366	3,767,510
Bones, unmfd.	$631,967	$945,028
Castor beans or seeds, bu.,[10]	—	419,846
Clays ....tons	218,080	279,645
Clover seed ....lb.	15,983,373	15,268,461
Coal tar colours and dyes	$4,531,539	$6,435,925
Cocoa butter or butterine[8] ....lb.	—	1,371,198
Collodion and mfrs. of[5] ......lb.	51,686	133,259
Copra ....lb.	17,147,986	24,724,806
Dead or creosote oil ....galls.	31,550,246	37,951,560
Dyewood, extract of ....lb.	3,612,236	3,384,011
Fusel oil ....lb.	—	2,526,932
Gambier ....lb.	29,651,307	27,807,967
Gelatin[3] ....lb.	528,379	1,268,639
Glass— ..		
Bottles, empty or filled	$655,449	$758,932
Cylinder, crown and common unpolished .... sq. ft.	21,478,920	24,595,515
Cylinder and crown, polished, unsilvered ....sq. ft.	543,489	1,064,301
Plate, cast, polished, unsilvered sq. ft.	1,659,558	2,259,494
Plate or discs, rough cut or unwrought, etc.	$407,207	$464,970
All other	$2,561,487	$5,913,849
Glue ....lb.	5,648,471	7,718,780
Glycerin ....lb.	28,114,505	41,536,430
Grease and oils	$960,420	$1,050,053
Grease	$307,437	$295,560
Guano ....tons	31,469	37,776
Gums—		
Arabic ....lb.	4,300,170	4,969,362
Camphor, crude ....lb.	1,812,718	2,658,667
Camphor, refined and synthetic[1] lb.	128,989	558,014
Chicle ....lb.	6,089,850	5,767,707
Copal, damar and kauri ..lb.	21,344,138	29,195,306
Hops ....lb.	7,367,684	6,807,689
Indigo ....lb.	6,225,755	8,537,413
Iodine, crude ....lb.	153,796	257,043
Kieserite ....tons	—	5.339
Lead—		
In ore and base bullion .....lb.	218,630,033	115,392,353[6]
In ore (lead contents)[7] ......lb.	—	34,791,037
Base bullion[7] ....lb.	—	71,027,037
Pigs, bars, old ....lb.	5,518,621	7,152,665
Lime, chloride of, or bleaching powder ....lb.	—	1,058,823
Lime, citrate of[1] ....lb.	74,602,059	91,390,094
Linseed, ...bu	44,721	1,479,631
Logwood ....tons	13,884	33,530
Magnesite, calcined[1] ....lb.	—	84,814,624
Manganese, oxide and ore tons	178,203	212,765
Mineral waters ....doz. qts.	1,011,656	1,222,079
Oils—		
Fish and other ....galls.	1,206,048	1,468,600
Mineral, free ....galls.	2,116	2,873,901
Mineral, dut. ....galls.	9,287,260	1,078,544

Imports—continued.

	1908.	1909.
Oils—*cont.*		
Cocoanut ....lb.	47,576,803	43,093,824
Rapeseed and hempseed[8] ..galls.	—	503,181
Nut oil ....galls.	2,238,406	3,601,268
Olive, commercial ....galls.	1,074,001	414,319
Olive, other ....galls.	3,805,542	3,633,447
Palm ....lb.	44,252,049	69,050,432
Volatile or essential and distilled—		
Lemon[9], free..............lb.	123,462	92,417
All other, free ....lb.	2,276,439	1,010,784
All other, dut..............lb.	656,783	621,714
Opium—		
Containing 9 per cent. and over of morphia, dut. ....lb.	309,587	584,130
Containing less than 9 per cent. of morphia, dut. ....lb.	146,006	16,933
Paints and colors	$1,495,098	$1,700,831
Perfumeries, cosmetics and all toilet preparations	$1,141,143	$1,036,355
Phosphates, crude ....tons	26,734	11,903
Fertilizers, n. e. s. ..../..	$4,395,434	$6,505,090
Plumbago ....tons	10,260	18,910
Potash—		
Carbonate ....lb.	18,584,309	21,023,695
Caustic or hydrate ....lb.	5,250,558	8,163,128
Cyanide[1] ....lb.	—	381,762
Muriate ....lb.	214,338,887	298,854,649
Nitrate, crude ....lb.	16,118,160	28,180,630
Sulphate ....lb.	46,626,532	70,161,832
Quebracho—		
Extracts of ....lb.	87,132,049	104,724,414
Wood ....tons	46,269	65,387
Quinine, sulphate and all salts of oz.	1,817,229	2,827,747
Shellac ....lb.	11,332,800	23,830,713
Soap—		
Fancy and perfumed ......lb.	1,067,919	1,940,309
All other	$380,545	$308,477
Soda—		
Nitrate ....tons	310,713	422,593
All other salts ....lb.	11,376,614	15,697,637
Sulphur or brimstone ......tons	26,118	26,914
Sulphur ore, in excess of 25 per cent. of sulphur ....tons	668,115	692,385
Sumac, ground ....lb.	9,990,460	12,138,204
Vanilla beans	756,326	1,137,736
Wax, vegetable or mineral, free lb.	41,300,820	52,789,005
Wax, vegetable or mineral, dut. lb.	27,257,238	33,612,427
Zinc or spelter—		
Ore, calamine[11] ....ton	21,012	69,580
Ore[11] ....ton	26,984	10,525
Blocks, pigs, old ....lb.	1,762,627	19,340,029

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[1] Included in "All other chemicals," prior to July 1, 1909.

[3] Figures cover period since August 5; free on and after August 6, 1909.

[3] Included in "Mineral oil, free," prior to July 1, 1907.

[4] Included in "All other fertillizers," prior to July 1, 1909.

[5] Included in "All other articles, dutiable," prior to July 1, 1908.

[6] Figures are for six months, January to June.

[7] Not separately stated prior to July 1, 1909.

[8] Included in "All other fixed or expressed oils, dutiable," prior to July 1, 1909.

[9] Included in "All other volatile, etc., free," prior to July 1, 1909.

[10] Included in "All other seeds, dutiable," prior to July 1, 1909.

[11] Included in "All other articles" prior to July 1, 1907; figures cover period January 1 to August 5, 1909, inclusive.

Exports of domestic merchandise.

	1908.	1909.
Acids—		
Sulphuric[1] ....lb.	3,626,120	5,680,973
All other ....lb.	326,469	372,640
Acetate of lime ....lb.	56,703,015	72,312,173
Alcohol—		
Including pure, neutral or cologne spirits ....pf. galls.	131,301	48,325
Wood ....galls.	1,380,820	1,188,623
Baking powder..............lb.	1,689,885	1,759,227
Bark, extracts of, for tanning ..	$255,616	$329,765
Blacking......................	$535,636	$555,011
Bones	$243,898	$211,984
Calcium carbide[2]............lb.	—	11,588,675
Candles ....lb.	3,076,149	3,805,573
Celluloid and mfrs. of	$445,800	$892,193
Copper, sulphate of ....lb.	7,663,882	2,965,713
Dyes and dyestuffs	$393,336	$404,632
Dynamite ....lb.	6,086,094	11,295,718
Emery and corundum and mfrs. of[3]	—	$367,202[2]
Glass—		
Cylinder, crown and common window	$71,574	$57,515
Glass—*cont.*		
Plate ....sq. ft.	57,189	30,142
All other	$2,032,900	$2,434,877
Glucose ....lb.	95,482,151	96,320,689
Glue ....lb.	2,529,448	2,515,668
Grape sugar ....lb.	21,862,339	24,804,635
Grease and all soap stock	$4,088,477	$5,107,620
Gunpowder ....lb.	876,344	999,664
Hops ....lb.	21,423,869	8,955,533
Lamp black, carbon black, and gas black	$481,162	$636,975
Lard ....lb.	581,934,236	458,261,434
Lard compounds and other substitutes ....lb.	76,739,375	73,245,815
Mercury......................lb.	224,692	510,241
Naphthas, including all lighter products ....galls.	43,887,044	68,758,675
Oil cake and oil-cake meal—		
Corn (Maize) ....lb.	55,603,993	50,393,494
Cottonseed ....lb.	1,217,738,444	814,423,733
Linseed ....lb.	685,870,002	623,416,320
Oil—		
Corn (Maize) ....lb.	20,383,530	21,202,348
Cottonseed ....lb.	366,977,858	341,358,266
Fish, not including whale galls.	56,268	1,462,444
Illuminating ....galls.	1,129,004,833	1,046,401,072
Lard ....galls.	260,515	182,077
Linseed ....galls.	297,331	256,147
Lubricating and heavy paraffine, galls.	147,769,024	161,630,609
Mineral, crude ....galls.	149,190,017	186,305,442
Mineral, residuum ......galls.	77,551,683	107,998,575
Peppermint ....lb.	172,539	128,585
Other essential	$244,770	$301,947
Other vegetable	$187,097	$290,795
Other animal ....galls.	764,633	533,325
Oleo oil and neutral lard ....lb.	195,213,681	161,273,364
Oleomargarine ....lb.	2,739,662	3,104,541
Paints and colours ....total	$3,721,312	$4,457,776
Paraffin wax ....lb.	141,067,470	181,327,568
Peanuts ....lb.	5,460,946	5,921,144
Perfumery, cosmetics, and all toilet preparations	$610,298	$789,257
Phosphate rock, ground or unground, not acidulated ..tons	1,196,175	1,020,556
Other fertilizers ....tons	32,814	38,204
Rosin ....bbls.	2,601,181	1,984,525
Seeds—		
Cotton ....lb.	40,995,830	43,267,393
Linseed, ...bu.	1,395,508	63,922
Soap—		
Toilet or fancy..............	$1,110,498	$1,310,971
All other ....lb.	53,569,895	48,084,275
Starch ....lb.	31,518,019	36,549,910
Sulphur or brimstone, crude, tons	27,894	37,142
Tallow ....lb.	70,489,762	50,113,092
Tar, turpentine and pitch ..brls.	23,356	29,519
Turpentine, spirits of ....galls.	19,433,181	16,061,783
Varnish ....galls.	852,845	930,690
Washing powder and fluid ....lb.	7,244,094	6,766,135
Zinc—		
Oxide of ....lb.	24,016,254	29,691,347
Ore ....tons	23,311	11,121
Dross ....lb	16,810,259	14,138,898
Pigs, bars, etc. ....lb.	5,280,344	5,131,360

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[1] Not separately stated prior to July 1, 1908.

[1] Figures are for July to December, 1909, inclusive

[3] Included in "All other articles," prior to July 1, 1909.

Books Received.

Kolloidchemische Beihefte (Ergänzungshefte zur Kolloid-Zeitschrift). Monographien zur reinen und angewandten Kolloidchemie, herausgegeben von Dr. Wo. Ostwald. Bd. I. Heft 3—5. Theodor Steinkopff's Verlag. Dresden. 1910. Price of each Heft for purchasers of the entire volume, M. 1. Single numbers, M. 1.20.

8vo pamphlet, containing 220 pages of subject matter. It includes two articles, one by M. H. Fischer ("Das Oedem als kolloidchemisches Problem, nebst Bemerkungen" ueber die allgemeine Natur der Wasserbindung in Organismen"), and the other by W. S. Ssadikow ("Ueber das Verhalten der Kollaine oder Leimstoffe gegen Schwefelkohlenstoff").

The Simple Carbohydrates and the Glucosides. By E. Frankland Armstrong. D.Sc., Ph.D. Longmans, Green & Co., 39, Paternoster Row, London; also New York, Bombay, and Calcutta. 1910. Price 3s. 6d. net.

8vo volume, containing 91 pages of subject matter. 18 pages of bibliographic references, all classified and arranged for the chapters to which they appertain, and an alphabetical index of subjects. The subject matter is subdivided and allocated to chapters under the following heads: I. Glucose. II. Chemical properties of glucose. III. Hexoses and pentoses. IV. Disaccharides. V. Relation between configuration and properties. VI. Hydrolysis and synthesis. VII. Natural and synthetical glucosides.

Practical Chemistry. By James Bruce and Hy Harper. Macmillan and Co., Limited, St. Martin's Street, London. 1910. Price 2s. 6d.

Small 8vo volume, containing 235 pages of subject matter, with 62 illustrations, numerous tables, and an alphabetical index. The subject matter is divided into two parts, classified as follows: Part I. *Section i.* Preparations. *Section ii.* Qualitative analysis. Part II. *Section i.* Volumetric analysis. *Section ii.* Gravimetric analysis.

Statistical Abstract for the Principal and other Foreign Countries in each Year from 1897 to 1907—8 (as far as the particulars can be stated). Thirty-fifth number. (*Cd.* 5053]. Wyman and Sons, Fetter Lane, E.C. Price 1s. 7d.

This abstract gives particulars regarding trade, navigation, agriculture, railways, telegraph and telephone systems, finance, mineral production, etc., of the principal foreign countries for a series of years. New tables have been included in the present issue, showing the quantities and values of principal articles imported into and exported from Peru, the trade of Peru with each country, pig iron production and consumption in Russia, Sweden, Belgium, and Austria-Hungary, and steel production of Russia, Sweden, Germany, Belgium, France, Austria-Hungary and United States.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT: MACHINERY.

Applications.

4914. Crombie. *See under* II.

5020. Kestner. Apparatus for concentrating liquids.* Feb. 28.

5264. Henning. Flodin, and Co. Treating material in tangential furnaces. [Swedish Appl., Oct. 21, 1909.]* March 2.

5428. Appleton. Renewable seating regulus metal stop-valve. March 4.

5576. Harger. *See under* VII.

5797. Evans. Appliances for abstracting fumes from crucibles and other vessels used in metallurgical or chemical operations. March 8.

5855. Cockerill. Drying and like machines. March 9.

5910. Schulte-Steinberg. Drying drum. [Ger. Appl., April 24, 1909.]* March 9.

5952. Davis. Apparatus for treating liquids with gases. [Addition to No. 2113 of 1909.]* March 9.

6042. Buck. Apparatus for vaporisation, diffusion, &c. March 10.

6079. McCourt. *See under* VIII.

Complete Specifications Accepted.

4962 (1909). Brown. Separating fluids having different densities. March 9.

5901 (1909). Willis. Calcining kilns. March 16.

8481 (1909). Blakeley. Apparatus for heating, cooling, or distilling liquids, and for treating gases. March 16.

19,767 (1909). Küppers. Apparatus for measuring gases. March 16.

23,866 (1909). Lindahl. Centrifugal slime separators. March 16.

24,903 (1909). Maschinenbau A.-G. Golzern-Grimma. Vessels for mixing, grinding, bleaching, &c. March 9.

25,761 (1909). Hansen and Winkler. Centrifugal apparatus for separating gas from liquid. March 16.

25,976 (1909). Wolff. Drying apparatus. March 9.

II.—FUEL; GAS; MINERAL OILS, AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

4914. Crombie. Separation of tar and dust from hot gases. Feb. 28.

5010. Felizal. Manufacture of a combustible agglomerate of wood charcoal.* Feb. 28.

5262. Soc. Franç. de Chaleur et Lumière. Manufacture of incandescent mantles. [Fr. Appl., March 5, 1909.]* March 2.

5388. Lederer, and Westinghouse Metal Filament Lamp Co., Ltd. Manufacture of metal filaments for incandescent electric lamps. [Addition to No. 6936 of 1909.] March 3.

5798. Cowper-Coles. Production of smokeless fuel. March 8.

5817. Hancock and Arnold. Gas generators.* March 8.

6041. Testrup. Wet carbonising of peat. March 10.

6170. Booth. Manufacture of blocks or briquettes of peat. March 11.

6177. Rowntree and Fryer. Removing solid impurities from producer gas, blast furnace gas, coke oven gas, &c. March 11.

6282. Wagener. Separating tar from hot gas produced in the destructive distillation of coal and the like. [Ger. Appl., March 29, 1909.]* March 12.

Complete Specifications Accepted.

25,549 (1908). Still and Adamson. Manufacture of incandescent mantles. March 9.

5362 (1909). Herring. Retort for carbonising or otherwise treating minerals. March 16.

5731 (1909). Adamson (Burmah Oil Co., and Campbell). Treating or purifying paraffin wax. March 16.

6027 and 10,376 (1909). Hall. Incandescent mantles. March 9.

12,466 (1909). Haddan (Bruno-Patente-Verwerthungs-ges.). Manufacture of incandescent bodies for gas burners. March 16.

21,010 (1909). Otto und Co. Recovery of by-products from gases derived from combustibles. March 9.

21,942 (1909). Werber. Manufacture of mantles for incandescent gas lighting. March 16.

III.—TAR AND TAR PRODUCTS.

Application.

6153. Ransford (Cassella und Co.). Manufacture of new sulphonic acids and azo colouring matters therefrom. March 11.

Complete Specification Accepted.

9689 (1909). Ransford (Cassella und Co.). Derivatives of carbazole and dyestuffs derived therefrom. March 9.

IV. COLOURING MATTERS AND DYES.

Applications.

5670. Newton (Bayer und Co.). Manufacture of vat dyestuffs. March 7.

5808. Kalle und Co. Manufacture of vat dyeing colouring matters. [Ger. Appl., March 19, 1909.]* March 8.

6153. Ransford (Cassella und Co.). *See under* III.

Complete Specifications Accepted.

1963 (1909). Newton (Bayer und Co.). Manufacture of dyestuffs of the gallocyanine series. March 9.

9689 (1909). Ransford (Cassella und Co.). *See under* III.

11,931 (1909). Newton (Bayer und Co.). Manufacture of anthracene derivatives. March 16.

14,143 (1909). Ransford (Cassella und Co.). Manufacture of sulphide colours from carbazole derivatives. March 9.

14,316 (1909). Bloxam (Chem. Fabr. Griesheim Elektron). Manufacture of monoazo dyestuffs for lakes. March 9.

25,752 (1909). Bloxam (Durand, Huguenin, et Cie.). Manufacture of gallocyanine derivatives. March 9.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

4959. Eichengrün. Manufacture of brilliant, frosted, or patterned layers or coatings from acetylcellulose. [Ger. Appl., April 15, 1909.]* Feb. 28.

5892. Woltereck. Apparatus for the production of artificial silk. March 9.

Complete Specifications Accepted.

5771 (1909). Rumpf. Producing a water- and soap-proof gloss on woven materials of cotton. March 9.

8763 (1909). Bayne and Subers. Manufacture of threads and waterproof fabrics. March 16.

10,460 (1909). Pinkus. Increasing the durability of animal tissues. March 16.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

5134. Act.-Ges. f. Anilinfabr. Process for dyeing hairs, furs, &c. [Ger. Appl., Oct. 23, 1909.]* March 1.

5214. Scott and Hindle. Printing in multicolours on textile and other fabrics, paper, &c. March 2.

5373. Maly. Dyeing spindles. [Addition to No. 5575 of 1909. [Hungarian Appl., March 5, 1909.]* March 3.

Complete Specifications Accepted.

9307 (1909). Regordosa and Regordosa. Continuous dyeing of skeins. March 16.

10,190 (1909). Johnson (Badische Anilin und Soda Fabrik). Printing or dyeing on fibrous material with or without discharge effects. March 16.

16,199 (1909). Gawlich. Coating woven fabrics, paper, &c. March 9.

18,649 (1909). Scholefield and Downham. Preparing cotton and other slivers for dyeing, bleaching, &c. March 16.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

4976. Swinton. *See under* XX.

5013. Ashcroft and Gaard. Manufacture of alkali metals, alkaline earth metals, and their derivatives. Feb. 28.

5361. Basset. Manufacture of caustic soda or sodium salts. [Fr. Appl., March 4, 1909.]* March 3.

5382. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia and aluminium compounds from mixtures containing aluminium nitride. March 3.

5445. Bradford. Recovery of by-products in the manufacture of copper sulphate. March 4.

5471. Clemm. Production of chlorine and hydroxides of barium and strontium from barium chloride and strontium chloride. March 4.

5576. Harger. Manufacture of carbides, artificial carbon, hydrogen, and other products from hydrocarbons. March 5.

5657. Price. Manufacture of nitrate of ammonia and compounding it with other salts for agricultural purposes. March 7.

5846. Hindley. Substitute for cream of tartar and tartaric acid. March 8.

6031. Horsley, and United Alkali Co., Ltd. Manufacture of monochloracetic acid. March 10.

6063. Soc. d'Electrochimie, and Hulin. Apparatus for the electrolytic production of sodium. [Fr. Appl., May 6, 1909.]* March 10.

6273 and 6274. Bailey. Process and apparatus for producing lead oxides and white lead. [U.S. Appls., March 12, 1909.]* March 12.

Complete Specifications Accepted.

8555 (1909.) Dolphin. Manufacture of copper sulphate. March 16.

11,694 (1909). John Bennet Lawes and Co., and Davis. Manufacture of tartaric acid. March 9.

12,966 (1909). Marks (Willson). Production of a silicide of an alkaline earth metal. March 9.

17,345 (1909). Stephens. *See under* X.

22,619 (1909). Justice (Cons. f. Electrochem. Industrie). Production of peroxide of hydrogen. March 9.

29,491 (1909). Chem. Fabr. Griesheim-Elektron. Manufacture of anhydrous caustic soda. March 16.

1315 (1910). Jeanneret and Chapoy. Calcium carbide. March 16.

VIII.—GLASS; CERAMICS.

Applications.

4980. Lilienthal and Lauer. Preparation or treatment of mica.* Feb. 28.

5287. Williamson. Glazing or enamelling. March 2.

5730. Griffiths. Decoration of earthenware, china, and tiles with ceramic colours or coloured clay slips. March 8.

6079. McCourt. Applying protective or refractory coatings and linings. March 11.

6215. Lunt. Circular kiln for enamelling and hardening on of colours to pottery ware. March 12.

IX.—BUILDING MATERIALS.

Applications.

5155. Zehrlaut and Zehrlaut. Manufacture of artificial marble from self-hardening hydraulic mortars.* March 1.

6079. McCourt. *See under* VIII.

6226. Hunt. Manufacture of artificial stone or building blocks. March 12.

6227. Brough and Richardson. Preparation and treatment of road paving material. March 12.

6270. Journet. Obtaining plaster materials having the appearance of enamel. [Fr. Appl., March 13, 1909.]* March 12.

Complete Specification Accepted.

8675 (1909). Mellersh-Jackson (J. et A. Pavin de Lafarge). Manufacture of cements. March 9.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

5023. Duke. Alloy and its manufacture. Feb. 28.

5079. Stuart-Bailey. Recovery of copper and like metals. March 1.

5165. Ashcroft. Metallurgy of lead-bearing zinc sulphides. March 1.

5166. Ashcroft. Metallurgy of zinc-bearing lead sulphides. March 1.

5167. Ashcroft. Metallurgy of metal sulphides. March 1.

5267. Brougham (Poldihütte Tiegelguszstahlfabrik). Smelting furnaces.* March 2.

5285. Ashcroft. Metallurgy of metal sulphides. March 2.

5369. Romar. Electroplating apparatus.* March 3.

5486. Sulman and Picard. Recovery of metals from ores by electrostatic methods. March 4.

5559. Hislop. Treatment of oxidisable metals. March 5.

5565. Percy, and Triumph Inventions Co. Depositing metals on metallic surfaces. March 5.

5667. Niedringhaus. Finishing galvanised sheet metal. [U.S. Appl., March 11, 1909.]* March 7.

5668. Niedringhaus. Galvanising apparatus. [U.S. Appl., March 11, 1909.]* March 7.

5700. Murex Magnetic Co., and Lockwood. Wet magnetic separation of minerals. March 7.

5712. Schoop. Coating surfaces with metal. [Ger. Appl., April 27, 1909.]* March 7.

5797. Evans. *See under* I.

5821. Sulman and Picard. Extraction of zinc from its ores. March 8.

5916. Barbanson and Lepersonne. Open hearth process of refining steel. [Belg. Appl., July 3, 1909.]* March 9.

5954. Sulman, Picard, and Wintle. Electroplating metal articles. March 9.

6036. Radford (Ahlers). Furnaces for metallurgical purposes. March 10.

6152. Trowbridge. Deposition of metals on metallic surfaces. March 11.

6168. Sulman, Picard, and Wintle. Electroplating metal articles. March 11.

6171. Fricker. Recovery of the constituent metals from copper-zinc alloys. March 11.

Complete Specifications Accepted.

2359 (1909). Greenway, Sulman, and Higgins. Concentration of ores. March 9.

4667 (1909). Lysaght, Ltd., and Beddoe. Zinc condensers. March 9.

5362 (1909). Herring. *See under* II.

7340 (1909). Bennett. Apparatus for distilling mercury from gold amalgam. March 16.

17,345 (1909). Stephens. Eliminating chlorine and zinc and recovery of tin or lead from tin or terne scruff, skimmings, or residues. March 16.

18,826 (1909). Gröndal. Concentration of oolitic ironstone and similar iron ores. March 16.

24,729 (1909). Potter. Working manganese steel to produce finished shapes. March 9.

XI.—ELECTRO-CHEMISTRY.

Applications.

5246. Gorham. Resuscitating the negative plates of secondary batteries and assisting in their formation. March 2.

5266. Brougham (Poldihütte Tiegelguszstahlfabrik). Electric induction furnaces.* March 2.

5691. Lake (Fabr. Elektrischer Zünder). Producing porous electrodeposits.* March 7.

5934. Johnson (Chem. Fabr. Griesheim-Elektron). Production and maintenance of long electric arcs. [Addition to No. 11,060 of 1909.] March 9.

6035. Petersson. Charging electric resistance furnaces. [Swed. Appl., June 2, 1909.]* March 10.

6063. Soc. d'Electro-Chimie, and Huhn. *See under* VII.

Complete Specifications Accepted.

12,507 (1909). Ruthenburg. Electrodes for electric furnaces. March 16.

12,709 (1909). Electrolytic Alkali Co., and others. Electrodes for electrolytic purposes. March 16.

XII. FATS; OILS; WAXES.

Applications.

5009. Soc. Anon. Huilerie et Savonnerie de Laurian. Extracting the oil from hydrosilicates, fullers' earth, animal charcoal, &c., which has been used for decolourising oils. [Fr. Appl., March 1, 1909.]* Feb. 28.

5183. Levinstein, and Levinstein, Ltd. Emulsive compound, its preparation and use. March 2.

5354. Stewart and Chard. Treatment of soya beans and cotton seed to facilitate extraction of oil. March 3.

Complete Specifications Accepted.

4990 (1909). Biertumpfel. Candles. March 9.

5715 (1909). Budde and Robertson. Decomposition of fats and oils into fatty acids and glycerin. March 16.

5797 (1909). Common, and Hull Oil Manuf. Co. Manufacture of soya-bean oil. March 16.

6931 (1909). Kayser. Detergent compositions. March 9.

9590 (1909). Bloxam (Jacobi). Soap cooling frames. March 9.

24,721 (1909). Arnaud and Posternak. *See under* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Application.

6273 and 6274. Bailey. *See under* VII.

Complete Specification Accepted.

4878 (1909). Strange and Burrell. Manufacture of varnish. March 9.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

5854. Cockerill. Production of indiarubber. March 9.

5931 and 5932. Perkin, Matthews, and Strange. Synthetic manufacture of caoutchouc or homologues. March 9.

6072. Tarver. Recovering rubber from waste rubber, &c. March 10.

6204. Melsom. Treatment of old or waste rubber, vulcanite, ebonite, &c. March 12.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

5211. Bennett and Thorpe. Waterproofing leather. March 2.

5489. Kohn. Tanning processes. [Austrian Appl., April 24, 1909.]* March 4.

6103. Varley. Drying chrome tanned skins or leather. March 11.

6123. Silberrad. Manufacture of artificial leather. March 11.

6192. Evans and Innes-Baillie. Tanning hides and skins. March 12.

6248. Wilson. Manufacturing leather or curing skins. March 12.

6268. Manns. Detanning leather.* March 12.

6281. Simon. Treatment of hides and skins.* March 12.

Complete Specifications Accepted.

10,460 (1909). Pinkus. *See under* V.

12,687 (1909). Winterbottom and Egerton. Manufacture of imitation leather. March 9.

XVI.—SOILS; FERTILISERS.

Applications.

5586. Milne. Manures.* March 5.

5657. Price. *See under* VII.

XVII.—SUGARS; STARCHES; GUMS.

Complete Specification Accepted.

5438 (1909.) Hawley, Ltd., and Saunders. Preventing sugar and other extract solutions clouding or discolouring when being cooled. March 16.

XVIII.—FERMEMTATION INDUSTRIES.

Applications.

4956. Spencer. Malt liquors and their production. Feb. 28.

5614. Freeman and Freeman. Malting process. March 7.

5757. Wilcocks. Stopping the production of alcohol in brewed beverages. March 8.

6007. Epstein. Treatment of fermentation or cultivation. March 10.

6175. Elmassian. Malting process and apparatus.* March 11.

Complete Specifications Accepted.

5583 (1909). Belgeonne. Filtering process for brewing and wine-making. March 16.

7419 (1909). Sherman and Lutyens. Sterilising agent for brewers' casks, vats, &c. March 16.

XIX.—FOODS. WATER PURIFICATION; SANITATION.

Applications.

4939. Lomax. Grain treatment, milling products, and the preparation of food. Feb. 28.

5393. Urbain, Feige, and Seal. Use of metals in the electric arc for sterilising liquids. [Addition to No. 4795 of 1910.]* March 3.

5622. Lomax. Treatment of grain and grain products and food therefrom. March 7.

5827. Lifebelt Coffee Co. (Kaffee-Patent A.-G.). Preparing coffee containing little or no caffeine.* March 8.

5948. Bichel and Roeder. Preparing food free from germs.* March 9.

Complete Specifications Accepted.

5562 (1909). Lamouroux. Obtaining table vinegar from whey. March 9.

20,933 (1909). Jones. Means for treating water. March 16.

21,195 (1909). Richet. Purification of air. March 16.

27,164 and 27,165 (1909). Andrews. Water purifying and softening plant. March 9.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

4976. Swinton. Manufacture of volatile organic acids from their calcium salts. Feb. 28.

5939. De Jahn. Manufacture of organic acid anhydrides. [U.S. Appl., March 27, 1909.]* March 9.

Complete Specifications Accepted.

6173 (1909). Fairweather (Valentiner und Schwarz). Production of a sulphur compound of quinine. March 9.

10,074 (1909). Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. March 16.

24,721 (1909). Arnaud and Posternak. Preparing certain unsaturated fatty acids from natural oils. March 16.

26,814 (1909). Johnson (Boehringer und Söhne). Preparation of pharmaceutical compounds. March 9.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

5154. Smith. Sensitiser for bleaching-out colouring matters and halogen silver emulsions. [Ger. Appl., March 3, 1909.]* March 1.

5377. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Polychrome screens for colour photography. [Addition to No. 29,273 of 1909. Fr. Appl., March 10, 1909.]* March 3.

Complete Specification Accepted.

14,473 (1909). James (Cie. Gén. de Phonographes, Cinematographes, et Appareils de Précision). Colouring photographic prints and cinematograph films. March 16.

XXII.—EXPLOSIVES; MATCHES.

Applications.

5335. Dart. Match composition. March 3.

5338. Flürscheim. Explosives. March 3.

5496. Caussemille jeune et Cie., and Roche et Cie. Ignition producing compositions. [Fr. Appl., June 23, 1909.]* March 4.

5707. Carlson. Producing combustibles for explosives.* March 7.

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No. 7, Vol. XXIX. APRIL 15, 1910. No. 7, Vol. XXIX.

Liverpool Section.

Meeting held at Liverpool University, on Wednesday, March 9th, 1910.

DR. JAMES T. CONROY IN THE CHAIR.

HURTER MEMORIAL LECTURE.

MODERN IATRO-CHEMISTRY: SOME SERVICES OF CHEMISTRY TO PHARMACO-THERAPEUTICS.

BY CHARLES ALEXANDER KEANE, D.SC., PH.D., F.I.C.

We meet this evening within a few days of the anniversary of both the birth and of the death of Ferdinand Hurter. He was born on March 15th, 1844, and died on March 12th, 1898, at the comparatively early age of 53.

It was my good fortune to be associated with Hurter for many years in the work of this Section of the Society. The opportunity thus given of knowing the man and his work, of learning, from the unrivalled skill with which he brought the highest branches of pure science to bear upon problems of technical chemistry, the true correlation of the work of the pure scientist and the technologist, which is so fundamental for the advancement of chemical industry, has been to me, as to many who are here to-night, a stimulating lesson for all time; in grateful remembrance of his inspiring example and masterly teachings, I ask you to accept my tribute to his memory.

Hurter's investigations were concerned essentially with two branches of chemical technology the Alkali and allied industries and Photography. Your first lecturers, Professor Lunge and Sir William Abney, have dealt with these subjects of his researches. Subsequent lecturers have been permitted to select a subject associated rather with their personal activities than with Hurter's work. As years pass by this must of necessity tend to be the case, but the occasion will none the less continue to fulfil the objects of its foundation—to recall to the members of the Section the labours and the personality of one, who did so much to establish and maintain its utility and its success, and whose name will always stand in the forefront of applied chemistry.

I, too, as in the case of my more immediate predecessors, must claim your indulgence in this respect.

Manifold as were Hurter's activities, it was characteristic of the man that he did not deal with subjects of which he was not a master, and which lay outside the scope of his own experimental enquiries; we wonder at the wide range of problems his indomitable energy permitted him to cover, not that some branches of our science were not illuminated by his stimulating insight. The latter include the subject of my address; as far as my knowledge of Hurter permits me to say he did not extend his work to what Wöhler once described in a letter to Berzelius as "the tropical forest primæval, full of the strangest growths, an endless and pathless thicket, in which a man may well dread to wander"—the chemistry of the carbon compounds.

The aim of his investigations will always, however, remain applicable to other branches of his science—an aim which he expressed with characteristic directness in a letter received from him at a time when a very controversial subject was under discussion in this Section, in which he said: "I do not suppose the world will be much the richer or the poorer whether the one or the other of us is right, but I want to show *the truth*."

The period known to the historian of chemistry as that of "Iatro-Chemistry" linked the mysticism of the alchemists with the dawn of the recognition of chemistry as an independent science; it held sway from the first quarter of the 16th to the middle of the 17th century.

The iatro-chemists broke away from the alchemical view that the transmutation of the metals was to be looked upon as the chief aim of chemists and sought to link chemistry with medicine by regarding the art of healing as essentially a branch of applied chemistry. In the well-known words of their founder, that unscrupulous and arrogant genius Paracelsus, "The object of chemistry is not to make gold, but to prepare medicines."

Imbued with the views of Geber and Basil Valentine that "sulphur," "mercury" and "salt" were the essential constituents of matter, he extended this conception to animal and vegetable substances, and regarded illness as due to an abnormal arrangement of these three fundamental principles in the human body and the art of curing to consist in the reinstatement of these principles in their due and normal proportions. According to Paracelsus, four pillars supported the art and practice of medicine—of these chemistry was one the three others were philosophy, astronomy and virtue! Despite his extravagant doctrines, his entire lack of scientific method and his confused and contradictory writings Paracelsus appears to have recognised the relations that must exist between the means employed and the end in view, and thus to have put before the medical men of the 16th century a first, if crude, attempt at rational therapeutics. The further merit must also be accorded to him and still more to his followers, Van Helmont, Sylvius, and Willis, of having fully recognised the indispensability of chemistry to medicine, thus associating the study of the two subjects for their mutual benefit. This recognition led to the employment of many metallic salts in medicine, such as those of antimony, mercury, lead, silver and zinc, the use of which had been previously feared on account of their poisonous properties, and to the initiation of a new era in pharmacy, whereby a lasting impetus was given to the work of the laboratories of the apothecaries, which have since contributed so much both in men and matter to the science of chemistry.

The ambition of the iatro-chemists to explain all metabolic and vitalistic phenomena by chemical means led to the fall of the school; chemistry was then far from ripe for such broad generalisations. The experimental data both in chemistry and in medicine that were accumulated during the succeeding two centuries lacked correlation and although in many instances vitalistic functions stimulated the chemist to scientific investigations, whilst the chemist on his part was able to place many compounds of therapeutic value in the hands of the practitioner, the close association and interdependence of the two sciences aimed at by the iatro-chemists has only become possible by the development of the borderland studies, chemical physiology and pharmacology, in association with modern organic and physical chemistry. This association, which has been effected with conspicuous and increasing success during the past 30 years, marks the new period of "Iatro-Chemistry."

Modern Iatro-Chemistry still falls short of the Utopia of the old iatro-chemists. The explanation of all vital phenomena on a chemical basis is still far beyond us, but the chemistry of the products and functions of life is being unravelled with steady and increasing success. No irritant can produce inflammation in a lifeless skin, no germ can cause fever in a lifeless body, but given that the creature lives, then the general laws of chemistry are applicable, neither more nor less, than to dead or inanimate nature. It is the study of the services of modern chemistry to the science and art of the introduction of medicaments into the human body with the view of healing it, a borderland branch of science appropriately termed "Pharmaco-therapeutics" that constitutes the present association of chemistry and medicine which I have ventured to term "Modern Iatro-Chemistry." These services may be summarised as comprising in the first place the synthetical preparation of physiologically active compounds and secondly the application of the principles and methods of chemistry to the study of the conditions and mode of action of drugs. The former is the work of modern organic chemistry, the latter essentially that of physical and of biological chemistry.

Since the discovery of kairine, the first synthetically prepared febrifuge, in 1882, as an outcome of the study of the physiological action of quinoline compounds by Otto Fischer and Filehne organic chemistry has contributed many hundreds of compounds to pharmaco-therapeutics. These comprise antipyretics, anæsthetics, hypnotics, antiseptics, astringents, diuretics, uric acid solvents, purgatives and toxic compounds, which have been prepared on the one hand by purely synthetical methods from compounds of known constitution and on the other hand by the introduction of substituting groups into, or by modifications in the structure of, naturally occurring substances, typically the vegetable alkaloids such as quinine, morphine and cocaine.

The teachings of physical chemistry have led to the study of the conditions of absorption of drugs by the various cells and tissue juices of the body, of the part played therein by osmosis, by electrolytic dissociation, by mass, and especially by the colloidal character of the substances concerned in metabolism. Such study associated with biological chemistry, or to give it its more recent nomenclature "bio-chemistry," has pointed the way to new methods of research which promise well for a fuller understanding of the complexities of the processes that are comprised in the physiological action of drugs.

Despite the mass of material that has thus been accumulated, a scientific basis for the preparation of physiologically active compounds is but in its infancy. The possibility of pre-calculating the action of a drug from its chemical structure is as yet developed to but a limited extent as has been repeatedly brought home during recent years by the discovery of new groups of compounds possessing valuable therapeutic properties, the physiological action of which was in no way anticipated. Indeed, the recognition of the therapeutic value of some of the earlier synthetic drugs was effected rather in accord with Priestley's belief that all discoveries are made by chance, and has been extended with some reminiscence of his view that scientific investigation was to be "compared to a hound, wildly running after and here and there chancing on game." The hypnotic property of sulphonal was a chance discovery, the physiological action of antipyrine was initially examined on account of its supposed relation in chemical structure to kairine and allied febrifuges which was subsequently proved to be incorrect, and the purgative properties of phenolphthaleïn (*Purgen*) became known from the results that followed its use to ear-mark for administrative purposes, a certain kind of wine in Austria-Hungary. The commercial success of antipyrine—the profits in one year from its manufacture before the expiration of the patent are said to have reached £60,000—was followed by a hunt for further "game" and many a compound such as acetanilide (*antifebrine*), has been called from the seclusion of chemical museums for the examination of its physiological properties.

The recognition of the therapeutic value of such substances has been followed by enquiry into the relation of their chemical structure and physiological action with the result that the study of this relation has since become more ordered and systematic.

It is now known that the specific physiological effect of compounds which act for example as antipyretics, hypnotics and anæsthetics is associated with the presence of typical molecular structures and that their action may be modified, extended or annulled either by the introduction of, or by the elimination of, substituting elements or radicals. Each physiologically active nucleus appears to need the presence of an anchoring group in order to effect its linking with the protoplasm of the specific cells which is necessary for it to produce its effect; in their absence the molecule is inert, not because of its intrinsic inactivity but because the conditions necessary for its reaction are absent, just as salt-forming or auxochromic groups are essential for compounds of the requisite structure to act as dyes.

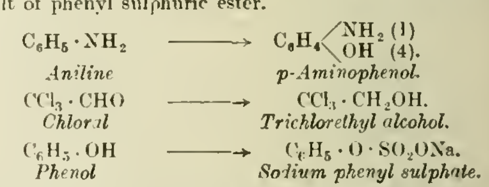
Thus, the antipyretic action of antipyrine is dependent on the presence of a methyl group attached to nitrogen ($N.CH_3$), the hypnotic action of sulphonal on the presence of the ethyl radical, and the anæsthetic action of cocaine on the presence of a benzoylated hydroxyl group ($O.COC_6H_5$), for in each case the corresponding unsubstituted nucleus has practically no physiological effect. In some cases such anchoring groups increase the activity of the nucleus so much, especially in regard to toxicity, that it is necessary to modify them by the introduction of suitable substituents in order to obtain substances that are applicable for therapeutic use. Such relations, in association with the physical properties of compounds, have formed the basis for the preparation of physiologically active substances. By studying the changes compounds containing specific nuclei and substituting groups undergo in the body and the decompositions that can be effected by the tissue juices concerned in metabolism this basis has been much extended as a reliable foundation for the scientific study of the clinical applicability of drugs.

The many-sided activities that have thus contributed to the development of modern iatro-chemistry embrace far too wide a field to be considered with any attempt at completeness on this occasion. I accordingly propose rather to put before you some account of the general character of this progress as illustrated by three typical groups of substances which have been the subject of careful and suggestive investigation, viz.:—

I.—The Antipyretics derived from *p*-Aminophenol.
II.—The Hypnotics derived from Malonyl Urea.
III.—The Local Anæsthetics derived from Cocaine and allied compounds.

I.—THE *p*-AMINOPHENOL GROUP OF ANTIPYRETICS.

The benzenoid hydrocarbons and their derivatives all possess, to varying degrees, the power of decreasing the production of heat. This antipyretic effect is shared by aniline and its salts; they are, however, far too powerful poisons for therapeutic use and in addition have a deleterious effect on the red blood corpuscles causing a decomposition of the hæmoglobin. As long ago as 1878 it was shown by Schmiedeberg, that aniline and its derivatives are oxidised to *p*-aminophenol, which is considerably less toxic than aniline, on passing through the system. This change is in accord with the general function of the body, viz.:—to convert drugs, which are to be regarded as foreign or poisonous substances to the animal economy, into innocuous, or less poisonous products. This result is effected either by oxidation as in the case of aniline, or by reduction as in the formation of trichlorethyl alcohol from chloral, or by chemical combination as in the elimination of phenol as the sodium salt of phenyl sulphuric ester.



$$C_6H_5 \cdot NH_2 \longrightarrow C_6H_4\begin{cases} NH_2\ (1) \\ OH\ (4). \end{cases}$$

Aniline — *p-Aminophenol.*

$$CCl_3 \cdot CHO \longrightarrow CCl_3 \cdot CH_2OH.$$

Chloral — *Trichlorethyl alcohol.*

$$C_6H_5 \cdot OH \longrightarrow C_6H_5 \cdot O \cdot SO_2ONa.$$

Phenol — *Sodium phenyl sulphate.*

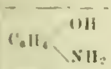
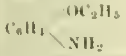
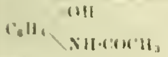
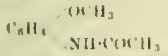
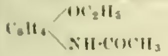
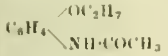
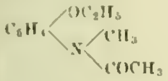
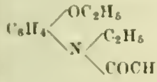
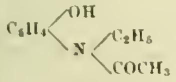
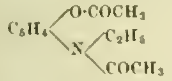
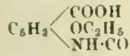
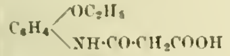
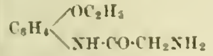
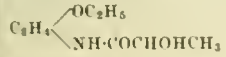
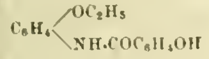
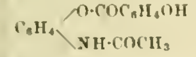
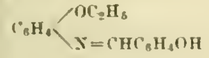
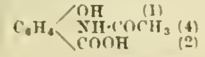
In many cases combination, typically with sulphuric acid, glycocoll or glycuronic acid follows the initial change; aniline is only partially eliminated as the free aminophenol, subsequent combination of this oxidation product with sulphuric acid and with glycuronic acid also occur and it is found in the urine in combination with both these substances.

The formation of compounds of decreased toxicity by these metabolic changes has been a very valuable guide in the synthetic preparation of drugs and full advantage has been taken of Schmiedebergs' observation on the oxidation of aniline and its simpler derivatives to prepare substances which, whilst retaining their antipyretic, and antineuralgic properties should be sufficiently free from toxic effects to be of practical use.

A summary of some of the compounds which have been prepared from this standpoint is given in Table I, together with some comparative data in regard to their antipyretic action and toxicity. The examples have been selected to illustrate on the one hand the influence of substituting groups and on the other the chemical character of the methods that have been adopted to arrive at therapeutically useful compounds.

TABLE I.

ANTIPYRETIC ACTION OF 1:4 AMINOPHENOL DERIVATIVES.

No	Formula.	Nomenclature.	Antipyretic Action.	Toxicity.
1	 $C_6H_4\left\langle\begin{matrix}OH\\NH_2\end{matrix}\right.$	Aminophenol.	Marked.	Toxic.
2	 $C_6H_4\left\langle\begin{matrix}OC_2H_5\\NH_2\end{matrix}\right.$	Ethoxyaminophenol (*Phenetidine*)	Similar to 1.	Less than 1.
3	 $C_6H_4\left\langle\begin{matrix}OH\\NH{\cdot}COCH_3\end{matrix}\right.$	Acetaminophenol	Similar to 1.	Less than 1.
4	 $C_6H_4\left\langle\begin{matrix}OCH_3\\NH{\cdot}COCH_3\end{matrix}\right.$	Methoxyacetaminophenol (*Methacetine*)	Greater than 1 and 5	Less than 3.
5	 $C_6H_4\left\langle\begin{matrix}OC_2H_5\\NH{\cdot}COCH_3\end{matrix}\right.$	Ethoxyacetaminophenol (*Phenacetine*)	Less than 4.	Less than 4.
6	 $C_6H_4\left\langle\begin{matrix}OC_2H_7\\NH{\cdot}COCH_3\end{matrix}\right.$	Propio-oxyacetaminophenol	Less than 5.	Greater than 4.
7	 $C_6H_4\left\langle\begin{matrix}OC_2H_5\\N\left\langle\begin{matrix}CH_3\\COCH_3\end{matrix}\right.\end{matrix}\right.$	Methyl phenacetine	Less than 5.	Greater than 5.
8	 $C_6H_4\left\langle\begin{matrix}OC_2H_5\\N\left\langle\begin{matrix}C_2H_5\\COCH_3\end{matrix}\right.\end{matrix}\right.$	Ethyl phenacetine	Less than 5.	Less than 7.
9	 $C_6H_4\left\langle\begin{matrix}OH\\N\left\langle\begin{matrix}C_2H_5\\COCH_3\end{matrix}\right.\end{matrix}\right.$	Ethyl acetaminophenol	Nil.	Nil.
10	 $C_6H_4\left\langle\begin{matrix}O{\cdot}COCH_3\\N\left\langle\begin{matrix}C_2H_5\\COCH_3\end{matrix}\right.\end{matrix}\right.$	O-acetyl ethylacetaminophenol	Less than 8.	Greater than 8.
11	 $C_6H_3\left\langle\begin{matrix}COOH\\OC_2H_5\\NH{\cdot}COCH_3\end{matrix}\right.$	Phenacetine carboxylic acid	Nil.	Nil.
12	 $C_6H_4\left\langle\begin{matrix}OC_2H_5\\NH{\cdot}CO{\cdot}CH_2COOH\end{matrix}\right.$	Phenacetine *a*-carboxylic acid	Nil.	Nil.
13	 $C_6H_4\left\langle\begin{matrix}OC_2H_5\\NH{\cdot}CO{\cdot}CH_2NH_2\end{matrix}\right.$	*a*-Amino phenacetine (*Phenocoll*)	Rapid.	Marked.
14	 $C_6H_4\left\langle\begin{matrix}OC_2H_5\\NH{\cdot}COCHOHCH_3\end{matrix}\right.$	Lactyl phenetidine (*Lactophenine*)	Less than 5.	Greater than 5.
15	 $C_6H_4\left\langle\begin{matrix}OC_2H_5\\NH{\cdot}COC_6H_4OH\end{matrix}\right.$	Salicylyl phenetidine	Slight.	Slight.
16	 $C_6H_4\left\langle\begin{matrix}O{\cdot}COC_6H_4OH\\NH{\cdot}COCH_3\end{matrix}\right.$	Salicylyl acetaminophenol (*Salophen*)	Slight.	Slight.
17	 $C_6H_4\left\langle\begin{matrix}OC_2H_5\\N{=}CHC_6H_4OH\end{matrix}\right.$	Salicyl phenetidine (*Malakin*)	Slow.	Slight.
18	 $C_6H_4\left\langle\begin{matrix}OH & (1)\\NH{\cdot}COCH_3 & (4)\\COOH & (2)\end{matrix}\right.$	Acetamino salicylic acid	Nil.	Nil.

Para-aminophenol (No. 1) has a marked antipyretic effect but it retains too much of the hæmolytic action of aniline to be of practical use. This toxicity is reduced by the replacement of the hydrogen of the hydroxyl group by an alkyl as in ethoxyaminophenol (phenetidine No. 2), and also by the replacement of the amino-hydrogen by an acid radical as in acetaminophenol (No. 3); both compounds possess powerful antipyretic and anti-neuralgic effects but are still too poisonous, and it is only when the two groups are simultaneously substituted that compounds are obtained which are sufficiently free from toxic effects to be of therapeutic value. The introduction of a methyl group into acetaminophenol (Methacetine No. 4) increases the antipyretic effect somewhat and decreases the toxicity; with the ethyl group (Phenacetine No. 5) the antipyretic action is maintained and the toxicity further decreased.

whilst with higher alkyls such as propyl (No. 6), and amyl the antipyretic action is decreased and the toxicity increased. The products of elimination of phenacetine are practically identical with those of aniline, aminophenol and acetaminophenol being the chief substances formed. This holds for all *p*-aminophenol derivatives which are physiologically active and the change is accordingly a valuable means for recognising an antipyretic action in such compounds. Indeed Treupel and Hinsberg* concluded from their experiments that the antipyretic action is, within certain limits, proportional or nearly proportional to the extent to which this change occurs in the organism; the formation of aminophenol is readily tested for by the indophenol reaction with β-naphthol.

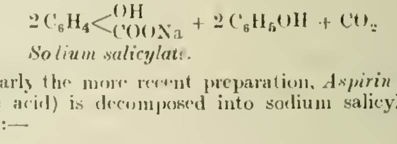
The presence of the hydroxyl and of the amino-groups in *p*-aminophenol allows of the preparation of numerous derivatives by the replacement of one or more hydrogen atoms by an acyl or alkyl radical. There has been no lack of proposals to improve the therapeutic value of aminophenol by such substitutions, but since the physiological action of all such derivatives is essentially dependent upon that of the base itself, such derivations vary in their effect only in accordance with the relative stability of the substituting groups towards the chemical reactions they undergo in the system. Substitution by an acyl radical decreases the basicity of the amino-group and the physiological effect is slowed; also the solubility is decreased, according to the nature of the radical introduced. It is important however that the combination should be sufficiently stable to resist decomposition by the acid of the gastric juice, the equivalent to 2 per cent. hydrochloric acid, as otherwise the acyl radical is split off in the stomach with the formation of toxic phenetidine or of aminophenol. On the other hand if the combination be too stable or too insoluble no absorption or oxidation may occur in the body with the result that the antipyretic action is either markedly decreased or annulled. The alkyl groups increase the stability of the molecule and decrease the toxicity; this is especially the case with the ethyl radical, the presence of which also carries its typical narcotic influence. This increased stability is illustrated in methyl- and ethyl-phenacetine (Nos. 7 and 8): both have less antipyretic action but the former is more toxic than phenacetine. In absence of the ethoxy-group, ethyl-acetaminophenol (No. 9) both effects are annulled, a change to be attributed to the inhibiting effect of the free hydroxyl on the oxidation of the substituting radical in the amino-group, nor is any aminophenol eliminated when this substance is administered. This is exactly analogous to the influence of the hydroxyl group on the oxidation of the side chain of benzenoid compounds by chemical reagents and just as in the latter case this effect is overcome by substituting the hydrogen of the hydroxyl by an alkyl or acyl radical, so the physiological effect of the group is restored in the corresponding acetyl derivative, O-acetyl-ethylacetaminophenol (No. 10). The toxicity of this compound is however greater than that of the corresponding ethyl compound (No. 8) on account of the greater ease with which the acetyl group is attacked.

The result of the study of these and many similar compounds indicates that the amino-group is the carrier of the antipyretic properties; either partially or completely substituted it remains the anchor or to use the term applied by Ehrlich to antitoxins the "haptophore" for the physiological effect. It is essential that the amino-group be directly attached to the benzene ring; benzylamine, $C_6H_5{\cdot}CH_2NH_2$, for instance has no antipyretic action.

The practical outcome of these investigations has led to the recognition of *Phenacetine* as the most suitable of these compounds for medicinal use. Since its introduction in 1887 its application has passed from that of a febrifuge more to that of an anti-neuralgic and analgesic and with the recognition of the depressant and toxic effects that may result from its prolonged or indiscriminate use†, it now stands as a safe and reliable drug.

One objection to its use is that it is only sparingly soluble in water (1 : 900) and in consequence is only slowly absorbed. Some examples of the attempts that have been made to increase the solubility by the preparation of suitable derivatives will illustrate the method that has been adopted in other similar cases. From a chemical standpoint the introduction of a carboxyl or sulphonic acid group, so as to allow of the formation of soluble salts, is an obvious means of approaching this problem. Pharmacologically, however, this is inapplicable as these substituents always decrease and in many cases entirely inhibit physiological action. Benzoic acid for instance is 6 times less toxic than benzene, and the two carboxylic acids of phenacetine, irrespective of whether the carboxyl group is in the ring (No. 11) or in the side chain (No. 12), have neither an antipyretic nor toxic effect. The introduction of basic groups, such as the amino- or glycocoll radical, from which soluble salts can be prepared, is a more rational method of effecting increased solubility which has been practised with some success; the drug retains its typical physiological effect, but secondary actions may arise dependent upon the nature of the radical introduced. Thus a-amino-phenacetine (*Phenocoll*, No. 13), the hydrochloride of which is soluble in 16 parts of water, retains the antipyretic and anti-neuralgic properties of phenacetine; its antefebrile action is, however, too transient for therapeutic use, a fact which appears to be due to its rapid elimination by the kidneys (Mosso). This is typical of many similar preparations,—the practical difficulty always lies in successfully obtaining the change in physical properties that is desired without impairing the physiological effect. This is further instanced by an example of another method by which the problem has been approached, viz., by the introduction of a more soluble acyl radical than acetyl, as in the case of lactyl-phenetedine (*Lactophenine* No. 14). This compound is considerably more soluble than phenacetine, but it is also less stable, so that there is a greater tendency for it to be decomposed by the acid of the gastric juice on its passage through the stomach, thus giving rise to the formation of toxic phenetidine. Its anti-neuralgic action is said to be specially favourable.

Three other compounds have been included in this Table, not on account of their intrinsic value, but to illustrate an important method that has been followed in the synthetic preparation of drugs, known as the "Salol principle." This principle, which was initiated by Nencki in 1886, consisted initially in the preparation of ethereal salts of physiologically active compounds such as acids or phenols; such compounds pass through the stomach unchanged, being stable towards the acid of the gastric juice, but are subsequently decomposed into their constituents by the alkaline pancreatic juice aided by the contained ferments. *Salol*, the phenyl ester of salicylic acid, was the first substance that was prepared from this standpoint. It possesses the advantage over salicylic acid as an anti-rheumatic that it does not give rise to the disturbance of the digestive functions the free acid may occasion, owing to its passage through the stomach unchanged. Its decomposition in the pancreas may be represented by the equation:—



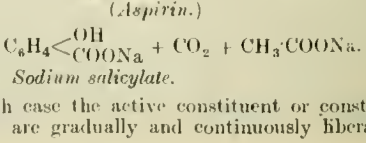
$$2\,C_6H_4{<}^{OH}_{COOC_6H_5} + Na_2CO_3 + H_2O =$$

Phenyl salicylate
(*Salol.*)

$$2\,C_6H_4{<}^{OH}_{COONa} + 2\,C_6H_5OH + CO_2$$

Sodium salicylate.

Similarly the more recent preparation, *Aspirin* (Acetyl-salicylic acid) is decomposed into sodium salicylate and acetate:—



$$C_6H_4{<}^{O\cdot COCH_3}_{COOH.} + Na_2CO_3 =$$

Acetyl salicylic acid.
(*Aspirin.*)

$$C_6H_4{<}^{OH}_{COONa} + CO_2 + CH_3{\cdot}COONa.$$

Sodium salicylate.

In each case the active constituent or constituents of the drug are gradually and continuously liberated by a definite function of the system at the place where it is desirable that the physiological action should be exercised; herein lies the value of Nencki's principle. The constituents may either be both physiologically active, as in the case of salol, or a physiologically active phenol or acid can be combined with an inactive acid or phenol as in the case of aspirin. A special extension of this principle has consisted in effecting the chemical combination of two physiologically active compounds with the object of obtaining a resultant effect of an additive character. The variety of methods open to the chemist to effect such combinations is illustrated in the three salicylic acid derivatives of phenacetine; Salicylyl phenetidine (No. 15), Salicylyl acetaminophenol (*Salophen* No. 16) and Salicyl phenetidine (***Malakin*** No. 17). Salicylyl-phenetidine has only a slight antipyretic action, compared with the phenacetine, despite the presence of the salicylic acid radical which itself also possesses antineuralgic and antipyretic properties, a fact due to the too great stability of the combination towards the metabolism of the system. *Salophen*, in which the ethyl group of phenacetine is replaced by the salicylyl radical, is decomposed in the system similarly to salol and the regenerated constituents appear to each exert their specific effect,—it acts as an analgesic and anti-rheumatic. ***Malakin*** is a combination of a somewhat different character. It is partially decomposed by the gastric juice with the formation of toxic phenetidine, but its subsequent decomposition is slow; its antipyretic action is accordingly only gradual, and 8 times the dose of phenacetine is necessary for it to be effective. Finally, the inhibiting influence of the carboxyl group is shown in an exceptionally marked manner in acetamino salicylic acid (No. 18), in which the effect of the physiologically active groups of phenacetine and of salicylic acid seem to be mutually annulled by its presence.

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* *Arch. exp. Pathol. a. Pharmakol.* 1904. **51**. 262.

† *Cf.* "The harmful effects of Acetanilide, Antipyrine and Phenacetine," by L. F. Kebler, F. P. Morgan and P. Ripp. United States Depart. of Agriculture. Bureau of Chemistry. Bulletin No. 126. 1909.

Whilst the chemical combination of physiologically active compounds, which are subsequently regenerated in the system has proved a valuable therapeutic discovery it is important to bear in mind that such combination may introduce entirely new physiological effects which must be duly weighed and if possible located. Glycerol nitrate and tri-acetyl glycerol, for instance, both of which, as ethereal salts, are decomposed in the pancreas similarly to salol, have specific actions which are not shared by their constituents. Small doses of glycerol nitrate dilate the blood vessels, whilst tri-acetyl glycerol acts as a narcotic and is distinctly poisonous although neither glycerol nor acetic acid are toxic.

The combination of two physiologically active compounds which are not thus regenerated, a method which has been exploited with great activity by manufacturers of synthetic drugs and also in the preparation of "substitutes" for patented products, is in itself unscientific and haphazard. The specific physiological action of a compound as has been pointed out is to be attributed to the presence of one or more anchoring groups in association with a definite molecular structure, and when two such compounds are combined chemically their resultant effect is, at most, the equivalent of that of a mixture of the two, whilst in other cases, owing to the elimination of substituting groups and changes in physical properties, especially solubility and volatility, it may be far removed from the algebraic sum of the effects of the components. Salipyrine (antipyrine salicylate), Quinophenine (phenetidine quinine carboxylate), Anilopyrine (acetanilide and antipyrine) and the like, are at best new names for equivalent mixtures of their components.

II. THE HYPNOTICS DERIVED FROM MALONYL UREA.

Hypnotics and anæsthetics are substances which have the power of acting upon the nerve centres. The most highly organised centres are first acted upon and then the most automatic and stable centres; this condition is essential for the clinical application of any hypnotic as otherwise the respiratory and circulatory centres would be too profoundly affected. The order in which these nerve centres are acted upon differs amongst the various derivatives of the hydrocarbons. Some, such as chloral hydrate, induce sleep as the first result of their action which only passes into anæsthesia when large doses are employed. Such substances are valuable as hypnotics; their action is weak but prolonged. Others act more rapidly and energetically so that, provided they are quickly absorbed and eliminated and cease to act very shortly after being administered they fulfil the conditions required

TABLE II.

HYPNOTIC ACTION OF ALCOHOLS.

No.	Formula.	Nomenclature.	Hypnotic Action.	Dose in grams.
	Primary Alcohols.			
1	$CH_2\cdot OH$	Methyl alcohol	Nil	6—12
2	$C_2H_5\cdot OH$	Ethyl alcohol	Sleep	12
3	$C_3H_7\cdot OH$	Propyl alcohol	Sleep after 5 minutes	12
4	$\begin{matrix}CH_3\\CH_3\end{matrix}\!>\!CHCH_2\cdot CH_2OH$	Iso-amyl alcohol	Drowsiness	2
	Secondary Alcohols.			
5	$\begin{matrix}CH_3\\CH_3\end{matrix}\!>\!CH\cdot OH$	Dimethyl carbinol	Drowsiness	2
6	$\begin{matrix}CH_3\\C_2H_5\end{matrix}\!>\!CH\cdot OH$	Ethylmethyl carbinol	Drowsiness	2
7	$\begin{matrix}C_2H_5\\C_2H_3\end{matrix}\!>\!CH\cdot OH$	Diethyl carbinol	Sleep	2
	Tertiary Alcohols.			
8	$\left.\begin{matrix}CH_3\\CH_3\\CH_3\end{matrix}\right\rangle C\cdot OH$	Trimethyl carbinol	Sleep	4
9	$\left.\begin{matrix}CH_3\\CH_3\\C_2H_5\end{matrix}\right\rangle C\cdot OH$	Dimethyl ethyl carbinol (*Amylene hydrate*)	Sleep, 8—9 hours	2
10	$\left.\begin{matrix}C_2H_5\\C_2H_5\\C_2H_5\end{matrix}\right\rangle C\cdot OH$	Triethyl carbinol	Sleep, 10—12hours	1

by a general anæsthetic. Consequently substances of low molecular weight and high volatility are included in the latter group, whilst hypnotics comprise substances having a relatively high molecular weight and which are only slowly absorbed.

It is convenient to distinguish the following three groups of hypnotics :—

I. Substances the action of which is dependent upon the presence of halogen atoms such as, chloroform, carbon tetrachloride, chloral hydrate and chloralimide.

II. Substances the action of which is dependent upon the presence of alkyl groups such as, alcohol, the urethanes, sulphonal, trional and veronal.

III. Substances the action of which is dependent upon the aldehyde or ketone group such as, paraldehyde and acetophenone.

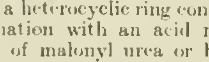
The hypnotic power of many of these substances is associated with the presence of more than one of the typical groups, whereby a contributory effect may be obtained from each. This is the case with *Veronal* the recognition of which as a valuable and reliable hypnotic has been the outcome of a series of careful and well-planned comparisons, carried out by Emil Fischer and v. Mering.[*] A special interest is associated with the physiological action of the compounds of this group because they are chemically very different in character to previously known hypnotics and afford an instructive instance of the good that has resulted from avoiding the tendency there has been to look for new drugs amongst allied compounds by modifications in their substituting groups, rather than to apply the knowledge obtained from the influence of such modifications to the search for new fundamental molecules to which they could be successfully attached.

Alkyl groups and especially the ethyl group have long been recognised as carriers of hypnotic action, and this effect becomes especially marked when several alkyl groups are attached to a central carbon atom. A simple example of this relation is shown in the relative hypnotic power of the following alcohols. (Schneeganz and v. Mering[†].)

These data show that the narcotic effect is greater with the secondary than with primary alcohols, and greater with the tertiary than with secondary ; also that it bears a direct relation to the number of the ethyl groups present. Similar relations have been established for the urethanes and for the sulphonal group of hypnotics and served Fischer and v. Mering as a guide in the preparation of the urea derivatives, the physiological action of which they compared.

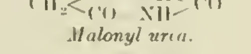
A number of the substances examined by these investigators are given in the following table (Table III) together with some data as to the rapidity and duration of their action as ascertained in experiments with dogs ; the body weight of the animals experimented upon was about the same in most of the experiments so that the figures may be regarded as approximately comparative.

Veronal belongs to the group of compounds known as ureïdes, the condensation products of urea with acids and which contain a heterocyclic ring consisting of the urea residue in combination with an acid radical ; it is the diethyl derivative of malonyl urea or barbituric acid :—



$$CH_2<\begin{matrix}CO-NH\\CO-NH\end{matrix}>CO$$

Malonyl urea.

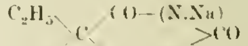


$$\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}CO-NH\\CO-NH\end{matrix}>CO$$

Diethyl-malonyl urea
(Veronal).

Contrasting its structure (No. 9) with that of the compounds that precede it in the table these data show that neither the acid (No. 1) nor the amide (No. 2) have any hypnotic effect ; each contains two ethyl radicals, but no urea residue. The carboxyl group inhibits the physiological action as in the case of the antipyretics derived from *p*-aminophenol ; the corresponding amides of aliphatic acids have a slight narcotic action, but this is only exhibited when large doses are employed. (Nebelthau). Diethyl-acetyl urea (No. 3) contains a urea residue together with two ethyl radicals ; its action is definite though less prolonged than that of veronal, whilst the replacement of its hydrogen by carboxyl (No. 4) suffices to stay the hypnotic power altogether. The substitution of the ethyl radical by methyl eliminates the hypnotic effect (No. 5) ; the action is definite with one methyl and one ethyl radical (No. 6), but is again stopped when only one ethyl group is present. Hence the methyl radical when associated with ethyl has a contributory effect, an influence also illustrated in the methyl propyl compound (No. 8). The influence of the propyl radical is to increase the hypnotic effect (Nos. 10 and 11), that of its homologues iso-butyl (No. 12), and iso-amyl (No. 13) to decrease it. The dibenzyl compound (No. 14) is inactive, probably on account of its sparing solubility. The increased toxicity that occurs when one of the imido-hydrogen atoms is replaced by methyl (No. 15) is very marked, but finds its parallel in methyl-phenacetine. The substitution of the guanidine radical for that of urea (No. 16) entirely eliminates the hypnotic effect, whilst the substitution of oxygen by sulphur (No. 17) causes a marked increase in toxicity. The latter effect was to be anticipated, but the former is remarkable as the imido group is usually very reactive physiologically especially in cyclic compounds. The last two compounds[*] in the Table (Nos. 18 and 19) have an aryl radical in place of the keto-group of veronal, but neither of them proved to have any hypnotic effect. As cinnamic amide has a distant narcotic action the association of the cinnamyl radical with the alkylated malonamide group indicated the possibility of obtaining a useful hypnotic, but here again, as in the guanidine compound, the presence of the urea group appears to be essential.

From these comparative results diethyl-malonyl urea, *veronal,* was first selected as the most suitable substance of the group for therapeutic use and it has proved an exceptionally reliable and safe hypnotic. It is only sparingly soluble in water (1 : 145) and to increase its solubility, which is advantageous for certain therapeutic uses such as subcutaneous applications, the sodium salt which is soluble in 5 parts of water has more recently been introduced as *veronal sodium* :—

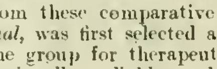


$$\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}CO-(N.Na)\\CO-NH\end{matrix}>CO$$

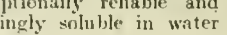
Veronal sodium.

The dipropyl compound has been found to possess advantages over veronal for some forms of insomnia and was introduced in 1905 under the name of *Proponal.*

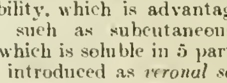
The hypnotic group in these compounds is clearly the urea radical :—.NH.CONH$_2$, the action of which is most marked when it is present in the cyclic form as a ureïde. The physiological activity however, only becomes evident when two alkyl groups are present one of which must be ethyl or a higher homologue ; these act as the haptophores and the influence of the ethyl radical is far greater than that of methyl. These relations may be compared with the chromogen and chromophore groups of the organic dyes :—



$$>C<\begin{matrix}CO-NH\\CO-NH\end{matrix}>CO$$ *Hypnotic group.*



$$\begin{matrix}H\\H\end{matrix}>C<\begin{matrix}CO-NH\\CO-NH\end{matrix}>CO$$ *Mother substance*



$$\begin{matrix}R\\R'\end{matrix}>C<\begin{matrix}CO-NH\\CO-NH\end{matrix}>CO$$ *Hypnotic*

R and R′ = Alkyl radicals, one of which must be ethyl.

A corresponding relation has been established amongst the sulphonal group of hypnotics ; in this case also the

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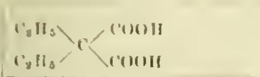
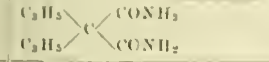
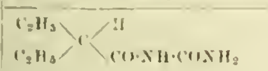
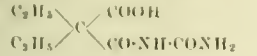
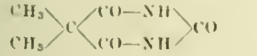
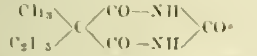
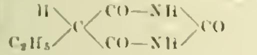
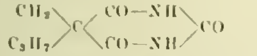
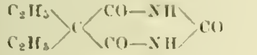
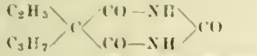
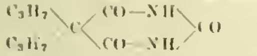
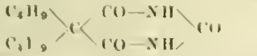
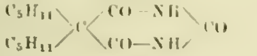
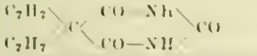
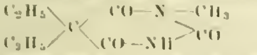
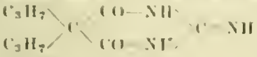
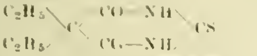
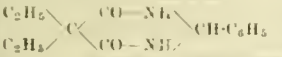
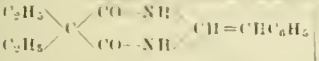
[*] *Therapie der Gegenwart.* 1903, **5**, 97.

[†] *Therapeutische Monatshefte.* 1892, p. 331.

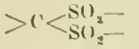
[*] Keane and Burrows. *J. Chem. Soc.* 1907, **92**, 269.

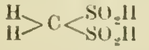
TABLE III.

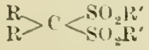
HYPNOTIC ACTION OF MALONYL UREA DERIVATIVES.

No.	Formula.	Nomenclature.	Time required to produce Sleep, Hours.	Duration of Sleep, Hours.	Dose in Grams.
1	 $\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}COOH\\COOH\end{matrix}$	Diethyl malonic acid	No action		5
2	 $\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}CONH_2\\CONH_2\end{matrix}$	Diethyl malonic amide	No action		4—5
3	 $\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}H\\CO{\cdot}NH{\cdot}CONH_2\end{matrix}$	Diethyl-acetyl urea	1	+ 9	3
4	 $\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}COOH\\CO{\cdot}NH{\cdot}CONH_2\end{matrix}$	Diethyl malonic ureide	No action		3
5	 $\begin{matrix}CH_3\\CH_3\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CO$	Dimethyl-malonyl urea	No action		3
6	 $\begin{matrix}CH_3\\C_2H_5\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CO$	Methyl-ethyl-malonyl urea	1	+ 8	3
7	 $\begin{matrix}H\\C_2H_5\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CO$	Mono-ethyl-malonyl urea	No action		3—4
8	 $\begin{matrix}CH_3\\C_3H_7\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CO$	Methy-propyl-malonyl urea	1	2½	1
9	 $\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CO$	Diethyl-malonyl urea (*Veronal*)	½	26½	1·5
10	 $\begin{matrix}C_2H_5\\C_3H_7\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CO$	Ethyl-propyl-malonyl urea	1	24	1
11	 $\begin{matrix}C_3H_7\\C_3H_7\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CO$	Dipropyl-malonyl urea (*Proponal*)	½	50½	1
12	 $\begin{matrix}C_4H_9\\C_4H_9\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CO$	Di-isobutyl-malonyl urea	1	8	1
13	 $\begin{matrix}C_5H_{11}\\C_5H_{11}\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CO$	Di-isoamyl-malonyl urea	Slight action		3
14	 $\begin{matrix}C_7H_7\\C_7H_7\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CO$	Dibenzyl-malonyl urea	No action		3
15	 $\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}CO—N—CH_3\\CO—NH\end{matrix}>CO$	N-methyldiethyl-malonyl urea	¼	48, then fatal	1
16	 $\begin{matrix}C_3H_7\\C_3H_7\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>C=NH$	Dipropyl-malonyl guanidine	No action		3
17	 $\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CS$	Diethyl-malonyl thiourea	1	48, then fatal	1
18	 $\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CH{\cdot}C_6H_5$	Diethyl-benzal malonamide	No action		
19	 $\begin{matrix}C_2H_5\\C_2H_5\end{matrix}>C<\begin{matrix}CO—NH\\CO—NH\end{matrix}>CH=CH{\cdot}C_6H_5$	Diethyl-cinnamyl malonamide	No action		

presence of an ethyl radical appears to be essential for the hypnotic action:—

 $>C<\begin{matrix}SO_2—\\SO_2—\end{matrix}$ *Hypnotic group.*

 $\begin{matrix}H\\H\end{matrix}>C<\begin{matrix}SO_2H\\SO_2H\end{matrix}$ *Mother substance.*

 $\begin{matrix}R\\R\end{matrix}>C<\begin{matrix}SO_2R'\\SO_2R'\end{matrix}$ *Hypnotic.*

R and R′ = Alkyl radicals, one of which must be ethyl or a higher homologue.

The hypnotics of the veronal and sulphonal groups are like other hypnotics, sparingly soluble compounds of relatively high molecular weight. The conditions under which the distribution of such substances can be effected in the body has therefore naturally been the subject of experimental inquiry. It is hardly necessary to emphasize the fact that both the physical and chemical properties of compounds as exhibited *in vitro* may have very different values in the environment of the functions and reagents with which they become associated in the living animal system. Thus, Baumann has shown that whilst the hypnotic effect of the sulphones is dependent upon their being decomposed on passing through the body, this decomposition cannot be determined *in vitro* as those compounds which are the most stable towards chemical reagents are most readily decomposed in the system and vice versâ. Very many similar examples might be selected to illustrate the important fact that is occasionally forgotten in heralding the triumphant advances of chemistry that the methods of the laboratory are seldom, if ever, identical with those of animal or vegetable life. Both the building up or the up-grade synthesis from simpler materials, and the breaking down or down-grade synthesis from more complex molecules by animal life are characterised by the fact that they take place at the ordinary body temperature, a condition very different from the flames and furnaces of our laboratories. How far such "natural syntheses" are dependent upon a "vital force" is a subject that awaits further investigation: as yet there is much that points to the probability of the conclusion that "Life can only be completely understood through life itself."

On the physical side similar factors call for consideration. The investigations of Overton and Hans Meyer[*] have shown that the capacity of many substances which are only sparingly soluble in water to enter the living cell is dependent upon their solubility in the "lipoids" of the protoplasm, a term that is applied generically to all the "fat like" constituents of animal and vegetable cells which can be extracted by means of ether or similar solvents; cholesterin, lecithin, cerebrin, etc., are the characteristic lipoids of protoplasm. This solubility in lipoids has been especially studied in the case of indifferent narcotics with the result that a definite relationship has been established between the ratio of their solubilities in fats and their solubilities in water, *i.e.*, the distribution coefficient in these solvents, and their narcotic action. Thus, the relative hypnotic power of sulphonal, tetronal, and trional is 1 : 2 : 3, the relative distribution coefficient 1 : 3·7 : 4 and many similar relations have been established by Meyer for other aliphatic narcotics. From these observations Overton and Meyer conclude:—

1. That all otherwise indifferent compounds which are soluble in lipoids must act as narcotics to living protoplasm cells in so far as their distribution therein is possible.

2. That this action will take place initially and to the greatest extent in those cells richest in lipoid substances and which act especially as the carriers of the cell functions —primarily the nerve cells.

3. That the comparative degree of action of such narcotics is dependent upon their mechanical affinity to the lipoid constituents of the cells on the one hand and to the other constituents, chiefly water, on the other, *i.e.*, to their distribution coefficient in a mixture of water and lipoids.

To conclude from this that solubility in lipoids is the origin of narcosis is to go too far, but these results point definitely to this factor as being the means whereby the narcotic gains access to the cells, where it is most probably absorbed by the colloidal constituents of the protoplasm. Their subsequent action is at present largely surmise, but in view of the part played by the nature of the nucleus and of the anchoring groups in narcotics both their chemical character as well as their physical properties must be regarded as determining their action. Moore and Roaf[†] have shown that chloroform and other general anæsthetics combine with the cell proteins to form unstable compounds which last so long as sufficient pressure of the gas in the tissue fluids is maintained. A less liable combination is probable in the case of hypnotics and with the increasing knowledge of the chemical character of proteins that has followed Emil Fischer's epoch-making researches, the mode of action of narcotics is likely to be advantageously supplemented from the chemical side.

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[*] *Cf.* E. Overton. "*Studien über Narcose.*" Jena, 1901.

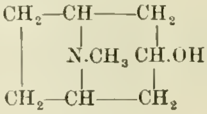
[†] *Proc. Roy. Soc.* 1904, 73, 494; 1906, 77, 86.

III.—The Local Anæsthetics derived from Cocaine and Allied Compounds.

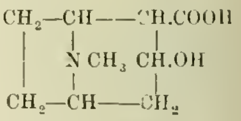
Cocaine was introduced as a local anæsthetic by Koller in 1885, and, as is well known, has proved invaluable in operative procedures especially upon the eye, the nose and the throat. It was not until 1901 that its structure was satisfactorily established. Previous to this however the presence of certain substituting groups in the molecule were recognised as essential for the anæsthetic effect, a relation that has since been advantageously made use of for the preparation of compounds some of which possess advantages over cocaine especially in respect to toxicity, applicability and cost.

Cocaine is a somewhat complex molecule and is correspondingly complex in its physiological effects. It acts as a stimulant to the vaso-motor centre, as an excitant and then as a depressant to the cerebral centres, causes a peculiar "foam like" degeneration of the liver cells, raises the body temperature, dilates the pupil and increases the power of muscular work, in addition to its action as a local anæsthetic. The influences of changes in and additions to its molecule on these various physiological effects has been the subject of much careful study[*]; the following considerations are restricted to its local anæsthetic action.

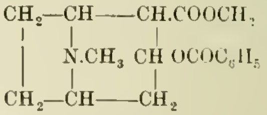
Cocaine is a heterocyclic compound containing a reduced pyridine ring and is a derivative of the carboxylic acid of tropine, the basic constituent of the important mydriatic atropine. It contains two important side chains, the carboxyl group which is present as the methyl ester, and an hydroxyl group, the hydrogen of which is substituted by tho benzoyl radical. The unsubstituted carboxyl-hydroxy-compound is known as ecgonine; cocaine is accordingly the methyl ester of benzoyl ecgonine.



Tropine.

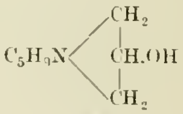


Ecgonine.

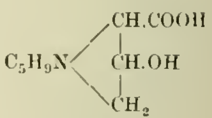


Benzoyl ecgonine methyl ester (Cocaine)

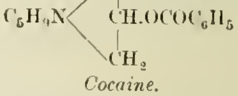
The following abbreviated formulae will serve for the comparisons under consideration:—



Tropine.



Ecgonine.



Cocaine.

Neither tropine nor ecgonine have any anæsthetic action. Benzoyl ecgonine and ecgonine methyl ester are both far less toxic than cocaine but neither have more than an appreciable anæsthetic effect[†]; this applies also to benzoyl tropine; the replacement both of the hydrogen of the carboxyl group and of that of the hydroxyl group in cocaine is necessary for the anaesthetic action.

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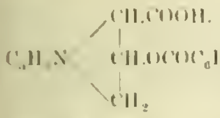
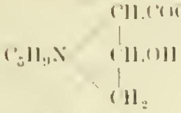
[*] *Cf.* A. Einhorn. *Annalen.* 1900, **311**, 26, 254; 1902, **325**. 305; 1908, **359**, 145; 1910, **371**, 125. Also Jowett & Hann, *J. Chem. Soc.*, 1906, 89, 357; Jowett & Pyman. *Ibid.* 1907 **91**, 92; 1909, **95** 1020; Pyman & Hann. *Ibid.* 1908, **93**, 1793,

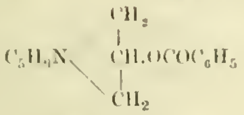
[†] Stockmann. *Pharm. J.* 1888, **16**, 897.



Benzoyl ecgonine.



Ecgonine methyl ester.

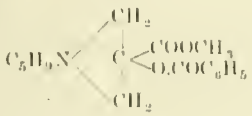


Benzoyl tropeine.

In regard to the alkylation of the carboxyl group the nature of the alkyl makes no difference; the methyl, ethyl, propyl, iso-propyl and iso-butyl esters all have a similar physiological effect in presence of the benzoylated hydroxyl group. The action is on the other hand predominately dependent in the presence of the benzoyl radical in the hydroxyl group; all other acyl radicals produce only a slight, if any, anæsthetic effect. The initial conclusion to be drawn from these relations is that the specific action of cocaine is to be attributed to the presence of a benzoyl radical and of an esterified carboxyl group associated with the nucleus of the molecule. The view formerly held that the benzoyl group is the source of the anæsthetic effect, the "anæsthiophore" group, is disproved by the inactivity of benzoyl tropeine.

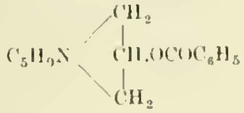
The inactivity of benzoyl ecgonine as constrasted with the activity of its methyl ester is characteristic of many acids and their esters, a relation that has been studied with most interesting results by Pauli [*], in respect to the conditions of their absorption. Whereas the salts of acids, which arise by the ingestion of carboxylic compounds and are to be regarded as ionised in the system, enter the protoplasm of cells only with difficulty, esters, which are practically undissociated, readily enter the cells on account of their solubility in its lipoids. Their subsequent saponification leads to the liberation of the constituent ions so that under favourable conditions a specific physiological effect may follow their administration. Such an effect will become apparent however only when an ion is thus liberated which is sufficiently active physiologically to show itself, otherwise the narcotic and circulatory effects common to all esters will conceal what Pauli calls "the intoxication picture." For the experimental study of this relation Pauli compared the toxic effect of sodium thiocyanate with that of the amyl ester of thiocyanic acid and found that whereas the intravenous injection of two or three drops of the ester sufficed to produce rapid and fatal intoxication, from 8—10 grams. of sodium thiocyanate were required to bring about the same effect. This marked difference, he concludes, is due to the ready absorption of the ester by the lipoids of the cell with the subsequent liberation of its ions, whilst the same ions when already formed in the case of the sodium salt only enter the cell with difficulty, and that in consequence a great excess of sodium thiocyanate is necessary to effect the same degree of intoxication.

Applying this result to the action of cocaine, the benzoyl ecgonine ion is to be regarded as the anæsthiophore group, the alcohol radical serves only as an anchor for its effective distribution by rendering it soluble in the cell substance; this view is consistent with the replaceability of the methyl radical by homologues and also with the results obtained by Veley on the relation of the toxicity of alkaloids to their affinity value[†] Pauli indeed concludes that "the existence in the form of an ester is apparently always the *sine qua non* of a useful local anæsthetic." This statement holds good, but there are however substances in the cocaine group with marked anæsthetic powers but which contain no carboxyl radical in addition to that of the benzoyl group and it is also important to recognise that the reverse of the statement does not apply. Thus *a*-cocaine, in which the two substituting groups are both attached to the same carbon atom has no anæsthetic effect; it may be that this is due to its instability and that it readily loses carbon dioxide in the system with the formation of physiologically inactive benzoyl tropeine.



a-Cocaïne.

Whereas the specific action of cocaine can thus be regarded as due to the benzoylated ecgonine radical, and the function of the carboxyl ion as that of the anchoring group, this relation becomes altogether inapplicable in the case of the benzoyl derivative of pseudo- or ψ tropine, a substance known as *Tropacocaine*, which is found in the leaves of the Japanese coca. ψ tropine has been shown to be a geometrical isomer of tropine [*]; the physiological effect of its benzoyl derivative differs however most remarkably from that of tropine. The latter, as stated, has practically no anæsthetic action, it has however a mydriatic effect; benzoyl ψ tropeine on the other hand is a more powerful anæsthetic than cocaine, but has no mydriatic action; it is less toxic than cocaine, more stable in solution and has proved one of the most reliable of the spinal anæsthetics:

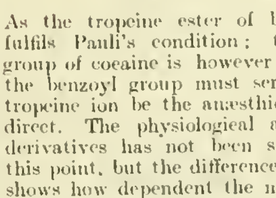


Benzoyl ψ tropeine (Tropacocaine).

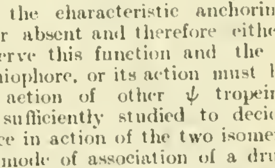
As the tropeine ester of benzoic acid this compound fulfils Pauli's condition; the characteristic anchoring group of cocaine is however absent and therefore either the benzoyl group must serve this function and the ψ tropeine ion be the anæsthiophore, or its action must be direct. The physiological action of other ψ tropeine derivatives has not been sufficiently studied to decide this point, but the difference in action of the two isomers shows how dependent the mode of association of a drug with the function affected is varied according to the structure of the compound involved. It is also interesting to note that so marked a difference should arise in the case of two geometrical isomers; a similar difference in effect has been observed in the case of maleic and fumaric acids, the former of which is toxic to higher animals whilst the latter is not poisonous.

The very complete investigations of Einhorn[†] on the relation of the structure of cocaine derivatives to their anæsthetic action, as illustrated in the above examples, furnished valuable data for the synthetical preparation of other local anæsthetics. Starting from the complex cocaine molecule the essentials and the accessories for this effect have been unravelled with much success with the result that far simpler substances have been prepared possessing applicable anæsthetic properties.

a- and *β-Eucaine* were amongst the first compounds prepared from these considerations.



a-Eucaine.



β-Eucaine.

Both compounds are acetonamine derivatives and contain the piperidine ring of cocaine with substituting methyl groups in place of the second (pyrollidine) ring of cocaine. In *a*-eucaine the benzoylated hydroxyl group, and the carboxy-methyl group of cocaine are also present, but attached to the same, instead of to adjacent, carbon atoms; this condition of linking corresponds therefore exactly to that in *a*-cocaine, which has no anæsthetic effect, a difference that may be in part due to the substituting methyl groups giving increased stability to the carboxyl radical, but which at the same time again shows how the effect of the anchoring group is dependent on the molecule with which it is associated. *a*-Eucaine resembles tropacocaine in its action but it has an objectional irritant effect on the mucous membrane. *β*-Eucaine is less toxic than the *a* compound, and much less toxic than cocaine; as a local anæsthetic it is almost as efficient as cocaine and has the advantage of not dilating the pupil. In this compound the benzoylated nucleus is to be regarded as the anæsthiophore, as in the case of tropacocaine, and the dissociated imido-hydrochloride as the anchoring ion. A number of very interesting relations in the physiological action of derivatives of these compounds have been worked out by Vinci.*

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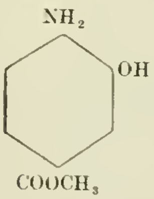
[*] "*Physical Chemistry in the Service of Medicine.*" W. Pauli, trans. by M. H. Fisher. 1907.

[†] *J. Chem. Soc.* 1908, **93**, 2114; 1909, **95**, 758.

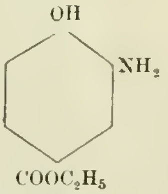
[*] Willställer. *Ber.* 1900, **33**, 1710; Barrowcliff & Tutin *J. Chem. Soc.*, 1909, **95**, 1966.

[†] *Loc. cit.*

The eucaines, like cocaine, contain a cyclic nitrogen atom. Subsequent investigations by Einhorn and Heinz† have shown that the anæsthetic action is preserved if the basic group substitutes a hydrogen of a benzene ring and that almost all hydroxyaminobenzoic esters act as local anæsthetics. *p*-Amino-*m*-hydroxymethylbenzoate and *m*-amino-*p*- hydroxyethylbenzoate are two compounds of this group that have been introduced as local anæsthetics under the names of *Orthoform* and *New Orthoform* respectively. They are sparingly soluble substances, and do not act through the unbroken skin; their soluble salts are not applicable owing to their irritant action.

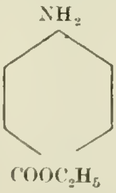


Orthoform.

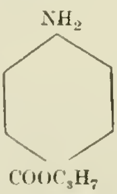


New Orthoform.

Further comparisons have shown that the hydroxyl group is not essential for the anæsthetic action. The simple *p*-aminoethylbenzoate (*Anæsthesine*) acts similarly to orthoform; the corresponding propyl ester (*Propasine*) is said to be more active.



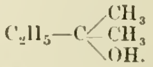
Anaesthesine.



Propasine.

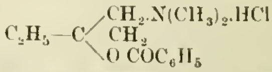
None of these compounds have proved efficient substitutes for cocaine, despite their less toxic character as, apart from various disadvantageous secondary effects, their anæsthetic action is not so deep-seated.

By the introduction of the amino-group into the side chain however, Fourneau‡ prepared a series of compounds derived from amino-dimethylethylcarbinol possessing more powerful anæsthetic properties of which *Stovaine* has proved the most applicable. Its anæsthetic value is equal to that of cocaine; it is less toxic, but differs from cocaine in causing vaso-dilitation instead of vaso-constriction. Judged by their direct effect on the contractility of isolated muscle§ there is no appreciable difference in the physiological action of the two drugs. It is employed in the form of the hydrochloride and has proved especially of value in the production of spinal anæsthesia. *Alypine* is a nearly related compound which has been specially employed in ophthalmic work; it has the advantage over stovaine that it has no mydriatic effect and that its hydrochloride is not acid in solution and is therefore compatible with alkalis.



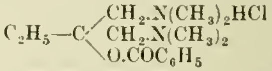
$$C_2H_5—C\begin{cases}CH_3\\CH_3\\OH.\end{cases}$$

Dimethyl ethyl carbinol.



$$C_2H_5—C\begin{cases}CH_2.N(CH_3)_2.HCl\\CH_2\\O\ COC_6H_5\end{cases}$$

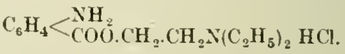
Dimethyl amino dime'hyl-ethyl carbinyl benzoate (*Stovaine*).



$$C_2H_5—C\begin{cases}CH_2.N(CH_3)_2HCl\\CH_2.N(CH_3)_2\\O.COC_6H_5\end{cases}$$

Tetramethyl diamino-dimethyl·ethyl carbinyl benzoate (*Alypine*).

Novocaine similarly contains a dialkyl-amino group in the side chain; it is the diethylamino derivative of anæsthesine.



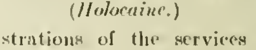
$$C_6H_4<\begin{matrix}NH_2\\COO.CH_2.CH_2N(C_2H_5)_2\ HCl.\end{matrix}$$

p.Aminobenzoyl-diethylamino-ethanol hydrochloride (*Novocaine*).

The hydrochloride of this compound is without irritant action even in concentrated solution; it is markedly less toxic than either cocaine or stovaine, but is more transient in its effects. Novocaine shares with tropacocaine and stovaine special applicability for the production of spinal anæsthesia, a development of anæsthetic practice in which great interest has been aroused by the remarkable work of Jonnesco*

From the chemical standpoint the action of the orthoforms, anæsthesine and propasine is in accord with that of the esters previously described. With stovaine, alypine and novocaine the alkylated amino-group most probably serves as the anchoring radical, the benzoylated residue as the anæsthiophore. This predominating influence of the benzoyl radical as the source of local anæsthesia is a remarkable outcome of these studies; it remains even in so simple a substance as methyl benzoate.

Other local anæsthetics are known, however, which do not contain a benzoyl group. The antipyretics, for instance, derived from *p*-aminophenol, have a slight local anæsthetic action, which is increased by the presence of a second basic group as in *p*-diethoxydiphenylethenylamidine, known in the form of its hydrochloride as *Holocaine*. This compound is more toxic than cocaine, it acts rapidly, but is only sparingly soluble; its practical application is limited to ophthalmic work. In several other groups of compounds an alkylated hydroxy-group attached to a benzene ring appears to serve as the haptophore for a local anæsthetic action (*e.g.*, the alkyl-hydroxy-phenyl guanidines) indicating that the chemical analogy of the ethers and esters is maintained physiologically.



$$CH_3—C\begin{matrix}\diagup\!\!\!\!\diagup N.C_6H_4OC_2H_5\\ \diagdown NH.C_6H_4OC_2H_5\end{matrix}$$

p. Diethoxydiphenylethenylamidine. (*Holocaine.*)

In these illustrations of the services chemistry has rendered to pharmaco-therapeutics I have endeavoured to place before you some examples of the lines along which progress has been made towards the realisation of successful practical results. In numerous other groups of compounds similar studies have been carried out with the result that many substances of therapeutic value have been added to the means for combating sickness and disease.

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* *Virchow's Archiv.* 1896, 145, 78; 1897, 149, 217; 1898, 154, 547.

† *Loc cit.*

‡ *Comptes rend.* 1904, **13**, 766.

§ Veley and Waller. *Proc. Roy. Soc.* 1910, Series *B*, **42**, 147,

* *Cp. Nature* 1909, 82. 99.

Whilst it must be fully recognised that the total additions to the pharmacopoeia that have thus been effected bear but a small proportion to the total number of so-called new drugs that have been introduced and that but a comparatively small number of fundamentally different physiologically active molecules have as yet been discovered, it is at the same time important to remember that the numerous derivatives of each physiologically active substance that have been examined have added their quota to the knowledge of the relation of physiological action to chemical constitution, albeit often in a negative direction.

On the more scientific side of the problem much new ground has been broken and new fields of enquiry opened during these first years of the present century which give every promise of active development. But the complexity of the animal body, the many functions it exercises and the numerous and mutually dependent processes which take place in it are factors that make the study of modern iatro-chemistry one of exceptional difficulty. The hypnotics for example have been very thoroughly investigated both from the side of synthetic and of physical chemistry but still as Emil Fischer and v. Mering have said[*] "despite the considerable number of synthetic hypnotics that have been prepared we know almost as little of the relation between their chemical constitution and physiological action as we do of the nature of natural sleep." The recognition of typical side chains in complex molecules that appear essential for physiologically active compounds to exert their effect and of certain physical conditions that enable such compounds to enter living cells is but a little contribution to the problems that await solution. The application of the knowledge available from these data to many other and varied groups of compounds is desirable so as to provide a wider and more complete basis for the study of the scientific relations involved. But few compounds are monotropic in their action; most drugs produce a number of physiological effects and it has been thought that advance is most likely to follow the quantitative study of one particular action in such cases. The number of measurable effects of this character, however, that can be studied are comparatively few and are usually only applicable apart from the ordinary functions of life, so that their value in regard to the therapeutic applicability of drugs is limited. It is the conditions under which the administration of drugs is required that are difficult to submit to experimental enquiry for, as is well known, their action is entirely different in health and in disease. Quinine, for instance, reduces the temperature 3° to 4° in cases of fever but under normal conditions its action is very slight and similarly, salicylic acid and its salts, which are valuable antipyretics in cases of acute articular rheumatism, have no such action on a healthy body and but little effect in most other febrile conditions. Experiments on animals, other than man, naturally form the basis for enquiry, but results vary according to the species of the test-animal and are not always directly applicable to man.

In this connection it is of importance to realise that despite the host of antipyretics, analgesics, hypnotics, etc., that have been synthetically prepared none of these substances—with possibly the exception of salicylic acid and its derivatives—are to be regarded as "specific" in their action; they are all "symptomatic" drugs, their use is limited to the symptoms to which diseases give rise, they do not attack the causes of the diseases concerned. The specific action of quinine in malaria is not shared by any of the synthetically prepared antipyretics. The knowledge of the structure of quinine may bring with it knowledge of the portion of its complex molecule to which this specific action is due and further studies on the relation of chemical constitution to physiological action may help to elucidate this relation, but so far nothing is known of the structural requirements for this specific effect; also, the antipyretic action of quinine appears to be physiologically different from that of the synthetic febrifuges.

Such specific effects which are so characteristically associated with the action of antitoxins have recently received much attention in the treatment of trypanosomiasis by means of synthetically prepared compounds of arsenic and of antimony. This development of the services of chemistry to pharmaco-therapeutics, termed by Ehrlich "Chemo-therapeutics" and which is being so actively investigated in its relation to "sleeping sickness"[*] marks an important extention of the study of the physiological action of drugs which surpasses the symptomatic limitations referred to. The physiological effects of organo-arsenic compounds upon trypanosomes and the considerations that have led to their preparation, together with the suggestive theories associated with their action have been fully discussed by Prof. P. Ehrlich in the Harben Lectures of the Royal Institute of Public Health for 1907[†] and more recently in his lecture to the Berlin Chemical Society[‡]; also the chemical relations of the compounds concerned were very completely summarised by C. W. Martindale[§] in a communication to the pharmaceutical-chemistry section of the International Congress of Applied Chemistry last year. Accordingly it is undesirable that I should do more than draw your attention to the important progress that is being made in this branch of applied chemistry.

The introduction of the subject matter of this address to a Society which exists for the promotion of Chemical Industry would be incomplete without some reference to the industrial side of the manufacture of synthetic drugs.

Since the discovery of antipyrine in 1883 this manufacture has developed to an industry of very considerable magnitude. The official statistical returns of trade both here and abroad are not sufficiently detailed to allow of a computation of the value of the synthetic drugs either manufactured abroad or imported into this country, nor has it proved possible, for reasons that may be obvious to manufacturers, to obtain data on these points from other sources. I have, however, been able to obtain the following statistics from a reliable authority of the quantities of some of these products that are imported annually by wholesale pharmaceutical firms. The figures are only to be regarded as approximate, and do not include the quantities imported directly from the manufacturers or through their agents and are therefore certainly below the actual total imports. Still they give the somewhat astonishing total of 20¼ tons and represent a money value of over £16,000 at wholesale prices for only six drugs.

Imports of Synthetic Drugs by Wholesale Pharmaceutical Firms.

				£
Antipyrine (Lion Trade Mark Brand) about	½	ton	at 12/11 lb. nett.	723
Aspirin	1½	,,	15/9 lb. ,,	2,646
Phenacetine..................	8½	,,	2/6 lb. ,,	2,380
Phenazone (Antipyrine) ...	6	,,	6/6 lb. ,,	4,368
Sulphonal	3	,,	8/- lb. ,,	2,688
Trional	8½	cwt.	at 17/9 lb. ,,	885
Veronal	6½	,,	68/- lb. ,,	2,475
Total				£16,165

Also the returns of the Patent Office, for the collection of which I am indebted to Mr. Walter H. Evans, M.Sc., illustrate in an instructive manner the growth of the industry as shown in the subjoined diagram in which the number of completed specifications for synthetic pharmaceutical products from 1883 to 1909 is shown in the form of a curve; the total number of chemical patents from 1883 to 1907 (the figures for 1908 and 1909 were not available) are given by way of con parison from which it will be seen that the patents for synthetic drugs have formed about 4 per cent. of the total chemical patents during the past 13 years. From the dates of the introduction of some of the most important drugs as set out below the diagram it will be seen that an impetus towards the Patent Office has usually followed a successful synthetic preparation bearing in mind that the completed specification here generally dates somewhat later than the introduction of the drug. The total specifications, which number 668, are, however, but a partial measure of the industrial activity in this direction as the manufacture of "substitutes" for protected products also contributes largely to the scope of the industry.

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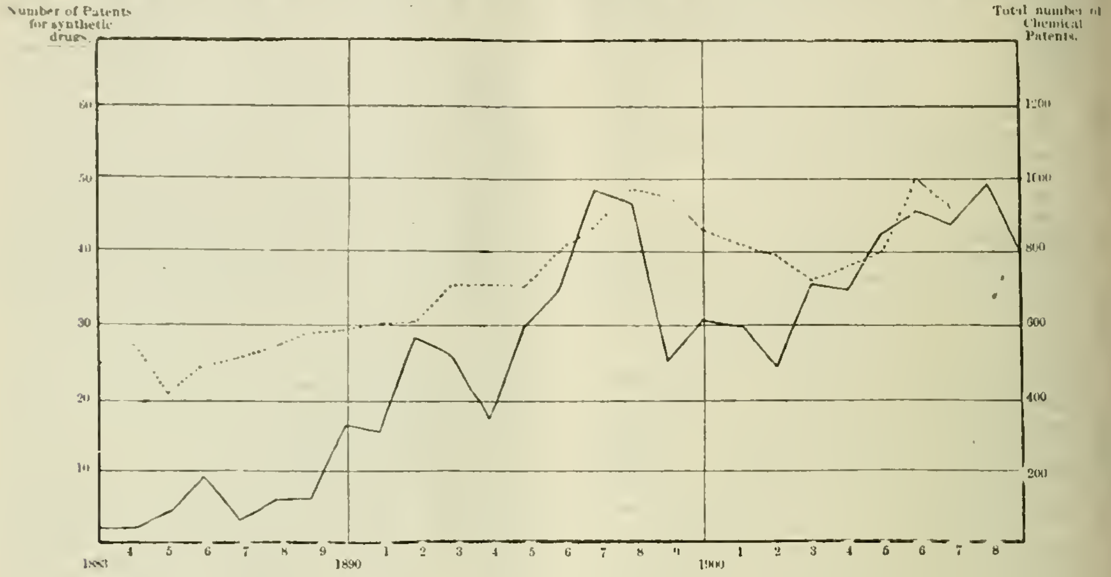
[*] *Therapie der Gegenwart.* 1903, 5, 97.

[*] *Cf.* Reports of the Sub-Committee of the Tropical Diseases Committee of the Royal Society. *Proc. Roy. Soc.* 1907, Series *B*, 79, 505; 1908, Series *B*, 80, 1, 477; 1909, Series *B*, 81, 354; 1910, Series *B*, 82, 233.

[†] "Experimental Researches on Specific Therapeutics." P. Ehrlich. The Harben Lectures of the Royal Institute of Public Health. Published by H. K. Lewis, 136, Gower Street, W.C.

[‡] "Ueber den jetzigen stand der Chemotherapie" P. Ehrlich *Ber.* 1909, 42, 17; this *Journal*, 1909, 28, 218.

[§] This *Journal*, 1909, 28, 907.



Date of Introduction of Synthetic Drugs.

1882	Kairine.
1883	Antipyrine.
1885	Urethane.
1886	Salol.
1887	Phenacetine. Antifebrine.
1888	Sulphonal.
1891	Guaiacol carbonate. Piperazine.
1892	Lactophenine.
1893	Pyramidon.
1894	Lysidine.
1897	Orthoform. Holocaine.
1899	Aspirin.
1902	Theobromine. Theophyllin.
1903	Veronal.
1904	Stovaine. Adrenaline.
1905	Novocaine. Alypine.
1907	Organo-Arsenic compounds.

This industry, as is well-known, is carried on almost entirely in the colour works of Germany and Switzerland, where the initial materials and well-staffed laboratories have provided most favourable conditions for its development. Practically, none of these synthetic preparations are manufactured in this country, a fact which received much consideration in the Report of the Departmental Committee on Industrial Alcohol (1905) and in connection with which I would claim your indulgence for a few concluding observations.

As with the manufacture of the aniline colours, so with this later development of industrial organic chemistry, it has been held that three factors have stayed its progress here in the past,—the absence of the provision of duty-free alcohol for manufacturing purposes, the defects in our patent laws and the deficiencies in the instruction provided for those who are to engage in our chemical industries, associated with the lack of appreciation of the full value of chemical science on the part of our manufacturers.

Thanks to the efforts of members of this Society, both individually and in conclave, and especially to Mr. Thomas Tyrer and Mr. Ivan Levinstein, the conditions for the industrial use of duty-free alcohol have been facilitated and a new Patent Law, involving compulsory manufacture has become operative.

The revision of the Patent Laws was a subject to which Hurter gave considerable attention and from his ripe and wide experience he fully recognised the necessity for reform. In a letter written in 1896, when the subject was under discussion amongst several members of this section, he gave me the following instructive example of the conditions that then obtained:—A patent was granted to a German firm for the manufacture of an aniline colour; an English firm was prevented from manufacturing the colour as a licence for doing so was not granted, and a Swiss firm which attempted to sell the same product here was successfully sued for infringement by the German firm. Hurter remarks: "Thus the English people are taxed by the German firm for 14 years to whatever tune the firm likes. There is no competition possible; when the 14 years have lapsed the experience gained by the German firm is such that no beginner could compete. Thus the patent law actually forbids the import of the patented article, and prevents the English nation from learning the business! A pretty state of affairs truly!" In further correspondence, whilst appreciating the advantages of compulsory working clauses he wrote: "I see difficulties, very great ones too. A law which compels a patent to be worked must render that patent void if it is not worked, else the law is no good. But that law cannot easily be restricted to foreign patents, it will touch the Britisher too. He will see a limitation of his liberty and rights, as well as of those of the foreigner, and he will not stand it." These are the difficulties that have to be faced now that the principle of compulsory working has become law. We have deliberately invited the foreigner to share the advantages and disadvantages of manufacture in this country and its convenience as a centre for distribution; he has and in many instances I am told, not unwillingly, accepted the invitation, and t appears that the best efforts of manufacturers will be necessary, as far as chemical industries are concerned, not to lose, rather than to gain by the change. As far s the industry in synthetic drugs is concerned, British manufacturers are, I believe, fully alive to the results hat have been obtained abroad, and are equally willing to prosper by their manufacture here if the prospect is sufficiently attractive. At present they are content to take the lead, as I am informed they still do, in the manufacture of many of the more staple products of the pharmacopoeia, and they do not feel tempted to employ their capital in the exploitation of compounds so many of which have but an ephemeral existence or to develop the costly commercial propagandism, which appears necessary to place these substances successfully on the market. Whilst for the present this position may be sound, the developments of the industry in the future may prove disadvantageous if too conservative an adherence to "staple products" be maintained. Meanwhile, it cannot but be a matter of concern to all, from the standpoint of our science and of the welfare of the community, to witness the continuously increasing misuse that is being made of these synthetic drugs, on the one hand in the extent to which they are taken without medical advice and on the other hand in the preparation of "Headache powders," "Cure alls" and similar nostrums—a trade regulated by an Act more than 100 years old, and which accounts for an expenditure by the public of over £3,000,000 annually; it is indeed high time that this unrestricted and harmful use of the services of chemistry to medicine received official enquiry.*

In regard to the deficiencies in the instruction provided for those who are to engage in our chemical industries and the lack of appreciation of the full value of chemical science on the part of our manufacturers, this subject has been to my mind so much discussed in this and other Societies that we should desist from further denunciations of our defects and turn our attention to more practical issues. As pointed out by Prof. Meldola† in his presidential address last year we have in this Society "a body of expert knowledge and experience both educational and technological possessed by no other organisation" which should be taken advantage of for the promotion of chemical industry. Speaking as a teacher I am convinced that no better training ground than the several Sections of this Society could be offered for the cultivation of a proper attitude of mind towards industrial work on the part of teachers, and I hope towards scientific investigation on the part of manufacturers. By taking full advantage of the opportunities thus available for co-operation on the lines indicated by Prof. Donnan in his suggestive paper read before this Section on "The University training of technical chemists"‡ effective results should follow; the teacher will especially be helped to appreciate something of the responsibilities and economic relations of large scale operations which are so different to the conditions of his laboratory work and thus to train his students to enter upon their life's work in a spirit of humility proportioned to their technological ignorance.

And speaking again as a teacher, it is our students and not our discussions that will convince manufacturers that well-trained men are worth their hire and such reforms as are necessary in our teaching must be in practice and not in preaching.

I desire to record my thanks for help in the preparation of this address to Dr. Otto Grünbaum, Mr. Peter MacEwan, Dr. Arnold Moritz and Mr. Thomas Tyrer and to the following firms which have kindly provided me with literature on the products of their manufacture:—Aktiengesellschaft für Anilin-fabrikation, Berlin; C. F. Boehringer and Sons, Mannheim-Waldhof; Chemische Fabrik von Heyden, Radebeul, Dresden; Chemische Fabrik auf Aktien vorm. E. Schering, Berlin; Cordes, Hermanni and Co., Hamburg; Farbenfabriken vorm. Fr. Bayer and Co., Elberfeld; Farbwerke vorm. Meister, Lucius and Bruning, Hoechst a/Main; Knoll and Co. Ludwigshafen; E. Merck and Co., Darmstadt; Vereinigte Chemische Werke Aktiengesellschaft, Charlottenburg; Zimmer and Co., Frankfort; La Société pour l'Industrie Chimique, Basle; Hoffmann La Roche and Co., Basle; Adrian and Co., Paris; Comar and Co., Paris; Dausse and Co., Paris; Poulenc Frères, Paris; Société Anonyme des Matières Colorantes et Produits Chimiques de St. Denis, Paris; and La Société Chimique des Usines du Rhone, Paris.

London Section.

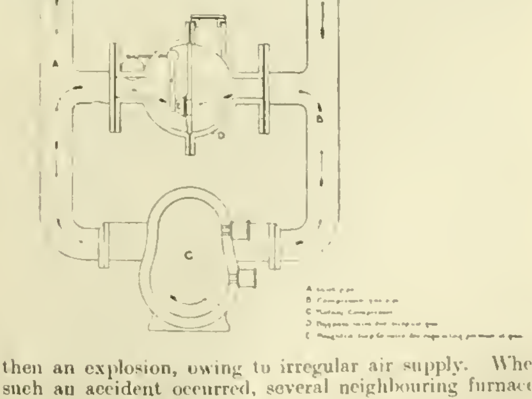
Meeting held at Burlington House on Monday, March 7th, 1910.

DR. J. LEWKOWITSCH IN THE CHAIR.

APPLICATION OF HIGH PRESSURE GAS TO FURNACE USE.

BY A. W. ONSLOW.

Many years experience in the employment of coal gas for heating purposes have led me to the conclusion that the methods commonly employed—that is, taking the gas from the mains and consuming with some form of Bunsen burner—are not only wasteful of gas, but are quite incapable of giving anything like a constant temperature, where that is desired, or, of heating any given kind of oven, or other apparatus to the same temperature in the same time in consecutive operations. With the ordinary burner and gas of the same composition, the variation in time of heating up a given furnace to a certain temperature may vary in consecutive days as much as two hours. It is impossible for the best of workmen to judge of the temperature or heating power of a flame by its appearance, or to regulate the air supply to a gas supplied directly from the main in which the pressure is constantly changing. Many times I have observed the most erratic behaviour of gas-fired furnaces using raw gas from a main—variations of from 1200 to 1600 cubic feet per hour not being at all uncommon, with now and then an explosion, owing to irregular air supply. When such an accident occurred, several neighbouring furnaces or ovens were generally put out of action.



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* Cf. "Secret Remedies: What they cost and what they contain." Published by the British Medical Association, 1909.

† This Journal, 1909, 28, 577.

‡ Ibid, 1909, 28, 275.

To obviate these irregularities and fluctuations, I employ a high pressure gas capable of working up to 160 inches of water. High pressure gas lighting has a limit of about 60 inches water pressure. Air is drawn in at ordinary atmospheric pressure in both cases.

A rotary exhauster and compressor draws the gas from the mains and supplies it at any desired constant pressure to the burners; any surplus gas is passed back again, and therefore does not interfere with the pressure as delivered from the burner nozzles, nor is it registered again in the meter. Variation of pressure in mains has no effect. Until gas is supplied from the works at high pressure, a small apparatus similar to this is necessary if high pressure gas is to be employed for heating.

Although some towns have high pressure gas mains, the gas does not appear to be used for heating, but merely for transmissional purposes, and is governed down to some ordinary pressures. In Birmingham, Dr. Davidson, the chief chemist to the Corporation, and Mr. Barrett, the lighting superintendent, seem to be alive to the possibility of its use for heating purposes, and a high pressure main is now being installed in that city. The gas meters for high pressures seem to present some difficulties however.

Assuming the maximum consumption of gas in a small laboratory plant to be 500 c. ft. per hour, and that 160 inches pressure is sufficient to meet all conditions, the valve acts directly the machine is put to work, and if 300 c. ft. of gas is used, the surplus 200 ft. is bye-passed back into the inlet main. The pressure would therefore be a constant one, whether one foot or 500 were consumed. The gas pipe need be only one-half the usual size, or half the size of the compressor outlet. The inlet pipe to compressor should be of full size. Having fixed the compressor, any temperature can be obtained by simply turning on a gas tap. Assuming the highest temperature required to be 2600° F. or thereabouts, 100 inches should suffice, and that can be the standard pressure. Supposing there are four furnaces in which different temperatures are required. The first furnace is to be heated to say 2600° F., and the gas taken directly from the standard pipe. The second furnace requires 2000° F. only; 70 inches pressure will suffice for this, and can be obtained by a reducing tap or governor, care being taken in the first instance to have a gauge to show what the pressure actually is. The third furnace requires 1000° F.; for this 35 inches pressure should suffice. Again, a pressure gauge is necessary, so that the tap at the burner can be fully open and not throttled. The fourth furnace may be, say, for melting lead only, for which 16 to 20 inches pressure is sufficient. Under the above conditions, the same temperatures will be obtained in the same length of time daily, and after the various burners have been once adjusted there will be the same consumption of gas. Quantities of about half a pound of copper have been melted in 6½ minutes, and re-melted in somewhat less time. If larger quantities have to be dealt with, a second or third burner is turned on, as I do not recommend interfering with the standard pressure, although it is quite possible that by raising the pressure, more gas and air would be used, and the second burner found unnecessary. But it is generally better to maintain a standard high enough for the particular purpose without constantly raising or lowering the pressure.

It might be argued, why not 100 inches for 1000° F. as well as 2600° F.? It has been found that at very high pressures crucibles are liable to be melted or distorted, and for certain purposes it is better to work with gas under known conditions rather than increasing the temperature too rapidly and over-heating some part of the article. With 100 inches pressure it is possible to soften the ordinary plumbago crucibles in 30 minutes. There are of course cases where the pressure has necessarily to be raised and lowered. In the manufacture of glass, for instance, 10 cwt. or 20 cwt. crucibles should be treated at 60 inches pressure for 12 hours to melt the composition; 90 inches for 6 hours are required to refine the glass, followed by a drop down to 40 inches for emptying. This process has been found to work by the clock perfectly, and only the cost of town's gas has prevented its general adoption commercially. If gas at 1s. 3d. per 1000 c. ft. could be obtained, glass could be made more cheaply by its aid than with coke at 15s. per ton.

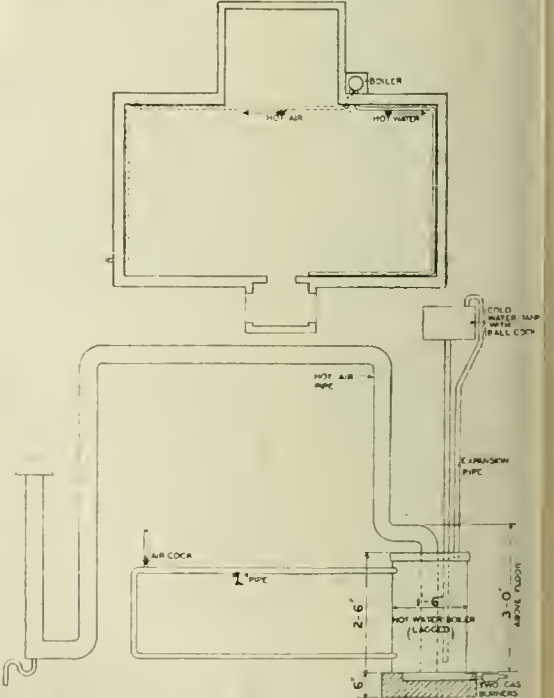
In the melting of lead in cast iron pots, 20 inches pressure is quite sufficient, but if it is obligatory to use 100 inches pressure, the heating must be by radiation and not by playing directly on the iron vessel.

Another application of high pressure gas heating is in the tempering of long steel bars, such as axle trees. These are suspended vertically, four or more together, and heated at 60 inches pressure for 30 minutes. At the expiration of that time, the burners are shut off for five minutes to allow the temperature to equalise. The axle trees or bars are then removed for tempering, and a new batch inserted. All burners are relighted by opening one stop-cock and the process continued, so that it is quite possible to temper 120 axle trees per day in a furnace 2 feet in diameter and 7 feet high.

Tempering, case-hardening and annealing furnaces as described by model need not have large combustion chambers. In fact by this method there is no need for large combustion chambers as the gas is directed more closely to the object, and only sufficient air for complete combustion is used. These furnaces have a division down the centre so that the gas is confined to each side, and so closely is the heat exerted, that furnaces have been equally heated all over with less than 10° F. difference in any part.

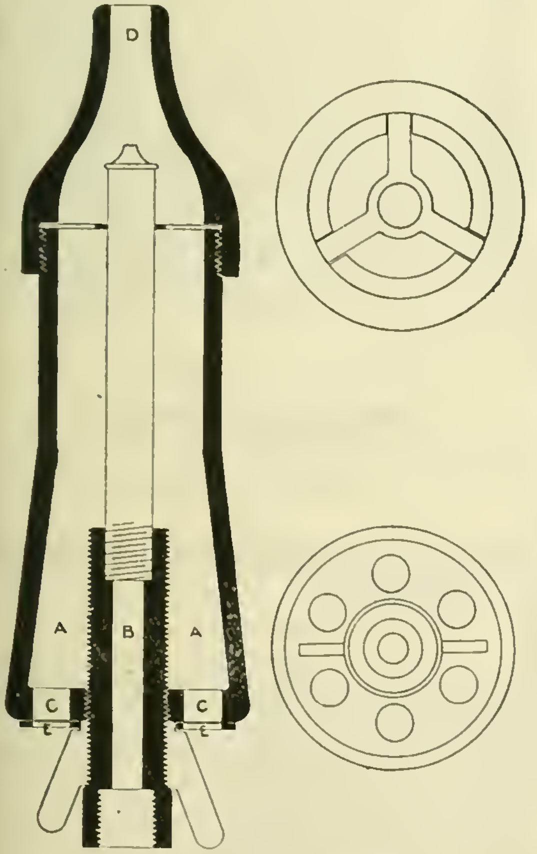
It is quite possible by these methods of restricting the supply of air and gas to the object to be heated, to reduce the consumption of gas from 600 c. ft. to 200 ft., as I have done already. Warming plates, instead of consuming 180 c. ft. per hour, now consume 25 feet. Metal melting pots requiring 1½ hours to melt with gas at 80 feet per hour now require gas at the rate of 45 feet. per hour, and melt in 25 minutes, after which the gas is shut down to the rate of 25 feet per hour. These are a few cases out of a large list, and will indicate the reason for drastic changes in our methods of heating. It is easy to take a high pressure flexible pipe any distance, and heat small or large furnaces built to suit any article from 1 inch diameter to 10 feet, so that any part of a large object may be case-hardened.

One more case, that of warming buildings, may be mentioned. It is well known that a large proportion of the heat generated in a gas fire or stove passes up the chimney with the products of combustion without useful

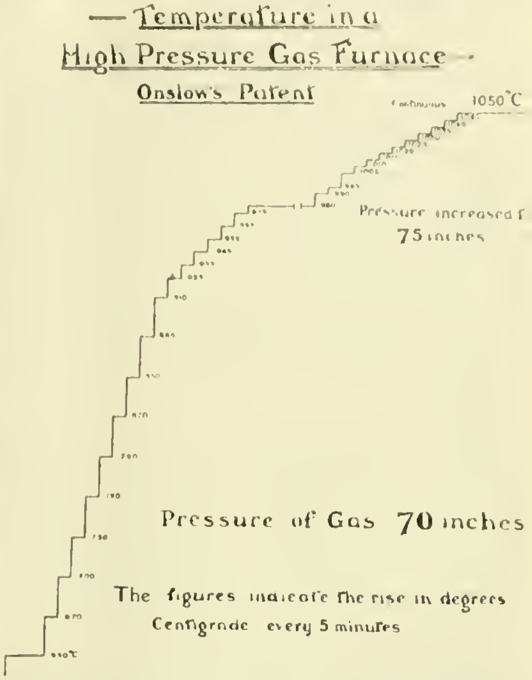


effect. If the highly heated products of combustion are carried through a metallic flue pipe passing through the room for a sufficient distance, nearly all the heat generated may be rendered available for warming the room. With an ordinary gas fire this can only be done to a limited extent because the flue will not draw owing to the cooled gases having little or no ascending power, and there is also the objection that an unlined metallic flue will at its base become dangerously hot. It is, therefore, desirable to give the flue gases momentum, so that one part is not unduly heated above another.

In order to accomplish this Colonel Bagnold, C.B., R.E., Superintendent Building Works, Royal Arsenal, conceived the idea that, granted sufficient initial pressure, either in the gas supply or in the air supply, the injector-like action of a high pressure burner would effect this. Under Colonel Bagnold's direction, experiments have been carried out which completely demonstrated the soundness of this theory; by means of two high pressure burners fed with gas at 60 inches pressure, a room 750 feet super floor space has been heated 31° F. above the outside temperature, the consumption of gas being 80 feet per hour. The installation is simple, and may be readily understood by reference to the diagram. The gas supply is taken from an adjoining building, and is on the same service as the lighting. Outside the building is a small combustion chamber lined with fire bricks into which play burners. From the combustion chamber a steel flue is led through the wall and around the room, and again through the wall to the outer air. On leaving the heating chamber (which attains a temperature of 2000° F.) the flue passes through a boiler from which are led water circulating pipes; thus part of the room is heated by hot water and part by a hot flue pipe. The flue pipe on leaving its water jacket only retains a temperature of about 250° F., as the water jacket is made long enough to prevent the flame passing into the pipe outside the jacket, and therefore is not considered dangerous. The gases pass out at the end of the flue pipe only slightly warmer than the air in the room. Following the example of modern steam boiler installations, this system is really one of "forced draught," the draught being caused by the velocity of the gas from the nipples. This installation has been in use for six months, and has given no trouble whatever. It possibly has an efficiency of about 90 per cent.



High Pressure Gas Burner.



In conclusion, I may say that the objects I had in view throughout the experiments described in this paper, were to simplify our present system of gas heating, and, by obtaining a higher efficiency and effective flame control, to ensure definite results. This has been so far achieved that the temperature in a furnace or crucible can now be controlled to such a nicety that it is merely necessary to open or close a gas tap and wait with certainty for the result. By this system explosions due to imperfect mixtures of air and gas are avoided, a more direct contact of the temperature is ensured, and a small flame is used, its heat radiating from the furnace walls, in place of the large, limp, and uncertain flame that has to a great extent been the practice hitherto. These improvements, in addition to giving better heating results, naturally tend towards economy and a lower cost of production, an end which is furthered by the use of smaller combustion chambers and the simplification of installations.

DISCUSSION.

Colonel Bagnold said that if high pressure gas were laid on, houses could be heated at a fraction of the cost now involved. The injector action of the high pressure burner put a forced draught at their disposal, and the products of combustion could be forced a very long distance, until all useful heat was extracted from them. For heating large masses of metal for manufacturing purposes, high pressure burners were invaluable. The only objection to high pressure lighting appeared to be that it was accompanied by a certain amount of noise; and, therefore, for a private house, was not altogether suitable; but for the general illumination of workshops and factories electric lighting was not to be compared with high pressure gas lighting.

Dr. W. R. Hodgkinson said that he had an installation of high-pressure gas in his laboratory, driven by a 3-horse power motor. He fully corroborated what had been said about the constancy of the temperature; and had perhaps experimented more extensively with it than even Mr. Onslow. He could keep the temperature in a small furnace within 2° or 3°, as measured by an iridium-platinum pyrometer, for a whole day, though the other gas in the laboratory might have to suffer.

Furnaces could be built up with a little fireclay and firebricks in a few minutes. The wet clay was shaped round a bottle, a hole or two made at the bottom and one or two of these burners introduced. The clay burnt and glazed with a very even surface, and did not crack. He had had one in use for eight months, and it was still perfectly sound; it was started five minutes after it was moulded. Those were very great advantages. The air supply could be regulated very nicely. After starting, the temperature rose gradually to that required in a few minutes; and the tap could then be set and the furnace left the day long at a constant temperature.

The Chairman remarked that householders might be rather alarmed at the idea of having gas supplied at 60 or 100 in. of pressure, considering that nowadays gas often contained 30 per cent. of carburetted water gas. It would, he thought, be useful if Dr. Davidson, of the Birmingham Gas Works, could give them some information on that point.

Dr. W. B. Davidson said that they, in Birmingham, had applied to Mr. Onslow more than once for advice and he had kindly helped them. Now they were trying to introduce high pressure furnaces for purposes of annealing, melting, case-hardening, brazing, and such-like processes, especially for the jewellers' quarter in Birmingham; they were putting down a 24-in. high pressure main to be used partly for lighting and partly for heating. They had made many experiments already; but he could not give many results because they were not quite so far advanced as he should wish; but he could corroborate what had been said with regard to the economy of high pressure gas; he should think there was a saving of at least 60 per cent. One could melt 10 lb. of copper for less than a penny, using gas at 1/6 per thousand. The great feature about it was the uniformity of temperature. Carbon monoxide was a danger when there was a leakage; and no doubt, as the Chairman had hinted, it would be a serious matter to have a leak in a high pressure service.

Mr. E. Grant Hooper asked if Mr. Onslow could give any further information with regard to small installations. They had to look forward to the day when they would get high pressure mains; but meanwhile, had he any acquaintance with individual applications of the high pressure system? For instance, what class of motor was used for the air compression: and were there any such motors on the market applicable for use in laboratories as for example, for assay purposes?

Mr. T. Girtin said one very important application of high pressure gas had not been touched upon, namely, melting gold and silver bullion residues and gold and silver bullion itself. He had lately taken up the melting of these metals by high pressure gas and could entirely corroborate what had been said as to its advantages. Gas had been used frequently for those purposes before, chiefly in America; but there the air was generally put under pressure, and the result was that high velocity of the burning gases threw the volatilised gold and silver about considerably and made it difficult to collect. It was important in melting a large quantity of gold and silver not to dissipate this volume, which impregnated the pot and everything else. He found the high-pressure gas slightly more expensive than coke for melting purposes, but its great advantage was its cleanliness. If gold and silver were melted with coke the whole of the ash from the coke had to be treated afterwards. He had treated as much as 90 or 100 tons of that ash in a year; so that he found a very great saving by the use of high-pressure gas. He only used a pressure of about 12 or 14 in. of water, and under these conditions found no noise whatever. He had tried gas under air-blast and oil under air-blast, but had abandoned both in favour of this comparatively moderate pressure gas.

Colonel Sir Hilaro Barlow said he had used furnaces like that shown (for melting, chilling, and treatment before hardening) for the so-called "heat treatment" of the present day, a form of annealing. The question of a very accurate temperature was of enormous importance in the case of armour piercing projectiles. It was no exaggeration to say that in the treatment of a certain steel results just within or just without a certain range of 60° C. were either good or excessively bad. The modern armour piercing projectile was called upon to do very heavy work. A 12 in. armour piercing shell of to-day must pierce 12 in. of Krupp steel, with a hardened face and a tough back, and come out on the other side unbroken. If the energy and tenacity required were calculated, the difficulty of the problem would be realised. It could be solved, however, with certain steels; but only within a range of the temperature of heat treatment of 60° or perhaps even 50° C. So far as his experience went, on either side of that, there would be failure. Under those circumstances they could understand the enormous value of a furnace which could be trusted. He did not say that in all cases he used that class of furnace, but he did for very large shells. For small shells, he was content with an ordinary annealing furnace with coal or coke, the pyrometer being carefully watched. The great advantage of that class of furnace was that the pyrometer need not be watched so closely. He should never now use electric arc light for lighting a factory, as incandescence mantles with high pressure gas gave incomparably superior results in large workshops.

The Chairman asked if equally good results could be obtained with poor gas like producer gas? As the lighting of factories had been mentioned, they must remember that there might be factories not situated near a gas works; could one obtain similar results by using ordinary producer gas?

Dr. H. G. Colman, in answer to the Chairman's question, said that even with high pressures it was not possible to get so much light in an incandescent burner with producer gas, as with coal-gas, owing to the presence of the former of from 50—70 per cent. of inert gas, which lowered the temperature of the flame considerably.

Mr. Onslow, in reply, said that they were using some small installations, one of them being for soldering irons; the plant passed 500 cb. ft. of gas per hour and had a one-eighth H.P. electric motor to drive it. It was quite possible that gas properly applied in a suitable furnace would be cheaper than coke or anthracite coal. In the case of a 4-ton pot for printers' type, 12 burners at 16 in. pressure were used, and when melted seven were shut off and one or two lit up from time to time if required to deal with extra large quantities, but each burner was working at its maximum heating capacity, and not altered.

Nottingham Section.

Meeting held at Nottingham, on Wednesday, March 23rd, 1910.

NOTE ON THE ESTIMATION OF CHROMIUM IN ONE BATH CHROME LIQUORS BY MEANS OF THE COLORIMETER.

BY J. T. WOOD AND DOUGLAS J. LAW, B.SC.

The use of the small dipping colorimeter of Schmidt and Haensch for comparing colours of tan liquors was suggested to us by Procter. We have tried the use of it for the estimation of chromium salts. It was thought that by reason of the variation of basicity of used one bath chrome liquors accurate matches could not be obtained. We find that the variation of basicity of spent liquors from the same process is very small, and does not prevent a good match being made. The average basicity of the unused liquor $\frac{Cr_2O_3}{H_2SO_4}$ was 0·87 (mean of 3 samples), after use it was found to be 0·75 (mean of 8 samples).

The standard for comparison may be a fresh stock liquor diluted to a convenient amount, but a more accurate standard is a spent liquor whose strength has been determined by analysis. In the latter case, however, after about three weeks a new standard must be taken, as the old liquor becomes greener in colour, and cannot be accurately matched with liquors which have only just been spent. The liquors are simply filtered to remove organic matter, the standard being placed in the lower trough, and the liquor under examination in the 15 mm. trough.

The following series of comparisons by analysis shows that, although the method is not absolutely accurate, it is quite good enough for purposes of works control. The analyses were made in the usual way by oxidising and titration with iodine and thiosulphate.

Per cent. Cr_2O_3	
Analysis.	*Colorimeter.*
0·505	0·508
0·410	0·437
0·312	0·336
0·840	0·854
0·750	0·735
0·875	0·882
0·312	0·301
0·274	0·266
0·302	0·294
0·249	0·233
0·196	0·187
0·252	0·237

Comparison of results obtained using two different standards.

	Chromic oxide. Grams per litre.	
	A.	*B.*
1	2·96	2·93
2	3·65	3·40
3	3·65	3·40

(A) Diluted stock liquor containing 2·54 grams of chromic oxide per litre as standard

(B) Used liquor as standard containing 4·10 grams. of chromic oxide per litre

Attempts were made to use the colorimeter for spent two bath liquors, but it was found that they could not be directly compared owing to varying proportions of reduced chromium salts present in the liquors along with the bichromate. On reducing to chrome chloride, a difficulty is found in making the liquors brilliant enough to match with a standard solution of chromium chloride. A method could, no doubt, be devised, but the process of preparing the liquor would probably take longer than the usual volumetric estimation.

Yorkshire Section.

Meeting held at Midland Hotel, Bradford, on Monday, March 21st, 1910.

MR. F. W. BRANSON IN THE CHAIR.

THE SYNTHESIS OF A GLAZE, GLASS, OR OTHER COMPLEX SILICATE.

PART IV.—THE INTERACTION OF SODA WITH SILICA AND WITH ALUMINA.

BY JOHN W. COBB, B.SC.

In the synthesis of $Na_2O.CaO.Al_2O_3.10SiO_2$ by the method explained in Part I (this Journal, 1910, p. 69) of this study, double oxide mixtures of lime, silica, and alumina were taken first (*vide* Part II, this J., 1910, p. 250). The corresponding investigation for soda, silica, and alumina followed and the results are given below. The soda was supplied as sodium carbonate, the silica as quartz sand, and the alumina in an ignited condition, insoluble in normal hydrochloric acid. It will be readily understood from former explanations that it was advisable to begin with a determination of the temperatures at which sodium carbonate and sodium sulphate began to decompose, when heated either alone or mixed with silica or alumina.

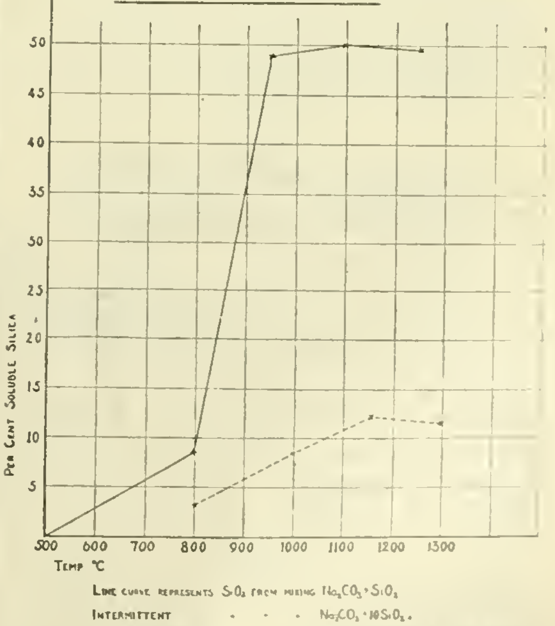
Decomposition of sodium carbonate, etc.—The temperature at which a heated mixture, $Na_2CO_3+SiO_2$ first evolved carbon dioxide was found by heating in a porcelain tube as described in Part I (this J., 1910, p. 72) to be 680—690° C., and for reasons already given 680° was taken as the temperature of incipient sodium silicate formation when the soda was supplied as carbonate. The temperature at which carbon dioxide was evolved from a heated mixture, $Na_2CO_3+Al_2O_3$, was 710—720° C., and 720° was taken as the temperature of incipient sodium aluminate formation when the soda was supplied as carbonate. It was found also by direct determination of the loss on weighing that a mixture of sodium carbonate and silica $Na_2CO_3+SiO_2$, and also one of sodium carbonate and alumina $Na_2CO_3+Al_2O_3$ lost weight freely at 800° C. Sodium carbonate, on the other hand, did not suffer appreciable loss at 800°. The melting point of sodium carbonate is 850° and at 900° the loss in weight of the liquid carbonate became appreciable. The dissociation pressure of sodium carbonate in vacuum has been determined, (P. Lebeau, Comptes rendus, 1903, **137**, 1255—1257) at 820° as 2·5 mm. of mercury at 880°, 10 m.m., and at 1200° 41 mm. It was taken as established that the silicate and aluminate of soda formed about 700° C., under the condition of these silicate heatings, when the soda was supplied as carbonate; the temperature of formation was below the melting point of either ingredient or of the compound formed. Also it was proved justifiable to calculate a formula for a compound formed up to 850° C., on the assumption that any carbon dioxide expelled was replaced in its combination with soda by silica or alumina as the case might be.

Decomposition of sodium sulphate, etc.—Experiments on sodium sulphate were made by the porcelain tube method described in Part I (this J., 1910, p. 72). In dry air it commenced to decompose, as evidenced by the evolution of sulphur gases at 1200—1220° and dissociated more rapidly at 1330—1350°.

In dry hydrogen decomposition, as shown by evolution of sulphuretted hydrogen, commenced at 530—540° increasing steadily with the rise in temperature to fairly free decomposition at 900°. It was deduced that, as in the case of calcium sulphate, no decomposition could be counted as due to silica or alumina if the atmosphere was reducing. The mixing, $Na_2SO_4+3SiO_2$, gave off sulphur oxides at 1120—1130° in dry air, and that temperature was therefore taken as necessarily above the temperature at which free soda and silica combined; it was the temperature at which silica decomposed sodium sulphate with

CURVE 4

INTERACTION OF SODA AND SILICA.



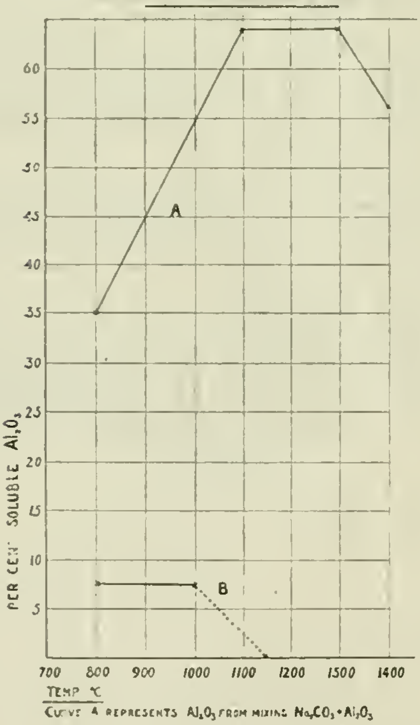
the formation of sodium silicate, as was confirmed by analysis of the resulting mass. $Na_2SO_4 + Al_2O_3$ gave off sulphur oxides at about 1120°.

Admixture with silica lowered the temperature of decomposition of calcium sulphate from 1225° to 1005° C. *i.e.*, 220 (*v.* Part I. this J., 1910, p. 73). The effect of silica on sodium sulphate was much less the lowering of the decomposition temperature being 1210° to 1125°, *i.e.*, 85° C. The range of temperature through which the expulsion of sulphur trioxide from sodium sulphate could be taken as due to the entrance of silica, was therefore small, and calculation of formulæ on this basis (applied previously to the analytical results of heated calcium sulphate-silica mixings) was likely to be rarely permissible.

Soda and Silica.—A mixing corresponding with the formula $Na_2CO_3 + SiO_2$ was next heated, extracted, and analysed as before described; the results are collected in Table X. For simplification only one extraction with normal hydrochloric acid for twenty-four hours was made in these and succeeding experiments, and the matter extracted thereby is the "soluble" of the table.

CURVE 5.

INTERACTION OF SODA AND ALUMINA.



CURVE A REPRESENTS Al_2O_3 FROM MIXING $Na_2CO_3 + Al_2O_3$
B $Na_2CO_3 + 10Al_2O_3$

All the "heatings" absorbed moisture in the laboratory on standing excepting that at 800°, in which most of the sodium carbonate was undecomposed. The 1250° heating was poured out molten on an iron plate. Some beads quickly became white as if crystallising, others remained bright, transparent, colourless glass. None of the heatings contained sulphuric oxide. The course of the inter-action can be followed from Table X. At 800° C. all was solid, and the inter-action had commenced as shown by the presence of 8·6 per cent. of soluble silica. On raising the temperature, at 850° C. the sodium carbonate would fuse, and the mass would become a bath of liquid sodium carbonate containing solid silica, with some sodium silicate. This would naturally cause a rapid increase in the rate of inter-action, silica taking the place of carbon dioxide in combination with soda, and it was not surprising to find that in the 950° C. heating practically all the silica was converted into non-resistant silicate. Since however the melting point of the silicate is well above that of sodium carbonate, this conversion was accompanied by a "drying-up" of the mass and the 950° heating was on cooling only slightly hardened. The inter-action is interesting as an example of the combination of a liquid and a solid to form a solid. On raising the temperature further the silicate would melt and at 1100° and 1250° C. the mass was quite liquid when hot and a transparent glass on cooling, but above 950° no further chemical change was detected. There was no formation of an insoluble silicate and no volatilisation of soda. The complete and rapid passage of the free silica into soluble combination with soda at the comparatively low temperature of 950°, and the easy fusibility of the silicate formed mark some difference between the inter-action of silica with soda and with lime in the mixtures $Na_2CO_3 + SiO_2$ and $CaCO_3 + SiO_2$, but the general result is the same, the formation of a non-resistant silicate throughout the mass.

Sodium sulphate and silica.—A mixing, $Na_2SO_4 + SiO_2$, heated to 1100° C. for one hour, hardened with some fusion on the surface. Extraction showed it to contain much sulphuric oxide but no soluble silica, *i.e.*, no silicate had formed; heating to 1150° C. for 24 hours in the works furnace gave an opaque glass which contained only a trace of sulphur trioxide and much soluble silica. These results accorded with the previous observation that silica began to decompose sodium sulphate at 1120—1130° C. It was evident that the fusion of the sodium sulphate, which would occur at 885° had not been able to determine any inter-action; the chemical affinities had dominated.

Soda with more silica, $Na_2O + 10SiO_2$.—The mixture examined next corresponded with $Na_2CO_3 + 10SiO_2$, made to determine the influence of an excess of silica on the course of the inter-action. $Na_2O + 10SiO_2$ is the soda-silica double oxide mixing of the synthesis. The results of heating, extraction, and analysis are collected in Table XI.

From Table XI. it was clear that the formation of soluble silicate was appreciable at 800° C., and more advanced at 1000°, when sugary fusion resulted. At 1150° there was 2·2 per cent. of soluble silica, and raising the temperature

TABLE X.

Soda and Silica ($Na_2CO_3 + SiO_2$).

$Na_2CO_3 + SiO_2$ contains $\begin{cases} Na_2O & 37{\cdot}5 \text{ per cent.} \\ SiO_2 & 36{\cdot}1 \quad ,, \quad ,, \\ CO_2 & 26{\cdot}5 \quad ,, \quad ,, \end{cases}$ $Na_2O + SiO_2$ contains $\begin{cases} Na_2O & 50{\cdot}8 \text{ per cent.} \\ SiO_2 & 49{\cdot}2 \quad ,, \quad ,, \end{cases}$

Where heated.	Time (hours)	Temp.	Soluble		SiO_2 in Na_2CO_3	Total Sol. SiO_2	CO_2	Total sol.	Total insol.	Remarks.
			Na_2O	SiO_2						
		Blank		0·4	0·4	0·8				
Muffle	1	500		0·5						No interaction.
,,	1	800	36·2	3·2	5·4	8·6	22·5	67·3	32·7 by difference. 32·9 determined.	Very slightly coherent. Interaction commenced.
,,	1	950	49·3	34·9	13·8	48·7	0·4	95·4	1·6 by difference. trace determined.	Slightly hardened. Interaction practically complete.
Injector	20mins.	1100		35·5	14·5	50·0	—	98·8	1·2 determined.	Clear and transparent glass. Dissolved very quickly.
Injector	1 hour	1250	48·5	44·0	5·4	49·4	—	97·9	2·1 by difference. 1·4 determined.	Transparent glass. SiO_2 insol = 1·2% Na_2O insol = 0·2%

TABLE XI.

Soda and Silica ($Na_2CO_3 + 10SiO_2$)‡

$Na_2CO_3 + 10SiO_2$ contains $\begin{cases} Na_2O & 8\cdot8 \text{ per cent.} \\ SiO_2 & 85\cdot0 \text{ ,, ,,} \\ CO_2 & 6\cdot2 \text{ ,, ,,} \end{cases}$ $Na_2O + 10SiO_2$ contains $\begin{cases} Na_2O & 9\cdot4 \text{ per cent.} \\ SiO_2 & 90\cdot6 \text{ ,, ,,} \end{cases}$

Where heated.	Time (hours)	Temp. °C.	Soluble		SiO_2 in Na_2CO_3	Total. Sol SiO_2	Total sol.	Total insol.	$\frac{\text{Sol. } Na_2O}{\text{Sol. } SiO_2}$	Physical condition.	Remarks.
			Na_2O	SiO_2							
		Blank	7·5	—	—	—					
Muffle	1	800	6·9	0·2	5·7	5·9				Very hard, not fused	Contained CO_2
,,	1	1000	6·7	0·4	8·0	8·4	15·1	83·2 * 84·9 †	$\frac{1}{1\cdot3}$	Shrunk, sugary fusion	,, no CO_2
Injector	1	1150	3·1	0·2	12·0	12·2	15·3	84·7 †	$\frac{1}{4\cdot1}$	Sugary fusion	
Works furnace	24	1150	3·8	—	13·3	13·3	17·1	83·2 * 82·9 †	$\frac{1}{3\cdot6}$	,,	Tl. $Na_2O = 7\cdot8\%$ insol. ,, $= 4\cdot0\%$ No SO_3
Injector	1	1300	3·4	0·2	11·2	11·4	14·8	85·2 †	$\frac{1}{3\cdot5}$	,,	

* Determined. † By difference.

to 1300° or prolonging the time of heating to 24 hours did not alter this figure appreciably. At 1150 the diminution of soluble soda to about half its original amount was also noticeable, indicating the formation of an insoluble silicate of soda in that heating; longer heating in the works furnace or a higher temperature (1300°) did not alter the figure for soluble soda. The formula of the soluble silicate as seen by the Sol. Na_2O Sol. SiO_2 ratio of the table was about $Na_2O.3\cdot5\ SiO_2$ or $Na_2O.4SiO_2$, which is interesting as agreeing with that accepted for commercial water-glass. The calculation assumed that all the soluble soda was combined with silica; the temperatures being so high above that of incipient inter-action, the quantity of silica present so great, the period of heating in one case so long (24 hours) and the ratio of soluble soda to soluble silica so constant, were taken together as fully justifying the assumption.

An experiment was made by heating a mixture of sodium carbonate and silica corresponding with $Na_2CO_3 + 20SiO_2$ to 1300° C.; it contained after heating 0·8 per cent. soda extracted by normal hydrochloric acid, and a trace of soluble silica. It will be noticed from Table XI. that the long-period heating at 1150° of $Na_2CO_3 + 10SiO_2$ contained no sulphur trioxide. A mixing made from the sulphate of soda and silica, $Na_2SO_4 + 10SiO_2$, was treated similarly, but although the furnace gases also contained sulphur oxides, the resulting mass only contained traces of sulphur trioxide; the strength of silica as a high temperature acid was so attested.

Summary for soda and silica.—The interaction of soda and silica, when the soda was supplied as carbonate, became appreciable at 700° C. and had increased at 800°. At 850° the sodium carbonate would fuse. With the proportion, $Na_2O + SiO_2$, the interaction was complete, with the formation of a solid non-resistant silicate at 950° C., and no further chemical change was detected on further heating, but the silicate was a mobile liquid at 1150° and a glass on cooling. With the proportions of the double oxide soda-silica mixing of the synthesis, $Na_2O + 10SiO_2$, a non-resistant silicate corresponding with water-glass ($Na_2O.4SiO_2$) had formed at 1150°, and also a resistant silicate presumably containing more silica, with the mass in sugary fusion. Further heating increased fusion somewhat, but no further chemical change was detected. There was no appreciable volatilisation of soda from any mixing during heating. It may be said generally that addition of soda to silica increases fusibility and diminishes resistance to acid attack, whilst addition of silica to soda confers the resistance to acid attack and non-volatility.

It is now possible to compare the behaviour of lime and soda in the two double oxide mixings, $CaO + 10SiO_2$ and $Na_2O + 10SiO_2$. With the soda-silica mixture interaction begins and is complete at lower temperatures, and proceeds more rapidly, partly, no doubt, because one constituent, the soda, fuses easily. Lime only combines with enough silica to form the non-resistant compound, $CaO.SiO_2$, and hence remains soluble in normal hydrochloric acid, but soda takes up sufficient silica to form the non-resistant $Na_2O.4SiO_1$ and a silicate which presumably contains still more silica, and is resistant to normal hydrochloric acid. Silica expels sulphur trioxide from combination with both lime and soda, but at a lower temperature with the former than with the latter.

Soda and alumina ($Na_2O + Al_2O_3$). To determine the inter-action of soda and alumina the simplest proportions were taken first, those of $NaO + Al_2O_3$. For this purpose a mixture of sodium carbonate and alumina, corresponding with $Na_2CO_3 + Al_2O_3$ was made heated, extracted and the extract analysed. The results are collected in Table XII.

This inter-action presented new features. Beginning to combine at 720°, as previously determined, about half the alumina was soluble at 800° and the whole at 1150°, the mass becoming entirely soluble, presumably completely converted into a non-resistant aluminate. The soda would fuse at 850° facilitating inter-action, the solid sodium aluminate would form from the mixture, drying up the liquid sodium carbonate, and so far all was the same as in the corresponding reaction between soda and silica; the less fusible aluminate did not melt however to a glass at 1150° (like the silicate) but remained a solid, quite powdery on cooling; the soda did not flux the alumina, although combining with it. On raising the temperature to 1300° a little insoluble alumina reappeared, without insoluble soda, and at 1400° it had increased to 10 per cent. This novelty was accompanied by another, for 14 per cent. of the soda originally present had volatilised at 1300°, and 23·1 per cent. at 1400°. The two phenomena may be associated and explained on the assumption that the non-resistant aluminate of soda ($Na_2O.Al_2O_3$) was not sufficiently stable to resist the higher temperatures; on this view it was partially dissociated at 1300° C., and more so at 1400°; the soda, set free volatilised more or less completely, and the liberated alumina, from the influence of high temperature, again became acid-resisting. The assumption seems quite reasonable and was supported strongly by

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‡ By mistake the soda used as Na_2CO_3 in this mixing was not the theoretical 9·4 per cent. of $Na_2O.10SiO_2$ but only 8·1 per cent.

TABLE XII.

Soda and alumina ($Na_2CO_3 + Al_2O_3$).

$Na_2CO_3 + Al_2O_3$ contains Na_2O 29·8 per cent., Al_2O_3 49·0 ,, ,, CO_2 21·2 ,, ,,

$Na_2O + Al_2O_3$ contains Na_2O 37·8 per cent., Al_2O_3 62·2 per cent.

Where heated.	Time (hours)	Temp. °C.	Soluble.		Insoluble.		Total Sol.	Total insol.	CO_2	SO_3	$\frac{Na_2O}{Al_2O_3}$ Sol.	Appearance	Remarks.
			Na_2O	Al_2O_3	Na_2O	Al_2O_3							
		Blank.	29·0	—				49·7	21·3				
Muffle	1	800	33·8	34·9				21·0	10·3	1	$\frac{1}{1·1}$	Shrunk powdery	
Injector	1	1150	36·0	64·0			100·0	—	—	—		Powdery	
Works furnace	24	1150	28·6	36·1	1·4	19·4		20·8	—	4·1	$\frac{1}{1·2}$	Slightly coherent	Volatilisation of Na_2O = 11·5 per cent
.	48	1150	21·2	3·8	4·0	44·9		48·9	—	25·0		,,	Volatilisation of Na_2O = 14·2 per cent.
Injector	1	1300	31·0	64·1			95·1	4·9 †		—		Powdery	Volatilisation of Na_2O = 26·0 per cent. Crucible sides glazed above mixing.
..	1	1400	31·1	57·6	0·7	10·4	88·7	11·3 † 11·1 *		—		Slightly coherent	Volatilisation of Na_2O = 23·1 per cent.

† By difference. * By determination.

results obtained with more alumina (see below). It was noted that the completely soluble 1150° heating absorbed carbon dioxide and became partially insoluble on standing in the laboratory. The long period heatings deserve special mention. They were for one and two complete burns of the works furnace, and the times at the highest temperature are given in Table XII. as 24 and 48 hours. After the first burn the mass contained 36·1 per cent of soluble alumina as against 64 per cent. for the one hour laboratory heating at the same temperature, but whereas the short-period heating contained no sulphuric oxide, the long-period heating contained 14·1 per cent. The explanation, consistent with other observations, was that some of the soda was combined as aluminate and the rest as sulphate, the necessary sulphur trioxide having been taken up from the furnace gases leaving some alumina, free and insoluble without soda. When the burn was repeated, *i.e.*, after the same material had been subjected for the second time to the same process, only 3·8 per cent. soluble alumina was present, but the sulphur trioxide had increased to 25 per cent. ; this double heating indicated that the formation of the soluble aluminate was not prevented by the sulphur oxides in the furnace gases, but that the soluble aluminate was first formed (as in the first burn) and afterwards decomposed.

Decomposition of non-resistant sodium aluminate again followed its formation as observed previously. This exemplifies in exaggeration what may happen at certain times to a glass or glaze of insufficiently acid composition if exposed to the sulphur oxides in products of combustion. The loss of soda by volatilisation was increased from 11 per cent. in the first burn to 14 per cent. in the second. Making the reasonable assumption that all the soda not combined as sodium sulphate after the first long period heating, was combined with alumina as soluble sodium aluminate, the formula calculated for

TABLE XIII.

Soda and alumina ($Na_2CO_3 + 10Al_2O_3$).

$Na_2CO_3 + 10Al_2O_3$ contains Na_2O 5·5 per cent., Al_2O_3 90·6 ,, CO_2 3·9 ,,

$Na_2O + 10Al_2O_3$ contains Na_2O 5·7 per cent., Al_2O_3 94·3 ,, .

Where heated.	Time (hours)	Temp. °C.	Soluble.		Insol. Na_2O	Total Na_2O	Total sol.	Total insol.	CO_2	SO_3	$\frac{Na_2O}{Al_2O_3}$	Appearance.	Remarks.
			Na_2O	Al_2O_3									
Muffle	1	800	4·3	7·6			11·9	88·1 *	—		$\frac{1}{1·1}$		
Injector	1	1000	4·7	7·5		4·7	12·2	87·8 *	—		$\frac{1}{1·2}$		
,,	1	1150	2·2	—	3·8	6·0	2·2	97·8 *	—			Unchanged	
Works furnace	24	1150	3·8	—		4·5 4·2	3·8	96·2 * 80·8 †	—			,,	Presumably most of Na_2O was Na_2SO_4
,,	24	1150	4·0	—	0·3	4·5	4·0	90·5 * 97·2 †		5·5		,,	
Injector	1	1350	1·9	—	3·6	5·5	1·9	98·1 *	—	—		,,	Na_2O extracted by water = 1·4%
,,	1	1350	2·3	—									Extracted for 7 days with Normal HCl

† Determined. * By difference.

the latter is $1{\cdot}0Na_2O : 1{\cdot}2Al_2O_3$, probably $Na_2O.Al_2O_3$. Another calculation made by regarding the soda in the 800° heating, less that quantity equivalent to the carbon dioxide present, as combined with the soluble alumina gave the same result.

$Na_2O.Al_2O_3$ was therefore taken as the formula of the non-resistant aluminate of soda formed.

Soda with more alumina.—The influence of increasing largely the amount of alumina present in the mixture with soda was determined next. Sodium carbonate and alumina in the proportions of $Na_2CO_3+10Al_2O_3$ were mixed, to obtain $Na_2O+10Al_2O_3$ on expulsion of carbon dioxide, and the mixing was heated and extracted. The extract was analysed and the results are collected in Table XIII.

From Table XII. it was plain that at 800° C. the interaction, which had been found to commence at 700°, had gone so far as to expel all the carbon dioxide and give 7·6 per cent. soluble alumina; the non-resistant aluminate formed was approximately $Na_2O.Al_2O_3$, and was a solid powder formed below the melting point of sodium carbonate or alumina. Heating to 1000° C. caused no change physically and very little chemically, the ratio sol. Na_2O/sol. Al_2O_3 being unaltered, but a little soda became insoluble. At 1150° a novel result was obtained, since all the alumina and a portion of the soda had become insoluble, but another part of the soda was left in the soluble condition. This remarkable condition persisted even on raising the temperature to 1350°; no change of importance was produced, but the free soda was a little reduced. The presence of soluble soda without corresponding soluble alumina, after the two had been found at a lower temperature in combination, was taken as indicating that the non-resistant aluminate formed was only stable at the lower temperatures, about 800° to 1000°, and was completely dissociated or decomposed on raising the temperature to 1150°. The results obtained from the mixture, $Na_2CO_3+Al_2O_3$, containing less alumina had already led to the same conclusion, although in that case no indication so emphatic as the complete disappearance of soluble alumina leaving soluble soda alone had been forthcoming. The 1350° heating was then extracted with cold water alone, and the extract titrated with $N/10$ sulphuric acid. The percentages of soda (Na_2O) obtained in 1 hour, 2 days, 9 days, 11 days, successive periods of extraction, were respectively 0·59, 0·40, 0·34, 0·06, totalling 1·4 per cent.; this result could be taken as confirming the existence of free soda in the mass, slowness of extraction suggesting very intimate physical association of the soda with the insoluble constituent, such as would be expected if it was a product of dissociation or decomposition. That raising to 1350° did not result in the conversion of the free soda into insoluble sodium aluminate may indicate that the alumina was already taken up to form a stable resistant sodium aluminate. The same thing was noticed in the corresponding silica heating, $Na_2O+10SiO_2$, where the relative amounts of soluble and insoluble silicate of soda did not alter on raising the temperature to 1350°. The difference between the silica and the alumina reaction is that the soluble silicate persisted but the soluble aluminate dissociated. It was not surprising to find that in the long period heating no soluble alumina was present, but that sulphur trioxide equivalent to the soda had been absorbed from the furnace gases by the mixing, forming sodium sulphate and not insoluble sodium aluminate.

A mixing containing still more alumina, corresponding with $Na_2CO_3+20Al_2O_3$, after heating at 1300°, gave up 0·6 per cent. of soda soluble in normal hydlochloric acid in 24 hours, and 0·25 per cent. soluble alumina.

Summary for soda and alumina.—The inter-action of soda and alumina when the soda was supplied as carbonate was detected at 710—720° C. and was extensive at 800°. With the proportions of $Na_2O+Al_2O_3$, those of the silicate synthesis, interaction was complete at 1150°, a non-resistant aluminate of the calculated formula, $Na_2O.Al_2O_3$, having formed throughout the mass. Above this temperature the soluble aluminate was gradually decomposed, some of the soda volatilised, and some of the alumina again became insoluble. There was no distinct evidence of the formation of an insoluble aluminate and no approach to fusion. With a much higher proportion of alumina, that of $Na_2O+10Al_2O_3$, all the soda went to form non-resistant sodium aluminate, $Na_2O.Al_2O_3$, up to 1000° but at 1150° this compound had completely dissociated; it had not merely been converted into insoluble aluminate, for about half the soda was found to be again in the free state. There was evidence also of the formation of an insoluble aluminate. Little or no volatilisation of soda occurred with this large excess of alumina, and no trace of fusion, the heating remaining a loose powder even at 1350°.

Thus taking the proportions, $Na_2O+Al_2O_3$, of the synthesis, an addition of soda to alumina does lessen its resistance to acid attack but does not flux it, and an addition of alumina to soda confers a little resistance to attack by acids, and lessens volatility without preventing it.

Comparison of silica and alumina.—Comparing the results obtained from soda and alumina with those from soda and silica, both formed soluble compounds, containing much soda and insoluble compounds containing much less soda, below 1100° C., but whereas the soluble compound of soda and silica was stable, that of soda and alumina was dissociated as the temperature rose. Hence the alumina mixture lost soda at the higher temperatures by volatilisation, but the silica mixture retained it. A marked physical difference between the silica and alumina mixings lay in the tendency of the former to fuse at the higher temperatures used, while the latter remained unaffected.

Comparison of lime and soda.—A comparison of the soda-alumina and lime-alumina results reveals one difference at once inasmuch as the soda is liable to volatilise from its mixing with alumina. The general course of the reaction is similar since both form soluble aluminates containing much of the base and insoluble aluminates presumably containing less of the base, but a difference arises from the dissociation of the soluble sodium aluminate at the higher temperatures, leading to the re-formation of free soda in the mass. Interaction in each case commences before the fusion of any constituent.

Other work.—The work done by others upon silicates of soda is summarized by Hinrichsen in the "Handbuch der Anorganische Chemie," by Dr. R. Abegg and Dr. Fr. Auerbach (Vol. II, part 1, p. 307). Commercial water glass is noted there as containing three to four molecules of silica, and one of soda. The melting point of sodium carbonate is given as 852° and that of $Na_2O.SiO_2$ as 1007°. Berthier in his "Essais par la voie sèche (Tome premier)" describes the results of heating mixtures of soda with silica (p. 387) and with alumina (p. 416). He says, and the author's results confirm it; "l'alumine se combine avec les alcalis caustiques à la chaleur rouge, mais elle ne forme point de combinaison fusible avec ces bas." and also notes the volatility of alkali in quantity from a strongly heated alkaline aluminate.

The other double-oxide mixings.—The remaining doubl-oxide mixings of the synthesis were $Al_2O_3+10SiO_2$ and Na_2O+CaO. The former yielded nothing before or after heating to normal hydrochloric acid in 24 hours and the latter was entirely soluble, so that the method of investigation was not applicable. A long period heating (24 hours) at 1150° of a mixture corresponding with $Na_2CO_3+CaCO_3$ was made in the works furnace, and there resulted a glassy mass with white inclusions, containing 32·8 per cent. of sulphur trioxide absorbed from furnace agses; 57·8 per cent. of the soda originally present had volatilized during the burn. Sulphur oxides were detected from a mixture, $Na_2SO_4+CaSO_4$, heated in a current of dry air, at 1080—1100°; the corresponding temperature for either sulphate alone is much higher, and that suggests combination. On heating in vacuum a mixture of sodium and calcium carbonates, Lebeau (Comptes rendus, 1904, **138**, 1496; this J., 1904, 714) found the dissociation pressure throughout lower than that of calcium carbonate at the same temperature, and that the residue after complete dissociation at 1000° consisted of pure lime.

This concludes that part of the synthesis which deals with the double oxide mixtures. The thanks of the author are again tendered to the directors of the Farnley Iron Co., and to his chief assistant, Mr. C. A. King, M.Sc.

Discussion.

Mr. F. W. **Richardson** said that it was a mistake to fuse some silicates with alkali carbonates at a very high temperature, since there was a tendency to throw out alumina which should be obtained as the aluminate. Also sodium carbonate could be volatilised by roasting over a blast flame, and this treatment should therefore be avoided.

Mr. J. H. **Wright** asked if the sulphur in the furnace gases did not come off as sulphur dioxide giving a sulphite, since much reducing matter must be present.

Dr. M. G. **Christie** wrote that Mr. Cobb's work threw new light upon a question which strongly concerned the manufacture of coke in by-product ovens in South Yorkshire. The coal seams adjacent to or underlying the Permian formation on the east flank of the Yorkshire coalfield had been impregnated with saline solutions, from which they had retained a deposit distributed throughout their pores and cavities. Some of the coals contained up to 0·6 per cent. of sodium chloride. Even when such material was washed before charging, large quantities of salt were brought into the hot oven chambers, the wall brickwork of which being of a highly refractory nature, must contain a considerable percentage of free silica. The effect was not perceptible for a year or more if the system of combustion in the flues avoided any strong local superheating. During this period, however, sodium chloride was continuously being evaporated out of the charge and brought into contact with the brickwork; then, in the presence of water vapour, hydrochloric acid was evolved and a sodium silicate or double silicate was formed, first on the surface and afterwards penetrating further into the bricks. This process hardly altered the mechanical structure of the brick; there was no perceptible difference in the surface or shape of the red-hot bricks and joints, nor did the coke cling to the brickwork during the pushing of the charge; yet analysis shewed an increase of several per cent. of alkali in the composition of the chamber lining. After a time, the lining suddenly began to "chatter" or disintegrate, beginning at the foot in the case of vertical flued ovens and spreading upwards, especially towards the centre of the wall. During the ramming of the oven, the brickwork was torn away in pieces which severed themselves from the chamber wall about 1 in. to 1½ ins. below the surface. Mr. Cobb's research seemed to afford a satisfactory explanation of this. Briefly described, the sodium chloride vapours decomposed at first on the surface and in the pores of the brickwork, binding the free silica and forming with it and the alumina complex silicates, in agreement with the inter-actions demonstrated by the author in his paper. As the temperature on the skin of the oven lining hardly exceeded 1000° C. to 1100° C., and was even lower for the greater portion of the coking period, the brick surface remained stable and the complex silicates of soda and alumina did not fuse until the chloride advanced a certain distance towards the flue, and this marked the line at which severance took place during the ramming. The speed at which the sodium chloride penetrated to the point of fusion was dependent upon the concentration of free silica and the density of the brick; thus a fine grained material with the least quantity of ganister withstood the corrosion longest. Obviously the most efficient remedy against salt troubles would be narrow chambers and low heats, but from economic reasons such a drastic cure could not be adopted. No doubt Mr. Cobb would be able to point out the lines upon which the remedy must be sought. At all events his work contained valuable data which were bound to serve as a sound basis for the solution of a problem which was of such vital importance to a large and growing branch of industry.

Mr. J. W. **Cobb** said that the dissociation of the soluble sodium aluminate, did come into play in analysis by fusion, if the temperature was too high. A mixture of the formula, $3Na_2CO_3 + Al_2O_3$, containing about three parts of sodium carbonate to one of alumina by weight, was heated for an hour at 1350° C., and extracted for 24 hours with normal hydrochloric acid. About one third of the alumina was undissolved, and about on half of the soda was volatilised. In reply to Mr. Wright, the atmosphere in the works furnace was continuously oxidising, and no carbon was present except as carbon dioxide, accompanied by oxygen in the products of combustion; consequently the "heating" contained the sulphur finally as sulphate, not as sulphite or sulphide. The gas obtained in the wash bottle in the laboratory tests on the dissociation of sulphates, was often sulphur dioxide and not the trioxide; the latter was not very stable. Dr. Christie's notes were valuable, as showing how the formation of silicates below their fusion point might assume importance in large scale operations. He had indicated generally the line along which a satisfactory solution of the problem might be sought, and the maker of refractory bricks and the coking expert had to follow that line.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Ice machines; Decomposition of ammonia in ——, and the danger of explosion due to this cause. Behr. Sozialtechnik, 1909, 8, 464—465. Chem.-Zeit., 1910, 34, Rep., 138.

In consequence of several explosions having occurred in connection with ammonia-compression ice-machines, the so-called "air" which is discharged periodically from the machines was examined. The analytical results obtained with three samples were as follows:—

	Hydrogen.	Nitrogen.	Oxygen.
	per cent.	per cent.	per cent.
1.	95·5	4·5	*Nil*
2.	30·5	69·2	0·8
3.	43·8	55·9	0·3

Explosions are hence probably due to hydrogen produced by decomposition of ammonia, owing to the strong heating caused by the compression.—A. S.

Patents.

Filters; [Rotary ——]. E. Burt, El Oro, Mexico. Eng. Pat. 4045, Feb. 18, 1909.

A rotary filter is claimed consisting of a cylindrical shell having perforated longitudinal plates or channel irons spaced apart, on its internal surface for supporting the filtering medium. The edges of the filtering medium are held in place by strips or rope forced into the spaces between the perforated plates. Holes are provided in the cylindrical shell for the discharge of the liquid. The filter is supported by means of a hollow trunnion at one end and by rollers at the other, a removable cover at this other end providing for the discharge of the cake formed. This cover may be withdrawn or closed by means of a hydraulic cylinder without stopping the rotation of the filter. A number of spring tappets, carrying longitudinal bars at the surface of the filtering medium, may be brought into action, one after the other, to break up the cake before its discharge. A hydraulic cylinder is also arranged for tilting the filter to facilitate the discharge of the broken cake. The filter being put in rotation by means of suitable gearing arranged near its trunnion end, the slime to be filtered, compressed air, wash water and again compressed air, are admitted in turn, through the hollow trunnion. The cake formed is then broken up by operating the tappets and the cover of the filter opened. The admission of wash water or the inclination of the filter discharges the broken cake, whereupon the cover may be closed and the operations repeated.—J. W. H.

Filtering blocks. A. A. Simonet. Fr. Pat. 406,281. July 23, 1909. Under Int. Conv., July 24, 1908.

Suitable filtering materials, for example sand, gravel, etc., are agglomerated into blocks which may be made of any desired capacity for filtration. Any suitable agglutinant may be used. Such blocks can be used for upward filtration and can be easily cleared by reversing the flow of liquid without disturbing the filtering material, as would be the case with loose materials.—W. H. C.

Mixing emulsions and the like: Apparatus for ——. W. T. Boothroyd Ltd. and J. H. Wooliscroft, Bootle. Eng. Pat. 4623, Feb. 25, 1909.

The liquid, *e.g.*, codliver oil emulsion, is introduced into a vessel containing an inner vessel provided with a sieve or sieves through which the emulsion is driven under pressure by means of a screw conveyor fitting into the inner vessel. The sieves may be in the form of perforated plates or bands encircling the inner vessel, whilst means may be provided for the removal of the outer container for cleaning, without disturbing the inner receptacle. There may also be a water jacket to reduce the heating of the mixture during emulsification.
—C. A. M.

Separation of gaseous mixtures into their constituents. R. J. Lévy, Twickenham. Eng. Pat. 5931, Mar. 11, 1909.

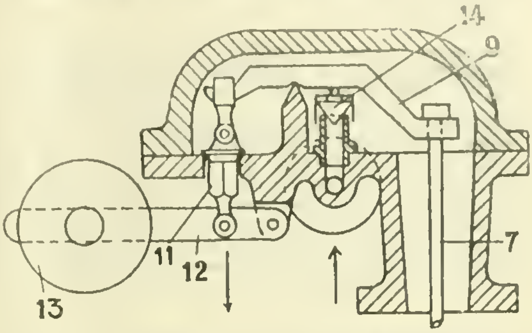
A method of separating gases, by taking advantage of their different solubilities, is claimed, in which a fall of fluid, such as a waterfall used for power purposes, is utilised. The mixed gases are forced into the descending column, and the constituent gases or enriched gases are collected from the head and tail water respectively. An additional stream of a constituent of the mixed gases may be forced into the column for the purpose of more completely separating the constituent required. In the case of air, a quantity of oxygen may be forced into the column of liquid solvent at a point lower than that at which the air is introduced, nitrogen being collected from the "tail water" and oxygen from the "head water."—J. W. H.

Material for producing liquid- and gas-tight joints upon receptacles for storage of petroleum, oils, spirits, and gas cylinders. C. S. Bedford, Leeds, and F. Atkins, Hull. Eng. Pat. 8201, April 6, 1909.

A composition is claimed for making joints in the screw-cap stoppers of vessels for the storage of petroleum, benzol, etc., consisting of gelatin, 40 lb.; glycerin, 42 lb.; pigment, 2 lb.; water, 15 lb. The composition is made into sheets or spread upon a suitable fabric, from which discs or washers may be cut for making the joints referred to.—J. W. H.

Raising liquids by means of compressed air. P. Kestner, Lille, France. Eng. Pat. 21,737, Sept. 23, 1909. Under Int. Conv., Oct. 1, 1908.

The claim relates to the valve mechanism for pulsating liquid elevators. When the vessel or "monte-jus" is filling, the weight of the float suspended from the lever, 9, by the rod, 7, overcomes the weight of the counterpoise lever, 12, closes the air-inlet valve, 14, and opens the exhaust valve, 11. As soon as the vessel is full of liquid,



the float is buoyed up and the counterweight, 13, overbalances the lever, opening the compressed-air valve, 14, and closing the exhaust, 11. The pressure keeps the valve, 11, which has for this reason a relatively large surface, closed until the air has forced the whole of the liquid up the rising main and itself begins to escape. Then the pressure falls and the weight of the float overbalances the lever, again closing 14, and opening 11.—W. H. C.

Separating various materials from gases; Art of ——. W. J. Baldwin, New York. U.S. Pat. 950,607, Mar. 1, 1910.

The gas, with or without the admixture of a fluid, is projected against a perforated screen. The apparatus consists of a fan, the casing of which carries a perforated screen near the tips of the blades of the "flier." The fluid is introduced between the blades of the "flier," and that part of the casing outside the perforated screen is connected with the inlet of the fan. The separated materials pass through the perforated screen together with any added fluid, while the main bulk of the gas leaves the fan by its outlet, the small amount passing through the screen being returned to the inlet of the fan for retreatment.—J. W. H.

Volatile liquids, such as alcohol and ether, in the state of vapour diluted with air; Process for the recovery of —— in the manufacture of artificial silk, smokeless powder and analogous operations. Soc. "L'Air Liquide" (Soc. anon. pour l'Étude et l'Exploit. des Proc. G. Claude). First Addition, dated July 16, 1909 to Fr. Pat. 397,791, March 6, 1908 (this J., 1909, 880).

The addition claims the application of the method described in the original patent to the separation of water vapour from air.—W. H. C.

Regenerative furnaces. Blair Engineering Co. Fr. Pat. 405,382, July 24, 1909.

The claim relates to the method of reversing the flow of air and gas in a regenerative furnace. The various flues are all brought up vertically through a floor or a platform, above which they terminate. The ends of the flues have annular water-seal flanges and lutes and the connections are made by inverted U-shaped bends suspended from a framework. The bends are swung round upon one leg as a pivot and the lutes raised and lowered to reverse the flow, as desired, by a system of cords, rods and levers.
—W. H. C.

Distilling apparatus. J. Destria and L. G. Corbière. Fr. Pat. 405,759, Aug. 5, 1909.

Steam is introduced into the centre of the still, above the level of the liquid, through a nozzle consisting either of a tubular ring, perforated with small holes, or of two circular cup-shaped pieces of metal separated from one another at the circumference by a very small distance and thus forming a circular horizontal slot. The steam forms a horizontal sheet, which acts as a screen, breaking down any froth that may be produced during distillation, and assisting in the rectification of the distillate. It also protects the contents of the still from oxidation. The arrangement is particularly applicable to the distillation of resins.—E. W. L.

Drying wood or other materials in a closed vessel and by revivified dry air. A. Sainte-Beuve. Fr Pat. 405,817, Aug. 7, 1909. Under Int. Conv., Aug. 10, 1908.

Air is circulated through a system consisting of a chamber in which the material to be dried is placed, a fan or other suitable means of moving the air, and a chamber containing calcium chloride or other suitable drying agent disposed on trays, the whole being suitably connected by conduits and forming a closed system. The dry air takes up moisture from the material, gives up the moisture to the calcium chloride as it passes over the trays and returns as dry air to the drying chamber again.—W. H. C.

Vacuum evaporating apparatus; Process for the automatic regulation of the pressure in the last effect of ——. J. C. Grière. Fr. Pat. 406,191, Aug. 18, 1909. Under Int. Conv., Aug. 31, 1908.

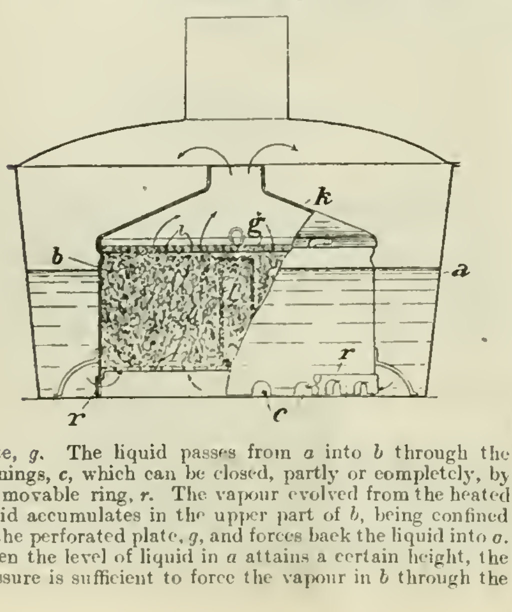
The pressure in the last effect or vessel of the series is maintained constant by using a pump of sufficient capacity to produce a diminution of pressure in excess of that which is required and then admitting to the pump small regulated quantities of air to adjust the vacuum to the desired amount. The admission of air is controlled by an adjustable column of water and a float which actuates a valve. An alternative method, when motor-driven pumps are used, is to cause the pressure in the last effect to govern or control the speed of the motor.—W. H. C.

Crystals; Process for obtaining large, well-shaped —— *from solutions saturated whilst hot.* V. Schütze. Ger. Pat. 217,187, Jan. 14, 1908.

The crystallising vessel is provided with two concentric jackets, through which heating agents are passed in opposite directions. One of the jackets is provided with a series of outlet openings along its length, so that as desired, either a part or the whole of the jacket may be traversed by the heating agent.—A. S.

Treating solids with liquids; Process and apparatus for ——. Chem. Werke Kirchhoff und Neirath Ges. m. b. H. Ger. Pat. 217,238, Aug. 4, 1907.

The apparatus comprises a boiler or heating vessel, *a*, containing the liquid, and an inner vessel, *b*, containing the solid substance, this inner vessel being closed by a perforated plate, *g*. The liquid passes from *a* into *b* through the openings, *c*, which can be closed, partly or completely, by the movable ring, *r*. The vapour evolved from the heated liquid accumulates in the upper part of *b*, being confined by the perforated plate, *g*, and forces back the liquid into *a*. When the level of liquid in *a* attains a certain height, the pressure is sufficient to force the vapour in *b* through the perforations, *i*, into the hood, *k*. Owing to the release of the pressure in this manner, the liquid in *b* is brought suddenly to violent ebullition, and a vigorous circulation in the direction indicated by the arrows is set up.—A. S.



Gases and vapours; Process and apparatus for bringing liquids into intimate contact with. ——. I. Moscicki, Freiburg, Switzerland. Eng. Pat. 8958, April 15, 1909. Under Int. Conv., June 1, 1908.

See Fr. Pat. 403,401 of 1909; this J., 1910, 76.—T. F. B.

Furnaces; Regenerative ——. A. J. Boult, London. From Blair Engineering Co., Chicago. Eng. Pat. 17,246, July 24, 1909.

See Fr. Pat. 405,382 of 1909; preceding.—T. F. B.

Kiln; Continuous ——. W. H. Smith, Swinton. U.S. Pat. 951,461, March 8, 1910.

See Eng. Pat. 19,525 of 1908; this J., 1909, 1035.—T.F.B.

Temperature fluctuations; Apparatus for controlling ——. J. E. Hedin, Lidköping, Sweden. U. S. Pat. 949,825, Feb. 22, 1910.

See Eng. Pat. 15,273 of 1908; this J., 1909, 78.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Switch and transformer oils; Physical properties of ——. W. P. Digby and D. B. Mellis. Manchester Local Section of the Institution of Electrical Engineers. Times Eng. Supplmt., 1910, March 30.

The authors remarked that oil for oil-break switches and transformers, had not received due scientific attention. As a result of casual rather than scientific selection, followed by carelessness and neglect, trouble had arisen. Generally, the electrical engineer had purchased his oil on the strength of the literature of one or other of the rival makers which had guaranteed a flash-point, specific gravity, viscosity, and degree of chemical purity, or else upon a curve of the dielectric strength of a special sample of the oil. Thanks to taking matters on trust in this manner, the purchaser had not been aware that while flash-point, specific gravity, and viscosity were generally as advertised, the guaranteed chemical properties were less frequently afforded, while the widely-circulated splendid curve of the dielectric strength (which was true enough of the special sample) was rarely reproduced in any commercial sample. Regarding oil as an insulator it was an obvious deduction from the physical facts of electrical conduction through metals and alloys that, just as the presence of any impurity in a metal increased its specific resistance, so the presence of any soluble impurity in oil must tend to decrease its value as a medium offering a resistance to the flow of electric current. Impurities ordinarily present in the oils supplied for use for oil-break switchgear, or for transformers, fell under the following heads: (1) Moisture; (2) alkaline substances; (3) resinous or resinoid matter; (4) acids; and (5) sulphur compounds. Their presence might be due to improper or inadequate refining, or to wilful adulteration, or to accidental contamination. In storage the oil might undergo chemical changes. An alkaline oil would be likely to absorb moisture from the atmosphere, which would lower both its dielectric strength and its specific resistance. An oil stored or transported in wooden barrels might be contaminated by resinoid substances. During use in oil-break switchgear, chemical and physical changes occurred. These included the absorption of moisture from the atmosphere, the carbonisation of the oil, increases in specific gravity and in viscosity, and changes in flash-point. Also dust found its way into the oil tank, while the effect of the arc which was broken on opening the switch was to produce decomposition and a gradual change in the properties of the oil. When used in transformers the absorption of vegetable oils from varnishes, nominally but not actually oil-resisting, was probably the most prolific of the sources of trouble. Dust, in this instance, also found its way into the oil and either or both of these foreign matters rendered the oil more viscous, and restricted or reduced its circulation; further, through electrostatic attraction, dust adhered to windings and core, interfering with the heat transfer. Among the properties requisite in a mineral oil for transformers were: (1) Absence of moisture; (2) good dielectric strength; (3) low viscosity to facilitate the heat transfer from the core and windings to the case; (4) flash-point expressed by a figure which was two to three times the designed temperature limit of the transformers in degrees Centigrade; (5) absolutely neutral reaction; (6) complete absence of vegetable oils or resinoid material; and (7) freedom from metallic salts. For switchgear the authors emphasised the need of points 1, 2, 5, 6, and 7; and the flash-point might be put at least six times the expected engine-room temperature.

Use of mineral oils mixed with concrete. Moyer. *See IX.*

Determining acid and saponification values of dark oils and fats. Moyer. *See XII.*

Volumetric determination of sulphuric acid by the barium chromate method. Holliger. *See XXIII.*

Patents.

Washers for coal or like materials. H. J. Greaves, Wakefield, Yorks. Eng. Pat. 1563, Jan. 22, 1909.

The washer comprises a tank in which are one or more trays or troughs carrying the coal, these trays receiving a suitable vibrating or reciprocating motion. A large number of mechanisms are described for producing a suitable motion, including cam-gears and various types of quick-return motions. For separating several sizes or grades, the trough is divided into successive or superposed compartments by a series of perforated plates. One of these plates is hinged at its centre transversely to the length of the trough, and is normally inclined, so that as the heavier pieces of coal collect on the lower half of this hinged plate, they tilt it and automatically discharge at the side of the trough. Elevators are suitably arranged for the removal of the washed coal from the tank, and may be of the combined bar and scraper type for dealing with two sizes of material in one elevator.—A. T. L.

Coal and other minerals; Apparatus for the washing of ——. J. Shaw, Kirby Moorside, Yorks. Eng. Pat. 16,056, July 9, 1909.

The washer is of the type described in Eng. Pat. 7111 of 1907 (this J., 1908, 113), in which the coal is washed to the lower end of an inclined trough by a current of water, whilst the heavier impurities are taken to the upper end of the trough by the movement of a series of dams carried by pivoted arms on a frame arranged above the trough. The coal is fed to the trough at about the middle of its length. The arms carrying the dams are inclined towards the lower end of the trough and stops are provided on the frame to limit the movement of the arms, so that during the upstroke of the frame the dams rest in the bottom of the trough, and during the earlier part of the downstroke they rest upon and strickle the coal. During the later part of the downstroke, the wheels upon which the frame is carried come on to raised parts of their rails, so that the frame is raised, lifting the dams clear of the coal and allowing a more rapid flow towards the lower end of the trough.—A. T. L.

"Paris coal" (charcoal briquettes); Manufacture of ——. Cie. des Charbons et Briquettes de Blanzy et de l'Ouest. Fr. Pat. 405,692, Nov. 21, 1908.

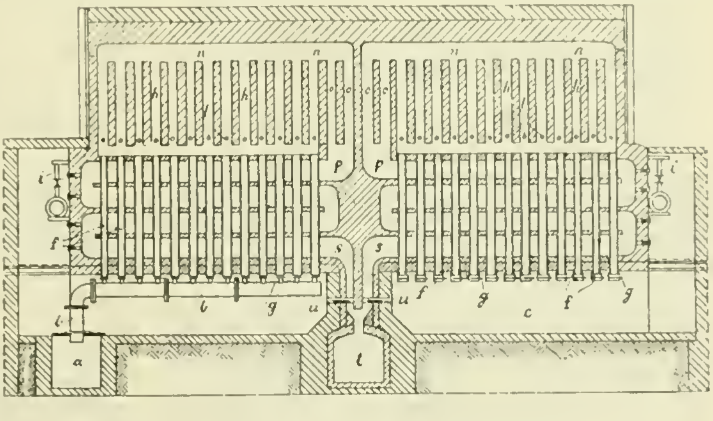
The coal-tar usually employed as binding agent in making "Paris coal" from a mixture of wood-charcoal and other fuels together with a certain proportion of combustion-supporting substances, is replaced by pitch, and the mixing is effected in a steam-heated chamber.—A. T. L.

Coke-ovens. C. A. Baglin, Chesterfield. Eng. Pat. 9405, April 21, 1909.

In coke-ovens with vertical flues, the combustion chambers are constructed with only one inlet for air and gas. The air supply is divided into two streams which pass on either side of the gas conduit and re-unite at the inlet to the combustion chamber, the gas entering between the two currents of air.—W. H. C.

Coke-ovens; Horizontal —— with heating flues and heating devices for the air of combustion arranged below them. F. Weidl, Dresden, Germany. Eng. Pat. 15,206, June 29, 1909.

The air for combustion is either forced through the main, *a*, and the distributing pipe, *b*, into the vertical air-heating pipes, *f*, or it is drawn through them by the suction of the chimney from the passage-way, *c*. The gas passes from the main, *i*, through gas passages to the nozzles, *l*, mixes with the air from the upper ends of the pipes, *f*, and burns in the vertical flues, *h*. The products of combustion pass along the horizontal flue, *n*, down the flues, *o*, into the horizontal zig-zag flues, *p*, where they circulate round the outside of the air pipes, *f*, to the flue, *s*, and thence to the main flue, *x*. The draught is regulated by the dampers, *u*, and the air by the slides, *g*. The single air-heating pipes, *f*, may be replaced by groups of smaller pipes.—W. H. C.



Coal-dust; Process for the utilisation of —— to form metallurgical or other coke. G. de Velna. First Addition, dated July 9, 1909, to Fr. Pat. 357,687, Sept. 12, 1905 (this J., 1906, 116).

The pitch used as binding agent in the process described in the principal patent may be replaced by hydrocarbons obtained from petroleum, whether solid or liquid, with or without the admixture of silicates of calcium, sodium, potassium, or aluminium, or the binding agent may be dispensed with, the agglomeration being effected by pressure only.—A. T. L.

Gas producers. K. I. Crossley and T. Rigby, Manchester. Eng. Pat. 4524, Feb. 24, 1909.

The producer is of the type in which the raw fuel is converted into coke in a distilling chamber by the heat of the gases leaving the producer chamber, and is intended for the use of caking coal with recovery of by-products. The invention consists in spreading the raw fuel in a layer on a long horizontal grate which is operated mechanically, so that the fuel is prevented from caking during the process of distillation. In a suitable form of producer this horizontal grate is arranged in a lateral chamber at the upper part of the producer proper. The fuel is fed mechanically on to one end of the grate and is delivered from the other end past a rotating spiked drum or breaker into a storage bell arranged centrally over the producer chamber. The grate consists of separate bars, alternate bars moving in opposite directions, so as to agitate the fuel and keep the grate clear for the passage through it of the hot gases from the producer chamber. —A. T. L.

[Illuminating] gas: Apparatus for manufacturing ——. H. W. Benner, Chambersburg, Pa., and A. G. Kelterborn, New York, Assignors to International Gas Development Co., New York. U.S. Pat. 950,779, Mar. 1, 1910.

The apparatus comprises a retort chamber in which are arranged vertical retorts for the production of a mixture of coal-gas and water-gas, and for the production of carburetted water-gas, respectively. Of these retorts the former are provided with charging hoppers at the upper end, and with steam-inlets at the lower end, whilst the latter are provided with inlets for steam and for oil and contain a bed of iron to act as a carrying agent in combining the oxygen of steam with the carbon of oil. —A. T. L.

Gas producer working by suction or by pressure. A. Béchevot. First Addition, dated Nov. 16, 1908, and Second Addition, dated June 26, 1909 to Fr. Pat. 400,329, May 29, 1908 (this J., 1909, 1027).

(1). To adapt the producer for coke or lean coal containing up to 25 per cent. of ash, the cylindrical vaporiser forming the lower part of the producer described in the principal patent is replaced by two superposed vaporisers, separated by an annular space through which the steam from the two vaporisers, unmixed with air, enters the fire during the normal working of the producer. This annular space is inclined downwards, and poking holes or doors are provided in line therewith in the shell of the producer. The excess of water from the lower of the vaporisers runs into another vaporising chamber below it. This vaporiser forms an inverted conical wall for the lower part of the producer chamber. The steam space is entirely separate from that of the upper vaporisers. In normal working, air is admitted to the lowest vaporiser and thence to the fire. Whilst the poking holes are open for cleaning the fire, air enters through them and mixes with the steam from the upper vaporisers. (2). To facilitate the removal of clinker and ash, the inverted conical casting described in the principal patent is dispensed with, the producer chamber being cylindrical throughout. Below the cylindrical vaporiser is an annular plate or hearth covered with refractory material, the fuel column resting partly on this hearth and partly on an iron plate beneath the central orifice in the hearth. An annular space between the vaporiser and the hearth serves for the admission of air and steam from the vaporiser to the fire. Clinker and ash are withdrawn both through this space and also from beneath the annular hearth.—A. T. L.

Combustible gas from coal with its natural content of water; Process for the manufacture of ——. E. Riepe and F. Küchler. Ger. Pat. 218,101, Feb 26. 1909.

After the carbonisation of a charge of the coal, from 20 to 50 per cent. of the incandescent coke is left in the retort, and a fresh charge of coal introduced, the gases, containing steam and tar vapours, evolved from the raw fuel being led through the glowing coke.—A. S.

Paraffin from paraffin butter; Process for separating —— and apparatus therefor. J. Weiser, Mahrisch, Austria. Eng. Pat. 18,120, Aug. 5, 1909.

The object of this process is to dispense with the use of the hydraulic press in the manufacture of paraffin. The paraffin butter obtained from the filter presses is either brought at once to a consistency in which it can be conveyed and pressed, or first treated so that it may be conveyed and then converted, directly before pressing, into a suitable state for that operation. In the first case, the paraffin butter may be heated and then granulated by means of water, or it may be rendered pasty by agitators in reservoirs provided with heating and cooling appliances. In the second case, the material is heated so that it may be conveyed, and then cooled immediately before entering the perforated press-pipe. Suitable apparatus is described for carrying out the various operations. —T. F. B.

Paraffin wax; Treatment or purification of ——. The Burmah Oil Co. Fr. Pat. 405,974, June 26, 1909. Under Int. Conv., Mar. 10, 1909.

Instead of "sweating" the paraffin wax and then cooling it in the same chamber, the series of trays on which the paraffin is placed for the "sweating" process is mounted on a trolley on rails and is run out of the heating chamber, as soon as the "sweating" process is complete, into a separate cooling chamber, whilst another trolley takes its place in the heating chamber.—A. T. L.

Pulverulent material; Process and apparatus for treating —— before moulding into briquettes or other shapes. H. Woodruff and H. B. Budgett. Fr. Pat. 406,067, Aug. 12, 1909. Under Int. Conv., March 18, 1909.

See Eng. Pat. 6519 of 1909; this J., 1910, 10.—T. F. B.

Coke ovens. F. Weidl. Fr. Pat. 405,975, June 26, 1909.

See Eng. Pat. 15,206 of 1909; preceding.—T. F. B.

Gas for illuminating, heating, or power purposes; Manufacture of ——. H. S. Elworthy, St. Albans. U.S. Pat. 950,067, Feb. 22, 1910.

See Eng. Pat. 14,333 of 1904; this J., 1905, 1006.—T. F. B.

Gas producer with reversed combustion. Soc. Franç. d'Exploitation des Appareils Koerting. Fr. Pat. 405,646, Aug. 2, 1909. Under Int. Conv., Aug. 6, 1908.

See Eng. Pat. 18,123 of 1909; this J., 1910, 263.—T. F. B.

Gases derived from combustibles; Recovery of by-products from ——. Dr. C. Otto und Co., Ges. m. b. H., Dahlhausen a. Ruhr, Germany. Eng. Pat. 21,010, Sept. 14, 1909. Under Int. Conv., Oct. 7, 1908.

See Ger. Pat. 211,577 of 1908; this J., 1909, 830.—T. F. B.

Coal-gas and analogous gases; Treatment of —— for obtaining tar and ammonia. W. Feld, Hönningen on Rhine, Germany. U.S. Pat. 951,778, March 8, 1910.

See Eng. Pat. 20,139 of 1907; this J., 1908, 1011.—T. F. B.

Gas-analysing apparatus. U. S. Pat. 944,274. *See* XXIII.

Apparatus for volumetric gas analysis. Fr. Pat. 405,972. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Commercial analysis of crude calcium acetate. Jedlicka. *See* VII.

Patents.

Electrodes for arc lamps. Gebr. Siemens und Co., Charlottenburg, Germany. Eng. Pat. 21,374, Sept. 18, 1909. Under Int. Conv., Oct. 5, 1908.

In order to increase the illumination given by carbon electrodes, a molybdate or tungstate of a rare earth metal is added to the electrode, or materials which will form such a compound during the burning of the arc may be used, and if desired an iron compound such as iron tungstate and also an alkaline-earth fluoride may be added. A suitable electrode would consist of a sheath of pure carbon within which is a wick composed of about 60 per cent. of a mixture of molybdates and tungstates of cerium, lanthanum, and didymium, about 20 per cent. of iron tungstates, and about 20 per cent. of fluorides of the rare earth metals or of fluorspar.—A. T. L.

Tungsten powder [for filaments for electric lamps]; Process for producing an amorphous ——. J. Schilling, Colonie Grunewald, Germany. U.S. Pat. 950,869, March 1, 1910.

The process consists in decomposing an ammonium salt of tungsten to oxide, by heating it in a non-oxidising atmosphere, and maintaining the temperature at a little above the dissociation temperature of the gaseous product. The reducing gases thereby liberated, reduce to metal the tungsten oxide first formed.—F. R.

Gases resulting from destructive distillation or gasification of combustibles: Recovery of by-products, particularly ammonia, from ——. H. Koppers. First Addition, dated Aug. 18, 1909, to Fr. Pat. 351,268, Feb. 4, 1905. Under Int. Conv., Sept. 11, 1908.

See U.S. Pat. 945,332 of 1910; this J., 1910, 144.—T.F.B.

Incandescent mantles: Process for manufacturing ——. H. Süssmann, Assignor to Deutsche Gasglühlicht A.-G. Auerges., Berlin. U.S. Pat. 950,734, March 1, 1910.

See Fr. Pat. 379,928 of 1907; this J., 1907, 1272.—T.F.B.

Calorimeter. Addition to Fr. Pat. 404,131. *See* XXIII.

III.—TAR AND TAR PRODUCTS.

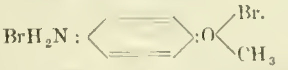
Organic acids and bases; Solubility of —— *in solutions of their salts.* (*Prelim. note.*) N.V. Sidgwick. Chem. Soc. Proc. 1910, **26**, 60–61.

Aniline is known to be more soluble in a solution of its hydrochloride than in pure water. An attempt was made to determine how far this property was shared by other bases, and by phenols and acids. *o*-Toluidine behaves in the same way as aniline; but the alkylamines examined (amylamine, diamylamine, and dipropylamine) appeared to be less soluble in the salt solution. With phenols and monobasic acids an increase of solubility was found in every instance, whether they separated from the solution as liquids or as solids. The results are contained in the following table.

The table gives the solubility (in terms of normality) of the substance in the salt solution and in pure water, the ratio of the first of these to the second, and the dissociation constant of the acid or base. β-Phenylpropionic acid at 25° separates in a liquid form containing less than 50 per cent. of pure acid; at 11° the solid acid crystallises out, but some of the salt with it. Phenol is miscible in all proportions with a normal solution of its sodium salt at temperatures above 13°. Where the substance separates as a liquid, the salt no doubt dissolves in both layers, and this may partly (and perhaps wholly in the case of the aromatic amines) explain the increase in solubility, since the mutual solubility of two liquids is always increased by the addition of a third substance, which dissolves more or less equally in both. Where the solid acid separates, this explanation cannot apply, and the phenomenon is probably due to the formation in the solution of a compound between the acid and the salt or its ions. This is confirmed by the numerous instances in which acid salts of monobasic acids, of the type $NaHA_2$, have been isolated in the solid state (*see* Farmer, Chem. Soc. Trans., 1903, **83**, 1440, and this J., 1903, 1371).

p-Anisidine and dimethyl-p-anisidine; Oxidation of ——. H. Wieland. Ber., 1910, **43**, 712—728.

When *p*-anisidine is oxidised with bromine water in mineral acid solution at a low temperature, an Indigo-blue coloration makes its appearance which gradually becomes reddish. When more bromine is used and the oxidation carried on as quickly as possible, an almost quantitative yield of benzoquinone is obtained. The dyestuff is obtained in brown flocks when the oxidation is performed in acetic acid solution. It is probably an oximonium salt of the formula,



$$BrH_2N:C_6H_4:O\begin{matrix}Br.\\CH_3\end{matrix}$$

In aqueous solution the benzene ring is not attacked, but in chloroform solution a dibromoanisidine, m. pt. 81°C., is produced. *p*-Dimethylanisidine, prepared by treating *p*-anisidine with dimethyl sulphate, when similarly oxidised in chloroform solution with bromine, yields first a red dyestuff and then a green compound of 3 atoms of bromine with one of anisidine, which with water is converted into benzoquinone. Oxidation in aqueous solution with 4 atoms of bromine furnishes a quinonoid perbromide which in contact with water yields benzoquinone, but on reduction with zinc dust and acid is converted into *p*-dimethylaminophenol, this furnishing a convenient method of preparing this phenol.—J. C. C.

Thiosalicylic acid; Colourless and yellow ——. O. Hinsberg. Ber., 1910, **43**, 651—654.

Thiosalicylic acid, $C_6H_4(SH).CO_2H$, which has hitherto been described as a sulphur yellow, crystalline powder, is

Substance.	Temperature.	Normality of salt.	Solubility in		Ratio.	K
			Water.	Salt solution.		
Aniline	25°	1	0·38	0·54	1·4*	$9{\cdot}05 \times 10^{-8}$
	40°	1	0·42	0·65	1·5*	
	60°	1	0·50	0·81	1·6*	
	80°	1	0·61	1·07	1·7*	
o-Toluidine	25°	1	0·14	0·28	2·0	
Phenol	25°	1	0·85	—	—	50×10^{-8}
o-Cresol	25°	1	0·24	0·70	2·9*	
	40°	1	0·26	0·77	3·0*	
	60°	1	0·31	0·91	3·0*	
	80°	1	0·39	1·26	3·2*	
o-Nitrophenol	48°	1	0·028	0·069	2·4*	750×10^{-8}
Benzoic acid	25°	1	0·026	0·044	1·7	0·006
p-Toluic acid	25°	1	0·0031	0·0054	1·8	0·005
p-Nitrobenzoic acid	25°	1	0·0024	0·0046	1·0	0·040
Salicylic acid	25°	1	0·016	0·036	2·3	0·102
Cinnamic acid	25°	0·5	0·0041	0·0105	2·5	0·004
β-Phenylpropionic acid	25°	1	0·050	1·15	22·9*	0·023
	11°	--1	0·032	0·051	1·6	
Hippuric acid	25°	1	0·039	0·078	2·0	0·022
β-Iodopropionic acid	25°	1	0·40	0·63	1·6	0·009

Those cases where the substance separates in the liquid form are marked with an asterisk.

found by the author to exist in a second, colourless form. This, which is designated as the *a*-modification, is obtained by treating commercial thiosalicylic acid with glacial acetic acid, concentrated hydrochloric acid and tin, and warming until solution takes place. The filtered solution deposits colourless prisms which melt at 164°—165° C. This colourless form can also be obtained from dithiosalicylic acid by the above treatment and also by heating the yellow modification to 200° C., or by boiling it with stannous chloride and glacial acetic acid. The yellow (β-)modification can be conveniently prepared by warming dithiosalicylic acid with glacial acetic acid, a little hydrochloric acid and zinc dust. On cooling the filtered solution some of the *a*-modification separates out first and the β-form is obtained from the filtrate by dilution with water and allowing to remain for some time. It melts between 160° and 165° C. The above isomerism was not observed in the case of the methyl [$C_6H_4(S.CH_3).CO_2H$] or acetyl [$C_6H_4(S.CO.CH_3).CO_2H$] thiosalicylic acids which occur in only one, colourless form.—J. C. C.

Bromination ; A new method of ——, with aqueous hypobromous acid. O. Stark. Ber., 1910, **43**, 670—674.

Bromination of organic compounds can, in certain cases, be carried out very easily by shaking the substance in the cold with a solution of hypobromous acid. The reagent is prepared as follows: 102 grms. of bromine and 300 grms. of mercuric oxide are added, in alternating portions of 30 grms. of mercuric oxide and 10 grms. of bromine, to 1 litre of water with constant shaking. When all has been added, the mixture is shaken for 10 minutes and filtered. The solution contains about 6·2 per cent. of bromine as hypobromous acid. When shaken with this solution in the cold, benzene gives an 83 per cent. yield of bromobenzene; toluene a 73 per cent. yield of a mixture of o- and *p*-bromotoluene, and benzoic acid an 89 per cent. yield of *m*-bromobenzoic acid. Aniline yields tribromoaniline; phenol gives tribromophenol, but by-reactions occur with amyl alcohol, pyridine and ethyl acetate, whilst phthalic acid and nitrobenzene cannot be brominated by this method. Instead of preparing the hypobromous acid specially, the substance to be brominated may be mixed with bromine and mercuric oxide, which are added alternately.—J. C. C.

Sandmeyer's reaction ; Quantitative results with ——. G. Heller. Z. angew. Chem., 1910, **23**, 389—392.

In chlorinating aniline, and *o*- and *p*-toluidine by Sandmeyer's method, almost quantitative results are said to be obtained if the reaction is carried out at a temperature of about 5° C. The yield of pure chlorobenzene is at least 90 per cent. of the theoretical quantity, that of *o*-chlorotoluene 90 per cent. (97 per cent. unpurified) and that of *p*-chlorotoluidine 95 per cent. of the calculated quantity. It is considered probable that a reduction of the quantity of copper chloride necessary might be effected, but this has not been worked out yet. A resumé of the literature of this reaction is also given.—A. Seld.

Wood preservation. See IX.

Patents.

Tar ; Dehydration and partial distillation of ——. Chem. Fabr. Lindenhof C. Weyl und Co., A.-G. Ger. Pat. 217,659, May 10, 1908.

The tar whilst passing through a system of tubes, and under diminished pressure, is heated by means of waste heat derived from any available source.—A. S.

5-Halogen-6-chloro-2-acidylamino-1-methylbenzene ; Process *for preparing ——.* Badische Anilin und Soda Fabrik. Ger. Pat. 217,896, March 7, 1909.

By the action of halogenating agents on the acidyl derivative of 6-chloro-2-aminotoluene, preferably in presence of a diluent or solvent, the halogen atom will enter the 5-position to the methyl group.—T. F. B.

Mononitroanthraquinone-quinolines ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 218,476, March 19, 1908.

One nitro group can easily be introduced into the three known anthraquinone-quinolines (1.2, 2.1, or 2.3) by the usual nitrating methods. On the contrary, anthraquinone-1.5-diquinoline could not be nitrated, even with hot and concentrated nitric acid.—T. F. B.

Indolinones ; Process for preparing ——. C. F. Boehringer und Söhne. Ger. Pat. 218,727, June 27, 1908.

By heating the alkali-metal compounds of β-acidyl derivatives of phenylhydrazine or its homologues, ammonia is split off and indolinones are formed. The alkali-metal compounds are obtained by the action of alkali metals or alcoholates on the phenylhydrazides. Propyl-3-methyl indolinone is obtained in this way from β-propionylphenylhydrazide.—T. F. B.

Formaldehyde and phenols ; Process for preparing condensation products from ——. L. Sarason. Ger. Pat. 219,570, March 5, 1908.

The condensation of formaldehyde with phenols is effected in presence of sulphurous acid. The reaction proceeds more smoothly than when mineral acids are used as condensing agents, the products are lighter in colour, and easily soluble in caustic alkalis and the majority of liquid solvents.—T. F. B.

Phenylglycine-ortho-carboxylic acid compounds and intermediate products ; Manufacture of substituted ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 6991, March 23, 1909.

See Ger. Pat. 216,748 of 1908 ; this J., 1910, 80.—T. F. B.

Condensation product suitable for use in making colour lakes. Badische Anilin und Soda Fabrik. First Addition, dated July 30, 1909, to Fr. Pat. 396,917, Nov. 30, 1908. Under Int. Conv., June 3, 1909.

See Eng. Pat. 17,546 of 1909 ; this J., 1909, 1029.—T. F. B.

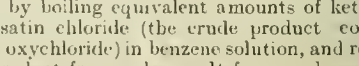
IV.—COLOURING MATTERS AND DYES.

Vat colours ; New ——. F. Buckley. J. Soc. Dyers and Col., 1910, **26**, 58—63.

The author deals with some vat colours, which with one exception are derivatives of indigo, and gives the proportions of caustic soda, sodium carbonate, soluble oil, and hydrosulphite to be used in the preparation of the stock vats, and the most suitable temperatures for reduction and dyeing. He describes in detail the method of dyeing and the precautions to be observed. In the discussion upon the communication it was mentioned that the high price of some of the dyestuffs is due to the large proportion of bromine which they contain (indigo MLB/6B being a pentabromoindigo) ; further, that the higher the bromine content of the dyestuff the weaker is the depth of shade it gives. Attention was drawn to the fact that pieces containing threads dyed with vat colours may be kier-boiled without risk of bleeding if an addition of anthraquinonesulphonic acid is made to the liquor.—F. M.

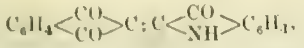
Indigoid dyestuffs. A. Felix and P. Friedländer. Monatsh. Chem., 1910, **31**, 55—79.

The authors have prepared the following indigoid dyestuffs :—2-Indane-2-indolindigo,



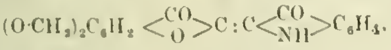
$$C_6H_4{<}{\begin{matrix}CO\\CH_2\end{matrix}}{>}C:C{<}{\begin{matrix}CO\\NH\end{matrix}}{>}C_6H_4.$$

is obtained by boiling equivalent amounts of ketohydrindene and isatin chloride (the crude product containing phosphorus oxychloride) in benzene solution, and recrystallising the product from xylene. It forms red needles and gives a yellow vat on treatment with alkaline hydrosulphi from which cotton is dyed in bluish red shades. 2-Indanone-2-indolindigo,



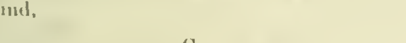
$$C_6H_4{<}\substack{CO\\CO}{>}C:C{<}\substack{CO\\NH}{>}C_6H_4,$$

prepared from α-isatinanilide and diketohydrindene, crystallises in brown violet bronzy needles and is decomposed by boiling with sodium hydroxide. Dimethoxycumarane-2-indolindigo,



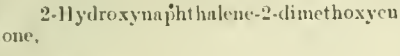
$$(O{\cdot}CH_3)_2C_6H_2{<}\substack{CO\\O}{>}C:C{<}\substack{CO\\NH}{>}C_6H_4,$$

prepared by condensing α-isatinanilide and dimethoxycumaranone, forms copper-red glistening needles and gives a yellow vat. Dimethoxycumaranone also condenses with aldehydes, forming oxygen analogues of the indogenides; thus with protocatechualdehyde it yields the compound,



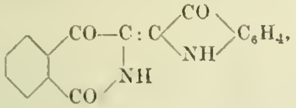
$$(O{\cdot}CH_3)_2C_6H_2{<}\substack{C\\O}{>}C:CH\cdot C_6H_3(OH)_2,$$

which dyes aluminium-mordanted cotton in orange red, and iron- or chromium-mordanted cotton in olive brown shades. 2-Hydroxynaphthalene-2-dimethoxycumarane-indolignone,

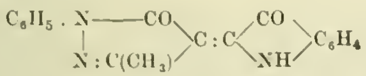


$$(O{\cdot}CH_3)_2C_6H_2{<}\substack{CO\\O}{>}C:C_{10}H_5(OH):O,$$

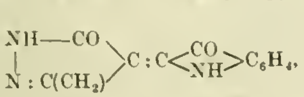
prepared from dimethoxycumaranone and β-naphthoquinone-4-sulphonic acid, crystallises in orange brown needles. 1-Oxy-3-isoquinoline-2-indolindigo,



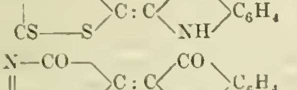
is prepared from α-isatinanilide or α-isatin chlorido and dioxyisoquinoline: it crystallises in dark blue needles and gives an orange red vat. 1:3-Phenylmethyl-4-pyrazole-2-indolindigo.



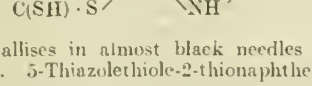
results from the condensation of phenylmethylpyrazolone and α-isatinanilide. It forms nearly black scales and gives a yellow vat on reduction. 3-Methyl-4-pyrazole-2-indolindigo,



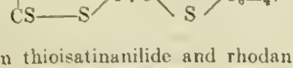
prepared from 3-methylpyrazolone and α-isatinanilide, forms dark violet, metallic needles and is easily decomposed by alkalis. The condensation of rhodanic acid and α-isatinanilide leads to the formation of 5-thiazole-2-indolindigo,



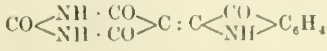
or



which crystallises in almost black needles and gives a yellow vat. 5-Thiazolethiole-2-thionaphthenindigo,



prepared from thioisatinanilide and rhodanic acid forms red brown, glistening needles and yields a yellow vat Barbituric acid and α-isatinanilide condense in acetic anhydride solution to form dioxypyrimidine-2-indolindigo,



$$CO{<}\substack{NH\cdot CO\\NH\cdot CO}{>}C:C{<}\substack{CO\\NH}{>}C_6H_4,$$

which forms small, carmine red, metallic needles.—J. C. C.

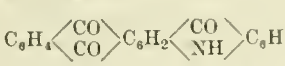
Tetrazo dyestuffs; A reaction by means of which a new series of —— may be obtained from p- and m-nitraniline. R. Lepetit. Sealed Note No. 730, April 13, 1893. Report by E. Noelting. Bull. Soc. Ind. Mulhouse, 1909, **79**, 481—483.

The author, in his attempt to prepare the dyestuff of the formula, $HO.C_6H_4.N{=}N.C_6H_3.OH.CO_2H$, from *p*-aminophenol and salicylic acid, did not get satisfactory results and started therefore from *p*-phenylenediamine. He diazotised and combined the diazo compound with salicylic acid and replaced the residual amino group by diazotising and boiling with dilute acid. The dyestuff possessed the expected property of dyeing well upon a mordant, but the intermediate amino-compound appeared to possess superior properties. This dyestuff ($NH_2.C_6H_4.N{=}N.C_6H_3.OH.CO_2H$) is named *p*-Flavalizarin and two distinct methads of preparation are given. The more interesting on fellows lines proposed in 1885 by Meldola, depending upon the reduction of nitro-groups by means of alkali sulphides. Diazotised *p*-nitraniline is combined with salicylic acid and the product is reduced by means of sodium sulphide. The *m*-nitraniline compound (Alizarin Yellow GG), treated with sodium sulphide yields a *m*-Flavalizarin, which however has little practical interest. The *p*-Flavalizarin upon diazotising and combining again with salicylic acid yields a tetrazo dyestuff, which dyes unmordanted cotton in yellow shades similar to those obtained with Chrysamine but rather more orange in tone. Corresponding compounds are obtained by combining with hydroxynaphthoic acid, naphthylaminesulphonic acids, etc., and these dye cotton direct, in the same manner as benzidine derivatives.

—F. M.

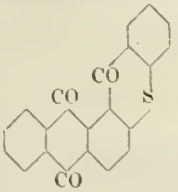
Anthraquinone series; Studies in the ——. F. Ullmann. Ber., 1910, **43**, 536—539.

In conjunction with his students the author has extended his researches on the action of copper powder on halogenated compounds of the benzene and naphthalene series to those of the anthraquinone series. *p*-Toluenesulphaminoanthraquinone, prepared from α-chloroanthraquinone and *p*-toluenesulphamide under the influence of copper powder, unlike benzoylaminoanthraquinone, has no dyeing properties. Toluenesulphanilinoanthraquinone however, prepared in a similar manner, when reduced in the vat, loses the toluenesulphonic acid group and gives shades identical with those produced by 1-anilinoanthraquinone. Stronger dyestuffs are obtained when other nuclei are introduced into the anthraquinone molecule, thus anthraquinone-1 : 2-acridone,



$$C_6H_4{<}\substack{CO\\CO}{>}C_6H_2{<}\substack{CO\\NH}{>}C_6H_4,$$

prepared by condensing 2-bromoanthraquinone with anthranilic acid in presence of copper powder and amyl alcohol, and treating the chloride of the resulting anthraquinone-2-anilinocarboxylic acid with aluminium chloride, gives a blood red vat from which cotton is dyed in the same shade. On exposure the colour changes to blue and then to orange yellow. The isomeric anthraquinone-2 : 1-acridone gives a blue vat dyeing cotton in the same shades, which on exposure turn to red violet. 4-Chloroanthraquinone-2 : 1-acridone dyes cotton in violet shades: it can be condensed with α-aminoanthraquinone to α-anthraquinonylamino-4 - anthraquinone - 2 : 1-acridone, which forms black violet needles. When 1 : 5-dichloroanthraquinone is condensed with anthranilic acid and the product treated with anthranilic acid, both chlorine atoms are displaced and a blue violet anthraquinonediacridone is obtained. By the condensation of β-chloroanthraquinone and thiosalicylic acid, anthraquinonyl-2-thiosalicylic acid is formed, which on treatment with sulphuric acid yields anthraquinone-1 : 2-thioxanthone.



This compound gives a green vat dyeing cotton in blue green shades which on exposure become yellow.—J. C. C.

4 : 4′-Dimethylpyranthrone ; A new synthesis of ——. R. Scholl, K. Liese, K. Michelson, and E. Grunewald. Ber., 1910, **43**, 512—518.

The new synthesis of 4 : 4′-dimethylpyranthrone, which does not give such a good yield as that previously described (this J., 1910, 266) owing to the production of by-products, has been effected as follows: *as*-Di-*m*-xylyl (prepared from *as*-iodo-*m*-xylene and copper powder) is mixed with phthalic anhydride in carbon bisulphide solution and treated with aluminium chloride. At least three acids are produced, of which 2 : 4 : 2′ : 4′-tetramethyl-1 : 1′-diphenyl-5 : 5′-diphthaloylic acid.

$CO_2H.C_6H_4.CO.C_6H_2(CH_3)_2.C_6H_2(CH_3)_2.CO.C_6H_4.CO_2H$

m. pt. 242° C. alone can be converted into 2 : 4 : 2′ : 4′-tetramethyl-1 : 1′-dianthraquinonyl (*loc. cit.*) by treatment with sulphuric acid. Under the conditions previously described, this compound is readily converted into 4 : 4′-dimethylpyranthrose.—J. C. C.

Dyestuffs ; Diffusion of certain synthetic ——. L. Vignon Comptes rend., 1910, **150**, 619—622.

Ten c.c. of a 0·1 per cent. solution of various dyestuffs were placed in a Schleicher and Schüll diffusion tube which was surrounded by 250 c.c. of water, the height of which was the same as that of the dyestuff solution. After 24 hours at the ordinary temperature, the amount of dyestuff which had diffused into the water was estimated colorimetrically. It was found that the chemical constitution of the dyestuff has no influence on its diffusion, but that the less the number of carbon atoms contained therein, the greater is the amount of diffusion. There is a sharp distinction between those dyestuffs containing 3 (or less) benzene rings and those containing 6, for the latter, which were all substantive dyestuffs for cotton, did not diffuse at all. The conclusion is that these form a colloidal solution, whilst the others (picric acid, Magenta, Eosine, Safranine, etc.) form true solutions.—J. C. C.

Dyestuff ; A natural substantive ——. A. G. Perkin. Chem. Soc. Trans. 1910, **97**, 220—223.

The "red dura" of the Soudan which is obtained from the *Andropogonsorghum*, var. *vulgaris*, is a substantive dyestuff for wool and has the formula, $C_{16}H_{12}O_5$. When fused with caustic potash it yields phloroglucinol and *p*-hydroxybenzoic acid. From its similarity to santalin the author names it dura-santalin.—J. C. C.

Patents.

Sulphide dyestuffs ; Manufacture of brown ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 2627, Feb. 2, 1910.

The diphenylmethane derivatives which are produced by condensing *o*- or *p*-nitrophenol with formaldehyde yield, when heated with sulphur and alkali sulphide, with or without the addition of copper salts at temperatures above 100° C., dyestuffs which give shades on unmordanted cotton varying from blackish grey to olive green.—J. C. C.

Dyestuffs of the gallocyanine series ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,207, May 24, 1909.

In the ordinary process for preparing Gallocyanines it is found that better results are obtained if, instead of the hydrochlorides of the nitroso-compounds, salts of the nitroso-compounds are employed which are derived from such acids as form with the nitroso-compounds or with the dyestuffs prepared therefrom or, with both, salts sparingly soluble in water and organic solvents such as alcohol, etc. Example : A solution of 10 parts of gallic acid in 200 parts of methyl alcohol is boiled, and 20 parts of the neutral salt of 1 : 5-naphthalenedisulphonic acid with nitrosodiethylaniline are added. The solution is heated until the nitroso-compound has disappeared. The dyestuff is then collected, washed and dried, and, if necessary, converted into the hydrochloride.—J. C. C.

Dyestuffs ; Yellow to brown ——. A. Blank and W. Rodionow, Leverkusen. Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 951,046, 951,047, 951,048, and 951,049, March 1, 1910.

Direct yellow is condensed with *p*-phenetidine, aminoazobenzenesulphonic acid, dehydrothiotoluidinesulphonic acid or *p*-sulphobenzene azo-1-naphthylamine. The resulting dyestuffs produce on unmordanted cotton, yellow, orange, and reddish-brown shades respectively.—J. C. C.

Anthracene dyestuffs ; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated July 13, 1909, to Fr. Pat. 400,653, March 10, 1909 (this J., 1909, 1029 ; 1910, 81).

Vat dyestuffs are produced by treating aminodianthraquinonyls with agents capable of introducing the benzoyl or substituted benzoyl group into the amino-group. The dyestuff obtained from benzoyl chloride and *pp*-diaminoanthraquinonyl dyes cotton in fast yellow shades, whilst if the diamino-compound is first treated with copper and sulphuric acid and then with benzoyl chloride, the resulting dyestuff produces orange red shades on cotton.—J. C. C.

Dyestuffs of the diphenylnaphthylmethane series ; Chrome ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated July 13, 1909, to Fr. Pat. 404,800, July 6, 1909. Under Int. Conv., Nov. 28, Dec. 8, 1908 ; Mar. 1, March 8, 1909. (See this J., 1910, 207.)

Part of this Addition is covered by Ger. Pat. 216,924, Addition to Ger. Pat. 216,305 (this J., 1910, 207). Hydroxybenzaldehydes can also be condensed with hydroxycarboxylic acids, and phenols may be used alternatively with the latter. The shades produced vary from violet to brown. In place of hydroxyaldehydes aminobenzaldehydes can be condensed and the product diazotised and heated with water.—J. C. C.

Diphenylnaphthylmethane dyestuffs ; Process for preparing acid chrome ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 216,686, Nov. 18, 1908. Addition to Ger. Pat. 216,305, Oct. 22, 1908. (See this J., 1909, 1309.)

Instead of using 2-hydroxy-1-naphthaldehyde-disulphonic acid, other *o*- or *p*-hydroxynaphthaldehydesulphonic, -carboxylic, or -sulphocarboxylic acids may be condensed with salicylic acid or *o*-cresotinic acid to form leuco compounds, which are oxidised to acid, chrome diphenylnaphthylmethane dyestuffs.—T. F. B.

Monoazo dyestuffs ; Manufacture of a black ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning. Eng. Pat. 15,089, June 28, 1909.

The dyestuff obtained by combining diazotised 4-chloro-2-aminophenol with 1:8:5-aminonaphtholsulphonic acid in alkaline (sodium hydroxide or calcium hydroxide) solution produces, on mordanted wool, a violet-bluish

black tint which is very fast to light, hot-pressing, milling, and to potting and acid boiling. The dyestuff exhausts completely from the bath and dyes perfectly evenly.
—J. C. C.

[*Azo*] *dyestuffs which can be developed ; Process for preparing* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 217,628, Nov. 7, 1908. Addition to Ger. Pat. 208,968, March 29, 1908. (See this J., 1909,517.)

The sulphonic acids of mononitrobenzoyl derivatives of aromatic diamines are diazotised and combined with *p*-nitrobenzoyl-2.5.7-aminonaphtholsulphonic acid. The resulting dyestuffs produce bluish-red shades on unmordanted cotton; the shades after development with *B*-naphthol are red.—T. F. B.

Penta-and hexa-halogenised indigos. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on Maine, Germany. Eng. Pat. 28,171, Feb. 8, 1909.

Penta-and hexa-halogenated Indigos are prepared by brominating chlorinated Indigos (obtained by chlorination) with an excess of bromine alone, or with bromine in presence of concentrated sulphuric acid, fuming sulphuric acid or chlorosulphonic acid. The penta-halogenated compounds, for example, monochlorotetrabromoindigo, dichlorotribromoindigo or the like, dye in greenish blue shades and the hexa-halogenated derivatives, for example, monochloropentabromoindigo, dichlorotetrabromoindigo or the like, give even greener tints.—J. C. C.

Disazo-dyestuffs ; Manufacture of substantive ——. A. G. Bloxam, London. From Akt. Ges. für Anilinfabr., Berlin. Eng. Pat. 15,403, July 1, 1909.

Blue substantive dyestuffs are prepared by diazotising 4-nitro-1-naphthylamine-6- (or 7-) monosulphonic acid or a mixture of these acids and combining the diazo-compound with a middle component such as *m*-amino-*p*-cresol methyl ether, o-amino-*p*-chlorophenol methyl ether, aminoquinol dialkyl ether, *p*-xylidine, etc.; the aminoazo-compound is then diazotised and combined with a naphtholsulphonic acid and the nitro-group is finally reduced with sodium sulphide. An example illustrates the manufacture of a dyestuff from 4-nitro-1-naphthylamine-6-sulphonic acid which is diazotised and combined with *m*-amino-*p*-cresol methyl ether, the final component, after diazotising this intermediate compound, being 2-naphthol-7-sulphonic acid. After reduction the resulting dyestuff gives blue shades on cotton, which on diazotising and developing with β-naphthol on the fibre, become deep blue and very fast to washing.—J. C. C.

Gallocyanine derivatives ; Manufacture of ——. A. G. Bloxam, London. From Dye Works, formerly L. Durand, Huguenin and Co., Basle, Switzerland. Eng. Pat. 25,752, Nov. 8, 1909.

In Eng. Pat. 19,001 of 1907 (this J., 1907, 1273) is described the transformation of the arylamino-gallocyanines by treatment with acids and reducing agents, into leuco-derivatives of decomposition products in which the arylamino-group is exchanged for the hydroxyl-group. It is now observed that this result is produced by two independent reactions and it is possible to obtain unreduced hydroxygallocyanines by heating the arylamino-gallocyanines with acids, care being taken to prevent the temperature of the reaction mixture from becoming too high and to interrupt the heating as soon as the elimination is complete. Means are given for determining the necessary conditions. Example: 84 grms. of the anilide of Cœlestine Blue are introduced into 500 c.c. of sulphuric acid of 37 per cent. strength and the mixture is heated whilst stirring. At 75° C. the reaction begins and the heating is continued for two hours at 75°–80° C. The mass is then diluted with 270 c.c. of water and filtered whilst still hot. The hydroxy derivative of Cœlestine Blue thus obtained is washed, pressed and dried.—P. F. C.

Anthraquinone derivatives ; Manufacture of new ——. F. Ullmann, Berlin, Germany. Eng. Pat. 30,480, Dec. 30, 1909. Under Int. Conv., Mar. 15, 1909.

When anthraquinonylthiosalicylic acids (prepared by condensing α- or β-chloroanthraquinone with thiosalicylic acid) are treated with dehydrating agents such as concentrated sulphuric acid, or converted into the acid chloride and the latter acted on with aluminium chloride, anthraquinonylthioxanthones are formed which are vat dyestuffs. The dyestuff from α-anthraquinonylthiosalicylic acid dyes cotton in orange red shades, that from 4-methyl-anthraquinonyl-1-thiosalicylic acid gives a similar dyestuff, and from β-anthraquinonylthiosalicylic acid a dyestuff is obtained which gives a green vat dyeing cotton in yellow shades.—J. C. C.

Indigo dyestuffs ; Preparation of leuco-derivatives of——. Badische Anilin und Soda Fabrik. First Addition, dated July 23, 1909, to Fr. Pat. 396,794, Nov. 26, 1908. Under Int. Conv., June 11, 1909.

The mixture such as is described in the chief patent (this J., 1909, 596) is improved by the addition of a small amount of an alkali such as potassium or sodium hydroxide.—J. C. C.

Vat dyestuffs of the anthracene series ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 215,182, Dec. 10, 1908.

Anthracene dyestuffs which dye fast yellow to brownish-orange shades from the vat are obtained by condensing one molecule of a diamine of the benzene or naphthalene series or their derivatives with 2 mols. of a halogenide of anthraquinone-2-carboxylic acid or a derivative, preferably in presence of a solvent or diluent, and a substance which will combine with a mineral acid.—T. F. B.

Vat dyestuffs ; Process for preparing red ——. Badische Anilin und Soda Fabrik. Ger. Pat. 217,395, May 14, 1907.

By condensing 4-amino-2-methylanthrapyridone with 2-halogen or 2·6- or 2·7-dihalogen-anthraquinones, red dyestuffs are obtained which are insoluble in water and dilute alkalis and acids, and easily soluble in most organic solvents. They form brownish-red vats with alkali hydrosulphite solutions, by means of which cotton is dyed fast red shades.—T. F. B.

Vat [*anthracene*] *dyestuffs ; Process for preparing red* ——. Badische Anilin und Soda Fabrik. Ger. Pat. 218,161, Jan. 19, 1908. Addition to Ger. Pat. 217,395, May 14, 1907.

4 - Halogen - 2 - methyl - 1- acetaminoanthraquinones are condensed with 2-amino- or 2·6- or 2·7-diamino-anthraquinones (*e.g.*, in presence of sodium acetate and phenol), by heating under pressure to 230°–260° C. The dyestuffs are identical with those obtained by the condensation of 4-halogen-2-methylanthrapyridones with the above mentioned aminoanthraquinones (as in the principal patent preceding).—T. F. B.

Indigo, its homologues and substitution products ; New derivatives of ——, *and their application in dyeing, printing, and photography.* L. Kalb. Fr. Pat. 405,538, July 28, 1909. Under Int. Conv., Aug. 3 and Dec. 28, 1908, April 30 and May 1, 1909.

See Ger. Pats. 216,889 and 217,477 of 1908; this J., 1910, 207 and 343. Halogen derivatives of dehydroindigo-bisulphites are obtained by treating dehydroindigo-bisulphite or its derivatives with halogenating agents. Dehydroindigo-bisulphites may be made up into vats by means of hydrosulphites or other reducing agents, or pastes or solutions prepared by their aid may be applied in the usual manner to textile materials or paper, with subsequent development by acids, steaming, etc. The bisulphite derivatives of dehydroindigos may be utilised in photography: paper or fabric impregnated with the substances is exposed to light under suitable patterns or negatives, the indigo dyestuff being regenerated by the action of the light, especially in presence of moisture. —T. F. B.

Sulphide dyestuff; Preparation of a blue ——. Soc. Anon. des Mat. Col. et Prod. Chim. de St. Denis. Fr. Pat. 406,225, Dec. 2, 1908.

The indophenol obtained by the simultaneous oxidation of 1 kilo. of *p*-phenylenediamine and 900 grms. of phenol is mixed (in the form of a 33 per cent. paste) with 100—200 grms. of manganese sulphate or 60—100 grms. of manganese dioxide, or the equivalent of another compound of manganese. The mixture is now boiled for 20 hours with 1200 grms. of 61 per cent. sodium sulphide, 1200 grms. of sulphur, and 2400 grms. of water. The product is diluted with water, filtered, and the insoluble powder washed with dilute sulphuric acid, and with water, and dried with sodium carbonate. The dyestuff produces indigo-blue shades on unmordanted cotton.—J. C. C.

Vat dyestuffs containing sulphur; Process for preparing ——. Kalle und Co. Ger. Pat. 215,785, June 10, 1908. Addition to Ger. Pat. 182,260, Nov. 14, 1905.

Yellow to brown and Bordeaux-red vat dyestuffs are obtained by condensing alkyloxyisatins (substituted in the benzene nucleus) with 3-oxy-(1)-thionaphthenes or their alkyloxy derivatives (also substituted in the benzene nucleus). The condensation may be made in presence of sodium carbonate, acetic acid, etc.—T. F. B.

Indigo series; Process for preparing leuco-compounds of the ——. E. Merck and W. Flimm. Ger. Pat. 217,945, April 9, 1908.

The condensation products of dextrose with aromatic *o*-aminocarboxylic acids, esters, salts, amides, etc., are converted, by fusion with alkali hydroxide (preferably in presence of sodium amide, an alkali metal, or other substance which facilitates condensation) into leuco compounds, which are converted into indigo dyestuffs by oxidation. For example, one part of the condensation product of dextrose and anthranilic acid is fused with 5 parts of potassium hydroxide, in an atmosphere of ammonia, until the mixture is dark orange-red in colour: the temperature may be raised to about 250° C. The product is dissolved in water, and the indigo precipitated by means of air or other oxidising agent.—T. F. B.

Dyestuffs of the gallocyanine series; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4963, March 1, 1909. Addition to Eng. Pat. 20,368, Sept. 28, 1908.

See Addition of Feb. 23, 1909, to Fr. Pat. 396,564 of 1908; this J., 1909, 1029.—T. F. B.

Gallocyanine series; Process for producing dyestuffs of the ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 405,537, July 28, 1909. Under Int. Conv., Jan. 30, 1909.

See Eng. Pat. 12,207 of 1909; preceding.—T. F. B.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7821, April 1, 1909.

See U.S. Pats. 935,829 and 935,830 of 1909; this J., 1909, 1120.—T. F. B.

Azo dyes. F. Runkel and M. Herzberg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 950,404 and 950,405, Feb. 22, 1910.

See Addition of May 22, 1909, to Fr. Pat. 402,546 of 1909; this J., 1910, 81.—T. F. B.

[Azo] dyestuffs; Black —— and process for producing them. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 405,928, Aug. 11, 1909. Under Int. Conv., Oct. 5, 1908.

See Eng. Pat. 1397 of 1909; this J., 1909, 1309.—T. F. B.

Basic dyes; Yellow to red ——. W. König, Dresden Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 949,906, Feb. 22, 1910.

See Addition of Nov. 23, 1908, to Fr. Pat. 395,793 of 1908; this J., 1909, 595.—T. F. B.

Vat dyes of the anthracene series. H. Raeder, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 950,343 and 950,344, Feb. 22, 1910.

See Fr. Pat. 403,259 of 1909; this J., 1909, 1309.—T. F. B.

Anthracene colouring matters; Manufacture and employment of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pats. 9888, April 26, 1909, and 13,323, June 7, 1909.

See Addition of May 28, 1909, to Fr. Pat. 365,920 of 1908; this J., 1910, 267.—T. F. B.

Tetrazo dyestuffs; Production of substantive ——. Société pour l'Industrie Chimique à Bâle. Third Addition, dated Nov. 21, 1908, to Fr. Pat. 337,449, Dec. 5, 1903.

See U.S. Pat. 936,367 of 1909; this J., 1909, 1120.—T. F. B.

Dyestuffs of the anthracene series; Production of vat ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 405,920, Nov. 25, 1908.

See Ger. Pat. 208,969 of 1908; this J., 1909, 650.—T. F. B.

Disazo dyestuffs giving orange shades on cotton; Process for making substantive ——. Fabrique de Prod. Chimiques ci-dev. Sandoz. Fr. Pat. 405,987, July 13, 1909.

See Eng. Pat. 20,649 of 1909; this J., 1910, 15.—T. B. B.

Monoazo dyestuffs especially suitable for making lakes; Manufacture of ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 406,311, Aug. 11, 1909.

See Ger. Pat. 217,277 of 1908; this J., 1910, 268.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Silks; Composition and constitution of various ——. *VIII. Monoamino acids from "Tai-Tsao-Tsam" silk (China).* E. Abderhalden and J. Schmid. *IX. Monoamino acids from "Cheefoo" silk.* E. Abderhalden and E. Welde. Z. physiol. Chem., 1910, **64**, 460—461. 462—463. (See also this J., 1909, 240, 323, 518, 978. 1083.)

Cocoons of "Tai-tsao-tsam" silk yielded 15 per cent. of gum. The degummed cocoons lost 4·6 per cent. of moisture on drying at 110° C. and gave a residue of 0·43 per cent. of ash. On total hydrolysis with 25 per cent. sulphuric acid, the degummed material left no appreciable residue, and yielded the following percentages of amino-acids, calculated on the dry, ash-free substance: glycocoll, 25·2; alanine, 18·2; leucine, 0·9; serine, 1·2; aspartic acid, 2·1; glutamic acid, 2·0; phenylalanine, 1·0; tyrosine, 7·8; proline, 1·0. The results correspond closely with those obtained with "Niêt-ngô-tsam" silk (this J., 1909, 1083). "Cheefoo" silk required a thorough mechanical purification; it then yielded 15 per cent. of gum. The degummed silk lost 6·0 per cent. of moisture on drying at 120° C. and left 1·5 per cent. of ash. On hydrolysis a residue of melanine products was obtained amounting to 18 per cent., which resisted all attempts at further resolution by acids. The percentages of amino-acids recovered were: glycocoll, 12·5; alanine, 18·0; leucine, 1·2; serine, 1·0; aspartic acid, 2·0; glutamic acid, 2·0; phenylalanine, 1·0; tyrosine, 8·5; proline, 2·5. —J. F. B.

Proteins; Study of the partial hydrolysis of ——. E. Abderhalden and C. Funk. Z. physiol. Chem., 1910, **64**, 436—446.

In a previous paper (this J., 1907, 1165) it was shown that the free amino-group of the terminal amino-acid member of a polypeptide chain may be combined with β-naphthalenesulphochloride, and that the compound so obtained survives the hydrolysis of the chain and appears in the products as the naphthalenesulphonic acid derivative of the amino-acid which occupied the terminal position. It is now shown that the phenolic hydroxyl group of tyrosine also forms a stable compound with β-naphthalenesulphochloride, and that if a tyrosine group be present in the chain, it will form either a mono- or a di-naphthalenesulphonic derivative, according to its position. Thus it is possible to determine whether tyrosine or another amino-acid occupied the position at the end of the polypeptide chain. In the analysis of the products of total hydrolysis of a polypeptide which has been combined with naphthalenesulphonic acid, the amino-acids are converted into their esters by treatment with alcohol and gaseous hydrogen chloride. The amino-acid, the amino group of which is combined with the naphthalenesulphonic acid and which is thus identified as the terminal member of the chain, occurs in the form of the free ester, which may be separated by shaking out with ether from the aqueous solution of the other esters which occur as hydrochlorides, including that of the mono-naphthalenesulphonic derivative of tyrosine. The latter body is described in the paper; it is readily isolated from the other ester-hydrochlorides owing to its sparing solubility in cold water; it does not react with Millon's reagent. The authors have applied their process in the investigation of the peptone derived from silk. This peptone was combined with β-naphthalenesulphochloride and then subjected to total hydrolysis by hydrochloric acid. From the products were isolated: the mononaphthalenesulphonic derivative of tyrosine (hydroxyl group combined), the naphthalenesulphonic derivative of alanine, free glycocoll and alanine. The terminal member of the silk-peptone chain is therefore an alanine group.

—J. F. B.

Cellulose; Acetylation of cotton ——. C. G. S. Schwalbe. Z. angew. Chem., 1910, **23**, 435—441.

The production of soluble acetyl derivatives of cellulose by the action of acetic anhydride and glacial acetic acid on cellulose, always requires the presence of a so-called catalytic agent. The catalytic agents specified in a very large number of patents may be classed under three heads, viz.: free mineral acids, weaker acids and acid salts, and neutral salts which are readily dissociated. The author discusses the mechanism of these reactions and points out that the production of the cellulose acetate is invariably accompanied by a more or less profound modification of the cellulose, with the production of hydrocellulose, as evidenced by the cupric-reducing properties of the cellulose residue after saponification of the ester. Of the mineral acid group of catalytic agents, sulphuric acid is by far the most important, and its application is sufficiently illustrated by the patents of Lederer and of Bayer and Co. (this J., 1902, 870 and 1550). The principal representatives of the second group are the phenolsulphonic acid of Mork's patent (this J., 1902, 1345) and the halogenated fatty acids of Knoll und Co. The author attributes the catalytic effect of these bodies to the presence of limited quantities of free mineral acid, either as an impurity in the original substance or as the product of its dissociation in the presence of cellulose at the temperature of the reaction. Representatives of the third group are found chiefly in Knoll und Co.'s patents (this J., 1907, 776) and include such bodies as ferrous sulphate, ferric chloride, diethylamine sulphate, ammonium sulphate, etc. Here again it is pointed out that these so-called neutral salts contain weak bases and that free mineral acids are produced from them by dissociation, which is peculiarly favoured by the presence of the cellulose and the high temperature necessary for the reaction. The author describes the method adopted for the saponification of the cellulose acetates examined. The material (3—5 grms.) was triturated with 50 c.c. of a 25 per cent. solution of potassium hydroxide and the mixture allowed to stand in a closed flask for 48 hours. The solution was diluted and neutralised with sulphuric acid. After standing for some hours the precipitated cellulose was filtered off and washed, whilst the acetic acid in the solution was distilled in a current of steam. The cupric-reducing power of the hydrocellulose residue was then determined by the author's method (this J., 1907, 548), due corrections being made for the "copper value" of the original cotton and the cupric hydroxide precipitated by dissociation. In this way it was found that the products obtained by the Lederer and Bayer processes showed high and identical "copper values," the products obtained by Mork's process gave intermediate numbers, whilst those prepared by Knoll's process showed the lowest "copper values."

—J. F. B.

Pulp wood and straw; Deterioration of —— *by infection.* B. Haas. Papierfabrikant, 1910, **8**, 74—78, 150—152, 177—178, 197—201.

Cut pulp wood and straw are particularly liable to deterioration during storage under the attacks of various mycelial fungi and even of bacteria. The deterioration may manifest itself in the production of coloured products and undesirable odours or else in the rotting and chemical disintegration of the fibre. The author describes a number of the principal organisms concerned in the various types of disease, and in conclusion lays down certain rules which should govern the stacking of the raw materials, whether logs or straw. At first, it must be recognised that deterioration may have proceeded already, to a greater or less extent, by the time the material is delivered at the mill, and only the soundest consignments should be selected for storing at all at the latter place. The stacks should never be built directly on soil or grass land, but the ground should be cleared and covered with a suitable layer of broken stone or gravel. Whenever possible a free space should be left between the bottom of the stack and the ground, the logs being supported by tarred stumps or stone or concrete pillars. The whole of the gravel bed, and especially the part underneath the stack should be sprinkled from time to time with a suitable antiseptic such as "carbolineum," copper sulphate, "antinonnin," etc. The upright supports, cross beams or preferably reinforced concrete-work should likewise be treated; for the latter material only "antinonnin" is suitable. The broadside of each stack should be turned away from the weather quarter, since this is the best position for ensuring dryness and ventilation. The refuse which drops from the stacks should be removed and destroyed as quickly as possible. A space of half a yard around the stack should be frequently sprinkled with antiseptic, and the same applies to the ground around the mill buildings and half-stuff stores. Coal heaps are a fertile source of infection, the mycelia of the fungi creeping along the ground from the coal to the wood stacks; the ground around coal heaps should receive particular antiseptic treatment. Wood grown on the plains and river-floated logs should not be stacked for long periods; the same applies to young wood. Wood which has suffered from the attacks of vermin or borers or is otherwise damaged should be stacked by itself and taken quickly into work. The refuse from such wood is particularly dangerous. Cereal straws are always heavily infected, and their storage and ventilation require even more careful attention than in the case of wood. Frequently, for commercial reasons, straw has to be stacked for very long periods, and it is highly susceptible to the action of heat and moisture. Ventilating pipes should be inserted in the stacks at intervals, particularly near the bottom, arranged at right angles to the broadside. In the case of stacks which have to remain for a very long time, the straw, especially the lower layers, should be sprayed with paraffin or sulphurous acid, during stacking. This spraying may be repeated at intervals by means of pipes inserted deep into the stacks. Half-stuffs should be protected from the action of moist heat, and the stores should be situated as far away as possible from the stacks of raw material.—J. F. B.

Sulphate [soda] wood pulp mills ; Abatement of nuisance from ——. P. Klason. Svensk Pappers-Tidning ; through Papierfabrikant, 1910, **8**, 183—185, 211—212.

THE author reports on the nuisance existing at a certain sulphate pulp mill, manufacturing "Kraft" papers, and concludes his report with some general suggestions. In all cases the ultimate outlet for the gases blown off from the pulp digesters should be the main chimney of the mill. In the pipe conducting the gases to the chimney, a condenser should be erected near the digesters, which will condense the steam and oil of turpentine. The oil should be collected, and the water should be used exclusively for dissolving the soda ash in the preparation of fresh lye. The noxious gases passing through the condenser should be conducted through two or three absorption vessels charged with caustic liquor and provided with cooling arrangements. The gas issuing from these absorption vessels should no longer show the yellow mercaptan reaction with lead acetate paper. The lye saturated with mercaptan in the absorption vessels should be discharged directly into the rotary soda furnace, after the separation of any oil of turpentine which may have collected on the surface. The crude turpentine oil should not be used for industrial purposes until it has been refined ; on no account should it be discharged into the river. The vapours arising from the black lye, when the digester is emptied, should also be condensed in the manner described. The digestion lyes should be as concentrated as possible, for which reason the wood should be as dry as possible. Combustion in the rotary furnace should be as complete as possible. The so-called "fanners" in the concentration pans should revolve at as high a speed as possible, in order to prevent destructive distillation of the lyes. The mill chimney should have a height of about 50 metres. The proportion of sodium sulphate used should not exceed that which is sufficient for rational practice, and it should be fed continuously into the rotary furnace. The waste lime-mud derived from the causticising process should never be discharged into the river. The quantity of suspended matter in the effluents should not exceed 60 mgrms. per litre. If oil has been used in washing engines, means should be provided to effect its separation from the effluents before discharge ; such oil should not be petroleum.
—J. F. B.

Rosin size ; Dissolving ——. Von Possanner. Papierfabrikant, 1910, **8**, 221—223.

A ROSIN soap, prepared by boiling 100 parts of rosin with 9 parts of soda ash, will contain about 40 per cent. of its rosin in the free state. Such a soap may be dissolved in water to a permanent emulsion by stirring by hand or mechanically, but the results are at the best uncertain. It is preferable, therefore, in the absence of a steam emulsifier, to employ 10 per cent. of soda ash as a minimum. An emulsion containing free rosin must not be heated to the boiling point ; coagulation will thereby be produced the more readily the lower the proportion of alkali. In preparing an emulsion from a soap containing free rosin, the temperature of the soap must always be sufficient to ensure its complete liquefaction, and the condition of the emulsion depends on the conditions under which it is first prepared ; subsequent dilution has no effect upon it. The colour of the original rosin has no influence on the colour of the emulsion, although it may affect the colour of the sized paper. The colour of an emulsion depends on the size of the particles of free rosin, and may vary with the same soap. White emulsions are obtained by dissolving a soap containing free rosin in water by mere stirring ; a white, opaque emulsion indicates coarse particles, *e.g.*, 0·01 mm. in diameter, or over ; these particles possess no power of independent motion. On the other hand, by a suitable adjustment of the steam emulsifier it is possible to prepare an emulsion, from the same soap, which appears brown and nearly transparent by transmitted light and strongly opalescent by reflected light. The particles of such an emulsion have a diameter of 0·002 mm., or less, and are endowed with a rapid oscillatory motion. With the steam emulsifier the colour and condition of the emulsion may be varied at will. Soaps prepared with 7—9 per cent. of soda ash are common in practice, and it is possible to go as low as 6.5 per cent. if the conditions are favourable. Local conditions, particularly the hardoess of the water, have to be allowed for in each case, and the composition of the soap must be accurately known in order that emulsification may be properly conducted. The temperature at which the emulsion is prepared must not be less than 70° C. nor more than 90° C. ; the temperature of the soap must be at least sufficient to melt it. The concentration of the emulsion should be, at most, double that of the stock solution of size, *i.e.*, 30—40 grms. per litre ; the stock solution is prepared by blowing the hot emulsion into an equal quantity of cold water, whereby its temperature is reduced to a degree suitable for immediate use. It must be noted that the composition of the water is of primary importance, since an exceptionally hard water may entirely destroy a perfectly prepared emulsion.
—J. F. B.

Absorption of sulphur dioxide by rubber and wool. Reychler. *See* VII.

PATENTS.

[*Artificial threads, etc.*] *Albuminoids ; Process of dissolving* ——, *and its industrial applications.* H. L. J. Chavassieu. First Addition, dated Nov. 28, 1908, to Fr. Pat. 395,402, Dec. 27, 1907.

THE products obtained by the process described in the principal patent (this J., 1909, 442) are rendered more supple and elastic by treating them with solutions of quinone or quinol (hydroquinone) (2—5 per cent.) or with a 10 per cent. solution of tannin, and then washing and drying them. If it is desired to render the products more resistant to water, they are either immersed in a dilute solution of potassium bichromate or treated with a condensing agent such as formaldehyde in the presence of a dehydrating agent.—P. F. C.

Yorns, textiles, and the like ; Process for the preparation of ——. F. Baum. Ger. Pat. 218,220, Nov. 10, 1907.

FRESH muscle-flesh is freed from fat and skin, and treated by known methods for the separation of the fibres, for example by treatment with chemicals or by beating. The fibres are then strengthened by treatment with a tanning material, or with a solution of formaldehyde. It is stated that fibres prepared in this way are especially suitable for the manufacture of tissues for covering balloons and motor-car tyres.—A. S.

Beetroots and other roots ; Preparation of cellulose from the pulpy residues of ——. G. Leclerc and P. Carré, Fr. Pat. 406,006, Nov. 28, 1908.

THE exhausted chips or pulps constituting the residue from the extraction of sugar from beetroots are treated in wooden vats with a solution of lime or other alkali and digested at a temperature of 80°—100° C. for about half an hour, until thoroughly softened and free from an acid reaction. The pulp is then thoroughly washed and reduced to a uniform mass by suitable machinery. It is then bleached, preferably by the addition of a hypochlorite in small portions at a time, or else by steeping with a solution of sulphurous acid for several hours. The cellulose thus obtained is sufficiently pure to serve as a raw material for the manufacture of nitrocellulose, or it may be employed in the manufacture of paper or cardboard.—J. F. B.

Pulp articles and processes for making the same M. D. Porter, Lewiston, U.S.A. Eng. Pat. 8184, April 5, 1909.

A SUITABLE quantity of a filling material such as ground talc is mixed with wood pulp, and water is added until the mass on stirring becomes of a uniform thick creamy consistence. Materials are then added which can react together and form an insoluble waterproof and binding substance, a mixture of sodium resinate, aluminium sulphate and casein being suitable for this purpose. The mixture thus obtained is moulded, and then subjected to heat to dehydrate it.—P. F. C.

Cellulose formate; Manufacture of ——. Nitritfabrik Akt.-Ges. Fr. Pat. 405,293, July 21, 1909.

Cellulose dissolves readily in concentrated formic acid in presence of sulphuric acid or zinc chloride, with the production of cellulose formates. According to the present invention the treatment with the mineral acid or zinc salt may be performed in a separate operation and the product subsequently dissolved in formic acid alone. For instance, cellulose is treated with sulphuric acid of 55° B. until it forms a thick viscous paste. The paste is poured into water and the precipitated cellulose is recovered, washed free from acid, and dried; the product is then dissolved in concentrated formic acid with the production of cellulose formates. According to another method, 50 parts of zinc chloride are dissolved in 40 parts of dilute formic acid, and cellulose is treated with this reagent until dissolved. The product is precipitated, purified, dried and dissolved in concentrated formic acid as described. Solutions of cellulose formate may also be produced in a single operation by treating cellulose with a solution of 30 parts of zinc chloride in 100 parts of concentrated formic acid until the cellulose is dissolved.—J. F. B.

Cellulose; Preparation of viscous solutions of ——. Rheinische Kunstseide Fabrik Akt.-Ges. Fr. Pat. 405,571, July 29, 1909. Under Int. Conv., July 31, 1908.

A solvent for cellulose is prepared by treating 1–3 parts of solid copper sulphate with 2–4 parts of a solution of sodium hydroxide at 21° B. and adding to the mixture 5–15 parts of aqueous ammonia at 25° B. The solution is then cooled to 0° C. and the crystals which form are separated. This liquid is sufficient for dissolving 1 part of cellulose at any convenient temperature. The solvent is particularly applicable to the cellulose derived from cottonseed hulls or a mixture of this with ordinary cellulose. If desired, substances may be added to the reagent to prevent the precipitation of cupric hydroxide. —J. F. B.

Cellulosic materials and fibrous industrial wastes [sugar cane megass]; Treatment and utilisation of ——. R. Lhuilier and L. Maurice. Fr. Pat. 405,684, Aug. 3, 1909.

The object of this invention is the conversion of fibrous wastes of any kind, particularly of sugar-cane megass, into pure bleached cellulose suitable for the manufacture of cellulose derivatives. The cellulosic material is preferably packed in iron baskets which can be immersed in boilers, lifted out and transferred to other boilers without unloading. The chemical treatments consist of a digestion, at the boiling temperature or otherwise, in a solution of an alkali carbonate, followed by a bleaching operation by means of an alkaline solution of an alkali hypochlorite. The digestion with sodium carbonate is best effected with a "battery" of three boilers in order to obtain a systematic exhaustion of the liquors.—J. F. B.

Celluloid substitute from albumino-mucilaginous mixtures; Preparation of a ——. H. Heydenhauss, A. Banhegyi, and K. Glaser. Fr. Pat. 406,139, Aug. 14, 1909.

A substitute for celluloid is prepared by mixing, hot, 25 parts of glue, previously swollen with water, with 10 parts of a saturated solution of carragheen moss, and adding to the mixture 10 parts of glacial acetic acid and 10 parts of alcohol. The paste so formed is hardened by immersion in a solution of formaldehyde.—J. F. B.

Cellulose readily soluble in solvents, and yielding easily soluble derivatives; Process for the preparation of —— *by heating.* O. Glum und Co. Ger. Pat. 217,316, Oct. 16, 1908.

The cellulose is immersed in a suitable liquid, such as glycerin or oil, and heated at a temperature above 100° C. —A. S.

Paper; Manufacture or treatment of ——. L. Green, Maidstone. Eng. Pat. 7206, Mar. 25, 1909.

Paper, either during the process of manufacture or in the finished state, is treated with a solution containing 5–10 per cent. of potassium ferrocyanide, 0·5–1 per cent. of potassium iodide, and 2–5 per cent. of sodium "hyposulphite" and then dried. Ink written on paper so treated will either resist the action of obliterating agents or its removal will be accompanied by the formation of a purple stain on the paper. Even if the potassium iodide be omitted, the treatment is still effective.—P. F. C.

Radiferous fibres and their manufacture. H. Farjas and A. Jaboin. Fr. Pat. 406,299, Dec. 4, 1908.

See Eng. Pat. 14,760 of 1909; this J., 1909, 1194.—T. F. B.

Artificial silk and similar fibres; Apparatus for making ——. Soc. Franç. de la Viscose. Fr. Pat. 406,344, Aug. 20, 1909. Under Int. Conv., Sept. 11, 1908.

See Eng. Pats. 19,157 and 19,158 of 1908; this J., 1909, 880.—T. F. B.

Celluloid; Substitute for ——. H. Heydenhauss, Vienna U.S. Pat. 950,392, Feb. 22, 1910.

See Fr. Pat. 406,139 of 1909; preceding.—T. F. B.

Proteo-cellulosic products; Process of obtaining ——. H. L. J. Chavassieu, Lyon, France. U.S. Pat. 950,435, Feb. 22, 1910.

See Fr. Pat. 395,402 of 1907; this J., 1909, 422.—T. F. B.

Barrel bodies from paper pulp; Process and apparatus for making ——. Solvay Process Co. First Addition, dated July 15, 1909, to Fr. Pat. 404,813, July 6, 1909.

See U.S. Pat. 928,249 of 1909; this J., 1909, 958.—T. F. B.

Lacquer-like products with a metallic lustre [from cellulose nitrate]. Ger. Pat. 217,852. *See* XIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Cotton bleaching; Removal of size in ——. E. Justin Mueller. Bull. Soc. Ind. Mulhouse, 1909, **79**. Procès verbaux du Comité de Chimie, 21.

As a result of a comparison of the material turned out from a number of bleach-works, the author concludes that the most important factor in the removal of the dressing is the duration of the lye-boil. Different methods of bleaching, properly carried out, yield almost equally good results. An acid steep in dilute sulphuric or hydrochloric acid does not appear to be very efficacious and the most efficient and rapid agent for the destruction of the starch is diastofor.—F. M.

Logwood black on piece goods; The dyeing of —— *in the continuous machine.* E. Blondel. Rev. Gen. Mat. Col., 1910, **14**, 65—66.

The method described by the author was first employed about 1882 and comprises the following operations. The pieces are prepared by boiling out in a continuous machine containing sulphuric acid, (2 litres of sulphuric acid of 52° B. per 1000 litres of water), and are then rinsed, squeezed and dried by exposure to the air. They are then passed through a hot solution of logwood extract (5° B.), contained in a continuous machine upon which are mounted two pairs of squeezing rollers. The logwood solution is made slightly alkaline with ammonia, and upon leaving the machine, the pieces are rolled upon bobbins and left to stand for 12—18 hours. At the expiration of this period they are passed through a bath containing 2½ litres of "nitrate of iron" (55° B.) per 40 litres of water, then through lime water, and finally rinsed and dried. With a daily production of some 10,000 metres, the cost of dyeing is about 2·62 francs per piece of 85 metres. The author expresses the opinion that a logwood black dyed in this manner possesses many advantages over dyeings obtained with substantive or sulphide dyestuffs or with Aniline Black.—F. M.

Vat colours; The relative cost of ——. W. F. A. Ermen. J. Soc. Dyers and Col., 1910, **26**, 56—57.

THE cost of dyeing with vat dyestuffs upon cotton depends, owing to the prices of the dyestuffs, very largely upon the depth of shade required. A light grey may be obtained with a sulphide dyestuff at a cost of only ½d. per 100 lb. of yarn; with Indanthrene Green the cost would be 1s. and with Ciba Grey no less than 3s. Yellows and oranges may cost as much as 39s. to dye 100 lb. of yarn; pinks up to 22s., navy blues and violets £2. For full reds the price may be as high as £10, for a shade which for depth and brilliancy does not compare with one with Benzopurpurin 4B. The great value of the colours however, lies in the fastness of the shades produced; thus a 50 per cent. dyeing with Indanthrene Green B, although expensive, will withstand a bleaching such as is given to Egyptian yarn, whilst Aniline Black, subjected to the same treatment is much reduced in shade or completely destroyed. The author states that there is little or no difference in the depth of shade produced upon unmercerised or mercerised yarn, and draws attention to the necessity of maintaining absolutely identical conditions if identical shades are to be obtained in consecutive dyeings.—F. M.

Benzidine Yellow; Production of —— on cotton. E. Lang. Bull. Soc. Ind. Mulhouse, 1909, **79**, 470—473.

BY treating benzidine with oxidising agents, there is produced a di-imide, which is unstable and condenses to form an azo dyestuff of the formula.

$$NH_2(C_6H_4)_2N : N.(C_6H_4)_2NH_2.$$

The author finds that the dyestuff can be produced upon the fibre by impregnating, at the ordinary temperature, with a solution of benzidine in hydrochloric or formic acid, drying, and treating with a dilute solution of hypochlorite. A yellow colour is obtained, which is fast to chlorine, acids, and alkalis, but possesses no great fastness to light. Developed in an acid hypochlorite bath the shade tends towards orange. The colour may be diazotised and developed on the fibre, but the more complete the degree of oxidation, the less change is there to be noticed in the shade after coupling. A. Lipp reports that the dyestuffs produced upon the fibre in this manner from benzidine, tolidine and dianisidine differ in constitution from those obtained by Binder and Scheurer by the oxidation of the three bases in substance.—F. M.

Sulphide and other dyestuffs, which are fixed upon the fibre in the reduced condition. R. Aubert and L. Goubyrin. Sealed Notes Nos. 1767, Sept., 1907, and 1864, Sept. 30, 1908. Bull. Soc. Ind. Mulhouse, 1909, **79**, 474—477.

IT is found that with dyestuffs which are brought into solution by reduction, in the presence of alkali, the addition of β-naphthol to the printing paste results in the production of fuller shades. The dyestuffs mentioned as examples are Immedial Carbon B, Immedial Brilliant Black 5BU, Indigo, Thioindigo Red and the Indanthrene colours. The dyestuffs are reduced by means of alkaline hydrosulphite, the printing pastes containing glycerin and β-naphthol besides the thickening (starch). The prints are dried, steamed for 3—4 minutes, developed in cold running water or with a solution of bichromate, and finally soaped at 50° C. The presence of β-naphthol tends to make the paste more stable and in some cases assists the solution of the dyestuff. A. Musculus reports that the effect of β-naphthol in this connection has been noted elsewhere, but that the earlier date of the first of these sealed notes ensures priority of the application for this purpose, to the authors.—F. M.

Red colour discharges on direct shades which are to be developed with diazotised p-nitraniline after dyeing. A. Stiegler. Sealed Note No. 1932, Sept. 24, 1909. Bull. Soc. Ind. Mulhouse, 1909, **79**, 478—480.

THE material, dyed with a suitable direct dyestuff, is printed with a hydrosulphite discharge paste to which an addition of β-naphthol has been made. The prints are steamed for 2—3 minutes at 102°—105° C., and developed on the jigger with a 1 per cent. solution of diazotised *p*-nitraniline. H. Schmid reports that the process gives bright red discharge effects, and mentions that the date of the sealed note ensures priority for the application to the author, over a similar process of rather later date by Krasuski and Poplawski.—F. M.

Rendering fibres non-inflammable; Process for ——. A. Chaplet. Rev. Gen. Mat. Col., 1910, **14**, 74—76.

THE process results in the fixation of insoluble magnesium-ammonium phosphate in the fibre. The materials are padded in a concentrated solution of a soluble phosphate (preferably the mono-calcium salt), and are then passed through an ammoniacal solution of magnesium chloride. Magnesium-ammonium phosphate is thus precipitated on and in the fibre, and after rinsing in very dilute ammonia and drying, the material is, for all practical purposes, non-inflammable. The property is but little affected by rubbing or washing.—F. M.

Valuation of commercial hydrosulphites. Sinnatt. *See* VII.

PATENTS.

Washing loose material; Machine for ——. H. J. Haddan, London. From The Oil and Waste Saving Machine Co., Philadelphia, U.S.A. Eng. Pat. 15,571, July 3, 1909.

A ROTATABLE cage having a perforated bottom is arranged inside a washing chamber which is provided with a removable lid. The material under treatment is put into the cage and kept in agitation by steam jets discharged into it through the perforations in the bottom. The cage is rotated by means of a variable steam jet acting on vanes connected with the centre piece of the cage. Water is led into the washing machine near the bottom and is drawn away, together with the scum washed from the material, through an outlet placed above the level of the top of the cage. After the washing is complete, the washing chamber is emptied, and the cage, driven at its maximum speed, can then be used as a hydro-extractor to partially dry the material.—P. F. C.

Mercerising yarn in hanks; Machine for ——. P. Hahn. Fr. Pat. 405,551, July 29, 1909.

A MODIFICATION of the machine described in Fr. Pat. 325,329 (this J., 1903, 739) in which are provided yarn carriers revolving periodically round a common axis and on which at intervals in different parts of the machine and simultaneously, the operations of putting on, impregnating, applying tension to, squeezing, rinsing and taking off the yarn, take place.—H. P. P.

Dyeing and washing machines. N. Kemp, Galashiels. Eng. Pat. 21,024, Sept. 14, 1909.

THE improvement refers to machines in which the yarn or other material is placed in a cage inside the dye-vessel, and the dye liquor is circulated by means of steam issuing from a perforated steam pipe between the cage and the walls of the vessel. The circulation is only efficient at the boiling temperature, but it is found that by causing the steam to issue from vertically fixed nozzles (which may or may not be placed beneath pipes, which assist the action), the dye-liquor is forced over the sides of the cage and circulates through the material whilst the temperature of the bath is being raised.—F. M.

Dyeing and similarly treating textile material upon bobbins or the like; Apparatus for ——. A. Marshall, Heywood. Eng. Pat. 5734, Mar. 10, 1909.

A dye-tank is provided with a horizontal perforated partition having arranged on its upper side a number of perforated spindles. Each spindle has one end firmly fixed in one of the perforations of the partition. A bobbin, carrying the material to be dyed is then placed over and around each spindle, the lower end of each one being so constructed as to form a seal with the partition, whilst the upper end is closed by a screw plug which also serves to tighten the seal made by the lower end of the bobbin. The dye-liquor is forced into the lower part of the tank and circulates through the perforations in the partition, spindles and bobbins, and finally passes through the material wound on the bobbins into the upper part of the dye-tank.—P. F. C.

Green shades on cotton fibre; Production of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,355, May 13, 1909.

By combining the tetrazo-compounds of paradiamines with one molecule of 1·8-aminonaphthol-3·6-disulphonic acid in acid solution and one molecule of phenol, its homologues or their carboxylic acids, dyestuffs are obtained, which, if dyed on cotton and then developed with diazotised nitranilines, give green shades of great fastness to washing. Example:—18·4 parts of benzidine are tetrazotised and after the free acid has been mainly neutralised, a neutral or weakly acid solution of 31 parts of 1·8-aminonaphthol-3·6-sulphonic acid is slowly added to the solution. After stirring until the formation of the intermediate compound is complete, the excess of acid is neutralised with sodium carbonate, and a concentrated solution of 10 parts of phenol and 4 parts of sodium hydroxide in water is added, followed by a concentrated solution of 8 parts of sodium hydroxide. After stirring for a time, the mixture is neutralised and the dyestuff is salted out. It dyes cotton a blue-black, which when treated in the usual way with diazotised para- or meta-nitraniline, exposed to air and rinsed, changes into a deep green, which can be discharged to a pure white with hydrosulphites.—P. F. C.

Dye-jigs, etc. J. Brierley and S. Melling. Eng. Pat. 16,285, July 13, 1909.

In place of the small rollers arranged at the bottom of a jigger, which are very liable to get out of order, it is proposed to pass the cloth round a skeleton or built up roller, which will assist the circulation of the dye-liquor, and in the interior of which the heating arrangement is placed. In the end walls of the jigger, hollow trunnions (through which steam may be passed) are fixed, and over these, inside the jigger, metal discs are placed so as to be capable of revolving freely. These discs serve as the end pieces of the skeleton roller; the periphery of each is cut away at intervals and metal cloth rails (shaped to fit over the projections) are bolted to them, thus forming a winch-like roller. A straight or coiled steam pipe is connected to the hollow trunnions, and is suitably supported to keep it in position inside the roller.—F. M.

Dye-vessels for piece-goods. L. Derreumaux-Bulteau. Fr. Pat. 405,290, July 21, 1909.

An improvement in the ordinary dye-vessel for piece-goods designed to ensure rapid and uniform heating of the bath by increased circulation. Between the usual perforated, vertical, wooden partition and the front of the vessel is fixed a perforated, horizontal partition about two-thirds the way down, and the heating is effected by a horizontal perforated steam pipe placed at the bottom of the vessel under a number of solid partitions arranged at angles. —H. P. P.

Furs; Apparatus for treating and dyeing ——. H. Duboc-quet. Fr. Pat. 405,300, July 21, 1909.

In order to economise in labour, the ordinary vat is furnished with a hollow cylindrical, revolving cage in which the furs are placed.—H. P. P.

Dyeing apparatus; Circulatory ——. Ch. Lumpp et Cie. Fr. Pat. 405,432, Nov. 14, 1908.

In an apparatus for dyeing fibrous materials, by circulating the liquor through them, the materials are arranged in perforated cells round the periphery of a closed basket adapted to fit either on to the cone of a hydro-extractor, or into a vat in which the pipes connecting to the pump are so arranged that the liquor can be circulated either from the inside of the basket, through the materials and out into the vat, or from the vat, through the materials and into the basket.—H. P. P.

Fast dyeings; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 406,145, Aug. 16, 1909. Under Int. Conv., July 23, 1909.

The 2.2-dimethyl-1.1-dianthraquinonylamine prepared as described in Ger. Pat. 162,824 (this J., 1906, 175) is a valuable vat dyestuff which dyes vegetable fibres pink shades of great fastness. Example: 6 kilos. of a 10 per cent. paste of 2.2-dimethyl-1.1-dianthraquinonylamine are well mixed with 1000 litres of water. To the mixture are then added 2 litres of sodium hydroxide solution (30 B.), 20 litres of a solution of sodium hydrosulphite (prepared in the proportions of 130 grms. of sodium hydrosulphite and 60 c.c. of sodium hydroxide solution of 30° B. to a litre of water) and 40 kilos. of Glauber's salt. The cotton is dyed in the bath thus obtained for half an hour in the cold and is then washed, soaped and dried.—P. F. C.

Bowking vegetable fibres which have been dyed with vat dyestuffs; Process for ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 218,254, Dec. 25, 1908.

Vegetable fibres dyed with vat dyestuffs are liable to bleed when boiled with caustic alkalis or alkali carbonate solutions; it is found that this can be prevented by adding an alkali bromate to the bowking liquor, which may consist of a solution of 1·2 per cent. (on the weight of the goods) of solid caustic soda, with the addition of 0·2 to 0·5 per cent. of potassium bromate (also on the weight of the goods). (Compare Fr. Pat. 392,858 of 1908; this J., 1909, 89.)—T. F. B.

Blue and violet dyeings on fibres; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 218,255, Feb. 20, 1909.

Cotton is dyed with the asymmetric dyestuff obtained from one mol. of diazotised monoacidyl-phenylenediamine or -toluylenediamine, or their derivatives, one mol. of 2.2-dinaphthylamine-5.5-dihydroxy-7.7-disulphonic acid, and one mol. of a naphtholsulphonic acid or 2.5.7-aminonaphtholsulphonic acid (which may be substituted in its amino group): the goods are then treated with diazotised nitraniline, when fast, clear, blue to violet shades are produced, on which white resists may be printed. —T. F. B.

Effects upon textile fabrics; Production of certain ornamental ——. The Calico Printer's Assoc., Ltd., Manchester, F. Ashton, Hyde, and H. A. Costobadie, Overdale. Eng. Pat. 7650, March 31, 1909.

The material to be treated is first printed with suitable colours by one or more rollers of a rotary printing machine, but the last roller, which is heated and provided with a heated doctor-box, doctor and colour-box, prints a mechanical resist of high melting point either partially or wholly over the colours first printed. The exact composition of the resist, which consists essentially of a mixture of resin and waxes or fats, is varied according to the effects desired. For solid resists enough wax is added to the resist to prevent it from becoming brittle when cold. If it is desired to produce vein-like markings on the resist pattern, a brittle resist is used, which, when cold, is cracked by mechanical treatment or otherwise. Whichever resist is employed, the printed material is dyed and the resist is then removed.—P. F. C.

Gloss on woven materials of cotton; Production of a water and soap proof——. C. Rumpf, Elberfeld, Germany. Eng. Pat. 5771, Mar. 10, 1909.

The goods are first well moistened and a high, shiny gloss is imparted to them by hot calendering, pressing or lustering processes. This gloss is then fixed by submitting the goods, preferably in the stretched condition, to a very high temperature, say 400° C. By the action of the heat a part of the gloss is lost owing to the displacement of the fibres. This can be prevented by treating the goods with a shiny adhesive material, preferably containing starch, either before or after the "glossing" process. After the gloss has been fixed, this material is removed by an after treatment.—P. F. C.

Coating woven fabrics, paper, or the like; Process for——. G. Gawlich, Breslau, Germany. Eng. Pat. 16,199, July 12, 1909. Under Int. Conv., Aug. 26, 1908.

A waterproofing material, with or without weighting ingredients, is applied to the paper or fabric in a dry or slightly plastic condition and is subsequently dissolved and rendered adhesive by the action of solvents in the form of gas, vapour, mist or spray, the waterproofing material being insoluble in water.—P. F. C.

Finishing material; Preparation of a ——. Erste Triester Reisschäl-Fabriks-A.-G. First Addition, dated June 19, 1909, to Fr. Pat. 349,074, Dec. 17, 1904.

The product obtained by the process described in the principal patent (this J., 1905, 617) is submitted to the usual treatments for converting starch into sugar, dextrin, or vegetable gum.—P. F. C.

Drying and finishing dyed yarns and fabrics; Process for simultaneously ——. W. Aderholdt. Fr. Pat. 406,447, Aug. 24, 1909.

The wet material is passed through a calender having at least one bowl heated, so that a very rapid drying takes place. This causes the material to assume the design of the drying bowl, which may be either smooth or engraved, and the effect produced is not affected by the action of steam or water.—P. F. C.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

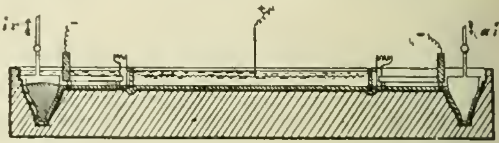
[Boric and oxalic acids:] reciprocal increase of solubility. W. Herz. Z. anorg. Chem., 1910, **66**, 93—94.

The solubility of boric acid in water is augmented by increasing addition of oxalic acid, and the solubility of oxalic acid is affected in like manner by boric acid, reciprocal saturation being reached when 13·77 grm.-mols. of oxalic acid and 11·98 grm.-mols. of boric acid are present in 10 litres of solution. A complex boroxalic acid is probably formed.—F. Sodn.

Chloride electrolysis; Technical alkali ——. R. Taussig. Trans. Faraday Soc., 1910, **5**, 258—268.

The author has constructed a special experimental cell with appliances for: (1), supplying and regulating the current, and for measuring the intensity and E.M.F. of the current passing through the cell, as well as the E.M.F. of polarisation; (2), maintaining and controlling the temperature and the circulation of mercury and brine; (3), taking samples of amalgam and estimating the sodium; and (4), withdrawing and absorbing the chlorine. The relation between the different factors (temperature, E.M.F., current density, rates of circulation, etc.) is shown in tables, and the current efficiency is plotted as a function of various quantities. The efficiency is generally more or less reciprocal (other factors being constant) to the rate of re-formation of the amalgam, and is found to fall off gradually at first and then more rapidly as the concentration of the amalgam is increased (from 0·0026 to 0·0280 per cent. of sodium in the mercury). As a function of the brine circulation the current efficiency is seen to increase gradually with the rate of circulation to a maximum, which is subsequently maintained. In the author's apparatus holding about 150 c.c., there was very little increase of efficiency above 1 c.c. per minute. The effect of temperature variation shows a distinct maximum in current efficiency at about 17° C., with a large falling off in either direction. The effect of varying current density is connected also with the variation in concentration of the amalgam and rate of mercury circulation, but the curves show that high efficiencies (of 96 per cent. and upwards) can be obtained with comparatively low current-densities. In discussing technical processes the author refers to disadvantages of the old Castner-Kellner rocking cell (now practically superseded) and then describes the Kellner compressed air cell (see Figure) which has three compartments joined by siphons, the chlorine cell being in the middle and the caustic soda ones at the sides. In the alkali compartments are wells into which dip the vessels for compressed air. These drive the mercury from one side compartment to the other, through the central one. The anodes are wire gauze sheets, 5×5 cm., weighing 1 grm. each, and each 4000-ampère chlorine cell contains 518 of these sheets mounted in six cement electrode boxes. The cathodes are grids of cast iron and a shunt is provided between mercury and iron to prevent loss of mercury. Other commercially applied processes are the Kellner-Solvay and the new Castner-Kellner. In the former the circulation of mercury is produced by a cup-wheel, and in the latter by an Archimedean screw. For building the cells, concrete finished with cement is almost the universal material at present, slate and other similar substances having been abandoned. Of recent inventions using carbon anodes, the Wildermann cell (this J., 1903, 703) which permits of the use of very high current densities, and the Bell cell which has special provision for preventing contamination of the mercury by anodic impurities are apparently workable. Soap diaphragms have proved unworkable in practice, but baryta diaphragms which are very durable and have only small resistance seem to be meeting with wider application.

—W. H. P.



Sodium carbonate; The isolation of stable salt hydrates, with special reference to the stable hydrates of ——. Alex. C. Cumming. Chem. Soc. Proc., 1910, **26**, 57—58.

If a mixture of hydrates be exposed to the dehydrating action of a large supply of the corresponding anhydrous salt, the hydrates lose water until the lowest hydrate is left in a pure state, after which no further dehydration occurs. The next lowest hydrate may be prepared in a similar manner by the use of the lowest hydrate as the desiccating agent. It is very probable that all the hydrates of a salt may be prepared in this manner. The process may be carried out in the reverse direction, that is, a hydrate may be prepared in a pure state by the hydrating action of the next higher hydrate, or in the case of the highest hydrate by the hydrating action of the saturated solution.

These two methods have been applied to the isolation of the monohydrate, heptahydrate, and decahydrate of sodium carbonate. The rates at which these and other hydrates gain or lose water under certain conditions, and some incidental phenomena, such as a well-defined case of suspended transformation, were described.

Sodium hydrosulphite. M. Bazlen and A. Bernthsen. Ber., 1910, **43**, 501—504.

The authors maintain that the views put forward by Orloff (this J., 1908, 501) as to the constitution of hydrosulphites and sulphoxylates are quite untenable. They point out several weak points in the experimental methods adopted by Orloff, and state that his results afford no trustworthy evidence against the correctness of the constitution established by Bernthsen many years ago for sodium hydrosulphite (see this J., 1905, 329).—A. S.

Hydrosulphites ; Valuation of commercial ——. F. S. Sinnatt. J. Soc. Dyers and Col., 1910, **26**, 57—58.

The method employed is based upon the fact that by complete oxidation with hydrogen peroxide, each molecule of hydrosulphite produces one molecule of free sulphuric acid. About 0·6 grm. of the hydrosulphite powder is slowly added to a mixture of 25 c.c. of *N*/1 caustic soda and 50 c.c. of hydrogen peroxide of about 10 volume strength. The hydrosulphite rapidly dissolves; the mixture is then heated to destroy the excess of peroxide, and the excess of caustic soda is determined by titration with *N*/1 sulphuric acid. The results obtained agree very well with those obtained by the reduction of Methylene Blue.—F. M.

Sodium arsenate solution ; Volumetric valuation of ——. E. Lukanow. Apoth.-Zeit., 1910, **25**, 122.

Ten c.c. of the solution, in a stoppered flask, are treated with 3 grms. of potassium iodide and 20 c.c. of concentrated hydrochloric acid. After standing for 10 to 15 minutes, not longer, any sublimed iodine in the neck of the flask is washed down with about 20 c.c. of water, and the free iodine is titrated in the usual manner, with *N*/10 thiosulphate solution. Every two molecules of iodine liberated are equivalent to one molecule of arsenic acid.—J. O. B.

Percarbonates. E. H. Riesenfeld. Ber., 1910, **43**, 566—568

Replying to Tanatar (this J., 1910, 210) the author shows that solutions of true percarbonates, to which sodium carbonate has been added in the proportion of 2 molecules to 1 molecule of percarbonate still liberate iodine from potassium iodide, whilst "pseudo" percarbonates containing much less sodium carbonate liberate none or only traces.—J. T. D.

Percarbonates. R. Wolffenstein. Ber., 1910, 43, 639—641

Riesenfeld and Reinhold (this J., 1910, 21) have overlooked the fact that von Hansen (Z. Elektrochem, 1897, **3**, 495) prepared electrolytically a 99 per cent. potassium percarbonate. The author maintains also that the salts obtained by Peltner and himself by reacting with carbon dioxide on sodium dioxide and trioxide are true percarbonates.—J. T. D.

Nitrate of soda. W. Montgomery and Co., March 16, 1910. [T.R.]

Owing to a very active demand, deliveries in Europe during February were 330,000 tons, against 250,000 last year, whilst those for 1-15 March were 187,000 against 136,000 in 1908. Visible supply is now practically the same as last year. On the Continent it is believed that deliveries will still continue on a large scale, in which case there would be room for further improvement. £9 15s. per ton free conveyance in dock for delivery in equal monthly quantities from now to June is the ruling price for commercial quality.

Calcium acetate ; Commercial analysis of crude ——. J. Jedlicka. Z. anal. Chem., 1910, **49**, 97—102.

The author recommends the following modification of Fresenius' distillation method (see this J., 1908, 1012), as both simple and accurate. 5 grms. of the sample are distilled in a 300 c.c. Erlenmeyer flask with 50 c.c. of water and 50 c.c. of phosphoric acid (sp. gr. 1·20), until spirting begins; 50 c.c. of water are then added, and the distillation is repeated; instead of distilling a third time, the distillate is then titrated with alkali, and 0·10 c.c. of *N*/1 sodium hydroxide are added, as a correction, to the volume of alkali required. The first distillation should last an hour and the second, half-an-hour, and the first distillate should measure 87—90 c.c—F. Sodn.

Cupric oxide and of cupric hydroxide ; Affinity relations of ——. A. J. Allmand. Chem. Soc. Proc. 1910, **26**, 55.

Crystalline cupric hydroxide is stable in ordinary moist air. When, however, it is shaken with alkaline or ammoniacal solutions at 25° C, it loses water and becomes converted into cupric oxide. These two facts are apparently contradictory, and to explain them, tensimetric and electrometric experiments have been carried out, leading to the following results. (A) Freshly-prepared cupric oxide "ages" with time, as indicated in what follows, its free energy content thereby falling. (B) This ageing is attributed to increasing molecular complexity—not to crystallisation or to surface changes—and is irreversible. (C) The explanation given accounts qualitatively for the electromotive behaviour of samples of copper oxide which have been subjected to varying thermal treatment, and may perhaps throw some light on phenomena noticed in the determination of dissociation pressures of certain oxides at higher temperatures. (D) The tensimetric and electrometric evidence shows that crystalline cupric hydroxide is stable with respect to freshly-prepared cupric oxide and unstable with respect to aged samples of cupric oxide. A saturated solution of cupric hydroxide is unsaturated with respect to "fresh" cupric oxide, and supersaturated with respect to "aged" cupric oxide, which fact explains the apparently anomalous stability relations of cupric hydroxide, on the one hand, and cupric oxide and water on the other. (E) The free energy changes associated with a number of reactions at the ordinary temperature have been measured or calculated. (F) The dissociation pressure of cupric oxide at 1030° has been deduced, and shows excellent agreement with the experimentally determined values.

Zinc peroxide ; Valuation of commercial ——. P. Lemaire. Rép. Pharm., 1910, **22**, 1—4.

0·2 grm. of the sample is dissolved in 10 c.c. of dilute (1 : 10) sulphuric acid. The solution is titrated to a permanent pink tint with *N*/10 permanganate, each c.c. of which is equivalent to 0·0008 grm. of oxygen derived from peroxide (or with the above quantities, to 2·425 per cent. of zinc peroxide). Of 15 samples thus examined, the best contained 40·98 per cent. of zinc peroxide, and the worst 11·15 per cent.—J. O. B.

Hydrogen peroxide in presence of persulphuric acid ; Volumetric determination of ——. A. Skrabal and J. P. Vacek. Oesterr. Chem.-Zeit., 1910, [2], **13**, 27—29. Chem.-Zeit., 1910, **34**, Rep. 121.

The solution containing the hydrogen peroxide and persulphate is treated with dilute sulphuric acid and a measured quantity of ferrous sulphate solution, then diluted with an equal volume of boiling water, and the excess of ferrous sulphate titrated with permanganate. If x be the quantity of hydrogen peroxide, y that of persulphate, f that of the ferrous sulphate used, and p that of permanganate, then the total oxidising power, s, of the solution is represented by the equation: $s - x + y = f - p$, all the quantities being expressed in terms of c.c. of the permanganate solution. Another equal portion of the original solution is treated with a solution of 3—5 grms. of manganese sulphate, acidified with dilute sulphuric acid, and permanganate solution run in until a considerable quantity of manganese dioxide is precipitated. When the evolution of gas has ceased, excess of ferrous sulphate is added, the solution is diluted with an equal volume of boiling water, and the excess of ferrous sulphate titrated with permanganate. If f^1 be the quantity of ferrous sulphate used, and p^1, the total quantity of permanganate, then $x = \frac{1}{2}(s + p^1 - f^1)$, and from this equation, together with that given above, the values of x and y can be calculated.—A. S.

Bismuth subnitrate ; Determination of the acid radical and its relation to the constitution of commercial ——. J. B. P. Harrison. Analyst, 1910, 35, 118—124.

The author finds that the acid radical of bismuth subnitrate is determined most satisfactorily by heating the subnitrate with sodium hydroxide until the bismuth oxide formed has assumed a uniform yellow colour. then filtering the mixture, heating an aliquot portion of the filtrate with a slight excess of sulphuric acid to remove carbon dioxide, and determining the nitric acid present in the usual way in a nitrometer. The sodium chloride method proposed by Brown (this J., 1908, 355) yields concordant results, and the nitric acid may also be determined, in the filtrate obtained on the decomposition of the bismuth subnitrate with sodium hydroxide, by means of the "nitron" method (this J., 1905, 291). The method described by Smith (this J., 1901, 149) is considered to be untrustworthy, owing to the absorption of carbon dioxide during the heating with sodium hydroxide solution; the results obtained are too high, whilst, when heat is not used, the results are lower than the average figure for the percentage of nitric acid. Various samples of bismuth subnitrate examined by the author yielded from 79.8 to 80.5 per cent. of bismuth trioxide on ignition, one sample, however, gave 78.8 per cent., but this is regarded as being exceptional); from 15.35 to 15.81 per cent. of nitric anhydride and from 4.03 to 5.77 per cent. of water. The average molecular proportion of these constituents in ten samples (omitting the exceptional one) was 1·19 : 1·00 : 1·69, so that $6Bi_2O_3.5N_2O_5.8\frac{1}{2}H_2O$. represents the simplest constitutional formula for commercial bismuth subnitrate.—W. P. S.

Antimony hydride; [Reactions and determination of ——]. H. Reckleben and A. Güttich. Z. anal Chem., 1910, **49**, 73—84.

ANTIMONY hydride resembles the corresponding arsenic compound in its behaviour towards most reagents. Its action on silver nitrate solution is precisely analogous to that of arseniuretted hydrogen (this J., 1906, 236), being expressed by the equation.
$H_3Sb+6AgNO_3+3H_2O=6Ag+H_3SbO_3+6HNO_3$, but, as in the case of arsenic, the antimony cannot be determined by weighing the precipitated silver; of the antimony hydroxide, part is precipitated and part remains in the solution. On account of the insolubility of antimony oxide, the complete oxidation of antimony hydride to antimonic acid is difficult, except in the presence of a suitable solvent, such as tartaric acid. By the fixed alkalis and alkaline-earths, however, antimony hydride is more readily decomposed than arseniuretted hydrogen. For the absorption of antimony hydride from a gaseous mixture, provided the proportion be not too small, solutions of silver, iodine, or iodic acid are best; strong solutions of mercuric chloride also act slowly in this capacity, but sodium hypochlorite is ineffective. The diminution in volume of the gas may be directly observed, or the proportion of the hydride may be obtained indirectly by determining the antimony present in the precipitate and solution; when using a solution of iodine or iodic acid, the antimony may also be determined by titrating the excess of the absorbent.—F. SODN.

Sulphur dioxide; Absorption of——by rubber and by wool. A. Reychler. J. Chim. phys., 1910, **8**, 3—9.

MEASUREMENTS of the absorption of sulphur dioxide by rubber and wool show that, with the former substance, the phenomenon is one of solution only, but that wool, which absorbs the gas much more slowly than rubber, fixes part of it chemically. (See also this J., 1910, 83.)—F. SODN.

Carbon bisulphide; Equilibrium in the formation of ——. F. Koref. Z. anorg. Chem., 1910, **66**, 73—92.

EQUILIBRIUM in the formation of carbon bisulphide from solid carbon and gaseous sulphur has been studied at various temperatures between 800° and 1100° C., and the equilibrium constants obtained, both by the formation and dissociation of the substance; in either case, the gas concerned was passed at varying rates through a heated tube, and equilibrium was assumed to be reached when the constant remained unaltered at different rates. Carbon bisulphide is found to be an exothermic compound, its heat of formation being 12,500 cals.; the negative heat of formation observed by previous workers, using solid sulphur, is probably due to the very large heat of vaporisation of sulphur. —F. SODN.

Phosphorus; Transformation of —— in the cardioid ultramicroscope. H. Siedentopf. Ber., 1910, **43**, 692—694.

WHEN white phosphorus is placed in the quartz chamber of a cardioid ultramicroscope, the transformation into red phosphorus can be readily followed. This is caused by the action of light, mainly by that of the visible spectrum. The rays of long wave-length are removed by long water-chambers and those of short wave-length by the glass of the illuminating lens. The transformation only takes place in the field of intense illumination, but a few tenths of a millimetre in diameter. The source of light was an arc lamp. Almost immediately, white submicrons appeared but rapidly became so bright that further observation could only be carried on through a cobalt glass, which transmitted the red and blue rays. It was then observed that the white particles all finally became red. In subdued light fewer submicrons were formed, and threw off three or more whitish prolongations, some of which were slightly curved. These were not polarised. When intense light was now admitted, both the particles and the prolongations were converted in a few seconds into red phosphorus in the same manner as in the experiment first described. Similar phenomena occurred in a concentrated solution of white phosphorus in carbon bisulphide, but the submicrons which were first formed adhered to the sides of the chamber.—E. F.

Atmospheric nitrogen; Utilisation of ——. [Illustrated. A. W. Crossley. Pharm. J., 1910, **84**, 329—340.

Alkalimetry and acidimetry of dirty and coloured solutions. McMyn. *See* XXIII.

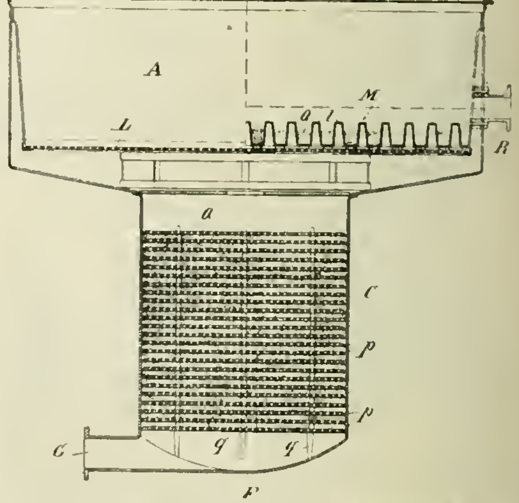
Volumetric determination of sulphuric acid by the barium chromate method. Holliger. *See* XXIII.

Iodometric determination of phosphoric acid. Artmann. *See* XXIII.

PATENTS.

Sulphur trioxide; Apparatus for manufacturing —— by the contact process. G. Eschellmann, A. Harmuth, and Ges. der Tentelewschen Chem. Fabrik, St. Petersburg. Eng. Pat. 23,419, Oct. 13, 1909.

A PRELIMINARY contact chamber (A) is disposed above a second contact chamber (C), a circular, perforated plate (L), which carries a system of contact elements (M) of the first chamber, serving to separate (A) and (C). The plate



(L) is made up of a number of annular sections, which rest one upon the other, and are easily removable. Each of the elements of (M) consists of a perforated, truncated pyramid (l), closed at the top and open at the bottom, these elements also being independent of one another, and each unit easily removable. The lower cylinder (C) contains a system of 25 identical, perforated plates (p), the lowest of which rests upon a series of vertical bars (q), which rest upon the concave bottom (F). The catalytic material (Q), preferably platinised asbestos, is placed upon the upper perforated plate system in a layer of about the same height as the pyramids (l), thus forming a relatively thick layer spread over a large surface. Upon the lower perforated plate system, the catalytic material is loosely placed upon each plate, before the next plate is placed in position. All the parts of the upper cylinder are easily removable through the cover (E), which can be taken off, and through an opening in the head (D). Access to the lower system (p) is obtained by removing the units (M) and all the intervening perforated plates and discs. Repairs and replacements of any portion of the apparatus may thus be conveniently made. To get rid of any moisture retained by the contact mass, when starting the apparatus, a valve (R) in the side of (A) is opened, and hot air is forced through the opening (H) and passes out at (R). The valve is then closed, the mixture of sulphur dioxide and air is led in at (H), passed through the catalytic layers, and out at (G).—O. R.

Sulphuric acid; Process for the manufacture of —— by oxidation of sulphurous acid by means of ultra-violet light. A. Coehn and H. Becker. Ger. Pat. 217,722, July 9, 1907.

Sulphuric acid is prepared by exposing a mixture of sulphur dioxide and oxygen (or air), preferably containing excess of oxygen, to ultra-violet light of low intensity, the gases being heated above 300° C. The yield of sulphur trioxide is increased if the reaction-mixture, after exposure to the rays, be cooled in stages. (See also this J., 1910, 269.)—A. S.

Acid mixtures suitable for nitrations; Process of denitrating and recovering ——. [Utilisation of atmospheric nitrogen.] V. Vender. Fr. Pat. 405,819, Aug. 7, 1909. Under Int. Conv., Aug. 8, 1908.

The hot gases obtained by the combustion of atmospheric nitrogen are employed, in this process, for denitrating acid mixtures which have been used for nitration purposes (*e.g.*, the nitration of glycerin), and the oxides of nitrogen are subsequently condensed. A system of two towers may be used, the first of which is heated externally by the hot gases; these then pass through the second tower, which is fed by the acid mixture to be treated, and from the bottom of which strong sulphuric acid is withdrawn. The nitrous gases from the second tower are condensed, and furnish nitric acid of about 60 per cent. strength; this is admitted to the first tower, together with a part of the strong sulphuric acid previously obtained, and strong nitric acid (98 per cent.) is thus obtained by distillation, the sulphuric acid, reduced to about 75 per cent. strength, being sent back to the second tower. All the sulphuric acid and nitric acid are thus recovered in a concentrated form, and synthetic nitric acid is prepared at a reduced cost.—F. Sodn.

Sodium bicarbonate as a product in the manufacture of alumina; Process of manufacture of ——. D. Péniakoff. Fr. Pat. 405,611, Nov. 18, 1908.

The impure liquors containing sodium carbonate, which are obtained in making pure alumina from bauxite, are concentrated to 32°—33° B. and then treated with carbon dioxide, which causes the precipitation of pure sodium bicarbonate. The process may be carried out in an apparatus which consists of an upright cylindrical absorption chamber, containing two central superposed jets, through which the liquor is projected vertically upwards in a pulverised form, thus coming into intimate contact with the ascending gas; any liquid particles are separated from the gas by a series of baffle-plates arranged near the top of the chamber, and the liquor which collects at the bottom flows out, through a pipe dipping into a receiver which forms a seal, and is aspirated, through a filter on which the bicarbonate is retained, to one of a pair of reservoirs, which are used alternately, and from which it is pumped back into the chamber again; this treatment is repeated until the liquor is exhausted. Instead of one such apparatus, a series may be arranged, each batch of liquor being confined, for example, to one apparatus, and the gas passing first to the chamber in which the liquor has been longest circulated. The expenditure of power necessary to drive the gas through the chambers is very small, and only clear filtered liquors have to be dealt with by the pumps; the process is, therefore, economical as well as rapid.
—F. Sodn.

Alumina from bauxite; Process of extracting —— with the production of barium carbonate as a by-product. L. Pernot and J. Guirard, Fils. Fr. Pat. 405,891, Aug. 5, 1909.

A mixture of bauxite, barytes, and carbon, containing 233 parts of barium sulphate, 105 parts of alumina, and 40 parts of carbon, with the addition of a carbonate, if desired, is crushed as finely as possible, and then heated to a red heat. Barium sulphate is thus reduced to barium sulphide, and when this reduction is complete, a current of carbon dioxide, with or without steam, is admitted to the heated mass; barium carbonate is formed and hydrogen sulphide evolved, and the carbonate, interacting with alumina, gives soluble barium aluminate and carbon dioxide. The mass is then withdrawn from the furnace and lixiviated, and the solution of aluminate is treated with hydrogen sulphide; this causes alumina to be precipitated and yields a solution of barium sulphide, which is finally decomposed by a current of carbon dioxide, giving barium carbonate and hydrogen sulphide again. The gases required during the various stages of the process are furnished by the process itself.—F. Sodn.

Nitrates; Treatment of natural ——. C. Vautin, London. Eng. Pat. 3939, Feb. 17, 1909.

The raw material is reduced to a comparatively fine state of division, either by dry or by wet crushing, but preferably the latter. It is then agitated with water in any of the ordinary forms of apparatus, and the slime or pulp, left after decantation of the bulk of the nitrate solution, is finally subjected to vacuum filtration. The water may be used at atmospheric temperature, or may be slightly heated, but to a lower degree than has hitherto been usual, a considerable saving of fuel being claimed for the process. Agitation is effected by means of compressed air or steam.
—O. R.

Nitrogen oxides; Absorption of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 10,465, May 3, 1909.

An alkaline-earth oxide, hydroxide, or carbonate suspended in water, more especially milk of lime of 6° B., is introduced in a state of fine division into the gaseous mixture containing nitrogen oxides. The absorbing agent may conveniently be sprayed through nozzles into towers or other vessels containing the gases to be absorbed, or the nozzles may spray the absorbing agent into a number of tubes, through which the gases are passing, either in series or in parrallel.
—O. R.

Oxides of nitrogen from the air; Apparatus for producing ——. F. I. du Pont, Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 950,703, Mar. 1, 1910.

The apparatus comprises a container, the inner surface of which is a non-conductor of electricity, and electrodes, situated inside the container, which produce an arc along the length of its inner surface. Means are provided for cooling the walls of the container, and a rotary magnetic field is provided, adjacent to the arc space, and of sufficient strength to deflect the arc against the inner surface of the container.—O. R.

Borates containing active oxygen ; Manufacture of ——. Chem. Werke vorm. Dr. H. Byk, and F. L. Schmidt, Charlottenburg, Germany. Eng. Pat. 19,755, Aug. 28, 1909.

Borates containing active oxygen are obtained by melting sodium peroxide with boric acid, or a mixture of boric acid and a borate, in the presence of water or of salts containing water of crystallisation. The boric acid may be partially or wholly replaced by other acids, especially higher fatty acids. —O. R.

Trisodium phosphate with hydrated sodium carbonate ; Manufacture of ——. W. E. Ridenour, Assignor to Franklin Chem. Works, Philadelphia, Pa. U.S. Pat. 950,159, Feb. 22, 1910.

Claim is made for a material which is prepared by combining sodium carbonate, sodium phosphate or other salt, and water, with or without the addition of sodium hydroxide. The ingredients may be mixed approximately in the proportion of 250 lb. of sodium carbonate, in the form of soda ash, 250 lb. of sodium phosphate, 92 lb. of water, and "the equivalent of 64 lb. of caustic soda solution." The addition of the water to the carbonate is accompanied by stirring, and the amount is insufficient to effect solution, so that a non-crystalline pulverulent product is obtained. —F. Sodn.

Lead sulphate ; Method of preparing pure —— *from impure sulphate.* A. S. Ramage, Assignor to Chemical Development Co., Buffalo, N.Y. U.S. Pat. 950,677, Mar. 1, 1910.

Crude lead sulphate is dissolved in an alkali hydroxide, the solution is oxidised and heated, the precipitated impurities are removed, and pure lead sulphate is re-precipitated from the solution.—O. R.

Whiting ; Method of manufacturing ——. W. Nelan, Akron, Ohio. U.S. Pat. 950,793, March 1, 1910.

Raw chalk is thoroughly dehydrated at a temperature just below that of incipient dissociation, after which the material is passed through grinding, pulverising, and separating appliances.—O. R.

Nitrogen compounds of silicon and their employment for obtaining ammonia ; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 405,712, July 27, 1909. Under Int. Conv., Feb. 9, 1909.

The process, which furnishes a cheap technical method for the production of ammonia, consists in heating silica with carbon, in the presence of nitrogen (or gases containing it) and oxides, hydroxides, metallic salts, or metals, which may be present as natural impurities in the silica or carbon used, or in the form of silicates, and then heating the nitrogen compounds of silicon, thus formed, with solutions or suspensions of oxides, hydroxides, or salts having an alkaline reaction, so as to convert the whole of the nitrogen into ammonia. For example, 75 kilos. of finely powdered silica are intimately mixed with 25 kilos. of wood charcoal and 2 kilos. of sodium carbonate, and the mixture is heated for 10—12 hours in a current of nitrogen, at 1300°—1400° C. ; after cooling in an atmosphere of nitrogen, the compound produced is boiled with a 20 per cent. solution of sodium hydroxide, using a reflux condenser, and the liberated ammonia is collected or absorbed by an acid. Other examples are given in the specification.—F. Sodn.

Potassium sulphate from alumstone and analogous minerals ; Process for the extraction of ——. Soc. Dior, Fils. Fr. Pat. 405,842, Nov. 24, 1908.

The finely crushed mineral is calcined, and the product is lixiviated with water. Potassium sulphate is thus extracted, and is afterwards crystallised, a residue of hydrated alumina being obtained. Sulphur dioxide and oxygen are evolved during the calcination, and any native sulphur present in the mineral is recovered as flowers of sulphur.—F. Sodn.

Crude potash salts ; Process for dissolving ——. G. Wachtel. Ger. Pat. 218,191, Feb. 12, 1907.

The crude salt and the lixiviating liquor are passed in opposite directions through a series of rotating perforated iron drums, arranged end to end, and provided inside with helical projections which serve to move forward the solid material. Constituents of the salts which dissolve with difficulty are gradually forced through the perforations into the vessel surrounding the drums, and are afterwards moved forward by projections on the outer surfaces of the drums, being finally discharged into a receptacle in the form of slime.—A. S.

Stannic chloride ; Process for the extraction of pure —— *from tinware and other substances containing tin, by means of chlorine.* P. Wolff and H. von Schütz. Fr. Pat. 405,851, Aug. 9, 1909. Under Int. Conv., Oct. 13, 1908.

Material containing tin is treated with dry chlorine, unmixed with air, by introducing this gas at the bottom of the reaction vessel, at as low a pressure as possible, and withdrawing the air at the same time by suction from above. When the vessel is full of chlorine, it is closed, and the reaction is allowed to proceed. This is accompanied by a decrease of pressure, in spite of the heat of reaction, because the tin chloride forms as a liquid. More chlorine is sucked into the vessel as required, and admission is so regulated that the temperature and pressure remain almost constant, the temperature being maintained at about 100° C. to prevent iron being attacked with the tin. When the reaction is complete, the product is distilled under reduced pressure, at 100° C., and commercially pure stannic chloride is thus obtained directly.—F. Sodn.

Stannic chloride ; Process for the manufacture of ——. Soc. Industrielle de Produits Chim. Fr. Pat. 406,300, Dec. 4, 1908.

Tinstone or other mineral containing tin is crushed and then heated with hydrogen or other reducing agent in a cast-iron tube or other apparatus, at as low a temperature as suffices for reduction. When water vapour is no longer produced, the apparatus is allowed to assume the ordinary temperature, and a current of dry chlorine is passed in, the tube being meanwhile cooled. The stannic chloride, thus produced, is condensed in a coil immersed in water ; it is finally purified by re-distillation with a little tin.—F. Sodn.

"Cupro-cupric oxychloride" and alkalis ; Process of manufacture of —— *by electrolysis.* Soc. Anon. d'Etudes Electro-Chimiques. Fr. Pat. 406,107, Aug. 13, 1909. Under Int. Conv., Aug. 25, 1908.

The compound here called "cupro-cupric oxychloride" is said to be composed of cuprous chloride, cuprous oxide, and cupric oxide. It is made by electrolysing a solution of potassium or sodium chloride, using anodes of copper or a copper alloy and unattackable cathodes (of iron, for instance), in an apparatus provided with diaphragms ; these diaphragms allow the potassium hydroxide formed at the cathode to pass through and react with the cuprous chloride formed at the anode, giving the compound claimed. An apparatus described by way of example, consists of an oblong rectangular cell containing a series of flat-shaped porous pots, forming the cathode compartments ; the cathodes dip into these pots and the anodes are placed between them, and a supply of the solution is constantly admitted at the bottom of each pot and the main cell, the liquid overflowing by tubes near the top and at the opposite end. The liquid becomes charged with the oxychloride which is collected by decantation and washed ; the product is intended to be used in the treatment of cryptogamic diseases of the vine.—F. Sodn.

Zinc compounds [oxide, etc.]; Process for the preparation of —— by electrolysis. E. Leriche. Fr. Pat. 406,150, Dec. 1, 1908.

The process consists in electrolysing, with a zinc anode and without a diaphragm, a solution containing a salt of a soluble base, the acid radical of which forms a soluble salt with zinc; under these conditions, the anode and cathode products interact to give a precipitate of zinc hydroxide. In order to prevent secondary electrolysis, the cathodes are preferably of iron and an alkali chromate is added to the electrolyte. A suitable electrolyte is made by dissolving 150—200 grms. of common salt per litre and adding 25 grms. of sodium or potassium chromate per 100 litres; the solution of salt should be made with boiled water and sufficient sodium carbonate added to precipitate any calcium or magnesium salts present, the precipitate being removed. In the particular form of apparatus described, the electrolyte is supplied to the cells from a reservoir in which it is heated to 70°—80° C. The electrodes are arranged alternately in each cell, but so that the first and last are cathodes; they are spaced about 2 cm. apart, and are suspended so as not to reach the bottom of the cell; under these conditions and with a current density of 2 amps. per sq. dm., each cell takes about 0·5 volt, and, for the manufacture of 5000 kilos. of zinc oxide per 24 hours, 100 H.P. are required for the electrolysers. The effect of the current is, however, merely to accelerate the action, and, if preferred, an external source of electricity may be dispensed with and the cells short-circuited; but in this case no chromate should be added. The suspension of zinc hydroxide is drawn off through a pipe in the bottom of each cell and filtered, by passing it upwards through glass wool or other suitable material, packed so that the hydroxide passes through, but solid impurities are retained. The zinc hydroxide is then allowed to deposit, and is finally washed, dried, and, if necessary, calcined, the clear liquid being used again. Very pure zinc oxide, suitable for use in the arts or in pharmacy, is obtained. By blowing carbon dioxide into the electrolysers, various carbonates of zinc may be produced.
—F. Sodn.

Nitrogen [from air]; Production of —— by combustion. E. F. Aumont. Fr. Pat. 405,493, July 27, 1909.

The invention relates to the separation of nitrogen from atmospheric air by the complete combustion of a combustible gas, and the subsequent removal of carbon dioxide and water vapour from the product. A suitable apparatus for the purpose comprises a mixing chamber for the gases, a combustion grate (cooled, if preferred), with narrow openings to prevent the flame striking back into the mixing chamber, and a closed combustion chamber, with a suitable arrangement for cooling the burnt gases. The combustion may be controlled by the use of an apparatus for automatically determining and recording the proportion of carbon dioxide in the burnt gas, and, where the composition of the combustible gas is variable, an automatic regulator may be introduced; this consists of a metal tube filled with copper, maintained at about 400° C., through which a part of the burnt gas is made to pass; the tube is connected to one pole of a source of electricity, and the copper is connected at various points, through the coils of four electro-magnets, with the other pole; any excess of oxygen reduces the conductivity of the copper by oxidation and causes one or more of the electro-magnets, which control the air supply, to become inactive. A water blast (filter-pump) is preferably employed for withdrawing the gases from the combustion chamber; this cools the gases and effects the absorption of carbon dioxide therefrom, leaving nitrogen to pass on to the receiver.
—F. Sodn.

Oxygen; Process for liberating ——. L. Sarason. Fr. Pat. 405,644, Aug 2, 1909.

Claim is made for a process for liberating oxygen from peroxides, perborates, and the like, by means of the catalytic action of colloidal manganese dioxide, employed either dry or in solution, or formed *in situ*. The colloid is made by oxidising manganous salts or by reducing manganates or permanganates, in the presence of a protective colloid, such as gelatin, casein, gum, etc., or by reducing permanganate in very dilute alkaline solution.
—F. Sodn.

Oxygen from alkali peroxides, or hydrogen from calcium hydride; Process for the production of ——. M. Bamberger, F. Böck, and F. Wanz. Ger. Pat. 218,257, March 31, 1908.

Alkali peroxides are mixed with substances, such as gypsum, sodium bicarbonate, soda-lime, or boric acid, which contain water or carbonic acid, but which react with the peroxide only when heated to about 80° C., or a higher temperature. In order to obtain oxygen from such a mixture, the reaction is started at a particular spot by the application of heat, and will then be gradually propagated throughout the mass without further heating. Such mixtures may be used with advantage in place of a portion or the whole of the alkali peroxide in the apparatus for the revivification of vitiated air described in Ger. Pat. 168,717. Mixtures of calcium hydride with the substances mentioned above may be used in a similar manner for the preparation of hydrogen.—A. S.

Sodium carbonate; Process of making ——. W. Hasenbach, Mannheim, Germany. U.S. Pat. 951,243, March 8, 1910.

See Fr. Pat. 383,136 of 1907; this J., 1908, 282.—T. F. B.

Sodium chloride and other chlorides; Electrolytic decomposition of —— to make caustic soda and other products. R. J. Lévy. Fr. Pat. 406,350, Aug. 20, 1909. Under Int. Conv., Oct. 2, 1908.

See Eng. Pat. 20,787 of 1908; this J., 1909, 1125.—T. F. B.

Nitrates; Production of commercially pure ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 10,867, May 7, 1909.

See Ger. Pat. 210,167 of 1908; this J., 1909, 656.—T. F. B.

Silicide of an alkaline earth metal; Processes for producing a ——. E. C. R. Marks, London. From T. L. Willson, Ottawa, Canada. Eng. Pat. 12,966, June 2, 1909.

See U.S. Pat. 934,379 of 1909; this J., 1909, 1087.—T. F. B.

Hydrated lime; Apparatus for producing ——. C. C. Kritzer. Fr. Pat. 406,142, Aug. 16, 1909.

See U.S. Pat. 932,789 of 1909; this J., 1909, 1034.—T. F. B.

Carbon; Treated —— and method of producing it. P. J. Mulvey, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 949,988, Feb. 22, 1910.

See Eng. Pat. 28,062 of 1904; this J., 1905, 1230.—T. F. B.

Oxygen and nitrogen from liquid air; Process for the separation of ——. G. Claude, and Soc. l'Air Liquide, Paris. U.S. Pat. 950,436, Feb. 22, 1910.

See Fr. Pat. 328,245 of 1903; this J., 1903, 950.—T. F. B.

Oxygen and hydrogen from alkali peroxides or calcium hydride; Process for the production of ——. N. Bamberger, F. Böck, and F. Wanz. Fr. Pat. 405,709, July 21, 1909.

See Ger. Pat. 218,257 of 1908; preceding.—T. F. B.

Oxygen; Process and apparatus for preparing —— by autocombustion. G. F. Jaubert. Fr. Pat. 405,956, Nov. 26, 1908.

See Eng. Pat. 22,034 of 1909; this J., 1910, 25.—T. F. B.

VIII.—GLASS; CERAMICS.

Iron in clays; Determination of small amounts of ——; and colorimetric determination of cobalt in presence of nickel. J. W. Mellor. Trans. Eng. Ceram. Soc., 1908—9. 8. 125—132.

For clays containing less than 0·5 per cent. of iron oxide, the usual volumetric processes are not accurate. The author accordingly tried the colorimetric methods, using ammonium sulphide, hydrogen sulphide in sodium pyrophosphate solution, potassium ferrocyanide, tannin, salicylic acid, and ferric acetylacetonate, but ultimately chose the thiocyanate method, originally proposed by Herapath in 1853, as most convenient. The presence of organic acids, and of alumina and alkaline-earths, exerts an unfavourable influence on the development of the colour. Tatlock therefore proposed (this J., 1887, 276, 352) to eliminate the effects of other substances by extracting the ferric thiocyanate with ether and comparing the tints of the ethereal solutions. Instead of ether, the author uses equal volumes of methylated ether and isoamyl alcohol. The hydroxides of iron, aluminium, etc., precipitated by ammonia, are ignited, fused with potassium bisulphate, the cake is extracted with water, the solution made up to a known volume, and in an aliquot part the iron is estimated colorimetrically with thiocyanate, the colour being compared with that obtained under similar conditions with a measured volume of a standard solution of ferric potassium alum. In this manner, an iron determination can be made in 20 minutes. (See also Hadank, this J., 1909, 885.)

Potassium thiocyanate can also be used for the colorimetric determination of cobalt in presence of nickel, a blue coloration being developed in aqueous solutions of cobalt salts, which is soluble in ether and amyl alcohol.—H. H. S.

Patents.

Glass; Electric furnace for the continuous manufacture of ——. M. Sauvageon. Second Addition, dated July 28, 1909, to Fr. Pat. 401,744, Aug. 7, 1908 (this J., 1909, 1130 and 1200).

Supplementary electrodes are placed in the vault of the furnace, so that an electric arc plays over the raw material and melts the upper surface, thus allowing the main current to be transmitted through the bulk of the glass.—H. H. S.

Tiles, bricks, pottery and the like; Manufacture of —— E. G. P. Bousfield, Blyth Bridge, Staffs., and L. Schulte and Metal Finishers, Ltd., London. Eng. Pat. 364, July 7, 1909.

Articles are strengthened by an electrolytic coating of metal, whereby the tendency to chip or fracture is reduced. The electrolyte used has the following composition by weight:—water, 60; copper sulphate, 25; dextrose, 5; glycerin, 5; sulphuric acid, 5 per cent. —H. H. S.

Porcelain, china, or other ceramic ware; Manufacture of double-walled vessels of ——. F. W. Golby, London. From C. Rensch, Holzminden, Germany. Eng. Pat. 22,571, Oct. 4, 1909.

Double-walled vacuum-jacketed vessels, often called Dewar vessels, are made by moulding the component parts separately and uniting them by firing in the kiln, supporting pieces being provided for keeping the inner vessel in position. An evacuating tube from the inner vessel is jointed by a glaze of the composition:—broken porcelain, 48; calcined felspar, 15; dolomite, 12; silica, 16; calcareous spar, 3; kaolin, 4; and chromic oxide, 2 parts by weight.—H. H. S.

Glass and enamels; Process for making —— opalescent. A. Lesmüller. Ger. Pat. 218,316, April 1, 1909.

Oxides of quadrivalent elements (silicon, tin, lead, titanium, zirconium, or thorium) are fused with boric acid derivatives, such as borax or boron trioxide, and the fused mass is either exposed to the action of steam or acid vapours while it cools, and the solid product subsequently melted with the glass or enamel mass; or it is added to the fused glass or enamel mass, and the whole treated with steam or acid vapours, while cooling. It is stated that the opalescence produced in this manner is more uniform than that produced by the usual methods. —A. S.

Quartz rendered plastic by fusion; Process for shaping ——. Deutsche Quarzgesellschaft. Fr. Pat. 406,130, Aug. 14, 1909.

See Eng. Pat. 18,713 of 1909; this J., 1910, 89.—T. F. B.

IX.—BUILDING MATERIALS.

Wood preservation. Report of Committee, No. 17 of the American Railway Engineering and Maintenance of Way Association. Bull. Internat. Railway Congress Assoc. (Eng. Edit.), 1909, 23, 359—407.

The conclusions arrived at by the Committee, as the result of extensive inquiries and tests, may be briefly summarised as follows:—By efficient creosoting to the extent of 16—24 lb. per cub. ft. of wood, piles can be preserved for 20 to 25 years, but ties only for 15½ to 19 years unless protected against mechanical destruction. Ties will only last for from 5 to 12 years if not efficiently impregnated. "Burnettising" (treatment with zinc chloride) will preserve ties for from 10 to 14 years; for arid climates, ¼ lb. of dry zinc chloride may give good results, but for moist and warm climates at least ½ lb. must be used. Ties treated by the combined zinc chloride and creosote process are stated to have lasted for from 12 to 18 years in Germany. The following standard is proposed for creosote to be used for impregnating wood:—The creosote should be a pure product of coal-tar distillation, free from suspended matter, completely liquid at 38° C., and having a sp. gr. of at least 1·03 at that temperature. When distilled in an 8-oz. retort covered with asbestos, with the bulb of the thermometer ½ in. above the surface of the liquid, nothing should pass over below 200° C., and not more than 5 per cent. below 210° C., and 25 per cent. below 235° C.; the residue not distilling up to 355° C., if amounting to more than 5 per cent., should be soft. The creosote should not contain more than 3 per cent. of water. Zinc chloride to be used for the impregnation of wood, should be slightly basic and as pure as practicable. It is recommended that quantities of creosote be expressed wherever possible by weight. If expressed by volume, the volume at 100° F. should always be given, a correction of 1 per cent. for every 22½° F. being made for expansion or contraction when the volume is measured at another temperature. Woods should be divided into groups for separate treatment, according to the species, proportions of heartwood and sapwood, and conditions with respect to moisture-content and structure. The most satisfactory results are generally obtained if the wood is seasoned in the air before being impregnated. The report is accompanied by the following appendices: (A). (W. H. Courtenay). Experience on the Louisville and Nashville Railroad with creosoted piles and timber. (B). (O. Chanute). Precautions to be observed in "Burnettising" ties. (C). (H. D. Tiemann). Microscopic structure and physical condition of wood, and their effect with respect to penetration by preservatives. (D). Practice in grouping of species of woods.—A. S.

Cement; Testing —— by the Brinell ball method. Lalorbe. Rev. Métallurgie, 1909, 988—1004.

The rapidity of setting of cements, as shown by the times of initial and final setting can be determined with considerable accuracy by a modification of the Brinell ball method used for determining the hardness of metals. A ball 30 mm. diameter and weighing 1 kilo. is allowed to rest on a flat smooth surface of the setting cement for from 8 to 10 seconds at different times, and the diameter

of the impression is noted. The ball may be loaded with lead discs, the first weighing 4 kilos., the others 5 kilos. each, so as to give total weights of 5, 10, 15, etc. kilos. The hardness of the cement at any time is given by dividing the spherical area of the impression in sq. cm. by the pressure in kilos. The initial and final settings as determined by the Vicat needle, correspond to hardness numbers of 2 and 8. The sample tested should be at least 2 or 2½ times as thick as the depth of the impression. The impressions must not be too near each other or too near the edge of the sample. In 116 measurements, the variations from the mean seldom reached 10 per cent.
—A. T. L.

Concrete; Possibilities of the uses of mineral oils mixed with ——. A. Moyer. Concrete and Constructional Engineering, 1910, **5**, 166—169.

It has been suggested that for certain purposes the mixing of mineral oil with concrete would be advantageous. The cement, sand, gravel and water are mixed in the usual way, and 10 to 15 per cent. (of the weight of the cement) of non-volatile mineral oil is added, and thoroughly mixed with the concrete. The oil, alkalis and water form an emulsion, which becomes incorporated with the concrete. Additions of from 5 to 15 per cent. of oil slightly retard the initial and final set, and hardening. The tensile strength is reduced, and also the toughness, but not in proportion to the increase in the percentage of oil used. Some experiments of the author seem to show that concrete and mortar, to which 10 per cent. of "oil petrole" (a white non-volatile petroleum product of about the consistence of melted vaseline) had been added, when dried in air, had no tendency to contract or crack; that the emulsified oil tends to keep the cement particles wet, and furnish the same conditions as if set under water. Concrete mixed with mineral oil appears to be suitable for roads, retaining walls, foundations, tanks, cisterns, dustless waterproof floors, non-absorbent floors, and for impervious concrete drain tiles and sewers. The absence of contraction cracks would make it suitable for terrazzo floors and for stucco and exterior plaster work. Where colour is not important, heavy black bituminous oils may be used, but at present and until further experiments have been made, it is recommended that animal or vegetable oils should be avoided, and only mineral oils used.
—W. C. H.

Magnesia cement. A. Krieger. Chem.-Zeit., 1910, **34**, 246—247.

On treating 5 grms. of magnesia with 200 c.c. of magnesium chloride solution, of specific gravity 1·25, at the room temperature, a gelatinous mass was obtained in 2 days. The excess chloride was removed by repeatedly extracting the mass with alcohol (99 per cent. by weight) and the residue dried at 40° C. in a good current of air. The slow rate of formation of the oxychloride is seen from the following figures:—

	Proportion of		
	$MgCl_2$	MgO	H_2O
After 2 days	1·0	5·0	16·1
" 2 weeks	1·0	3·3	10·2
" 4 "	1·0	2·0	8·9

After 4 weeks the proportion between the 3 components was constant, and corresponded with the formula, $MgCl_2.2MgO,9H_2O$. The resulting product resembles magnesia in appearance, and consists of well-formed, transparent crystal needles, without any admixture of amorphous particles. It appears from other experiments, that owing to the slowness of the reaction, if the mixture is exposed to atmospheric carbon dioxide, a portion of the magnesia may combine with the carbon dioxide before it has time to react with the magnesium chloride. Since the temperature, the proportions of the ingredients, and the duration of the reaction markedly affect the product, it is hardly possible to assign a constitutional formula to Sorel cement. In practice, the reaction is also modified by the presence of filling materials, such as wood-meal, cork, etc., in "*Estrich*," or sand, stone-meal, clay, asbestos, etc. in "*Steinholz*." From such mixtures the free chloride can be removed by extraction with alcohol, and the combined chloride, which is not soluble in alcohol, can be obtained by difference from the total chloride. In a mixture containing infusorial earth, the ratio of magnesia to magnesium chloride which had reacted was 100 to 96, compared with the theoretical 100 to 79. In a mixture, with sawdust as filling material, a ratio of 100 parts of magnesia to 77 parts of combined magnesium chloride was obtained. Such mixtures, of course, are not serviceable in practice because of the absorption of water by the free magnesium chloride, the content of which should not exceed 4 to 5 per cent. Fine grained, spongy magnesia, burnt at a low temperature reacts best. The following table shows the amounts of combined water found in 3 samples of magnesia which were hydrated.

	After 24 hours.	After 28 hours.	After 14 days.
1. Burnt at 450—500 C.	23·0%	23·5%	30·0%
2. Good, commercial burnt magnesite ..	13·0%	22·2%	27·6%
3. Magnesia, by Solvay process from [magnesium chloride ..	12·6%	19·5%	21·0%

The theoretical amount is 30·8 per cent. The value of a burnt magnesite for cement can be judged better from physical tests such as fineness, volume-weight, tensile strength in various mixtures (neat, as "*Estrich*," and as "*Steinholz*") than by mere analysis. Some experiments were also made in which magnesium sulphate was substituted for the chloride. It was found that the reaction is complete in a short time, and that very little sulphate enters into combination with the magnesia. The powder formed is decidedly heavy, and non-crystalline, and possesses very little tensile strength. A magnesia-magnesium chloride mixture after 7 days had a tensile strength of 31·7 kilos., but when a sulphate solution of equivalent concentration was substituted for the chloride, the strength was only 17·5 kilos., and when equal quantities of both solutions were used, the strength rose to 29·2 kilos.—W. C. H.

Thermal conductivity of firebricks in blast heating stoves. Osann. *See* X.

Patents.

Artificial stone; Manufacture of light and durable ——. A. Cordes. Fr. Pat. 406,435, Aug. 24, 1909.

Stones made from plaster and peat, together with coke dust or wood shavings, as a filling material, usually lack durability. To overcome this, barium hydroxide or carbonate is added, in order to form insoluble barium sulphate which, it is stated, materially assists the setting of the stone.—H. H. S.

Concrete compositions; Process of manufacturing ——. J. W. Adams, Curtis, Nebr. U.S. Pat. 949,924, Feb. 22, 1910.

Sand, cement, and gravel or broken stone, are mixed with a moistening agent, and moulded into blocks under pressure. The blocks are alternately moistened and dried till a permanent set has taken place, when they are wetted till they shed water, and afterwards thoroughly dried.—H. H. S.

Cement; Bituminous ——. J. H. Amies, Assignor to The Amies Asphalt Co., Philadelphia, Pa. U.S. Pat. 951,471, March 8, 1910.

A binder and cement, for road and street surfacing and re-surfacing or the like, is obtained by mixing from fifteen to sixty per cent. of solid "elements," such as hard asphalt, and about forty to eighty-five per cent. of "fluxing elements," such as "maltha," mineral tar, asphalt oil, mineral and vegetable pitch or the like. The product is mixed with about thirty per cent. of calcium oxide or hydroxide, in order to secure a desirable binder or cement, which will be indifferent to changes of temperature, and from which "aging" is practically eliminated.—B. N.

Cement; Manufacture of impermeable ——. Deutsche Rekord Cement Werke, I. Krümpelmann und Co., Fr. Pat. 406,094, Aug. 13, 1909.

Constructions in cement are usually rendered impermeable to water by a coating of tar. To obviate this, a material which can be mixed with the cement to render it impermeable, is made of a mixture of silicic acid and bitumen. The gelatinous silicic acid is made by the action of hydrochloric acid on slag, and to this is added bituminous schist containing 25 per cent. of bitumen and 15 per cent. of chalk, and then about 9 per cent. of a tar or oil. The mass is subjected for several hours to a pressure of 5 atmospheres. It is then ground and added in suitable proportions to Portland cement.—H. H. S.

Finely-divided lime, such as meadow lime, lime waste of chemical and sugar works, etc.; Process for making —— suitable for burning. H. Westphal. Ger. Pat. 218,428, Aug. 23, 1908.

The finely-divided lime is mixed with ground quicklime or dry slaked lime, with addition of quartz sand if necessary, and is then pressed into briquettes, which are hardened by exposure to the air or to the waste gases from a lime-kiln. —A. S.

Cements; Manufacture of ——. W. J. Mellersh-Jackson, London. From J. et A. Pavin de Lafarge, Viviers, France. Eng. Pat. 8675, April 10, 1909.

See Fr. Pat. 401,493 of 1909; this J., 1909, 1132.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Gold production of Australasia. Mining World (Chicago), March 19, 1910. [T.R.]

The gold output in Australasia in 1909 according to an official report was 3,430,463 fine oz. as compared with 3,545,970 fine oz. in 1908, a decrease of 115,507 oz. The falling off is largely accounted for by the shutting down of some of the copper smelting works during the year. The increase in the returns from New Zealand is due to the increased production of the mines at Waihi.

The following shows the output in the Commonwealth and New Zealand for 1908 and 1909:

	1908.	1909.
	Fine oz.	Fine oz.
W. Australia	1,647,911	1,595,263
Victoria	670,910	654,222
N. Zealand	472,000	472,476
Queensland	465,085	450,937
N. S. Wales	224,792	201,709
Tasmania	57,085	44,669
S. Australia and N. Territory	8,187	8,187
Total	3,545,970	3,430,463

Following is the production of Australasia for the past 10 years:

Year.	Fine oz.
1900	4,176,156
1901	3,761,132
1902	3,946,443
1903	4,315,684
1904	4,220,720
1905	4,156,692
1906	3,985,691
1907	3,667,609
1908	3,545,970
1909	3,430,463

Blast; Advantages of enriched air ——. J. W. Richards. Met. and Chem. Eng., 1910, **8**, 123—124.

The effect of the use of an air blast enriched in oxygen on the working of the blast-furnace will be an increased temperature in the smelting zone. Using a blast preheated to 500° C., pure air gives a theoretical maximum combustion temperature of 2096° C. If the amount of oxygen present be increased by 5 per cent., the theoretical maximum temperature will rise to 2466° C. The gases produced by combustion will be 16 per cent. smaller in volume and 18 per cent. higher in temperature. They will therefore give off their sensible heat to the materials in the furnace at a faster rate, while the radiation losses will be reduced and the amount of waste gases diminished. The author estimates that a blast-furnace using air enriched 5 per cent. in oxygen will run one-third faster than when using the ordinary air blast and will save one-sixth of the fuel requirement.—J. W. H.

Hoesch process of steel making; Experimental investigation of ——. F. Springorum. Stahl u. Eisen, 1910, **30**, 396—411.

In the Bertrand-Thiel process, the pig-iron is heated with ore and lime till the phosphorus is reduced to about 0·2 and the carbon to 1·5—2·0 per cent.; the metal is then run off from the slag into a second furnace, previously charged with calculated quantities of scrap, ore, and lime, where it is finished. One of the practical difficulties of the process is that the lining of the first furnace continually increases, whilst that of the second, owing to the higher temperature and less amount of lime, is eaten away. The modification of the process patented by the Hoesch works consists in carrying out the two stages in the same furnace. At the end of the first stage the slag is poured away and the metal run into a ladle, the furnace is charged with scrap, etc., the metal run back from the ladle, and the operation finished. In this way the accretions to the lining during the first stage balance the losses during the second. During the first stage solid oxides are mainly formed, viz., of silicon, phosphorus, manganese; the metal contains its highest proportions of these substances, and thus any reducible oxides in the slag are reduced, a slag of high phosphorus content being obtained. During the second stage the carbon is oxidised; a slag with a high oxide-content acts on a metal containing but little foreign substance, so that everything oxidisable is rapidly oxidised. In the experimental investigation of the process seven charges were worked through, and samples of the metal and the slag analysed at intervals. As illustrating the progress of the conversion, the percentages of the chief constituents from one of these experiments may be given:—

	Carbon.	Phosphorus.	Manganese.	Silicon.	Sulphur.
Original pig-iron	3·280	1·860	0·96	0·32	0·132
End of first stage	1·460	0·260	0·34	trace.	0·082
Finished steel	0·080	0·040	0·47	trace.	0·067

The first four of these are entirely oxidised during the process; but the sulphur goes into the slag chiefly as sulphides of calcium, manganese, and iron. The complete figures show that to some extent the reactions are reversible, and that the manganese and phosphorus especially may revert from the slag into the metal again. The circumstances influencing the reactions are chiefly four. 1. *Temperature of the bath*:—A low temperature, just above the melting-point of the pig-iron, allows of the oxidation of phosphorus, silicon, and manganese, whilst the carbon is but slightly affected. As the temperature rises, however, the relative avidity of the carbon for oxygen increases, so that at a sufficiently high temperature carbon will reduce the other oxides, and they can only be removed from the pig after removal of the carbon. 2. *Composition of the slag*:—The more basic the slag, the more readily is the phosphorus removed, and the more difficult is the reduction by carbon of the phosphate formed. A basic slag also favours the oxidation of silicon, and hinders that of manganese. Much lime or much manganese in the slag favours the removal of the sulphur $FeS+CaO+C=CaS+CO+Fe$. 3. *The concentrations, in metal and slag, of the reacting substances :* The amount of reaction is increased by higher concentration of the reacting substances. Thus, from the same metal, phosphorus will be removed at a higher rate by a slag containing 40 than by one containing 10 per cent. of ferrous oxide, whilst the same slag will remove more phosphorus per minute from a metal containing 2 than from one containing 1 per cent. 4. *The relative weights necessary for a determined reaction :*—In order to oxidise unit weights of carbon, manganese, phosphorus, and silicon there are needed respectively 6, 1·3, 5·8, and 5·5 units of ferrous oxide; accordingly, the oxidation of manganese will proceed most readily, and manganese will reduce ferrous oxide where the latter is present in so low concentration as to be unaffected by carbon, say. Similarly as unit weight of carbon requires only 2·4 units of phosphoric anhydride, but 6 units of manganous oxide, for its oxidation the reduction of phosphorus from the slag will be possible at a much lower concentration than would be the case with manganese. These principles are illustrated in the following table of intensites of reaction which shows the number of kilos. per minute of each substance reduced (+) or oxidised (—) during successive intervals of the first (12 hrs. 15 mins. to 2 hrs. 5 mins.) and final (2 hrs. 35 mins. to 5 hrs. 15 mins.) stages.

Intervals of time.		Iron.	Carbon.	Phosphorus.	Manganese.	Silicon.	Sulphur.
Hrs. Mins.	Hrs. Mins.						
12·15 —	1·30	+ 30·7	— 3·92	— 4·23	— 2·26	— 0·99	— 0·09
1·30	1·45	+ 5·6	— 4·10	— 1·66	+ 0·00	+ 0	+ 0·00
1·45	2·05	+ 3·5	— 2·35	— 1·40	+ 1·40		— 0·20
2·35	3·50	+ 9·8	— 3·20	— 0·52	— 0·20		+ 0·10
3·50	4·10	+ 0·4	— 2·75	— 0·65	— 0·26		— 0·26
4·10	4·30	— 5·0	— 1·80	— 0·05	+ 0·45		+ 0.00
4·30	4·45	+ 7·7	— 0·26	— 0·20	+ 0·00		— 0·20
4·45	5·05	— 3·7	— 0·33	+ 0·00	— 0·15		+ 0·00
5·05	5·10	— 16·0	— 0·26	— 0·40	— 1·20		— 0·20
5·10	5·15	— 5·2	+ 0·00	+ 0·60	— 19·4		— 0·60

The rapid dephosphorisation at the low temperature of the first period is striking, and the reduction of rate afterwards shown, is due both to the rise of temperature in preference being given to the carbon, and also to the lowering of concentration both of phosphorus in the metal and of ferrous oxide in the slag; when most of the carbon is removed, the two elements are oxidised side by side gradually, without any serious reversion of the phosphorus. For secure dephosphorisation the slag should contain at least 40—45 per cent. of lime, and not more than 15 per cent. of silica. Ferrous oxide in the slag hastens the oxidation of the phosphorus, but is not of importance as far as the final result is concerned. The manganese, like the silicon, would be rapidly and completely removed near the beginning of the reaction, but for the reducing action of the carbon on the manganese oxide in the slag as the temperature rises. What happens afterwards depends on the balance between the reactions $MnO+C=Mn+CO$ and $FeO+Mn=Fe+MnO$, of which the first is favoured by rise of temperature, and by high concentration of manganese oxide or of lime in the slag, and the second by high concentration of ferrous oxide in the slag and of manganese in the metal. This "mobility" of the manganese is of very great importance in freeing the metal from ferrous oxide and insuring good quality in the steel. For this reason, since most of the manganese is removed with the slag in the first stage, it is necessary in the second stage to add some manganese ore so as to give the desired concentration of manganese oxide in the slag The carbon is present in such quantity in the pig iron that even at first, whilst the temperature is low, its rate of oxidation is considerable; before the end of the first stage, though the temperature has risen, the rate of oxidation of the carbon has fallen, because the concentration of ferrous oxide in the slag has fallen so low, but the rate rises again when the second stage begins, and falls off only because of the greatly lowered concentration of carbon itself and of ferrous oxide in the slag. The great variations in the sulphur are not yet satisfactorily explained; and the difficulty here is greater than with the other constituents, for we have to deal not only with the sulphur in the charge, but also with that in the gases. Detailed balance sheets of the process are given both in regard to materials and to heat; it is shown that the losses of heat due to radiation and to that carried off in the waste gases are enormous, amounting to practically 70 per cent. of the total. A comparison of the basic Bessemer and open-hearth processes shows that to produce 1 kilo. of steel the former process requires 700 calories, the latter 2200 calories. The fact that in spite of this the use of the open hearth process is continually growing shows what great technical and commercial advantages it possesses, *e.g.*, its independence of the phosphorus-content of the pig-iron, the possibility of direct reduction from the ore, and the control over the uniformity of quality of the product.—J. T. D.

Mild steel; Brittleness of —— due to nitrogen. C. E. Stromeyer. Inst. of Naval Architects; Times Eng. Suppl., Mar. 30, 1910.

Until quite recently nothing was known with regard to the effect of nitrogen in causing brittleness in steel. With reference to phosphorus, 0·060 per cent. was considered to be a reasonable upper limit, and steel plates containing more than this were expected to give trouble. This view had now to be modified. One sample which the author had tested, which was undoubtedly of very bad quality contained only 0·047 per cent. of phosphorus, but it also contained 0·0123 per cent. of nitrogen, which was more than twice as much as that contained in any of the good steels. Another sample, cut from a boiler plate which burst under the hydraulic test, contained only 0·052 per cent. of phosphorus but 0·0200 per cent. of nitrogen, or four times as much as that contained in any good steels. The author presented a table which gave the leading chemical impurities of various steels, and showed the sums of the percentages of phosphorus added to five times the percentages of nitrogen. This ratio in the relative brittleness influences, had been adopted, partly because it was the inverse ratio of the squares of the respective atomic weights of the two elements, and partly because nitrogen had ten times the effect of phosphorus in raising the tenacity of steel, an addition of 0·01 per cent. increasing the tenacity by about three tons. A safe rule was that the sum of the percentage of phosphorus *plus* five times the percentage of nitrogen, should not exceed 0·080 per cent. A further conclusion to be drawn was that no investigation into the cause of the failure of a mild steel plate could be considered complete unless both the phosphorus and nitrogen percentages had been determined. In consequence of the conclusions, the plan now adopted by the Manchester Steam Users' Association was to determine the nitrogen of any samples of steel which had failed. Some Continental angle irons intended to be used in some small portable locomotive boilers failed in the boiler shop; they contained 0·0146 per cent. of nitrogen. On cutting out portions of a damaged furnace plate, it proved to be quite brittle: the nitrogen amounted to 0·0180 per cent. Fractured steel plates from a ship being built in a Continental port, which plates had been duly tested and passed for shipbuilding, and gave good results when retested, contained 0·023 per cent. of nitrogen. These percentages were from three to five times as great as the maximum found in any of the good steels yet tested. A very natural question to ask was, When did the nitrogen get into steel, and how could it be removed when it had got there? The most natural explanation of the origin of the nitrogen would be that it was introduced by the contact of molten steel with the nitrogen of the air blasts in the blast furnaces and in the Bessemer converters. It was necessary to bear in mind that as yet it had not been possible to combine nitrogen with steel by merely heating the two together, and that the only means of effecting the combination was to heat steel in an atmosphere of ammonia. Ammonia was not introduced into Bessemer converters, but it might be present in blast furnaces if the coking of the fuel had not entirely removed the nitrogen which was in the coal, and it seemed that nitrogen when once it had entered the pig iron in the blast furnace could not be removed by subsequent heating. The suitable chemical for effecting the removal was believed to be titanium, but the addition of ferro-titanium alloy to steel, probably owing to the necessary temperature conditions being as yet unknown, had not demonstrated that this beneficial action occurred. Nevertheless a strong argument in favour of the belief that titanium could remove or reduce the percentage of nitrogen was recently brought to the author's notice by the discovery inside the now dismantled blast furnaces of the Farnley Iron Company of some crystals of titanium nitride, which were now to be seen in the Leeds Museum. It therefore seemed desirable to ascertain more definitely how titanium acted in practice: it appeared that attempts to introduce titanium by adding its ores in the blast furnace had not been a success, nor had additions of titanium ores or titanium-iron alloys to molten steel or cast iron resulted in marked improvements, and in none of these cases had the nitrogen percentage been determined. Of late, however, since the production of practically pure titanium had been effected, its addition to steel and cast iron had been attended with varying degrees of success, more particularly in removing blowholes. The author had analysed two cast steel and two cast iron samples. Unfortunately, the original charge of cast iron, contained very little nitrogen—viz., 0·0014 per cent., but even in this case the addition of 0·2 per cent. of titanium reduced it to 0·0013 per cent. Of the two cast steels the untreated one contained 0·0063 per cent., which was reduced in the other sample, to which titanium had been added, to only 0·0045 per cent. Further attempts in this direction might lead to the removal of nitrogen from Bessemer steel, and thus make it available for plates.

Cementation steel; Manufacture of ——. IV. Specific functions of gaseous and solid carburising agents in the cementation process. F. Giolitti and L. Astorri. Gaz. chim. ital., 1910, **40**, I., 1—20.

See this J., 1908, 1154; 1909, 255. In the present experiments the carburising of iron by means of mixtures of carbon monoxide and benzene vapour in different proportions, by solid carbon in presence of carbon monoxide, and by solid carbon *in vacuo* and in an atmosphere of pure nitrogen was studied. It was found that with mixtures of carbon monoxide and benzene vapour, the concentration of carbon in the outer layer of the carburised metal increased with increasing proportions of the hydrocarbon up to the point at which carbon was separated from the hydrocarbon at a greater speed than it was dissolved by γ-iron and hence was deposited on the metal. By suitable regulation of the composition of the gaseous mixture, it was possible to obtain any desired carbon content of the outer layer of the carburised metal between the minimum corresponding with that obtained with pure carbon monoxide, and the maximum corresponding with that obtained with hydrocarbons. The special effect of carbon monoxide used in conjunction with hydrocarbons or solid carbon is to render the distribution of the carbon more uniform; *i.e.*, to insure a gradual diminution of the carbon content from the outermost layer inwards, instead of abrupt changes. The experiments with solid carbon in a vacuum showed that although in the ordinary cementation process, undoubtedly gaseous agents play the chief part, yet solid carbon is capable of carburising iron provided intimate contact be obtained. The results obtained by cementation with solid carbon in presence of pure nitrogen were very similar to those obtained with pure carbon monoxide, and this subject is being further investigated. (See also Fr. Pats. 392,960 and 393,355; this J., 1909, 25, 145).—A. S.

Iron-silicon alloys; Magnetic and electrical properties of ——. C. F. Burgess and J. Aston. Met. and Chem. Eng., 1910, **8**, 131—133.

Barrett and Brown showed in 1901 that certain iron alloys made by Hadfield, containing $2\frac{1}{4}$ per cent. of aluminium or $2\frac{1}{2}$ per cent. of silicon, had magnetic permeabilities exceeding that of pure iron. The authors have shown that similar results are obtained with irons containing 2 per cent. of tin or 4 per cent. of arsenic. The improvement in the magnetic qualities appears to be due to some change in the physical structure of the iron rather than to a chemical effect. Annealing at such a temperature as will remove the cooling and forging strains improves the entire magnetisation curve of pure iron, while a high temperature annealing deteriorates the quality with high and improves the permeability with low magnetising forces. The authors have investigated the magnetic properties of a number of iron-silicon alloys containing from 0·2 to 4·6 per cent. of silicon. The bars were compared with a bar of electrolytic iron of high purity. In the unannealed condition all these bars fall below the standard bar in quality, the best results being obtained with the irons of lowest silicon content. Annealing at 675° C. improved the results; the bar containing 0·613 per cent. of silicon being very nearly equal to the standard bar. Annealing at 1000° C. produced a falling off in permeability of the bars of lowest silicon content, but in the bars of highest silicon content (silicon 2·83, 3·33 and 4·66 per cent.), there was a considerable improvement in permeability with low magnetising forces and little change in the higher ranges. The bar containing 4·66 per cent. of silicon had a very high permeability below $H=10$. Quenching at 900° C. resulted in deterioration of quality at the lower range and but little change in the higher range of magnetising forces. The improvement in these bars is not so marked as in commercial samples and it seems that the effect of silicon is more pronounced in the presence of certain impurities or after a certain heat treatment. Silicon steels have a high electrical resistance which is of great advantage in preventing eddy currents. With an addition of silicon of 4·66 per cent., the alloy has a minimum hysteresis loss, and an electrical resistance more than five times that of the electrolytic standard.
—J. W. H.

Nickel in nickel-steel; Gravimetric methods for the determination of ——. E. L. Rhead. Analyst, 1910, **35**, 97—103.

An examination of the various methods available for the gravimetric determination of nickel showed that (1) precipitation of the metal as the hydroxide is unsatisfactory in the presence of tartaric and other organic acids, potassium cyanide and ammonium salts; (2) precipitation with bromine and sodium hydroxide is interfered with by ammonium salts; (3) precipitation as sulphide, with subsequent conversion of the precipitate into oxide or sulphate, gives satisfactory results; (4) precipitation by means of ferricyanide or as the triple nitrite of potassium, calcium, and nickel is untrustworthy; (5) precipitation by dimethylglyoxime (this J., 1907, 643) yields excellent results; the scarlet precipitate obtained is copious and is readily filtered and washed; (6) chromic acid completely prevents the electrolytic deposition of nickel, and chlorides have a similar effect, but to a less extent; complete deposition of the metal takes place in sulphate solutions and in ammoniacal solutions according to the method of Fresenius and Bergmann. As methods for the determination of nickel in steel are dependent on the separation of the iron with the production of a solution from which the nickel can be recovered, the author has also investigated various methods which will effect this separation. The acetate method and precipitation with sodium hydroxide in the presence of potassium cyanide gave good results, as did extraction of the bulk of the iron with ether from a hydrochloric acid solution of the steel, the remainder of the iron being then separated by means of sodium hydroxide and potassium cyanide. Separation of the iron by means of ammonia, either alone or in the presence of potassium cyanide, yielded unsatisfactory results.—W. P. S.

Iron-copper alloys; Magnetic and electrical properties of ——. C. F. Burgess and J. Aston. Metall. and Chem. Eng., 1910. **8**, 79—80.

The alloys were prepared from electrolytic iron and copper of a high degree of purity (see this J., 1910, 28). It was found that the magnetic quality of the iron deteriorated almost in proportion to the amount of copper added, but this deterioration was practically negligible in the case of such small percentages of copper as are ordinarily found in commercial products. The alloys containing from 1—2 per cent. of copper, which, as stated previously (*loc. cit.*), possess mechanical properties comparable with those of iron-nickel alloys containing 3—4 per cent. of nickel, resemble nickel steels with 1·93 and 7·05 per cent. of nickel, in their magnetic properties, possessing permeabilities sufficiently high for commercial purposes. With regard to electrical conductivity, the resistance rose with increase of copper content to a maximum of 1·41 times that of the electrolytic iron at 1·51 per cent. of copper; between 2 and 6 per cent. of copper the resistance was only slightly greater than that of the iron, but rose again to 1·31 times that of the latter at 7 per cent. of copper.—A. S.

Cyanide solutions; Precipitation of gold and silver from —— *by various forms of carbon and cellulose.* A. J. Clark and W. J. Sharwood. J. Chem., Met., and Min. Soc., S. Africa, 1910, **10**, 234—238.

A series of laboratory experiments was made to ascertain the relative activity of certain precipitants. 5 grms. of a precipitant were agitated with 300 c.c. of a cyanide solution assaying 2·7 dollars per ton, and the solution filtered twice through the same filter. It was found that zinc dust precipitated 99·3 per cent. of the contained gold, pine charcoal, 27·0; coke, 19·6; bituminous coal, 7·0; calcium carbide, 5·0; and Dixons flake graphite, nil. The coal, coke, and charcoal were of 40-mesh size. In a modified experiment, using about 4 times as much precipitant as before, the graphite failed to precipitate any gold, though under similar circumstances, the amount precipitated by coal was raised to 22 per cent. The author considers that the re-precipitation occurring in the case of "graphitic" ores is probably caused by a portion of the carbon being present in non-graphitic form, such as hydrocarbons. Details are also given of the "clean up" of a wooden cyanide tank of 40 ft. diam., the filter cloth, cocoanut matting, and wooden false bottom of which were burnt, and the total gold values obtained. The filter cloth, consisting of 12,000 sq. ft. of 8 oz. "duck," contained only 5 cents of gold, the entire cocoanut matting filter, 46 cents; and the 75 cb. ft. of wooden slats, 16·6 dollars. The cloth had been in use 8 months, and the matting and false bottom for 12 months. The staves from two similar tanks, that had been in use for 3 or 4 years, were assayed and found to contain only a trace and 47 cents per ton respectively. A bibliography on charcoal precipitation is appended.—F. R.

Copper ores; Electric smelting of —— *and of the intermediate products of the copper furnace. Part II. Copper refining.* G. von Rauschenplat. Metallurgie, 1910, **7**, 151—155.

In continuation of the experiments on the electric smelting of copper ores (see this J., 1910, 356), a series of cascade electric furnaces of a deep form has been designed containing molten copper and ferric oxides. A mixture of 50 grms. of copper oxide and 100 grms. of ferric oxide, corresponding to the formula, CuO,Fe_2O_3, melted between 1450° C. and 1500° C. and did not decompose. A melt of the composition Cu_2O,Fe_2O_3, decomposed into metallic copper and the same copper ferrite. Raw copper containing 0·61 per cent. of iron, 0·08 of sulphur and 1·81 of arsenic was melted and poured through the molten copper ferrite from one furnace to another through the series, and yielded a refined copper containing 0·01 per cent. of iron, 0·016 of sulphur and 1·67 of arsenic. Experiments were also carried out with molten copper silicate, a refined copper containing 0·007 per cent. of iron, 0·06 of lead, 0·61 of sulphur and 3·62 of arsenic being obtained from a raw copper containing 0·21 per cent. of iron, 3·46 of lead, 0·92 of sulphur, and 3·80 of arsenic.—A. H. C.

Bronzes; Special ——. *I. Lead-bronzes.* F. Giolitti and M. Marantonio. Gaz. chim. ital., 1910, **40**, I., 51—77.

Some preliminary experiments with binary alloys of copper and lead, showed that these two metals form no definite chemical compound, are not completely miscible in the fused state, and are immiscible in the solid state. A study was then made of 26 ternary alloys of copper, lead, and tin, containing up to 20 per cent. of lead and up to 24 per cent. of tin, and the constitution and microstructure of these alloys are discussed. The authors also determined the hardness of the alloys by the Brinell method, using a ball of 10 mm. diam. under a pressure of 500 kilos. The results are shown in the following table:—

Composition of alloy.		Hardness.	Composition of alloy.		Hardness.
Tin.	Lead.		Tin.	Lead.	
per cent.	per cent.		per cent.	per cent.	
4·5	0	49	4	6·9	46
8·8	0	63	8	6·9	59
16·3	0	77	13·9	7·0	80
25·9	0	230	2·4	10·6	39
0	10	27·2	8	10·4	48
0	20	23·8	13·9	10·4	86
0	40	13·8	4·1	14·12	39
4·1	0·95	57	9·2	15·3	57
8·1	1·1	67	19·8	5·0	130
14·1	1·15	83	20·4	8·8	130
3·9	3	46	21·5	8·05	150
7·8	3·2	61	11·0	5·0	70
13·9	3·1	83	17	5·0	109
3·99	5·0	46	5	20	44
8·0	5·0	61	24	5	182
13·7	5·1	93	12	20	70

—A. S.

Furnace gases; Sprague process for treating ——. C. B. Sprague. Eng. and Min. J., 1910, **89**, 519—520.

The method of filtration through woollen bags has proved successful for the removal of fume from the gases of lead blast-furnaces, which are free from sulphur trioxide, but fails with the gases from copper blast-furnaces, reverberatory furnaces, pot-roasters, and converters, the sulphur trioxide present rapidly destroying the fabric. The gases mentioned, however, can be successfully filtered if the sulphur trioxide be first neutralised with zinc oxide, lime, or magnesia. If only relatively small quantities of sulphur trioxide are present, neutralisation is effected by mean of zinc oxide fume produced in an auxiliary furnace from suitable zinc ores. In the case of relatively large quantities of sulphur trioxide, the bulk is neutralised by means of very finely-divided lime or magnesia introduced into the gases, but a certain quantity of zinc

oxide fume is also used, in order to effect complete neutralisation, which cannot be attained with finely-divided solid materials fed mechanically into the gases. The neutralised gases are cooled to below 100° C. and then passed to the bag-house (see this J., 1909, 1139). The process has been in successful operation since August, 1908, at the lead smeltery of the U.S. Smelting, Refining and Mining Co., at Midvale, Utah, where the plant includes 5 or 6 blast-furnaces, 18 pot roasters, 6 hand roasters for matte, a small reverberatory furnace for smelting matte, and an arsenic refining plant. Moreover, on account of the results obtained, permission has recently been granted to restart the copper-smelting plant at the same place, which plant was shut down early in 1908 in consequence of the nuisance caused by the smelter-fumes.
—A. S.

Blast-furnace slags; Blue iron ——. A. Harpf, M. Langer, and H. Fleissner. Oesterr. Z. Berg- u. Hüttenw., 1909, **57**, 709—715, 727—731, 746—751, 762—766. Chem. Zentr., 1910, **1**, 967—968

THE conclusion arrived at by the authors after a lengthy investigation, is that the blue colour of blast-furnace slags is in most cases, probably due to the presence of ultramarine. In support of this view, it is pointed out that all the constituents necessary for the production of ultramarine, *viz.*, silica, alumina, sulphur, and alkalis or lime, are present in the slags, and that during cooling the latter pass through the temperature range most favourable to the production of ultramarine. The blue colour is always found in the partially or wholly devitrified portions of the slag, and in the inner parts of the mass, that is, in the parts which have cooled most slowly. The blue slags mostly behave towards hydrochloric acid in the same manner as ultramarine does, being decomposed, with decolorisation, separation of silica, and evolution of hydrogen sulphide. In some cases, however, the blue portions are only slightly attacked by hydrochloric acid, probably owing to the coloured substance being protected by a coating of insoluble silicates.
—A. S.

Firebricks in blast-heating stoves; Thermal conductivity of ——. Osann. Tonind.-Zeit., 1909, **33**, 1405—1409, 1418—1424.

THE specific thermal conductivity of a substance is defined as the number of calories, which flow in 1 second through a cube of 1 cm. side, the difference of temperature between the two heat-conveying sides of the cube being 1° C., and the four remaining sides being regarded as entirely heat-insulated. When heat passes from a material having the specific conductivity, K_1, to another material having the specific conductivity, K_2, a third factor has to be considered, namely the specific conductivity of transfer at the junction of the two materials, K^a, and the following relationship then holds good :—

$$W = \frac{(t_1 - t_2)q}{\frac{L_1}{K_1} + \frac{1}{K^a} + \frac{L_2}{K_2}},$$

where W is the number of heat units passing in 1 second through the lengths L_1 and L_2, of the two materials respectively, q being their common cross section, and t_1 and t_2 the temperatures at their two extremities. When heat passes from a gaseous substance in motion to a solid substance, the specific conductivity of transfer increases greatly with increasing velocity of the gas, and it has been found by experience that this increase is directly proportional to $(2+\sqrt{v})$, where v is the velocity of the gas. The relations which exist are then expressed by the equations,

$$K_1 = \frac{W.\,L}{(t_1 - t_2)q}, \quad \text{and}$$

$$K^a = \frac{W}{(2+\sqrt{v})\left[(t_1 - t_2)q - \frac{WL_1}{K_1}\right]}.$$

Applying these formulæ to the practical case of the heat communicated to the firebricks of a Cowper stove by blast-furnace gases, the temperatures of the gases in the stove and of the brick walls (at points representing various thicknesses of brick, through which heat is being conducted) may be determined by means of suitable recording pyrometers. The constants K_1 and K^a can then be evaluated if W, the quantity of heat flowing through 1 sq. cm. of the inner stove surface in 1 second, is known. This quantity is identical with the amount of heat lost by radiation and conduction by 1 sq. cm. of the outer walls of the stove in 1 second, and is determined by difference. Knowing the composition of the furnace gases entering the stove, the theoretical temperature of combustion can be calculated. The difference between this temperature and the average blast temperature found by experiment, in conjunction with the knowledge of the composition of the furnace gases, the composition of the products of combustion, and their specific heats at the temperature of the blast, give the required data for calculating the loss of heat due to radiation and conduction, and thence W in the equation.—O. R.

Standardisation of permanganate solutions for iron titrations by Reinhardt's method. Kinder. *See* XXIII.

Iodometric determination of phosphoric acid. Artmann. *See* XXIII.

PATENTS.

Ores; Concentration of ——. Minerals Separation Ltd., London. From A. H. Higgins, Broken Hill, Australia. Eng. Pat. 26,852, Dec. 10, 1908.

THE powdered ore is mixed with slightly acidified water (*e.g.* 0·2—0·5 per cent. sulphuric acid) containing in solution a very small quantity of an aromatic hydroxy-compound (*e.g.* 0·01—0·002 per cent. of phenol). The mixture is then agitated in such a way as to form a froth or scum carrying a large proportion of metallic sulphides, which floats on the surface of the water and is afterwards separated. The mixture may, if necessary, be heated during agitation.—O. F. H.

Ore concentration [*by flotation*]; *Apparatus for* ——. T. J. Hoover, London. Eng. Pat. 4911, Feb. 27, 1909.

THE apparatus consists of the combination of an agitator in which the liquid, containing the ore in suspension, has air beaten into it, and a spitzkasten leading directly from it, having a baffle-plate near the inlet, so arranged that the stream of ore particles and air bubbles are led towards the surface of the water in the spitzkasten and thus form an efficient flotation froth.—F. R.

Briquetting copper ore concentrates; Agglomerating or ——, *preparatory for smelting.* T. Rouse, London. Eng. Pat. 4914, Feb. 27, 1909.

COPPER concentrates, contaning about one-third of their bulk of water, are mixed with an amount of coal or coke, not greater than that required for smelting, and the mass mixed with an equal measure of a weak solution of water-glass (sodium silicate) made with water containing ferric oxide, and the plastic mass briquetted. If the concentrates are dry, the addition of fuel may be omitted.
—F. R.

Copper and other metals; Method of separating —— *from liquors obtained in wet metallurgical processes.* J. H. Thwaites and S. J. Ralph, Peterborough. Eng. Pat. 4167, Feb. 20, 1909.

THE greater part of the copper is precipitated by means of a sulphite of an alkaline-earth metal such as calcium or magnesium. The copper remaining in the liquor may be separated by precipitation on scrap iron or by means of zinc sulphite, and the cobalt and iron then precipitated by means of an alkali sulphite or sulphide.
—O. F. H.

Lead and zinc from compounds containing those metals, Method of recovering ——. H. W. Hemingway, Stratford, Essex. Eng. Pat. 4471, Feb. 23, 1909.

COMPOUNDS containing lead and zinc oxides are treated with lead or zinc acetate or with acetic acid, so that the lead goes into solution as subacetate, whilst the zinc is precipitated. From the subacetate solution the lead is subsequently precipitated as arsenate, by arsenic acid, with the formation of acetic acid or normal lead acetate, which may be used for treating a fresh charge. —F. R.

Gases from cupolas and like furnaces for melting metals; Apparatus for extracting sulphur dioxide and other ——. S. Osborn and D. Carnegie, Sheffield. Eng. Pat. 6461, Mar. 18, 1909.

The apparatus consists of a spark arrester, or hood, fitted to the top of the cupola, and leading into an arched flue having a vertical "downcomer" terminating in a closed water tank having gas and water outlets. A water spray is fixed in the "downcomer" to dissolve the sulphur dioxide or other gases, and if desired, the level of the water in the tank can be adjusted to cause the gases to pass through, instead of over the surface of the water. Two or more cupolas may be connected up to one gas extractor.—F. R.

Metals or metalliferous substances; Process for separating volatile from non-volatile ——. T. Huntington, London. Eng. Pat. 12,198, May 24, 1909.

The ores, such as sulphide ores of zinc, are moistened with water, and charged into a closed converter with coke, coal, sulphides or other suitable reducing agent. The top of the charge is ignited, and a blast of air or steam passed through the mass in a downward direction. The volatile metals are driven off and subsequently recovered as oxides.—O. F. H.

[Volatile] metals; Process and apparatus for the extraction of ——. F. C. W. Timm. Fr. Pat. 406,434, Aug. 24, 1909.

The material is heated in a reverberatory furnace and the volatilised metal passed through a column of incandescent coke. When the coke has become cooled by the reduction of the metal, the passage of gases from the reverberatory furnace is suspended and the coke reheated by means of an air blast. The separate melting and reducing furnaces may be arranged in series and the gas produced during the reheating of the coke, used for firing the reverberatory furnaces.—F. R.

Materials, [metals and fats]; Process of recovering —— from waste. W. H. Allen, Detroit, Mich. U.S. Pat. 944,533, Dec. 28, 1909.

The accumulated greasy waste from the buffing and polishing of brass and the like, which contains a considerable percentage of metal and fats, is placed in a tank, containing a solution of alkali, and agitated by means of steam or compressed air. The heavy particles, consisting of metal and abrasive, sink, and the cotton and textile fibres rise to the surface and each are separately removed. The latter are subsequently treated with acid and an oxidising agent to recover any oleates, stearates, or palmitates of the non-alkali metals.—F. R.

Metal; Compound —— and process of making the same. W. M. Page, Philadelphia, Pa., Assignor to Duplex Metals Co., New York. U.S. Pat. 919,837, Feb. 22, 1910.

The clean metallic surface of an iron object is heated and brought into contact with the vapours of a metal of low melting point, the reaction being carried out in a closed chamber into which the fumes are passed from a species of retort. The object is subsequently plated by a momentary immersion in a molten bath of copper, brass, or any high-melting non-ferrous metal.—C. A. W.

Steel; Composition for softening ——. G. F. Diez, New York. U.S. Pat. 949,980, Feb. 22, 1910.

The composition comprises an alkaline-earth base, a soluble caustic alkali, and iron, the whole, if desired, being formed into a paste with water. A mixture of calcined shells, caustic potash, and iron may be employed. —C. A. W.

Steel; Composition for converting iron into —— G. F. Diez, New York. U.S. Pat. 950,095, Feb. 22, 1910.

The composition consists of a mixture of charcoal powder, 8 parts; steel filings, 1¾ parts; and potassium ferrocyanide, ¼ part, the whole being formed into a paste with a sufficient quantity of oil. The iron articles to be converted into steel are embedded in this mixture and heated.—C. A. W.

Cast iron; Process of manufacture of pure —— by synthesis in the electric furnace. C. A. Keller. Fr. Pat. 405,277, Nov. 10, 1908.

Scrap iron or steel, with or without ordinary cast iron scrap, is melted in an electric furnace in the presence of carbon. The basic lime slag used may be either of a non-oxidising character for the purpose of desulphurisation, or an oxidising one for the purpose of dephosphorisation. In the latter case the slag is poured off after dephosphorisation, and the metal is then recarburised by the addition of carbon in the presence of a non-oxidising lime slag.—O. F. H.

Alloy; A new —— and its application to the reduction of metallic oxides, as in the refining of steel and other metals. Soc. des Carbures Métalliques. Fr. Pat. 405,820, Aug. 7, 1909.

The alloy is made in the electric furnace and has the following composition; about 55 per cent. of silicon, 28 per cent. of aluminium and 17 per cent. of iron. The alloy is almost free from carbon, and on oxidation yields an easily fusible silicate of the formula, $Al_2O_3,4SiO_2$. By treating the natural double silicates of aluminium and iron containing titanic acid in the electric furnace in the presence of carbon, a similar alloy containing 2·7 per cent. of titanium is produced.—O. F. H.

Oolitic iron ores and the like; Process for the enrichment of ——. G. Gröndal. Fr. Pat. 406,441, Aug. 24, 1909

Iron ores, intimately mixed with gangue, such as oolitic iron ores and brown hæmatite, are crushed and the cementing material, consisting mainly of hydrated iron oxide, separated by water in the form of slimes. The coarse residue is then treated to convert the remaining iron oxide into magnetic oxide (Fe_3O_4), which is separated magnetically. The slimes are subsequently mixed with the magnetic concentrates and the material briquetted.—F. R.

Metals; Apparatus for heating and separating ——. J. H. Reid, Newark, N.J. U.S. Pat. 950,028, Feb. 22, 1910.

The apparatus comprises a vessel, cylindrical in form but provided internally with sloping walls, so that the bottom forms the apex of an inverted cone. Tap-holes are arranged at different levels, including one at the bottom, and means are provided for rotating the vessel about a vertical axis, and for exhausting the interior during rotation. During the movement, the upper portion only of the charge is kept in a molten condition by means of electrodes placed above the upper tap-hole, sliding contacts being provided for conveying the current to the vessel.—C. A. W.

Electroplating apparatus. N. S. Emery and B. W. Gilchrist, Woodhaven, N.Y. U.S. Pat. 950,068, Feb. 22, 1910.

A shaft, mounted horizontally at one side of the electrolytic tank, is provided with a number of worm gears mounted loosely, and with clutch devices, moving horizontally, which are adapted to engage the gears. A number of drums are mounted transversely on the top of the tank on shafts, which are also provided with worm gear wheels, adapted to operate in connection with the worm gears. The drums can be removed from the tank, each being composed of end members of insulating material, and a framework of metal covered with perforated, insulating material.—B. N.

Metallic films or flakes; Apparatus for making —— [electrolytically]. T. A. Edison, Orange, N.J. U.S. Pat. 950,227, Feb. 22, 1910.

THE cathode is arranged so as to be moved successively into an electrolytic bath in which a readily-soluble metal film is to be plated, and into a second in which a permanent film is deposited. The cathode is provided with a support, movable horizontally, and with means for lowering and raising the support, so as to immerse the cathode and raise it from the bath. Spring-pressed devices are provided for locking the support in the successive positions corresponding to the two tanks. The cathode is rotated, during the whole period of immersion, by means of an electric motor. Two circuits, of high and low tension respectively, are provided, permanent connections being made between the field of the motor and the high-tension circuit, and between the low-tension circuit and the cathode; a switch connects the motor armature with either of the circuits. —B. N.

Tin; Process of removing —— from scrap. C. J. Reed, Philadelphia, Pa. U.S. Pat. 950,115, Feb. 22, 1910.

THE mixture of metals is heated to a temperature about the melting point of one of them and agitated in a revolving drum with a pulverised foreign body, such as magnetite, having a specific gravity greater than four. One of the metals, in this case tin, is subsequently removed as a powder by means of a current of air and, finally, the magnetite is separated from the unpowdered residue.—C. A. W.

Ores and metals; Process of treating ——. J. H. Reid, Newark, N.J. U.S. Pat. 950,116, Feb. 22, 1910.

THE ore is reduced electrically, the mixture being fed slowly into a cylindrical furnace through a hopper at the top. The bottom of the furnace at the zone of reduction, is conical in form, and contains an aperture at the apex through which the molten metal falls into a receptacle below. As it falls, the thin stream of metal is brought into contact with a gaseous reducing agent, and at the same time it is subjected to a sufficient suction in order to free it from the gaseous oxides of carbon.—C. A. W.

Metallic oxide ores; Process of reducing ——. H. E. T. Haultain, Toronto, Ontario. U.S. Pat. 950,595, March 1, 1910.

FINELY divided metallic oxide ore is showered through an aperture in the roof of a closed furnace chamber, without obstruction, into an electrically heated bath of the molten material. A highly heated atmosphere of reducing gas is maintained in the zone of the falling particles, the surplus gas being burnt near the walls and roof of the furnace chamber, which thereby becomes strongly heated.—F. R.

Sintering ore; Process for ——. G. G. Vivian, Tintic, Utah, Assignor to J. Knight, Provo, Utah. U.S. Pat. 950,798, March 1, 1910.

THE ore is spread in a thin layer on the hearth of a reverberatory furnace and gradually heated. When it has become sufficiently sticky, but before the "heat elements" in the ore are consumed, the mass is worked up into irregular lumps, which are then withdrawn from the furnace.—F. R.

Zinc; Electric furnace for the continuous extraction of —— from its ores. E. F. Côte and P. R. Pierron. Third Addition, dated Nov. 9, 1908, Fr. Pat. 385,018, Feb. 22, 1907 (this J., 1908, 342, 632, and 864).

ZINC blende, containing lead, is reduced by iron in an electric furnace, which consists of a conducting crucible forming one electrode, the other being of carbon, descending vertically in opposition to a protuberance in the centre of the crucible. The charge is progressively heated, first by indirect resistance, then by direct resistance, and finally by arc, so that the lead is first reduced and sinks to the bottom, then the zinc is volatilised, and the slag rendered fluid. The volatilised zinc passes up through a column of red hot coke where it is condensed.—F. R.

Zinc; Process for the utilisation of spongy —— obtained electrolytically. E. Sanna. Ger. Pat. 217,632, Oct. 6, 1908.

THE spongy zinc is washed in a solution of sodium nitrate, and then while still moist is heated to 100°—150° C. and simultaneously exposed to a pressure of about 1000 kilos. per sq. cm. It is stated that dense metallic zinc is readily obtained in this way.—A. S.

Metals or other materials; Process for the heating, fusion, refining or decomposition of ——. Soc. Anon. des Hauts Fourneaux et Forges de Dudelange. Fr. Pat. 405,911, Aug. 11, 1909.

THE material is first smelted with charcoal, and the molten metal transferred to the highly heated hearth of an electric furnace, which is provided with an air blast and a flue to conduct away the gaseous products of combustion. The metal is then subjected to the action of powdered charcoal, which is introduced by means of the air blast. —F. R.

Metals; Process and apparatus for increasing the density of molten ——. W. B. Bary. Fr. Pat. 406,319, Aug. 18, 1909.

THE process, called the "process Bary," consists in casting the metal into moulds, arranged radially on a rapidly revolving horizontal table, whereby the metal is compressed by centrifugal force, towards the outer ends of the moulds. The rotation of the table is continued until the metal has solidified. The table is mounted on a central pivot, and the circumference supported on ball bearings. The molten metal is poured into a central chamber which has a number of lateral openings, corresponding with the inner ends of the radially disposed moulds.—F. R.

Colloidal mercury; Process for the preparation of ——. I. Weinmayr. Ger. Pat. 217,724, June 14, 1908.

A COLLOIDAL solution of gold, prepared by electrical disintegration of the metal, and containing about 1 part of the metal per million, is mixed with an equal quantity of a solution of a mercuric salt of the same concentration, containing 1 part of hydrogen peroxide per 1000. Colloidal solutions of mercury obtained in this way gradually lose their activity, and hence should be freshly prepared when required.—A. S.

Iron or other ores; Process for reducing —— and refining the metal obtained. J. H. Reid, Newark, N.J., U.S.A. Eng. Pat. 6821, March 22, 1909.

SEE U.S. Pat. 920,391 of 1909; this J., 1909, 609.—T. F. B.

Steel; Process for refining molten ——. R. H. Wolff. Fr. Pat. 406,391, Aug. 23, 1909. Under Int. Conv., April 21, 1909.

SEE U.S. Pat. 946,302 of 1910; this J., 1910, 219.—T. F. B.

Zinc obtained electrolytically; Process for utilising the spongy ——. E. Sanna, Iugurtosu, Italy. Eng. Pat. 24,631, Oct. 26, 1909.

SEE Ger. Pat. 217,632 of 1909; preceding.—T. F. B.

Metallic paper or the like; Production of ——. S.O. Cowper-Coles, London. U.S. Pat. 951,365, March 8, 1910.

SEE Eng. Pat. 4984 of 1907; this J., 1908, 342.—T. F. B.

Electroplating-barrel apparatus. T. A. Smith and T. Deakin Walsall. U.S. Pat. 951,662, March 8, 1910.

See Eng. Pat. 21,687 of 1908; this J., 1909, 1207.—T. F. B.

Cleaning metal objects to be galvanised or nickel-plated; Electrochemical process for ——. H. Vollert. Fr. Pat. 405,878, Aug. 10, 1909.

See Eng. Pat. 27,034 of 1908; this J., 1910, 30.—T. F. B.

Brass dust. A. Sang. Fr. Pat. 406,209, Aug. 18, 1909.

See U.S. Pat. 946,738 of 1910; this J., 1910, 283.—T. F. B.

Extracting pure stannic chloride from tinware. Fr. Pat. 405,851. *See* VII.

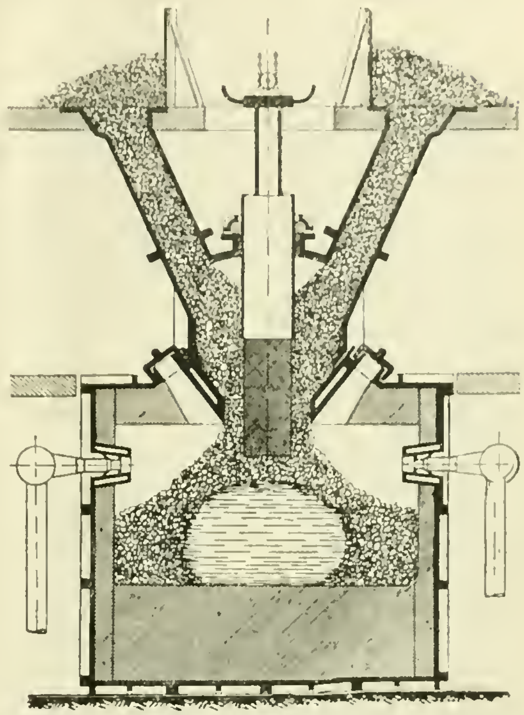
XI.—ELECTRO-CHEMISTRY.

Electrodes; Properties and behaviour of [electric] furnace ——. C. Hering. Met. and Chem. Eng., 1910, **8**, 128—130.

The author discusses the energy losses and flow of heat in the electrodes of electric furnaces. The rate of flow of heat from the furnace through the electrode is modified by the development of heat in the electrode by the current. The rate of production of this heat will depend on the local resistivity, and the "centre of gravity" of this heat will depend on the change of resistance of the material of the electrode with its rise in temperature. A rising resistivity will diminish the loss, by bringing the "centre of gravity" nearer the hot end of the electrode. On the other hand a falling thermal conductivity is a desirable feature, for if the thermal conductivity falls as the temperature rises, the heat gradient will be steeper in the hot half of the electrode than it would be with an electrode of constant thermal conductivity. Up to 1000° C. and probably above that temperature, carbon has a falling electrical resistivity and a rising thermal conductivity—both undesirable features. Iron, on the contrary, has a rising electrical resistivity and a falling thermal conductivity. Graphite, has, to a lesser degree than carbon, a falling electrical resistivity, but its thermal conductivity falls quite rapidly with a rise in temperature, much more rapidly than is the case with iron, so that graphite like iron and unlike carbon, tends to concentrate the heat towards the hot end of the electrode. The leakage of heat from the electrode to the furnace walls will also vary with the material of the electrode. The author's investigations show that from these points of view, carbon is the worst material for electrodes, while copper, if it could be used, is by far the best. Two quantities, *viz.*, "electrode voltage" and "specific section," are proposed by the author as giving rational physical quantities from which calculations relating to the sizes of electrodes and their energy losses may readily be made.—J. W. H

Electric furnaces; Large ——. [*for calcium carbide*]. R. Taussig. Trans. Faraday Soc., 1910, **5**, 254—257.

The paper is a review of improvements in high-power furnaces chiefly those due to Helfenstein. The highest power consumption at present at a built-up electrode is from 2500—3000 kilowatts, which in a double three-phase furnace with six electrodes in the same hearth means 15,000—18,000 kilowatts (20,000—24,000 h.-p.) and the production of 80—110 tons of compact carbide per hour. In open furnaces there are great disadvantages due to heat and smoke produced by combustion and the difficulty of charging raw materials. With a closed furnace and continuous mechanical charging, the concentration of power at the electrode is assisted, the smoke nuisance may be avoided, and the large quantity of valuable carbon monoxide (easily purified, if necessary, from water and carbon dioxide) becomes available for preheating the charge or for other purposes.



The figure shows the section of a furnace with mechanical feed, mixing chamber (5000—7000 kilos. capacity) and nozzles at the side for blowing or sucking in the air required for the combustion of the gases in the corner space with a view to preheating the charge.—W. H. P.

Resistance furnaces with electrically heated nickel wire. R. Lorenz and G. von Hevesy. Z. Elektrochem., 1910, **16**, 185—190.

The authors show that the principal cause of the short life of electric resistance furnaces using nickel wire as resistance, is the brittleness of the metal caused by the formation of oxide. The oxide is not only formed on the surface, but also fills the crevices (penetrating to the interior of the wire) which are caused by the evolution of the gases originally enclosed in the metal. If the furnace is not heated above 700° C., it has quite a long life, but for the production of higher temperatures (up to 1200° C.) it is necessary to exclude air. This is accomplished by packing the spiral tightly with asbestos and by surrounding it with a tube of non-porous porcelain. The wire itself is always covered with an asbestos sheathing, and its disintegration can be detected by the changes which take place in its resistance. The authors describe in detail the various forms of furnace they have constructed on these lines.—W. H. P.

Nitrobenzene; Electrical conductivity of halogens in ——. L. Bruner. Z. Elektrochem., 1910, **16**, 204—205.

Using perfectly dry materials it is found that the nitrobenzene solutions of the halogens are non-conductors, while in slightly moist solutions bromine and iodine conduct, while chlorine does not. On electrolysis of the bromine and iodine solutions with bright silver electrodes, it was found that one equivalent of halogen was liberated by 96,540 coulombs at the anode, while reduction took place at the cathode. The passage of the current of electricity is considered to be mainly due to the motion of complex halogen ions.—W. H. P.

Technical alkali chloride electrolysis. Taussig. *See* VII.

Switch and transformer oils. Digby and Mellis. *See* IIA.

PATENTS.

Furnace ; Electric ——. A. Helfenstein, Vienna. U.S. Pat. 949,895, Feb 22, 1910.

A DOME is mounted over the furnace chamber, in which is suspended the carbon electrodes. The latter are inserted and removed through a slot in the dome, and means are provided for closing the slot when the electrodes have been introduced. The furnace and dome are furnished with supply pipes for the charge, and with arrangements for preventing the escape of gases, so that the latter may be utilised. The lower portion of the dome is contracted into the form of a cone, which is water-cooled, and a means of access to the pit of the furnace is provided.—B. N.

Furnaces ; Electric ——. J. Thomson, New York, Assignor to Imbert Process Co., New York. U.S. Pats. 950,877, 950,879, 950,880, 950,881, and 950,882, March 1, 1910.

1) THE furnace is provided with a resister of constant length, consisting of wedge-shaped elements alternately reversed, so as to be automatically transversely displaceable with respect to each other under changes of temperature. The resister thus maintains a practically constant resistance, irrespective of expansion and contraction, any change of pressure of the blocks being compensated for by the relative movement between the elements. (2) The resister comprises a number of grooved carbon plates, which are arranged to interlock with each other. (3) The cylindrical revolving furnace is provided with a resister comprising a number of concentric grooved discs or plates, these being suspended in the furnace by the interlocking of the elements. (4) The furnace is provided with a resister composed of a number of irregular carbon blocks, shaped so as to form, when assembled, a flat arch. The arch is supported from the end members, which abut against wedge-shaped conducting pieces, the latter being movable to compensate for thermal changes. (5) The resister is curved into the form of an arch, and comprises a number of blocks, the lower ends of which are narrower than the upper, so that, normally, the opposing faces at the narrower ends are out of contact with each other. By thermal deformation of the resister, the area of contact between the blocks increases. The ends of the arch are supported upon conducting pieces, which rest upon adjustable refractory members, extending to the exterior of the furnace.—B. N.

Furnace ; Electric —— and method of protecting resisters of electric furnaces. F. A. J. Fitz Gerald, Niagara Falls, N.Y., Assignor to Imbert Process Co., New York. U.S. Pats. 950,904 and 950,905, March 1, 1910.

(1) THE furnace is provided with a resister, as described in the abstract following (U.S. Pat. 951,086), directly above the melting chamber, and separated from the latter by an interposed plate of refractory material. The gaseous fuel is first passed around the resister, and then into and around the melting chamber. (2) The resister is protected from oxidising or other active gases, by introducing an inert gas into the melting chamber and around the resister "automatically according to the pressure in the melting chamber."—B. N.

Furnaces ; Electric ——. J. Thomson, New York, and F. A. J. Fitz Gerald, Niagara Falls, New York, Assignors to Imbert Process Co., New York. U.S. Pats. 950,878 and 951,086, March 1, 1910.

(1) THE furnace is a revolving cylindrical one, with end portions and a segmental casing, the segments of the latter being united together and to the ends. The hearth of the furnace is formed in four separable quadrants, each extending the entire length of the furnace, and curved to a radius about equal to the diameter of the furnace chamber, the arrangement for fastening the segments and ends being adapted to place the hearth-forming means under initial tension. The furnace is provided with a cylindrical central core containing the carbon elements forming the resister. (2) The furnace is provided with terminals, the faces of which are bevelled at an angle of about 30° to the vertical, and a number of carbon rods are loosely stacked upon each other between the bevelled faces to constitute a resister, through which the current is passed.—B. N.

Furnace ; Electric —— and method for operating same. J. F. Shawhan, Dayton, Ohio. U.S. Pat. 951,458, March 8, 1910.

THE furnace is provided with a chamber adapted to receive a charge, and a tuyère-sleeve in the furnace wall, with a set of electrodes so disposed that an arc is formed in the tuyère-sleeve outside the chamber. A blast of air is directed through the tuyère, so that it passes over the radiating surfaces of the latter, for directing the arc and the heated blast into the chamber. —B. N.

Battery ; Electric ——. W. Morrison, Chicago, Ill. U.S. Pat. 950,861, March 1, 1910.

THE battery is provided with a negative element, having a supporting surface of such a contour as to retain bromine deposited upon it from the electrolyte.—B. N.

Salts ; [Electrolytic] Method of decomposing ——, and electrolytic cell. J. Whiting, Assignor to the Whiting Co., Boston, Mass. U.S. Pats. 951,228 and 951,229, March 8, 1910.

(1) AN electric current is passed through an electrolyte to a number of quiescent bodies of liquid metal, acting as the cathode, and the bodies are transferred successively by gravity to a common region of oxidation. By maintaining in the latter region a continuous flow of liquid metal or alloy, motion is imparted to the body during oxidation, and the denuded metal is returned to the region of electrolytic decomposition. (2) The apparatus comprises a cell in which decomposition takes place, with a number of bodies of liquid metal, such as mercury, acting as the cathode. The cell is connected, by means of a conduit for conveying the mercury, with an oxidising cell, a controlling means in the conduit, with an arrangement for actuating it, removing the metal at predetermined intervals from the decomposing cell. The liquid metal is afterwards returned to the cell in which decomposition takes place.—B. N.

Insulating means ; Process for producing transparent, flexible, and infusible ——. K. Winkler, Zurich, Switzerland. U.S. Pat. 950,979, March 1, 1910.

SEE Ger. Pat. 208,753 of 1907 ; this J., 1909, 529.—T.F.B.

Electric arcs suitable for forming nitrogen oxides ; Apparatus for producing ——. P. Bunet and A. Badin. Fr. Pat. 406,115, Nov. 30, 1908.

SEE Eng. Pat. 16,225 of 1909 ; this J., 1910, 98.—T. F. B.

Gases ; Furnace for treating —— by the electric arc. Salpetersäure Industrie-Ges. Fr. Pat. 406,442, Aug. 24, 1909.

SEE Ger. Pat. 216,090 of 1908 ; this J., 1909, 1317.—T.F.B.

Electrodes for arc lamps. Eng. Pat. 21,374. *See* IIB.

Tungsten powder [for filaments for electric lamps]. U.S. Pat. 950,869. *See* IIB.

Apparatus for producing oxides of nitrogen from the air. U.S. Pat. 950,703. *See* VII.

Manufacture of "cupro-cupric oxychloride" by electrolysis. Fr. Pat. 406,107. *See* VII.

Preparing zinc compounds by electrolysis. Fr. Pat. 406,150. *See* VII.

Electric furnace for continuous manufacture of glass. Addition to Fr. Pat. 401,744. *See* VIII.

Electrochemical production of phosphatic fertilisers. Eng. Pat. 18,433. *See* XVI.

Apparatus for [electrolytically] ageing liquors. U.S. Pat. 950,579. *See* XVIII.

XII.—FATS; OILS; WAXES.

Linseed oil; Standardisation in testing ——. Oil, Paint, and Drug Rep., March 21, 1910. [T.R.]

Committee E, of the American Society for Testing Materials, has proposed the following specifications for testing linseed oil:—

We would recommend that, provisionally, the methods given relating to specific gravity, acid value, saponification value, unsaponifiable matter, refractive index, and iodine value, be considered standard, and that a raw linseed oil shall be considered pure when it tests between the following:—

	Maximum.	Minimum.
Specific gravity at 15·5° C.	0·936	0·932
Specific gravity at 25° C.	0·931	0·9270
Acid value	6·00	—
Saponification value	192	189
Unsaponifiable matter, per cent.	1·50	—
Refractive index at 25° C.	1·4805	1·4790
Hanus iodine value....................	190	178

The details of the methods recommended are as follows:—

1. *Specific gravity.*—Use a pyknometer, accurately standardised and having a capacity of at least 25 c.c., making a test at 25° C., water being 1 at 25° C., and another test at 15·5° C., water being 1 at 15·5° C.

8. *Acid value.*—Expressed in milligrams of potassium hydroxide per gram of oil. Follow the method described in Department of Agriculture, Bureau of Chemistry, Bulletin 107, revised page 142.

9. *Saponification value.*—Expressed as with acid number and stating length of time test is run. Blanks should also be run to cover effect of alkali in glass. Follow the method given in the above referred to Bulletin 107, pages 137—138.

10. *Unsaponifiable matter.*—Follow Boemer's method taken from Ubbelohde's Handbuch der Oele u. Fette, p. 261—2. "To 100 grams of oil in a 1000 to 1500 c.c. Erlenmeyer flask add 60 c.c. of an aqueous solution of potassium hydroxide (200 grams potassium hydroxide dissolved in water and made up to 300 c.c.) and 140 c.c. of 95 per cent. alcohol. Connect with a reflux condenser and heat on the water bath, shaking at first until the liquid becomes clear. Then heat for one hour with occasional shaking. Transfer while yet warm to a 2000 c.c. separatory funnel to which some water has been added, wash out the Erlenmeyer flask with water, using in all 600 c.c. Cool, add 800 c.c. of ether and shake vigorously one minute. In a few minutes the ether solution separates perfectly clear. Draw off the soap and filter the ether (to remove last traces of soap) into a large Erlenmeyer flask and distil off the ether, adding if necessary one or two pieces of pumice stone. Shake the soap solution three times with 400 c.c. of ether, which add to the first ether extract. To the residue left after distilling the ether add 3 c.c. of the above potassium hydroxide solution and 7 c.c. of the 95 per cent. alcohol, and heat under reflux condenser for ten minutes on the water bath. Transfer to a small separatory funnel, using 20 to 30 c.c. of water, and after cooling shake out with two portions of 100 c.c. of ether: wash the ether three times with 10 c.c. of water. After drawing off the last of the water, filter the ethereal solution so as to remove the last drops of water, distil off the ether, dry residue in water oven and weigh."

After determination of unsaponifiable matter convert it to acetate and determine the melting point of the acetate as directed by Lewkowitsch, page 372, third edition.

15. *Iodine value.*—Follow the Hanus method as described in Department of Agriculture, Bureau of Chemistry, Bulletin 107, revised page 136.

The Committee desires information from consumers and manufacturers on the following points:—

First.—Would you be willing to accept the specifications suggested by this committee, as above, for American linseed oil? Also, would you accept them for oil made from imported seed?

Second.—How far would you advise on, or be willing to agree to, specifications for quality of linseed oil based on the tests for turbidity and foots, the moisture and volatile matter, and the free acid value? Any suggestions you may offer on this point will be appreciated.

Third.—Many of the tests which are included in the work of this committee were found to give discordant results. We refer particularly to the acetyl value, hexabromide and oxygen absorption tests. It is to be hoped that we can get some of our universities and colleges to investigate these tests and develop scientific methods. Any influence you may exert or suggestions you can offer in this direction would be very helpful to the committee's work.

Fourth.—How far would a flash point test be advisable—for either purity or quality?

Fifth.—What would you advise as to specifications for boiled linseed oil? Should a boiled oil contain any rosin or rosin derivatives, as shown by the Liebermann-Storch test? And what per cent. of rosin would you permit? And should the amounts of lead and manganese present be specified? Also, should boiled oil specifications have a minimum specific gravity? What would you advise that this minimum should be?

Letters relative to these, or on other matters relative to this subject, will be welcomed by the secretary to the committee, G. W. Thompson, 129, York Street, Brooklyn, N.Y.

Dark oils and fats; Determination of acid and saponification values of ——. F. Mayer. Chem.-Zeit., 1910, **34**, 238—239.

In the case of dark mixtures of mineral oils with tallow, the acid and saponification values of the latter may be determined as follows:—About 10 grms. of the mixture (cylinder oil, etc.) are dissolved in 25 c.c. of benzene and boiled for an hour with 25 c.c. of $N/2$ potassium hydroxide solution to saponify the tallow. The liquid is then shaken with 30 c.c. of water, and the resulting aqueous layer drawn off, this treatment being repeated until the washings are practically free from alkali. In this way a yellowish, slightly turbid aqueous solution is obtained, in which the excess of alkali may be readily titrated, with phenolphthalein as indicator.—C. A. M.

Detecting paraffin wax in lard. Thompson and Hurst. *See* XIXa.

Determination of fat in cocoa, etc. Prochnow. *See* XIXa.

Patents.

Alkaline solvents and the manufacture thereof. G. and H. Nauton, G. de Marsac and T. F. Tesse, Paris. Eng. Pat. 14,725, June 23, 1909.

The products may be employed in the removal of grease and fat from cloth, for the preparation of non-caustic soaps, and similar purposes. They are prepared by mixing halogen derivatives of hydrocarbons (for example di- and trichloroethylene, perchloroethylene or tetra- or pentachloroethane) with a solution of a sulphonated vegetable oil saponified with caustic soda or caustic potash, and heated to a temperature suited to the boiling temperature of the substituted hydrocarbon to be added.—F. M.

Linseed and similar oils; Method and apparatus for thickening ——. A. Genthe, Frankfort on Maine, Germany. Eng. Pat. 16,665, July 16, 1909. Under Int. Conv., Jan. 29, 1909.

See Fr. Pat. 405,074 of 1909; this J., 1910, 223.—T. F. B.

Oil decolouring, bleaching, and thickening apparatus. J. C. L. van der Lande, Deventer, Netherlands. U.S. Pat. 950,723. March 1, 1910.

See Eng. Pat. 17,670 of 1908; this J., 1909, 317.—T. F. B.

Detergent compositions. A. Kayser, Lockport, N.Y., U.S.A. Eng. Pat. 6934, March 23, 1909.

See U.S. Pats. 923,850 and 924,792 of 1909; this J., 1909, 802. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 1440 of 1869.—T. F. B.

Soap; Manufacture of ——. Lever Bros., Ltd. Fr. Pat. 405,943. Aug. 12, 1909. Under Int. Conv., Dec. 14, 1908.

See Eng. Pat. 27,083 of 1908; this J., 1910, 165.—T. F. B.

Recovering materials [metals and fats] from waste. U.S. Pat. 944,533. *See* X.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Turpentine substitutes; Examination of ——, and the determination in turpentine of hydrocarbons other than terpenes. J. H. Coste. Analyst, 1910, **35**, 112—115.

The details of the examination of 13 samples of turpentine substitutes are given and the figures illustrate the differing properties of various materials of this kind. Some of the samples were satisfactory as to volatility at ordinary temperatures, although only a few would pass a distillation test of not more than 2 per cent. below 140° C., and not less than 90 per cent. below 180° C. The sp. gr. and refractive indices of all the liquids was remarkably high for the range of boiling points, whilst the iodine value in all cases, except one which contained turpentine, was low. The action of a mixture of equal volumes of concentrated nitric acid and sulphuric acid on some of the samples led to the separation of three layers consisting of (1) unaltered aliphatic hydrocarbons and cycloparaffins, (2) nitro-compounds of the higher homologues of benzene, and (3) a layer of sulphuric acid with some nitric acid. The hydrocarbons could be separated by steam-distillation from the less volatile nitro-compounds; the latter, on reduction with tin and hydrochloric acid yielded amines. It is concluded therefore, that homologues of benzene, probably *m*-xylene, mesitylene, and cumene, were present. This being the case, it is evident that a method such as that proposed by Richardson and Bower (this J., 1908, 613) can only be of very limited application. Armstrong's method, when applied to these substitutes, left nearly the whole of the mixture unattacked (see this J., 1909, 482), and the author suggests that, after a preliminary examination as to physical properties and a determination of the iodine value, a hydrocarbon mixture could be analysed by the application of the following processes:—(1) removal of terpenes and some olefines by polymerisation with dilute sulphuric acid; (2) removal of remaining olefines with concentrated sulphuric acid; (3) nitration of aromatic hydrocarbons and separation by distillation of the unaltered aliphatic hydrocarbons from the products of nitration. Sulphonation with Nordhausen acid would probably be equally suitable. These operations would be preceded by a steam-distillation, the distillate only being treated in this manner.—W. P. S.

Miscibility curves of liquids; Use of —— in analysis. Application of the method to oil of turpentine. E. Louise. Comptes rend., 1910, **150**, 526—528.

The usual adulterants in oil of turpentine can be detected by the author's method (this J., 1907, 932; 1909, 892.) but aniline should be substituted for acetone in making the double mixtures. 10 c.c. of aniline (boiling at 182° C., and giving a double mixture with the standard petroleum spirit) are used for each experiment. Traces of moisture in the products examined were first removed by barium alcoholate. Authentic samples of turpentine were found to give closely approximating parallel curves. Petroleum ether (white spirit) gives a very much longer curve much above, whilst rosin oil gives a characteristic sharp curve below that of pure turpentine. The presence of 20 per cent. of either adulterant alters the curve very considerably and 5 per cent. can be easily detected.—A. Seld.

Patents.

White lead; Manufacture of ——. S. Pope, Manchester. Eng. Pat. 11,525, May 15, 1909.

Precipitated white lead is taken as it comes from the precipitating or carbonating vessels, and ground wet in a mill such as is used for the wet grinding of "stack-made" white lead. The effect of this grinding is to destroy or reduce the porosity or woolliness of the white lead and consequently its powers of occluding moisture, with the result that the latter is reduced from 20—25 to 14—18 per cent. in good hard-packed cakes. The loss of acetic acid is also reduced, and the time required for drying diminished. In addition the quality of the product is said to approximate more closely to that of "stack-made" white lead.—E. W. L.

Azure blue; Process and special arrangement for the manufacture of ——. A. E. Pain and G. F. Muger. Fr. Pat. 406,317, Aug. 17, 1909. Under Int. Conv., Aug. 17, 1908.

The material is divided into masses of small volume, each being disposed in relatively thin layers, so as to leave between the layers the intervals necessary for the escape of gas. The following mixture is said to give a good yield; China clay, 12 parts; alumina, 15 parts; silica, 11 parts; a mixture of sodium sulphate and carbonate, 38 parts; flowers of sulphur, 16 parts; poplar charcoal, 6 parts; and resin, 2 parts.—B. N.

Distillation of resins, etc.; Apparatus for ——. J. Destriau and L. G. Corbière. Fr. Pat. 405,758, Aug. 5, 1909.

The still is heated by means of a steam jacket, and also by means of a series of vertical tubes constituting an arrangement known as a "hedgehog" ("*hérisson*"). Each heating tube consists of an outer tube passing upwards through the inner bottom wall of the still and closed at the upper end, remaining open at the lower end which is situated within the outer steam space. Inside each of these inverted tubes is a smaller tube, open at the top and connected at its lower extremity with a steam-box, or with one of a series of concentrically-arranged steam-pipes, of which there may be several, each carrying its series of concentrically arranged vertical heating-tubes. By this arrangement the heating of the liquid actually begins at the top, the steam afterwards passing downwards between the inner and outer vertical tubes into the hollow walls of the still. The vertical arrangement of heating tubes does away with the collection of sediment on them and with the consequent superheating of the liquid. Special valves suitable for use with resinous liquids, and also valves by means of which the liquid can be observed during the course of the distillation are employed, and are described.—E. W. L.

Wood ; Bath destined to extract certain products [turpentine, etc.] from ——. Southern Manufacturing Co. Fr. Pat. 406,080, Aug. 13, 1909.

A BATH is employed for the extraction, containing soft pitch, pine oil, and one of the harder products obtained by the distillation of products arising from the pine tree. Several different proportions are given for the mixture, containing at least 10 per cent. of the soft pitch, and about 10 per cent. of pine oil.—B. N.

Varnishes containing albumin. P. Horn. Ger. Pat. 217,508, Sept. 27, 1908.

IN order to give flexibility to coatings produced by varnishes containing albumin, the latter are mixed with halogenhydrins. For example, 100 parts of a solution of an albuminoid substance in spirit, are mixed with 100 parts of epichlorhydrin and 100 parts of alcohol, and 2·5 per cent. of linseed oil is added to the mixture.—T. F. B.

Shellac substitute ; Process for the preparation of a ——. F. L. Blumer. Ger. Pat. 217,560, June 17, 1908.

THE resinous products, soluble in alkali, obtained by the condensation of phenols and formaldehyde, are treated in acid or alkaline solution, with oxidising agents such as persulphates or perborates. The resulting products are odourless, and differ from the original condensation products in that they are not affected by exposure to light and air. In their behaviour towards solvents, the products resemble shellac.—A. S.

Lacquer-like products with a metallic lustre ; Process for the preparation of —— *[from cellulose nitrate].* H. Heil and E. van den Kerkhoff. Ger. Pat. 217,852, Nov. 24, 1908.

PREVIOUS attempts to prepare lacquer-like products with a metallic lustre by mixing solutions of cellulose nitrate with powdered metals have failed, because either the solution soon coagulated after addition of the powdered metal, or the product became turbid on drying. It has been found that these difficulties can be obviated by using cellulose nitrate, soluble in alcohol, dissolved in absolute alcohol or alcohol of high concentration.—A. S.

Distilling apparatus [for resins]. Fr. Pat. 405,759. *See* I.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Euphorbia tirucalli, a source of rubber. O. Sperber. Tropenpflanzer, 1910, 14, 159—162.

THE species, *E. tirucalli*, yields a latex of which 2 litres give about 1 lb. of rubber. By experiments with hothouse plants it has been found that the plant may be tapped without injury, throughout the year, at intervals of 8 to 14 days. A six-year-old pot plant gives 10 litres of latex per annum, corresponding to a yield of 5 lb. of rubber. The product is soluble in the usual solvents of rubber, and is slightly soluble in alcohol. When heated in water it is converted into a jelly-like sticky mass, which floats on the surface. Hot nitric acid is stated to be the only acid by which the rubber is attacked. The rubber melts at 130° F. and has a specific gravity of 0·964.—E. W. L.

Para and "Ceylon-Para" rubber ; Method of distinguishing between —— *and other rubbers.* F. W. Hinrichsen and E. Kindscher. Chem.-Zeit., 1910, 34, 230—231. (See also this J., 1910, 224.)

UP to the present there has been no certain means of identifying a particular rubber when present in a mixing, more especially in the vulcanised state. The determination of the resin-content is uncertain and may lead to erroneous conclusions. The authors show, for example, that the presence of 5 per cent. of ceresin in a Ceylon-Para rubber mixing may be responsible for an increase in the resin-content from 2·4 to 3·5 per cent. on vulcanisation. The authors then refer to the possibility of making use of the property of optical activity, shown by the resins of all rubbers examined (except Para and Ceylon-Para) both before and after vulcanisation, for the purpose of distinguishing between these, the most valuable rubbers, and all others of less value. It was shown (*loc. cit.*) that the activity exhibited by the resins was due to the unsaponifiable constituents. Further experiments have confirmed this, the following figures having been obtained for the specific rotation of the unsaponifiable constituent :— Sudan sheets, + 32° ; Equateur, + 43·1° ; Guayule, + 16·1°.—E. W. L.

Absorption of sulphur dioxide by rubber and wool. Reychler. *See* VII.

PATENTS.

Plastic substances such as india-rubber, gutta-percha, and the like ; Apparatus for shaping ——. British Murac Syndicate, Limited, and M. M. Dessau, London. Eng. Pat. 3630, Feb. 13, 1909.

THE apparatus consists of a stationary table surmounted by a revolving plate provided with apertures which serve as dies and confine the plastic material laterally while it is being compressed vertically by means of a plunger. The table and plate are surmounted by a bridge carrying a central bearing for the vertical spindle of the revolving plate, and also bearings for a cam shaft, from which the compressing plunger, and an ejecting plunger situated on the diametrically opposite side of the plate, are actuated by cams. The plungers are maintained in engagement with the cams by means of springs. Ejection of the compressed cake is effected through an aperture in the stationary table, on to a travelling endless band by which the cake is carried through a cooling medium such as cold water. The motion of the revolving plate is brought about intermittingly through a distance equal to the pitch of the apertures, by means of a cam, lever, rack and pinion, ratchet mechanism, actuating a horizontal shaft below the plate, the shaft gearing with the underside of the plate by means of bevel-gear-wheels. Means are provided for feeding the plastic material into the dies from a vessel, which may be steam-jacketed, resting above the revolving plate. In order to ensure the smooth entry of the plunger into the die, the former may be made somewhat smaller than the latter, in which case metal plates of the exact size of the die may be placed loosely on the under and upper sides of the cake and removed from the cake after ejection.—F. W. L.

Rubber ; Process for treatment of ——. *[Recovery and deresinification].* G. Austerweil. Fr. Pat. 405,437, June 26, 1909.

WASTE rubber is heated with a quantity of limonene equal to about 3½ to 4 times the weight of actual rubber present, in a closed vessel, either under artificial pressure at 120° C. or without external pressure at 170°—180° C. Fibrous matters and rubber substitute are separated by squeezing the treated waste. A considerable portion of the solvent is then removed by distillation *in vacuo*, or in a current of steam, and the residue is worked up with acetone, alcohol or other precipitant of rubber. The pasty mass obtained is re-dissolved in toluene or benzol or other light hydrocarbon, and the solution decanted from the heavy loading materials. The solution is again distilled, and the residue worked up with acetone or alcohol to remove the last traces of rubber solvent, and finally washed first with hot, then with cold water, sheeted and dried. In order to de-resinify low-grade rubber, the latter is dissolved in limonene either in the hot or in the cold, and re-precipitated from the solution by means of alcohol, acetone, etc.—E. W. L.

Waste [vulcanised] rubber ; Process for regeneration of ——. W. van Oosterzee. Fr. Pat. 405,678, Aug. 3, 1909. Under Int. Conv., Sept. 29, 1908.

THE ground waste is cleaned by heating it with an alkaline solution, and is then mixed with 10 to 30 per cent. (according to the quality of the waste) of a rubber solvent such as light benzine, petrol, gasoline, etc., and heated for 3 to 4 hours at a temperature of 130° to 140° C. under a pressure of 80 to 100 kilos. per sq. cm. The operation may be conducted in any suitable apparatus. The plastic mass obtained is sheeted between rollers.—E. W. L.

Resins, faktis, and raw rubber ; Process for the preparation of solutions of —— and of solutions of old rubber especially suitable for the regeneration of the rubber. N. Chercheffsky. Ger. Pat. 218,225, April 22, 1908.

Claim is made for the use as solvents of resins, faktis (vulcanised oil), and rubber, of naphthenic acids obtained from the waste alkali lyes of petroleum refining works, by treatment with a mineral acid. The naphthenic acids are obtained in the form of an oil of sp. gr. 0·960 at 15° C., b. pt. about 250°—300° C. The acids constitute a good solvent for rubber, resins, etc. For use in the regeneration of rubber from old rubber, the latter is dissolved in the naphthenic acids and the solution treated in one of the three following ways :—(1) A liquid (*e.g.*, acetone) is added which is miscible with the naphthenic acids, acts as a precipitant of rubber, and retains the impurities in solution. (2) The solution is treated with alkali, and the alkali naphthenates removed from the precipitated rubber by washing with water. (3) The naphthenic acids are separated from the solution by distillation.—A. S.

Elastic substance [from starch] ; Process of manufacture of ——. E. G. Puntschart and H. Alschech. Fr. Pat. 405,711, July 23, 1909.

Starch powder is added to an aqueous solution of magnesium chloride which is then heated until the starch is gelatinised. For example 150 parts of starch are added to a solution of 100 parts of magnesium chloride in 50 parts of water. If desired a colouring matter may be added. The mixture is then heated until the starch is gelatinised, after which it is allowed to cool. The degree of elasticity of the product may be varied by altering the proportion of starch used. Its solubility in water may be decreased by the addition of a small quantity of chromates and subsequent exposure to light. The product is specially designed for use as a filling for tyres ; its specific gravity may be diminished by the addition of powdered cork, by aeration during manufacture, or by the disengagement of gases in the body of the substance by chemical means. An addition of glycerin to the mixture during manufacture is advantageous.—E. W. L.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Tannin ; Constitution of ——. M. Nierenstein. Ber., 1910, **43**, 628—634.

The author confirms his previously expressed opinion that commercial tannin is a mixture of digallic acid and leuco-tannin (this J., 1909, 535). Repeated fractional precipitation of the acetyl derivative of tannin yielded a strongly rotatory leuco-tannin and a feebly optically active digallic acid. Inactive digallic acid could not be thus obtained ; it is however obtained from tannin by treatment with ethyl chloroformate and potassium hydroxide and saponification of the resulting carboethoxy derivative by means of pyridine, according to E. Fischer's method (Ber., 1908, **41**, 2885), the product obtained being subjected to the same process 3 or 4 times. *Digallic acid*, $(OH)_3C_6H_2.CO.O.C_6H_2(OH)_2(COOH)$, crystallises from a solution in alcohol and water (1 : 3) in small needles, which lose 2 mols. of water of crystallisation at 110° C., and melt at 268°—270° C., with evolution of gas. It gives a precipitate with gelatin : two analyses by the hide powder method gave 99·8 and 99·4 per cent. of tannin. Ferric chloride gives a blackish-blue coloration, but potassium cyanide only colours it after some time (hydrolysing it to gallic acid). Dilute sulphuric acid also hydrolyses it to gallic acid. It is optically inactive. On oxidation with hydrogen peroxide it yields luteoic acid, $C_{14}H_8O_9$, and ellagic acid, $C_{14}H_6O_8$ (this J., 1905, 898, 1087 ; 1908, 680 ; 1909, 665, 804). These acids can be separated by means of pyridine. The digallic acid obtained by Fischer (*loc. cit.*), differs from the above by having a higher melting point (275°—280° C.) and in not yielding a diphenyl derivative on oxidation with hydrogen peroxide. By the action of acetic anhydride on digallic acid, *penta-acetyldigallic acid*,

$$(CH_3.CO.O)_3C_6H_2.CO.O.C_6H_2(O.CO.CH_3)_2(COOH)$$

is obtained and this on reduction with zinc dust and acetic acid yields *d.l-hexa-acetylleucotannin*,

$$(CH_3.CO.O)_3C_6H_2.CH(O.CO.CH_3).O.C_6H_2$$
$$(O.CO.CH_3)_2(COOH)$$

cyrstallising in small cubes melting at 154°—155° C.; by conversion into the strychnine salt, it can be separated into the two active components.—A. Sbld.

Lactic acid and its anhydride. A. Besson. Collegium, 1910, 73—79.

Commercial lactic acid contains not only free acid but also anhydride and it is usually sold on the total amount of these two constituents. English tanners, however, buy it on the percentage of free acid only, maintaining that the anhydride has no deliming effect ; this has arisen from the fact that the amount theoretically required for deliming, calculated on the total acid (including anhydride) content, was found to be insufficient in practice. The author traces this discrepancy to an error in the estimation of the anhydride, the usual method consisting in determining free acid by direct titration with alkali, adding a known excess, boiling and titrating back with acid. The results thus found vary with different circumstances ; the longer the boiling, and the larger the excess of alkali, the greater is the amount of anhydride found. This is due to the presence of foreign substances which take up alkali during the boiling, and also to the absorption of carbon dioxide from the air, by the alkali. By this method of analysis, therefore, the tanner's calculations have been too high and he has been led to regard the anhydride as useless for deliming. The author describes a method whereby the exact amount of anhydride present may be estimated :—After direct neutralisation of the free acid with alkali, excess of alkali is added, and the cold solution is allowed to stand for ten minutes ; this converts the anhydride into lactate. Excess of acid is now added, the solution boiled, and the excess of acid titrated back with alkali.
—A. T. H.

Filtration method ; The asbestos-kaolin ——. [Analysis of tannin solutions.] F. H. Small. J. Amer. Leather Chem. Assoc., 1910, 5, 179—198.

Tannin solutions for analysis are filtered through asbestos covered with a layer of kaolin on a filter plate in a funnel connected with an air pump. The apparatus is arranged so that the first portion of the filtrate may be run into a different receptacle from that in which the remainder is collected, without breaking the vacuum. Considerable variation of opinion is expressed by those to whom the method was submitted for trial. The advantages of the method are, a great saving of time and greater accuracy of results compared with those obtained by the official method using filter-paper. Difficulty seems to have been experienced in obtaining a satisfactory " filter-mat " and the cumbersomeness of the apparatus required is a drawback to its adoption as the official method of filtration.—D. J. L.

Degras-former ; A modified method for determination of —— in moellons and mixed greases. L. E. Levi and E. V. Manuel. Hide and Leather, March 5, 1910.

Fahrion's method of estimating degras-former, as adopted by the Amer. Leather Chem. Assoc., is fairly satisfactory when analysing pure sod oils, and moellons containing only a little wool grease, but in extracting the fatty acids from manufactured greases, an emulsion is often formed, caused by the insolubility of the higher fatty acids of wool grease, and the partial solubility of degras-former and cholesterol in the alcohol and glycerol in solution. To overcome these difficulties the authors recommend saponifying 7—8 grms. of the oil with alcoholic potassium hydroxide, evaporating the alcohol, adding 100 c.c. of water and then acetic acid until just acid. Excess of alkali is now added, and the whole diluted to 200—300 c.c. and gently heated. The insoluble matter should rise in clots, but if the reaction is slow, it may be accelerated by adding a little saturated salt solution. The mixture is now filtered, and the filter washed with water ; the filtrate is treated with hydrochloric acid and the fatty acids extracted with petroleum ether. The degras-former is finally washed free from salt or ignited after weighing. The results by this method are more accurate than by Fahrion's method.—A. T. H.

Gelatins ; Comparative valuations of——by means of melting-point determinations. J. Herold. Chem.-Zeit., 1910, **34**, 203—204.

Experiments showed that the melting-points of jellies from the same gelatin rise with the concentration : the results, when plotted, always give a straight line, increases in the temperatures being proportional to the increased percentages of gelatin and the poorer the quality of the gelatin the lower is the angle of elevation of its melting-point line. The tangents of these angles (or the difference between the melting-points of two different solutions of the same gelatin and the difference between the melting-points of two such solutions of another quality) are proportional to the percentages of glutin contained. Comparative valuations of gelatins can therefore be deduced from the melting-points of solutions of known percentages (10—20 per cent.) of each quality. The comparative solutions must be allowed to set at a constant temperature for 1 hour (if possible at 19°—23° C., according to quality). Thermometers graduated to tenths of a degree centigrade, are placed in glass tubes closed at the bottom and filled with the jellies, and then hung in a water bath : the temperature is noted when the tube falls off, owing to the melting of the jelly. The space between the thermometer and the walls of the tube should be about 1 mm. The water bath must be heated slowly and the temperature of the water regulated so that it only exceeds the melting point of the jelly by about 1·5°C. The first determination of the melting point of a new sample is often too low ; the subsequent ones agree closely.—A. Sbld.

Fischer's ester method ; A modification of ——. [Separating the products of hydrolysis of proteins.] B. O. Pribram. Monatsh. Chem., 1910, **31**, 51—54.

In order to obtain the free ester from the ester hydrochloride produced by the hydrolysis of proteins with hydrochloric acid and subsequent esterification of the resulting amino-acids, Fischer has proposed the use of sodium hydroxide with subsequent salting-out of the ester with sodium carbonate, and Levenne recommends the use of barium oxide. The author finds that dry ammonia gas may advantageously be employed for this purpose and obtained 119·3 grms. of esters from 400 grms. of gelatin, whilst the yield by Fischer's method was 117 grms. from 500 grms. of gelatin.—J. C. C.

Proteins ; Course of hydrolysis of —— with aqueous or alcoholic hydrochloric acid. M. Pfannl. Monatsh. Chem., 1910, **31**, 81—85.

The hydrolysis of both gelatin and silk-fibroin with either aqueous or alcoholic hydrochloric acid leads qualitatively and quantitatively to the same result. By the hydrolysis of gelatin with alcoholic hydrochloric acid, the author obtained 10·8 per cent. of glycocoll and 36·7 per cent. of ester, whilst Fischer's numbers were 16·2 and 31·5 respectively : the author's figures agree, however, with the later data of Skraup and Hummelberger (this J., 1908, 911) namely 9·7 per cent. of glycocoll.
—J. C. C.

Patents.

Hides and tan-ooze ; Apparatus for moving ——, for accelerated tanning. F. J. Hirt, Heerdt, Germany. Eng. Pat. 4958, Mar. 1, 1909.

The hides are suspended from parallel rows of bars within a vessel, the bottom of which is connected with the bars and can be made to oscillate simultaneously with them. Above these bars there may be an irrigation plate the slots in which lie above the spaces between the bars, whilst the liquid is drawn off in a uniform manner and conducted to the hides in the next container through escape channels beneath the oscillating bottom, the slots in these channels being of triangular section with the narrow part uppermost. It is stated that with this apparatus a soft grain is obtained, and the formation of stains prevented.—C. A. M.

Tanning extracts ; Process for decolorising ——. Deutsche Versuchsanstalt f. Lederindustrie, and H. Arnoldi. Fr. Pat. 406,362, Aug. 21, 1909. Under Int. Conv., Sept. 7, 1908.

See Eng. Pat. 19,804 of 1909 ; this J., 1909, 1321.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Bordeaux mixture ; Pickering's ——. W. H. Lyon. Hawaiian Planters' Monthly ; Internat. Sugar J., 1910, **12**, 142—144.

According to Pickering, the chief aim in making Bordeaux mixture should be to reduce the lime to the lowest possible proportions consistent with the precipitation of all the copper (see this J., 1909, 1220). Comparative experiments have been made with a view to determining the effect of treating sugar cane cuttings with Pickering's mixture. Twelve parallel rows of Lahaina cane cuttings (each cutting having two eyes) were planted out. Six of the rows were planted with cuttings inoculated with the pineapple disease ; of these six rows, three had had the cuttings soaked in Pickering's mixture for one hour, one in water, and one in normal Bordeaux mixture also for one hour, whilst the remaining row had untreated cuttings. The other six rows only differed in that their cuttings were not inoculated. It was found that Pickering's mixture injured the cuttings seriously, more than half of the eyes failing to germinate. The inoculated cuttings were much poorer than the non-inoculated ones, thus showing that the pineapple disease was able to enter the cuttings despite the presence of an excess of copper sulphate. The investigation proved conclusively that Pickering's formula should not be used in preparing Bordeaux mixture for the treatment of cane cuttings ; it also showed that copper sulphate can materially injure or even kill the eyes of cane cuttings, so that in preparing Bordeaux mixture for the treatment of cuttings, care should be taken that no considerable excess of copper sulphate is present in the mixture ; this can be avoided by the use of a proper amount of lime. The cuttings treated with normal Bordeaux mixture were found to give the best and most rapid germination.—L. E.

Determination of potassium. Cavazza. *See* XXIII.

Iodometric determination of phosphoric acid. Artmann. *See* XXIII.

Patents.

Fertilisers ; Electrochemical production of phosphatic —— G. Levi, Rome. Eng. Pat. 18,433, Aug. 10, 1909.

Natural tricalcic phosphate is decomposed in a direct current electric furnace by heat and electrolysis, or it is decomposed by heating with silicic acid or silica (or sand and any decomposable silicate), or with iron oxide and an anhydrous sodium salt, in an electric furnace heated by an alternating current, the phosphoric anhydride volatilised being collected. Claim is also made for the production of phosphoric anhydride and soluble sodium silicate by heating a mixture of tricalcium phosphate, silicic acid, and an anhydrous sodium salt, in an electric furnace, and for the production of phosphoric anhydride and mineral colours by heating a mixture of natural tricalcic phosphate, the metallic salt corresponding to the desired colour, and silicic acid, in an electric furnace.—L. E.

Fertilisers; Method of producing ——. L. R. Coates, Baltimore, Md. U.S. Pat. 947,795, Feb. 1, 1910.

Material containing organisms capable of "breaking down" rock is added to a sterilised solution of sugar and potassium phosphate: sterilised bone meal is then moistened with the culture thus obtained, and the product may be increased in bulk by the addition of ground and sterilised phosphate rock.—W. P. S.

Fertiliser and method of producing the same. L. R. Coates, Baltimore, Md. U.S. Pat. 947,796, Feb. 1, 1910.

The fertiliser is prepared by moistening sterilised bone meal with cultures of organisms capable of "breaking down" rock and of organisms obtained from the nodules of leguminous plants.—W. P. S.

Soil antitoxin; Process of making ——. L. R. Coates, Baltimore, Md. U.S. Pat. 947,797, Feb. 1, 1910.

Sterilised bone meal is moistened with a nutrient solution containing decomposing animal matter and the organisms causing this decomposition. The product may be used after the manner of a fertiliser, either in its concentrated form or increased in bulk by the addition of sterilised phosphate rock. The fertiliser or product thus obtained counteracts, in soils, the destructive effects of the presence of the excreta of micro-organisms capable of producing plant-foods, and also the effects of the toxic emanations of plants.—W. P. S.

Fertilisers; Method of producing ——. L. R. Coates, Baltimore, Md. U.S. Pat. 947,798, Feb. 1, 1910.

Sterilised bone meal is mixed with cultures of organisms capable of "breaking down" rock, of bacteria obtained from the nodules of leguminous plants, and of bacteria obtained from decomposing animal matter. The product, when applied to soil, acts as a fertiliser, and as a preventive against the toxic emanations of bacteria and plants.
—W. P. S.

Fertiliser; Stimulating manganese and manganese-lime —— for agricultural purposes. Process for the simultaneous manufacture of suboxides of manganese destined for use as a stimulating fertiliser in agriculture. Soc. Mines de Manganèse de Las Cabesses. Fr. Pats. 405,695 and 405,697. Nov. 21, 1908.

The fertiliser consists essentially of a mixture containing approximately: quicklime, 15 per cent.; calcium carbonate, 35; manganese carbonate, about 15; and manganese oxides (manganous, mangano-manganic, and manganic oxides, but not manganese dioxide), 15—20 per cent. The mixture of manganese oxides is prepared by heating manganese dioxide (100 parts) with powdered coal (about 3 parts) in a furnace or retort at 800°—1200° C., and finally heating at about 1250° C. for some minutes. The product is used as a stimulating fertiliser in conjunction with other materials such as phosphates, nitrates, quicklime, etc.—L. E.

Sub-oxides of manganese; Simultaneous manufacture of —— intended to be used as a stimulant manure for agricultural purposes. Mines de Manganèse de Las Cabesses, Paris. Eng. Pat. 26,868, Nov. 19, 1909. Under Int. Conv., Nov. 21, 1908.

See Fr. Pat. 405,697 of 1908; preceding.—T. F. B.

Phosphatic fertilisers; Electro-technical production of ——. G. Levy. Fr. Pat. 406,052, Aug. 12, 1909. Under Int. Conv., Aug. 19 and Sept. 25, 1908, and July 30, 1909.

See Eng. Pat. 18,433 of 1909; preceding.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Sugar factories; Influence of structure of cane on mill work in ——. N. Deerr. Bulletin No. 30, 1910, Agric. and Chem. Series. Experiment Station, Hawaiian Sugar Planters' Association.

The author defines absolute juice of the cane as meaning everything which is not left behind on extraction with water, and thus including protoplasm, the "colloid water" of Geerligs and the "water other than juice" of Watts. From the results of analyses of 57 canes, including Lahaina, Yellow Caledonian and Rose Bamboo, he deduces the factor or ratio of sucrose in cane to sucrose in expressed juice, and its variation (0·81 to 0·87) with the varying percentage of fibre and of expression. The ratio between the total solids per cent. of the absolute juice of the cane and that expressed by the first mill lies between 0·97 and 0·98, and this ratio is the same for at least three varieties of cane with fibre content varying from 10 to 14 per cent. The density of the absolute juice of the cane being known, then with analytical data only, all the essential measurements connected with mill control can be expressed in terms of cane; and if either the weight of cane, of bagasse, of mixed juice or added water be known, all the other quantities can be calculated. From experiments on different methods of milling, it was noticed that the highest extraction was obtained when a system of compound saturation was followed. The lowest result was obtained when all the water was added before the last mill. Between the use of hot water and cold water, little difference, if any, was to be found. Allowing for difference in fibre content, the trials led to the conclusion that a twelve-roller set treated 50 tons of cane per hour as efficiently as a nine-roller set treated 35 tons, with a dilution, however, of only 12 per cent. compared with one of 34 per cent. Since the purity of each successive fraction of juice obtained decreases, the earlier expressed portions have a higher available sugar value than the later ones. With reference to the effect of the influence of the structure of the cane, results showed that the milling process was very effective as regards the soft interior pith, but very crude as regards the extraction of sugar from the hard outer rind; probably with saturation processes using imbibition, very little of the water is taken up by the rind tissue; an increased extraction is then to be looked for by any of the following methods:—(1) Higher pressures resulting in the greater rupture of the rind tissue, giving at once a higher expression and a material more suited for the absorption of water. (2) More effective disintegration of the rind tissue, to be obtained by the use of knives, shredders, crushers, or heavily indented rollers. (3) More rational means of applying the added water such as by the use of a series of injectors, as recently suggested by L. Pellet, in place of a perforated pipe, or by the use of macerating baths through which the bagasse is drawn. Higher pressures have been recently advocated in preference to the exaggerated use of water, by A. Musy, who is inclined to relegate the maceration process to the second place instead of being the principal item in the milling process. There is one point more on which the analyses throw light. It not infrequently happens that while the fibre remains of constant percentage, the extraction varies largely, milling conditions remaining the same. Such a variation can be readily understood on the assumption that while the total amount of fibre remains the same, its distribution between the pith and rind varies, an increase in the proportion of the latter being accompanied by a decrease in the extraction.—L. J. de W.

Cane sugar [sucrose]; Quantitative determination of —— by the use of invertase. C. S. Hudson. U.S. Dep. Agric., Bureau of Chemistry, 1910, Circular No. 50, 1—8.

The author shows that in most cases, the difficulty encountered in determining sucrose by Clerget's method, in presence of other substances hydrolysed by the treatment with acid, is avoided by using invertase as hydrolyst, and he especially recommends the use of this enzyme in studying plant sugars. *Preparation of a stock solution of invertase.*—Five pounds of pressed baker's or brewer's yeast are broken up, treated with 30 c.c. of chloroform in a closed flask, and allowed to stand at the room temperature (20° C.) overnight. The mass is then filtered, several hours being allowed for draining. The filtrate is treated with normal lead acetate until no further precipitate forms, and filtered again. The filtrate is treated with potassium oxalate to remove excess of lead, and filtered, the filtrate now obtained being treated with 25 c.c. of toluene and dialysed in a pig's bladder for 2—3 days, using running tap water. The dialysed solution is colourless, quite clear after filtration, and neutral to litmus; it keeps indefinitely in an ice-box if a little toluene is kept on its surface (a sample kept at room temperature during the day, and in an ice-box at night, suffered no change in hydrolysing activity during 3 months). It does not reduce Fehling's solution, and its rotatory power is such (+1·0° V. in a 400 mm. tube), that the influence of the amount used in analysis is negligible in ordinary work. *Method of analysis.*—26 grms. of the sample are dissolved in water, clarified, made up to 100 c.c. at 20° C., and filtered: the polarisation (S) of the filtrate is determined in a 200 mm. tube. If lead has been used for clarification, the filtrate is treated with sodium carbonate or potassium oxalate to remove excess, and filtered. Fifty c.c. of the filtrate are treated with acetic acid, drop by drop, until acid to litmus, then with 5 c.c. of the stock invertase solution, and made up to 100 c.c. A few drops of toluene are added to the solution to prevent the growth of micro-organisms, the whole is shaken and allowed to stand at 20°—40° C. overnight (about 6 hours usually suffice for complete hydrolysis). The solution is then brought to a temperature of 20° C., and its polarisation (I) is determined in a 400 mm. tube. The percentage of sucrose is calculated from the formula,

$$\text{Percentage} = \frac{\text{S}-\text{I}}{141{\cdot}7-\frac{t}{2}} \times 100.$$

S being polarisation of solution before inversion; I, polarisation after inversion.

The difference between the factor, 141·7, for hydrolysis by invertase and the factor, 142·7 for hydrolysis by hydrochloric acid, is due to the effect of the acid on the rotatory power of invert sugar. In solutions hydrolysed by invertase, the lag in the change of rotation of lævulose due to change of temperature lasts about 10 minutes at 20° C.; hence, care should be used in reading solutions hydrolysed by invertase, to see that the rotation remains constant for a few minutes. After the polarisation of the hydrolysed solution has been obtained, the author adds a small quantity of sucrose to the solution and observes the rotation of the latter for a few minutes; a gradual change shows that the invertase is active, and is sufficient evidence that the sucrose originally present has been completely hydrolysed. Comparative tests with pure sucrose, Louisiana molasses, and bagasse, gave practically the same percentage of sucrose by the invertase method as by the acid method of hydrolysis. A plant (*Dasylirion texanum*) was found to contain only a trace of sucrose by the invertase method, though according to the acid method it appeared to contain 5·5 per cent. of sucrose, owing to the presence of a very easily hydrolysable carbohydrate, the nature of which is now being investigated. "Mixing glucose," which, owing to its method of manufacture, can contain no sucrose, gives a slight decrease in rotation on acid hydrolysis, but the invertase method shows that no sucrose is present. The stock solution of invertase does not hydrolyse lactose, maltose, starch, dextrin, cellulose, pentosans, amygdalin, or salicin; it hydrolyses raffinose (and probably stachyose) and hence, the invertase method cannot be applied to the determination of sucrose in presence of raffinose.—L. E.

Sucrose; Multirotation of —— in presence of alkaline solutions of uranyl salts. H. Grossmann and F. Rothgiesser. Ber., 1910, **43**, 676—682.

The authors have further studied the multirotation of sucrose in presence of alkaline solutions of uranyl salts (see this J., 1905, 1260). With a *N*/40 solution of sucrose containing 1·2 mols. of uranyl nitrate and 13·5 mols. of sodium hydroxide to 1 mol. of sugar, the specific rotatory power was $[a]_D = +110°$ after 5 mins.; it fell gradually to *nil* after 1 hour, and the solution then slowly became increasingly lævo-rotatory, with $[a]_D = -17{\cdot}8$ after 24 hours. With a *N*/80 solution, containing 2 mols. of uranyl nitrate and 15 mols. of sodium hydroxide to 1 mol. of sugar, the solution was optically inactive after 5 mins., whilst after 24 hours the lævo-rotation amounted to $[a]_D = -126{\cdot}7$. The rotation does not always fall below that of pure sucrose. For example with a *N*/20 solution containing 0·8 mol. of uranyl nitrate and 9 mols. of sodium hydroxide to 1 mol. of sugar, the rotation was $[a]_D = +103{\cdot}9$ after 5 mins., and fell to $[a]_D = +72{\cdot}2$ after 24 hours. The effect on the rotatory power is more pronounced the lower the concentration of the sugar. With a constant concentration of sucrose and a constant ratio between the amounts of uranyl salt and of alkali, the primary increase of rotatory power and the final decrease are both greater, the higher the content of uranyl salt in the solution. If the ratio between the amounts of sucrose and of uranyl salt be kept constant, then the primary increase of rotatory power is larger and the final decrease of rotatory power smaller, the higher the concentration of the alkali. The authors consider that the results can be explained most satisfactorily by the assumption that strongly dextrorotatory complex alkali-uranyl compounds of sucrose are first formed, and that these are slowly hydrolysed, with formation of sodium hydroxide and uranyl-compounds of sucrose. The hydrolysis would be accelerated by diluting the solution, but would be retarded by the presence of excess of sodium hydroxide.—A. S.

Glucose; Mechanism of the oxidation of —— by bromine. H. H. Bunzel. J. Biol. Chem., 1910, 7, 157—169.

In a preceding investigation (J. Amer. Chem. Soc., 1909, **31**, 464), the following conclusions were arrived at by Mathews and the author, concerning the oxidation of glucose by bromine:—(*a*) Glucose behaves both as a weak acid and as a weak base. In an alkaline or neutral solution, it dissociates into metal or H^+ ions and $C_6H_{11}O_6^-$ ions; in an acid solution, it forms a salt of the acid by addition, yielding $C_6H_{13}O_6^+$ ions and the anion of the corresponding acid. (*b*) Both of the glucose ions are oxidised by bromine side by side, the oxidation of the first being depressed by the addition of H^+ ions, while the other remains unaffected.—This hypothesis was found to hold under very diverse conditions of acidity and bromine-concentration. The authors have now carried out further investigations which show: (1) that the amount of acid and of bromide produced, and of glucose and bromine disappearing, in the oxidation of glucose by bromine in acid solution, is equal to that calculated, on the hypothesis that one molecule of bromine oxidises one positive glucose ion to gluconic acid; (2) that the velocity of the reaction is correctly represented by the equation,

$$\frac{dx}{dt} = \text{K.C}_{C_6H_{12}O_6{}^+} \times \text{C}_{OH^-} \times \text{C}_{Br_2\,(\text{free})},$$

as shown by the constancy of the velocity constant, K, under widely varying conditions of acidity and of different concentrations of bromine and glucose.—These results support the view that glucose forms two series of salts, one in which glucose behaves as an acid, dissociating into metal and negative glucose ions, the other in which glucose behaves as a base, forming an oxonium salt dissociating into $C_6H_{13}O_6^+$ ions and the negative acid radical. Both of the glucose ions are more easily oxidised than the neutral glucose molecule, and they give rise to different acids on oxidation; the positive ion is converted quantitatively into gluconic acid, which presumably is converted into lactone, and in the course of time would be still farther oxidised by the bromine; the negative ion, when oxidised by bromine probably gives rise to the large variety of acids described by many observers and studied particularly by Nef (see this J., 1908, 31).—L. E.

Pickering's Bordeaux mixture. Lyon. *See* XVI.

PATENTS.

Diffusion [Sugar]; Process of continuous ——. Wauquier et Cie. Fr. Pat. 406,012, Nov. 28, 1908.

THE apparatus includes a vertical, cylindrical, continuous diffuser, divided horizontally by a series of partitions which are provided with openings, at the centre and at the periphery alternately. The compartments between the partitions are provided with stirrers. At the lower part of the diffuser is a perforated plate which is constantly scraped by scrapers mounted on the same axis as the stirrers. The pulp or cossettes, previously mixed with juice and heated by injected steam, is pumped into the lowest compartment (immediately above the perforated plate) of the diffuser. Part of the juice flows through the perforated plate to an outlet controlled by a cock. The material ascends the diffuser, passing from one compartment to another, the juice which leaves by the outlet before-mentioned being replaced by liquid entering by a pipe or pipes, suitably placed, *e.g.* near the top of the diffuser. Steam is injected into one or more compartments of the diffuser. The extracted material passes from the top of the diffuser to a press, the expressed liquor, mixed with water and vinasse, being pumped back into the diffuser, through the pipe near the top of the diffuser. —L. E.

Sugar; Process for obtaining —— *ready for consumption, from beet- or cane juice directly.* F. Hlavati. Fr. Pat. 406,169, Aug. 17, 1909.

DIFFUSION juice is treated, at a low temperature, with a quantity of a suitable sulphate (sulphates of iron, aluminium, magnesium, etc.) or a mixture of sulphates, equivalent to that of the alkali salts in the juice. The mixture is treated with 1—1·5 per cent. of lime, preferably in the form of milk of lime, and saturated with carbon dioxide till the alkalinity is reduced to 0·06—0·09 per cent. It is then treated with clay or brick-dust (to facilitate filtration), heated to 75°—80° C., and filtered. The filtrate is treated with a quantity of a sulphide (*e.g.*, calcium sulphide or antimony pentasulphide) equivalent to that of the organic non-sugar, saturated with carbon dioxide till the alkalinity is reduced to 0·003—0·005 per cent., heated to 90°—95° C., and filtered again. The filtrate is concentrated to 30°—33° Baumé, filtered, and saturated with sulphur dioxide, sufficient ammonia, or suitable ammonium salts, having been added to render it nearly neutral to litmus. It is then heated to 90°—95° C. and filtered. The filtered syrup thus obtained has a purity of 96·7—98·8, and contains sugar and alkali sulphates only. It is boiled to grain, and centrifuged, the crystals obtained having a purity of 99·7—99·8 per cent. The residues are mixed with the diffusion juice, and the whole process is repeated until the residues contain a sufficiently high proportion of alkali salts. The residues are then boiled to grain and centrifuged, a further quantity of sugar being thus obtained. The final residues, which contain the alkali sulphates and a very small quantity of sugar, are diluted with cold water to 36°—37° Baumé, and left to cool; the alkali sulphates crystallise out completely at 4° C., and the mother liquors containing the sugar are mixed with the diffusion juice.—L. E.

Cossettes [beet]; Process for extracting crystalline substances from organic and vegetable materials, and in particular, from ——, *by lixiviation in presence of sulphurous acid.* A. Faragó. Fr. Pat. 406,206, Aug. 18, 1909.

As applied to the treatment of cossettes, the process consists in introducing sulphur dioxide, or an aqueous solution of sulphurous acid, into 4 or 5 diffusers constituting the middle zone of the battery, in such quantity that the water in these diffusers acquires a sulphurous acid-content of 1—1·5 per cent. The sulphurous acid is progressively removed from the juice by contact with the cossettes in the succeeding diffusers. Both the juice and the exhausted cossettes, withdrawn from the battery, are free from sulphurous acid. The sulphurous acid coagulates the albumin, and allows of the diffusion being carried on at the ordinary temperature (20°—40° C.); it purifies the juice and prevents the injurious action of micro-organisms. —L. E.

[Sugar] juice and a nutritive residue containing sugar; Method of obtaining —— *by means of an extraction or diffusion process.* C. Steffen. Ger. Pat. 217,303, June 6, 1907.

INSTEAD of introducing water into the last vessel of the extraction- or diffusion-battery, a solution of molasses or syrup, containing about 2 per cent. of sugar, is used and is circulated through the battery in the usual manner. In this way the juice becomes richer in sugar, and the beet slices richer in non-sugar in their passage through the battery. —A. S.

Diffusion waste waters of sugar factories; Process for the purification of ——. Dempewolf und Buerschaper, Ges. für Ind. Feuerungsanlagen. Ger. Pat. 218,189, Sept. 22, 1908.

THE waste water is caused to flow through a trough disposed in the smoke-box of a boiler-installation in such a manner that the smoke-gases issue from the smoke-flues in a direction at right-angles to the flow of the waste-water. The latter is heated by the smoke-gases, and the evolved steam causes deposition of the floating ash in the gases, this ash then falling into the waste-water and exerting a purifying action on the latter.—A. S.

Starch; Manufacture of soluble ——. E. Flick, Cologne, Germany. Eng. Pat. 25,121, Nov. 1, 1909.

THE use of the so-called per-salts (*e.g.*, persulphates) for converting starch into its soluble form, presents the difficulty that a large part of the active oxygen escapes without taking part in the reaction. The object of this invention is to regulate the liberation of the active oxygen, so that it has time to act on the starch, by the addition of certain salts. Powdered starch is finely divided in cold water, stirred to a uniform milk, and a small quantity of aluminium hexachloride, iron perchloride, or zinc chloride (the first of these salts has the best effect), is added and dissolved. Afterwards, whilst the mass is well stirred, sodium persulphate or other suitable per-salt, is added in small portions, until the whole mass is converted into soluble starch. The starch is then well washed with cold water, filtered, and dried.—L. E.

Soluble starch; Process for preparing —— *by means of per-salts.* E. Flick. Fr. Pat. 406,084, Aug. 13, 1909.

SEE Eng. Pat. 25,121 of 1909; preceding.—T. F. B.

Starch; Manufacture of modified ——. W. Thomson, Manchester, Assignor to J. A. Morrice, Glasgow. U.S. Pat. 951,666, March 8, 1910.

SEE Eng. Pat. 21,973 of 1906; this J., 1907, 980.—T. F. B.

Utilisation of cellulosic materials and fibrous industrial wastes [sugar cane megasse]. Fr. Pat. 405,684, *See* V.

Preparing cellulose from the pulpy residues of beetroots or other roots. Fr. Pat. 406,006. *See* V.

Elastic substance [from starch]. Fr. Pat. 405,711. *See* XIV.

XVIII.—FERMENTATION INDUSTRIES.

Malt; Specific heat of —— and calculation of the "initial heat" of the mash. H. T. Brown. J. Inst. Brewing, 1910, **16**, 112—126.

The specific heat of finely ground malt has been determined by means of the apparatus described by Pickering (Chem. Soc. Trans. 1887, **51**, 293). The values observed range from 0·38 for anhydrous malt to 0·41 for malt containing 6 per cent. of moisture, and may be taken as accurate to within ±1 per cent. If this value be taken for calculating the "initial heat" of a mash from the known weights and temperatures of the malt grist and water, the author finds that the calculated temperature is invariably several degrees lower than the actual temperature of the mixture. This circumstance is attributed to the "slaking heat" or heat of hydration of the malt, which is developed when dry malt (or indeed any other organised matter) is moistened with water. The author has determined the "slaking heat" of malt containing varying percentages of moisture, and the results are tabulated. For instance, the slaking heat of anhydrous malt is 28 grm.-cals. (F.); that of malt containing 3 per cent. of moisture is 18·2; for 6 per cent. of moisture it is 11·5; for 9 per cent., 7·0; and for 12 per cent., 3·5. But if the slaking heat be included in the calculation it is found that the calculated initial temperature of the mash is higher than the actual by about just the same amount as, in the previous case, it was lower. The author shows that for all practical purposes the initial temperature of the mash may be calculated with sufficient accuracy by including half the slaking heat in the calculation. He explains the discrepancy by assuming that the starch of the malt is disorganised under the action of the hot water before the whole of the "slaking heat" has had time to develop itself. The formula given for the calculation stands thus: $\frac{St^\circ + RT^\circ}{S + R} + \frac{\frac{1}{2}H}{S + R} = I^\circ$ where S = the specific heat of the malt; t° = temperature of the malt; R = weight of water used per unit weight of malt; T° = temperature of the water; H = the full "slaking heat" of the malt, determined with cold water, in grm.-cals. F.; I° = the initial temperature of the mash.—J. F. B.

Malts; Determination of extract and colour values of coloured ——. A. C. Chapman. J. Inst. Brewing, 1910, **16**, 129—136.

The so-called "colour malts" are used exclusively for their colouring and flavouring qualities, and the latter deteriorate rapidly on storage. But in the purchase of roasted malt, it is desirable that attention should also be paid to the yield of extract, since this may vary within wide limits for malts of apparently the same quality. In determining the yield of extract, the result varies somewhat according to the method of procedure and the author points out the desirability for the adoption of some uniform method. His usual practice, in the case of black malt, is to make a 10 per cent. infusion by digesting the malt with water in a flask immersed in a boiling water-bath for one hour, the extract being calculated from the specific gravity of the infusion. As an alternative, the malt may be mashed with diastase solution, but the results are substantially identical in most cases. If the extract be determined by infusing the malt with water at 150° F., the results are usually appreciably lower, but in view of the fact that black malts are frequently boiled with the wort in the copper, the first method is to be preferred. Brown and "crystal" malts, on the other hand, which are used mainly for their flavour, are converted in the mash tun, and since they are practically devoid of diastase and contain starch in a very refractory condition, great variations in yield may result from different methods of mashing. The maximum yield in the laboratory is obtained by boiling the malt with water, cooling and then mashing in the ordinary way after the addition of diastase solution, but the yield under brewery conditions, where the coarse grist is mashed with pale malt, is always considerably less, owing to the refractory condition of the starch. Some general understanding is therefore most desirable in the case of such malts, in order that the analytical results obtained in the laboratory may afford some indication of the maximum yield to be expected under brewery conditions.—J. F. B.

Wine; Decolorisation of ——, with arsenical animal charcoal. A. Bruno and P. Turquand d'Anzay. Ann. Falsific., 1909, **2**, 404—405.

It is found that when wine is treated with arsenical animal charcoal, no trace of arsenic appears in the liquid. Of nine samples of animal charcoal examined, three were free from arsenic; three contained only fractions of a mgrm. in 100 grms.; two contained 8 mgrms.; and one, 22 mgrms.; The last was added to arsenic-free wine in the proportion of 10 grms. to the litre. After 3 weeks maceration, the wine remained free from arsenical contamination. —J. O. B.

Wines; Detection of formaldehyde in ——. A Hubert. Ann. Chim. analyt., 1910, **15**, 100—103.

The test recommended by Rouillard and Goujon (this J., 1910, 229) for the detection of formaldehyde in wine, which has been treated with hexamethylenetetramine, is a general reaction for aldehydes; it would give a coloration with the acetaldehyde present naturally in wine as well as with added formaldehyde, thus leading to erroneous conclusions should formaldehyde not be present. The author points out that there are several well-known reactions, characteristic of formaldehyde, which may be employed for detecting the latter even in the presence of acetaldehyde. In some cases a distinct odour of formaldehyde may be noticed when a small quantity of the treated wine is heated in a test-tube with a little calcium peroxide. Attention is also drawn to the fact that hexamethylenetetramine forms a compound with sulphurous acid which is partially insoluble in alcoholic solutions; the apparent desulphitating action of hexamethylenetetramine is, therefore, not solely due to the formation of a moderately stable compound of formaldehyde with sulphurous acid.—W. P. S.

Amyl alcohol; Reaction of ——. H. von Wyss, E. Herzfeld and O. Rewidzoff. Z. physiol. Chem., 1910, **64**, 479—480.

In testing for amyl alcohol by the new reaction described, the following solutions are employed: (1) 4·5 grms. of *a*-naphthol dissolved in 100 c.c. of cold 50 per cent. alcohol; (2) 4·5 grms. of *p*-phenylenediamine in 100 c.c. of cold absolute alcohol; (3) 4·5 grms. of sodium carbonate in 100 c.c. of water. If 2 c.c. of amyl alcohol be treated with 4 drops each of solutions 1 and 2, freshly prepared, and 4 drops of solution 3, an intense dark bluish-violet coloration is rapidly produced. The following substances show a similar reaction but in a far less pronounced degree: isobutyl alcohol, heptyl alcohol, ethyl alcohol, cetyl alcohol, glycerol and wax. It would appear that in the formation of indophenol, the amyl alcohol is capable of playing the part of a mixture of a peroxydase and hydrogen peroxide. If urine be substituted for the amyl alcohol, and 10 drops of a 3 per cent. solution of hydrogen peroxide be also added, the same blue coloration is developed owing to the presence of oxidising enzymes in the urine.—J. F. B.

Determination of d-tartaric acid. Kling. *See* XX.

Patents.

Liquors; Apparatus for [electrolytically] ageing ——. J. Seitz, Chicago, Ill. U.S. Pat. 950,579, Mar. 1, 1910.

The apparatus consists of a closed vessel, the cover of which is pierced by a non-conducting sleeve or collar through which passes a central rod. This rod extends into the liquor in the vessel and carries a number of electrodes which can be extended radially from the rod. Insulated positive and negative cables, connected with a source of electricity, pass through the sleeve and are attached to alternate electrodes.—W. P. S.

Fermented Liquors; Manufacture of ——. O. Huber, Assignor to Schneible Co., Chicago, Ill. U.S. Pat. 950.791, Mar. 1, 1910.

The process consists in fermenting wort, separating the developed yeast cells and immediately and rapidly effecting the development of the light and undeveloped yeast cells remaining in the liquid by the addition of readily fermentable sugars. The liquid is then separated from the yeast cells thus developed, cooled, and charged with gas. The operations are carried out as a continuous process.—W. P. S.

Grape beer; Process for making ——. E. W. Kuhn. Fr. Pat. 406,224, Dec. 2, 1908.

Sterilised grape juice (or concentrated must, or solutions obtained from dried grapes by diffusion) is diluted with water to such a degree that the proportion of sugar is reduced to about 100 grms. per litre, and the diluted liquid is boiled with hops in suitable proportions, and fermented with beer yeast.—L. E.

Denaturant for alcohol; Process for preparing a ——. J. Kluge. Fr. Pat. 406,373, Aug. 21, 1909.

See Eng. Pat. 19,257 of 1909; this J., 1910, 170.—T. F. B.

XIXa—FOODS.

Protein solutions; Behaviour of —— *towards acetone.* [*Determination of casein in milk, etc.*]. T. Weyl. Ber., 1910, 43, 508—511. (Compare Peters, this J., 1909, 103.)

Neutral solutions of most protein preparations are precipitated by commercial acetone, as also are natural protein solutions, *e.g.*, milk, blood and the aqueous extracts of animal organs. Protein solutions in dilute ammonia are not precipitated by acetone. Acetone also precipitates glycine, valine, dextrose and lactose. To prepare casein, 100 c.c. of milk are diluted with 100 c.c. of water and poured into 300 c.c. of acetone: after 45 minutes the precipitate is filtered off, dissolved in a minimum quantity of dilute ammonia, the liquid strained through linen, and the casein precipitated by the cautious addition of dilute acetic acid. To determine the total protein in milk, 20 c.c. are diluted with 20 c.c. of water and poured into 80 c.c. of acetone. The precipitate is collected on a weighed filter-paper, washed with a mixture of equal volumes of acetone and water, and then with absolute alcohol, and finally extracted in a Soxhlet apparatus with ether before drying at 115° C. The ash must be subtracted from the total weight of protein. Concordant results were obtained in this manner; they are higher than the values for casein obtained by Hoppe-Seyler's method. The method was also applied to the estimation of protein in defibrinated ox-blood.—E. F. A.

Butter fat; Alteration of —— *under the influence of air and light.* A. Nestrelajew. Milchwirtschaftl. Zentr., 1910, 6, 1—8. Chem. Zentr., 1910, 1, 755.

Experiments were made with a large number of samples of butter of different origin. Samples of the butter and of the butter fat were exposed to sunlight and air in glass vessels for 107 days at an average temperature of 12° C. (11·5°—12·5° C.), being weighed at intervals. In all cases there was a progressive increase of weight, but the compositions of butters of different origin were affected in different ways. The greater the proportion of unsaturated acids in the butter, the greater were the increase of weight and change of composition. If, however, the butter contained an excessive quantity of free acid, the change of composition and increase of weight did not depend upon the proportion of unsaturated acids present. The greatest changes were observed in the saponification value and in the mean molecular weight of the non-volatile acids, which both became larger, and in the iodine value, which became smaller. Butters from mountainous districts showed the least, and those from flat districts, the greatest alterations.—A. S.

Paraffin wax; Detection of —— *in lard.* G. R. Thompson and H. Hurst. Chem. News, 1910, 101, 109.

The following solubility test devised by Gerrans (Brit. Food J., Jan., 1910.) enables a small quantity of paraffin wax in lard to be detected with certainty:—Three c.c. of melted fat are dissolved in 10 c.c. of a mixture of equal volumes of absolute alcohol and chloroform, with the aid of heat, and the tube cooled in cold water. In the presence of paraffin wax, turbidity or separation of crystals takes place within five minutes. In the authors' experience a turbidity resulted within three minutes when the lard contained 1·5 per cent. of wax, but the presence of 1 per cent. could not be detected with certainty.—C. A. M.

Cocoa, etc.; Determination of fat in ——. A. Prochnow. Arch. Pharm., 1910, 248, 81—88.

Results of determinations of fat in various specimens of cocoa beans are given. The percentage of fat found in the raw beans varied from 50·80 to 53·98, and in the roasted beans from 50·12 to 53·70. The method employed in the determination was a modification of that described by Welmans (this J., 1900, 1151); the cocoa mass was obtained in a finely-divided condition as described and the powder was then extracted with ether in a Soxhlet apparatus for 18 hours. At the end of this time the extracted powder was removed from the cartridge, rubbed down in a mortar, and again extracted with ether for three hours; in several cases this second extraction yielded an additional quantity (up to 1·5 per cent.) of fat. As regards the detection of foreign fats in cocoa fat, determinations of the usual chemical and physical constants afford useful evidence of sophistication. A test proposed by Neuberg and Rauchwerger was found to be quite useless for the detection of animal fats in cocoa fat; this test, according to Neuberg and Rauchwerger, depends on the fact that cholesterol, when mixed with rhamnose, alcohol and concentrated sulphuric acid, yields a red-coloured solution which exhibits a characteristic spectrum. The author finds that phytosterol gives a similar spectrum and that it is impossible to distinguish the cholesterol of beef fat from the phytosterol of vegetable fats by means of the test. —W. P. S.

Tea and tea infusions; Analysis of ——. R. R. Tatlock and R. T. Thomson. Analyst, 1910, 35, 103—110.

The results of analyses of 22 samples of tea from different countries are given, the methods employed in the investigation being, with slight variations, those described by the authors in their paper on the analysis of coffee, etc. (this J., 1910, 138). The following table shows the minimum, maximum and average percentages obtained:—

	Indian teas. 11 samples.			Ceylon teas. 5 samples.			China teas. 6 samples.		
	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.
Water extract	43·47	49·75	46·43	41·32	48·25	44·10	38·43	46·94	43·09
Caffeine	2·79	4·91	3·45	2·34	4·14	3·25	2·62	3·10	3·05
Tannin	13·32	14·98	14·33	10·13	13·91	12·29	7·27	10·94	9·50
Ash soluble in water	2·84	3·91	3·35	2·76	3·27	3·01	2·92	3·61	3·16
Silica (chiefly sand)	0·04	0·46	0·18	0·03	0·05	0·04	0·08	2·74	0·61
Total mineral matter	5·22	6·65	5·85	5·14	5·48	5·32	5·78	8·87	6·51
Moisture originally present	5·30	8·20	6·82	5·60	8·00	6·83	6·12	9·70	7·81

The general conclusions from these results is that the Indian teas yield most extract to water, the Ceylon teas come next, and the China teas yield the lowest quantity of all. As regards caffeine, the results in the case of China and Ceylon teas bear out the contention that "the amount of caffeine present in tea is in most cases proportional to the commercial value and quality," but with Indian teas there are many exceptions to this rule. Analyses were also made on infusions of the teas, the infusions being prepared by steeping quantities of 7·5 grms. of the tea in 300 c.c. of water (soft water from Loch Katrine), at a temperature just below the boiling point, for three and five minutes, respectively. The infusions were then strained through muslin while still hot. The results show that the caffeine in China teas, or those containing least tannin, is extracted during infusion to a greater extent than the tannin or water extract, and that the proportion of tannin extracted is in almost every case lower than the water extract, thus showing that a much longer infusion than five minutes must give a liquor rather richer in tannin.—W. P. S.

Foods; A new substance contained in ——. A. Backe. Comptes rend., 1910, **150**, 540—543.

Various kinds of bread and biscuits were found to contain, in very small quantity, a new substance which resembles maltol, but differs in crystalline structure, is much more volatile, does not turn brown on exposure to air, and melts at 95° C. (m. p. of maltol = 159° C.). It is extracted by chloroform or ether, and can be detected by giving with ferric chloride (even in acid solutions) a red colour, changing to violet with excess of the reagent. It is destroyed by heating with caustic soda solution. The substance appears to be formed by baking (caramelising), but only after the action of a diastatic enzyme present in flour and malt, but which is not amylase: it can also be detected in certain sugars and in coffee and cocoa after roasting. Distillation with sulphuric or phosphoric acid produced the same effect as baking or caramelising.—A. Seld.

Patents.

Malt composition for use as food. Edme, Ltd., London, and E. J. Lovell, Mistley, Essex. Eng. Pat. 25,341, Nov. 3, 1909.

Malt is mixed with the germ portion of wheat separated in the preparation of flour, the mixture is extracted and the extract evaporated *in vacuo* at 128° F. so as not to destroy the enzymes. The extract is added to the flour used for bread-making during the process of kneading, and the dough is allowed to ferment before baking.
—J. H. J.

Bread; Manufacture of ——. C. A. Heudebert, Nanterre, France. U.S. Pats. 950,920 and 950,921, Mar. 1, 1910.

(1) A semi-liquid paste, prepared by mixing flour containing about 53 per cent. of moist gluten, with yeast and water, is allowed to ferment for 2 hours. To the frothy paste thus obtained is added a mixture consisting of the same flour, salt, and soluble casein, the casein being in the proportion of from 30 to 70 per cent. of the weight of flour employed. The whole is then kneaded, and the dough is cut up into loaves, allowed to rise, and baked. (2) A gluten bread is prepared by dissolving soluble casein in tepid water, adding salt and allowing the solution to cool. Yeast is then added and the solution is kneaded with gluten flour containing about 96 per cent. of gluten; the quantities of casein and gluten used should be in the proportion of 150 grms. of the former to 500 grms. of the latter. The dough thus obtained is allowed to ferment and is then baked.—W. P. S.

Aeration of liquids and hygienic beverages; New method of —— by the use of tartaric acid and sodium bicarbonate. L. Aubinaud. Fr. Pat. 406,238, Aug. 17, 1909.

A mixture of tartaric acid and sodium bicarbonate, both in the granular form, is employed. This mixture, in contact with a liquid, gives a slow and regular evolution of carbon dioxide.—L. E.

Mineral waters; Process for preserving ——. J. L. Gaune. Fr. Pat. 405,575, July 29, 1909.

In the bottling process, a relatively small quantity of citric acid (0·1—0·5 grm. per litre) is added to the mineral water, whereby potash, soda, lime, iron and magnesium are converted into citrates, and the deposition of ferric oxide is prevented.—L. E.

Fruit juices; Process of concentrating ——. R. Oehme, Brussels, Assignor to O. Volz, Berlin. U.S. Pat. 950,950, March 1, 1910.

See Eng. Pat. 612 of 1906; this J., 1906, 332.—T. F. B.

Flour grist; Process of treating —— to obtain products of uniform quality. A. E. Humphries. Fr. Pat. 405,971, June 5, 1909. Under Int. Conv., June 19, 1908.

See Eng. Pat. 13,135 of 1908; this J., 1909, 1059.—T. F. B.

Extracting caffeine [from coffee]. U.S. Pat. 950,357. *See* XX.

XIXb—WATER PURIFICATION; SANITATION.

Mache units; Radio-activity of mineral springs, etc., expressed in ——. F. Henrich. Z. angew. Chem., 1910, **23**, 340—342. (See also this J., 1910, 369—370.)

According to a proposal made by Mache, the quantity of emanation in 1 litre of the water in question is determined. The emanation is first distributed in a definite volume of air (*e.g.*, by passing a current of air through the water), the air being circulated until it is "activated" up to the saturation current (maximum activity), and then the rate of fall of potential in 60 minutes is determined. This fall of potential, after applying certain corrections, is calculated into absolute electrostatic units, and the value obtained multiplied by 1000. Round numbers that can be easily compared are thus obtained, which form the "Mache units."

Water softening; Control of ——. E. Ristenpart. Z. angew. Chem., 1910, **23**, 392—396.

Determinations of the alkalinity of the softened water with both phenolphthalein and methyl orange as indicators, together with the determinations of the "permanent hardness," are recommended as the simplest and best means of controlling the working of the soda and lime softening process, the results indicating the nature and the extent of the irregularity. *Excess of lime-water*: This is indicated by the equal increase in the figures obtained on titration with phenolphthalein (P) and with methyl orange (M). If P be equal to or less than one-half of M, no excess of lime water has been added. *Excess of sodium carbonate* is shown by the increase of P being half of the increase of M. Even in a well-softened water, P has a minimum value equal to half the quantity of the constant amount of dissolved calcium carbonate or 0·84° of hardness (German scale, 1 c.c. of $N/28$ sulphuric acid required by 100 c.c. of water = 1° hardness); any excess of P (in the absence of calcium hydroxide) indicates excess of sodium carbonate. *Deficiency of lime-water* is at once shown by the difference between P and $\frac{M}{2}$, as the bicarbonate left in the water has no appreciable influence on P. *Deficiency of sodium carbonate.* This is ascertained by the total hardness giving a value greater than M. *Hardness.* Titration with standard soap solution is recommended on account of its simplicity, but the end reaction taken by the author, is the point when no more bubbles burst in the froth during an interval of 5—10 seconds. For more accurate work, titration with potassium stearate solution and phenolphthalein is considered preferable. *Water in steam boilers.* The above method is equally suitable for testing the water in the boiler itself, the rules $P \leqq \frac{M}{2}$ and $H \leqq \frac{M}{2}$ (H = tne hardness) are the measures for the proper softening of the feed waters, but the minimum value of P is higher owing to the pressure and temperature. The following reactions are stated to occur in the boiler.

(I). $Na_2CO_3 + H_2O = 2NaOH + CO_2$;

(II). $Na_2SO_4 + CaCO_3 = Na_2CO_3 + CaSO_4$.

The first is not of practical importance as it does not take place if no excess of sodium carbonate has been added to the water; the second reaction is unavoidable to the extent of the solubility of calcium carbonate in water and the quantity of sodium sulphate formed in the softening process, but in practice the author has never found P to exceed 8, or about 10 times the minimum amount.
—A. SBLD.

Water; Sterilisation of —— by means of the ultra-violet rays. E. Urbain, C. Scal, and A. Feige. Comptes rend., 1910, **150**, 548—549.

THE rays emitted by an arc formed between electrodes made from a mixture of equal parts of carbon and aluminium, were found to contain a good proportion of ultra-violet rays with a wave length from 1860—2900 Ångstrom units. Placed 1 metre above a circular trough containing town's water, the rays from the arc (with a current of 2 ampères) completely sterilised the water, after an illumination lasting 1 minute (see also this J., 1910, 171).
—A. SBLD.

Ultra-violet rays; Comparison of the photo-chemical and bactericidal action of ——. P. Cernovodeanu and V. Henri. Comptes rend., 1910, **150**, 549—551.

THE authors have previously shown the strong germicidal action of the ultra-violet rays, having a wave-length below 2900 Ångstrom units (this J., 1910, 171) and have now compared this with the photo-chemical action. The selected reactions were:—Decompostition of hydrogen peroxide, decomposition of potassium iodide in presence of hydrochloric acid and in presence of starch, reaction between mercuric chloride and ammonium oxalate, oxidation of leuco-derivatives of fluorescein, and the blackening of silver citrate paper. Taking as a standard the action of the rays passing through a glass screen of 1 mm. thickness (wave length over 3022 units), the rays passing through a viscose screen, having a wave length of over 2534 units, were found to have 300 times the bactericidal power but only 1·6 to 5 times the chemical action, and rays passing through a quartz screen, with a wave length over 2224 units, had only 4—16 times the chemical action, whilst the sterilising power had increased to 1000 times the standard. The germicidal action is therefore a much more characteristic property of the ultra-violet rays than the photo-chemical action. Living organisms are never subjected in nature to ultra-violet rays with a wave length under 2800—2900 units, this being the limit of the ultra-violet rays reaching the earth from the sun. A Cooper-Hewitt mercury lamp of 110 volts and 3 ampères was used for the experiments.—A. SBLD.

Ultra-violet rays; Penetration and bactericidal action of —— in relation to the chemical constitution of the medium. G. Vallet. Comptes rend., 1910, **150**, 632—634.

THE author has studied the action of ultra-violet rays, generated in a quartz-mercury lamp, on various solutions containing *Bacillus coli communis.* It is found that liquids such as ethyl alcohol, glycerol and certain saline solutions, are easily traversed by the rays, but albumin, peptone and oil for example, are strongly opaque. Moreover compounds like the latter seem to be additive in their effect, for solutions containing amounts of them which separately would not be sufficient to stop the rays, no longer allow them to pass when present together and are therefore not sterilised.—J. C. C.

Disinfection and colloid-chemistry. H. Bechhold. Z. Chem. Ind. Kolloide, 1909, 5, 22—25.

IF disinfection be considered from the point of view of colloid-chemistry, many phenomena become clear which were formerly wholly or partially unexplained. In the case of a bacterial emulsion to which a disinfectant in solution is added, the bodies of the bacteria considered as mere surfaces will cause a concentration of the disinfectant on themselves. From this it follows that a disinfectant dissolved in water acts better than when dissolved in an organic liquid, as is seen from the fact that anthrax spores are killed by a 5 per cent. phenol solution in water in 2 days, but not in 100 days by a five per cent. solution in oil. Thus adsorption plays an important rôle in disinfection, and the experiments of other workers are quoted in support of this view. This theory must not be pushed too far however, for if one disinfectant is stronger than another for one organism, then it should be so for all; but this is not so, and the differing behaviour must be put down to differences in the bodies of the bacteria themselves. An experimental curve is given which well shows this specific action of the bacteria. An organic group into which successive bromine atoms could be introduced was used as the disinfectant, and the curve shows how the strength of the disinfective action of the successive halogen-substituted compounds varied according to the organism acted on.—J. H. J.

PATENTS.

Digester for treating garbage. A. J. Morse, Minneapolis, U.S.A. Eng. Pat. 767, Jan. 12, 1909.

AN improved digester for which greater efficiency and economy is claimed. A low-pressure boiler supplies steam, heated to any desired temperature in a superheater, to a steam-jacketed tank provided with manholes for the introduction of the refuse. Means are provided for rotating the tank, for withdrawing condensation water and water given off by the material, and for introducing steam into the digester, as well as into the jacket.
—H. P. P.

Effluents; Separating light or floating substances from ——. R. Schilling, Dahlem, and Ges. f. Abwässerklärung, Berlin-Schöneberg, Germany. Eng. Pat. 20,179, Sep. 3, 1909.

THE effluent passes from a pipe into the centre of a circular tank of large cross-section, so that a considerable reduction in the rate of flow is obtained, and the light suspended matter consequently rises to the surface. The water does not pass out over the top of the tank, but flows downwards into the lower portion which has a conical false-bottom connecting with an inverted cone, the apex of which opens into a pipe passing outside the tank and upwards to a level slightly below that of the top of the tank. By this means the water below the floating layer has its velocity increased in its passage through the constricted lower portion of the tank, and therefore the heavy suspended matter does not remain in the tank but passes out along with the rapid current of water.—J. H. J.

Sewage sludge; Desiccating ——. J. Grossmann, Manchester. Eng. Pat. 22,140 of 1908; date of application, April 20, 1909.

THE apparatus used is a centrifuge consisting of a revolving drum of large diameter with non-perforated sides, into the centre of the bottom of which the sludge is fed slowly from an agitator placed above. The desiccated sludge collects against the periphery and a moderately clear liquid nearer the centre. A horizontal arm of a siphon is slid along a rest against the inner face of the liquid column at the top of the drum, and conveys the liquid away as more sludge enters. As the layer of desiccated sludge increases, the siphon moves towards the centre, until when a sufficiently thick layer has been obtained, the supply of sludge is cut off. The siphon then moves towards the periphery, removing the last of the clear liquid and finally the thinnest of the sludge layer. At this point the drum is stopped and the desiccated sludge removed. A sludge of about 60 per cent. moisture is obtained. The method of working the siphon enables the centrifuge to be run at a lower speed than has been possible heretofore.—J. H. J.

Water, Purification of ——. F. Candy, London. Eng. Pat. 8296, Apr. 6, 1909.

The excess of chlorine in solution in water which has been sterilised by addition of chlorinating agents, may be removed by bringing the water into contact with coal, cocoanut fibre, or sponge. This is done by passing the water through a layer of the material in a fine state of division; the coal should be in pieces from $\frac{1}{32}$ to $\frac{1}{8}$ inch in diameter, the cocoanut fibre as sold for horticulture, and the sponge in $\frac{1}{4}$ inch pieces. The depth of the layer of coal should be two feet, but a deeper layer would be required for coarser material. The fibre and sponge should be in layers six inches thick. The coal and fibre gradually lose their power after 2 weeks, and the sponge after 4 weeks. The dechlorination can also be effected by mechanically mixing one part by weight of coal with 300 parts by weight of water, and one part of fibre with 500 parts of water, and then depositing or filtering through sand.—I. H. J.

[*Water purification*] *Liquids; Process and apparatus for imparting certain properties to —— by the action of light and of metals.* C. Neff and A. Brandes. First Addition, dated August 14th, 1909, to Fr. Pat. 378,877, June 15, 1907 (this J., 1907, 1196).

A modified apparatus, suitable for treating boiler supply water, is claimed. The water to be treated, flows from a number of tubes over a large metallic surface (preferably of corrugated aluminium) which is exposed to the action of a source of light, the length and inclination of the surface corresponding to the nature of the water. The water thus treated does not form boiler incrustations, yielding, at most, small, fine deposits which are easily removed.—L. E.

Water; Process for removing iron and micro-organisms from ——. J. D. Reidel, Akt.-Ges. Fr. Pat. 405,990, July 17, 1909. Under Int. Conv., Nov. 23 and Dec. 10, 1908.

The process consists in treating the water with insoluble higher oxides of manganese with the co-operation of natural or artificial zeolites. If a calcium-zeolite is treated with a solution of a manganous salt, a manganese zeolite is formed, which, on treatment with calcium permanganate, yields a product consisting of higher oxides of manganese distributed in a fine state of division throughout a calcium-zeolite. On filtering the water to be treated through this material, the iron is rapidly oxidised and removed, and organic matter and bacteria are destroyed; the process also removes any manganese that may be present in the water. The exhausted material is treated with an oxidising agent such as a permanganate, manganate, persulphate, or ozone, and employed again. —L. E.

Therapeutic and disinfecting substances, intended especially for the treatment of the respiratory organs; Process for the atomisation of ——. W. von Skorzewski. Ger. Pat. 217,789, Jan. 15, 1909. Addition to Ger. Pat. 200,489, Jan. 22, 1907.

The substances are incorporated with the porous briquettes prepared from vegetable materials, without pressing, as described in Ger. Pats. 200,489 and 215,141. The briquettes, when ignited, continue to glow until completely burnt, and the vapours of the incorporated substances are distributed through the surrounding air by means of the smoke from the briquettes.—A. S.

Formaldehyde; Process for preparing gaseous —— from formaldehyde solution or polymerised formaldehyde. Chem. Fabr. Griesheim Elektron. Ger. Pat. 217,944, Feb. 11, 1908.

Gaseous formaldehyde is obtained by the action of hypochlorites, either solid or in solution, on formaldehyde solutions or on the polymers of formaldehyde. Paraformaldehyde and bleaching powder, when made up into tablets, generate formaldehyde in air, and when dissolved in water furnish formaldehyde solutions.—T. F. B.

Water: Process for removing iron and organic germs from ——. R. Gans, Pankow, Assignor to J. D. Riedel, A.-G., Berlin. U.S. Pat. 951,641, March 8, 1910.

See Fr. Pat. 405,990 of 1909; preceding.—T. F. B.

XX. ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Quinine and urea hydrochloride. G. L. Schaefer. Pharm. J., 1910, **84**, 324.

A substance used as a local anæsthetic is prepared by mixing one molecular proportion of quinine bihydrochloride with one molecular proportion of urea, and crystallising the product from water. It forms nearly colourless hard prisms, having the composition,

$$C_{20}H_{24}N_2O_2(HCl)_2,CO(NH_2)_2,\ 5H_2O.$$

It dissolves in one part of water, and the solution has a strong acid reaction; it will also dissolve in 2 to $2\frac{1}{2}$ parts of strong alcohol. When crystallised, it softens at 65° C., and melts almost completely, with some decomposition at 135° C. The anhydrous salt decomposes at 180°—190° C. The substance gives the usual reactions for quinine and urea.—F. Shdn.

Hydrastine; Determination of —— in fluid extract of hydrastis. E. Rupp. Apoth.-Zeit., 1909, **24**, 922—923.

Ten grms. of the liquid extract are mixed, in a tared 125 c.c. Erlenmeyer flask, with 20 grms. of water, and evaporated by gentle boiling until the weight is reduced to 9 or 11 grms., in order to drive off the alcohol. After cooling somewhat, 1·5 grms. of dilute hydrochloric acid are added, and the total weight is brought up to 20 grms. by the addition of more water. One grm. of talc is then added the mixture is strongly shaken for one minute, and thrown on a plain filter. Ten grms. of filtrate are collected in a 100 c.c. flask; 4 grms. of solution of ammonia and 20 grms. of ether are added and the whole is well shaken for a minute: 20 grms. of light petroleum spirit are then added, and thorough agitation is repeated; after a further addition of 1·5 grms. of powdered tragacanth, the whole is shaken until the gum aggregates. Thirty-two grms. of the clear liquid (= 4 grms. of the original extract) are then decanted into a tall, tared beaker; the solvent is evaporated off, and the residue of hydrastine dried till of constant weight.—J. O. B.

Carpaïne; Constitution of ——. Part I. G. Barger. Chem. Soc. Proc. 1910, **26**, 53.

Carpaine, the alkaloid from the leaves of the Papaw tree, *Carica Papaya*, L., was discovered by Greshoff, and has been further examined by Merck and by van Ryn (Arch. Pharm., 1897, **235**, 332), who found that it is a secondary base of the formula, $C_{14}H_{25}O_2N$. In the present investigation it has been so far shown that carpaine is hydrolysed by acids and baryta to a substance, $C_{14}H_{27}O_3N$, soluble in water, which contains a carboxyl group and is also a base. It closely resembles certain amino-acids, and the name *carpamic acid* is suggested for it. When heated with alcoholic hydrogen chloride, carpaine yields the hydrochloride of *ethyl carpamate*, $C_{13}H_{26}ON.CO_2C_2H_5,HCl$. The hydrochloride of carpaine is transformed by chlorine into a very unstable, neutral *substance*, $C_{14}H_{23}O_3NCl_2$, insoluble in water and melting at 77° C. after crystallisation from methyl alcohol. The yield of all the above substances is quantitative. On oxidation by potassium permanganate in acetone solution, a nitrogenous acid results, from which ultimately a minute quantity of a crystalline dibasic acid, $C_8H_{14}O_4$, can be obtained, probably $\alpha\delta$-dimethyladipic acid. The latter acid is also produced, in very much larger quantity, by oxidation of carpaine with nitric acid.

Glucosides; Formation of —— by plants. G. Ciamician and C. Ravenna. Atti R. Accad. dei Lincei, Roma, 1909, [5], **18**, II., 594—996. Chem. Zentr., 1910, **1**, 935—936.

From 1 to 2 kilos. of maize plants, ground to a pulp were allowed to stand for about two months in contact with aqueous solutions of salicin, saligenin, catechol, quinol, and benzalcyanhydrin (mandelic acid nitrile), respectively, in presence of toluene as an antiseptic. In the case of salicin, a portion of the glucoside was decomposed, a quantity of saligenin being formed corresponding to 3—12 per cent. of the glucoside used. The addition of dextrose to the salicin had no perceptible influence on the result. In the experiments with saligenin, about 0·3—0·4 per cent. of the latter was converted into salicin. In comparative experiments in which equimolecular amounts of saligenin and dextrose in water were treated with emulsin, 0·25—0·8 per cent. of the saligenin was converted into salicin. In the other experiments with the maize pulp, catechol yielded a small quantity of a glucoside, as also apparently did mandelic acid nitrile; quinol gave small quantities of a crystalline substance which has not been identified.—A. S.

Amygdalin; The hydrolysis of —— by emulsin. L. Rosenthaler. Arch. Pharm., 1910, **248**, 105—112.

The action of emulsin on amygdalin results first of all in the formation of decomposition products: these, under the action of the emulsin, undergo further changes, condensation substances being formed. By the cleavage, dextrose and mandelonitrile-glucoside are produced; the latter substance is then decomposed into benzaldehyde, hydrocyanic acid, and dextrose; probably an intermediate product, *d*-benzaldehydecyanohydrin, is also formed. As regards the second part of the reaction, the benzaldehyde and hydrocyanic acid combine to form benzaldehydecyanohydrin; under the influence of the emulsin both the *d*-nitrile and the inactive form may be produced. The formation of the latter is favoured by the catalytic action of cyanogen-ions produced by the presence of inorganic substances in the emulsin.—W. P. S.

Salicin; Hydrolysis of —— by the enzyme emulsin. C. S. Hudson and H. S. Paine. U.S. Dep. Agric., Bureau of Chemistry, 1909. Circular No. 47, 1—8.

Noyes and Hall showed that the rate of the acid hydrolysis of salicin in aqueous solution, follows the law of unimolecular reactions; in this process, owing to the presence of the strong acid and the high temperature employed, the mutarotation of the glucose liberated, proceeds so rapidly compared with the rate of the hydrolysis that it may be neglected. In the hydrolysis of salicin by emulsin, however, the rotation of the solution during hydrolysis is affected by the mutarotation of the glucose, the case resembling the hydrolysis of sucrose by invertase (cp. Hudson, this J., 1908, 822, 1076; 1909, 744). Owing to neglect of this factor, it has hitherto been assumed that the hydrolysis of salicin by emulsin does not follow the unimolecular law. The authors have determined the real rate of the hydrolysis of salicin by emulsin at 0° and 30° C.; the mutarotation of the glucose was brought to completion, and the action of the emulsin stopped by rendering the solution slightly alkaline with sodium carbonate, or by heating it rapidly. These experiments show that the rate of hydrolysis of salicin by emulsin follows the unimolecular law, and it is also shown that the glucose liberated from salicin is β-glucose. The authors also find that emulsin is active in only a small region of acidity and alkalinity near the neutral point.—L. E.

Oleuropein; Variations in the proportion of —— in the olive during its growth. E. Bourquelot and J. Vintilesco. J. Pharm. Chim., 1910, **1**, 292—296.

The amount of the glucoside, oleuropein, (this J., 1908, 1038) present in the fruit of the olive tree during various stages from its first appearance to full ripeness was approximately found by determining the quantity of reducing sugars already present and those formed after treatment with invertase and with emulsin. From the results, which are given in tabular form, it appears that the glucosidal principle in the olive diminishes during its growth, and in the process of drying, and is not present in the olives of commerce. (See also Power and Tutin, this J., 1908, 1221.)—C. A. M.

Ornithogalum thyrsoides; Chemical examination of ——. F. B. Power and H. Rogerson. Pharm. J., 1910, **84**, 326—329.

An investigation of the constituents of the plant, *Ornithogalum thyrsoides*, Jacq., has been made, as it is reported to have proved poisonous to horses in Cape Colony. No alkaloid was found to be present. The portion of the alcoholic extract of the plant soluble in water contained inorganic salts and a sugar yielding *d*-phenylglucosazone. The portion of the alcoholic extract insoluble in water was a dark green resin, amounting to about 4 per cent. of the weight of the whole dried plant. This resin was extracted with several solvents. Palmitic acid, pentatriacontane, and a phytosterol, $C_{27}H_{46}O$, m. pt. 133°—134° C., $[\alpha]_D = -33{\cdot}6°$ in chloroform, were found in the light petroleum extract. Ether removed resinous material and ipuranol, $C_{23}H_{38}O_2(OH)_2$, which has now been found to have $[\alpha]_D = -37°{\cdot}2$ in pyridine. Chloroform, ethyl acetate, and alcohol extracted amorphous matter. The toxic principle appears to be chiefly contained in the resin, especially in that portion soluble in ether. All the solvents, except light petroleum, dissolved out physiologically active substances.—F. Shdn.

Essential oils free from terpenes and sesquiterpenes. E. Böcker. J. prakt. Chem., 1910, **81**, 266—281.

As a general rule the hydrocarbons of essential oils are of little value from the point of view of odour or taste. Moreover they are insoluble in aqueous alcohol and have a tendency to resinify. The author has separated each essential oil into two portions. One contains all the hydrocarbons, terpenes and sesquiterpenes, but none of the substances giving the oil its characteristic aroma. The other portion of the oil is quite free from hydrocarbons. Special methods have to be used for each oil. The author has drawn up a table showing the specific gravity, optical rotation, solubility in alcohol of various strengths, and other constants of the natural oil, and of the same oil when freed from hydrocarbons. Figures are given for upwards of sixty oils.—F. Shdn.

Aniline antimony tartrate. P. Yvon. J. Pharm. Chim., 1910, **1**, 233—238; 281—285.

A useful therapeutical substitute for tartar emetic may be prepared by adding to a hot solution of 150 grms. of tartaric acid in a litre of water, 93 grms. of aniline, followed by 288 grms. of antimonious oxide, and keeping the liquid for about an hour at 10° C., with constant agitation. It is then filtered and allowed to crystallise. The salt formed at 15° C. is a hydrate containing one molecule of water, whilst the anhydrous salt, which crystallises at 35° C. in hexagonal crystals, has the composition, $C_4H_5O_6(SbO)C_6H_7N$, and is the same as that first obtained by Evans (Ber., 1882, **13**, 1787). Both forms of the salt are dextro-rotatory, the hydrated salt giving $[\alpha]_D = 115° 61'$ at 17° C., and the anhydrous salt, 121° 28′ at 19° C. The sp. gr. of the hydrated salt at 20° C. was 1·569, whilst that of the anhydrous salt at 18° C. was 2 117. Aniline emetic is readily soluble in water, 1 grm. of the anhydrous salt dissolving in 6·36 grms. of water at 15° C., and in 0·567 grm. at 100° C. It is only sparingly soluble in alcohol. In aqueous solution it gives a violet red coloration with calcium chloride; a white precipitate (soluble in slight excess) with hydrochloric acid; a white precipitate (soluble in large excess) with nitric acid; and an orange-red precipitate (soluble in ammonium hydrosulphide) with hydrogen sulphide.—C. A. M.

Artificial colouring matters; Detection of —— in pharmaceutical preparations and especially in vegetable juices by means of hydrogen peroxide. M. Paul. J. Pharm. Chim., 1910, **1**, 289—292.

A method is based upon the fact that natural colouring matters are bleached by hydrogen peroxide much more rapidly than solutions of synthetic dyestuffs. If from 3 to 10 c.c. of a fruit juice (cherry, raspberry, quince, gooseberry, mulberry) be mixed with 20 c.c. of hydrogen peroxide solution and the tube left open, decolorisation will take place within 48 hours at the ordinary temperature. In the case of buckthorn 1 c.c. of the juice treated in the same way gives a greenish coloration owing to the presence of chlorophyll; but if, after about 25 minutes the mixture of juice and hydrogen peroxide is shaken with 2 to 3 c.c. of petroleum spirit, a colourless liquid is finally obtained. Red wine (3 c.c.) is also decolorised within 48 hours. On the other hand the same fruit juices and wine artificially coloured by means of one of the following dyestuffs (orcein, Bismarck brown, rosaniline hydrochloride, Bordeaux red, magenta) will retain its colour for eight days after the treatment. Liquids coloured with picric acid, methyl green, or copper sulphate also remain unaffected by hydrogen peroxide. The colorations due to the two latter substances may be distinguished from that of chlorophyll by the fact that they do not disappear on shaking with petroleum spirit.—C. A. M.

Guaiacol; Action of phosphorus trichloride on —— P. Dupuis. Comptes rend., 1910. **150,** 622—623.

When phosphorus trichloride acts on guaiacol, three compounds are formed, namely, (1), monoguaiacophosphorous chloride, $CH_3.O.C_6H_4.OPCl_2$. a colourless, fuming liquid boiling at 135° C. under 13 mm. pressure: it combines with two atoms of chlorine to form a yellow solid; (2), diguaiacophosphorous chloride, $(CH_3O{\cdot}C_6H_4{\cdot}O)_2PCl$, a colourless oil boiling at 235° C. under 13 mm. pressure, which also combines with two atoms of chlorine; and (3), guaiacol phosphite $(CH_3.O.C_6H_4.O)_3P$ which forms cubical octahedra melting at 59° C. With water it is quantitatively decomposed into guaiacol and phosphorous acid.—J. C. C.

Phenol, salicyl alcohol (saligenin), salicylic acid, and p-hydroxybenzoic acid; Determination of —— as tetrabromophenol. W. Authenrieth and F. Beuttel. Arch. Pharm., 1910, **248,** 112—127.

When phenol, saligenin, salicylic acid, and *p*-hydroxybenzoic acid are treated in aqueous solution at the ordinary temperature with an excess of bromine, the compound formed in each case consists of tetrabromophenol, and not tribromophenol. The yield is quantitative and the reaction may be employed for the determination of these substances. For this purpose, a weighed quantity of the substance is dissolved in, or emulsified with, cold water and shaken thoroughly with an excess of bromine-water; after the lapse of 6 hours. or more, the precipitate is collected on a weighed filter, washed with a small quantity of dilute bromine-water, dried under reduced pressure over sulphuric acid, and weighed. The compound has the formula:—$C_6H_2Br_4O$. In a number of experimental determinations the method yielded from 95·7 to 101·8 per cent. of the weight of the substance taken. The cresols do not yield tetrabromophenol when treated as described above, a number of different bromine compounds being obtained.—W. P. S.

d-Tartaric acid; New method of determination of ——. A. Kling. Comptes rend., 1910, **150,** 616—618.

The errors which arise in the usual method of estimating tartaric acid by precipitation of its acid potassium salt may be avoided by precipitating the acid as calcium racemate, $Ca(C_4H_4O_6)_2.8H_2O$, and titrating a solution of this with potassium permanganate. The details of the method are as follows: 25 c.c. of a solution of ***d***-tartaric acid (containing 3—4 grms. per litre) are added to 100 c.c. of water, 25 c.c. of a solution of ***l***-Rochelle salt (16 grms. per litre: free from *d*-salt) and 20 c.c. of a solution of pure calcium acetate (30 grms. per litre). The precipitate is collected, washed and dissolved in 20 c.c. of hydrochloric acid (40 grms. per litre). The solution is diluted to 150 c.c. and added to 40 c.c. of a solution of sodium acetate (10 per cent.) and of calcium acetate (1 per cent.) and boiled. After cooling, the racemate is collected, washed with water, redissolved in 10 per cent. boiling sulphuric acid and titrated at the boiling point with a solution of permanganate (containing about 16 grms. per litre) of which the titre has been determined by means of pure bitartrate. The method gives good results and can be used for the estimation of tartaric acid in wines.
—J. C. C.

Formaldehyde; Detection of traces of —— in presence of acetaldehyde, by means of magenta bisulphite. G. Denigès. Comptes rend., 1910, **150,** 529—531.

The coloration given by acetaldehyde with magenta bisulphite disappears after some hours, whilst the colour given by formaldehyde is stable. The difference is increased by strongly acidifying the solution with sulphuric acid. If 1·2 c.c. of sulphuric acid (1·66 sp. gr.) and 5 c.c. of magneta bisulphite solution are added to 5 c.c. of an aqueous solution of acetaldehyde (containing not more than 2 per cent.), the colour formed will practically quite disappear after some time, but a coloration remains it the acetaldehyde contains even one ten-thousandth of its weight of formaldehyde. The method can be utilised for the detection of compounds which readily yield formaldehyde, *e.g.*, traces of methyl alcohol in alcohol can be readily detected, after oxidation with permanganate, and comparative estimations can be made. The magenta bisulphite used is prepared by adding 20 c.c. of sodium bisulphite to 1 litre of magenta solution (containing 1 grm.) and after 5—10 minutes, 20 c.c. of hydrochloric acid (1·18 sp. gr.) are added to the mixture; after an hour or two the solution is sufficiently decolorised for use.—A. Sbld.

Metallic calcium and absolute alcohol as a reducing agent C. Marschalk. Ber., 1910, **43,** 641—642.

Calcium and alcohol cannot be substituted for sodium and alcohol in reductions, as they are not nearly so energetic. They have an individual reducing power, however, reducing benzophenone, for example, to diphenylcarbinol, whilst sodium and alcohol reduce it to diphenylmethane.
—J. T. D.

Volumetric valuation of sodium arsenate solution. Lukanow. *See* VII.

Patents.

Immunisation of diseased tissues; Substances serving for the local ——. A. Wassermann, Berlin. Eng. Pat. 25,675, Nov. 6, 1909. Under Int. Conv., Nov. 7, 1908.

Immunising substances which have a specific local effect on the tissues to which they are applied, are prepared by making extracts of suitable living or killed micro-organisms or their products, sterilising the same and incorporating them with various pharmacological emulsifying agents, or else with unguents and the like. It is claimed that when these preparations are applied to diseased parts, the active principles are absorbed and impart local immunity from infection.—J. F. B.

Organic compounds containing the acetyl group; Process of preparing ——. M. Mugdan, Assignor to Consortium f. Elektrochem. Industrie, Nuremberg, Germany. U.S. Pat. 944,372, Dec. 28, 1909.

By the action of silicon tetrachloride on an acetate, acetyl chloride or acetic anhydride is produced quantitatively, according to whether two or four mols. of the acetate are employed to each mol. of silicon tetrachloride. The process may be carried out by heating a mixture of the two substances, or by passing silicon tetrachloride vapour over sodium or other acetate heated to 160°—180° C. In the first case, the mixture should be assisted by making the acetate into a paste with an indifferent substance, *e.g.*, a small quantity of acetic anhydride, before adding the silicon tetrachloride.—T. F. B.

Caffeine [from coffee]; Process of extracting ——. H. Trillich, Munich, Germany. U.S. Pat. 950,357, Feb. 22, 1910.

Unground raw coffee is thoroughly moistened and the mass is subjected to the action of an electric current, whilst maintained in agitation, in order to dissociate the caffeine from the tannic acid. The coffee is then treated with a hot caffeine solvent, which dissolves the alkaloid without extracting the aromatic and other ingredients of the coffee, which is still agitated during the process of extraction. Finally the residual solvent adhering to the coffee is removed.—J. F. B.

Bornylene; Process for preparing —— from dextropinene. I. L. Kondakow. First Addition, dated Aug. 10, 1909, to Fr. Pat. 397,161, Dec. 8, 1908 (this J., 1909,745).

THE bornylene, prepared by the method described in the original specification, may form the basis for the preparation of a new "β" series of camphor derivatives, such as β-bornylene ether, β-borneol, β-camphor, etc.—J. F. B.

Camphor; Manufacture of artificial ——. H. du Boistesselin and J. Verny. Fr. Pat. 406,005, Nov. 28, 1908.

THE process described for the manufacture of camphor in a single operation consists in treating oil of turpentine, dissolved in benzene, petroleum spirit or other neutral solvent of camphor, with a source of nascent oxygen, such as hydrogen or alkali peroxides or monopersulphuric acid. For instance, a mixture of 90—100 kilos. of oil of turpentine with 80—120 kilos. of benzene or petroleum spirit is treated gradually with 25—35 kilos of sodium peroxide and sufficient water to make with the latter a solution of 3—5 per cent. concentration. The mixture is stirred continuously, and the reaction may be hastened by the addition of small quantities of suitable known catalytic agents, or else by heating. After about 24 hours, the layer of benzene is separated and the camphor is recovered, with almost quantitative yields, by the evaporation of the solvent. If desired, the quantity of peroxide prescribed above may be replaced by 75—85 kilos. of monopersulphuric acid.—J. F. B.

Stibine; Preparation of compounds by the dissociation of aromatic derivatives of ——, and preparation of the stibines necessary therefor. L. Kaufmann. Fr. Pat. 406,138, Aug. 14, 1909. Under Int. Conv., Aug. 18, 1908, Jan. 17 and July 2, 1909.

THE claims relate to the decomposition of compounds of the general formula, R_3SbX_2, where R is a simple or substituted aryl group, whilst X_2 represents two similar or different monovalent elements or radicals or one divalent radical. In the decomposition, the antimony may be split off in combination with the aryl radicals or with the other radicals. Specific cases relate to the preparation of nitro-*p*-tritolylstibine and of triphenylstibine sulphide, by the action of hydrogen sulphide on halogenated derivatives of triphenylstibine or on its hydroxide. Further compounds are obtained by dissolving triphenylstibine sulphide in alkali sulphides or ammonium sulphide. Arylstibines are prepared from their sulphides by decomposing the latter by treatment with metals and heating. Arylstibine iodides are prepared by treating arylstibines or their sulphides with iodine in alcoholic solution. In all specific cases the claims cover the homologues and derivatives of the compounds cited, and instead of the derivatives of the triarylstibines, the corresponding derivatives of arylalkylstibines may be used or prepared.—J. F. B.

Sodium glycerophosphate; Process for preparing ——. J. A. Wülfing. Ger. Pat. 217,553, March 13, 1909. Addition to Ger. Pat. 205,579, April 30, 1908.

IN the principal patent (this J., 1909, 161) a by-product which has been identified as the glyceryl ester of acid sodium pyrophosphate, is formed and is difficult to saponify. To avoid this, soluble, finely-divided sodium metaphosphate (which may be obtained by evaporating concentrated solutions of commercial sodium metaphosphate containing glycerol, or by neutralising metaphosphoric acid with the calculated quantity of alkali, is heated with excess of glycerol *in vacuo*, to temperatures not exceeding 145° C., and the monosodium glycerophosphate thus obtained converted into the disodium salt and separated in the known manner.—T. F. B.

Theophylline and piperazine; Process for preparing a double compound of —— easily soluble in water. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 217,620, July 17, 1907. Addition to Ger. Pat. 214,376, May 4, 1907.

SOLUBLE compounds of theophylline and piperazine are obtained by the interaction of the salts of the two compounds, such salts being employed which produce an insoluble by-product (compare U.S. Pat. 919,161 of 1909; this J., 1909, 543).—T. F. B.

Organic acids; Process for preparing ——. E. Erdmann. Ger. Pat. 217,846, Nov. 22, 1908.

COPPER and nickel salts of organic acids are easily decomposed when heated in a current of hydrogen, the free acid being formed. The temperatures of the reactions vary between 150° and 250° C. This process forms a ready means of preparing concentrated liquid acids from their solutions.—T. F. B.

Metabolic glands; Process for obtaining solutions suitable for injection of the colouring matters of ——. E. Diesing. Ger. Pat. 217,853, Nov. 15, 1908.

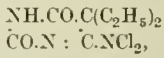
THE finely divided glands are allowed to stand for 12 hours or more with a 1 per cent. solution of sodium carbonate, the solution is shaken with ether, and the ethereal extract, containing the dyestuff, is distilled and the residue dissolved in a 1 per cent. solution of soap.—T. F. B.

Silver succinimide and hexamethylenetetramine; Process for preparing concentrated aqueous solutions containing the double compound of ——. J. D. Riedel A.-G. Ger. Pat. 217,897, Aug. 8, 1908.

SILVER succinimide and hexamethylenetetramine are dissolved in water, aqueous methyl or ethyl alcohol, or aqueous acetone, and the solutions warmed, preferably *in vacuo*, until crystallisation commences. Concentrated solutions of the double compound are obtained either by dissolving it in aqueous solutions of hexamethylenetetramine, or by mixing together aqueous solutions containing one mol. of silver succinimide and two or more mols. of hexamethylenetetramine. The resulting solutions are stable, and are not discoloured by exposure to light, neither do they coagulate albumin.—T. F. B.

Iminodialkylpyrimidines; Process for preparing halogen-substituted ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 217,946, Jan. 30, 1909.

BY the action of halogenating agents on iminodialkylpyrimidines, halogen derivatives are produced; for example, from 2·6-dioxy-4-imino-5-diethylpyrimidine, a dichloro-derivative,



$$\begin{array}{l}NH.CO.C(C_2H_5)_2\\ CO.N : C.NCl_2\end{array}$$

is obtained. The products are decomposed by acids, halogen being liberated and the original substance being re-formed, whilst by heating with water the corresponding oxy-derivatives are obtained.—T. F. B.

p-Aminobenzoic acid isobutyl ester; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 218,389, March 12, 1909.

p-AMINOBENZOIC acid isobutyl ester is prepared by esterifying *p*-aminobenzoic acid or its salts with isobutyl alcohol or an isobutyl halogenide, or by reducing *p*-nitrobenzoic acid isobutyl ester or the corresponding azo compound. The resulting ester has more powerful anæsthetic properties than the other known esters of *p*-aminobenzoic acid. —T. F. B.

Alkali salts of acetylsalicylic acid; Process for preparing ——. G. Richter. Ger. Pat. 218,467, April 5, 1908.

SOLUTIONS or suspensions of acetylsalicylic acid in methyl alcohol or in acetone containing a small percentage of water, are decomposed by agitating with solid alkali carbonates, carbon dioxide being evolved. The resulting solutions are filtered and the salts of acetylsalicylic acid precipitated by means of ether. The products are readily soluble in water and alcohol.—T. F. B.

Sulphur compound of quinine; Process of producing a ——. W. Fairweather, London. From Valentiner und Schwarz, Leipzig-Plagwitz, Germany. Eng. Pat. 6173, March 15, 1909.

See Fr. Pat. 400,631 of 1909; this J., 1909, 1062.—T. F. B.

Pharmaceutical compounds [esters of diglycollic acid]. Preparation of ——. G. W. Johnson, London. From C. F. Boehringer und Söhne, Waldhof, Germany. Eng. Pat. 26,814, Nov. 18, 1909.

See U.S. Pat. 948,084 of 1910; this J., 1910, 298.—T. F. B.

Reduction of organic substances. F. Bedford, Assignor to C. E. Williams, Sleaford. U.S. Pat. 949,954, Feb. 22, 1910.

See Eng. Pat. 9112 of 1908; this J., 1909, 1005.—T. F. B.

p-Aminobenzoic acid; Process of making the n-propyl ester of ——. R. Lüders, Hamburg, Germany. U.S. Pat. 950,936, March 1, 1910.

See Eng. Pat. 2020 of 1909; this J., 1909, 814.—T. F. B.

Ether and alcohol; Apparatus for recovering ——. C. Crépelle-Fontaine, La Madeleine lez Lille, France. U.S. Pat. 951,067, March 1, 1910.

See Fr. Pat. 396,664 of 1908; this J., 1909, 597.—T. F. B.

Hydrocarbons; Process of converting carbohydrates into ——. A. Heinemann, London. U.S. Pat. 951,072, March 1, 1910.

See Eng. Pat. 13,252 of 1908; this J., 1909, 1157.—T. F. B.

Guaiacol; Compound of —— and process of making same. F. Elger, Basle, Switzerland. U.S. Pat. 951,634, March 8, 1910.

See Eng. Pat. 24,072 of 1908; this J., 1909, 490.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Printing surfaces; Processes for producing ——. O. Dodge, Norwich, Conn., U.S.A. Eng. Pat. 5080, March 2, 1909.

A copper plate is coated with a solution of sodium chloride and albumin and then with a solution of glue, ammonium potassium chromate, and potassium ferrocyanide. An image is printed on it through a negative, the plate is immersed in a solution of rosin and then washed in water until the deepest shadows are clear, when it is flooded with wood spirit, burnt off, and heated to 380° F., until a dark brown picture is produced. It is now slightly etched with dilute chromic acid solution, and immersed in an electro-plating bath containing a copper salt, whereby an intaglio printing plate is produced. Instead of the above process, after the plate has been coated with the two solutions first mentioned, it receives a thin coating of rubber and then a gelatin-bromide emulsion; the whole is exposed in a camera, developed, fixed, exposed to sunlight or electric light, stripped after treating with warm water, and introduced into petroleum spirit: it is then developed and treated as described in the first process to produce the intaglio.—T. F. B.

Kinematographic films; Colouring ——. R. W. James, London. From Comp. Générale de Phonographes, Cinematographes, et Appareils de Précision, Paris. Eng. Pat. 14,824, June 24, 1909.

The developed and fixed cinematograph films are toned so as to obtain a ground colour in monochrome, the gelatin film is rendered insoluble by alum or formalin, or by varnishing, and a further thin layer of gelatin is applied, on which the final colouring is effected.—T. F. B.

Colour photography. F. L. Dyer, Montclair, N.J. U.S. Pat. 947,965, Feb. 1, 1910.

This invention relates to the preparation of grains or particles suitable for staining for use in preparing colour screen plates. Exceedingly fine filaments of collodion, celluloid, or similar substance, are formed by passing their solutions, separated into thin films or other attenuated form, into an "electrically polarised atmospheric field, produced by the convective passage through an atmospheric medium of an electric current of high tension." The volatile solvent is thus evaporated, leaving very fine fibres or filaments, which are now rendered brittle by cooling, *e.g.*, by liquid air. Whilst brittle, the fibres are crushed to powder, and the particles sifted to suitable size and stained in the usual manner.—T. F. B.

Photographic fixing solutions; Apparatus for separation of silver from ——. C. W. Judd, Los Angeles, Cal. U.S. Pat. 951,372, March 8, 1910.

A perforated casing, on which are supported a number of iron plates to deposit the silver, is immersed in the thiosulphate solution containing dissolved silver.—T. F. B.

Colour-screen plates [for photography] and their use. H. W. H. Palmer. Fr. Pat. 406,147, Aug. 17, 1909.

Instead of using colour screen plates ruled with parallel lines, the plates are ruled with a series of concentric circles, about 1/1200 inch apart; the spaces between the circles are coloured with the requisite colours (*e.g.*, orange, green and violet). The plates are utilised in the same way as those already known.—T. F. B.

Photographic prints; Treating ——. E. A. Cunningham, Ealing. Eng. Pat. 7518, March 29, 1909. Under Int. Conv., April 9, 1908.

See U.S. Pat. 895,970 of 1908; this J., 1908, 959.—T. F. B.

Indigo, its homologues and substitution products and their application in photography. Fr. Pat. 405,538. *See* IV.

XXII.—EXPLOSIVES; MATCHES.

Patents.

Smokeless powder; Manufacture of ——. V. Vender. Fr. Pat. 405,822, Aug. 7, 1909. Under Int. Conv., Aug. 8, 1908.

In the manufacture of smokeless powders the incorporation of hydrated magnesium carbonate or of manganese peroxide with the usual ingredients is claimed. It is stated that since these substances are decomposed at a relatively low temperature with a considerable absorption of heat and development of gases, they yield a stable powder with a very low temperature of explosion, and that the gases evolved prevent the blowing back of the flame, by diluting or burning the carbon monoxide produced in the explosion. A suitable mixture is composed of 60 kilos. of nitrocellulose, 28 kilos. of nitroglycerin and 12 kilos. of hydrated magnesium carbonate, gelatinised by acetone and moulded in the ordinary way.—J. F. B.

Safety-match-boxes; Striking surface on ——. A. Swoboda. Assignor to Enzesfelder Munitions- und Metallwerke Anton Keller A.-G., Vienna. U.S. Pat. 949,920, Feb. 22, 1910.

See Eng. Pat. 70 of 1909; this J., 1910, 235.—T. F. B.

Denitrating and recovering acid mixtures suitable for nitrations. [Utilisation of atmospheric nitrogen]. Fr. Pat. 405,819. *See* VII.

XXIII.—ANALYTICAL PROCESSES.

Volumetric analysis; Physico-chemical ——: precipitation accompanied by electrical conductivity determinations. P. Dutoit. J. Chim. phys., 1910, 8, 12—26.

The measurement of electrical conductivity, as already utilised in acidimetry (this J., 1908, 871, 912), has been applied in volumetric determinations involving precipitation. Precipitation curves, quite analogous to neutralisation curves, are obtained, in which the completion of the reaction is marked by a point of inflexion. The solution to be tested should be very dilute ($N/100$—$N/200$) and the precipitating reagent comparatively concentrated (about $N/1$). The radical of the precipitant which is not involved in the formation of the precipitate should have an ionic conductivity as low as possible, salts of lithium or organic bases being suitable for titrating metals, and acetates or salts of other organic acids for the titration of acid radicals. In the presence of polyvalent positive ions, a few drops of acid may be added, and with polyvalent negative ions a slightly alkaline solution may be used; the addition of alcohol is also often of advantage in accelerating the precipitation and preventing adsorption. The apparatus described is fitted with platinised electrodes of 10 sq. cm. surface and 0.3 mm. thickness, and about 30 c.c. of solution are required for a determination. The burette should be graduated in hundredths of a c.c., and the temperature of the cell kept constant within 0·1° C. Six or seven additions of the reagent are, as a rule, sufficient, and, with practice, the complete titration may be finished in 5—10 minutes. The method is of very general application and often proves more accurate and rapid than existing methods; it cannot however be employed in the precipitation of metallic sulphides, hydroxides, and ferrocyanides, but in these cases the differences of potential may often serve to indicate the end of the reaction. The method may even be applied where the precipitate is appreciably soluble, for although there is no sharp point of inflexion in the precipitation curve, the final point of the titration may be accurately obtained by prolonging the straight portions of the curve.—F. Sodn.

Volumetric analysis; Physico-chemical ——: determination and separation of the alkaline-earth metals. P. Dutoit and P. Mojoïu. J. Chim. phys., 1910, 8, 27—41. (Compare preceding abstract).

Calcium may be determined as oxalate in neutral, slightly acid, or alkaline solution, and as sulphate in neutral or very slightly acid solution, if 2 volumes of alcohol be added. Strontium may be determined as chromate by adding an equal volume of alcohol, as sulphate by adding 1½—2 volumes of alcohol, and as oxalate in the presence of acetic acid and a little alcohol. Barium may be determined as sulphate in solutions which are preferably slightly acid, as chromate by adding an equal volume of alcohol, and as fluosilicate, with copper fluosilicate, in the presence of 1 volume of alcohol. The reagents, which, except in the case specified, should be the lithium salts, are best standardised by a preliminary experiment with a standard solution of barium chloride. For the separation of calcium, strontium, and barium, an aliquot part of the solution is first titrated with lithium sulphate, in the presence of 2 volumes of alcohol; this precipitates all three metals as sulphates; a portion is then titrated with lithium chromate, in the presence of 1 volume of alcohol, which precipitates barium and strontium as chromates (a slight inflexion of the curve indicates the complete precipitation of barium chromate which is precipitated first); finally, in a third portion, the barium is precipitated as fluosilicate. A moderate quantity of other salts may be present without affecting the accuracy of the determinations, provided these salts are not precipitated by the reagent. The method is suitable for the direct determination of the alkaline-earth metals in waters, wines, physiological liquids, etc.
—F. Sodn.

Alkalimetry and acidimetry of dirty and coloured solutions. J. W. McMyn. J. Soc. Dyers and Col., 1910, 16, 63.

In the titration for acid or alkali in deeply coloured solutions, the use of fluorescein, as an indicator, is recommended. The end reaction is sharp and well defined with the alkali hydroxides (also with ammonia and lime), with alkali sulphides, borates and phosphates, and with mineral acids. With the sulphides the titration gives the amount of total alkali present, but with carbonates it is necessary to remove all free carbonic acid in order to obtain a distinct end reaction.—F. M.

Permanganate solutions; Standardisation of ——, for iron titration by Reinhardt's method. Kinder. Stahl u. Eisen, 1910, 30, 411—414.

The Analysts' Committee of the Verein deutscher Eisenhüttenleute have investigated this question; this paper is their report. It will not do to standardise permanganate solutions against either iron, ferrous salt, or oxalic acid, in sulphuric acid solution, if they are to be used for the Reinhardt process; the standardisation must be done in hydrochloric acid solution under the same conditions as the titrations. In regard to the choice of a standard substance, ferrous salts are objected to because of the variability of their water of crystallisation, as well as the possibility of impurities in them. Iron wire and soft steel may not be homogeneous, though in rolled pieces of 1—2 kilos. weight this is not very likely; the carbon they contain is objectionable, though oxidation by strong solution of permanganate or chlorate of potassium, before reduction by stannous chloride, will destroy any effect this might have on the titration. Electrolytic iron is troublesome to prepare; but it is obtainable pure, and gives in sulphuric acid solution with permanganate, results identical with those got from Sörensen's sodium oxalate. The iron obtained by reduction in hydrogen of pure ferric oxide is also pure, and gives identical results with those from electrolytic iron. By this method the purity or otherwise of samples of ferric oxide can be measured. The Committee asked the firm of Kahlbaum to prepare a pure ferric oxide as a standard, and the first samples of this gave very satisfactory results (69·86, against 69·95 per cent. in theory); later samples, however, differed by some tenths per cent., so that the Committee doubt whether a pure oxide can be prepared on a large scale. The reporter investigated Brandt's process (this J., 1908, 1001) for preparing pure ferric oxide. Apart from the fact, however, that any phosphorus in the original iron goes into the ethereal solution, it was found that the ferric chloride was not completely decomposed by the nitric acid till ignited, and that consequently traces of platinum went into the oxide and disguised the end-point of the reaction. The following process was preferred: As pure iron or steel as possible was dissolved in hydrochloric acid, peroxidised, dissolved out with ether as in Brandt's process, the ether distilled off, the ferric chloride reduced with hydrogen sulphide, the sulphur filtered off, the solution boiled down with excess of sulphuric acid and crystallised, the crystals washed with water, dissolved in water, precipitated by means of ammonium oxalate, the ferrous oxalate washed, and ignited in a muffle till constant in weight. This, reduced in hydrogen and dissolved in sulphuric acid, gave results, with permanganate solution standardised by Sörensen's sodium oxalate, varying with different operators from 69·86 to 70·00 per cent. The same oxide, titrated according to Reinhardt's method, gave results differing, with the same operator by a constant quantity, but with different operators by from 0·4 to 1·0 per cent., from the true percentage. Hence it is clear that the standard, whether iron of known purity, or ferric oxide, must have its content of iron determined in the first instance, and then be treated by Reinhardt's method when standardising permanganate for titrations by that method. The details of the Reinhardt method as used by the Committee are as follows:—A quantity of the standard substance containing 0·30—0·35 grm. of iron is dissolved in 25 c.c. of hydrochloric acid (sp. gr., 1·19) in a 300 c.c. flask with a watchglass cover or funnel in the neck (if iron, enough potassium chlorate is added to oxidise the iron and the hydrocarbons evolved). The solution is evaporated at a gentle heat to 15 c.c., then boiled to expel chlorine. The cover is washed with 1:3 hydrochloric acid, and the boiling solution reduced with stannous chloride. Traces of stannous chloride are washed down into the solution, and, after cooling, 25 c.c. of mercuric chloride solution are added. After one minute's standing, the solution is poured into a porcelain basin containing 2 litres of water and 60 c.c. of the usual manganese sulphate solution, which have been just rendered pink by permanganate, and the iron solution is then titrated to the same final pink tint.—J. T. D.

Sulphuric acid ; Volumetric determination of —— by the barium chromate method. M. Holliger. Z. anal. Chem. 1910, **49**, 84—93.

THE author has modified the barium chromate method of determining sulphuric acid, as applied by Pennock and Morton to the analysis of coal and coke (this J., 1904. 131) ; the procedure is as follows :—The nearly neutral sulphate solution, which should be free from carbonates, calcium salts, oxidising agents, and large quantities of alkali nitrates and ammonium chloride, is heated to boiling and precipitated with an acid solution of barium chromate. After boiling for a few minutes, one or two drops of ferric chloride solution are added, followed by an excess of ammonia ; the excess is removed by boiling, the liquid, which filters easily, is filtered into a stoppered flask, and the precipitate is washed with a little hot water. 20 c.c. of strong hydrochloric acid and 20 c.c. of a 10 per cent. solution of potassium iodide are next added to the cooled filtrate, and this is subsequently diluted to 400 c.c. and allowed to stand for half-an-hour, the flask being closed. The iodine is then titrated with thiosulphate in the usual way, 1 c.c. of *N*/10 thiosulphate indicating 3·269 mgrms. of sulphuric acid. The barium chromate solution is made by dissolving 19·44 grms. of normal potassium chromate and 24·44 grms. of barium chloride, each in 400—500 c.c. of water, and mixing the boiling solutions ; the precipitated barium chromate is washed with hot water and is then suspended in water, in the proportion of 0·05 grm. of barium chromate per c.c. of the mixture. For use in the precipitation of the sulphate, the necessary volume of this suspension is diluted to 50 cc. and mixed with 1 c.c. of strong hydrochloric acid. The results given by this method are claimed to be as accurate as those obtained gravimetrically, and only half the time is required. If it be used for the determination of sulphur in coal with the calorimetric bomb, nitrous acid must first be decomposed by boiling the feebly acid solution for ten minutes.—F. SODN.

Potassium ; New method for the determination of ——. I. L. E. Cavazza. Alba. Scuola di Vitic. ed Enol., Jan., 1910. Chem. Zentr., 1910, **1**, 962—963.

THE method proposed by the author is based on the fact that by evaporating an alkali chloride solution three or four times with excess of oxalic acid, and then igniting the resulting oxalate, the chloride is converted quantitatively into the corresponding carbonate. For the determination of potassium in soils, 500 grms. of the dried soil are digested on the water-bath with 200—350 c.c. of 10 per cent. hydrochloric acid for ½ hour, with frequent agitation, the mixture is then filtered, and 20—35 c.c. of the filtrate are mixed with 5 grms. of oxalic acid, and evaporated. This operation is repeated four times or until hydrochloric acid is no longer evolved. The residue is incinerated and weighed. The alkali carbonates are then extracted with a small quantity of water, and may be determined by titration. The method is also recommended for the determination of potassium in fertilisers. —A. S.

Phosphoric acid ; Iodometric method of determining ——. P. Artmann. Z. anal. Chem., 1910, **49**, 1—25.

THE following method is recommended for the analysis of phosphates containing from 15 to 25 per cent. of phosphoric acid. One grm. of the substance is dissolved in a mixture of about 30 c.c. of water and from 8 to 10 c.c. of nitric acid of sp. gr. 1·2 ; from 2 to 3 c.c. of hydrochloric acid are added subsequently, and the mixture is heated to boiling for a few minutes. If much sulphate be present, it is advisable to precipitate the sulphuric acid by treating the boiling mixture with barium nitrate. The whole is then diluted to 250 c.c. and filtered through a dry filter. To 25 c.c. of the filtrate are added 4 grms. of ammonium nitrate and 2 c.c. of nitric acid of sp. gr. 1·2 ; the solution is next heated to a temperature of 40° C., and 12 c.c., or at the most 15 c.c., of molybdic acid solution, also heated to 40° C., are added with constant stirring. The molybdic acid solution is prepared by dissolving 100 grms. of ammonium molybdate in 600 c.c. of cold water, and pouring the solution into 300 c.c. of nitric acid of sp. gr. 1·2 ; the solution is kept in a dark place. The addition of the molybdic acid solution should extend over at least 1 minute and the stirring should be continued for 5 minutes. After the lapse of 15 minutes, 5 c.c. more of the molybdic acid solution are added and the whole is kept at 40° C. for 1 hour. The clear supernatant solution is then poured through a small hardened filter and the precipitate is washed by decantation with water at a temperature of 14° C. until 5 drops of the filtrate no longer yield a perceptible coloration with potassium ferrocyanide. The precipitate on the filter is then dissolved in *N*/2 sodium hydroxide solution and transferred back again into the precipitation vessel in which the bulk of the precipitate is dissolved by the addition of 4 or 5 c.c. of 2-*N* sodium hydroxide solution. The filter is washed with about 50 c.c. of water, and to the alkaline solution of the precipitate are added 20 c.c. of hypobromite solution prepared by dissolving 15 c.c. of bromine in 1 litre of *N*/1 sodium hydroxide solution, and diluting the mixture to 2 litres ; this hypobromite solution should be prepared 8 days before being used and must be standardised against *N*/10 thiosulphate solution immediately before being employed for the determination. After the hypobromite has been added, the solution is supersaturated with sodium phosphate (about 10 gms. of the crystallised salt are required for this purpose), 1·5 grms. of potassium iodide and 15 c.c. of 4 *N*-sulphuric acid are added, and the liberated iodine is titrated with *N*/10 thiosulphate solution. When 1 grm. of the substance is taken for the determination, the percentage of phosphoric acid present is calculated from the formula : $x=\frac{a(b-c)}{0{\cdot}016088.d}$ where a=grm. of iodine per 1 c.c. of the thiosulphate solution, b=c.c. of thiosulphate solution corresponding with 20 c.c. of hypobromite solution, c=c.c. of thiosulphate solution used for titrating the liberated iodine, and x=percentage of phosphoric acid. The method may be used for the determination of phosphoric acid in manures, phosphorus in iron, etc., but if the quantity of phosphoric acid present be small, *N*/20 thiosulphate solution should be employed for the titration. —W. P. S.

Phosphoric acid and magnesium ; Iodometric determination of —— in ammonium-magnesium phosphate precipitates. R. Brandis. Z. anal. Chem., 1910, **49**, 152—157.

PHOSPHORIC acid or magnesia may be determined volumetrically by dissolving the ammonium-magnesium phosphate, obtained in the usual way, in sulphuric acid, treating the solution with sodium hypobromite and potassium iodide, and titrating the liberated iodine. The ammonium-magnesium phosphate precipitate is washed with alcohol and ether after the usual washing with ammonia, and is then dried at a temperature of 60° C. The least possible quantity of 4 *N*-sulphuric acid is employed for dissolving the precipitate, and the solution is then rendered slightly alkaline by addition of 2 *N*-sodium hydroxide solution. After the addition of a definite volume of a standardised solution of sodium hypobromite and 2—3 grms. of potassium iodide, the mixture is rendered acid by adding 20 c.c. of 4 *N*-sulphuric acid, and the liberated iodine is titrated with a solution of thiosulphate. This quantity of iodine is subtracted from the total amount corresponding to the hypobromite solution in order to obtain the quantity equivalent to the phosphoric acid or magnesium present, respectively

One mol. of phosphoric acid (P_2O_5) corresponds with 6 atoms of iodine and 1 mol. of magnesia (MgO) with 3 atoms of iodine. (See also this J., 1897, 262).—W. P. S.

Nitric nitrogen; General method for the determination of ——. Salle. Ann. Chim. analyt., 1910, **15**, 103—105.

The following method, in which zinc and a ferrous salt are employed as reducing agents, is stated to be trustworthy for the determination of nitrogen in nitrates and nitrites; it is more rapid than the methods in which aluminium, etc. are used, and the reduction of the nitric nitrogen to ammonia is complete. A weighed quantity of about 0·5 grm. of the nitrate is dissolved in 200 c.c. of water contained in a flask, and 5 grms. of zinc dust, 2 grms. of ferrous sulphate, and 50 c.c. of sodium hydroxide solution are added. The flask is connected with a condenser and the contents are at once heated to boiling, the ammoniacal distillate being collected in a receiver containing a known volume of standardised acid. The distillation is completed in about 35 minutes and the excess of the acid in the receiver is then titrated in the usual way. It is advisable to fit a piece of wire gauze in the neck of the distillation flask and to place a plug of glass wool above this gauze in order to prevent the alkaline solution splashing over into the condenser and receiver.—W. P. S.

Manganese; Determination of —— *by the method of Volhard and Wolff.* E. Deiss. Chem.-Zeit., 1910, **34**, 237—238.

The author concludes that the frequent occurrence of lower oxides of manganese in the precipitates of manganese dioxide obtained in this method is due, not merely to adsorption, as assumed by Fischer (this J., 1910, 47), but also to reverse reactions taking place in the decomposition of the permanganate. To obviate these, it is necessary to dilute the solution strongly and to raise the temperature; to eliminate the influence of substances (*e.g.* zinc oxide) producing an alkaline reaction: to retard the precipitation of the manganese dioxide until manganous ions are no longer present; and to have an excess of permanganate. These conditions are fulfilled in the following modificaton of the method:—The solution of iron and manganese chlorides, in which the proportion of iron to manganese should not exceed 10 : 1, is evaporated to a small volume and neutralised with potassium carbonate solution so that the liquid is of a brown colour but is free from precipitate. It is next diluted to about 600 c.c. with boiling water, and a measured quantity (in slight excess) of permanganate solution added. The hot solution, which should still contain no precipitate, is shaken and treated with a small quantity of zinc oxide mixed with water, the precipitated iron hydroxide and manganese dioxide allowed to subside, and the excess of permanganate in the supernatant liquid determined by a suitable method. Another modification giving equally accurate results is to dilute the solution of the iron and manganese chlorides with boiling water to about 600 c.c., and, after the precipitation of these metals with pure zinc oxide, to pour suddenly the measured quantity of permanganate solution from a beaker into the hot liquid. The beaker is subsequently rinsed with hot water, and after subsidence of the precipitate in the flask, the excess of permanganate is titrated as before.—C. A. M.

Mercury and silver; Volumetric separation of ——. F. Rupp and F. Lehmann. Chem.-Zeit., 1910, **34**, 229—230. (See this J., 1909, 1202.)

The mercury is first estimated in the following manner:—A convenient quantity of the solution containing mercury and silver is mixed with a slightly alkaline solution of potassium iodide (2—3 grms. of potassium iodide and about 1 grm. of sodium hydroxide), and is then made up to a known volume, and filtered either through a double filter paper, or through a single paper dusted over with kieselguhr. To 50 c.c. of the filtrate are added 15 c.c. of dilute caustic soda and a solution of 3 c.c. of 30—40 per cent. formaldehyde in 10 c.c. of water. The liquid is shaken frequently for about 5 minutes, and then 10 c.c. of glacial acetic acid are added and 25—50 c.c. of $N/10$ iodine solution run in. After shaking for a few minutes until the whole of the mercury has gone into solution, the excess of iodine is titrated with $N/10$ thiosulphate. 1 c.c. of $N/10$ iodine is equivalent to 0·01 grm. of mercury. The total silver and mercury are next estimated by the method already described (*loc. cit.*) and the silver found by difference.—E. W. L.

Cadmium; Detection of ——, *by hydrogen sulphide in presence of copper.* L. Wöhler and Z. von Hirschberg. Ber. 1910, **43**, 753—754.

The method of detecting cadmium in presence of copper by passing hydrogen sulphide into an ammoniacal solution, to which potassium cyanide has been added until the blue colour due to the copper is destroyed, may give misleading results. Frequently, even when cadmium is absent, small quantities of an orange-red precipitate are formed, especially if the solution be cooled, and no excess of potassium cyanide, beyond that necessary for decolourising the solution, be present. This precipitate was identified as dithio-oxamide, $C_2H_4N_2S_2$.—A. S.

Hydrocarbons in gas mixtures; Modification of Fresenius' method for determination of ——. F. Henrich. Z. angew. Chem. 1910, **23**, 441—446.

For the determination of small quantities of methane and other hydrocarbons in gases, Fresenius used the ordinary methods of elementary analysis, passing the gas, freed from carbon dioxide, through a tube of heated copper oxide and weighing the products. In the course of an investigation of the composition of the gases from the Wiesbaden thermal springs, the author had occasion to use this process and has introduced certain modifications. In order to obtain constant results it is necessary to employ a layer of copper oxide of 75 cm. in length instead of the ordinary length of 25 cm. The apparatus includes, at the one end, a gasometer filled with air and a Bunte's burette containing 100 c.c. of the gas to be analysed, previously freed from carbon dioxide. The discharge tubes from these two vessels are joined to a bulb provided with 3 tubulures in the form of a T-piece. The third arm of this T-piece bulb is connected with the drying apparatus, consisting of two bottles containing potassium hydroxide and sulphuric acid, respectively, and a long tube filled with granulated soda-lime and calcium chloride. Then follows the combustion tube 75 cm. long, then the tared absorption vessels for the determination of the products of combustion, and finally an aspirator with a calcium chloride guard-tube. The combustion is effected by passing a fairly rapid stream of air and of the gas from the Bunte burette through the apparatus, in such a way that the passage of the 100 c.c. occupies 15—20 minutes, and by sweeping out the apparatus subsequently by means of at least 2 litres of air. The gases in question, freed from carbon dioxide, were found to contain 0·41—0·77 per cent. by volume of methane. In certain cases the ratios of carbon to hydrogen indicated the presence of unsaturated hydrocarbons other than methane. The paper contains a detailed account of the methods and apparatus used for taking the samples of gases from the springs and absorbing the carbon dioxide before analysis.—J. F. B.

Bile acids [*and acetone*]; *Detection of* ——. R. Fritsch. Z. anal. Chem., 1910, **49**, 94—97.

For the detection of bile acids, Jolles' reaction (the appearance of a transient rose colour on heating with a solution of rhamnose and strong hydrochloric acid, and the subsequent development of a yellowish-green fluorescence) is to be preferred to Pettenkofer's test, because it is found to be more characteristic and to demand no special precautions as to temperature and concentration. A delicate test for acetone, by means of which 0.01 grm. per c.c. may be readily detected, is the following:—The solution is warmed with an equal volume of strong hydrochloric acid containing a few drops of a 5 per cent. solution of rhamnose; in tho presence of acetone, a fine magenta colour is obtained, which is very permanent.—F. Sodn.

Valuation of commercial hydrosulphites. Sinnatt. *See* VII.

Volumetric valuation of sodium orsenote solution. Lukanow. *See* VII.

Commercial analysis of crude calcium acetate. Jedlicka. *See* VII.

Valuation of commercial zinc peroxide. Lemaire. *See* VII.

Determining hydrogen peroxide in presence of persulphuric acid. Skrabal and Vacek. *See* VII.

Determination of the acid radical, and its relation to the constitution of commercial bismuth subnitrate. Harrison. *See* VII.

Antimony hydride [*reaction and determination*]. Reckleben and Güttich. *See* VII.

Determining small amounts of iron in clays, and colorimetric determination of cobalt in presence of nickel. Mellor. *See* VIII.

Determining nickel in nickel-steel. Rhead. *See* X.

Determining acid and saponification values of dark oils and fats. Mayer. *See* XII.

Examination of turpentine substitutes and the determination in turpentine of hydrocarbons other than terpenes. Coste. *See* XIII.

Use of miscibility curves in analysis. Application to oil of turpentine. Louise. *See* XIII.

Distinguishing between Para and "Ceylon-Para" rubber and other rubbers. Hinrichsen and Kindscher. *See* XIV.

Lactic acid and its anhydride. Besson. *See* XV.

Asbestos-kaolin filtration method. [*Analysis of tannin solutions*]. Small. *See* XV.

Determination of degras-former in moellons and mixed greases. Levi and Manuel. *See* XV.

Comparative valuation of gelatins by means of melting point determinations. Herold. *See* XV.

Determination of cane sugar [*sucrose*] *by the use of invertase* Hudson. *See* XVII.

Detecting formaldehyde in wine. Hubert. *See* XVIII.

Reaction of amyl alcohol. Von Wyss and others. *See* XVIII.

Behaviour of protein solutions towords acetone. [*Determination of casein in milk, etc.*]. Weyl. *See* XIXa.

Detecting paraffin wax in lard. Thompson and Hurst. *See* XIXa.

Determination of fat in cocoa, etc. Prochnow. *See* XIXa.

Determining hydrastine in fluid extract of hydrastis. Rupp. *See* XX.

Detecting artificial colouring matters in pharmaceutical preparations. Paul. *See* XX.

Determining phenol, salicyl alcohol (*saligenin*), *salicylic acid, and p-hydroxybenzoic acid as tetrabromophenol.* Autenrieth and Beuttel. *See* XX.

Determination of d-tartaric acid. Kling. *See* XX.

Detecting traces of formaldehyde in presence of acetaldehyde. Denigès. *See* XX.

Patents.

Hydrometers, saccharometers, and similor instruments; Scale for comparison or conversion of strengths of solutions according to various —. E. Jones, London. Eng. Pat. 4011, Feb. 18, 1909.

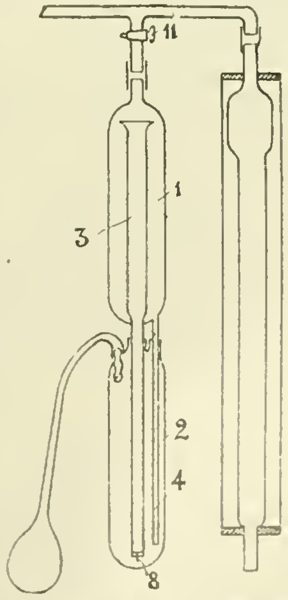
A number of scales are printed on a rule in such a manner that equivalent values of each scale stand side by side in a horizontal line. A cursor is provided on the rule to indicate simultaneously the equivalents of any degree of one scale in terms of all the other scales. (Reference is directed to Eng. Pat. 1355 of 1896).—J. F. B.

Gas-analysing apparatus; Automatic ——. E. H. Peabody, New York. U.S. Pat. 941,274. Dec. 28, 1909.

The apparatus is for the determination of carbon dioxide in flue gases, and is of the type in which a definite volume of the gas to be analysed is passed from a measuring chamber into an absorption chamber, the percentage of carbon dioxide being indicated by the position of either end of the column of absorbent in a graduated tube, into which it is forced when displaced by the gas not absorbed. The measuring chamber is an inverted U-tube, with a connection at the bottom of each limb through which water can be admitted to force the gases from the measuring chamber into the absorption chamber. Two tubes connected to the furnace flues at points where there is a sufficient difference in the draught, pass vertically down the two limbs of the inverted U-tube and are open at the lower end, so that normally a current of flue gases passes into one limb and out from the other so as to thoroughly sweep out the gases left after the previous test. In making a test, water is caused to rise in the measuring chamber, thereby sealing the gas-inlet and outlet tubes and entrapping a definite volume of the flue gases, and forcing these gases out through a capillary tube into the absorption chamber. The latter may take the form of a spiral tube wound around the measuring chamber, or it may consist of a bulb in which are a series of shallow trays or dishes, so as to expose a large surface of the absorbing liquid after the body of liquid has been displaced and forced into the measuring tube. The apparatus may be adapted by suitable known means to work automatically and to give a continuous record of the results on a chart.—A. T. L.

Gas analysis; Apparatus for volumetric ——. A. Lomschakow. Fr. Pat. 405,972, June 14, 1909.

The absorption vessel, 1, communicates at its upper as well as its lower part with the reservoir vessel, 2, by the tubes, 3, 4, the former being provided with a valve, 8. When the gas has been driven over into 1, the tap, 11,



is closed and after an interval, some of the liquid in 2, is forced by the rubber hand pump up the tube, 3, into 1, to ensure more rapid and complete absorption of the soluble constituent.—W. H .C.

Calorimeter. C. Féry. First Addition, dated Aug. 10, 1909, to Fr. Pat. 404.131. June 17, 1909 (this J., 1910, 48).

The additional claims are first: the use of compound spirals composed of different metallic ribbons having different coefficients of expansion, placed in the inlet and outlet ports of the apparatus. The spirals are connected together in pairs by a rod, and are so constructed that one spiral tends to unroll and the other to roll up when exposed to increase of temperature. The pair of spirals is connected to a pointer which moves over a graduated scale. The second claim is for the arrangement of frames of compound metallic ribbons placed as before and connected to a float which dips into one limb of a U-tube filled with mercury. The other limb of the U-tube is connected to the gas supply in a similar manner to an ordinary chemical thermostat. As the frames are altered in shape due to expansion or contraction, the float sinks or rises in the mercury. The latter rises or sinks in the other limb of the U-tube and alters the size of the orifice through which the gas passes.—W. H. C.

Specific gravity of liquids; Apparatus for determining the ——. T. Hillmer, Bucharest, Roumania. Eng. Pat. 16,536. July 15, 1909

See Fr. Pat. 405,005 of 1909; this J., 1910, 237.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Potassium mercuri-iodide dissolved in ether and water. Phenomena observed. Jas. E. Marsh. Chem. Soc. Proc. 1910, **26**, 50.

The salt, KI.HgI$_2$,H$_2$O, dissolves in ether with evolution of heat, and this solution dissolves water with a further evolution of heat. On the other hand, water acts on the double salt with absorption of heat and with separation of part of the mercuric iodide; the addition of ether to this mixture brings about complete solution with evolution of heat. A solution of one molecular proportion of potassium and mercuric iodides in seventeen molecular proportions of ether and water separates, on warming, into three layers. As the temperature rises, the middle layer gradually diminishes in quantity and disappears. On cooling, the middle layer reappears again, and increasing in quantity as the temperature falls, eventually absorbs the other two. A solution of less concentration than the above gives, on warming, two layers, the upper one increasing as the temperature rises and being re-absorbed as the temperature falls. With a solution of greater concentration, two layers are also formed on warming, but in this case it is the lower layer which increases with the temperature and is re-absorbed on cooling. When potassium iodide and mercuric iodide in molecular proportions are dissolved in cold ether with the addition of sufficient water to form the double salt, KI,HgI$_2$.H$_2$O, the latter crystallises on warming the solution, but redissolves on cooling. In dry ether the two salts dissolve, forming a heavy liquid of the composition KI,HgI$_2$.4(C$_2$H$_5$)$_2$O, which does not appreciably dissolve in excess of ether. The salt, 2KI+HgI$_2$, does not bring about the miscibility of ether and water to the same extent as the salt, KI+HgI$_2$, nor is the effect of change of temperature so marked.

Absorption spectra of solutions; a possible method for detecting the presence of intermediate compounds in chemical reactions. H. C. Jones and W. W. Strong. Amer. Chem. J., 1910, **43**, 224—227.

When sulphuric acid is added to a solution of uranyl nitrate containing free nitric acid (to render the absorption bands sharper), certain of the bands in the absorption spectrum of the nitrate are displaced to new positions, the amount of displacement becoming greater as the amount of sulphuric acid added is increased, until finally the bands occupy the positions of those observed with a solution of pure uranyl sulphate to which sulphuric acid has been added. Analogous results were obtained on adding hydrochloric and hydrobromic acids to uranyl nitrate, nitric acid to uranous acetate, and hydrochloric acid to neodymium acetate, and they are interpreted as being due to the formation of series of intermediate compounds in the reactions mentioned.—A. S.

Tobacco smoke; The cyanogen compounds contained in ——. J. Tóth. Chem.-Zeit., 1910, **34**, 298—299.

The author determined the cyanogen compounds in the smoke from different cigar-tobaccos by two different methods. In the first method the cyanogen compounds were absorbed by a solution of caustic potash containing ferrous hydroxide in suspension, the ferrocyanide produced being converted into copper ferrocyanide, and the iron in the latter determined. In the second method the cyanogen compounds were absorbed in caustic potash solution in a number of absorption-bottles, the quantity of alkali used being such that in the last absorption-bottle, the alkali was free from carbonate at the end of the experiments. The results obtained corresponded to 0·02—0·03 per cent. of cyanogen (C_2N_2) by the first method and 0·09 per cent. by the second method, the figures in both cases being referred to the weight of the tobacco. The author has not been able to determine the nature of the cyanogen compounds present in the smoke, but points out that free hydrocyanic acid cannot be present, because the smoke possesses a strong alkaline reaction.—A. S.

Patent.

Colour; Production of —— *by heating certain substances.* C. K. Tinkler, Birmingham. Eng. Pat. 4866, Feb. 27, 1909.

The author claims the production, by mixing diphenylamine or other primary or secondary aromatic amines with chloronitrobenzene, nitrotoluene, or similar nitro-compounds, of a substance which, on being heated to a temperature approximately corresponding with the eutectic point of the constituents, gives rise to an unstable compound of a different colour from the mixture, but resumes the colourless condition on cooling. It is proposed to use such mixtures for thermometric purposes, or as a temperature indicator, or in pictorial toys.—J. C. C.

Trade Report.

Mineral production of the United Kingdom in 1909. Board of Trade J., March 24, 1910.

The following tables, showing the output of coal and other minerals in the United Kingdom at mines worked under the Coal and Metalliferous Mines Regulation Acts (the returns from quarries under the Quarries Act are not yet available) during the year 1909, with comparative figures for the preceding year, are extracted from an advance proof of the Mines and Quarries General Report and Statistics for 1909:—

I.—Output of Minerals under the Coal Mines Regulation Acts.

	1908.	1909.
	Tons.	Tons.
Barium (compounds)	5,217	4,897
Coal	261,512,214	263,758,562
Clay and shale, other than fire-clay and oil shale	292,981	297,604
Fire-clay	2,814,411	2,695,861
Igneous rock	404	551
Iron pyrites	7,212	7,173
Ironstone	7,890,814	8,039,441
Limestone	15,416	16,392
Oil shale	2,891,564	2,966,937
Sandstone (including "Ganister"*)	110,513	118,641

* The quantity of ganister obtained was 106,477 tons in 1908, and 112,317 tons in 1909.

II.—Output of Minerals under the Metalliferous Mines Regulation Acts.

	1908.	1909.
	Tons.	Tons.
Barium (compounds)	32,074	35,212
Clay and shale	123,911	120,282
Gold ore	7,123	5,538
Gypsum	191,497	200,962
Igneous rocks	67,627	70,318
Iron ore	1,540,469	1,673,843
Lead ore	28,540	29,688
Limestone†	500,517	407,830
Rock salt	222,500	209,552
Sandstone‡	198,822	148,925
Slate	104,050	92,223
Zinc ore	15,225	9,902
Other minerals	97,373	91,662

† Including 2,655 tons of calcspar in 1908 and 2,540 tons in 1909.
‡ Including 7,922 tons of ganister in 1908 and 8,413 tons in 1909.

The above figures do not in all cases represent the total production of the minerals for the year. Large quantities of several important minerals, such as iron ore, limestone, sandstone, slate, clay, &c., are obtained from quarries under the Quarries Act and from other open workings, the returns from which are not yet available. The totals for coal and the ores of copper, lead, and zinc may, however, be regarded as substantially complete.

The German chemical industry. Chem. Trade J., March 19, 1910.

The German chemical industry depends on the foreign trade to a greater extent than any other industry in that country, and, therefore, a correct interpretation of the import and export statistics enables a good idea of its condition to be formed. The figures have just been published by the Imperial Statistical Bureau, and the following table shows the aggregate amounts and values for the past three years :—

	Imports.		Exports.	
	Weight metric tons.	Value million pounds.	Weight metric tons.	Value million pounds.
1907	1,360,000	15	2,800,000	28·6
1908	1,410,000	14	2,800,000	27·0
1909	1,600,000	15·4	3,130,000	31·2

The following table relates to coal-tar colour exports :—

	Total Mill. pounds.	Aniline colours Mill. pounds.	Alizarin Red. Mill. pounds.	Other Alizarin colours. Mill. pounds.
1907 ...	11·8	5·6	—	0·69
1908 ...	10·4	4·9	0·43	0·61
1909 ...	11·7	6·0	0·56	0·54

The indigo exports last year amounted to about £2,000,000, about the mean between the values of 1907 and 1908. The exports of both alizarin colours and indigo to Great Britain fell about 33 per cent. as compared with 1908. Strenuous efforts are being made to develop the coal-tar industry in the United States, which is Germany's principal market for these products. The marked increases made under the new tariff in the duties on finished products, especially coal-tar colours, will doubtless have an adverse effect, and it is feared that more rigid precautions will be taken with regard to the compulsory working of patents. The figures for the past year are as follows :

	Exports to United States of America. (Metric tons.)			
	Aniline colours.	Aniline oil and salts.	Anthracene and Alizarin colours.	Indigo.
1907 ...	10,682	3,258	1,839	3,407
1908 ...	8,562	2,317	1,386	2,957
1909 ...	12,139	2,083	1,115	3,402

The Far East comes next in importance to America as a market for German chemical products. Complaints are made regarding the growing competition of English and American producers, whilst in Japan the home competition is increasing. Apart from the production of natural drugs, such as camphor, peppermint oil, and menthol, which have long been produced here, other branches of the industry are developing. The manufacture of fertilisers is now one of importance, whilst the output and export of iodine and its compounds are growing notably. Germany is an important consumer of Japanese camphor, which is principally used in the manufacture of celluloid, of which Japan in turn is a large buyer. Attempts are being made to establish the celluloid industry in Japan, and if they are successful, German manufacturers will naturally be affected. The export of coal-tar colours to Japan increased from 2,059 metric tons in 1908 to 3,069 metric tons in 1909, whilst the exports of artificial indigo to that country last year were 1289 metric tons. As a market for pharmaceutical products the Far East is of great importance, and Japan is taking synthetic aromatic oils, which are used in the scenting of soaps in rapidly increasing quantities. Germany's third great market for chemical products is Russia, and the fears chiefly expressed, so far as the near future is concerned, relate to the impending tariff changes and the proposed alterations in the patent law. It is understood that the Tariff Revision Commission now sitting at St. Petersburg is in favour of an increase on some classes of chemical products.

In heavy chemicals slight increases are shown in several products, though the export of carbonate of soda has decreased from £255,000 in 1908 to £245,000. Caustic soda has increased from £82,000 in 1908 to £89,500 last year, chloride of lime from £107,500 to £123,000, and caustic potash from £437,500 to £481,000. Synthetic sodium nitrate is specially mentioned in the statistics for the first time, the total imports last year being 252 tons, against an estimated 22 tons in 1907; nitrate of lime was imported from Norway to the amount of 2,007 tons, against 1,099 tons in the previous year.

Netherlands Customs decisions. Board of Trade J., March 17, 1910.

A Dutch Decree, dated Jan. 28, 1910, determines the customs classification of the following articles :—Mineral wax or ceresine; water-glass; dinitrochlorobenzene; celluloid in pipes or rods; cocoa butter in tablets for medical purposes; cobalt acetate. All the foregoing are free of duty. Celluloid in sheets; and "washing substance," a solution of soap containing less than 5 per cent. of *æther sulphuricus*, are dutiable at 5 per cent. *ad valorem*. Milk powder, made by thickening natural milk, and packed in sealed tins, is dutiable at 25 florins per 100 kilos.

Norway ; Chemical and allied industries in —— in 1909. Chem.-Zeit., 1910, 34, 302.

The plant at Notodden for the manufacture of Norwegian saltpetre (calcium nitrate) was in regular operation during 1909, 16,000 metric tons being produced, with an expenditure of 40,000 horse-power. The erection of the plant near the Rjukan waterfall for the manufacture of Norwegian or "air-saltpetre" (by the Badische process;

see Bernthsen, this J., 1909, 706), is being proceeded with vigorously. The State works at Konigsberg produced in the working year 1908—9, about 8300 kilos. of fine silver or about 1300 kilos. more than in the previous year, but as the price fell to an average of 65·47 kronen (£3 12*s.* 3½*d.*) per kilo. there was a loss on the year's working. At Egje in Säterstal, 6600 tons of nickel ore were mined in 1909, from which 168 tons of nickel-copper matte, with a content of 70 tons of nickel, were produced for export purposes. A zinc ore washing plant began working at the beginning of November at Grua in Hadeland; up to the end of the year, 12,700 tons of crude ore were treated. At Hakedalen 5400 tons of zinc ore were mined by the Bergwerks-Akt.Ges.Norge. Important new deposits of zinc ore were discovered at several places in eastern Norway during the year. In the large iron ore districts of North Norway, the new plant at South Varanger will begin working in July next, with an estimated annual production of 600,000 tons of concentrates and ore-briquettes. At Salaugen (Tromsö) an ore-briquetting plant with a capacity of 5000 tons per month will shortly be in operation. The works at Dunderlandstal were closed down during 1909, but will resume work after the reconstruction of the ore-concentrating plant. In the Beitestaden district, to the north of the Trondhjem fjord, a new ore-field has been discovered, which, it is estimated, covers an area of 35,000 sq. m., and will yield, at a depth of about 100 m., nearly 7½ million tons of ore containing about 55 per cent. of iron. The production of iron and steel by the use of electrical power appears to have good prospects in Norway, and several works have been or are being erected. During 1909, whilst the price of copper remained about normal, that of sulphur was very low, and hence tolerably large stocks of pyrites remained unsold at the end of the year. At Sulitjelma 126,000 tons of pyrites were produced, of which 110,000 tons were exported, whilst 16,000 tons were treated by the Elmore process, yielding 8000 tons of concentrates from which 950 tons of copper were obtained. At Röros, 27,000 tons of pyrites were produced, of which 10,000 tons were exported, and 17,000 tons were smelted, yielding 700 tons of copper. The total Norwegian production of copper and pyrites products represented a value of about £427,800 as compared with £414,000 in the previous year.—A. S.

Books Received.

Two Wall Charts for Sugar Chemists. Published by Norman Roger, Altrincham, Manchester, England. Entered at Stationers' Hall, 1910. Price 5s. net the set, or 3s. net for either one singly. Postage for the set, 3d.

One chart contains two tables of corrections of the Brix hydrometer for different temperatures, the first in which the hydrometer is tested at 84° F., the second, at 17·5° C.

The other chart contains a table for finding the sucrose content of juices, clarified with 10 per cent. of sub-acetate of lead, from the specific gravity of the original juice, and the readings taken in a Schmidt and Haensch's polariscope, when observed in a 200 mm. tube.

Some Technical Methods of Testing Miscellaneous Supplies, including Paints and Paint Materials, Inks, Lubricating Oils, Soaps, &c. By Percy H. Walker. Chief, Contracts Laboratory. U.S. Department of Agriculture. Bureau of Chemistry. Bull. No. 109. Govt. Printing Office. Washington, 1910. Issued April 22, 1908. Revised *Feb.* 28, 1910.

Pamphlet, 8vo. size, containing 68 pages of subject matter. Carefully revised methods are given in detail, for the testing and analysis of materials referred to in the title, and acknowledgments are made to such authorities as Lunge, Lewkowitsch, Rideal, Fernbach, Hall, Parry, Hurst, Low, and others, for methods found most useful. The methods, it is stated, "are presented in this form because of their inaccessibility at present—scattered as they are throughout chemical literature—and because those selected have been tested in practice and found especially satisfactory." The principal sections treated of are as follows:—I. Specific gravity determinations. II. Paint materials. III. Paints. IV. Black pigments. V. Coloured pigments. VI. Mixed paints. VII. Inks. VIII. Typewriter ribbons and carbon papers. IX. Miscellaneous, including Babbitt metal; glue; glycerin; inking pads; lubricating oils; rubber; soap, &c.

Die Gewinnung des Broms in der Kali-industrie. Von Dr. phil. Max Mitreiter. Monographien ueber chem.-tech. Fabrikations-Methoden. Bd. XX. Wilhelm Knapp's Verlag. Halle a. S. 1910. Price M. 2·00.

8vo. volume, containing 54 pages of subject matter with 24 illustrations. The text is subdivided and classified as follows:—I. History and occurrence of bromine. II. Extraction and preparation of bromine. A. Chemical processes. B. Electrolytic processes. C. Refining the bromine. D. Iron bromide and "Bromsalz" (a mixture represented as $NaBrO_3+NaBr$). E. Further treatment and extraction of the effluents of the bromine manufacture. F. Analytical methods employed. G. Properties, uses, and commercial relations of bromine.

Cases of Industrial Poisoning, Fatal and Non-fatal Accidents, and Dangerous Occurences in Factories, Workshops, &c., during 1909. [Cd. 5048.] Wyman & Sons, Fetter Lane, London, E.C. Price 1d.

The total number of cases of poisoning which occurred in premises under the Factory and Workshops Act, during 1909, was 625, whilst 42 deaths are reported, against 727 and 40 in 1908, respectively. In 1909, there were 553 cases of lead poisoning, 9 of mercury, 3 of phosphorus, 4 due to arsenic, and the remaining 56 to anthrax. 15 fatal accidents occurred in printing, bleaching, and dyeing works, 6 in glass works, and 31 in chemical works. No fatal accident occured in explosives works. (Compare this J., 1909, 388.)

Draft Customs Tariff Law for Japan, with the Tariff of Import Duties. Board of Trade, Commercial Dept., March 1910.

This volume shows, as far as possible, the present rates of duty on the articles specified under the proposed new tariff, together with the English equivalents of the present and the proposed rates of duty.

Journal of the Municipal School of Technology, Manchester. Volume 2.

This volume contains the following papers, amongst others:—"The electric discharge and the production of nitric acid," by W. Cramp and B. Hoyle. "Electrolytic corrosion," by W. W. H. Gee. "A means of estimating the degree of mercerisation in cotton yarns," by E. Knecht. "A qualitative test for mercerised cotton," by E. Knecht. "The action of oxalic acid on cellulose," by E. Knecht. "Some quantitative measurements on the effect of drying on the affinity of ordinary and mercerised cotton for dyestuffs," by E. Knecht. "New reactions for the characterisation of mercerised cotton," by J. Hübner. "Experiments on the synthesis of 1-methylcyclohexylidine-4-acetate acid," by W. H. Perkin and W. J. Pope. "Relation between the crystalline form and the chemical constitution of the picryl derivatives," by G. Jerusalem and W. J. Pope. "Polymorphism with especial reference to sodium nitrate and calcium carbonate," by W. Barlow and W. J. Pope. "Testing of yarns," by W. Myers.

Oil shales of New Brunswick and Nova Scotia and of Scotland. By R. W. Ells. Canadian Dept. of Mines. Government Printing Bureau, Ottawa.

This report contains reports on the oil shales of New Brunswick and Nova Scotia, and also on the Scottish oil-shale industry, including an account of the processes and plant employed at the Scottish works.

*New Books.

Böhm, Dr. C. R.: Die Fabrikation der Glühkörper f. Gasglühlicht. Ein Lehr- u. Handbuch aus der Praxis f. die Praxis. (XIII, 454 S. m. 431 Abbildgn. u. 8 Taf.) 19b. Monographien üb. chemisch-technische Fabrikationsmethoden. Hrsg. v. L. Max Wohlgemuth. gr. 8°. Halle, W. Knapp. 1910. M. 22; cloth, M. 23—.

Clennell, J. E. The chemistry of cyanide solutions resulting from the treatment of ores. 2d. ed., corrected and enl. N.Y., McGraw-Hill Book Co. 1910. 4+202 p. tabs., O. cl., $2.50 net.

Clerc, L. P.:—Les Reproductions photomécaniques monochromes. Photogravure, similigravure, phototypie, heliogravure, etc., etc. In-12 avec 115 fig. Doin. Encyclopédie scientifique.— Bibliothéque de photographie. Paris, 1910. 5 fr, Cart.

Dessau, Prof. B.: Die physikalisch-chemischen Eigenschaften der Legierungen. Mit 82 Abbildgn. im Text u. auf 3 Taf. (VIII, 208 S.) 33. Heft. Die Wissenschaft, Sammlung naturwissenschaftl. u. mathemat. Monographien. 8°. Braunschweig, F. Vieweg & Sohn. 1910. cloth, M. 8.

Dragendorff, G.: Plant analysis, qualitative and quantitative; tr. from the German by H. G. Greenish. N.Y., G. E. Stechert & Co., 1909, [1910]. 16+280 p. tabs., O. (reprint) cl., $3.50 net.

Ehrsam. H.: Fabrication des huiles minerales et pyrogénées. Préparation des huiles composées pour le graissage des machines et autres huiles spéciales. In-8. Béranger. Paris, 1910. 10 fr.

Ferchland. Dr. P.: Die elektrochemischen Patentschriften der Vereinigten Staaten v Amerika. Auszüge aus den Patentschriften, zusammengestellt u. m. ausführl. Sach- u. Namenregister versehen. 1. Bd.: Elektrothermische Verfahren u. Apparate; Entladgn. durch Gase. (VI. 204 S. m. 352 Fig.) 33b. Monographien üb. angewandte Eektrochemie, hrsg. v. Vikt. Engelhardt. gr. 8°. Halle, W. Knapp. 1910. M. 12—.

Hilkbrand, W. F.: Analyse der Silikat- u. Karbonatgestoine. Deutsche Ausg., unter Mitwirkg. des Verf. übers. u. besorgt v. E. Wilke-Dörfurt. 2. stark verm. Aufl. der "Prakt. Anleitg. zur Analyse der Silikatgesteine" v. W. F. Hillebrand, deutsch v. E. Zschimmer, Leipzig. 1899. (XVI, 258 S. m. 25 Fig.) gr. 8°. Leipzig, W. Engelmann 1910. M. 6; cloth, M. 7.

Jones, H. C.: Introduction to physical chemistry. Cr. 8vo. Macmillan, London, 1910. net, 7s.

Latta, M. Nisbet: American producer gas practice and industrial gas engineering. N.Y., D. Van Nostrand Co. 1909, [1910]. 550 p. il. 8°, cl., $6 net.

Leeds, F. H., and *Butterfield*, W. J. A.: Acetylene: The Principles of its generation and use. 2nd ed. revised and enlarged. Cr. 8vo, pp. 408. C Griffin, London, 1910. Net 8s. 6d.

Löb, Dr. W.: Grundzüge der Elektrochemie. 2., Verm. u. verb. Aufl. m. 42 in den Text gedr. Abbildgn. (VIII 174 S.) kl. 8°. Leipzig, J. J. Weber. 1910. Cloth, M. 3.

Ostwald u. Dr. R. *Luther*: Hand- u. Hülfsbuch zur Ausführung physiko-chemischer Messungen. 3. Aufl., hrsg. v. Drs. R. Luther u. K. Drucker. (XVI. 573 S. m. 351 Fig.). gr. 8°. Leipzig. W. Engelmann. 1910. Cloth, M. 13.

Ostwald's: Klassiker der exakten Wissenschaften. 8°. Leipzig, W. Engelmann.

(*a*). *Rey's* (Nr. 172) Dr. Jean: Abhandlüngen üb. die Ursache der Gewichtszunahme v. Zinn u. Blei beim Verkalken. Deutsch hrsg. u. m. Anmerkgn. versehen v. Ernst Ichenhäuser u. Max Speter. (56 S. m. 2 Abbildgn.) 1909. cloth. M. 1.20.

(*b*), *Berthelot* (Nr. 173) u. *L. Pean de Saint-Gilles*: Untersuchungen ub. die Affinitäten. Ueber Bildung u. Zersetzung der Aether. Annales de chimie et de physique. 3e série, tome 65, p. 385; 66, p. 5 et 68, p. 225. Uebers. u. hrsg. v. Margar. u. Alb. Ladenburg. (242 S. m. 2 Taf.) 1910. Cloth, M. 4.40.

Pieraerts, J.: Les Combustibles. 1re partie, Produits industriels, agricoles et commerciaux. Gr. in-8 avec 48 fig. Doin, Paris, 1910. 7 fr.

Plotnikow, Dr. J.: Photochemie. (VIII, 182 S. m. 15 Fig.) gr. 8°. Halle, W. Knapp. 1910. M. 7.50.

Pöschl, Dr. V.: Einführung in die Kolloidchemie. Ein Abriss der Kolloidchemie f. Studierende, Lehrer u. Fabriksleiter. 2., verm. Aufl. (69 S.) 8°. Dresden, Th. Steinkopff, 1910. M. 1.80.

Poulsen, A.: Zement in Meerwasser. Bericht üb. Versuche, die auf Veranstaltg. des Vereins skandinav. Portlandzementfabrikanten 1896 ihren Anfang nahmen. (Der internationale Verband f. die Materialprüfgn. der Technik. V. Kongress, Kopenhagen, im Septbr. 1909.) (III, 63 S. m. Abbildgn. u. 4 Taf.) gr. 8°. Kopenhagen (G. E. C. Gad) 1910. M. 3.

Russell, H. L., and *Hastings*, E. G.: Agricultural bacteriology. Madison. Wis., H. L. Russell, 1909, [1910]. c. 6+241 p. il. diagrs., 12°, cl., $1.25.

Sharpe, T: Modern foundry practice: incl. moulding, materials used, machinery and appliances, etc. 2nd ed. N.Y., Spon & Chamberlain, 1909, [1910]. 10+759 p. il. pls. 8°, cl., $8.

Textil-Literatur, die, 1890—1910: Verzeichnis der wichtigeren Erscheingn. der letzten 20 Jahre, abgeschlossen im Jan. 1910. (43 S.) kl. 8°. Leipzig, Schulze & Co. 1910. M. 1.

Zeitschrift f. physikalische Chemie, Stöchiometrie u. Verwandtschaftslehre. Hrsg. v. emer. Prof. Wilh. Ostwald u. Prof. J. H. van't Hoff. 70. Bd. II. Jubelband. Svante Arrhenius zur Feier des 25 jähr. Bestandes seiner Theorie der elektrolyt Dissociation gewidmet v. seinen Freunden u. Schülern. (VI, 657 S. m. 70 Fig.) gr. 8°. Leipzig, W. Engelmann. 1910. M. 17.

*Dissertations.

(Prices vary, from two to three shillings.]

Aronstum, B.: Synthese des 1.2¹-Dioxy-3-Methylflavons. Bern. 1909. 33 S. 8°.

Berkold, O.: Ueber Stickstoffbindung durch Bariumcarbidbildungsgemische u. techn. Bariumcarbid. Berlin. 1908. 58 S. 8°.

Glesen, R.: Ueber die proteolytischen Fermente der als Futtermittel benutzten Körnerfrüchte. Bern. 1909. 34 S. 8°.

Hahn, A.: Boiträge zur Kenntniss der Mono- und Sesquiterpene. Leipzig. 1909. 81 S. 8°.

Heller, R.: Étude sur la vitesse d'oxydation de l'acide chlorhydrique par l'acide chromique en présence de catalysants minéraux. Gent. 1909. 60 S. m. 6 Abb. 8°.

Lindemann. O.: Beiträge zur Kenntniss der Einwirkung von Natronlauge auf Baumwolle. Dresden. 1909. 55 S. m. 17 Fig. u. 4 Taf. 8°.

Pinsker, J.: Zur analytischen Bestimmung der Unterphosphorsäure, phosphorigen Säure u. unterphosphorigen Säure einzeln u. nebeneinander. Zur Kenntniss der Unterphosphorsäure. Berlin. 1909. 30 S. 8°.

Reutlinger, E.: Ueber den Einfluss des Kesselsteins und ähnlicher wärmehemmender Ablagerungen auf Wirtschaftlichkeit u. Betriebssicherheit von Heizvorrichtungen. München (Techn. Hochsch.) 1909. 74 S. m. 22 Fig. Gr. 8°

Tuckermann, E.: Regelungen von Zweitact-Gross-Gasmaschinen. Berlin-Charlottenburg. 1909. 48 S. m. 12 Fig. 8°.

Richter, E.: Zur Kenntniss des Möhrenöles, des ätherischen Oeles der Früchte von Daucus Carota L. Berlin 1909. 47 S. 8°.

Rinne, F.: Zur chemisch mineralogischen Erforschung d. dtschen. Kalisalzlagerstätten. Leipzig. 1909. 8°.

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* Compiled by H. Grevel and Co., 33, King street, Covent Garden, London, W.C., from whom all the works and dissertations in the following lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT: MACHINERY.

Applications.

6315. Leask. Apparatus for cooling water or treating gases with liquids. Mar. 14.

6697. Coplans and Longsdon. Centrifugal separating machines for use in purifying water, etc. Mar. 17.

6712. Lloyd. Manufacture of tanks and other vessels. Mar. 17.

6967. Tattersall. Drying machines.* Mar. 19.

7109. Reid. Apparatus for separating liquids and solids. Mar. 22.

7152. Humphrey. Raising or forcing liquids. Mar. 22.

7183. Szönyi (Dobiányi). Stoves or furnaces. Mar. 22.

7287. Klauser (Muhlenbauanst. u. Maschinenfabr. vorm. Gebr. Seck, and H. Krusemark). Apparatus for loosening goods laden in bulk.* Mar. 23.

7529. Davey. Raising or forcing liquids. Mar. 26.

7537. Donnan and Slade. Removal of small particles from air and other gases. Mar. 26.

Complete Specifications Accepted.

3302 (1909). Ilges. Rectifying liquids by distillation. Mar. 23.

3924 (1909). Dawkins (McLeod). Centrifugal separators. Mar. 23.

4358 (1909). Isherwood. Filtering apparatus. Mar. 31.

6515 (1909). Schmidt. *See under* II.

6557 (1909). Kirkham, Hulett, and Chandler, Ltd., and Blake. Apparatus for cooling and condensing gases, vapours, &c. Mar. 31.

19,694 (1909). Maschinenbauges. Martini und Huneke. Production of non-oxidising protective gas for use with inflammable liquids. Mar. 31.

20,822 (1909). Matter. Concentrating apparatus. Mar. 31.

21,418 (1909). Tattersall. Apparatus for evaporating and cooling liquids and moistening gases. Mar. 31.

24,594 (1909). Fleischhauer. Vacuum jacketed vessels. Mar. 23.

27,599 (1909). Lehmann. Composite filtering apparatus for liquids. Mar. 31.

30,478 (1909). Foster. Pyrometers. Mar. 31.

II. FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

6487. Christie. Horizontal regenerative coke ovens. Mar. 15.

6502. Sandmann. Gas producers.* Mar. 15.

6504. Summers. Coking furnaces. [U.S. Appl., Mar 19, 1909.]* Mar. 15.

6508. Burstall, and British Pure Fuel, Ltd., Extracting tar and other by-products from gases. Mar. 15.

6509. Burstall, and British Pure Fuel, Ltd. Retort. Mar. 15.

6527. Jones. *See under* VII.

6622. Diehl and Faber. Manufacture of coke.* Mar. 16.

6745. Mombaur. Manufacture of artificial coal. Mar. 17.

6755. Weil. Gas producers of the suction type. Mar. 17.

6793. Tully. Retort furnaces for the destructive distillation of coal. [Addition to No. 20,592 of 1909.] Mar. 17.

6813. Fabry. Regenerative coke ovens.* Mar. 18.

6898. Hüssener and others. Apparatus for removing aqueous vapour from distillation gases freed from tar and ammonia. [Ger. Appl., Sept. 8, 1909.]* Mar. 18.

6899. Hüssener and others. Extracting tar from hot distillation gases. [Ger. Appl., Sept. 2, 1909.]* Mar. 18.

6900. Hüssener and others. Extracting ammoniacal salts from distillation gases free from tar. [Ger. Appl., Sept. 8, 1909.]* Mar. 18.

7007. Clarkson and Behrmann. Manufacture of briquettes from peat bog. Mar. 21.

7018. Morgan. Incandescent gas mantles. Mar. 21.

7049. Summers. Coking processes. [U.S. Appl., Apr. 26, 1909.]* Mar. 21.

7201. Bourdos. Manufacture of metal filaments for electric lamps. Mar. 22.

7316. Von Bauer. Coke ovens.* Mar. 23.

7331. Madden and Houskeeper. Preparation of conducting filaments. [U.S. Appl., Mar. 31, 1909.]* Mar. 23.

7240. K. & A. Water-Gas Co., Ltd., and Smith. Utilising in water-gas plants, fine breeze and other similar fuel of small grade. Mar. 24.

Complete Specifications Accepted.

28,053 (1908). Mason's Gas Power Co., and others. Production of gas from bituminous fuel in gas producers. Mar. 31.

28,054 (1908). Mason's Gas Power Co., and others. Production of recoverable ammonia in making producer gas. Mar. 31.

6279 (1909). Zirfas. Coke ovens. Mar. 23.

6449 (1909). Wilson. Working of vertical gas retorts. Mar. 31.

6515 (1909). Schmidt. Purification of gases. Mar. 23.

8163 (1909). Bloxam (Treibacher Chem. Werke). Manufacture of pyrophoric masses. Mar. 23.

13,097 (1909). Burnett. Extracting water from washed coal, especially for treating washed fine coal for coking. Mar. 23.

13,796 (1909). Zindler. Manufacture of gas by continuous dry distillation. Mar. 31.

15,643 and 22,290 (1909). Richards and Pringle. Apparatus for distilling coal and recovering the products. Mar. 31.

15,661 (1909). Thomas. Gas producer. Mar. 31.

16,211 (1909). Kunheim und Co. Substance for igniting purposes. Mar. 23.

19,419 (1909). Bröker. Retort furnaces for making gas. Mar. 23.

19,829 (1909). Bloxam (Treibacher Chem. Werke). Manufacture of pyrophoric masses. Mar. 31.

22,703 (1909). Bloxam (Sparlicht-Ges.). Mantles for incandescent gas lamps. Mar. 23.

214 (1910). Chandler. Apparatus for purifying gas. Mar. 23.

III.—TAR AND TAR PRODUCTS.

Application.

7057. Newton (Bayer und Co.). Manufacture of octendione and its homologues. Mar. 21.

Complete Specifications Accepted.

7315 (1909). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Catalysts for the hydrogenation or dehydrogenation of organic compounds. Mar. 23.

11,932 (1909). Newton (Bayer und Co.). Manufacture of anthracene derivatives. Mar. 31.

IV.—COLOURING MATTERS AND DYES.

Applications.

6351. Imray (Soc. Chem. Ind. in Basle). Manufacture of brominated vat dyestuffs.* Mar. 14.

6364. Newton (Bayer und Co.). Manufacture of dyestuffs of the triphenylmethane series. Mar. 14.

7056. Newton (Bayer und Co.). Manufacture of azo dyes. Mar. 21.

7060. Ransford (Cassella und Co.). Manufacture of dyestuffs. Mar. 21.

7404. Le Sueur. Substances for use in the manufacture of dyes. Mar. 24.

Complete Specifications Accepted.

11,736 (1909). Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of violet-blue dyestuffs of the gallocyanine series. Mar. 31.

16,377 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture and use of indigo colouring matters. Mar. 23.

21,580 (1909). Johnson (Kalle und Co.). Manufacture of new compounds and colouring matters. Mar. 31.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

6538. Berg and Imhoff. Preserving tin-weighted silk.* Mar. 15.

6608. Merckens. Manufacture of inflammable celluloid substitutes. [Ger. Appl., Mar. 17, 1909.]* Mar. 16.

6631. Haage. Increasing the waterproof property of substances prepared with sulphite-cellulose lye as binding material.* Mar. 16.

6785. Inouye and Mochida. Treating the raw material of spun silk. [Japanese Appl., July 15, 1909.]* Mar. 17.

7042. Millspaugh. Paper making. [U.S. Appl., Oct. 7, 1909.]* Mar. 21.

7051. Riesenfeld and Langfelder. Apparatus for treating textile goods.* Mar. 21.

7324. Edward Lloyd, Ltd., and Martin. Paper making. Mar. 23.

7511. Tickel. Treatment of ramie, rhea, china grass, and other vegetable fibres. Mar. 26.

Complete Specifications Accepted.

27,201 (1908). Manissadjian. Manufacture of a non-inflammable celluloid-like material. Mar. 23.

10,795 (1909). May and Grosvenor. Coating and drying apparatus for paper, cloth, &c. Mar. 23.

19,772 (1909). Galay and Galay. Applying coatings of metal and collodion to paper, glass, &c. Mar. 23.

23,547 (1909). Friedländer and Tuebben. Providing linen and the like with a washable coating. Mar. 23.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

6510. Simpson. Apparatus for dyeing fabrics. Mar. 15.

7051. Riesenfeld and Langfelder. *See under* V.

7094. Ges. f. Chem. Ind. in Basel. Producing discharge effects on coloured grounds. [Ger. Appl., Feb. 14, 1910.]* Mar. 21.

7120. Calico Printers' Assoc., Ltd., and Kenyon. Block-printing on textile fabrics.* Mar. 22.

Complete Specifications Accepted.

18,701 (1909). Johnson (Badische Anilin und Soda Fabrik). Production of colours on vegetable fibres. Mar. 23.

19,776 (1909). Margotin. Bleaching fabrics, threads, and other material. Mar. 31.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

6463. Acheson. Deflocculating insoluble bodies.* Mar. 15.

6525. Jones. Ammonia concentration plant for gas works, etc. Mar. 15.

6601. Ruthenburg. *See under* X.

6900. Hüssener and others. *See under* II.

7079. Mackenzie. Hydrating lime.* Mar. 21.

7092. Imray (Soc. Chem. Ind. in Basle). Precipitation of alkaline earth oxalates.* Mar. 21.

7175 and 7305. Soc. l'Air Liquide. Separation of nitrogen from air. [Fr. Appls., Mar. 23 and 24, 1909.]* Mar. 22 and 23.

7319. Presser. Production of oxides of nitrogen. [Ger. Appl., June 1, 1909.]* Mar. 23.

7472. King's Norton Metal Co., Ltd., and others. Treatment of ammoniacal solutions used for dissolving cupro-metallic fouling from the bores of guns and rifles. Mar. 25.

Complete Specifications Accepted.

28,054 (1908). Mason's Gas Power Co. *See under* II.

15,641 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds containing silicon and nitrogen. Mar. 23.

22,384 (1909). Wetter (Vogel). Compounds of antimony. Mar. 31.

23,188 (1909). Parker. Manufacture of sodium peroxide. Mar. 23.

24,945 (1909). Ozonair, Ltd., and Joseph. Production of ozone. Mar. 31.

25,027 (1909). Klencke. Manufacture of sulphuric acid. Mar. 31.

27,231 (1909). Humann and Teisler. Production of sodium-aluminium fluoride. Mar. 31.

29,669 (1909). Von Schmoll. Production of a solution of water-glass. Mar. 23.

VIII.—GLASS: CERAMICS.

Complete Specification Accepted.

19,772 (1909). Galay and Galay. *See under* V.

IX.—BUILDING MATERIALS.

Applications.

6384. Sundell. Composition for making artificial stone, and method of hardening articles made therefrom. [Swed. Appl., Mar. 15, 1909.]* Mar. 14.

6751. Hewitt. Manufacture of Portland cement. Mar. 17.

7136. Reuss. Process for making paste for plaster. Mar. 22.

7155. Cecchi. Manufacture of artificial stone or plates and other cement agglomerates.* Mar. 22.

Complete Specifications Accepted.

19,997 and 27,366 (1909). Earle. *See under* XIII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

6368. Casper. Recovery of copper from solutions. Mar. 14.

6374. Simpson. Manufacture of hardenable steel. Mar. 14.

6485. Wilm. Process for improving alloys.* Mar. 15.

6601. Ruthenburg. Recovery of metals from fused salts. Mar. 16.

6670. Ashcroft. Metallurgy of lead-bearing zinc sulphides.* Mar. 16.

6754. London Elektron Works Co., Ltd., and Kardos. Detinning tin plate or tin plate scrap. Mar. 17.

6774. Casper. Treatment of pyritic ores. Mar. 17.

6780. Duke. Alloys. Mar. 17.

6977. Arbuckle. Apparatus for treating crushed ore products for the recovery of the metal content.* Mar. 19.

7024. Graf. Alloys and process of making them.* Mar. 21.

7224 and 7225. Smith and Deakin. Apparatus for the electrodeposition of metals. Mar. 23.

7226. Smith and Deakin. Electroplating barrel apparatus. Mar. 23.

7283. Haslam. Apparatus for treating desiccated air for use in blast furnaces. Mar. 23.

7303. Harden. Reduction of metals from their oxides or other compounds. Mar. 23.

7329. Ashcroft. Metallurgy of zinc-bearing lead sulphides.* Mar. 23.

7444. Ashcroft. Metallurgy of metal sulphides. Mar. 24.

7472. King's Norton Metal Co., and others. *See under* VII.

7536. Ashcroft. Metallurgy of metal sulphides.* Mar. 26.

Complete Specifications Accepted.

28,173 (1908). Sulman, Picard, and Ballot. Concentration of ores. Mar. 31.

6529 (1909). Ruthenburg. Treatment of manganese and chromium ores containing iron. Mar. 23.

14,351 (1909). Harrison (Resinelli). Furnaces for producing cast iron and steel. Mar. 23.

14,541 (1909). Hubner. Apparatus for desulphurising or otherwise treating ores. Mar. 31.

15,183 (1909). Custer. Producing from foundry iron a product having properties of high grade tool and high speed steel. Mar. 23.

19,867 (1909). Headson. Metallic compositions. Mar. 23.

21,497 (1909). Batchelor and Batchelor. Recovery of tin and iron from tin plate scrap. Mar. 23.

XI.—ELECTRO-CHEMISTRY.

Applications.

6596 and 6597. Schott und Gen. Electrolytic apparatus having a liquid anode. [Additions to No. 14,288 of 1909. Ger. Appls., Mar. 30, 1909.]* Mar. 16.

6768. Stora Kopparbergs Bergslags Aktiebolag. Electric furnaces and method of charging them. [Swed. Appl., Mar. 19, 1909.]* Mar. 17.

7224 to 7226. Smith and Deakin. *See under* X.

Complete Specifications Accepted.

6820 (1909). Reid. Electric furnaces. Mar. 23.

12,469 (1909). Cowper-Coles. Apparatus for electroplating tubes and rods. Mar. 31.

27,972 (1909). Hay. Electric furnaces. Mar. 23.

XII.—FATS; OILS: WAXES.

Complete Specification Accepted.

16,148 (1909). Wijnberg. Extracting and purifying waxes, fats, and oils. Mar. 23.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

6365. Newton (Bayer und Co.). Manufacture of pigments or lakes. Mar. 14.

6552. Sparshott. Manufacture of linoleum. Mar. 15.

Complete Specifications Accepted.

5976 (1909). Ogilvie and Mitchell. Obtaining resins and oils from wood. Mar. 23.

6573 (1909). Boosé (Stern and Boosé). Paints and like coating compositions. Mar. 23.

17,277 (1909). Bellet. Apparatus for making ultramarine blues, etc. Mar. 23.

19,997 and 27,366 (1909). Earle. Colour washes for plaster, brickwork, etc. Mar. 23.

24,001 (1909). Fabr. de Vernis et Prod. Chimiques. Composition for coating the hulls of ships, etc. Mar. 31.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

6486. Bloxam (Callender). Production of rubber or substances closely resembling it, and ferments therefor. Mar. 15.

7139. General Caoutchouc Co. Separating caoutchouc from resinous products. [Fr. Appl., June 22, 1909.]* Mar. 22.

7153. Bary. Regeneration of valcanised rubber.* Mar. 22.

7299. Perkin and Weizmann. Treatment of raw natural products containing caoutchouc, gutta-percha, &c. Mar. 23.

7338. Matthews. Treatment of raw natural products containing caoutchouc. Mar. 23.

Complete Specifications Accepted.

3617 (1909.) Marlow and Marlow. Drying and storing rubber and similar products. Mar. 23.

9064 (1909). Guiguet. Apparatus for extracting rubber and other gums from plants, barks, fibres, &c. Mar. 31.

13,390 (1909). Laarmann. Manufacture of an elastic foam or sponge structure from rubber, &c. Mar. 23.

XV.—LEATHER; BONE: HORN; GLUE.

Applications.

7066. Hoenig. Manufacture of extracts for use in tanning. [Austrian Appl., April 19, 1909.]* Mar. 21.

7438. Dickerson. Production of tanning agents from waste liquors.* Mar. 24.

Complete Specifications Accepted.

27,536 (1909). Beaulieu. Machine for carroting skins. Mar. 31.

2499 (1910). Jensen (Fitzroy Tanning Co.). Tanning process. Mar. 23.

XVII.—SUGAR; STARCH; GUM.

Application.

7032. Wulkan. Manufacture of dextrine. Mar. 21.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

6376. Loew. Pasteurising beer.* Mar. 14.

6481 and 6482. Pich. Production of yeast. Mar. 15.

6506. Epstein. Treatments or utilisations of fermentations or cultivations. Mar. 15.

6741. Ekström. Production of alcohol. Mar. 17.

7166. Winde. Manufacture of malt.* Mar. 22.

7188. Nance. Production of beverages. Mar. 22.

7398. Adlam. Apparatus for sparging brewers' wort.* Mar. 24.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

6697. Coplans and Longsdon. *See under* I.

6721. Loring. Manufacture of flour. Mar. 17.

7041. Sulzberger. Utilisation of waste products. Mar. 21.

7427. Gebr. von Niessen. Improvement of coffee. [Ger. Appl., Mar. 25, 1909.]* Mar. 24.

7466. Herendeen. Manufacture of flour.* Mar. 24.

7548 and 7549. Leask. Refuse destructors. Mar. 26.

Complete Specifications Accepted.

4786 (1909). Jones. Apparatus for treating water. Mar. 31.

14,649 (1909). Le Faguays. Method and apparatus for disinfecting. Mar. 31.

21,184 (1909). Gans. Removing iron from water and regenerating the materials used. Mar. 31.

23,765 (1909). Greiser. Manufacture of cocoa. Mar. 31.

30,512 (1909). Nogier. Method of sterilising liquids. Mar. 23.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Complete Specifications Accepted.

7315 (1909). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). *See under* III.

7322 (1909). Kondakow. Manufacture of bornylene from dextro-perinene. Mar. 31.

24,062 (1909). Arnaud and Posternak. Preparing iodine derivatives of fatty acids. Mar. 23.

25,138 (1909). Chem. Pharm. Laboratorium "Sahir." Producing a dry formaldehyde compound. Mar. 23.

25,773 (1909). Von Wülfing. Preparing salts of lactalbumen. Mar. 31.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

6327. Dawson and Finlay. Colour photography. Mar 14.

Complete Specifications Accepted.

19,772 (1909). Galay and Galay. *See under* V.

21,281 (1909). Sury and Bastyns. Colour photography. Mar. 31.

XXII.—EXPLOSIVES: MATCHES.

Application.

6517. Pierce. Explosives. Mar. 15.

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The following take office after the Annual General Meeting:—*Chairman:* Arthur Carey; *Vice-Chairman:* Max Muspratt, M.P.; *Committee:* J. T. Conroy, F. G. Donnan, J. Kent Smith, Frank Tate.

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Hon. Local Secretary:

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Hon. Local Secretary:

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Committee:

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F. Stanley Kipping.
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G. J. Ward.
J. White.
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Vice-Chairman: Robert Hamilton.

Committee:

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Jas. J. Dobbie.
D. B. Dott.
Harry Dunlop.
Thos. Ewan.
Thos. Gray.
F. W. Harris.
G. G. Henderson.
George Lean.
J. S. Macarthur.
W. G. McKellar.
H. Marshall.
David Perry.
R. T. Thomson.
Chas. W. Townsend.
John Traquair.

Hon. Secretary and Treasurer:

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Vice-Chairman: R. Greig-Smith.

Committee:

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W. A. Dixon.
W. B. Gray.
G. Harker.
L. Meggitt.
Jas. M. Petrie.
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S. E. Sibley.
F. W. Spencer.

Hon. Local Secretary and Treasurer:

T. U. Walton, Colonial Sugar Co., O'Connell Street, Sydney, N.S.W.

Yorkshire Section.

Chairman: W. M. Gardner.

Vice-Chairman: H. R. Procter.

Committee:

W. A. Bone.
F. W. Branson.
E. A. Brotherton, M.P.
J. Evans.
W. Basil Hill.
L. L. Lloyd.
W. McD. Mackey.
L. T. O'Shea.
A. G. Perkin.
F. W. Richardson.
A. Smithells.
A. W. Wilson.

Hon. Local Secretary and Treasurer:

T. Fairley, 17, East Parade, Leeds.

The following take office after the Annual General Meeting:—*Chairman:* E. A. Brotherton, M.P.; *Committee:* J. W. Cobb, S. H. Davies, W. M. Gardner.

Official Notice.

ANNUAL GENERAL MEETING, 1910.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will will be held in the Natural Philosophy Lecture Theatre of the Technical College, Glasgow, at 10.30 a.m., on Wednesday, July 6th, 1910. A programme of the proceedings is contained in this number of the Journal.

In accordance with the provisions of By-law 72, the Council hereby notifies that it has awarded the Medal of the Society of Chemical Industry to Mr. Thomas Tyrer for his conspicuous services to the Society and to Applied Chemistry.

In accordance with the provisions of By-law 24, Notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Walter F. Reid has been nominated to the office of President under By-law 20; Dr. J. Lewkowitsch, Dr. Russell W. Moore, and Dr. Harvey W. Wiley, have been nominated Vice-Presidents under By-law 21, and President Ira Remsen has been nominated a Vice-President under By-law 20. Mr. Thomas Tyrer has been appointed Hon. Treasurer, and Dr. R. Messel, Hon. Foreign Secretary, under By-law 35.

Members are hereby invited to nominate, on or before May 23rd next, fit and proper persons to fill four vacancies among the ordinary members of the Council under By-law 24. Forms for this purpose can be obtained, on application, from the Secretary of the Society.

By-law 23:—An ordinary member of Council shall be nominated by ten or more members upon Form B in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:

a. The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

b. The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

c. The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

d. The nomination form is not received before or upon the day appointed therefor.

e. The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the Secretary, and shall not be submitted for election.

CHARLES G. CRESSWELL,
Secretary.

Birmingham Section.

Meeting held at University Buildings, Edmund Street, Birmingham, on Thursday, February 10*th*, 1910.

MR. HARRY SILVESTER IN THE CHAIR.

THE FORMATION OF AND ANALYSIS OF CLAYS.

BY ALEX. E. TUCKER, F.I.C.

During recent years it has been recognised that the properties of clay intended either for the manufacture of fire clay goods or for pottery and porcelain, are in all probability attributable entirely to a hydrated silicate of alumina, which in one body combines the greatest infusibility and plasticity known, the other materials occurring in clay may all be regarded as impurities and lower both the infusibility and plasticity.

Unfortunately various names have been given to this silicate and confusion has resulted; thus we find the names "kaolin," "china clay," "kaolinite," and "clayey material" given in text books and apparently used for the same body. It is only very recently that discrimination in their use is noticeable. Analyses have been published of the so-called kaolin in which the alumina shows a variation in its percentage of between 26 and 45, and a variation in the silica from 45 to 58.[*] The facts are that kaolin is a trade name of Chinese origin for china clay, which is a manufactured article, and kaolinite is the petrological name for the clayey material, or acting principle, of clays. Kaolinite has the formula $Al_2O_3,2SiO_2,2H_2O$, and the composition 39·5, 46·5, 14·0. It is therefore a body of definite composition with clearly defined properties and may be treated as such; indeed its determination may be regarded as parallel to the determination of the acting or commercial constituent of an ore or other body, etc., the value of which depends on the percentage of such acting constituent.

Probably the finest treatise on clays is that published by La Société d'Encouragement pour l'Industrie Nationale.[†] In this work, M. E. Vogt, of the French National Porcelain Factory of Sèvres and one of the most eminent ceramic chemists, commits himself to the statements,

1. That kaolinite is essentially a plastic body, and forms nearly the whole mass of kaolin and refractory clays.

2. That the alkalis which are present in clays are present in the white mica, etc., which exists in these clays. These minerals, however, when in the finely-divided condition, acquire a plasticity and analogous properties to those of kaolinite.

3. The clayey material of marls which is entirely different in character from kaolinite appears to be chiefly formed by the debris of magnesium minerals—biotite, chlorite, etc. Pure kaolinite exists in two forms, both of which are crystalline. The one is a rare form existing in small quantities. It has been found in Anglesey by Dick,[‡] and also by Johnson in Utah, U.S.A. The specimen I have is from the National Bull Mine, Colorado, and has been described by H. Rensch, Jahrbuch für Mineralogie, Bands II., 1887. It was given to me by the late Professor Banerman. The other crystalline form of kaolinite is that found in all clays and it is present to the extent of something like 85 per cent. in the best china clay or kaolin of commerce.

Hussak stated in 1890[§] that china clay was a mass of almost pure kaolinite, the plates of which had a rounded or irregular outline. This form of kaolinite has quite recently been very carefully examined by Mr. George Hickling, B.Sc., Lecturer on Geology at the University of Manchester. He states in his paper:[‖] "If the various grades of material derived from the washing of china clay rock are examined, nearly the same minerals will be found in each grade, the relative proportion only varying. Not a trace of felspar is ordinarily to be found. As the material becomes finer, quartz and tourmaline diminish, while mica increases and soon preponderates. The coarser muds, in which spangles of mica are still large enough to be seen glittering, are technically known as "mica clay," or simply "mica." In this mud we find a new element, which is described below, and identified as kaolinite. In the still finer muds, the quartz and tourmaline still further diminish in relative quantity, but the very finest clays still contain all four constituents—kaolinite, mica, quartz and tourmaline; biotite, however, being no longer recognisable. The first two may be seen to make up the greater bulk (90 per cent. or more) of the material, while tourmaline forms an insignificant proportion. The amount of quartz is difficult to estimate, as it is very readily missed, while the relative abundance of kaolinite and mica is difficult to judge for reasons which will be obvious when they have been described. These proportions will be discussed later. The size of the various fragments varies from about 0·0079 inch (0·02 mm.) down to 0·00079 inch (0·002 mm.) in diameter. Consequently magnifying powers of 500 to 2000 diameter must be used for effective work."

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[*] Bischoff. Elements of Chemical and Physical Geology, vol. 2, page 177. More recent works show similar confusion.

[†] Contribution à l'etude des Argiles et de la Céramique, Paris, 1906.

[‡] Dick. Mineralogical Magazine, 1888—9, vol. viii.

[§] Sprechsaal 22, 154, 136.

[‖] Institution of Mining Engineers, July 3rd, 1908.

Hickling gives petrological and optical details of kaolinite and states with Hussak that the whole of the clay is crystalline, and is sometimes "microvermiculate," *i.e.*, the crystals take the form of plates or rouleaux which in their aggregate form present a worm-like appearance. I have had the pleasure of seeing these crystals in Mr. Hickling's laboratory. I do not think it would be possible to photograph them. I show a lantern slide of the drawing Mr. Hickling has made of them, as well as some slides I have made of various clays prepared by macerating the clays in water and pipetting the top water off after 30 sec. setting. These are microphotographs taken under a uniform magnification of 1000 diameters; they are therefore comparable, and show various minerals which are easily recognizable. They do not, however, show the kaolinite described by Mr. Hickling, it being, as before mentioned, not photographicable. I also show a print of fire clay taken as 2000 diameters, but this again fails at showing the rouleaux, or indeed, any kaolinite crystals, though the incidental crystals of other minerals are again easily seen. Dealing with these microphotographs as a series, it will be seen that there is no apparent essential difference between the purest china clay and the brick clay, in respect of their mineralogical character. Their ultimate analysis shows an unbroken sequence of composition. They vary only in their respective contents of minerals, which apparently are common to all, the purest clays being those in which the alkaline minerals have been kaolinized, the felspar decomposing first. Further the purest clays —china clay—have been artificially treated for the removal of their contaminating minerals.

From the rouleaux structure described by Mr. Hickling it is obvious that in worked clay or clay which has been much acted on mechanically either naturally or artificially, these rouleaux would be broken up into fragments whose crystalline structure would be difficult to recognise. We can generally see only a rounded or irregular outline and can only demonstrate their crystalline character by their optical properties.

Seeing then that the universality of kaolinite in refractory clays is established, its source in them will be of interest. Von Buch in 1824 apparently from the occasional presence of tourmaline in clays, was led to believe that kaolin in the neighbourhood of Halle owed its origin to the action of hydrofluoric or boric acid vapours on the granite of this district. These vapours are supposed to have proceeded from below. Daubrée again writing on china clays in 1841, remarks that they must have had some such origin. Collins in 1874 supports the same theory, and seems to have been convinced of its accuracy by some experiments he made. He attacked granite with hydrofluoric acid, and states that "without otherwise altering its appearance, he changed it into kaolin."[*] This remarkable statement and this theory have found their way into many text books. The theory seems to have been unimpeached for years, and I find illustrations indicating its acceptance in the Museum of the School of Mines. The theory bears the title of "Pneumatolitic Action."

Johnson, however, in 1889 showed that minerals of the mica family are attacked by water containing carbonic acid[†] and later[‡] Victor Selle states that weathering and kaolinization are entirely analogous processes, and are only a question of degree. In both cases mica is formed as an intermediate product of the final decomposition of the felspar, and this mica is again resolved into kaolinite. I have recently had occasion to examine this explanation of the formation of clays generally. I found—

1. That felspar when powdered is decomposed in ten days when acted on at ordinary temperatures with very dilute hydrochloric acid, *i.e.*, of a solution containing 0·075 per cent. of this acid, into a white milky substance indistinguishable in appearance from the china clay of commerce.

2. That in this action the felspar yielded scales which were micaceous in character.

3. The above action takes place with shap granite, Falmouth granite, and china stone. The action on these granites is not so rapid as with pure felspar, but in all cases the contained felspar is ultimately decomposed as above.

4. This action takes place at ordinary temperatures with nitric, sulphuric, hydrochloric, and hydrofluoric acids.

5. The action also takes place when the felspar and granites are exposed to the action of the water in which carbonic acid is present.

The following are the details of the latter tests:—

I took corked instead of stoppered bottles, and after putting the powdered felspar and granites in them I filled them three quarters full with distilled water to which a few drops of litmus were added. Carbonic acid was then passed into the respective bottles, the corks were inserted, and the bottles inverted to prevent the escape of gas. On opening the corks absorption of carbonic acid was apparent, and glass stoppers would have led to trouble in removal. The litmus showed alkaline reaction and carbonic acid was passed repeatedly during fourteen days. The alkaline reaction was not very definite in the case of the granites, but in all cases at the end of three weeks the formation of a whitish material having the appearance of kaolin was apparent.

In another experiment I operated on very finely ground felspar with water, only using an open vessel, and no added acid of any kind. In 24 hours the water was distinctly alkaline and in three weeks the existence of kaolin was evident.

From the natural weathering alone of igneous rocks like granite, and composed as they are principally of felspar, mica and quartz, it therefore follows that these felspars and micas must have become kaolinized without reference to aqueous or acrid vapours emanating from below, and of all possible acids hydrofluoric is the most improbable. The granites were disintegrated by weathering action from above, and quite possibly by the attack of carbonic acid and steam from below, and the softer and lighter products of decomposition washed away by rain or streams and carried down to lower levels, forming stratified clay of varied composition and quality. An example of such result may be seen at Bovey Tracey, S. Devon, where beds of fire clay exist which had their source in the older granites of Dartmoor, parts of which still remain as the Tors, which add so much to the scenery of the district. The wholly disintegrated granite itself is to be seen in the well-known china clay districts of Cornwall, along with other granite of varying degrees of disintegration.

It is in these decompositions of alkaline minerals of the older rocks and their debris that we have an explanation of the weathering of clays themselves. There is no doubt that the micas and felspars, etc., which form so considerable a part of their composition, continue to be attacked by carbonic acid and water with the formation of kaolinite, with also the removal to some extent of the potash by drainage. The clay therefore becomes more infusible and more plastic.

White mica (muscovite) as already mentioned, is said to be formed in the first stage of the decomposition of potash felspar and we get in such supposed decomposition a removal of potash and silica, the composition alteration being as follows:—Felspar, K_2O, 16·59, Al_2O_3, 18·06, SiO_2, 65·30; muscovite, K_2O, 11·8, Al_2O_3, 38·5, $S O_2$, 45·20, water 4·5. It will be seen that mica is kaolinite plus potash and minus water. The reality of the suggested formation of muscovite in the ultimate decomposition of felspar appears to me very doubtful, but that kaolinite is a decomposition product of these minerals as well as of albite, biotite, many other alkali bearing minerals, is unquestionable.

When the disintegrated granite has been washed and the clayey matter removed and deposited by natural waters.

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[*] On the China Clay and China Stone of Devon and Cornwall. J. H. Collins, F.G.S., Society of Arts, May, 1876.

[†] Johnstone. Quarterly Jrnl. Geo. Soc. 1889, vol. xlv. p. 363.

[‡] Inaugural address, "Weathering and formation of Kaolinite in the Quartz Porphyries of Halle. Spechsaal, 1907, vol. xl. pp. 463—466.

the clay is usually much more coloured and impure than when it is extracted from the rock by artificial means, but in both cases considerable amounts of quartz, mica, and other minerals are carried with the stream. Similarly we get in the naturally deposited clays a greater variety and quantity of such mineral impurities all of which by a process of natural levigation are mostly in microscopical fragments.

Bearing in mind the very definite character of kaolinite, its origin and its freedom from alkali, it may be seen that if the free silica can be accurately estimated and the alkalis found in the ultimate analysis of clays, are allocated to their respective minerals, we get an ideal proximate analysis.

With ordinary fire clays the greatest variation is in the free silica and I shall presently show the importance of estimating this even if it is not desired or possible to carry the proximate analysis any further than this. For with the determination of the free silica, mica and kaolinite, we can form a very good idea of the character of such a fire clay. Generally, as has been shown, the minerals other than these are present in small amounts. The magnesia and some of the iron are derived principally from the biotite or chlorite and so may be calculated fairly accurately into these minerals, a microscopic examination determining which.

Detailed directions of the more recent metals used for the separation of sand quartz and other minerals are given by M. Lavezard in the work referred to* and as I am not aware that these memoirs have been translated the reference in view of the careful work involved may be useful. These methods consist in the use of sulphuric acid and caustic soda for the resolution of the silicates and it is in the details of the application of these that the work is so important. I have had occasion to use these methods, and I would strongly recommend them as being the most satisfactory with which I am acquainted. In the washing of clays for the removal of the heavier quartz, etc., I have sometimes found that the clay will remain suspended in the water for very long periods, it is much too fine to separate by filtering. If, however, a few drops of a solution of alum be added, such suspended clay will often settle quickly. M. Lavezard recommends a few drops of very weak hydrochloric acid for the same purpose, and I have found this works equally well. The reason of these actions is obscure, but I am aware that alum is used for precipitating clays when levigating them for ceramic or other work. Vogt, in his article on the composition of clay, has arrived at the following conclusions :—

1. That kaolinite and white mica are entirely decomposed by boiling sulphuric acid and that the quartz and felspar are unattacked.

2. Kaolinite and biotite (magnesian mica) are decomposed on boiling with a solution of caustic potash Sp. gr. 1·08. White mica and felspar are quite unaffected, while the finer quartz is attacked slightly.

As, therefore, the two solutions named give a method for the isolation of the quartz, white mica, kaolinite, and magnesian mica (biotite) these minerals can be calculated into a percentage composition which is of much practical utility.

The question of the allocation of the alkalis—always a difficulty in the ultimate analyses on account of the separation of the soda and potash, is assisted materially when it is recollected that a small amount of felspar is nearly always present in fire clays, and can be recognized under the microscope. Mica—a potash mineral is universal, and contains 11·8 per cent. of potash; hence $\frac{100}{11{\cdot}8} = 8{\cdot}5$ units of mica correspond to one of potash. Any soda present may fairly be allocated to albite (soda felspar).

Rutile and tourmaline are generally present in fire clays, especially the former, and both are easily recognized. They may be seen in the microphotographs which I have prepared. In some clays which I have examined they exist only in very minute amounts.

The following table shows some of the results which I have obtained by the methods named. The free silica has in these been estimated directly and the other two factors have been calculated.

Table of Ultimate and Rational Analyses of Various Clays.

	CORNISH CHINA CLAYS.		FIRECLAY.		BRICK-CLAY.
	1	2	Devon.	Stourbridge.	W.Bromwich.
SiO_2 (free)	2·69	1·75	11·49	24·01	27·20
SiO_2 (comd.) ...	40·45	41·85	37·00	31·35	22·01
Al_2O_3	41·24	40·23	38·92	29·63	22·40
Fe_2O_3	0·52	0·30	0·85	1·80	10·50
TiO_2	Trace	1·37	0·50	0·71	1·84
CaO	0·48	0·41	0·82	0·45	1·58
MgO	Trace	Nil	Trace	0·21	0·50
$K_2O + Na_2O$	2·39	1·73	1·31	1·84	42·4
Comb. Water ...	12·23	12·63	9·00	9·80	8·83
	100·00	100·00	100·00	100·00	100·00
Quartz	2·69	1·75	11·49	24·01	27·20
Mica	20·16	14·70	19·63	15·64	36·04
Other material, chiefly Kaolinite	77·15	83·55	68·88	60·35	36·76
	100·00	100·00	100·00	100·00	100·00

The variations in the percentages of free silica are interesting. The importance of this method of stating the analytical results obtained with clays may be appreciated when it is recollected that the hydrated silicate of alumina-kaolinite is the most refractory natural body known whose plasticity admits of its being worked into bricks and other technical products when much mechanical strength is also required. Seger has shown that Bischoff's previous observation was correct, *i.e.*, that the addition of silica to kaolinite lowers its melting point,* and for the manufacture of his higher number cones 36 to 38, he adds alumina and not silica to the mixture. This observation is of much technical importance because the well-known silica bricks have for many years been used in places where extremely high temperatures are used. Their mechanical weakness is, however, much against them, and many fire clay manufacturers have added silica to their clays in the hope of raising their melting points and obtaining at the same time a strong brick. The fallacy of doing this has been demonstrated, and I know some manufacturers are alive to it. In my technical work I have found from practical tests that the bricks which will stand the highest melting point are those which contain the highest kaolinite and least free silica. In my practice I very frequently determine the softening and melting points of clays and bricks, these being now often and very properly required in specifications. For the purpose I use the apparatus shown. The burner is a detailed improvement on the ordinary vapourizing burner in common use for blow lamps, etc. The former with the furnace itself possesses points which may be of interest. The furnace is built with china clay, alumina and grog, and has a removable side block. This block enables the test pieces to be conveniently examined and handled. By the use of a small jet of oxygen leading into the burner practically any desired temperatures may be reached; thus I have melted a No. 36 Seger Cone = 1830° C. (3360° F.).

In these tests on the melting points of clays and bricks I have come to the conclusion that within limits the percentage of alkalis, iron, lime and magnesia have not the influence on such melting points as is generally associated with them. It is often forgotten that a brick is not made up of flour fine powder intimately mixed, a condition which certainly would give a more fusible brick. Thus I have recently tested a brick containing an average of 9 per cent. of iron. This withstood a temperature of over 1700° C. The well known Scotch bricks contain much more iron than the average Stourbridge brick, yet their reputation is high.

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* Contributions à l'étude des Argiles et de la Céramique.

* Thonindustrie Zeitung, t. xxi. p. 48.

At elevated temperatures it would seem that the alkalis, iron, magnesia and lime are driven off. I have examined this point, and I found a removal of these bodies which was proportional to the time and temperature. In one experiment I made I found that a clay containing 2·20 of alkali lost 23 per cent. on heating for 40 minutes to 1400° C., at 70 minutes it had lost 32 per cent., and on heating again to 1700° for a further 30 minutes the total loss of alkali was 61 per cent. From experiments made on this point by Seger it appears that the protoxides of iron, lime and magnesia are volatilised with the alkalis as alumina silicates. Seger* collected the sublimate from a clay which contained less than 1 per cent. of these bodies, and found it had the following compounds—SiO_2 59·6, Al_4O_5 12·4, Fe_1O_3 6·1, CaO 1·2, MgO 7·5, Alkalis, 9·95. This volatilisation is also confirmed by a spectroscopic examination of the hematite Bessan flame in which lime and potash can always be seen. We have evidence in these results of the rationale of adding crushed burnt clay to the plastic clay for working up into bricks and other fire-clay goods. Not only does such addition diminish shrinkage, the material having been already shrunk, but further, it having been exposed to high temperatures, the alkalis are lower and the new brick will withstand a corresponding higher temperature. It would therefore appear that the advantages of adding such crushed fire-brick —technically known as "grog," are very great, and probably they are not yet appreciated to the full value. From what I have discussed the significance becomes apparent of using on the one hand well weathered clay and admixture with burnt clay and no added silica, when the best possible results in the fire clay goods are desired.

DISCUSSION.

Mr. W. J. **REES** said much work on this, and kindred matters had been done by Dr. Mellor. In regard to that proportion of clay which was soluble in sulphuric acid he suggested that the name of kaolinite should be altered to the term, clayite. Mr. Tucker had pointed out that rational analyses would tell one far more about clay than the other analysis, particularly about the possible uses and refractoriness of clay. There was extreme necessity in doing a rational analysis of adhering to one strength of solution, and to a standard time, chiefly in the treatment of strong sulphuric acid. A period of about ten hours gave a fairly complete decomposition, and it was satisfactory in other ways.

Professor **THOS. TURNER** said that a committee was engaged on obtaining standards in connection with the refractoriness of clays, and he was hopeful that they would do a useful work. He had used, for some years, the standard Cramer apparatus, which he considered as simple as that of the author. In this, the sample to be tested was supported upon a small block of highly refractory material; and enclosed in what was really a small crucible. This was heated in an anneal furnace; thus, a more uniform temperature was obtained than if the flame were allowed to impinge on the article. The flame was blown by a small bellows or fan, and the fuel used was graphite, which was to be obtained from the gas works. The graphite was broken into pieces rather smaller than a walnut. The varying temperatures were got by regulating the supplies when weighing out the graphite; and an approximate temperature might be obtained by regulating the weight of fuel and maintaining a regular supply of air. He thought a little more liberal use might have been made of the collected works of Cramer dealing with fire clays, which were very important.

Dr. W. B. **DAVIDSON** insisted that there were grave dangers with regard to the use of grog. It was possible to have too much of it in the fire-clay material, and that was a bad thing if the grog was inferior. All grog must be carefully selected. As to the volatilisation of the alkalis and iron, that raised an interesting point which was worth further study. In testing bricks, he had used gas for the furnace, and he found that with a high speed concentric blast furnace one could obtain 1600° C. without much difficulty; and he believed that with a Mecker burner furnace temperatures of 1800° C. could be obtained. He thought that high pressure gas would give equally good results.

Mr. E. P. **PAGE** observed that the suggestion had been made that plasticity was due to the kaolinite, and asked, if this was so, why china clay, which mainly consisted of what had been termed kaolinite, was not the most plastic clay, instead of being the least plastic. He noticed a reference to mica in the analysis. If these figures were obtained by the method of the "rational" analysis, surely the portion designated mica should have been termed felspar. Mica doubtless was present, but not to the extent of 16·4 per cent. He had observed considerable quantities of mica in the clays and sandstones which were found above and below the clay measures proper, but even in these he doubted if there was anything like 16·4 per cent.

As to the furnace which had been exhibited, he wished to remark that this was the fourth pattern he had found in use for testing the pyrometric properties of fireclay, and that if each individual worker used his own particular furnace results of tests would not be at all comparable. One of the objects of the committee to which Prof. Turner had referred was to arrive at some definite understanding on the question of testing the refractoriness of fire clays. The last furnace put on the market was an electric furnace sold by Seger & Cramer. A furnace of this type was in use in the North Staffs. Pottery School, and from what he had seen of it it was really serviceable and economical to operate. One of the chief advantages of the furnace was that the progress of operations could be observed whilst the furnace was at work.

The argument that grog was of benefit because in being fired the content of alkali was reduced, he did not consider sound. He thought there were three main reasons for the addition of grog. The first was that of convenience of manufacture, clays worked up with a proper addition of grog were easier to dry and burn. Second, the products containing grog of proper size and quantity could be made to withstand alternations of temperature without cracking much better than those made altogether from raw clay. The third reason was the fact that it was possible to make mixtures of raw clay and grog in which the grog acted as a retarder of the softening process. This was difficult to explain without the aid of specimen bricks, but anyone who had compared samples of material made with grog and without, which had been in actual use would appreciate the point. He did not think that the ordinary weathering appreciably affected the content of alkali or that the felspathic matter was decomposed The decomposition of felspar by atmospheric influences was an exceedingly slow process, and it was very questionable if clay tipped in heaps in the usual way would be poorer in felspathic matter if left for ten years.

Mr. **BYWATER** said he was in agreement with Mr. Tucker as to the great value of the rational analysis itself, and although some were rather sceptical as to the uses which could be made of it he thought it was a very valuable method of analysis if properly used. If they could win the manufacturer from taking the view that the refractoriness of clay was always due to the silicon content, then they would have achieved a great work. He thought this view had been responsible for many failures in connection with refractory material. The practical application to which Mr. Tucker had referred was at the present time being practised in Stourbridge. Manufacturers were selecting clay which otherwise was fairly good, and were adding silica sand or silicon in various forms; and then they called it a "silica" brick.

The brick was of very little use for withstanding high temperatures when it was made; yet a lot of manufacturers were adding silica sand to an otherwise good clay, and in his judgment spoiling it. As to the Refractory Materials Committee, he could say, as a member, that practical work was being done, and several industries were collecting data. Valuable information was being collected as to temperatures, the working life of furnaces, etc., and it was hoped that the whole question would then be discussed by the Standardisation Committee, and that mutual good would result to manufacturers and users alike. He did not think nearly sufficient well-burnt grog was got into fire-clay goods. The difficulty was that the clays would not carry it. It was usually not possible to get more than 25 per cent. or 30 per cent. into Stourbridge clay. If they were going to improve the suitability of Stourbridge clay for retorts and other goods which were subjected to variations of temperature the clay would need to carry more grog. In Germany it was a common thing for such material to contain 50 per cent. and 55 per cent. of grog. The small particles were taken out and only the large were added; but the Germans had clay which would carry the grog, and they imported what they needed. Instead of getting the clay from the ground and using it unmixed, they bought large quantities of suitable material from all parts of the world, and then combined them as desired. What they had not got they bought; and they had in consequence obtained very successful results.

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* Thon Industrie Zeitung, t. xxi, p. 288.

Mr F. R. O'Shaughnessy asked for information as to the influence of lime and magnesia in clays, and their influence on the life of tiles and agricultural drain pipes made therefrom. His experience was that such goods varied in their weathering properties. He had examined samples of agricultural drain pipes containing 7 per cent. and 8 per cent. and even more of lime and magnesia. What should be the safe maximum of those constituents?

Mr. H. T. Pinnock enquired as to the comparative refractoriness of bricks in relation to the fire brick. His firm had been using silica bricks for a high temperature furnace, and when they contracted the crown of the furnace fell in almost immediately. He thought it was necessary to protect the Seger cones. He had found that cones which should have melted at about 1100° melted at about 950° C.

Mr. F. H. Alcock, discussing the types of furnaces to which reference had been made, said it appeared to him in one of the examples (that mentioned by Prof. Turner) in which graphite was used they would find that a considerable amount of alkali would be forced by the blast against the cone. Being largely potash or soda, possibly more potash than soda, it would greatly affect the fusion point of the cone, if his surmise was correct. He thought himself that such an apparatus would not be conducive to accuracy. It appeared to him that very much was to be said in favour of the electrical furnace. He was surprised to know that weak acids, such as nitric acid and hydrochloric acid, disintegrated the felspathic products, and would like to know whether, in the elutriation of clays any hydrolysis took place, and whether the quantity was affected other than the more uniform gradation of the size of the clay particles. He was interested in the suggestion with regard to sedimentation. Mr. Tucker suggested that if a little alum be introduced it expedited precipitation. There was considerable difficulty in filtering many precipitates, and amongst them he named antimonic acid, but the addition of diluted acids, such as nitric acid, was remarkably effectual in causing rapid precipitation and clear filtration. Ammonium chloride was also as effective in this direction as in the case of barium sulphate. What was the explanation of this use of alum seeing that many of the minerals were themselves aluminous?

Dr. Davidson said in the furnace to which he alluded a liner was always used, and the gas did not impinge on the objects under test. His references to grog were to bad grog, which might contain a large percentage of iron oxide.

The Chairman said, with regard to the elimination of alkalis by heat, under the conditions of the small experiment described, it was possible that a slight percentage of alkalis originally present in the clay would be volatilised; but he did not think that loss would occur when dealing with fire-clay goods in the mass, as would be the case under ordinary working conditions. He had analysed firebricks and retorts, and also the clays used in their manufacture, but had been unable to detect any diminution in the percentage of alkalis originally present in the raw material as a result of the firing.

Mr. Tucker, in replying to the discussion, pointed out, in regard to the question raised by the chairman, that the temperatures at which the alkalis volatilised were very high, and although these were the results of heating comparatively small pieces of the clay, he thought the experiments described by Seger and by himself were sufficient to illustrate an important point in practical working, *i.e.*, the reality of volatilisation of these alkalis, etc. He did not know whether it was appreciated before Seger's paper, but it appeared to him that the bearing of it in technical work was great. As to the character of the furnace he had described as affecting the melting point of the Seger cones, he hoped they would not think he presumed he had got together something for which he claimed great advantages. The apparatus was in a simple, inexpensive form, and did its work. Retort carbon and graphite were not always available. Petroleum nearly always was, and mechanical power for obtaining the blast was not always obtainable or convenient; but his apparatus had its own self-contained blast, and on that point showed many points of practical convenience. He suggested that Mr. Alcock might be a little off the line in his reference to alkalis impinging on the test piece in the furnace, because retort carbon would not contain alkalis except as mere traces, but ordinary coke might seriously affect the results. With regard to the action of water on clays by hydrolysis he had not the slightest doubt that that was a reality. It was a point he wished emphatically to bring out in the paper. If clay, any clay practically, were treated by water and given sufficient time, one could always obtain an alkaline reaction in it. He regretted he was unable to give any information with respect to the contractions of silica goods, or to the respective melting points. But it seemed that silica would be more suitable, under certain conditions, than the fire-clay brick, where corrosive materials were in contact with them. The two bricks, he conceived, would have their respective uses. He was unable to answer Mr. O'Shaughnessy's enquiry as to what was the influence of lime and magnesia on the coarser kinds of goods. The only reason for disintegration he could suggest was the probability that they were not glazed goods. (Mr. O'Shaughnessy: They were not glazed.) They may have been destroyed by the frost. (Mr. O'Shaughnessy: No, because they were five feet underground). Mr. Page raised a question on the obscure subject of the plasticity of clays—a subject which had puzzled eminent chemists and physicists, and on which a satisfactory theory had not yet been arrived at. Therefore it would be well to define terms before discussing the matter. He was not sure he agreed that china clay was less plastic than fire clay. He agreed with Mr. Page in his suggestions as to the use of grog. Perhaps it would have been better had he pointed out that not only did it reduce the shrinkage, but must, obviously from keeping the clay much more open, give facilities for drying the goods which would not otherwise be available. He was glad to notice Professor Turner appreciated his suggestions as to the chemical character of the weathering of clays. He (Mr. Tucker) certainly could not claim any merit of novelty on the point. The novelty he did want to bring out was that it should be more generally recognised that something was done by the weather and that weathered clay was substantially more refractory and more plastic than raw clay.

He did not approve of Mr. Rees' suggestion for a change in the nomenclature from kaolinite to clayite unless some benefit was to be derived, seeing that the name was recognised by chemists generally—certainly in Germany and France. They regarded kaolinite as the acting principle of clays, and any new name for this body was evidently undesirable.

Scottish Section.

Meeting held at Glasgow, on Tuesday, February 22nd, 1910.

MR. D. J. PLAYFAIR IN THE CHAIR.

THE RETORTING OF COAL.

BY HENRY O'CONNOR, A.M.I.C.E., F.R.S.E.

The subject of the retorting of coal is a very important one, when it is considered that in Great Britain alone some 15,000,000 tons of coal are annually carbonised for the making of gas. For many years gas engineers were justly accused of shewing little progress in the methods of applying the necessary heat to the conversion of the solid coal into the very complex matter called "gas" and the residual coke. Of recent years, however, proposals have been brought forward for improving the yield of gas as to both quantity and quality, whether illuminating or calorific, and also making a better coke.

There is no doubt that one of the greatest advances was made when Siemens introduced his gas-fired furnace, when he proposed the partial combustion in the furnace and the final conversion to carbon dioxide among the retorts. The adoption of most of the modern methods of retorting coal would be impossble without this system of firing. The next movement in the direction of improvment occurred about 25 years ago, when Coze introduced his system of sloping retorts at Rheims. He was not the inventor of sloping retorts, as these were apparently tried by Murdoch, the first inventor of gas. Coze, however, arranged a complete system of setting such retorts together with charging apparatus, which there is no doubt considerably reduced the labour and cost of gas-making. Mr. Newbigging, many years ago, laid down the axiom that "Dividends were made in the retort house" and if so it is in the retorts themselves where we must look for the making of the largest profits. It is little use saving money in the after-purification methods, if the gas has not been all evolved from the coal in the retorts, or the impurities have been increased owing to imperfect carbonization. The fundamental principle of the sloping retorts is that they are set at or about the angle of repose of the coal, which may be roughly said to be from 30° to 33° and nearly all the installations of this style are put up with the floor of the retorts lying at an angle between these two extremes. The coal then slides down, when given the slight impetus of being tipped in, but does not mass at the bottom, lying at various depths according to the rate at which it is tipped. This gives a very even layer on the floor of the retort, which is, of course a great desideratum, as any great difference in the thickness will mean that the time when the charge will be completely burnt off will vary, and sulphur, carbon dioxide and other impurities will be given off from the thinner portions, while the others will be still evolving gas. This applies equally to horizontal retorts, worked in the ordinary way.

The most recent adoption of these sloping retorts on a large scale is probably that of Mr. Herring at the Granton Gas Works, Edinburgh, where the average make per ton, throughout the year 1904 was 10,438 c. ft.; in 1905, 10,802 c. ft.; in 1906, 10,982 c. ft.; in 1907, 10,953 c. ft.; in 1908, 11,074 c. ft.; and in 1909, 10,690 c. ft. The entire costs of carbonising, including wages for foremen, discharging coal, attending to coal breakers, elevating, conveying coal to the bunkers, charging and drawing retorts, attendance to mouthpieces, cleaning and repairing retorts, greasing machinery, furnace attendants, hot coke conveyor, and engine men attending to the machinery were for 1904, 1·482d. per 1000 c. ft.; in 1905, 1·3d.; in 1906, 1·28d.; in 1907, 1·245d.; in 1908, 1·212d.; and in 1909, 1·263d., or probably little more than half the average cost of such work in the principal cities in this country. These figures are actual working results and not test results only. The retorts are D shaped, 20 ft. long by 22½ in. by 15¼ in. high, set at 32° with the horizontal and the coal lies about 7 in. thick over the floor of these retorts and is completely carbonized in four hours. In this respect they follow the usual custom with Scotch coal in horizontal retorts of four hour charges, but in England the coal used there requires the longer period of six hours to complete the carbonization.

The late Mr. Love of the Guildford Gas Works introduced a sloping retort on an angle of 45° with the horizontal, which he arranged to fill completely with coal, and at such an angle the coke would easily fall out. Owing to his death, complete figures are not available of the results from these retorts, but, by the courtesy of Messrs. Winstanley, who are erecting these retorts, I am able to give some tests made by Dr. Harold G. Colman, of the tar and ammoniacal liquor from these retorts, which are as follows:—

1. Tar—Sp. gr. at 60° F., 1·095; water (*i.e.*, amm. liquor), 2·2 per cent. by volume. The amount of water is fairly low, but would probably be still lower if the tar had the amount of time for settling in the wells, which it gets under normal manufacturing conditions.

Distillation test.—The following are the results of the distillation, and for comparison are added the test carried out in the same way, of a sample of coal tar from Durham coal carbonized in horizontal retorts with a yield of about 11,500 c. ft. per ton. In both cases the results are calculated for the tar freed from water.

	Tar from 45° retorts.	Tar from horizontal retorts.
	per cent.	per cent.
Boiling below 170° C.	4·4	1·1
" 170°—270°	28·5	13·1
" 270°—350°	19·2	13·2
" above 350°	47·5	72·1
So called "free carbon"	2·6	28·7

The middle oils, boiling at 170°—270°, differ not only quantitatively, but also qualitatively in the two cases. Whereas that fraction from the horizontal tar becomes almost solid from separated naphthalene on cooling, that from the 45° retorts remains completely liquid at ordinary temperatures, shewing that the proportion of naphthalene in the tar to other liquid substances having about the same boiling point, is very much smaller in the 45° tar; it is probable that under these conditions, and with the higher amount of light oils present, there will be no trouble from naphthalene in the gas.

The heavy oils from the 45° tar, deposit some crystals on cooling, but to a much smaller extent than the corresponding fraction from the horizontal tar.

Owing to the very small quantity of free carbon present, the pitch from the 45° tar, is very different from that prepared from the horizontal tar, having a bright jet like appearance.

(2) *Ammoniacal Liquor.* Sp. gr. at 60° F. 1·045—9·0° Twaddell.

Analysis.

	Grams per 100 c.c.	Ozs. strength.
Volatile ammonia	2·38	10·98
Fixed ammonia	0·66	3·07
Total ammonia	3·04	14·05
Sulphuretted hydrogen	0·10	
Carbonic acid	4·34	
Amm. sulphocyanide	0·25	

In this case the oz. strength does not agree with the usual assumption of oz. strength = 2° Twaddell on account of the percentage of carbon dioxide in the liquor, which is unusually high proportionally to the amount of ammonia present. The sulphuretted hydrogen is low, and that of ammonium sulphocyanide also.

The results seem to indicate that the amount of cyanide in the gas from the 45° retorts is low, but that the percentage of carbon monoxide is rather high.

The latter is what might be expected with a full retort as the gas does not get heated to so high a temperature, and the tendency then is to increase the amount of carbon dioxide and diminish that of the monoxide.

A more recent plan, which has been adopted in England with horizontal retorts, and which was first suggested by Mr. C. C. Carpenter, of the South Metropolitan Gas Company, is to fill the retort completely with coal, so as to utilize the whole space, and to cause the gas to pass quickly out of the retort and to reduce the number of times the mouthpieces have to be opened, which of course causes a certain loss of gas. This plan was impossible with scoop charging and with the ordinary methods of drawing the coke, as room had to be left for the rake to pass over the top of the coal to draw it out. It is also impossible with any but through retorts. The de Brouwer charger, which by the movement of a rubber band, driven at varying speeds by electricity, projects the broken coal in a stream throughout a 20 foot retort, has enabled the complete filling of it; and the use of the various pushers for forcing the coke out at the opposite side has provided means for removing the coke when the carbonization is completed.

Mr. Bell, of Derby, with such completely filled retorts, obtained the following results with medium Derbyshire gas coals and 25 per cent. good rough Derbyshire coking slack added, with 12-hour charges and 80 retorts in use.

Gas made per ton	11,463 c. ft.
Candle power (No. 2 Met. burner)	14·77
Sperm value per ton	580 lb.
Calorific value per c. ft. of gas gross	134·6 calories.
Calorific value per c. ft. of gas net	122·6 calories.
Impurities in crude gas, carbon dioxide volume	3·25
Impurities in crude gas, hydrogen sulphide per 100 c. ft.	620 grains.
Impurities in crude gas, carbon bisulphide per 100 c. ft.	47·4 grains.
Coke for sale per ton of coal	10·34 cwt.
Breeze for sale per ton of coal	1·33 cwt.
Tar for sale per ton of coal	12·84 galls.
Ammonium sulphate for sale per ton of coal	34 lb.

There is no doubt that the idea of this system was due to the methods adopted in the coke oven plants, many of which have been in use for a long time.

The coke ovens are usually set in batteries of 50; each retort being about 35 ft. long by 6 ft. high and 18 in. average width and these hold some 6 tons. Like the ordinary horizontal through retorts these are open at each end and have luted doors. The coal is charged through three or more charging holes in the roof of the oven and then it is levelled and the luted doors closed. The hydraulic main, as in a gas works, is not always used, but a rising pipe and ordinary main serves the purpose, valves being provided. The gas is rich at first but poorer later. With coke ovens for the making of foundry coke from slack coal the latter half of the gas made is used for heating the furnaces through tuyères with hot air, but in the gas coke ovens the heat is obtained by regenerative coke furnaces. The charge usually works off in 24 to 30 hours and is then mechanically pushed out from one end and quenched as it leaves the oven. Coke ovens reduce labour to a minimum by larger charges and long periods of carbonization. Recent practice requires that the coals should be broken and compressed in moulds the same size as the oven and then, while so compressed, run into the oven and not put in through the top. It is said that an increased output of 10 per cent. is obtained of a denser coke, with less breeze and wear on the oven lining and a saving of labour.

Mr. Thos. Glover, of Norwich, has devised chamber retorts which follow somewhat the same ideas as the coke ovens, but are smaller, holding only about one-sixth the coal. With them, however, the number of operations is greatly reduced, as compared with the ordinary horizontal retort practice, and the losses through opening and closing the mouthpieces are lower. The ammonia is considerably increased, by some 15 per cent. to 17 per cent.; the tar is distinctly thinner with much less "free carbon" and some 20 per cent. increase in quantity, of greater value, it is easier distilled and contains more benzenes and other hydro-carbons; the naphthalene, however, is not reduced. The carbon in the retorts is found at the top only, showing that the gas passes along the top of the retort, but owing to the small space through which the gas has to pass, the sulphur is not long in contact with the carbon and therefore less is combined with it, in the form of carbon bisulphide, and more of it is found in the form of hydrogen sulphide.

The first installation of these retorts at Norwich consists of a single bed containing six chamber retorts each 21 ft. in length, 3 ft. in depth, and increasing from 12 in. in width at the charging end to 13 in. at the discharging end. The vertical sides of the chambers are slightly cambered in order to allow of their straightening out under the internal pressure set up by the expansion of the brickwork when heated. The six chambers are set horizontally in an arch of the same dimensions as those containing 10 ordinary retorts set in five rows, each containing two retorts. These retorts should not sag owing to their deep vertical sides. In ordinary retorts the heat is required at the bottom, but in these narrow filled up retorts it is required at the sides and is so supplied in these Norwich settings. Mr. Glover found that with ovens 12 in. wide the rate of carbonization equalled 0·5 in. per hour from each side, with ovens 16 in. wide, 0·47 in., and 17 in. ovens, 0·425 in., and 20 in. ovens, 0·305 in. From these figures he was able to easily decide the proper length of carbonization.

The charging of the coal is effected by a de Brouwer projector, the retort being filled as full as possible, except at each end, where the coal is allowed to slope at its natural angle of rest. The coke discharge is effected by a de Brouwer ram discharger.

Owing to the fact that the bed of chamber retorts is working in conjunction with the ordinary beds of retorts in the same house, the gas mixing in the foul main, Dr. Colman was only able to make a test at such times as the ordinary retorts were shut down for the usual Sunday stop from 10 a.m. to 10 p.m., and the period of the test was therefore limited to 12 hours.

The gas made during the test period passed through the ordinary works condensers, scrubbers and purifiers, but although as many of these were shut out as possible, the plant actually in use was very large for the volume of gas being made, which had the disadvantage that any small quantities of air getting into the gas, on the vacuum side of the exhausters, would represent a large percentage of the actual volume of the gas passing; it appeared, therefore, not unlikely that from this cause the gas made would contain more nitrogen than is normally present, which would somewhat increase the make of gas per ton and simultaneously reduce the illuminating and calorific power.

The test was carried out between 10 a.m. and 10 p.m. on Sunday, October 4th, only the bed of the chamber retorts being at work during this period, precautions being taken to ensure that no gas from the other beds could possibly mix with the gas from the chamber retorts. The temperatures of carbonization was judged to be 2,000° to 2,100° F. and during the test, except while charging was in progress, the retorts were worked without seal, the pressure in them being maintained as nearly as possible about 1/10th of an inch by means of the retort house governor.

The coal employed consisted of washed nuts, from the South Yorkshire district, a sample of which gave the following analysis:—

	per cent.
Free moisture	2·14
Volatile matter, not including free moisture	31·14
Ash	4·43

Three chambers were charged at 10 a.m. and the remaining three at 4 p.m., the period of carbonization being 12 hours, 6 tons 6 cwt. was used, or an average of 21 cwt. per chamber. The gas made was 84,300 c. ft. at 64° F. and 30 in. bar, or 83,457 c. ft. at 60° F. and 30 in. bar, equal to 13,247 c. ft. per ton.

The coke was of good character, bright and lustrous, and of a size and hardness intermediate between that of ordinary coke and metallurgical oven coke. On analysis it gave the following figures:—

	per cent.
Free moisture	0·56
Volatile matter, not including free moisture	0·58
Ash	7·70

There was a marked decrease in the free carbon in the chamber tar as compared to the ordinary retort tar and an increase in the proportion of heavy oils, shewing that the volatile products from the coal were not subjected to the action of so high a temperature before escaping from the chamber as is the case with the ordinary retorts.

The results obtained in the analysis of the gas from the chambers show that, as was expected, the nitrogen content was high, namely 9·7 per cent. as against 5·0 per cent. obtained in the coal gas working under normal conditions, this excess being due to the infiltration of the air. Had the percentage of nitrogen been only the same as in the coal gas the make per ton would have been reduced to 12,624 c. ft. per ton, whilst the illuminating power in the No. 2 met. argand would have been from 16 to 16·5 candles, the gross calorific power 576·1 B.Th.U., and the net 518·2 B.Th.U.

	Chambers.	Ordinary.
Gas made per ton............	13,247 c. ft.	
Ill. power in No. 2. met......	14·94 candle.	15·84 candle.
Calorific power gross by Junker	549·48 B.Th.U	565·9
do net...........	493·9 ,,	512·6 candle.
Sulphur in purified gas	45·7 grs.	per 100 c. ft.
Free carbon in tar	11·1 per cent.	
Sp. gr. at 60° of tar	1·18 ,,	1·22 per cent.
Water, per cent. in tar, by volume	10·1 ,,	6·0 ,,

Analysis of dry tar.

	Per cent.	Per cent.
Light oils up to 170°	0·4	1·4
Middle oils, 170° to 270°	10·2	10·5
Heavy oils, 270° to 350°......	30·1	16·14
Pitch above 350	53·9	71·8
Naphthalene	4·7	4·7
Free carbon	11·1	23·2

Dr. Lessing has summed up the advantages of the carbonization in chambers generally as follows :—

Long period charges permit a great saving in labour and consequent reduction in carbonizing cost, particularly in the case of 24 hour charges, where no night work is required, except for tending the producer fires and watching the process. High make of gas, due to limited secondary decomposition therefore good calorific value. Little carbon deposit ; scurfing to be done easily and conveniently. Ascension pipes kept clear. Small consumption of fuel and little loss through radiation. Coke of very good quality and size. Tar thin and containing little free carbon. Smaller heated surface per ton of coal carbonized than in retorts, and less chance for decomposition and infiltration of flue gases. Large yield of gas on small area covered, manipulation is simple and comfortable for the men. The life of the plant should be considerably longer than that of ordinary retort plant.

The disadvantages being :—Low illuminating power. This, of course, is in this country, and in view of parliamentary obligations, an all important factor. High cost of installation, which, however, can soon be made good by greater economy in working and smaller capital charges on account of higher durability.

The Dessau vertical retorts patent thus describes the invention :—The manufacture of gas by subjecting coal to distillation in a vertical retort heated to a higher temperature than is usually employed in gas manufacture so that the coke is formed from the internal walls of the retort inwards and the gas generated passes inwards and upwards through the central portion of the charge, the retort being charged with coal up to the same level as that up to which the external heat is applied so that no space is left in which the tar can quickly separate, it being compelled to pass upwards through the uncoked portion of the charge, before leaving the retorts. This gives a good idea of the points of interest about this system, though whether all the claims can be substantiated in law is doubtful. These vertical retorts which are some 4 metres long (say 13 ft.) diminish in cross section towards the top to ensure the easy removal of the coke past any inequalities on the face of the retort. Chambered vertical retorts or large units have been tried, but were not successful. It is claimed that the gas from these vertical retorts requires only half the purification of that from inclined retorts, while the sulphur is reduced and there is little or no formation of pitch or thick tar in the take-off or dip-pipes. Designs have been made for the installation in small units which will make only some 100,000 c. ft. per day.

In these retorts the coal is inserted periodically and the whole mass carbonized, as in coke ovens or completely filled horizontal retorts, and when the process is finished, they are emptied and a new charge again inserted. In this way the gas given off must pass through various depths of completely or partially carbonized coal and the products must vary from hour to hour.

The most recent installation of this system has been at the Sunderland Gas Works where the guarantee tests of the four metre retorts was as follows :—

Duration of test (10 a.m. Jan. 6 to 10 a.m. Jan. 8)	48 hours.
No. of retorts at work	60
Duration of charge (no steaming)	11 hours.
Coal carbonized (Holmside Durham)	124·11 tons.
Gas made corrected to 30-in. bar and 60° F.	1,492,900 c. ft.
Gas made corrected per retort	12,441 c. ft.
Gas made corrected per ton of coal carbonized ..	12,028 c. ft.
Illuminating power (No. 2 Met. burner)	17·55 candle.
Calorific power (gross)	635·4 B.Th.U.
Calorific power (net)	568·9 B.Th.U.
Coke used for fuel dry	17·33 tons.
Coke used for fuel per ton of coal carbonized ...	13·96 per cent.
No. of retorts at work (12-hour charges including one hour's steaming)	60
Weight of average charge of coal (12-hour charges including one hour's steaming)	9½ cwt.
Gas made per ton corrected (12-hour charges including one hour's steaming)	12,465 c. ft.
Ill. power (No. 2 Met. burner), (12-hour charges including one hour's steaming)	16·84 candle.
Calorific power net (12-hour charges including one hour's steaming).......................	559·2 B.Th.U.
Sulphur (carbon bisulphide) in purified gas (oxide only)	20 grs. per 100 c. ft.

The Woodall and Duckham system of vertical retorts uses the continuous carbonizing process and the retorts are made up in about 3 ft. lengths to 25 ft. long, with cast iron mouthpieces. Their dimensions are 20 in. by 29 in. at bottom tapering to 9 in. by 21 in. at top, where a rotary feeding device is attached and a gas off take pipe at side of same. This device consists of a faced cylindrical drum rotated by power. The coke extractor can be set to remove the coke at any desired speed and the coal feeder is worked in proportion. The retort is always kept full of coal so that the gas as soon as it is made has to pass constantly through the same thickness of uncarbonized coal. The hottest part of the retort is near the top, as the combustion chamber, which is built entirely of silica brick, is there, and the heating gases descend to the bottom of the retorts before entering the regenerator chambers.

Tests made with these vertical retorts at Nine Elms Gas Works with coal which had been stored in the open, and was wet ; but in which no allowance had been made for moisture shew the following results :—

Coal used (Birley Silkstone)	86·3 tons.
Gas made	1,072,294 c. ft.
Gas made per ton..........................	12,423 c. ft.
Ill. power (No. 2 Met.)	15·82 candle.
Sperm value	674
Calorific value (gross)	596·6 B.Th.U.
Calorific value (net)	530·7 B.Th.U.

Composition :—Carbon dioxide, 2·22 per cent.; hydrocarbons, 2·88 per cent. ; oxygen, 0·27 per cent. ; carbon monoxide, 7·41 per cent. ; methane, 35·05 per cent. ; hydrogen, 45·85 per cent. ; nitrogen, 6·32 per cent. It will be noticed that the proportion of carbon monoxide is not high and therefore the gas does not partake of the nature of water-gas. There is an increase of gas and ammonia, better coke and tar, less cost for land and buildings, less nitrogen, less fixed sulphur and less naphthalene. Improved working conditions and less wear and tear of retorts.

It was at first thought that the introduction of steam to make some water-gas would be advantageous, but up to now this has not been found so. This would, of course, utilize some of the heat in the coke after carbonization which unless it can be fed directly into the furnace while hot, is lost. If a lower candle power and calorific value would satisfy the people of this country as it does on the continent, then no doubt the steaming could be carried out and full advantage of this heat be obtained.

The Glover-West vertical retorts at St. Helens have 20 ft. retorts 24 in. by 12 in. at top expanding to 30 in. by 18 in. at bottom. Each carbonizes about 2½ tons a day, and each charge is 12¼ hours passing through the retort. The producer is at one side and is fed with cold coke. The secondary air is heated by the coke before discharge, and the highest heat is at the top rather than at the bottom. The coke in the retort rests on a plate at bottom which is swept by an arm at any desired speed and the coke falls into a chamber below, from which it is periodically removed, this chamber is luted with water. There is no steam admitted for the purpose of making water gas. The lower portion of the charge for 2 or 3 ft. is coke then the uncarbonized portion takes a V shape, gas passes through uncarbonized coal, and issues at 160° C. (320° F).

The average results per ton from three coals, one from Durham (Thornley) and two from Yorkshire (Barrow Colliery and Wigan Arley Mine) are given below.

Gas made per ton	12,561 c. ft.
Quality by No. 2 Met. burner	15·66 candle power.
Calorific power, gross 578·2 net	517·6 B.Th.U.
Coke, dry	13·8 cwt. per ton
Fuel per cent. of dry coke	12·6 per cent.
Tar	11·81 galls.
Ammoniacal liquor galls. of 10 oz. per ton	28·1 = 23·7 lb. of sulphate.
Cyanide ($Na_4FeCy_6.10H_2O$) lbs. per ton	5·54.
Naphthalene	31·1 grains per 100 c. ft.

The tar is not reduced in quantity and is much freer from carbonaceous matter, it may amount to 12·9 galls. per ton of coal.

The production is 60 per cent. greater for the same ground space. The system of regeneration by absorption of heat from the coke at bottom of retort is only applicable to verticals. The coke is decidedly improved, there are no stopped pipes or pitched hydraulics. The same coals used in the ordinary horizontal retorts would only make some 10,250 c. ft. per ton. From such continuous carbonization there is no smoke.

E. Körting states the disadvantages of continuous carbonization as follows, but I think I am right in stating that he is interested in the intermittent system:—1. Separate charging and discharging machinery is required for each retort. 2. Continuous movement of the whole contents of the retort cannot possibly be advantageous to the coke. The economy of the system would be very dubious if the reduced durability of the coke increased the quantity of breeze by only a small percentage of the weight of the coal carbonised. 3. It is impossible to inspect the inside of the retorts, because they are always full, and to ascertain whether they need repair and whether the coal is properly disposed in them.

The latest proposals for vertical retorts come from Mr. Herring, of Edinburgh, who is erecting at Granton Gas Works a single setting of these retorts, upon the same area as is at present occupied by one of the ordinary sloping retort beds, a set of six vertical retorts. The arrangement allows of the heating of the retorts in almost any manner, either with the greatest heat at the top, the middle or the bottom, by means of ports for the admission of the producer gases and the secondary air at any level from top to bottom; suitable means having been provided to close off any ports not required. Mr. Herring does not suggest that these designs are in any way final, but has erected them purely as experimental retorts with every possibility of testing, so as to obtain the best arrangement for future carbonisation of the coals with which he has to deal. The retorts are built of grooved bricks, and are made square to avoid expense of special bricks, and in the hope that the corners will become filled up in time with carbon. A good taper is given to them so that the coke may not be obstructed in leaving. In most things he has followed the vertical oil retorts practice, as he points out that that industry has had a number of years experience which must have led to the survival of the fittest. The only part patented is the ground valve type of coal inlet and coke-outlet.

Having described the various modern systems and the results obtained by them, we may now profitably discuss their advantages or otherwise.

With small charges the separation of the carbon occurs so energetically that the ascension pipes are constantly becoming blocked and coke must be drawn before being completely burned off; a large charge on the other hand is more evenly distributed than a thin one, and the decomposition, with filled retorts, is avoided, so that higher temperatures of carbonisation can be used. It is evident that filling the retorts has made a different tar which should be easier handled and has removed many of the gas manager's greatest troubles, namely, stopped ascension pipes and pitched hydraulic mains.

Heating surface compared to the weight of the charge is a good indication of the comparative efficiency, but this is only the case with vertical and completely filled retorts, as it is only the heat, which is acting directly on the coals, which is wanted. Tests have shown that with tiles and asbestos on the tops of horizontal ordinary retorts, where the heat is not wanted on the inside, the quality of the gas has been improved. This might be expected, as the heat would convert some of the hydro-carbons into the solid carbon which usually collects on the inside of a partially filled retort and must thereby reduce the illuminating power. The lengthy contact with the hot side of a retort which is partially filled, must injure the gas, so that an improvement may well be expected when there is little room and consequently a quick passage for the gas away from this heat.

The requirements of coal gas and the illuminating power is daily becoming of less moment, while the calorific value is of more and more moment. What this calorific value is to be fixed at depends on the coal available. On the continent they are satisfied with a much lower figure than in this country, but tests must be made, and this without delay, by all gas companies and corporations to ascertain the extent of the calorific power obtainable from the coals near at their hands. In many cases they will not have the necessary apparatus at their hands for the purpose, but they should arrange for a periodical test of each of the coals they are using when being carbonised under the usual conditions prevalent in their works. Further than this, they should aim to find out the particular method which will give the best heating result from these coals, so that they can alter their processes accordingly. The published tests by the coal owners are not of much assistance in this matter, but may be taken as a guide as to the extent to which their efforts may be aimed. The apparatus for carbonising coal varies so greatly in certain ways that similar results cannot be looked for in different gas works.

The great aim should be to obtain as much methane as possible, as such a gas has a calorific power of 1024 B.Th.U. gross and 919 net, while hydrogen has only 326 gross and 272 net and carbon monoxide 323 gross and net—all per c. ft. Consequently any process which will increase the proportion of the former in the gas made must prove the one which will be likely to succeed in the future.

Discussion.

Mr. James McLeod said that Mr. O'Connor's paper was very opportune, coming at a time when the gas industry was occupied with the question of vertical versus horizontal retorts. In his opinion, the vertical retort would be generally adopted for the carbonising of coal. In the first place, it meant a great saving in ground space. It had been shown, for example, that for an output of 750,000 c. ft. of gas per 24 hours, a space of only 30 ft. by 70 ft. was required. In the second place, the machinery required for a vertical retort system is simpler and much less subject to wear and tear than horizontal charging machinery.

Mr. David Vass said that vertical retorts on the continuous system might require a coal somewhat different from that hitherto used, because they were suitable only for small coal, whereas in Scotland the practice had been to break large coal into pieces of from four to six inches cube. He considered the Woodall-Duckham system one of the most perfect he had seen. Attempts were being made to obtain the same results from horizontal retorts by heavier charging, but there was the difficulty of getting the pusher to remove that large mass of material. In coke ovens it was found advisable to stamp the coal into a solid mass before putting it into the oven to be retorted, obtaining in that way a coherent mass which was easily pushed out when carbonised.

Mr. GEORGE R. HISLOP was of opinion that some time must elapse before horizontal retorts could be displaced. It had been proved to be an advantage to push the coke out of the retort, but in Scotland difficulties were met with. The coke from English coal was of a caking character, adhering together and therefore easily pushed out, while that from Scotch coal was very soft, and in the attempt to push it out, there was the risk of bursting the retort. No doubt, this difficulty might be reduced by the adoption of vertical retorts. If space was of great value, vertical retorts might be adopted and perhaps do fairly well with Scotch coal, but where space was not of much account, the extra cost of the distillation by the vertical system would be against it.

Dr. THOMAS GRAY said that the best results might be expected from some method of continuous distillation, since the conditions of working remained practically uniform, and that he had been surprised to find the coal gas industry so slow to adopt a system of this kind. Retorts working continuously, very similar in construction to some of the vertical retorts illustrated by the lecturer, had been employed successfully in distilling shale for about 30 years, and there was no reason to suppose that these would not be equally successful in dealing with coals of a non-caking character. While discussing the working of a chamber retort Mr. O'Connor had stated the yield of gas to be 13,247 c. ft. per ton of coal. That was a very high yield of gas even when allowance was made for leakage of air, and he found it difficult to explain how such a large quantity could be obtained except on the assumption that the tar had been partially decomposed, and was consequently viscous in character ; whereas the author had stated that a fluid tar had been obtained. He asked if Mr. O'Connor could give any data regarding the temperatures at various parts of the vertical retort.

Mr. ROBERT HAMILTON asked if there was any difference in the yield of ammonia in the vertical and in the horizontal system.

Mr. SAMUEL GLOVER (communicated) said that at St. Helens they had adopted the vertical system by means of which they could retort successfully coal of all grades. By special heating chambers the temperature of the retorts could be controlled, and the gases which came off easily were carried away readily from the top of the retort, while those which were evolved on the destructive distillation of the coal were not harmed by overheating, and the heat of the coke was returned to the setting as it was made to heat the secondary air going to the combustion chambers. The life time of the retorts would be a very long one and the through-put of coal very great compared with that of horizontal inclined or German retorts. The gravity charging worked well and the quality of the gas was very regular.

The CHAIRMAN said it would be interesting to know the difference in tar produced by the continuous as against the intermittent process. There was also the point of how much the gas engineer could improve the value of the by-products by varying the temperature of distillation. He would also like to know if it had ever been tried to have steam injected into very hot fuel so that a mixture of coal-gas and water-gas could be obtained.

Mr. O'CONNOR, in reply, said that no doubt there was a great advantage in vertical retorts when ground space was limited, but he believed that the extra amount of gas obtained on a certain space was manufactured at a somewhat heavy cost. In one case recently the system of vertical retorts cost four or five times that of horizontal retorts. One of the difficulties in the setting up of vertical retorts was that they must be tapered from top to bottom to prevent the coke sticking in the retort. Consequently it must be built up in rings, each ring being made of the proper taper, or must be built with special bricks, or as in the retort set up by Mr. Herring at Granton, built square with grooved bricks. Until a definite size was decided on and a definite taper accepted, so long would the expense in building vertical retorts be considerable, because each piece of the retort would have to be made of exact taper to fit the one above and the one below. A considerable increase in the yield of ammonia was claimed for the vertical system. So far as he knew, no tests had been made regarding the temperature at different parts of the retort, but it was intended to make these with the experimental plant at Granton.

In reply to the questions of the Chairman, the tar from the vertical system appeared to be heavier, and regarding the use of steam it was impossible to use a large quantity of this because the candle power was bound to be reduced. In Germany, where they were satisfied with a candle power of 11 or 12 steaming was used on practically every occasion. In lowering the candle power, care should be taken not to lower the calorific value. The aim should be not to manufacture hydrogen but methane. If water-gas was made, that meant carbon monoxide, which was not so valuable for heating purposes as hydrogen.

Journal and Patent Literature.

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I.—GENERAL PLANT ; MACHINERY.

Refrigeration for analytical and industrial investigations at low temperatures (−75° C.) ; Convenient method of ——. J. O. Handy. J. Ind. Eng. Chem., 1910, 2, 92—94.

THE author discusses various methods of refrigeration, and gives the preference to the use of carbon dioxide snow with acetone or with petroleum ether. Of these, the acetone mixture has some advantages. The "snow" is prepared by the usual method of allowing the liquid carbon dioxide to blow off through canvas or flannel bags. The temperatures resulting from various quantities of the "snow" with 150 grms. of acetone (at 23° C.) are given as follows :—6 grms. of carbon dioxide, −5° C. ; 11 grms., −20° C. ; 24 grms., −38° C. ; 45 grms., −54° C. ; 77 grms., −61° C. ; excess of carbon dioxide, −78° C. With 114 grms. of petroleum ether of 86° B. at 22° C., the temperatures obtained with different weights of carbon dioxide were as follows :—5 grms. of carbon dioxide, −22° C. ; 10 grms., −36° C. ; 15 grms., −55° C. ; 30 grms., −69° C. If absolute freedom from risk of fire is desired, carbon dioxide and carbon tetrachloride or chloroform can be used for a limited range.—R. C. P.

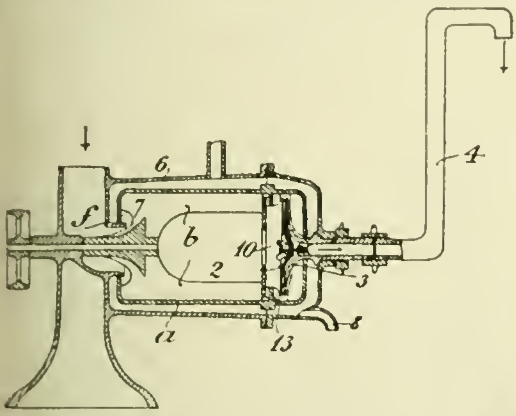
PATENTS.

Separating fluids having different densities ; Method and means for ——. C. S. Brown, Nashville, Ten., U.S.A. Eng. Pat. 4962, Mar. 1, 1909. Under Int. Conv., March 23, 1908.

THE invention consists of a valve which allows fluid to pass but prevents vapour or gas from doing so. It is said to be especially adapted for separating water of condensation and air from the steam in a steam heating system. A small circular opening in the centre of a flat circular surface is covered by a disc valve. The sizes of the circular surface and the valve are large in proportion to the size of the opening. The fluid passing through the opening and spreading out between the disc valve and the seating brings about a change of pressure between the valve and the seating, which is said practically to close the valve if steam be present, but to fail to do so in the case of water, which escapes.—J. W. H.

Separating air or gas from liquid; Centrifugal apparatus for eliminating or —— E. D. Hansen and G. G. F. C. Winkler, Kolding, Denmark. Eng. Pat. 25,761, Nov. 8, 1909. Addition to Eng. Pat. 12,004, May 21, 1909 (this J., 1910, 75).

The apparatus is intended for the separation of air from liquid or the elimination of froth. In the Fig. the vessel, *a*, with vanes, *b*, rotates at a high speed. The frothy liquid enters the inlet, *f*, and air separated from it passes between the front wall, 7, and the inlet into the jacket, 6, from which it escapes to the air. Any liquid from the spray runs out of this jacket by the pipe, 8. The separated liquid passes between the stationary discs, 2, and 3, where its motion of rotation is converted into motion in an axial direction, and leaves the apparatus by the pipe, 4. The inner surface of one or both of the discs, 2 and 3, is provided with radial ribs to facilitate this change of motion. A regulating valve may be fixed on the pipe, 4, and a froth-lock added, consisting of a disc, 10, with holes near its circumference and an annular flange, 13, so that the discs, 2 and 3, may never dip into froth.—J. W. H.



Centrifugal machines. W. Hulme and T. B. Job, Liverpool. Eng. Pat. 6448, Mar. 18, 1909.

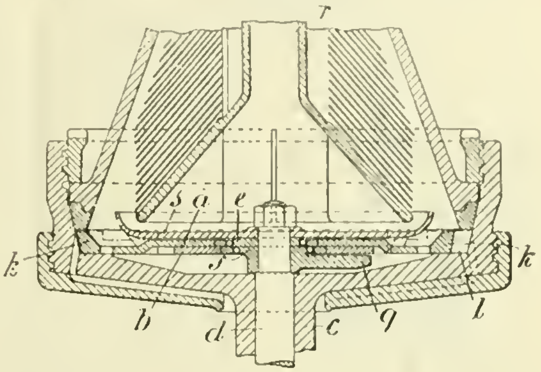
The invention relates to centrifugal machines having two concentric conical cages, capable of being driven at different speeds, and between which the material to be treated is fed continuously. The inner cage is of conical form, the apex being vertical, and provided with a helix on its surface for determining the flow of material through the machine. The outer cage, having perforated walls, forms a conical screen surrounding the inner cage. The material being fed into the hopper, falls upon the arms supporting the conical screens; these act as propeller blades, mix air with the material, and drive the mixture forcibly against the screen. Internal ribs are provided on the inner surface of the conical screen to facilitate the separation of the liquid from the solid matter.—J. W. H.

Centrifugal pumps and compressors. The Warwick Machinery Co. (1908) Ltd., London. From the General Electric Co., Schenectady, U.S.A. Eng. Pat. 10,094, April 28, 1909.

The casing of a centrifugal pump is made in two parts, the joint being at right angles to the spindle. One part carries the single bearing of the impeller together with the inlet and outlet of the pump, so that the other part may be removed to examine the interior of the pump without breaking the pipe connections. The bearing and other interior parts of the pump are water-jacketed.—J. W. H.

Slime separators; Centrifugal ——. J. T. Lindahl, Stockholm, Sweden. Eng. Pat. 23,366, Oct. 18, 1909. Under Int. Conv., Oct. 30, 1908.

In pressing out the slime from the centrifugal drum of a slime-separator, using a rotary disc rolling along the row of outlet openings, it is found that the material sometimes slides ahead of the disc without entering the outlet passages. It is therefore proposed to arrange within the drum one or more plungers which, rotating with the same speed as the latter, move into and out of the cells communicating with the slime outlets. These plungers may consist of circular discs, *a b*, with pressing edges, *k*, placed one above the other on the bottom of the drum. By means of eccentrics, *e*, *f*, mounted on a vertical shaft, *d*, passing up the centre of the hollow drum axle, *c*, these discs are given a reciprocating movement. The fluid with suspended slime is fed through the central tube, *r*, on to the disc, *s*, which has its edges curved upward in order to prevent the liquid from being forced directly outward. In the reciprocating motion of the discs, the slime is allowed to enter the cells, *l*, on one side of the drum, but is immediately pressed into the drum-outlets as the plunger moves round. A counterpoise, *q*, is fixed on the shaft, *d*, for the purpose of balancing the plungers, *a* and *b*.—C. A. W.



Gases; The purification of——. F. Schmidt, Berlin. Eng. Pat. 6515, May 18, 1909.

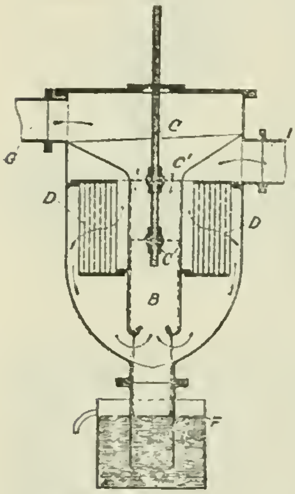
The process consists in liquefying the gas in a settling vessel in which the impurities of high boiling point are solidified and deposited. In carrying out the process with air, after the usual compressing and cooling operations, the gas is led into the settling vessels, which in the first instance are sprayed with liquid air or cooled by expansion according to Eng. Pat. 1828 of 1907, until the gas liquefies. The solid carbon dioxide precipitated is discharged from the bottom of the vessel by means of a cock and the clarified liquid released through an expansion valve into the chamber surrounding the vessel. The expanded material, now in the form of gas at a very low temperature, surrounding the settling vessel cools fresh air for treatment. To facilitate the cooling of the incoming air, in one form of the apparatus, it is made to pass through a spiral tube surrounding the settling vessel before entering it to be liquefied. Gases containing various proportions of oxygen, nitrogen, argon, etc., are stated to be obtained from outlets in the upper, middle, or lower part of the chamber containing the settling vessel—J. W. H.

Heating, cooling, or distilling, liquids, and for heating, cooling, purifying or enriching gases; Apparatus for ——. W. Blakeley, Ravensthorpe, Yorks. Eng. Pat. 8481, April 8, 1909.

The invention relates to apparatus in which gases are brought into contact with liquids by means of a series of superposed shallow trays through which the liquid falls and the gas rises. A rim around a central hole maintains a definite level of liquid in each tray. A deflecting plate above the hole compels the current of gas to flow near the surface of the liquid, and the shape of this deflecting plate is such as to maintain the area of each circular section through which the gas passes equal to that of the gas inlet pipe of the apparatus. At the circumference of this deflecting plate an extremely thin current of gas passes over the surface of the liquid. Corrugations may be made in the plate with the object of increasing the rippling effect of the passage of the gas. —J. W. H.

Air or other gases; Apparatus for the purification of——. A. Deters. Ger. Pat. 217,175, Jan. 12, 1908.

The gases are purified from dust, tar, etc., by passing them first through continuous films of water and then through layers of coke or other filtering material packed between concentric perforated metal cylinders. The apparatus is shown in the figure. The gas enters through the pipe, G, and in flowing downwards through the pipe, B, passes through several films of water formed between the wall of the pipe and openings, C', in the water-supply pipe, C'. The water, carrying with it dust, etc., flows down into the receptacle, F. The gas passes in the direction shown by the arrows, through layers of coke between the perforated metal cylinders, D, and issues through the pipe, I.—A. S.



Distilling device. O. A. Nenninger, El Paso, Tex. U. S. Pat. 952,343, March 15, 1910.

The claim is for the combination of a casing, a constant-level water tank, a tank heater and a condenser connected by several three-way valves, which can be operated in unison, to connect the tank heater with the casing or with a house-boiler.—W. H. C.

Emptying and filling vessels; Means for —— also applicable for mixing liquids, gases, or liquids and gases. O. Jahr, Gera, Germany. Eng. Pat. 18,220, Aug. 6, 1909.

A device is claimed for filling vessels with liquids under pressure, consisting of a casing, having liquid and gas connections, which is fixed on the vessel to be filled. A conical plug, which may be rotated by a key fitting into a hollow square, in one position brings the liquid passage into communication with a tube in the centre of the plug reaching to the bottom of the vessel, and the gas passage into communication with an annular passage formed between the tube and the plug and casing. In using the device, as the liquid enters the vessel by the tube, the compressed gas leaves it by the annular passage, the lower end of which determines the height of the liquid. The device may be protected from unauthorised opening by the provision of soldered caps over the gas and liquid connections and the plug recess.—J. W. H.

Measuring gases; Apparatus for ——. C. Küppers, Aachen, Germany. Eng. Pat. 19,767, Aug. 28, 1909.

In instruments, in which the position of a float in a vertical tapering tube indicates the rate of flow of a gas, the float is made to rotate by the provision near its periphery of inclined perforations.—J. W. H.

Drying bricks, tiles, cement, fruit, hops, peat, timber and like materials; Apparatus for ——. M. Wolff, London. Eng. Pat. 25,976, Nov. 10, 1909.

The apparatus consists of a drying chamber through which trucks carrying the materials to be dried are passed. In a trench or otherwise, between the rails upon which t trucks run, steam heating pipes are placed and belo these pipes air is admitted from openings in an air flu Steam is admitted to the heating pipes at the end whe the material leaves the dryer.—J. W. H.

Desiccating apparatus. H. J. Keith and S. C. Keith, jun Somerville, Mass., Assignors to H. J. Keith Co., Bosto Mass. U. S. Pat. 951,249, Mar. 8, 1910.

In a desiccating apparatus in which a thin film of th material to be dried is spread on a moving hot surface the feeding device consists of a box with a flexible wall i contact with the hot surface, the level of the materia being maintained above the upper edge of this flexibl wall.—J. W. H.

Drying apparatus. [Vacuum pan.] J. H. Duncan Ithaca, N.Y. U.S. Pat. 951,559, Mar. 8, 1910.

The apparatus consists of a vacuum pan connected by means of a pipe at its base with the "boot" of a enclosed elevator. The material deposited in the pan is carried by the elevator to a drying receptacle at a highe level. The liquid draining from the deposit is allowed to run back into the pan by means of a pipe to which is also connected the suction pipe.—J. W. H.

Furnace; Regenerative reversing ——. L. L. Knox, Ben Avon, Pa., Assignor to Keystone Furnace Construction Co., Pittsburg, Pa. U.S. Pat. 951,644, Mar. 8, 1910.

The gas and air flues of a regenerative reversing furnace are separated by a wall or arch of refractory material, the inner end of which is protected by a water-cooled box of arch form, which can be removed from the furnace through a door in the side wall.—J. W. H.

Digester and extractor; Inclined rotary ——. D. R. Yarnall, Philadelphia, Pa. U.S. Pat. 952,224, March 15, 1910.

A cylinder with domed ends is supported in an inclined position on roller bearings and by a thrust-bearing at the lower end. It is rotated by a pinion wheel which engages with an external toothed ring fixed on the drum. Fluid can be introduced into the cylinder through the hollow thrust bearing, which is provided with a gland and a spraying nozzle projecting into the cylinder. The cylinder is provided with an exhaust pipe which passes through a stuffing-box at the upper end and is turned upwards within the drum and terminates at its highest point. —W. H. C.

Packing-pieces; Tubular cylindrical or prismatic —— for heat-exchanging apparatus or for reaction- or absorption-chambers or the like. O. Niedenführ. Ger. Pat. 216,342, Oct. 18, 1907.

The several tubular packing-pieces are joined to one another by means of rods which fit in or pass through holes or slots in the packing-pieces.—A. S.

Receptacles containing highly inflammable liquids [collodion]; Process and apparatus for protecting ——. Maschinenbau-Ges. Martini und Hüneke. Fr. Pat. 406,528, Aug. 27, 1909. Under Int. Conv., Dec. 28, 1908.

See Eng. Pat. 19,692 of 1909; this J., 1910, 337.—T. F. B.

Compressing air and gases; Process and apparatus for ——. H. A. Humphrey. Fr. Pat. 407,446, May 29, 1909. Under Int. Conv., June 11, 1908.

See Eng. Pat. 12,565 of 1908; this J., 1909, 784.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Flames; Quenching of ——. W. P. Jorissen and N. H. Siewertsz van Reesema. Chem. Weekblad, 1909, 6, 1053–1062. Chem. Zentr., 1910, 1, 989.

As Clowes (this J., 1904, 1155) has already shown, a flame burning in a closed space is quenched more quickly by introduction of carbon dioxide than by introduction of nitrogen. This is due to the greater molecular heat capacity and greater heat-conductivity of carbon dioxide. On allowing carbon monoxide and hydrogen flames to burn in air in a closed space, until they were quenched, the residual atmosphere was found to contain 11·2 and 4—4·4 per cent. of oxygen respectively in the two cases. —A. S.

Petroleum production of the United States. Mining World (Chicago), April 2, 1910. [T.R.]

The U.S. Geological Survey furnishes the following estimate of the production of petroleum in the United States in 1909, by oil fields. The production of 1908 is given also for comparison, all in barrels:—

	1909.	1908.
Appalachian	27,000,000	24,945,517
Lima-Indiana	8,300,000	10,032,305
Illinois	28,200,000	33,685,106
Mid-Continent	43,300,000	48,323,810
Gulf	13,200,000	17,318,330
California and Rocky Mountain States	58,000,000	45,267,411
Total	178,000,000	179,572,479

Patents.

Coking process. L. L. Summers, Assignor to Continuous Process Coke Co., Chicago, Ill. U.S. Pat. 951,786, Mar. 8, 1910.

Carbonaceous material is passed continuously through a retort, heated on one side only to a temperature sufficient to decompose hydrocarbons. Hydrocarbon gases introduced into the cooler parts of the retort, or the gases generated from the carbonaceous material, are caused to pass through the retort towards the source of heat.—A. T. L.

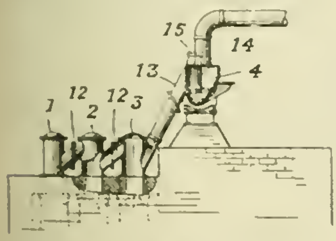
Gas; Retort furnace for the manufacture of ——. H. Bröker, Hamburg. Eng. Pat. 19,419, Aug. 21, 1909.

A retort furnace for gas making is claimed in which the inclined retort is heated by the combustion of producer gas in a number of inclined side flues in its walls. The upper openings of the side flues may be completely closed by means of gridiron slides controlled from the charging side of the furnace. One slide controls the upper flues, and, by the provision of a vertical partition, cut-off slides control the lower flues separately and independently. —J. W. H.

Gas from peat; Method of making ——. P. J. Buckley, Waukesha, Wis. U.S. Pat. 951,799, March 15, 1910.

The peat is placed in a series of independent but contiguous vertical retorts or chambers, and is ignited, air being then blown through the mass for a time until it is incandescent. The air is now cut off and steam is blown through the incandescent peat which is at the same time heated by conduction and radiation from the adjacent retorts, through which air is being blown. The operations are so timed that while some of the retorts are being blown with air, steam is being forced through the others.—W. H. C.

Vertical-retort gas apparatus. J. H. Taussig, Philadelphia, Pa. U.S. Pat. 951,856, March 15, 1910.

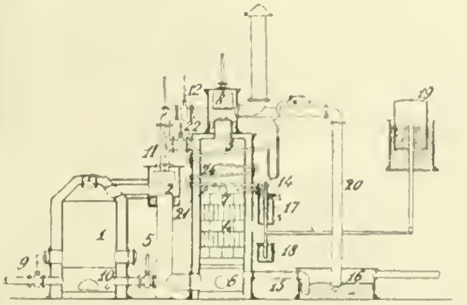


The vertical retorts are arranged in groups, the individual retorts of each group being connected together by straight pipes, 12, so arranged that they can be cleaned through the lids, 1, 2, 3, of the adjacent retort. The last retort of each group is connected to the hydraulic main, 4, by a V-shaped pipe, 13, 14, provided with a lid, 15, for cleaning purposes.—W. H. C.

Gas-producer. M. E. Crowell, Franklin, Ind., Assignor to F. F. Chandler, Indianapolis, Ind. U.S. Pat. 952,237, March 15, 1910.

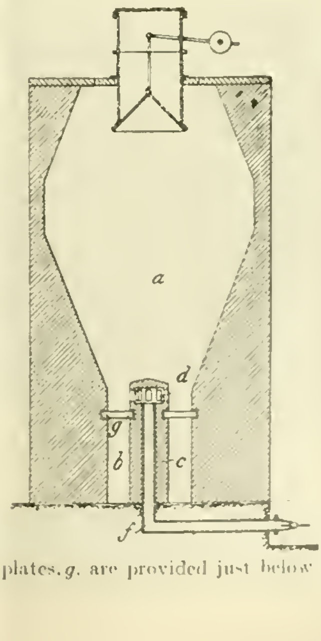
The producer consists of an inclined shell which can be rotated and within which a producer chamber surrounded by a water-jacket is placed. A fixed stirrer-shaft passes axially through the casing, which is also provided with a rotary gas pipe connected by a joint to a stationary gas main.—W. H. C.

Carburetted water-gas; Apparatus for the production of ——. H. Strache. Ger. Pat. 217,205, March 13, 1909.



The apparatus is shown in the accompanying figure. During the blowing period, the three-way valve, 2, is raised, and the valve, 5, is closed, the gases from the producer-chamber, 1, flowing into the lower part of the fixing chamber, 4. A secondary supply of air is blown in at 6 for the combustion of the gases in the fixing chamber, and a tertiary supply at 7 for heating the vaporising chamber, 3. The waste gases yield up their heat to the tubes, 24, and escape through the valve, 8, to the chimney. The valve, 9, is now closed, the valves, 2 and 8, lowered, and steam is blown into the producer-chamber at 10. The water-gas produced flows through the pipe, 11, into the vaporising chamber, 3, the valve, 12, being closed. The oil in the tubes, 24, is vaporised, and the vapours pass through the valve, 14, into the upper part of the fixing chamber. The carburetted water-gas produced passes through the pipe, 15, into the hydraulic main, 16. When the gas-making period is over, and blowing is again commenced, the small quantity of oil left in the tubes, 24, is vaporised, and the vapours pass through a small condenser, 17, the valve, 14, being closed. The condensed oil collects in 18, and any uncondensable oil-gas collects in the small gas-holder, 19, under a pressure greater than that prevailing in the fixing chamber during the gas-making period, so that when gas-making is again begun, the oil-gas flows from the holder into the fixing chamber. The apparatus may also be used for the production of "blue" water-gas, in which case the fixing chamber is used for superheating the steam, and the tubes, 24, may be used as a steam generator.—A. S.

Gas producer without a grate and without movable parts. F. Heller. Ger. Pat. 217,768, Dec. 11, 1907.



The gas producer is of the shape shown in the figure, the producer-chamber, *a*, communicating at its lower narrowest portion with a relatively deep ash-pit, *b*. A wind-box, *c*, provided with tuyères, *d*, projects into the bottom of the producer-chamber, and is connected by the pipe, *f*, with an air or steam blast. It is claimed that with this arrangement, whereby the most intense degree of combustion is produced at the narrowest part of the producer-chamber, clinkering is prevented without the usual mechanical devices. In order to prevent fuel from falling into the ash-pit during the removal of ashes therefrom, movable plates, *g*, are provided just below the tuyères, *d*.—A. S.

Carburetting water-gas and other gases; Process and apparatus for ——. F. Dannert. Ger. Pat. 217,280, April 21. 1909.

Vertical recesses are formed in the walls of a water-gas generator, and in these recesses the distributing devices for the carburetting liquid are arranged. By this method the volatilisation of the carburetting liquid is effected by the heat of the water-gas, and separation of graphite or retort-carbon owing to overheating is prevented.—A. S.

Gas; Apparatus for the the purification of ——. S. B. Chandler, London. Eng. Pat. 214. Jan. 4, 1910.

The invention relates to washer scrubbers in which wheels built up of separated and perforated plates, rotate in closed tanks. The plates of which the wheels are built up are pierced so that ragged edges of metal are produced round the perforations, and the plates are so arranged that the perforations produce zig-zag courses for the passage of the gas.—J. W. H.

Cooling and condensing towers for combustible gases. Berlin-Anhaltische Maschinenbau-Act.-Ges. Ger Pat. 219.214, March 7. 1909.

The patent relates to an improved form of air condenser for lighting gas, producer gas, etc. The cooling chamber is provided with a double wall, the annular space thus formed communicating at the top and bottom with the outer air by means of openings which can be partly or completely closed as required, thus allowing of the regulation of the volume of air passing through the cooling jacket. A pipe is also provided which connects the upper and lower portions of the cooling jacket and is in turn connected to a fan, so that the air can be circulated through the jacket either in the same direction as the gases passing through the inner space, or in the opposite direction. A pipe, open at the top, and connected to the gas-outlet pipe, passes through the bottom of the tower and extends nearly to the top. When the tower is used as a cooling tower only, the gas is passed in at the bottom and out at the top. When, however, after separation of tar, etc., by cooling, it is desired to warm the gas again to prevent separation of naphthalene during the passage of the gas to the naphthalene washer, the gas after passing up through the condenser is led downwards through the pipe mentioned and is thus warmed by the heat of the incoming gas. The pipe is provided at different heights, with valved connections leading to the gas-outlet pipe, so that the gas can be withdrawn after being heated to any desired extent. —A. S.

Petroleum products; Obtaining ——, *and apparatus therefor.* H. Frasch, New York, Assignor to Standard Oil Co., Bayonne. N. J. U. S. Pats. 951,271 and 951,729, Mar. 8, 1910.

(1) The fraction yielding a smoky burning-oil is treated with a liquid which has a different solvent action on the hydrocarbons of high and low carbon content. The two solutions thus obtained, are treated as so to recover the solvent and to give a non-smoking burning-oil and an oil richer in carbon than the original fraction. The solvent is used again. (2). The apparatus comprises a series of mixing vessels provided with stirrers, a series of settling and decanting vessels, and pipo connections between the mixing vessels and the middle portions of corresponding settling and decanting vessels, and between the ends of these vessels and preceding and following mixing vessels. Pumps for the petroleum have their stuffing-boxes at the top of a long vertical sleeve, of such height that the column of liquid in the sleeve balances the pressure exerted by the pump. —A. T. L.

Drying and charring materials, [peat, etc.]; Apparatus for ——. N. K. H. Ekelund, Jönköping, Sweden. U. S. Pat. 951,804, March 15, 1910.

See Fr. Pat. 387,198 of 1908; this J., 1908, 797.—T. F. B.

Gas producers; Recovery of certain by-products obtained in —— *designed principally for recovery of ammonia.* W. J. Crossley and T. Rigby. Fr. Pat. 406,608, Aug. 18, 1909. Under Int. Conv., Aug. 27, 1908.

See Eng. Pat. 17,978 of 1908: this J., 1909, 1026.—T. F. B.

Paraffin wax; Treating or purifying —— *and apparatus therefor.* R. W. Adamson, Glasgow. From Burmah Oil Co., Ltd., and A. Campbell, Rangoon. Burmah. Eng. Pat. 5731, March 10, 1909.

See Fr. Pat. 403,974 of 1909; this J., 1910, 408.—T. F. B.

Apparatus for expelling gas from water containing it [e.g., ammonia from gas liquor]. Ger. Pat. 217,680. *See* VII.

Calorimeter. U. S. Pat. 951,709. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Retorts for use in carbonizing or otherwise treating minerals and the like, particularly adapted for use in the recovery of gaseous, volatile and other products. W. R. Herring, Edinburgh. Eng. Pat. 5362, March 5, 1909.

The retort is of the vertical type, the material being fed in at the top and withdrawn at the bottom. It may be worked in conjunction with a number of others, the whole forming a series which is supplied by means of a horizontal screw conveyor overhead. In the case where a battery of retorts is employed, the material from the conveyor falls into a rectangular hopper and thence into delivery-shoots connected severally with the heads of the retorts, the rate of supply being controlled by means of a rotary toothed wheel arranged at the top of each shoot. In order to obtain a permanent closure of the retort and so prevent the escape of volatile products of distillation or the entrance of air, each shoot is provided near the head of the retort with a rotary valve, and a similar device is arranged near the foot of the retort at the bottom of the discharge tube. This closure device comprises a casing provided with an upper and a lower port and containing a hollow cylindrical valve divided into pockets. On the rotation of this valve, its mouths are presented to the upper and lower ports alternately, the body of the valve cutting off direct communication between the two parts of the shoot. In order to reduce leakage at this point, the casing and body may be correspondingly tapered and a spring introduced, so that, as the moving parts wear away, the valve is forced further into its seating. At the base of the retort, beneath the side faces and above the discharge tube, two horizontal shafts are arranged to rotate in opposite directions. These shafts carry radial arms which extend laterally across the opening, so that complementary arms extending between the two shafts form a support for the central portion of the charge. In this way, the carbonised material is withdrawn at a definite rate and broken up as it falls from the retort, the size of the lumps and the rate of flow being regulated by the position, size and number of arms with which the shafts are provided.—C. A. W.

Incandescent mantles; Manufacture of ——. W. M. Still and A. G. Adamson, London. Eng. Pat. 25,549, Nov. 26, 1908.

The fabric, before impregnation, is suspended in a chamber through which steam is passed so as to remove all air and to open the fibres, or the chamber may first be exhausted, and steam then admitted. The fabric is then impregnated, for example by allowing the solution to flow into the chamber as the steam condenses. The solution is then forced back, and the fabric dried, preferably in a high vacuum, which may be obtained by repeatedly condensing steam in a chamber connected to the chamber in which the fabric is suspended. The alts are now converted into oxides by admitting to the chamber ammonia, or the vapour of pyridine or other organic base, with or without steam, the chamber being first evacuated if steam is not used. The fabric is then washed, dried, cut, and finished in the usual manner. —A. T. L.

Incandescence bodies for gas burners; Manufacture of ——. H. J. Haddan, London. From Bruno-Patente-Verwertungsges. m. b. H., Berlin. Eng. Pat. 12.466, May 26, 1909.

See Fr. Pat. 403,133 of 1909; this J., 1910, 13.—T. F. B.

Electrode for electric arc lights. Gebrüder Siemens und Co. Fr. Pat. 407,151, Sept. 18, 1909. Under Int. Conv., Oct. 5, 1908.

See Eng. Pat. 21,374 of 1909; this J., 1910, 408.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Gas tar; Australian import duty on refined ——. Board of Trade J., April 14, 1910. [T.R.]

A Minister's Order dated 16th February, 1910, provides for the following duty to be levied on "Refined gas tar," as being capable of use as a substitute for Brunswick black, on importation into the Commonwealth, viz.:—

Refined gas tar (a similar substance to "one coat tar")—

Under the British Preferential Tariff	.. per gall.	2s. 0d.
,, General Tariff	.. ..	2s. 6d.

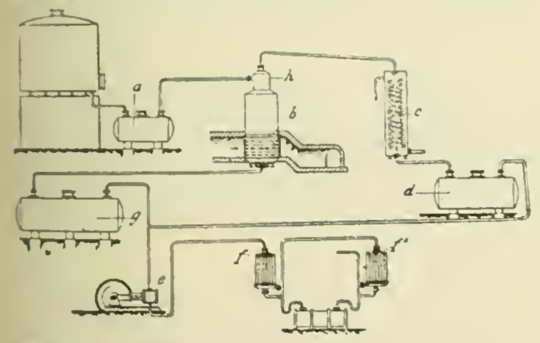
Patents.

Coal-tar; Removing free carbon from ——. C. B. Lowry, Lexington, Ky. and R. Bernhard, Cudahy, Wis. Assignor to S. A. Fletcher, Indianapolis, Ind. U.S. Pat. 951,993, March 15, 1910.

The crude tar is heated by a steam coil in a closed vessel and is forced by pressure through a number of discs of soft wood fixed in openings in the upper part of the vessel. The liquid portion of the tar passes through the pores of the wood and is collected in suitable receptacles, the free carbon remaining on the inner surfaces of the discs, from which it is removed by a rotary scraper.—W. H. C.

Tar; Process for dehydrating and partially distilling ——. Chem. Fabr. Lindenhof C. Weyl und Co. Ger. Pat. 218,780, Sept. 1. 1908. Addition to Ger. Pat. 217,659, May 10, 1908. (See this J., 1910, 410.)

The tar is warmed in the heater, *a*, and is pumped continuously into the dehydrator, *h*, which contains in its lower part a series of tubes, *b*, through which hot furnace gases are passed; the steam generated from the hot tar rises and meets the warm tar coming into *h*, and separates from it some of the water and lower-boiling constituents. The steam, together with some of the lighter distillate, passes through the condenser, *c*, into the receiver, *d*, whilst the dehydrated tar is run off into *g* by aid of the pump, *e*. In order to recover the benzene, the exit gases from the pump are passed through one or more condensers or oil-washers, *f*, *f′*.—T. F. B.



Anthracene and other high-melting products of coal-tar distillation; Process for dehydrating crude ——. E. Wirth. Ger. Pat. 220,214, Jan. 13. 1909.

Crude anthracene, or other tar product of high melting-point which contains water, is heated under pressure to a temperature between 140° and 180° C., so as to melt the product without evaporating the water; under such conditions the water separates from the anthracene, from which it is removed mechanically; the small amount of water remaining in the product may be removed by evaporation.—T. F. B.

Nitrobenzaldehyde sulphides; Process for preparing ——. G. Kränzlein. Ger. Pat. 219,839, Sept. 17, 1908.

Sulphides of *m*-nitrobenzaldehyde are obtained by treating with alkali thiosulphates, halogen derivatives of *m*-nitrobenzaldehyde which contain the halogen in the *o*- or *p*-position to the nitro-group, *e.g.*, 4-chloro-3-nitrobenzaldehyde or 2-chloro-5-nitrobenzaldehyde.—T. F. B.

Indoxyl and its derivatives; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 220,172, Dec. 29. 1908.

Indoxyl and its derivatives are obtained when ethylenedianiline, $C_6H_5.NH.CH_2.CH_2.NH.C_6H_5$, and its derivatives (excepting those which contain a carboxyl group in the *o*-position to the amino group) are heated with mixtures of alkali hydroxides with alkali or alkaline-earth oxides or other inorganic compounds which readily combine with water.—T. F. B.

Anthracene derivatives; Manufacture of —— [Anthrathiazoles]. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11.931, May 20, 1909.

See Ger. Pat. 216,306 of 1908; this J., 1910, 14.—T. F. B.

1.8-Naphthylenediamine-4-sulphonic acid; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 407,602, Oct. 5, 1909. Under Int. Conv., Oct. 28, 1908.

See Eng. Pat. 6831 of 1909; this J., 1909, 1082.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Coloration of clays with aniline colours. Grandjean. *See* VIII.

Colours employed in the manufacture of alimentary products. Gautier and others. *See* XIXa.

Patents.

Carbazole and dyestuffs formed therefrom; Derivatives of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort on the Maine, Germany. Eng. Pat. 9689, April 23. 1909.

If in the process described in Eng. Pat. 2918 of 1909 (this J., 1909, 517) a derivative of carbazole is employed which is substituted in the imino group, such as an alkyl- aryl- or aralkyl-carbazole, new condensation products are formed, similar in character to indophenols. If these new products, or their leuco-compounds, be treated in the usual manner with sulphurising agents, new dyestuffs are obtained dyeing bright blue to greenish blue shades of great fastness to washing, light and bleaching. Example —19·5 kilos. of ethylcarbazole are dissolved in about 195 kilos. of cold concentrated sulphuric acid of 66° B. To the solution is added whilst stirring and cooling well, a solution of 12·3 kilos. of *p*-nitrosophenol in 3—4 times its weight of concentrated sulphuric acid. When the reaction is complete, the mixture is poured on to ice and the separated condensation product is filtered off and well washed. If desired it may be purified by extracting it with hot alcohol, which dissolves the pure products but leaves the impurities undissolved.—P. F. C.

Sulphide colours from carbazole derivatives; Manufacture of ——. R. B. Ransford, London. From L. Cassella und Co., Frankfort on the Maine, Germany. Eng. Pat. 14,143, June 16, 1909.

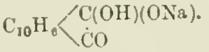
As described in Eng. Pat. 2918 of 1909 (this J., 1909, 517), sulphide dyestuffs are obtained by treating with a polysulphide, the bodies formed from carbazole and *p*-nitrosophenol, its homologues or derivatives. It is now stated that dyestuffs of great fastness to chlorine are obtained if copper or one of its salts is present in the reaction mixture. Example—40 kilos. of the pure condensation product of *p*-nitrosophenol and carbazole are stirred to a paste with a little water: to this are added 144 kilos. of sodium sulphide, 14 kilos. of copper sulphate and 72 kilos. of sulphur. The temperature of the mixture is raised to about 125° C. and the mass is then heated under a reflux condenser for about 18 hours. The melt is diluted with a solution of common salt and the dyestuff is filtered off. It may be purified by dissolving in sodium sulphide solution, filtering and precipitating again by blowing a current of air through the solution. The dyestuff thus formed dyes blue black shades.—P. F. C.

Sulphide dyestuffs [from carbazole]; Process for preparing blue ——. L. Cassella und Co. Ger. Pat. 218,371, Dec. 29, 1908.

WHEN carbazole is condensed with nitrosophenol or its derivatives in presence of sulphuric acid, indophenolic compounds are formed which, when heated with alkali polysulphides, are converted into blue sulphide dyestuffs. The dyeings produced are intense and of good shade, and fast to light and chlorine.—T. F. B.

Dyestuffs containing sulphur; Preparation of vat ——. Kalle und Co. Fr. Pat. 407.224. Sept. 21, 1909. Under Int. Conv., Oct. 28, 1908, Jan. 20, 1909.

WHEN acenaphthenequinone is treated with caustic alkalis it is converted into a compound of the formula,

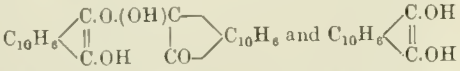


$$C_{10}H_6\left\langle\begin{matrix}C(OH)(ONa).\\ \dot{C}O\end{matrix}\right.$$

which is soluble in water or alcohol. On condensing this with 3-oxy- (1)-thionaphthene or its carboxylic acid, under the action of heat, vat dyestuffs are obtained. —J. C. C.

Acenaphthenequinone; Production of new reduction products of —— and of leuco-compounds of vat dyestuffs. Kalle und Co. Fr. Pat. 407.225, Sept. 21, 1909. Under Int. Conv., Jan. 26 and Feb. 17, 1909.

WHEN acenaphthenequinone is reduced by mild reducing agents in alkaline solution, a product is formed which is sparingly soluble in water and crystallises in yellow prisms melting at 248° C. On further reduction this is converted into a substance which is soluble in water and forms two series of salts. It forms small needles melting at 254° C. These compounds are considered to have the formulæ,



$$C_{10}H_6\left\langle\begin{matrix}C.O.(OH)C— \\ \| \qquad\qquad | \\ C.OH \qquad CO—\end{matrix}\right\rangle C_{10}H_6 \text{ and } C_{10}H_6\left\langle\begin{matrix}C.OH\\ \|\\ C.OH\end{matrix}\right.$$

respectively, and the latter can be condensed with indoxyl or 3-oxy- (1)-thionaphthene or their carboxylic acids, yielding vats from which cotton is dyed in violet and violet red shades respectively.—J. C. C.

Compounds capable of being converted into dyestuffs; Preparation of new ——. Kalle und Co. Fr. Pat. 407.226, Sept. 21, 1909. Under Int. Conv., Feb. 12, 1909.

WHEN isatin is condensed with 3-oxy-(1)-thionaphthene in alcoholic solution, an orange crystalline powder is obtained which when treated with sodium carbonate is converted into a red dyestuff. The colour may be produced on the fibre by printing the condensation product with the addition of British gum, drying, and treating with sodium carbonate. —J. C. C.

Thioindigo dyestuffs; Bromination of ——. Kalle und Co. Fr. Pat. 407,228, Sept. 21, 1909.

DYESTUFFS of the Thioindigo series are readily brominated in sulphuric acid or chlorosulphonic acid solution by means of bromine. According to the amount of bromine employed, mono- to tetrabromo- or even higher substitution products are obtained. The dyestuff produced by brominating Thioindigo Scarlet dyes cotton in fast red shades and that prepared from the condensation product of *a*-isatin chloride and 3-oxy-(1)-thionaphthene gives violet shades on cotton.—J. C. C.

Anthracene vat dyestuffs and the raw materials for their manufacture; Preparation of new ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 407.593, Jan. 4, 1909.

WHEN substituted benzylbenzoic acids are treated with condensing agents (such as sulphuric acid), new anthranols are obtained which on condensation with glycerin yield new benzanthrone derivatives. The condensation may be effected in one operation and the benzanthrones thus produced, when fused with caustic alkalis, furnish dyestuffs which dye cotton from the vat in violet to blue shades.—J. C. C.

Vat dyestuffs of the anthracene series; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 218,162, Feb. 11, 1909.

THE halogen dyestuffs obtained according to the addition to Fr. Pat. 357,239 (this J., 1908, 1055), or the dyestuffs from the mono- or dihalogen derivatives of 2.2′-dimethyl-1·1′-dianthraquinonyl (Eng. Pat. 10,505 of 1906; this J., 1906, 751) or these latter dyestuffs themselves, are halogenated in such a way that at least two more halogen atoms are introduced: the dyestuffs thus produced are redder and brighter in shade than the parent dyestuffs. —T. F. B.

Azo dyestuffs; Process for preparing —— insoluble in oil. K. Merz. Ger. Pat. 219,500, Nov. 23, 1906. Addition to Ger. Pat. 216,698, Sept. 25, 1906. (See Fr. Pat. 382,191; this J., 1908, 219.)

IT is found that azo dyestuffs which contain carboxyl groups in both components, but no sulphonic group, are insoluble in oil. They are obtained, in general, by combining diazotised aminocarboxylic acids with aromatic hydroxycarboxylic acids. Examples are given of dyestuffs from anthranilic acid, nitroanthranilic acid, and aminochlorobenzoylbenzoic acid on the one hand, and various naphtholcarboxylic acids on the other hand. Instead of using carboxylic acids, compounds containing groups easily converted into the carboxyl group may be used, the conversion being carried out after combination has been effected.—T. F. B.

Sulphide dyestuffs; Process for preparing red ——. A. Skita. Ger. Pat. 220,628, March 19, 1908.

BY heating fluorescein with sulphur chloride, or with a solution of sulphur in sulphur chloride, to 160°—190° C., red-violet or violet dyestuffs are obtained, which can be oxidised to red dyestuffs containing chlorine. The oxidation may be carried out on the fibre. Both the intermediate and the final product dye cotton in sodium sulphide solution.—T. F. B.

Derivatives of indigo colouring matters [dehydroindigo]; Manufacture and employment of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 16,377, July 13, 1909.

SEE Fr Pat. 405.538 of 1909; this J., 1910, 413.—T. F. B.

Sulphur dyes; Compound of —— soluble in water. E. Haussmann, Treptow, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 953,008, March 22, 1910.

SEE Ger. Pat. 209.537 of 1908; this J., 1909, 650.—T. F. B.

Nitro-o-hydroxyazo dyestuffs; Process for preparing pure ——. Kalle und Co., A.-G. Fr. Pat. 407,227, Sept. 21, 1909. Under Int. Conv., Jan. 2, 1909.

SEE Eng. Pat. 22,200 of 1909; this J., 1910, 15.—T. F. B.

Vat dyestuffs and process of making them. Farbenfabr vorm. F. Bayer und Co. Fr. Pat. 407,507, Oct. 1, 1909. Under Int. Conv., Oct. 8 and Nov. 17, 1908, and March 19, 1909.

See Eng. Pat. 7819 of 1909; this J., 1910, 81.—T. F. B.

Disazo dyestuffs; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 407,632, May 14, 1909. Under Int. Conv., July 2, 1908.

See Eng. Pat. 12,371 of 1909; this J., 1909, 1190.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose; Hydrolysis of —— by hydrofluoric acid. J. Ville and W. Mestrezat. Comptes rend., 1910, 150, 783—784.

The action of hydrofluoric acid on cellulose has been studied at the temperature of the boiling water bath in a lead apparatus similar to that used by Hugounenq and Morel (this J., 1909, 215, 902). Hydrofluoric acid of 40—50 per cent. concentration causes the formation of as much as 41 grms. of dextrose per 100 grms. of cellulose, but the acid subsequently decomposes the dextrose formed. It is hoped by acting on cellulose in turn with concentrated and dilute acid to increase the yield of dextrose and avoid decomposition. Dilute hydrofluoric acid has only very slight action on cellulose.—E. F. A.

Patents.

Mixing, grinding, bleaching and like purposes; Vessels for ——. [*Beating engines.*] Maschinenbau Akt.-Ges. Golzern-Grimma, Saxony. Eng. Pat. 24,903, Oct. 29, 1909. Under Int. Conv., July 27, 1909.

The width of the cross-section of the circulation part of a beating engine or hollander is reduced from the top to the bottom to prevent the settlement of material.—J. W. H.

Wood pulp; Processes for making articles out of moulded ——. M. D. Porter, Lewiston, N.Y., U.S.A. Eng. Pat. 8325, April 6, 1909. Addition to Eng. Pat. 8184, April 5, 1909 (this J., 1910, 416).

Wood pulp, with or without a small proportion of long, tough fibres, is mixed with water, and a filling material such as china clay or a mixture of this with talc, is added. To the mass is then added a principal binding material, which is waterproof when dried, such as aluminium resinate, also a supplementary binding material such as albumin or gelatin. The mixture is then moulded into shape and dehydrated by heat.—J. F. B.

Paper pulp; "Save-all" or apparatus for recovery of ——. S. Milne, Edinburgh. Eng. Pat. 5231, March 4, 1909.

The apparatus consists of a vat in which is mounted a rotatable open-ended drum composed of gratings bolted together and covered with wire cloth. The drum has no central axis or arms, but each end of the drum is formed to act as a bearing in contact with the sides of the vat. The water containing the fibres or other materials to be recovered is introduced into the space between the drum and the walls of the vat, and is strained and runs away free from fibres through the open ends of the drum as it rotates. A sheet, consisting of the solid matters previously suspended in the water, is formed on the surface of the wire drum and is removed therefrom by a jet of air, steam or water directed upwards through the wire from the inside of the rotating drum. The joints between the periphery of the drum and the sides of the vat, serving as the bearings on which the drum rotates, are closed by adjustable flexible metal straps which also support the drum.—J. F. B.

Paper, glass and other materials; Process of applying metal and collodion to ——. J. and B. Galay, Moscow. Eng. Pat. 19,772, Aug. 28, 1909.

Paper, glass or other materials are coated with a mixture of collodion and powdered metal by applying the fluid mixture to the surface of the material in a closed chamber or discharging it from a closed vessel through a slot. The coated material is then passed through a trough, in which a stream of water flows in an opposite direction to the travel of the coated material. The water absorbs the solvent of the collodion and fixes the film, the solvent being recovered by distillation. The thickness of the film may be varied at will, either by rolling it under water whilst the collodion is still plastic, or else by conducting the material from the coating vessel to the water trough at a suitable angle of inclination, so that the excess of the coating mixture flows back to the vessel.
—J. F. B.

Emulsions suitable for sizing paper; Process for the preparation of ——. A. Mitscherlich. Ger. Pat. 220,066, Dec. 16, 1908.

By the process described in Fr. Pat. 356,269 of 1905 (this J., 1905, 1320), it was not possible to obtain a homogeneous liquid, unless only relatively small quantities of sulphite-cellulose waste lye were added to the mixed animal and rosin size. It has now been found that if sulphite-cellulose waste lye, which has been treated with a quantity of sodium sulphate equivalent to the calcium salts present, be well stirred with the mixed animal and rosin size, in presence of sodium carbonate at 30°—60° C., a stable emulsion is formed which can be used for sizing paper in the usual manner. Viscous substances may also be added to improve the stability of the emulsion.—A. S.

Plastic material [celluloid substitute]. A. Chanard, St. Claude, France. Eng. Pat. 28,598, Dec. 7, 1909. Under Int. Conv., Dec. 11, 1908.

The plastic material is prepared by treating amylaceous substances with acetic acid and adding the product to a mixture of gelatin dissolved in water and resin dissolved in alcohol. The whole is then treated with formaldehyde. For instance, 100 kilos. of crushed haricot beans are immersed for 8 days in a 2 per cent. solution of acetic acid. The mass is then drained, pounded, and passed through a sieve. This paste is now added to a mixture consisting of 5 kilos. of gelatin dissolved in 20 litres of hot water and 20 kilos. of rosin dissolved in 10 litres of turpentine. A small quantity of a suitable antiseptic may also be added. The product obtained is cast into moulds while still hot, and after about 8 days the moulded shapes or objects are immersed in a 10 per cent. solution of formaldehyde for from 30 minutes to 2 hours. Colouring matters, etc., may be added to the starchy mass. The plastic material obtained is non-inflammable and may be used as a substitute for celluloid, ebonite, etc.—W. P. S.

Yarn-dressing machine. P. Turlur, Wattrelos, France. U.S. Pat. 951,858, March 15, 1910.

See Eng. Pat. 18,508 of 1906; this J., 1907, 196.—T. F. B.

Fibrous material impermeable to water; Manufacture of a ——. A. O. Tate. Fr. Pat. 406,782, Sept. 4, 1909.

See U.S. Pat. 933,861 of 1909; this J., 1909, 1085.—T. F. B.

Ligneous matter, resinous matter, and free cellulose; Process for treating a mixture of ——. W. J. Hough. Fr. Pat. 406,514, Aug. 27, 1909. Under Int. Conv., May 3, 1909.

See U.S. Pat. 931,608 of 1909; this J., 1909, 1148.—T. F. B.

Celluloid-like material; Manufacture of a non-inflammable —— capable of becoming plastic in heat, and suitable for making dies, moulds, and the like. H. B. Manissadjian, Basle, Switzerland. Eng. Pat. 27,201, Dec. 15, 1908.

See Fr. Pat. 397,429 of 1908; this J., 1909, 812.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing; The electrical theory of ——. W. W. Haldane Gee and W. Harrison. Trans. Faraday Soc. [Advance proof.]

The basis of the electrical theory of dyeing is that any two substances placed in contact are oppositely electrified. In tinctorial processes one substance is a non-conducting solid and the other a liquid, and there is no direct method of determining the potential differences. The methods employed in the deduction of the differences in potential between a liquid and a porous diaphragm are mentioned, and their suitability for the investigation of dyeing phenomena is discussed. The electrical charges of a number of substances, in contact with water, were determined by the U-tube method of Hardy or by the aid of the ultramicroscope, and the results show that, in a colloidal condition or in the form of a fine suspension, substances which are basic in character (basic dyestuffs, aluminium and magnesium hydroxides, etc.) are positively charged, whilst negative charges are carried by substances of acid character (acid dyestuffs, silica, tannic acid, etc), and such substances as rubber latex, soap, sulphur, paraffin wax, beeswax, starch, etc., etc. The average value of the potential difference with cotton and water is found to be 0·06 volt; with silk and water 0·22 volt, and with wool and water 0·91 volt. The views of Pelet-Jolivet and Wild, and Knecht and Batey, that dyestuffs are electrolytes, and that ionisation is increased by dilution and rise of temperature are supported. Wool and silk becoming negatively charged in contact with water, it is natural that basic dyestuffs (which carry a positive charge) should be capable of dyeing them from neutral solutions, but that when, by the addition of acid, the electrical condition of the fibre is changed (becoming positive), the affinity for these dyestuffs is diminished and that the power of fixing the predominant negative ions of acid dyestuffs is increased. In the general conclusions, it is stated that although the electrical theory explains why one type of colouring matter is selected by the fibre in preference to another, the method of fixation is still a matter of doubt. A table is given, showing the laws of contact electricity, colloidal coagulation, dyeing, and capillary ascension in absorbent materials, and some effects of temperature.
—F. M.

Patents.

Preparing cotton and other sliver, for dyeing, bleaching, and similarly treating the same, and apparatus therefor. D. Scholefield, Stockport, and J. Downham, Bury. Eng. Pat. 18,649, Aug. 13, 1909.

A wooden rod with a movable flange at its lower end is placed in the "coiler can" at the carding engine and the sliver, as it is made, enters the can and is coiled round the rod and made to rest upon the flange. When the can is full, the rod with the sliver coiled round it is transferred to a hand-press and the pins which secure the flange are removed. A perforated tube is then placed over the free end of the rod and in a line with it, the upper end of this tube being also provided with a pinned flange. The press handle is tightened and pushes the rod out of the press, substituting the perforated tube for it. When the sliver is sufficiently compressed, both the flanges are tightened on the tube so as to keep the sliver in position during subsequent operations.—P. F. C.

Alizarin; Process for preparing dye-baths or concentrated, water-soluble preparations of —— for dyeing. Chem. Fabr. Grünau, Landshoff und Meyer A.-G. Ger. Pat. 219,757, March 22, 1907.

Alizarin, purpurin, or isopurpurin is dissolved in solutions of alkali carbonate containing only sufficient alkali to form the monoalkali salt, alkali salts of weak inorganic or organic acids (*e.g.*, sodium formate) are added to the solution in quantity approximately equivalent to the alkali carbonate, and the whole is evaporated to dryness. In this manner, preparations containing upwards of 70 per cent. of alizarin, and easily soluble in water, may be obtained. Their solutions dye mordanted cotton in shades somewhat bluer than those produced by dyeing with alizarin in the usual way.—T. F. B.

Brown shades in dyeing and printing; Process for producing fast ——. H. Schmid. Ger. Pat. 218,474, March 2, 1909.

Various shades of brown can be produced on textiles by oxidation on the fibre of a mixture, in suitable proportions, of perfectly neutral salts of *p*-phenylenediamine or its homologues or derivatives with aromatic aminohydroxy compounds; oxidation is performed by means of chlorate and a vanadium salt. White or coloured reserves may be produced on these dyeings or printings by printing the dried material with a reserve paste containing a sulphite, hydrosulphite, or formaldehyde-sulphoxylate, and after a short steaming, treating with tannin mordant-dyestuffs or with lake colours fixed by albumin.—T. F. B.

Dyeing of skeins; The continuous ——. J. and L. Regordosa, Barcelona, Spain. Eng. Pat. 9307, April 20, 1909.

See Fr. Pat. 401,988 of 1909; this J., 1909, 1247.—T.F.B.

Printing or dyeing on fibrous material, with or without white or coloured discharge effects. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,190, April 29, 1909.

See Addition of May 1, 1909, to Fr. Pat. 357,472 of 1905; this J., 1910, 19.—T. F. B.

Vegetable fibres; Production of colours on ——. J. Y. Johnson, London. From Badische Anilin und Soda, Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 18,701, Aug. 13, 1909.

See Fr. Pat. 406,145 of 1909; this J., 1910, 419.—T. F. B.

Coating and drying paper, cloth, or other material; Coating and drying apparatus for ——. G. H. May, New York, and W. M. Grosvenor, Grantwood, N.J., U.S.A. Eng. Pat. 10,795, May 6, 1909.

See Fr. Pat. 403,520 of 1909; this J., 1910, 84.—T. F. B.

Drying textile yarns, fabrics, and other materials; Apparatus for ——. P. Turlur, Wattrelos, France. U.S. Pat. 951,859, March 15, 1910.

See Fr. Pat. 378,247 of 1907; this J., 1907, 1136.—T.F.B.

Fabrics; Process for preserving the lustre and finish on goffered ——. F. A. Bernhardt. Fr. Pat. 406,533, Aug. 27, 1909. Under Int. Conv., July 17, 1909.

See Eng. Pat. 20,728 of 1909; this J., 1909, 1246.—T.F.B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Fuming sulphuric acid; Formula for preparing —— of desired composition. J. Prats. Chem.-Zeit., 1910, **34**, 264—265.

The author refers to Gnehm's formula and points out that it entails the use of certain tables, which are not always to hand. He devises the following method of calculation, which is independent of such tables. Let a be the required weight of fuming sulphuric acid containing h per cent. of free sulphur trioxide, let x be the weight of the available fuming acid containing k per cent. of free sulphur trioxide, and y the weight of ordinary acid containing s per cent. of sulphuric acid (H_2SO_4). 80 and 18 being the molecular weights of sulphur trioxide and water respectively, it follows that

$$x=a\frac{9h+40(100-s)}{9k+40(100-s)}, \text{ and } y=a-x.$$

Since ordinary concentrated sulphuric acid contains 95·6 per cent. of sulphuric acid (H_2SO_4), 100 — s = 4·4, and if this value be approximated to 4·5, the equations become: $x=a\frac{h+20}{k+20}$, and $y=a\frac{k-h}{k+20}$, which are accurate enough for all practical purposes.—O. R.

Ammonia; Preparation of —— from nitrogen and hydrogen. F. Haber. Z. Elektrochem., 1910, **16**, 241—246.

At 200 atmospheres pressure, and in presence of suitable contact substances, nitrogen and hydrogen combine to form ammonia in sufficient quantity for practical exploitation of the process. The reaction is very incomplete and it is necessary to remove the ammonia as it is formed, which can be achieved by a system of circulation of the gases at high pressure. The ammonia is condensed, and can be removed either as gas or as anhydrous liquid; the uncombined gases continue to circulate throughout the high-pressure system. In a small experimental apparatus, 90 grms. of liquid ammonia were produced per hour at 185 atmospheres pressure. Osmium is the most active contact material for this purpose, and as a fine powder and at 175 atmospheres pressure and a temperature of 550° C., yields of 8 volumes per cent. of ammonia can easily be obtained from the mixed gases. As the amount of available osmium is very small, another more easily obtainable catalyst was sought for, and was found in the shape of uranium, containing a certain amount of carbide, or carbon, as obtained by reduction of the oxide with carbon in the electric arc. In the gaseous mixture at high pressure this is transformed into a very fine powder, with absorption of nitrogen, and this powder exerts a powerful catalytic action on the gaseous mixture at a temperature below 500° C. The power necessary for compression and circulation of the reacting gases is very small. The efficiency of the heat exchange appears to be of subordinate economical importance, and the industrial exploitation of the process may soon be hoped for.—E. F.

Ammonia; Methods for testing commercial, anhydrous, liquid ——. W. D. Richardson. J. Ind. Eng. Chem., 1910, **2**, 97—99.

Engineers of refrigerating plant being largely in agreement as to the quality of certain brands of liquid ammonia, samples of different makes were tested to ascertain whether their reputed characters for efficiency were borne out by their actual state of purity. The samples investigated are referred to by the letters A, B, C, D, and E, and the reputed efficiency of the different brands was in the order given, A being the best and E the worst. The tests included (*a*) the residue after evaporation, (*b*) the non-basic gases dissolved in the ammonia, (*c*) the non-condensing gases lying in the drum above the ammonia. The test for residue after evaporation gave, from 500 c.c. of the liquid ammonia: "A" 0·05 c.c.; "B" 0·05 c.c.; "C" 0·05 c.c.; "D" 0·075 c.c.; "E" 0·10 c.c. These residues all consisted of dark oily-looking matter containing some iron oxide. The amount of non-basic gases dissolved in the ammonia was determined by neutralising standard sulphuric acid with the ammonia, and determining the volume of gas evolved; the results obtained by this method calculated in c.c. of gas per grm. of ammonia were as follows: "A" 0·148 and 0·128; "B" 0·124, 0·129 and 0·107; "C" 0·166 and 0·156; "D" 0·163 and 0·139; "E" 0·293, 0·328 and 0·313. As to the non-condensing gases lying above the ammonia, similarly determined, "A" showed 0·6, 0·3 and 0·6 c.c. per grm. of ammonia; "B" 1·0 and 1·1; "C" 4·4, 3·8, 3·3, and 2·4; "D" 27·6 and 21·3; "E" 307·0 c.c. and 330 c.c. In order to get an idea of the direct loss to the buyer of these non-condensing gases, the gas lying above the ammonia in a drum was drawn off, and the ammonia absorbed in tubs of cold water until the whole of the issuing gas was absorbed; the loss per drum was then ascertained. Under this test "A" showed no measurable loss; "B" showed a loss of ¼ lb. to the drum; "C" 1¼ lb.; "D" 4½ lb.; and "E" 3 lb. per drum. Hence the reputation in which these brands are held from experience by engineers has its exact parallel in the results of the above investigation. As specifications for anhydrous ammonia, the author concludes that the total residue by the method described ought not to exceed 0·1 c.c. per grm. of ammonia; the non-condensing gases dissolved ought not to be more than 0·12 c.c. per grm. of ammonia; the non-condensing gases lying above the liquid ought not to be greater than 0·6 c.c. per grm. of ammonia; and the whole drum, tested on a scale as described, should not show any appreciable loss.—R. C. P.

Ammonia; Compounds of —— with water. A. Smits and S. Postma. Koninkl. Akad. van Wetensch. Amsterdam, Wisk. en Natk. Afd., 1909, **18**, 94—97. Chem. Zentr., 1910, **1**, 1217.

A determination of the melting point curve of mixtures of ammonia and water showed that two compounds are formed containing ammonia and water in the proportions of 1:1 and 2:1 mols. respectively. The two compounds, NH_4OH and $(NH_4)_2O$, melt at about —77° C. and —78° C. respectively.—A. S.

Borax; Technical preparation of ——. I. M. G. Levi and S. Castellani. Gaz. chim. ital., 1910, **40**, I., 138—176.

The present paper deals with: (1), the crystallisation of borax, and (2), the reaction between boric acid and sodium chloride.

Crystallisation of borax. Experiments were made with solutions prepared with sodium carbonate and caustic soda respectively and boric acid. The solutions were evaporated at about 85° C., in a current of air free from carbon dioxide. Whilst from solutions of sodium carbonate and boric acid in different proportions, borax was alone formed, with caustic soda and boric acid, it was possible, with suitable proportions, to obtain also crystals of sodium metaborate. Crystals of borax were obtained most readily and in highest yield from solutions containing a slight excess of alkali, preferably sodium carbonate. With a large excess of alkali, especially if caustic soda, or with excess of boric acid, "gelatinous" (viscous) solutions were obtained on evaporation from which crystals could be separated only with difficulty.

Reaction between sodium chloride and boric acid.—Mixtures of sodium chloride and boric acid were heated in a current of air, in a current of nitrogen, and in a current of steam. It was found that boric acid and sodium chloride do not interact below about 140° C., and at the latter temperature only with extreme slowness. Above 140° C. the velocity of the reaction, both in the air and in the presence of superheated steam increases to a maximum at about 200° C.; the yield of sodium borate amounts to about 15 per cent. and is not sensibly increased by rise of temperature up to 400°—500° C. At a bright red heat the reaction proceeds with considerable velocity, but becomes complete only at about 1000° C. At the latter temperature the presence of superheated steam increases the reaction-velocity about tenfold. Boric anhydride also reacts readily with sodium chloride at about 1000° C., some free chloride being produced in the reaction. Anhydrous borax may be fused without undergoing alteration, but in presence of steam, it loses a considerable quantity of boric acid. The possibility of the technical application of the reaction to the manufacture of borax is discussed, and also the probable nature of the reaction. It is suggested that at the high temperature free chlorine is liberated by the action of boric anhydride on the sodium chloride, and that hydrochloric acid may be produced, at least in part, by the interaction of this chlorine and steam.—A. S.

Barium and calcium; Sulphates and hydrogen-sulphates of ——. P. Rohland. Z. anorg. Chem., 1910, **66**, 206—208.

When barium sulphate or calcium sulphate is dissolved in hot concentrated sulphuric acid and the solution is cooled, deliquescent crystals of the corresponding acid salt,

$BaH_2(SO_4)_2$, or $CaH_2(SO_4)_2$, are deposited, and the mother liquor, which contains the same substance in colloidal solution, coagulates after a few hours, when separated from the crystals, giving a yellowish gelatinous form of the salt: both forms are decomposed by water, yielding sulphuric acid and the crystalline normal sulphate. The colloidal solution of calcium hydrogen sulphate may also be coagulated by adding a few drops of calcium sulphate solution. Barium hydrogen sulphate combines with a small proportion of water, giving a hard mass of the composition, $BaH_2(SO_4)_2$. $2H_2O$.—F. SODN.

saturated vapour; the volumes occupied by 1 kilo. of the liquid and of the saturated vapour, and the volumes occupied by the liquid and the saturated vapour in a cylinder for different charging densities at temperatures below the critical point. Experiments with commercial carbon dioxide containing variable proportions of air showed that the presence of 1 per cent. of the latter has the effect of increasing the pressure in the cylinder by about 4 per cent. In the following table are given figures by the aid of which cylinders for the safe storage and transportation of compressed carbon dioxide may be designed.

Maximum temperature to which cylinder may be exposed.

Maximum stress of metal of which cylinder is made, in lb. per sq. in.	100° F. (37·8° C.)	105° F. (40·5° C.)	110° F. (43·3° C.)	115° F. (46·1° C.)	120° F. (48·9° C.)	125° F. (51·7° C.)	130° F. (54·4° C.)	135° F. (57·2° C.)	140° F. (60° C.)	145° F. (62·8° C.)	150° F. (65·5° C.)	155° F. (68·3° C.)
	Ratio of the thickness (t) of the wall to the diameter (d) of the cylinder, or $\frac{t}{d}$											
15,000	0·0398	0·0426	0·0452	0·0476	0·0499	0·0521	0·0542	0·0562	0·0581	0·0599	0·0616	0·0633
16,000	0·0375	0·0401	0·0425	0·0449	0·0470	0·0491	0·0511	0·0530	0·0547	0·0564	0·0581	0·0597
17,000	0·0353	0·0378	0·0401	0·0423	0·0443	0·0463	0·0482	0·0500	0·0515	0·0532	0·0548	0·0563
18,000	0·0334	0·0357	0·0379	0·0400	0·0419	0·0438	0·0455	0·0472	0·0487	0·0503	0·0518	0·0533
19,000	0·0316	0·0338	0·0359	0·0378	0·0397	0·0415	0·0432	0·0448	0·0462	0·0477	0·0492	0·0506
20,000	0·0300	0·0321	0·0341	0·0359	0·0377	0·0394	0·0410	0·0425	0·0439	0·0454	0·0468	0·0481
21,000	0·0286	0·0306	0·0325	0·0342	0·0359	0·0375	0·0391	0·0406	0·0419	0·0433	0·0446	0·0459
22,000	0·0273	0·0292	0·0310	0·0327	0·0344	0·0358	0·0374	0·0388	0·0401	0·0414	0·0427	0·0439
23,000	0·0261	0·0279	0·0297	0·0313	0·0329	0·0344	0·0359	0·0372	0·0385	0·0397	0·0409	0·0421
24,000	0·0251	0·0268	0·0285	0·0300	0·0316	0·0330	0·0344	0·0357	0·0370	0·0381	0·0393	0·0405
25,000	0·0241	0·0258	0·0274	0·0289	0·0303	0·0317	0·0331	0·0344	0·0356	0·0367	0·0379	0·0390
26,000	0·0232	0·0248	0·0264	0·0278	0·0292	0·0306	0·0319	0·0331	0·0343	0·0354	0·0365	0·0376
27,000	0·0223	0·0239	0·0254	0·0268	0·0282	0·0295	0·0307	0·0320	0·0331	0·0342	0·0353	0·0363
28,000	0·0215	0·0231	0·0245	0·0259	0·0272	0·0285	0·0297	0·0309	0·0320	0·0331	0·0341	0·0351
29,000	0·0208	0·0223	0·0237	0·0250	0·0263	0·0275	0·0287	0·0299	0·0309	0·0320	0·0330	0·0340
30 000	0·0202	0·0216	0·0229	0·0242	0·0254	0·0266	0·0278	0·0289	0·0299	0·0310	0·0320	0·0329
	Charging density, or weight of carbon dioxide per litre of capacity of cylinder.											
	0·65	0·64	0·63	0·62	0·61	0·60	0·59	0·58	0·57	0·56	0·55	0·54

—A. S.

Ferric acetates and the acetic acid reaction with ferric chloride; also basic precipitation [of ferric acetate solutions]. R. F. Weinland and E. Gussmann. Z. anorg. Chem., 1910, **66**, 157—168.

SOLUTIONS of ferric hydroxide in acetic acid contain salts of a hexa-acetatotriferri-base, and the red coloration produced by adding ferric chloride to the solution of an alkali acetate is due to the formation of the mono-acetate of this base, according to the equation,

$$3FeCl_3+9CH_3.COONa+2H_2O=$$
$$[Fe_3(CH_3.COO)_6(OH)_2]CH_3COO+2CH_3.COOH+9NaCl.$$

The presence of the base may be demonstrated by adding a solution of sodium chloroplatinate, when the orange-red crystalline chloroplatinate is at once precipitated. All attempts to prepare normal ferric acetate, $Fe(CH_3.COO)_3$, have given acetates of the triferri-base, which functions usually as a mono-acid base. The precipitate obtained by boiling a solution of ferric acetate agrees in composition with the formula, $Fe_3(CH_3.COO)(OH)_8O$, and the deep red colour developed before precipitation commences is considered due to the formation of compounds intermediate between this substance and the mono-acetate.—F. SODN.

Carbon dioxide; Physical properties of —— and conditions of its economic storage for transportation. R. T. Stewart. Trans. Amer. Soc. Mech. Eng., 1909, 30, 1111—1168.

THE author states that in the report (1896) to the British Houses of Parliament of the Committee on Compressed Gas Cylinders, the chief table on p. 19 gives wholly unreliable data for carbon dioxide above 86° F. (30° C.). From the experimental results of Amagat (Comptes rend., 1892, **114**, 1093, 1322; J. de phys., 1892, 288; Ann. chim. phys., 1893, **29**), the author has calculated the vapour pressure of carbon dioxide at temperatures between 0° and 31·35° C., in atmospheres and in kilos. per sq. cm.; the densities of liquid carbon dioxide and of the

Thorium; Determination of —— in monazite sand. R. J. Meyer and M. Speter. Chem.-Zeit., 1910, **34**, 306—308.

THE authors have found that iodic acid is the best reagent to use for the separation of thorium from the solution of the mineral. The process is as follows: 50 grms. of the sample are heated with 100 c.c. of concentrated sulphuric acid for six hours at 250° C. in a large iron basin, and, after cooling, half a litre of cold water is added, and the mixture allowed to stand with repeated stirring until the sulphates have dissolved. The liquid is then filtered into a litre flask and made up to the mark. Of the solution so obtained, 100 c.c., representing 5 grms. of the sample, are mixed with 50 c.c. of nitric acid of sp. gr. 1·4 and cooled. Then a solution of 15 grms. of potassium iodate in 50 c.c. of concentrated nitric acid and 30 c.c. of water is added, and the mixture cooled again. A white flocculent precipitate of thorium iodate is formed, which settles quickly and is repeatedly stirred during half an hour and then filtered off. The beaker is washed out with a solution of 2 grms. of potassium iodate in 50 c.c. of dilute nitric acid and 200 c.c. of water. The precipitate is now washed back into the same beaker with more of the washing liquid, stirred up with 100 c.c. of the same, and again collected on the same filter. After draining, the precipitate is washed into the beaker with hot water, raised to boiling, and 30 c.c. of concentrated nitric acid stirred in, which dissolves the iodate. The reprecipitation of the iodate is brought about by adding a solution of 4 grms. of potassium iodate in a little hot water and dilute nitric acid, and filtration and washing are carried out as before. The thorium iodate is now free from cerium, and is washed from the filter, reduced by sulphurous acid in hydrochloric acid solution, precipitated with ammonia, and the precipitate washed free from iodine. The hydroxide is dissolved in dilute hydrochloric acid, the solution is precipitated with excess of oxalic acid, filtered, and the precipitate washed with acidified water, burned with the filter-paper, and weighed as oxide. The results of four estimations made on the same solution of the mineral agreed within 0·04 per cent. The process is rapid, since after the solution of the mineral has been prepared, the iodic acid separation can be performed in one day.—J. H. J.

Arsenic; Colloidal solution of ——. Lecoq. Comptes rend., 1910, **150**, 700—702. (See also this J., 1907, 1198.)

A COLLOIDAL solution of arsenic free from impurities is obtained by the electrolysis of an alkaline solution of arsenious anhydride (3 grms. of arsenious anhydride and 3 grms. of sodium hydroxide per litre). A strip of platinum (4—5 sq. cm.) is used as anode, and a layer of mercury covering the flat bottom (18—20 cm. diameter) of a crystallising pan serves as cathode. A current of 2—3 ampères and 100 volts is required. The solution must be cooled. A small quantity of arsenious anhydride always remains unreduced but is completely removed by prolonged dialysis. A small addition of gum or glycerin to the electrolyte greatly increases the stability of the resulting solution: colloidal solutions (containing 0·0008 grm. of arsenic and 0·005 grm. of gum per c.c.) made neutral by strong acids and freed from arsenious anhydride by dialysis, were found to be free from deposit after 6 months. A colloidal solution, thus prepared, has a deep brownish red colour and shows very small uniform granules with the ultramicroscope. Neutral or acid solutions are stable; alkaline solutions are rapidly oxidised by air and immediately by hydrogen peroxide, arsenites being formed. *N*/10 iodine oxidises it at once, forming an arsenate: this reaction is quantitative. On heating with a large excess of hydrochloric acid the arsenic is rapidly and totally precipitated; any arsenious anhydride present can be detected in the filtrate. A much less stable colloidal solution (showing larger and irregular granules with the ultra-microscope) is obtained by electrolysing an alkaline liquid with an anode of arsenic and a cathode of iron or platinum.—A. SELD.

Carbon monosulphide. Sir J. Dewar and H. O. Jones. Proc. Roy. Soc., 1910, **A 83**, 408—413.

THIOPHOSGENE reacts rapidly with nickel-carbonyl at the ordinary temperature to produce a brown solid and a large volume of carbon monoxide. The solid was found to consist of nickel chloride, which was readily extracted by water, and a brown solid containing carbon and sulphur. The reaction takes place between the two liquids or their vapours alone, or when mixed with dry ether, petroleum ether, carbon tetrachloride, or chloroform, and even when the two substances have been dried by contact with phosphorus pentoxide. Quantitative experiments support the view that the reaction takes place according to the equation:—

$$x\mathrm{Ni(CO)}_4 + x\mathrm{CSCl}_2 = x\mathrm{NiCl}_2 + 4x\mathrm{CO} + (\mathrm{CS})x$$

to produce a polymeric form of carbon monosulphide. Carbon monosulphide is a brown powder, which in some cases closely resembles some forms of carbon. The finely divided substance has a specific gravity about 1·6; after compression into a solid block it gave the value 1·83. In this condition it is a non-conductor of electricity. It is practically insoluble in alcohol, ether, benzene, and petroleum ether; it is slightly soluble in carbon bisulphide, ethylene dibromide, nitrobenzene, naphthalene and phenol, giving deep reddish brown solutions. It is not affected by dilute sulphuric acid; but with the concentrated acid it forms a brownish purple solution, the colour of which is only slowly destroyed at the boiling point of the acid, when carbon dioxide and sulphur dioxide are evolved. It is also dissolved by concentrated nitric acid; and in an aqueous or alcoholic solution of ammonia, ammonium sulphide, caustic potash, potassium sulphide, or potassium hydrosulphide, from which it is precipitated by acids in an apparently unchanged condition.—R. C. P.

Titrations with borax in presence of glycerin. Tanajew and Zuckermann. *See* XXIII.

Industries of the Ural mountains. Menget. *See* X.

Detecting nitric acid in presence of compounds of bromine, iodine, and ammonia. Goldschmidt. *See* XXIII.

PATENTS.

Sulphuric acid; Process for the manufacture of —— *with the help of towers.* Chem. Fabr. Griesheim-Elektron. Fr. Pat. 406,641, Aug. 30, 1909. Under Int. Conv., Sept. 21, 1908.

THE process is divided into two distinct stages which take place consecutively in separate towers or series of towers; these stages are: (1) the oxidation of sulphurous acid to sulphuric acid, and (2) the regeneration of the oxidising agent (nitric acid) employed. For the realisation of the process, it is important, (1) that the sulphurous acid be brought into immediate contact with an excess of nitric acid, so that oxidation is almost instantaneous, (2) that the regenerative apparatus be of such dimensions as to ensure the gas being retained for at least 4 minutes, and (3) that the absorbing liquid in the regenerating towers be made to present as large a surface as possible and be kept at a low temperature (not above 30° C.), especially in the last 40–50 per cent. of the region of absorption. The process may be carried out by passing gases containing sulphurous acid, which may have been cooled in a Glover tower, through a series of towers in which they are treated with nitric acid at 30° or 35° B., the acid being circulated until oxidation is complete: the sulphuric acid at 50°—54° B., thus obtained, contains about 1 per cent. of nitric acid and is denitrated and concentrated in the Glover tower or in special apparatus. The gases containing nitric oxide then pass to the regenerating towers, where the absorbing liquid for the first 20 per cent. of the space is nitric acid or a mixture of this acid and sulphuric acid at 25°—30° B., which is thus concentrated for use in the oxidation towers; in the next 30 per cent. of the tower space the gases meet acid at 10°—25° B., and, in the last 50 per cent., nitric acid of 0–13 per cent. strength is used. About 15 per cent. of the total tower space is concerned in the oxidation of sulphurous acid and 85 per cent. is used for regeneration, but the latter space may be reduced by about 50 per cent., if sulphuric acid, of at least 59° B., be used for absorbing the last traces of oxides of nitrogen. Advantages offered by the process are (1) the intensified production, 100—140 kilos. of acid, at 50—54° B., per cb.m., as compared with 5—7 kilos. of similar acid obtainable with lead chambers, and (2) the fact that sulphur dioxide of any or varying concentration may be employed. If a mixture of nitric and sulphuric acids at 56°—58° B. be used in the oxidation towers, sulphuric acid at 58° B. may be prepared.
—F. SODN.

Support for contact material platinised only at the surface; Process for the preparation of a ——. M. Neumann. Ger. Pat. 218,725, May 2, 1908.

THE porous supporting material is first subjected to a treatment whereby an insoluble precipitate is formed in its pores. For example, it may be treated first with potassium silicate and then with hydrofluosilicic acid, or first with barium chloride and then with sulphuric acid. It is then washed, dried, and platinised by heating and spraying with a platinum solution containing a reducing agent, after which, it is washed with water or with acids in which the precipitate is insoluble. By this method less platinum is used than by the process described in Ger. Pat. 188,503 (this J., 1908, 502).—A. S.

Nitric acid; Continuous process for the manufacture of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 406,969, Sept. 13, 1909. Under Int. Conv., Nov. 28, 1908.

A MIXTURE of sulphuric acid and sodium or other nitrate is made to pass through a succession of distillation vessels which communicate with each other and are preferably heated separately, the material being stirred or agitated by mechanical means to ensure thorough mixing and facilitate distillation. The stirring is especially important in the first vessel, and, by regulating the temperature, each vessel may be made to give a distillate of almost constant composition. For example, a system of five vessels communicating by siphons may be employed, and a warm mixture of 100 kilos. of sodium nitrate (96 per cent.) and 120 kilos. of sulphuric acid (94 per cent.) admitted, the temperatures of the vessels being maintained at 110°—120°, 150°—170°, 220°—250°, 260°—280°, and 280°—300° C. respectively. The first vessel then furnishes about 60 per cent. of the total nitric acid, of 96—97 per cent. strength; the second vessel gives an acid of 88—90 per cent., the third, acid of about 60 per cent., the fourth, acid of about 15 per cent., and the last, acid of about 2—5 per cent. strength. The rate of flow of the material is adjusted, so that the exhausted residue leaving the last retort is commercially pure bisulphate.—F. SODN.

Tartaric acid ; Manufacture of ——. J. B. Lawes and Co., Ltd., London, and W. A. Davis, Bromley, Kent. Eng. Pat. 11,694, May 18, 1909.

To avoid losses in the manufacture of tartaric acid from argols, tartars, etc., the process is carried out in the following manner. Chalk, slaked lime, or milk of lime is mixed with a solution containing 27 to 35 per cent. of anhydrous calcium chloride and the tartar, etc., is then stirred in. The chloride is used in excess, and the chalk or lime should be in slight excess when the reaction is complete. The precipitate is allowed to settle, and the liquor, which contains dissolved and suspended tartrates, is used repeatedly with further quantities of chalk and raw material until it contains too much potassium chloride or impurities. The liquor is then diluted, preferably with the washings of the tartrate precipitates, and finally used with fresh raw material in the proportion containing the quantity of chloride necessary fo the reaction. The tartrate precipitates are decomposed with sulphuric acid and worked up in the usual manner.—A. T. L.

Sulphur dioxide ; Process for obtaining ——, and sulphur burners therefor. C. B. Clark, Bangor, Me. U.S. Pats. 952,098, 952,099, and 952,100, Mar. 15, 1910.

(1). HOT air is admitted into a chamber, in which sulphur has been burnt, in order to effect the combustion of any vaporised sulphur, and the gases are kept at a temperature of about 1100° C., so as to decompose any sulphur trioxide that may have been formed. (2), (3). A sulphur-burning furnace comprises a preliminary combustion chamber, and a second combustion chamber, into which the products of the first chamber are directed. Means are provided for the admission of hot and cold air, and for the regulation of the furnace temperature.—O. R.

Caustic soda ; Manufacture of anhydrous ——. Chem. Fabr. Griesheim-Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 29,491, Dec. 16, 1909. Under Int. Conv., Dec. 23, 1908.

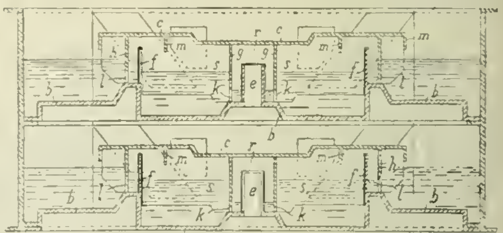
FOR the manufacture of anhydrous sodium hydroxide, the ordinary lye of commerce is concentrated to a point at which there is abundant precipitation of pure anhydrous crystals, and then a more dilute melt is added, in order to lower the solidification point of the remaining lye, which contains all the impurities; finally, when the temperature has fallen below 200° C., the crystals are separated. The following example is given:—A lye at 50° B., containing about 35 grms. of foreign salts per litre, is evaporated until it contains about 90 per cent. of sodium hydroxide, and the melt is allowed to stiffen, whilst stirring, to a thick pulp, the temperature being lowered to 210°—220° C.; then, while the mass is further cooled and stirred, it is mixed gradually with one-sixth of its weight of a melt at a temperature of 120°—130° C. and containing 70—73 per cent. of sodium hydroxide, the solidification point of which is about 100° C., and the crystals are separated from the mother liquor at about 170° C. As much as 80 per cent. of the 90 per cent. melt may be thus obtained as crystals containing 99 per cent. of sodium hydroxide.—F. SODN.

Ammonia ; Process for the production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 406,943, Sept. 11, 1909. Under Int. Conv., Oct. 12, 1908 and July 30, 1909.

A MIXTURE of nitrogen and hydrogen, generally in the proportion of 1 to 3 by volume, and maintained at a constant high pressure, is submitted, alternately, to the action of a heated catalyst (as a rule at 400°—800° C.), and to conditions bringing about the elimination from the mixture of the ammonia produced, the gas eliminated being continually replaced by more of the mixture of nitrogen and hydrogen. The process may be carried out as follows:—The catalyst, *e.g.* finely divided iron, is contained in a metal tube, which at one end communicates with a heat regenerator, and at the other receives the gases; these pass over the heated catalyst and through the regenerator, and then the cooled gas traverses either an absorption apparatus or a refrigerator in which the ammonia is condensed; the gas is finally made to return, by means of a pump, along the outside of the regenerating tubes and catalyser, to re-enter the latter and be circulated afresh, the supply of gas being replenished, as required, through a side tube. The apparatus is encased in heat-insulating material and is enclosed in an envelope, to enable the circulation to be effected under pressure. If the conditions favour the production of a gas relatively rich in ammonia, the regenerator may be omitted, and, in this case too, refrigeration is preferable to absorption, the necessary cold being obtained by the evaporation of previously liquefied ammonia.—F. SODN.

Gas from water containing it [ammonia from gas liquor] ; Apparatus for expelling —— by means of steam. F. L. Dill. Ger. Pat. 217,680, March 30, 1909.

Two chambers of the apparatus are shown in the figure. The walls, *g*, *h*, of the removable bells, *c*, divide each chamber into a number of compartments through which the gas-liquor flows in succession. The steam entering through the opening, *e*, passes through the liquor in the space, *r*, and through the openings, *k*, in the walls, *g*, throwing the liquor in *s*, in the form of spray, against the upper wall of the bell, *c*. The projections, *m*, prevent the spray from passing over the partitions, *f*. A similar effect is produced by the vapours passing through the openings, *l*, in the walls, *h*. By the arrangements shown, especially the form of the floors, *b*, of the chambers, the liquor remains for a sufficiently long time in intimate contact with the steam, and vigorous motion of the liquor is produced.—A. S.



Copper sulphate ; Manufacture of ——. H. E. Dolphin, Chester. Eng. Pat. 8555, April 8, 1909.

THE copper to be treated (granulated, turnings, or the like) is placed in a covered dissolving cistern or agitator, above which is slung a pipe fitted with a device for spraying sulphuric acid over the metal, and, at the same time steam or heated air is injected from below through perforated lead pipes. The copper becomes quickly heated and oxidised, and, after 15—30 minutes, water or mother liquor is pumped into the vessel until the metal is completely immersed. A saturated solution of copper sulphate is thus obtained, and, while in a state of effervescence, this is run into a settling tank below, through a pipe in the bottom of the cistern, which has a plug and seating, protected by a perforated sleeve to prevent choking; the mud is thus run off along with the liquor, and the copper is left clean and ready for renewed treatment without washing. After settling, the clear liquor is allowed to gravitate through a floating draw-off pipe (so that the mud is undisturbed) into another tank, where it is again heated to the boiling point by means of a steam coil, and from which it passes by an overflow to the crystallising vats. The settling tank is flushed out periodically into a mud filter, where the slimes are retained for subsequent treatment if containing gold and silver. The mother liquor is finally pumped back to the dissolving cistern. This cistern may be of any desired shape, but is made much shallower than the lofty towers usually employed; consequently the copper is oxidised more effectively, since the whole bulk is acted upon simultaneously.—F. Sodn.

Calcium carbide. E. Jeanneret and C. Chapoy, Yverdon, Switzerland. Eng. Pat. 1315, Jan. 18, 1910. Under Int. Conv., Jan. 22, 1909.

The invention relates to the manufacture of prepared calcium carbide blocks containing, in addition to a mineral oil and a binding medium which is solid both at ordinary temperatures and at the temperature reached during the generation of acetylene, at least one substance, such as gypsum, hydraulic lime, cement, etc., which hardens in contact with water and dries rapidly, and at least one salt that is soluble in water, such as calcium chloride or ferric sulphate. The soluble salt facilitates the action of the water on the carbide and prevents the lime sludge from adhering to the block, and the cement checks the liberation of gas when the flow of water ceases and also agglomerates the residue and prevents the formation of a sticky pulp. The substances selected must be such as do not lead to frothing and do not attack the metal parts of the apparatus; their properties also should be unaffected by the heat of the reaction. The carbide block is rendered waterproof by a coating of a fatty body or mineral oil or a solution of a hydrocarbon of high boiling point in a mineral oil, to which a drying substance is added. The process may be carried out, for example, by warming an intimate mixture of granular calcium carbide, petroleum, and sulphur, together with a quick-setting cement and ferric sulphate, until the mass becomes pasty, then compressing the material in moulds, and, when cold, coating the blocks with a solution of asphaltum in a mineral oil, mixed with oil of turpentine.—F. Sodn.

Barium chloride and carbonate; Process of manufacture of ——. A. Caffin. First Addition, dated Aug. 30, 1909, to Fr. Pat. 393,880, Sept. 2, 1908 (this J., 1909, 139).

A mixture of carbon and iron oxide, instead of iron filings, is proposed for the reduction of barium sulphate, the mixture being heated to a red heat in vertical retorts, fitted at the bottom with an air supply which can be regulated, and at the top with a pipe for the escape of carbon dioxide which is collected; suitable proportions are, barium sulphate, 1000 parts, iron oxide, 900 parts, and carbon, 300 parts. The iron oxide is reduced by carbon monoxide, and the nascent iron reduces the barium sulphate to sulphide, being itself reconverted into oxide. The calcined mass is lixiviated with cold water and the solution of barium sulphide separated, in a filter-press, from the iron oxide, which is used again. Other salts of barium may then be prepared from the filtrate, the carbonate, for instance, being precipitated by passing carbon dioxide through the boiling solution.—F. Sodn.

Alumina from bauxite; Process of extracting ——. A Simon and L. Penot. Fr. Pat. 406,590, Dec. 10, 1908, and First Addtion thereto, dated Jan. 23, 1909.

Bauxite is charged into a central retort which may be heated to about 1100° C. and communicates on either side with a pair of lateral retorts; the flues are so arranged that the main retort may be heated alone or in conjunction with either pair of lateral retorts by manipulating appropriate dampers. One retort of each pair, A or C, may be closed by a damper and contains a hydrocarbon, such as petroleum, and, of the other two, one, B, contains a saturated solution of aluminium chloride and the other, D, water. The central retort is first heated alone, to eliminate water from the bauxite, and then the heat is allowed to reach retorts, A and B, A however, remaining closed; the aluminium chloride in B is thus decomposed, aluminium hydroxide being precipitated and hydrochloric acid liberated; the hydrochloric acid passes to the main retort where it causes the ferric oxide to assume a crystalline and refractory form, and the damper of retort A is then opened, so that hydrocarbon vapours may mix with the acid gas; the alumina and silica in the bauxite are thus decomposed and volatilised as chlorides, but the ferric oxide is not attacked; the chlorides pass into retort D where the aluminium chloride is dissolved and that of silicon is decomposed, with the precipitation of silica and liberation of hydrochloric acid. The bauxite, when exhausted, is replaced by a fresh charge, the pure alumina is withdrawn from B, and the silica is removed from D, leaving a saturated solution of aluminium chloride therein; the process is then repeated, retorts C and D being heated, and B acting as receiver. Alumina is thus continuously produced and hydrochloric acid regenerated as required. The addition differs from the principal patent in that the central retort is heated at a much lower temperature (400° C.) and the preliminary treatment with hydrochloric acid alone is omitted. Under these conditions, it is the iron oxide and silica which are converted into chlorides and volatilised, and pure alumina remains as a residue in the retort. The hydrochloric acid is mostly recovered, as before, by decomposing the silicon chloride by water in the lateral retorts.—F. Sodn.

Alkaline-earth silicides; Process for the manufacture of ——. E. Merck. Ger. Pat. 217,551, May 13, 1909. Addition to Ger. Pat. 215,609, Feb., 25, 1909.

According to the chief patent (this J., 1910, 25), alkaline-earth silicides were prepared by a method analogous to the thermite process, a charge consisting of a mixture of silicon with the oxide and peroxide of the alkaline-earth metal being used. According to the present patent, ferrosilicon is used in place of silicon.—A.S.

Calcium citrate from crude citrate; Process for preparing pure ——. A. Buss. Ger. Pat. 219,002, Jan. 21, 1909.

Crude calcium citrate is treated with rather more than the calculated quantity of 3 to 6 per cent. hydrochloric acid solution, whereby the impurities are for the most part separated; in order to obtain more concentrated solutions of citric acid, further quantities of the crude citrate and 10 to 15 per cent. hydrochloric acid may be added. The clear solution, which may be decolorised if necessary, is precipitated by addition of alkalis or alkaline-earths or their salts, when pure calcium citrate is produced.—T. F. B.

Hydrogen peroxide; Process for producing ——. P. M. Justice, London. From Consortium für Elektrochem. Ind., Ges.m.b.H., Nuremburg, Germany. Eng. Pat. 22,019, Sept. 27, 1909.

The process for producing hydrogen peroxide by the distillation of a solution of persulphuric acid, claimed in Eng. Pat. 24,507 of 1905 (this J., 1906, 379), is modified by the addition of a small quantity of hydrochloric acid to the electrolyte during the production of the persulphuric acid, so that a concentrated solution may be obtained. Concentrated solutions of persulphuric acid and hydrogen peroxide, in good yield, are secured by adding less than 0·3 per cent. of hydrochloric acid per hour.—F. Sodn.

Hydrogen peroxide; Process for obtaining ——. Konsortium für elektrochem. Ind. Ges.m.b.H. Ger. Pats. 217,538 and 217,539, Aug. 10 and July 16, 1905.

(1). In the preparation of hydrogen peroxide by the transformation of persulphuric acid produced by the electrolysis of sulphuric acid, the platinum (or other metal of the platinum group) which dissolves at the anode, is separated from the solution by a separate electrolysis, by suspending an auxiliary cathode in the anode compartment during the main electrolysis, or by means of a rod of aluminium immersed in the solution. (2). Hydrogen peroxide is separated from solutions containing sulphuric acid, persulphuric acid, or Caro's acid by distillation *in vacuo*. The residue after suitable dilution can be again electrolysed for the production of a further quantity of persulphuric acid, yielding hydrogen peroxide on distillation *in vacuo*.—A. S.

Sodium peroxide or peroxide-hydrate; Process for the production of solid ——. Farbenfabr. vorm. F. Beyer und Co. Ger. Pat. 219,790, Oct. 7, 1908.

Crystallised hydrated sodium peroxide, $Na_2O_2,8H_2O$, is obtained in almost quantitative yield by mixing hydrogen peroxide solution with excess of caustic soda, and cooling. —A. S.

Oxygen baths; Process for the preparation of ——. Firm Max Elb, Ges.m.b.H., Dresden, Germany. Eng. Pat. 125, Jan. 3, 1910. Under Int. Conv., Jan. 20, 1909.

Oxygen baths are prepared by bringing an oxygen-carrier into contact with hæmoglobin in the water for the bath, this being effected directly, or one or both constituents may be enclosed in suitable envelopes. The hæmoglobin, which acts as a catalyst, imparts a slight yellowish tinge to the bath.—F. Sodn.

Nitrogen; Process of oxidising atmospheric ——. H. Howard, Boston, Mass. U.S. Pat. 952,248, Mar. 15, 1910.

A mixture of nitrogen and oxygen is compressed, subjected to the action of electrical discharges, and the highly heated, oxidised product, is then at once allowed to expand, the rapid cooling thereby produced serving to minimise subsequent dissociation of the reaction product.—O. R.

Oxides of nitrogen from mixtures of nitrogen and oxygen; Process for the preparation of —— *using a combustible producing considerable quantities of water.* O. Bender. Ger. Pat. 217,550, Nov. 4, 1908.

In the preparation of oxides of nitrogen from mixtures of nitrogen and oxygen by combustion, it is necessary, in order to obtain good yields, not only to cool the reaction products quickly, but also to remove water vapour from them. In the present patent claim is made for the use of devices, for example, inclined gutters, to prevent the condensed water from returning to the reaction chamber. —A. S.

Carbon having a high absorptive power; Process of producing ——. R. Goldstein. Fr. Pat. 406,905, Sept. 10, 1909. Under Int. Conv., Aug. 6, 1909.

The process consists in submitting a mixture of finely divided coal or wood and argillaceous earth, preferably rich in clay, to destructive distillation, at as low a temperature as possible (600°—800° C.). Lignite is specially suitable as the carbonaceous ingredient, and it may be mixed with about an equal weight of the earth. The product possesses great absorptive power and, on account of its small cost, may be used on an extensive scale; for example, in the sterilisation of water-supplies.—F. Sodn.

Nitrogen from the air; Process for the preparation of — by means of copper. Cyanid-Ges. m. b. H. Ger. Pat. 218,671, Nov. 25, 1908.

In the preparation of nitrogen by passing air over heated, finely-divided, metallic copper, and subsequently reducing the copper oxide to metallic copper for use again, claim is made for the employment of a double retort composed of two concentric tubes, through which air and reducing gases are passed alternately. In this way the heat of the reaction is utilised, and after the process has been once started, it can be continued without further application of heat.—A. S.

Cyanogen; Process for preparing ——. R. Schall, Karl Prinz zu Löwenstein, F. Hauff, and F. Freiherr von Gemmingen. Ger. Pat. 220,354, Oct. 27, 1908.

Gases containing 40 grms. of cyanogen or more per cubic metre may be obtained by the action of nitrogen or inert gases containing nitrogen, on carbon in the form of wood charcoal, charcoal dust, or soot, at a high temperature, preferably that of the electric arc. Graphitic carbon is only very slowly acted on under these conditions.—T. F. B.

Compounds containing silicon and nitrogen; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 15,641, July 5, 1909.

See Fr. Pat. 405,712 of 1909; this J., 1910, 424.—T. F. B.

Sodium peroxide; Manufacture of ——. D. E. Parker, Niagara Falls, U.S.A. Eng. Pat. 23,188, Oct. 11, 1909.

See U.S. Pat. 935,542 of 1909; this J., 1909, 1126.—T. F. B.

Ammonium sulphate from gases; Process of obtaining ——. N. Caro, Berlin. Assignor to Gewerkschaft der Steinkohlenzeche Mont Cenis, Sodingen, Germany. U.S. Pat. 952,560, March 22, 1910.

See Fr. Pat. 403,050 of 1909; this J., 1909, 1308.—T. F. B.

Hydrogen; Process for preparing ——. Consortium für Elektrochem. Industrie. Fr. Pat. 406,930, Sept. 11, 1909. Under Int. Conv., Nov. 9, 1908.

See Eng. Pat. 21,032 of 1909; this J., 1909, 1314.—T. F. B.

Borates containing active oxygen; Process for making ——. Chemische Werke vorm. Dr. H. Byk. Fr. Pat. 406,974, Sept. 13, 1909.

See Eng. Pat. 19,755 of 1909; this J., 1910, 424.—T. F. B.

VIII.—GLASS; CERAMICS.

Glass; Solubility of metallic sulphides in ——. E. Grieshammer. Sprechsaal, 1910, **43**, 153—156, 165—167.

Molten glass eagerly takes up foreign substances, and advantage is taken of this in the manufacture of stained glass. Gold and copper ruby-glass are prepared by the addition of those metals, but the sulphur in the fuel is apt to disturb the desired effects. The author accordingly experimented on the colours obtained by the introduction of sulphur and metallic sulphides into four glasses of different composition. These were—(*a*) fused borax, (*b*) phosphate glass containing 8 per cent. of alumina, 15 of soda, and 77 of phosphoric anhydride, (*c*) flint glass of the composition, lead oxide 36, potash 13, soda 2, and silica 49 per cent., (*d*) crown glass of the composition, soda 12, potash 12, lime 9, silica 67 per cent. The following results were obtained, but the actual amounts added are not given. Sulphur in glass is easily reduced to sulphide, sometimes escaping as sulphuretted hydrogen if water of combination be present. Melted borax takes it up quickly, giving colours from light yellow to dark red. Phosphate glass at first remains unaltered, but in greater quantities sulphur reduces it in the same manner as carbon does. Flint glass, also, is not easily decomposed by sulphur, but crown glass gives alkali sulphide colours from yellow to reddish-brown. The best molecular ratio of base to acid in glass is 1 : 2·5 for the production of sulphur colours. The alkali sulphides yield similar effects to those afforded by sulphur. Calcium sulphide, when present to the extent of from 10—20 per cent. in crown glass, gives a golden colour which diminishes with decreasing content till it is imperceptible at 1 per cent. of sulphide. With borax, barium and calcium sulphides give a dirty grey. The metals of the true earths, alumina, ceria, didymia, etc., have such little affinity for sulphur that their sulphides are not stable in molten glass. Ferrous sulphide in small quantities gives a greenish yellow,

which becomes black in greater concentration. The author states that it has a staining power second only to cobalt oxide. In larger quantities, it is liable to crystallise out, leaving a dirty green glass. With phosphate, it is oxidised to a red-brown. Manganese sulphide usually contains oxide, which is apt to spoil the purple effect. Zinc sulphide gives white and gold opaque glass, often with crystalline effects. With 5—6 per cent. of arsenic oxide it gives golden red colours. In lead glasses, however, black lead sulphide is formed. Cadmium sulphide gives an intense yellow, but a reducing atmosphere must be maintained at the surface of the glass. Phosphate oxidises cadmium sulphide. Cadmium sulphide when it crystallises in glass, exhibits the phenomenon of dichroism. Lead sulphide gives black colorations. All these effects are dependent on the composition of the glass and of the fire-gases, and also on the temperature of burning.
—H. H. S.

Zirconia ; Refractory vessels from ——. R. Bayer. Z. angew. Chem., 1910, **23**, 485—488. (See also this J., 1908, 449 ; 1910, 150.)

Crucibles were moulded from a plastic mass made by kneading together zirconium hydroxide (obtained as a jelly by pressing the precipitated hydroxide in a filter-press) and zirconium dioxide or native zirconia purified by treatment with hydrochloric acid. A little starch paste was also added to assist in keeping the crucible firm whilst drying. The crucibles were dried in the air for two days, heated to 50° C., then to 100° C., and finally gradually heated to 2000°—2300° C. in a Hempel electric resistance furnace. The crucibles were fairly strong, very resistant to chemical action, and extremely indifferent to sudden changes of temperature; the blowpipe flame could be directed against the cold crucible and the glowing crucible could be plunged into water. Zirconia is stated to be the only suitable insulating substance for electric currents at temperatures of about 2000° C. The author also reviews the methods of purifying native zirconia. The average percentage composition of the Brazilian mineral is stated to be—Zirconium dioxide, 88·7 ; silica, 7·4 ; ferric oxide, 4·1 ; titanium dioxide, 0·6 per cent. Treatment with hydrochloric acid removes about 5 per cent. of impurities, the ferric oxide being reduced to 1·86 per cent., and the product is then sufficiently pure for many purposes. To purify it further, it is recommended to fuse the treated product with four times its weight of barium carbonate. Small quantities are ignited in a platinum crucible for about an hour to 1400° C., larger quantities in a graphite crucible in a wind furnace, care being taken that the crucible is not attacked. The melt is extracted with hydrochloric acid, evaporated to dryness, the residue taken up with dilute hydrochloric acid, and the silica filtered off. The liquid is then allowed to crystallise ; the first crystals which contain nearly all the barium chloride are rejected. The next crop is dissolved in a large quantity of water and the zirconium precipitated as hydroxide by heating with ammonia. After washing by decantation the voluminous precipitate is pressed in a filter-press to a jelly, which contains 7·7 to 8·38 per cent. of zirconium dioxide, with 0·19 to 0·25 of silica, and 0·01 per cent. of ferric oxide.—A. Sbld.

Leadless glazes. H. Eisenlohr. Sprechsaal, 1910, **43**, 151—153.

Seger suggested (Collected Writings on Pottery, 453—470, 593—645) that the use of lead in glazes should be avoided as much as possible, and that it should be introduced as a non-poisonous silicate when its presence is indispensable. Leadless glazes, however, compare unfavourably in appearance with those containing lead ; they are also more viscous and have a tendency to craze. The author starts with a glaze of the general formula,

$$R_2O,0{\cdot}55Al_2O_3,3{\cdot}28SiO_2,1{\cdot}14B_2O_3,$$

and finds that, with single bases, the melting point is lowest when R_2O is Na_2O, then follow K_2O, BaO, CaO, and MgO, in the order named. In this he differs from Seger, who found that melting points increased in the order, BaO, K_2O, Na_2O, CaO, MgO—working, presumably, with a glaze of another formula. The author then replaced R_2O by mixtures of bases, fired them at cone 09 on various bodies and found that the best results were obtained when R_2O was composed of—BaO 0·05, CaO 0·25, MgO 0·25, K_2O 0·225, Na_2O 0·225. The low firing temperature of cone 09 was chosen to compensate for the alleged fact that the raw materials of a leadless glaze are more expensive than those of glazes containing lead. The bodies used were all biscuited at cone 9, and had the following compositions :—Stoneware, (a) clay-substance, 50 ; quartz, 45 ; felspar 5 per cent.; (b) clay-substance, 45 ; quartz, 48 ; whiting, 7 per cent. ; (c) clay, 42 ; quartz, 48 ; felspar, 10 per cent.: (d) clay, 50 ; quartz, 30 ; felspar, 20 ; Seger porcelain, clay 25, quartz 45, felspar 30 per cent. The tendency to craze in a glaze can often be overcome by grinding the body more finely. If leadless glazes be fired in an open kiln containing lead ware, there is a tendency to devitrification.—H. H. S.

Coloration of clays with aniline colours. F. Grandjean. Bull. Soc. franç. Minéral., 1909, **32**, 408—419. Chem. Zentr., 1910, **1**, 1063—1064.

Clay is coloured intensely by most aniline colouring matters, and the colour is not removed by solvents. In the presence of mixtures of two colours, clay does not always behave the same. With mixtures of Methyl Green and Safranine or Methyl Green and Gentian Violet, both colours are absorbed ; but with Methylene Blue and Safranine or Methylene Blue and Methyl Green, only the blue colour is absorbed. Moreover with clay coloured by Safranine or Methyl Green, the colour can be entirely displaced by Methylene Blue. In all these experiments, solutions of the colours in 20 per cent. alcohol were used. All clays possess this absorptive power, but in different degrees, the true amorphous clays (termierite, allophan) being the most, and crystalline clays, the least active ; sedimentary clays occupy an intermediate position in this respect. In nature clays come in contact with different mineral solutions, which they are able to absorb ; sometimes certain ions are absorbed selectively, *e.g.*, manganese oxide from potassium permanganate, iron hydroxide from bicarbonate of iron. Natural clays must therefore be regarded as aluminium silicates which have absorbed different foreign substances in different proportions, and hence cannot have any fixed composition. Thus only distinctly crystalline kaolins have a composition approaching $Al_2O_3,2SiO_2,2H_2O$, whilst the finer and especially the colloidal clays differ widely in composition.—A. S.

PATENTS.

Glass ; Method and apparatus for manufacturing sheet ——. J. Player, River Forest, Ill. U.S. Pat. 952,354, Mar. 15, 1910.

A sheet is drawn upwards from a mass of molten glass, and turned approximately horizontal on to a suitable carrier, the frictional contact between the sheet and the moving carrier serving to continue the drawing operation. The sheet is weighted by the superposition of a suitable material, such as finely divided plumbago.—O. R.

Plate-glass ; Manufacture of ——. F. L. O. Wadsworth, Morgantown, W. Va., Assignor to Pressed Prism Plate Glass Co., New York. U.S. Pat. 952,390, Mar. 15, 1910.

The entire free surface of a freshly formed, still plastic, glass plate, is subjected to uniform, momentary pressure, care being taken that as little heat as possible be lost by the glass in the process of pressing.—O. R.

Brick, tile, or other articles ; Apparatus for baking, glazing, or enamelling ——. L. Houze, Monterey, Cal., Assignor to R. H. Willey, Monterey, Cal., and W. J. Piatt, Berkeley, Cal. U.S. Pat. 952,196, Mar. 15, 1910.

The apparatus comprises a conveyor having a continuous longitudinal motion, and a furnace chamber, having a flat floor extending over the conveyor, and adapted to transmit and radiate heat to the latter from the furnace chamber. A warming chamber extends over part of the conveyor in advance of the furnace chamber, with which it communicates, the products of combustion passing from the furnace through the warming chamber. The furnace and warming chambers are wholly above the conveyor, the latter extending beyond the warming chamber to form a receiving portion, and beyond the furnace chamber to form a cooling and delivery portion.—O. R.

Ceramic wares ; Method of producing conductive layers on ——. S. Heller, Teplitz, Austria-Hungary. U.S. Pat. 952,901, March 22, 1910.

See Eng. Pat. 11,633 of 1909 ; this J., 1910, 26.—T. F. B.

Porcelain vessels ; Process for making double-walled ——. H. Kucht. Fr. Pat. 407,282, Sept. 23, 1909. Under Int. Conv., Nov. 27, 1908.

See Eng. Pat. 22,571 of 1909 ; this J., 1910, 426.—T. F. B.

IX.—BUILDING MATERIALS.

Portland cement paint as a protection to structural steel. Giesecke. *See* X.

Patents.

Wood ; Art of colouring ——. L. S. Gardner, Otts Mills, La., Assignor to Gardner Wood Co., Corbin, La. U.S. Pat. 952,245, Mar. 15, 1910.

A portion of the fibres of standing, live timber, is severed, or an incision is made in a tree, and a solution of colouring matter is injected or otherwise inserted, whereby it is absorbed and uniformly distributed throughout the wood by the natural process of circulation of the sap.—O. R.

Abrasive and refractory products resulting from electric furnace processes : Treatment of ——. A. C. Higgins and G. N. Jeppson. Fr. Pat. 406,661, Aug. 31, 1909. Under Int. Conv., April 23, 1909.

See U.S. Pat. 944,436 of 1909 ; this J., 1910, 153.—T. F. B.

Cement ; Process and apparatus for making vitrified ——. Pine Street Patents Co. Fr. Pat. 406,504, Aug. 26, 1909. Under Int. Conv. Sept. 14, 1908.

See U.S. Pat. 934,056 of 1909 ; this J., 1909, 1089.—T. F. B.

Portland cement ; Process for making ——. Blanc Stainless Cement Co. Fr. Pat. 406,554, Aug. 28, 1909.

See U.S. Pat. 932,374 of 1909 ; this J., 1909, 1038.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Combustion temperature of carbon and its relation to blast-furnace operations. C. P. Linville. Trans. Amer. Inst. Min. Eng., 1910, 237—248.

The difficulties of maintaining the hearths of blast-furnaces at the necessary constant temperature, are dealt with at some length, and the author considers that "scaffolds," "slips," etc., are largely due to raising or depressing the zone of fusion by alterations in the heat conditions. As the ore, flux and fuel may be kept practically uniform by selection, the chief cause of trouble is the blast, the variations in the moisture of the air largely affecting the combustion temperature. Roughly speaking, each grain of moisture per cb. ft. of air lowers the combustion temperature about 25° F., and if the moisture remains constant, an increase of the blast temperature of 100° F. will increase the combustion temperature 85° F., so that the cooling effect of each grain of moisture per cb. ft. of air, is neutralised by increasing the temperature of the blast about 30° F. A diagram is given showing the increase of blast temperature necessary to neutralise the effect of any amount of moisture up to 20 grains per cb. ft. for all temperatures up to 1600° F. A series of actual and theoretical curves are given illustrating 72 hours of the run of a 300-ton blast furnace, showing the relation between combustion temperature and furnace working.—F. R.

Cast-iron ; Specific and latent heats of molten ——. W. Schmidt. Metallurgie, 1910, **7**, 164—168.

500 grms. of Swedish white cast-iron, containing 4·37 per cent. of carbon, and solidifying at 1130° C., were melted and poured into a crucible lined with magnesite, in which was a quartz tube and thermo-junction, and standing in a specially designed ice calorimeter. The cast-iron was allowed to cool to 0° C., which took from 18 to 20 hours, and the water collected. Corrections were made for temperature, and for the calorimeter, and experiments were carried out from initial temperatures of 1375° C., 1275° C., 1175° C., and 1130° C., the last of which gave the heat of cooling in the solid state only. From the data thus obtained it was found that the specific heat of molten cast-iron between 1375° C. and 1275° C. was 0·3216, and between 1275° C. and 1175° C. it was 0·3136, while the latent heat of solidification was 59 calories. This latter figure is nearly double that given by Gruner, viz., 34 calories.—A. H. C.

Iron ; Electrolytic deposition of ——. A. Pfaff. Z. Elektrochem., 1910, **16**, 217—223.

The author finds that the most favourable conditions for the electrolytic deposition of iron are : an electrolyte containing ferrous sulphate of at least 2-N concentration, containing free sulphuric acid at about 0·01 N concentration ; a temperature of 70° C. ; a current strength at the cathode of 2 amps. per sq. dcm. ; the removal of hydrogen bubbles at the cathode by blowing in air. Under these conditions a very smooth and uniform deposit of iron is obtained, quite free from holes, and in parts of an almost mirror-like surface. If the air-current is replaced by a current of hydrogen, and the electrolyte covered with a layer of paraffin oil, to exclude air, no holes and excrescences due to gas-bubbles are formed, but vertical ridges appear on the metallic surface. The air-current obviates the necessity for mechanical stirring. When no air-current is used, the hydrogen bubbles cause unevenness, excrescences, and even holes in the deposit. The deposit can be removed as a continuous sheet. Deposition from a neutral ferrous ammonium sulphate solution under similar conditions also led to a uniform and smooth deposit, but this was brittle and broke into pieces when attempts were made to separate it from the cathode. —E. F.

Iron ; Phenomenon of the extinction of sound in ——. Robin. Comptes rend., 1910, **150**, 780—781.

A rod of iron suspended from a point near a vibration node gives a musical sound when struck, accompanied by a feeble deep hollow note in bars of sufficient length. The first-mentioned sound is produced most distinctly when the rod is suspended at a point about one-quarter or one-third of its length from one end. A comparison of the notes given by five very pure steel bars of similar dimensions and differing only in the proportion of carbon present, showed that the pitch varied inversely as the proportion of carbon. The differences are feeble but their detection is aided by the usual manifestation of beats when two rods are set in vibration near one another. When the temperature is increased, starting from the ordinary temperature, the pitch of the note diminishes in a regular manner and the intensity of the sound becomes rapidly less, disappearing altogether just below 100° C. in the case of iron and steel low in carbon. When the temperature is further raised, the sound reappears at about 150° C., grows to a maximum and vanishes again at a dull red heat. This anomalous variation of the intensity of the sound with the temperature appears to be characteristic of iron and possibly of nickel. The range of aphony varies according to the amount of carbon. With 0·2 per cent. of carbon it is complete between 95° and 147° C. ; with 0·45 per cent. of carbon it is complete between 85° and 120° C. In the case of a steel containing 1·3 per cent. of carbon and containing cementite, the intensity of the sound remained approximately constant from the ordinary temperature up to red heat.—E. F. A.

Structural steel ; Portland cement paint as a protection to ——. F. E. Giesecke. Cement Age, 1909, **9**, 424—429.

It is generally conceded that steel embedded in neat cement or dense concrete will not rust, and consequently many architects and engineers specify that structural steel shall not be painted. There are however two important sources of danger of rusting in the use of structural steel ; one arises from the exposure of the steel to the weather during construction, and the other from cavities between the steel and the concrete, which are specially likely to occur underneath beams or in sharp corners. Experiments with various paints have been made to test whether these had an injurious effect upon the adhesion between the concrete and the steel. Rods painted with red lead, boiled linseed oil, and with neat Portland cement, were allowed to dry and were then embedded to a depth of five inches in Portland cement concrete, which was allowed to set. The adhesions between the rods and the concrete expressed in pounds per square inch, were as follows :—

	At the end of	
	1 week.	9 weeks.
Oil-coated rod	34	72
Red-lead coated rod	68	38
Uncoated rod	136	170*
Cement coated rod	170	465

The figure 170 marked with * is too low owing to bad contact with the concrete. Further experiments were made to determine whether the adhesion in the case of the red lead coated rods was increased if the paint were allowed to dry for two months before the rods were embedded in concrete, and whether exposure of the cement coated rods to sun and weather had an injurious effect. The results of these tests were :—

	When concrete was		
	1 week old.	4 weeks old.	8 wks. old.
Red-lead coated rod	4	17	—
Uncoated rod	190	220	254
Cement-coated rod in shade	210	410	272
Cement-coated rod exposed to weather	390	390	305

From this table it appears that prolonged drying of the red lead paint does not increase the adhesion, and that exposure of the cement coating to the weather does not injuriously affect it, in fact repeated moistening improves the adhesion of the cement paint to the steel. If the adhesion between concrete and uncoated steel is taken as a basis, a coating of red lead reduces the adhesion about 90 per cent., a coating of linseed oil reduces it about 80 per cent., whilst a coating of neat cement increases it about 35 per cent. One pound of Portland cement with two thirds of a pound of water is sufficient to cover 70 square feet with one coat. Assuming the cost per "square" for one coat to be 22 cents, the cost per ton for those sizes and shapes commonly used, would be about 63 cents, or rather less than one per cent. of the cost of the structural steel.

—W. C. H.

Nickel [*in nickel-steel*] *; Determination of —— by dimethylglyoxime.* P. Bogoluboff. Stahl u. Eisen, 1910, **30**, 458—459.

Careful comparative determinations by precipitation with dimethylglyoxime and drying the precipitate, precipitation with dimethylglyoxime and ignition, and electrolytic precipitation of metallic nickel, have shown that there is no danger of loss during the ignition of the dimethylglyoxime precipitate. The results, indeed, come out sensibly but not notably higher in this way, probably through incomplete combustion of the carbon. The filter and precipitate are gently heated in the crucible till the paper is completely carbonised without flame, and the temperature is next gradually raised till the filter is incinerated, and the residue is then very strongly heated. In determining nickel in nickel-steel it is well to remove most of the iron by solution in ether, then to add tartaric acid and excess of ammonia to the residue and precipitate by dimethylglyoxime. In the presence of a large excess of iron, the nickel precipitate is always contaminated by iron, which it is impossible to wash out.—J. T. D.

Metal losses with ore of low copper contents. C. A. Heberlein. Eng. and Min. J., 1910, **89**, 617.

The author describes the blowing-in of a copper blast-furnace using an ore averaging 0·28 per cent. of copper, 20·1 of iron, 31·4 of silica, 5·6 of alumina, 14·6 of lime and 11·7 of sulphur, and consisting of pyrrhotite and a small quantity of chalcopyrite mixed with a calcite and shale gangue. At first a concentration of one in eight was effected, the matte averaging 2·2 per cent. of copper, 61·1 of iron, 27·5 of sulphur, 0·6 of zinc, no arsenic, antimony, and bismuth, and 12·5 oz. of silver and 0·96 oz. of gold, per ton. A careful sampling of the slag gave 45·4 per cent. of silica, 22·2 of iron protoxide, 22 of lime, 8·6 of alumina, 0·086 of copper, and about one ounce of silver per ton. A later sampling taken when the furnace was working at its best, with a smaller consumption of coke, and the concentration raised to 1 in 10, showed a loss in the slag of 23·7 per cent. of copper, 13 of silver, and 3·3 of gold, indicating that the small amount of copper present was sufficient to produce a fair extraction of silver and a good extraction of gold.—F. R.

Copper slags in the electric furnace ; Behaviour of ——. L. T. Wright. Trans. Amer. Inst. Min. Eng., 1910, 220—221.

A number of ferruginous copper slags containing from 0·25 to 0·55 per cent. of copper and 0·48 to 1·4 oz. of silver per ton, were tested by fusing 700 to 900 grms. in an experimental electric furnace for 1—1⅛ hours. About 57 to 77 per cent. of the contained iron (being from 22 to 31 per cent. of the weight of the slag), was reduced to metal and carried with it practically all the copper, gold, and silver, and more than 50 per cent. of the sulphur originally present in the slag. The buttons of iron were clean, hard, and not brittle.—F. R.

Sampling anode copper, with special reference to silver content. W. Wraith. Trans. Amer. Inst. Min. Eng., 1910, 209—214.

Comparisons are given of three methods of sampling copper anodes at the Washoe smelter, Anaconda. The smelters method consists in "shotting" a small portion of the molten stream of copper, during casting, by "batting" the stream into water with a wooden paddle and selecting the portion passing a 4-mesh and remaining on a 10-mesh screen. The refinery method consists in drilling a ½ in. hole through each fourth anode, a template the size of the anode being used having 99 holes arranged equidistantly over the surface, each hole being used in turn. The total drillings are mixed and ground to pass a 16-mesh screen. A ladleful of copper was also taken from the molten stream and "shotted." It was found that the smelter and refinery methods of sampling give the true silver content of the copper and check within practical limits, but ladle samples tend to give high results on account of the silver segregating towards the portion that solidifies last.—F. R.

Cobalt-copper alloys ; Chemical characteristics of ——. F. Ducelliez. Bull. Soc. Chim., 1910, 7, 158—160.

Alloys of cobalt and copper were prepared by heating the powdered mixtures of the purified metals to about 1500° C. in an atmosphere of hydrogen. They were very fragile when the proportion of copper was high, and were attracted by the magnet inversely to the proportion of copper they contained. Alloys containing more than 70 per cent. of copper had a red tint, whilst those containing 10 per cent. of copper were gray and brilliant and similar to cobalt. Dilute hydrochloric, sulphuric, and nitric acids yielded solutions containing the two metals in variable proportions, and it was not found possible to isolate any compound of fixed composition from the alloys (see this J., 1908, 127, 1065).—C. A. M.

Manganese, vanadium and chromium ; Magnetic properties of ——. P. Weiss and Kamerlingh-Onnes Comptes rend., 1910. **150.** 687—689.

MANGANESE, vanadium, and chromium when subjected to a temperature as low as the freezing point of hydrogen (14° C. absolute), gave no indication, contrary to expectation, of ferromagnetic phenomena nor of a considerably increased paramagnetism in accordance with Curie's law; the magnetic phenomena remained very slight. The paramagnetism of these metals is therefore of a new type not obeying Curie's law. Pure manganese, obtained by the decomposition of the pure amalgam in a current of hydrogen was found to be paramagnetic in powder, but after being melted in a magnesia boat in an electric resistance furnace, it became ferromagnetic.—A. SBLD.

Babbitt metals, solders and journal brasses ; Analysis of ——. D. J. Demorest. J. Ind. Eng. Chem., 1910, **2**, 80—83.

IN the analysis of alloys containing tin with lead and copper, but no antimony, the tin can be separated from the other metals by nitric acid as metastannic acid, contaminated, however, with oxides of lead and copper and phosphorus, which cannot be washed out. But the metastannic acid can be dissolved in ammonium sulphide, leaving the lead and copper as insoluble sulphides, and the solution then electrolysed, giving very accurately and quickly the amount of tin in the sample. The sulphides of lead and copper are added to the main solution of lead and copper, which is then electrolysed. When antimony is present this process cannot be used, because it is not rendered completely insoluble by nitric acid. In this case the sample is subjected to the action of tartaric acid, to which nitric acid is added. The solution is then treated with caustic soda until the hydroxides first formed are redissolved. The solution is poured with constant shaking into a boiling mixture of caustic soda and saturated solution of sodium sulphide. The sulphides of lead and copper will settle out, and, after washing, they are again treated with nitric acid, caustic soda and sodium sulphide; and are ready for the electrolytic process as before. The filtrate containing the antimony and tin is treated with sulphuric acid, and, after decantation, the precipitate is again dissolved by ammonium sulphide. Potassium cyanide is added and the solution electrolysed with rapid stirring, the two metals being deposited together on the cathode, which is made of platinum gauze. This deposit may be dissolved off the cathode, the antimony oxidised to antimonic acid, H_3SbO_4, and titrated iodometrically. The tin is obtained by difference. By these methods alloys of lead, copper, antimony and tin may be accurately analysed in three to four hours.—R. C. P.

Temperature of bright bodies [metals] ; Optical measurement of the ——. H. von Wartenberg. Verh. Dtsch. Phys. Ges., 1910, **12**, 121—127. Chem. Zentr., 1910, **1**, 1699.

THE author has determined the melting points of a number of substances by heating them in a "black body" (compare Waidner, this J., 1910, 339) consisting of a short, electrically heated tungsten tube, the temperature being measured by means of a Wanner pyrometer. The following melting points were thus determined:—Iridium, 2360° C.; rhodium, 1970° C.; platin-rhodium (thermo-couple alloy), 1830° C.; vanadium (97 per cent. purity), 1710° C.; Nernst electrode mass, 2550° C.; molybdenum, over 2550° C. The values for iridium and rhodium agree well with those calculated by means of the formula of Holborn and Henning from the "black body" temperatures determined by the latter authors. The calculated true melting point of tungsten is 2900° C. (compare this J., 1907, 931).—A. S.

Electrolytic corrosion. W. W. Haldane Gee. J. Proc. Inst. Elect. Eng., 41, [191]. J. Municipal School of Technology, Manchester, 1910, **2**, 87—136.

STARTING with the view that all corrosion is essentially electrolytic, the author reviews previous work on the subject, and gives also an account of some of his own experiments in connection with different aspects of the question. References are also made to technical applications of some of the processes discussed. A bibliography is appended to the paper.—A. S.

Ores ; Valuation of ——. A. Rzehulka. Z. angew. Chem., 1910, **23**, 481—485.

Lead ore. In Germany the London price of lead (M. 2 per 100. kilos. being considered equal to £1 per ton) and the Hamburg rate for silver bars are taken. In the absence of exceptional quantities of objectionable impurities, galena is usually valued at the combined value of the lead and silver contained, less M. 4 per 100 kilos. of ore for smelting, in the case of ores of 55 per cent. of lead and upwards, M. 5·5 are deducted for ores of 40 per cent., and intermediate percentages are calculated proportionately. Ores of lower grade are subject to special terms. Silver is usually not allowed for, if the percentage falls below 0·015, and sometimes if it is below 0·025. In France the value of the lead and silver present is calculated at the London prices, and 50—65 francs per 1000 kilos. of ore are deducted. In Spain the value is calculated according to the formula—

$$V=(A-0{\cdot}50)\,a+\frac{P-4}{100}\,\beta-5\text{ reals.}$$

V being the value of a cwt. of ore at the mine, A the silver in ounces per cwt. of lead, a the price of silver per ounce, P the percentage of lead, β the value of lead per cwt. *Zinc ores.* In Germany 95 per cent. of the London price of ordinary spelter is taken and 8 units deducted from the percentage of zinc (to allow for loss in distillation). From the value thus obtained at least M. 6 per 100 kilos. are deducted in the case of blendes and M. 4—5 for calamines. Blendes are accepted down to 25—30 per cent of zinc and ores like calamine to 20 per cent. In France and Belgium the deductions are—8 units from the percentage of zinc, 5 per cent. from the market price of zinc, and 65—70 francs per 1000 kilos. for calamines, with 15 francs additional for raw blende. *Iron ores.* No general formula can be given owing to the importance of the impurities and the physical condition of the ore. A few comparisons are given. If Swedish magnetic ore (60 per cent. of iron) is taken at M. 21 per ton, South Russian iron ore (60 per cent.) is valued at M. 23·25, Posen and Silesian limonite (40—45 per cent.) at M. 14—15, manganese iron ore (22—26 per cent. of manganese and 33—37 per cent. of iron) at M. 39, whilst Upper Silesian brown ore is practically worthless.—A. SBLD.

Sulphide ores ; Rate of oxidation of ——. H. A. Buehler and V. H. Gottschalk. Economic Geology, 1910, 5, [1]; Mining World, 1910, 561—562.

A SERIES of experiments on pyrite, marcasite, chalcopyrite, sphalerite, galena, and covellite carried out under conditions similar to those of natural weathering showed that: (1) natural sulphides are perceptibly oxidised by atmospheric air in presence of water, *e.g.*, about 3 per cent. of the iron was dissolved out from pyrite after washing daily with distilled water for 3 months; (2) pyrite and marcasite in contact with other natural sulphides greatly increase the rate of oxidation of the latter, *e.g.* galena in the presence of an equal quantity of pyrite was oxidised about 12 times as fast; this observation is borne out by the analysis of mine waters in districts where these minerals occur together; (3) fine grinding causes an increase in the rate of oxidation.—H.H.

Ural mountains ; Industries of the —— *with special reference to the Bogoslowsk works.* P. Mengel. Chem.-Zeit., 1910, 34, 272—273.

THE discovery of the mineral wealth of the Urals dates back to the 17th century, the chief industries being those of iron, platinum, copper, and gold, and latterly the extraction of chromates. The most important works in the district are those of the Bogoslowsker Hüttengesellschaft. Copper smelting was started at the Bogoslowsk copper works in the year 1771, and has been in more or less continuous operation ever since. The Bogoslowsk district is situate about 59° N, some 60 kilometres east of the main range of the Urals, and is served by two railroads, and by waterways connecting with the navigable systems of Western Siberia. Extensive forests provide the wood and charcoal used for smelting. The chief iron ore is magnetite containing 55—65 per cent. of iron, 3—10 of silica, and 0·03—0·1 of phosphorus. Copper is found mainly as pyrites with a little malachite and azurite, the average assay value being 6—7 per cent. of copper. Gold is almost entirely alluvial, 20 pud (8640 ounces) being the approximate annual yield of dredging operations. Chromite containing 40—45 per cent. of chromic oxide was formerly mined, but for chromate extraction richer ores (50—60 per cent. of chromic oxide) are now bought from other districts in the Urals, where the mineral is more abundant. Two ironworks, at Nadeschdinsk and Soswa, comprise 6 blast furnaces, 7 basic steel furnaces, and 5 rolling mills. The total pig iron production amounts to 95,000 metric tons annually at a cost of M. 38·5 (£1 18s.) per ton. The producer gas for the Siemens steel furnaces is generated from wood. Copper is smelted direct from pyritic ores in water-jacketed furnaces. The production in 1908 was 4600 metric tons. The chemical works consist of a sulphuric acid and of a bichromate plant, which were rebuilt in 1903—4. The vitriol works have a daily output of about 6½ tons of chamber acid of 53° B., made from ores containing 22—23 per cent. of sulphur; the bichromate plant has an annual capacity of 731 metric tons of bichromates, which represents about one-third of Russia's requirements.—O. R.

Mineral production of Canada in 1909. Board of Trade J., April 7, 1910. [T.R.]

The following provisional statistics of the mineral production (quantities sold or shipped) of Canada during the year 1909, with comparative figures for the preceding year, are taken from a preliminary report issued by the Canadian Department of Mines, Ottawa:—

Product.		1908.		1909.	
		Quantity.	Value.	Quantity.	Value.
Metallic—			Dols.		Dols.
Antimony ore	Tons*	148	5,443	—	—
Copper	Lb.	63,702,873	8,413,876	54,061,106	7,018,213
Gold	Oz.	476,112	9,842,105	—	9,790,000
Pig-iron from Canadian ore (*a*)	Tons*	99,420	1,664,302	149,444	2,222,215
Iron ore (exports)	,,	—	—	21,956	61,965
Lead	Lb.	43,195,733	1,814,221	45,857,424	1,959,488
Nickel	,,	19,143,111	8,231,538	26,282,991	9,461,877
Cobalt		—	113,423	—	66,319
Silver	Oz.	22,106,233	11,686,239	27,878,590	14,358,310
Zinc ore	Tons*	452	3,215	—	250,000
Total, metallic		—	41,774,362	—	45,188,387
Non-Metallic—					
Arsenic	Tons*	—	58,566	1,129	64,100
Asbestos	,,	66,548	2,555,361	63,349	2,284,587
Asbestic and asbestic sand	,,	24,225	17,974	23,951	17,188
Calcium carbide	,,	6,864	417,150	—	—
Chromite	,,	7,225	82,008	1,794	20,858
Coal	,,	10,886,311	25,194,573	10,412,955	24,431,351
Corundum	,,	1,089	100,398	1,491	157,398
Felspar	,,	7,877	21,099	10,286	35,604
Graphite	,,	251	5,565		
,, artificial	,,	214	—	730	37,624
Grindstones	,,	3,843	48,128	3,965	50,944
Gypsum	,,	340,964	575,701	468,551	667,816
Limestone for flux in iron furnaces	,,	418,661	289,705	†	†
Magnesite	,,	120	840	330	2,508
Mica	,,	436	139,871	—	154,106
Mineral pigments—					
Barytes	,,	4,312	19,021	4,119	20,213
Ochres	,,	4,746	30,440		
Mineral water		—	151,953	—	177,304
Natural gas (*b*)		—	1,012,660	—	1,205,943
Peat	Tons*	60	180	—	—
Petroleum (*c*)	Brls.	527,987	747,102	420,755	559,604
Phosphate	Tons*	1,596	14,794	597	4,618
Pyrites	,,	47,336	224,824	57,038	196,312
Quartz	,,	44,741	52,830	50,541	63,032
Salt	,,	79,075	378,798	84,037	415,219
Talc	,,	1,016	3,048	4,506	12,712
Tripolite	,,	30	195	—	—
Total, non-metallic		—	32,142,784	—	30,587,501
Structural Material and Clay Products—					
Cement, Portland	Brls.	2,665,289	3,709,139	4,010,180	5,266,008
Clay products—					
Brick		—	3,577,426	—	4,200,000
Sewer pipe, fireclay, drain tile, etc.		—	1,293,977	—	1,300,000
Lime	Bush.	3,601,468	712,947	5,163,874	1,049,473
Sand and gravel (exports)	Tons*	298,954	161,387	481,584	256,166
Stone—					
Granite		—	282,320	—	340,047
Limestone for flux in blast furnaces		‡	‡	—	328,091
Other products		—	1,973,460	—	1,600,000
Total structural material and clay products		—	11,710,656	—	14,339,785
,, all other non-metallic		—	32,142,784	—	30,587,591
Total non-metallic		—	43,853,440	—	44,927,376
,, metallic		—	41,774,362	—	45,188,387
Estimated value of mineral products not reported		—	300,000	—	300,000
Grand total		—	85,927,802	—	90,415,762

* The ton used throughout is that of 2,000 lb.

† Included under structural material and clay products in 1909.

‡ Included under non-metallic products in 1908.

(*a*) The total production of pig-iron in Canada in 1908 was 630,835 tons, valued at 8,111,194 dols., of which it is estimated that 531,415 tons, valued at 6,446,892 dols., should be attributed to the ore imported. The total production in 1909 was 757,162 tons, valued at 9,581,864 dols., of which it is estimated that 607,718 tons, valued at 7,359,649 dols., should be attributed to the ore imported.

(*b*) Gross returns from sale of gas.

(*c*) Quantity on which bounty was paid, valued at 1·41½ dols. per barrel in 1908 and 1·33 dols. per barrel in 1909.

Tin exports from the Federated Malay States. Board of Trade J., March 31, 1910. [T.R.]

The "Federated Malay States Government Gazette" of 18th February publishes the following statement of the weight of block tin and tin contained in ore (the weight of the tin being taken at 70 per cent. of the gross weight of the ore) exported from the Federated Malay States during the years 1908 and 1909 :—

State.	1908. Tin.	1908. Tin contained in ore.	1908. Total.	1909. Tin.	1909. Tin contained in ore.	1909. Total.
	Tons*	Tons*	Tons*	Tons*	Tons*	Tons*
Perak	5,247	25,939	31,186	7,691	23,085	30,776
Selangor	2,428	16,387	18,815	3,268	14,466	17,734
Negri Sembilan	1,268	3,013	4,281	302	2,902	3,204
Pahang	877	1,757	2,634	777	2,099	2,876
Total	9,820	47,096	56,916	12,038	42,552	54,590

* Tons of 2000 lb.

Tungsten production of the United States. Eng. and Min. J., March 26, 1910. [T.R.]

According to statistics collected for "The Mineral Industry," the production of tungsten-ore concentrates in the United States in 1909 was larger than in any previous year, amounting to 1607 short tons, valued at $559,500, of which Colorado (Boulder county) produced 1100 tons. In 1908 the total domestic production was 497 tons valued at $126,281. The present value of tungsten ore in the United States is $6.50 to $7 per unit per ton of 2000 lb. for ore containing 60 per cent. of tungsten trioxide. This price is paid for ferberite, wolframite and huebcrite ores Scheelite ores command from 50c. to $1.50 per unit less than the above prices.

Metal production of Russia. Board of Trade J., April 14, 1910. [T.R.]

The copper production of Russia in 1909 was 1,126,669 pouds (18,147 tons) of red metal, as against 1,025,444 pouds (16,528 tons) in 1908. The yield in the Caucasus increased from 293,128 pouds in 1908 to 391,290 pouds in 1909, and that in the Ural district from 522,584 pouds to 530,773 pouds, while the production in Siberia remained almost stationary at about 150,000 pouds. The yield of gold in the Ural district in 1909 was 244,369 oz. troy, an increase of 12,103 oz. troy as compared with 1908. The yield of platinum in the Ural district was 164,489 oz. troy in 1969, an increase of 7,375 oz. troy as compared with the previous year.

Patents.

Concentration of ores [by flotation]. H. H. Greenway and H. L. Sulman, London, and A. H. Higgins, Broken Hill, New South Wales. Eng. Pat. 2359, Feb. 1, 1909.

Ore pulp, consisting of finely divided ore suspended in slightly acidulated water, to which a small quantity of an organic frothing agent, such as amyl acetate, amyl alcohol, or the like, has been added, is agitated, and air beaten into it to form a froth which will float. Metallic sulphides and the like remain suspended in the froth and are removed by suitable means (see Eng. Pat. 4911 of 1909).—F. R.

Zinc condensers. J. Lysaght, Ltd., and B. Beddoe, Bristol. Eng. Pat. 4667, Feb. 25, 1909.

The outlet end of a zinc condenser is fitted with a tube, the mouth of which is partially closed by means of a plug, consisting of carbon and lime, preferably in the proportion of 2 to 1. When the plug becomes hot, the carbon of the plug prevents the access of atmospheric oxygen to the zinc in the condenser, while the lime reacts with any chloride of zinc, or of ammonium, that may be present. If the material being treated contains lead or arsenic, an additional tube containing carbon (coke) may be affixed to the outer end of the above-mentioned tube, maintaining however a space between the plug and the carbon filling.—F. R.

Zinc ores ; Treatment of —— by the precipitation method. Imbert Process Co. Fr. Pat. 407,305, Dec. 24, 1908. (See also this J., 1909, 1142.)

In the precipitation method for the treatment of zinc sulphide ores, where the molten mixture of ore and flux is brought into contact with a reacting metal, generally molten iron, it has been usual to employ for the flux some such mixture as lime and iron oxide or, when oxidised zinc compounds are present, a mixture of peroxide and monosulphide of iron. Since these substances are not always to be found in the neighbourhood of the mine, it is now proposed, independently of the ordinary fluxes necessitated by the special gangue in each ore, to employ a lead slag, that is the product resulting from the reduction of a lead ore in the blast-furnace. It is found that those slags constituted of a mixture of silica, alumina, oxides of iron and manganese, lime and various sulphides, give good results ; they form a good flux for the blende, which under these conditions, readily reacts with the iron. In some cases the addition of a special flux for the gangue is not necessary, the lead slag alone sufficing. Moreover these slags always contain a fairly considerable quantity of zinc, and, whether this be in the state of sulphide, oxide or silicate, it is always reduced and recovered with the bulk of the metal in the ore. The small quantity of lead is also precipitated in the same manner and can be collected separately. —C. A. W.

Kilns ; Calcining ——. W. J. Willis, Wednesbury. Eng. Pat. 5901, March 11, 1909.

The kiln is of the type employed for the roasting or calcining of ironstone, or the decomposition of pyrites, and is particularly designed for heating by blast-furnace gas. It contains a series of inclined beds or plates, which project downwards from opposite walls alternately, so that a staggered arrangement is obtained. Each set of inclined beds projects to approximately the centre of the furnace ; the lowest one, however, may extend rather farther. Inlets for gas and air are arranged under each inclined bed, where spaces or pockets are left by the falling ore, the combustion taking place at these points. In this way, the ore, fed in at the top and proceeding downwards in a zig-zag path, constantly exposes a fresh surface as it rolls down the successive inclines,which are kept at a high temperature. The products of combustion, passing away through outlet tubes, immediately under each inclined bed, may be made to heat the incoming air.—C. A. W.

Manganese and chromium ores containing iron ; Treatment of ——. M. Ruthenburg, London. Eng. Pat. 6529, March 18, 1909.

In order to separate a ferro-manganese or ferro-chrome ore into a high-grade material containing a preponderating proportion of manganese or chromium, and a low-grade one in which the iron predominates, the ore is subjected to the action of a reducing gas, such as carbon monoxide or producer gas, which has been previously heated to about 1000° to 1200° C. For this purpose the material, preferably in the form of small lumps, is packed in a tower connected with two regenerative chambers, so that the gas from the producer, after being heated in one chamber, passes through the ore into the other chamber, and is thence, by a reversal of the valves, passed back again. The temperature should not exceed 1200° C., or fusion may occur. At this temperature, it is found that the iron in the low-grade ore is reduced, whilst that in the high-grade one is untouched, so that only the low-grade material is rendered magnetic. The ore is allowed to cool out of contact with the air, and finally, after a partial crushing in the rolls in order to break away the silica, the lumps are graded in a magnetic separator. The enriched ores are stated to be practically free from carbon and to contain no admixture of slag —C. A. W.

Manganese steel; Working —— to produce finished shapes. W. S. Potter, New York. Eng. Pat. 24,729, Oct. 27, 1909. Addition to Eng. Pat. 24,685 of 1908.

The following improvement on Eng. Pat. 24,685 of 1908, (see this J., 1909, 527) consists in preventing excessive primary cooling, by removing the casting from the mould at the highest temperature possible without danger of rupture or injury. When the exterior has attained a temperature of about 950° to 1150° C., a solid envelope is formed of sufficient strength to permit of handling, while the interior is still at about the melting point, 1325° C. The casting is then placed in a non-oxidising atmosphere in a heating chamber until the outer and inner temperatures approach 1100°–1150° C. and 1200°–1275° C. respectively, which results in the formation of a strong tough envelope, and a plastic interior suitable for working. —F. R

Alloyed steel; Process of producing ——. F. L. Antisell, New York. U.S. Pat. 951,385, March 8, 1910.

Molten steel, free from slag, is introduced into a closed electric furnace, which already contains the alloying element, such as titanium.—F. R.

Steel alloy. S. S. Wales, Munhall, Pa., Assignor to The Carnegie Steel Co., Pittsburg, Pa. U.S. Pats. 952,391 and 952,392, March 15, 1910.

(1). An alloy steel containing, in addition to manganese, nickel, 1·00 to 4·00 per cent.; chromium, 0·5 to 2·00 per cent.; vanadium, 0·10 to 0·50 per cent., and titanium, below 1·00 per cent., is instanced. The proportion of manganese is not specified and, in a further instance, this metal is absent altogether, the proportions of the other elements remaining as before. (2). The specification provides for the manufacture of alloy steels containing up to 1 per cent. of copper, manganese, less than 4 per cent. of nickel, less than 2 per cent. of chromium, and up to 0·50 per cent. of vanadium. In another instance, where otherwise the proportions are similar, neither manganese nor chromium is mentioned.—C. A. W.

Steel castings; Method of heat-treating ——. W. G. Kranz, Sharon, Pa., Assignor to The National Malleable Castings Co., Cleveland, Ohio. U.S. Pat. 951,768, March 8, 1910.

Low-carbon steel castings are heated to about 1300° to 1400° F. and then carried, at a regulated speed, successively through a boiling liquid to cool them to below 700° F., and a heating chamber to re-heat them to a temperature less than red heat.—F. R.

Alloy: High resistance iron ——. W. R. Whitney, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 952,290, March 15, 1910.

The material consists of a sheet steel or iron containing 0·2 to 5 per cent. of boron or some element with an atomic weight less than that of carbon. It is characterised by a high electrical resistance.—C. A. W.

Ferrovanadium; Preparation of ——. J. M. Fieschi, E. Faërber, and J. E. Rigal. Fr. Pat. 407,235, Sept. 21, 1909.

In order to obtain a ferrovanadium with less than 0·20 per cent. of carbon, a mixture of vanadic acid with an oxide of iron is reduced, generally by means of aluminium. The mixture, containing a suitable amount of powdered aluminium, is placed in a crucible with magnesia lining and heated to about 1200° C., the reaction being started by means of a small quantity of a mixture of aluminium and barium dioxide. When the reaction is concluded, the liquid alloy is run into a mould. Other compounds, such as the sulphide, may be used instead of the oxides of iron, provided they be free from carbon; moreover the process is equally applicable to the compounds of analogous metals, and in this way mangano-vanadium free from carbon may be obtained.—C. A. W.

Tin or terne scruff skimmings or residues; Process and apparatus for the elimination of chlorine and zinc and the recovery of tin or lead from ——. J. Stephens, Swansea. Eng. Pat. 17,345, July 26, 1909.

The scruff is collected in a separating box secured across the coating bath. This box is provided with holes around the sides through which the liquid metal runs back into the bath, the impure and heavier metal sinking to the bottom of the box. The surface layer in this box is skimmed off in thin layers from time to time, broken up and removed to a vat which comprises a tank communicating, by means of a filter-bed of small coke, with a well. The material having been covered to a depth of about twelve inches with water, the liquid is heated to boiling by steam, the filtrate passing into the well being continuously returned, until the whole of the chlorides and zinc have gone into solution. A certain amount of ammonium sulphate, which need not exceed 5 per cent. of the material employed, is then added in order to precipitate any tin or lead dissolved. Finally the residue, after washing and draining, is calcined, when the amount of hydrochloric acid passed into the atmosphere is quite inappreciable.—C. A. W.

Tin plate scrap; Process for the recovery of tin and iron from ——. C. T. Batchelor, Water Orton, Warwick, and J. G. H. Batchelor, Stechford, Worcestershire. Eng. Pat. 21,497, Sept. 21, 1909.

The scrap is placed in a vat containing an aqueous solution of stannic chloride at a temperature of 130° F. The tin is stripped in less than three minutes, with the exception of about 10 per cent. contained in a surface-alloy of tin and iron, and no further action takes place. The scrap is removed, washed in water and introduced into a vat containing a boiling solution of caustic soda, where the remaining tin is electrolytically removed, the tank forming the cathode and the scrap the anode. By this means the iron receives a bright surface which shows no undue tendency to rust. Meanwhile, from the original vat, the stannous chloride is run off, any remaining stannic chloride is reduced by powdered tin and the solution evaporated and crystallised. The crystallised stannous chloride is now fused and introduced into a closed electrolytic cell which is kept at a temperature of over 442° F. In this cell the fused salt is electrolysed, the cathode consisting of melted tin and the anode of carbon or other suitable material. The molten tin collects at the bottom of the vessel and overflows automatically, whilst the anhydrous stannic chloride formed in the reaction passes away as a gas and, after condensation, is brought back to the original stripping vessel, mixing with the aqueous solution therein. In this way, and by the addition of the washings from the partially stripped tin referred to above, the preliminary vat is constantly replenished. —C. A. W.

Tin-scrap; Process of detinning ——. W. J. Phelps, Baltimore, Md. U.S. Pat. 952,351, March 15, 1910.

The tin-scrap, contained in a rotating drum, is subjected to the action of sprays of liquid air, or some such cooling medium. In this way, and by the simultaneous agitation of the mass, the tin is disintegrated, and the separated particles collected.—C. A. W.

Tin; Process for the manufacture of pure ——. Soc. Industrielle de Produits Chimiques. Fr. Pat. 406,988, Dec. 19, 1908.

The tin ore of any kind is heated in presence of a reducing agent, either solid, liquid, or gaseous; in most cases a current of hydrogen is preferable, since then the reaction commences a little above 500° C. The oxygen, sulphur, arsenic and antimony having been eliminated in this way, the mass is allowed to cool, when the current of hydrogen is replaced by one of dry chlorine. Owing to the evolution of heat which results, it is advisable to apply exterior cooling, and the temperature should never exceed 100° C. The stannic chloride passing over is condensed and subsequently re-distilled with a small quantity of tin, in order to free it from traces of chlorine and iron chloride. The pure compound is dissolved in a small quantity of water and submitted to electrolysis, the resistance being kept at a minimum by the constant addition of further quantities, either anhydrous or in very concentrated solution. The tin, precipitated partly in the form of powder, is collected and cast into blocks whilst the chlorine and the small quantity of hydrogen evolved serve for the reduction of fresh quantities of ore. The amounts of these gases produced are not, however, sufficient to make the process continuous, and, in any case, the formation of hydrogen in the electrolysis should be avoided as far as possible, in order to obtain the highest current efficiency.—C. A. W.

Ores; Apparatus for filtering and washing —— and the like. A. Grothe and H. F. Carter, Mexico. Eng. Pat. 18,060, Aug. 5, 1909.

The apparatus comprises two concentric circular members braced together by radial spokes, which divide the surface between the circles into similar truncated sectors, each of which contains a filtering box. The inner ring is connected by tie-rods to the outer casing of a cock in the centre, about which the whole apparatus revolves, the two rings bearing on rollers fixed on the radial members of a circular frame supported on columns at a convenient height above the ground. The motion is obtained by means of a pinion which, supported on the fixed frame and driven by an exterior pulley, engages with a circular rack attached beneath the outer concentric ring. The filter boxes are made in two detachable parts, an upper and a lower one, between which the filtering medium is placed. This last consists of some such material as duck or jute cloth, supported on a wire screen resting on strengthening ribs in the lower portion where the filtrate is received. Each filter box is mounted so that it can revolve within its segment by means of trunnions resting on the inner and outer frames respectively; when necessary, the whole box can be turned completely over. For this purpose, the outer trunnion carries an arrangement of pinion, pawl wheel and stop, whilst a short rack and a fixed stop are arranged at a certain point on the circumference of the fixed frame. The inner trunnion is made hollow so as to establish a passage for the filtrate which, draining into the bottom of the box, is thence conveyed, by means of a radial tube, to the manifold cock at the centre of the apparatus. This central cock consists of a hollow cylinder supporting the radiating spokes of the apparatus, and turning about the fixed centre. The upper part is divided by means of immovable partitions into three chambers, of which two communicate with sources of suction and one with a reservoir of compressed air. The radial tubes, through which the filtrate is discharged, pass into the hollow cylinder, so that, as the latter revolves about the fixed partitions, a suction is established in the filter-boxes except at one point where, a box becoming inverted, compressed air is passed into it in order to facilitate the discharge of the solid material. As the box regains its normal position, it is filled evenly with a fresh supply of pulp, from a distributor overhead. At another point on the travel, when the suction pipe of the box is momentarily closed, the contents are washed with water from a sprayer overhead.—C. A. W.

Treatment of ores; Agitating apparatus for the ——. J. E. Rothwell and R. P. Akins, Assignors to Colorado Iron Works Co., Denver, Colo. U.S. Pat. 951,742, March 8, 1910.

The apparatus consists of a tank with a conical bottom, having an open pipe fixed vertically in the centre, and extending nearly from the top to the bottom of the tank. A shorter outer pipe is arranged concentrically about the first and is open only at its upper end. Circulation of the liquid is maintained by means of a pump, connected to the annular space between the two pipes, and discharging into the upper end of the inner one. The open end of the outer pipe is protected from the inflow of the coarser particles of ore, suspended in the fluid.—F. R.

Ores; Method of lixiviating——. G. Vervuert, Imsbach, Assignor to E. Abresch, Neustadt-on-the-Hardt, Germany. U.S. Pat. 952,484, March 22, 1910.

The ore is introduced into a perforated drum in such quantity that a perfectly free movement for the particles is obtained. The drum is then partially immersed in the lixiviating solution and rotated, whilst air is allowed to enter in order to accelerate the chemical reactions.—C. A. W.

Blast furnaces; Method of charging ——. T. McDonald and J. C. Barrett, Youngstown, Ohio. U.S. Pat. 951,144, March 8, 1910.

An amount of water is added to the ore, or to the materials forming the burden of the furnace, in excess of that present, so as to make the total contained moisture equal to at least three per cent. by weight of such materials, and the charge is then fed damp into the furnace.—F. R.

[Sintering] ores; Process and apparatus for treating ——. W. G. Perkins, Smelter, Nev., and M. L. Requa, San Francisco, Cal., Assignors to Perkins Sintering Co., San Francisco. U.S. Pats. 951,198 and 951,199, March 8, 1910.

The process consists essentially in passing burning gases over a body of ore, supported upon a porous bed, and simultaneously and continuously drawing a supporter of combustion through the ore.—F. R.

Metal; Composition of elements to be used for the manufacture of an improved quality of ——. C. R. Bryson, Pittsburg, Pa. U.S. Pat. 952,069, March 15, 1910.

The composition of the alloy is given as follows: chromium, 6·00; nickel, 3·00; tungsten, 0·50; silicon, 0·30; carbon, 0·60; iron, 89·177; phosphorus, 0·014; manganese, 0·40; sulphur, 0·009 per cent.; and vanadium, a trace. —C. A. W.

Copper-zinc compositions; Method of producing —— and alloy for the production thereof. W. Rübel, Vienna. U.S. Pat. 952,585, March 22, 1910.

In order to increase the tensile strength and elastic limit of a copper-zinc composition, an alloy containing copper, iron, manganese, aluminium, and possibly nickel is added to the mixture of the two metals in an amount not exceeding ten per cent. of the whole. The alloy added has the composition: two atomic weights of copper, two of iron, three of manganese and one of aluminium; or, alternatively, two atomic weights of copper, two of iron, three of nickel and one each of manganese and aluminium.—C. A. W.

Furnace; Ore roasting ——. C. E. Mark, Chicago, Ill. U.S. Pat. 952,680, March 22, 1910.

The ore, falling down a shoot, is caught by mechanical rabbles and carried over the hearth of the furnace. The hearth structure of this furnace is composed of superimposed layers, the upper layer being constituted by a hard, rigid material provided with definite apertures, and the lower layer by some porous material. In the lower layer, pipes are arranged to supply currents of air through the porous matter into the pockets formed by the apertures, the ore being prevented from falling through these apertures by the porous layer beneath.—C. A. W.

Metallic layers; Production of —— on the surface of any objects by means of pulverised metals, these layers being adapted for separation from the object covered. M. U. Schoop. Fr. Pat. 407,178, Sept. 20, 1909.

The production of an adherent metallic coating on the surface of any object by means of a pulverised metal or by the vapours of an impalpable metal forms the subject of a former patent (Fr. Pat. 406,387). It is now proposed to obtain layers which subsequently can be easily separated from the support, by covering the object with a thin layer of grease or of graphite powder before exposing it to the metallic vapours. The same end can be attained by subsequently burning away or fusing the object coated, and in this way weldless metal tubes can be obtained. The object is not to be heated and in some cases it may even be advantageous to plunge it into water after the operation, in order to loosen the metallic coating. The specific gravity of the deposited metal is influenced by the chemical nature of the gas employed in obtaining the pressure and in pulverising the molten metal. If the gas be neutral, the density will be the same as that of the molten bath: if it be oxidising, the density will be less in consequence of the presence of metallic oxide in the deposited layer. —C. A. W.

Aluminium and other similar metals: Process of blackening and coloration of ——. F. A. Roux. Fr. Pat. 407,641, Aug. 12, 1909.

In order to protect the surface of the aluminium from dust and air, it is given an electrolytic deposit of some metal, such as iron. In making this deposit, however, a pure electrolyte is not taken, but different metallic solutions mixed in suitable proportions are employed, according to the current-densities to be used and the effects to be obtained. The coating may be effected either in one or in two operations. In the second case 1000 parts of a solution of ammonium chloride, which has been saturated with iron by electrolysis, are mixed with 15 parts of pure iron sulphate. The aluminium, having received a light, adherent coating of iron in this bath, is afterwards passed through some oxidising solution such as: water, 1000 parts; sodium nitrate, 50 parts; sulphuric acid, 30 to 40 drops. A few minutes immersion is sufficient, when, finally, the piece is dried in the ordinary manner. In the last method, the deposit is not black, but it may be given any colour from yellow to blue and brown by a graduated heating. The surface may subsequently be varnished, or it may be simply rubbed with vaseline. The process is equally applicable to other metals, such as zinc, copper or brass. C. A. W.

Electric furnaces. J. H. Reid, Newark, N.J., U.S.A. Eng. Pat. 6820, March 22, 1909. Under Int. Conv., Aug. 22, 1908.

See U.S. Pat. 917,796 of 1909; this J., 1909, 530.—T. F. B.

Electric furnaces. J. A. Hay, London. Eng. Pat. 27,972, Nov. 30, 1909. Under Int. Conv., June 19, 1909.

See U.S. Pat. 932,469 of 1909; this J., 1909, 1045.—T. F. B.

Mercury from gold amalgam; Apparatus for distilling ——. W. E. Bennett, London. Eng. Pat. 7340, March 26, 1909.

See U.S. Pat. 937,356 of 1909; this J., 1909, 1201.—T. F. B.

Furnaces for the production of cast iron and steel. G. Harrison, London. From F. Resinelli, Vadoligure, Italy. Eng. Pat. 14,351, June 18, 1909.

See Fr. Pat. 404,026 of 1909; this J., 1910, 95.—T. F. B.

Metal product having cutting and other properties of high grade tool and high speed steel; Art of producing from foundry-iron, a ——. E. A. Custer, Philadelphia, U.S.A. Eng. Pat. 15,183, June 29, 1909.

See U.S. Pats. 927,495 and 927,496 of 1909; this J., 1909, 889.—T. F. B.

Substance [pyrophoric alloy] for igniting purposes. Kunheim und Co., Berlin. Eng. Pat. 16,211, July 12, 1909. Under Int. Conv., Jan. 25, 1909.

See Fr. Pat. 405,021 of 1909; this J., 1910, 359.—T. F. B.

Concentrating oolitic ironstone and similar iron ores; Method of ——. G. Gröndal, Djursholm, Sweden. Eng. Pat. 18,826, Aug. 16, 1909.

See Fr. Pat. 406,441 of 1909; this J., 1910, 433.—T. F. B.

Iron; Process for melting and refining ——. H. Johnson, Saxilby. U.S. Pat. 952,260, March 15, 1910.

See Eng. Pat. 22,948 of 1908; this J., 1909, 1255.—T. F. B.

Smelting-furnace. B. de St. Seine, Paris, Assignor to Thwaites Bros., Ltd., Bradford. U.S. Pat. 952,284, March 15, 1910.

See Eng. Pat. 18,175 of 1908; this J., 1910, 94.—T. F. B.

Ore-briquetting. W. Lessing, Troisdorf, Germany. U.S. Pat. 952,914, March 22, 1910.

See Fr. Pat. 392,289 of 1908; this J., 1908, 1209.—T. F. B.

Process for painting iron and steel. Fr. Pat. 407,179. *See* XIII.

XI.—ELECTRO-CHEMISTRY.

Patents.

Electrodes for electric furnaces. M. Ruthenburg, London. Eng. Pat. 12,507, May 27, 1909.

The electrode consists of carbon, and a central core of metal corresponding to that under treatment in the furnace, so that the core may melt into the bath without contaminating it.—B. N.

Electrodes for electrolytic purposes. The Electrolytic Alkali Co., Ltd., Middlewich, C. C. Connor, Belfast, and J. W. Stubbs, Middlewich, Cheshire. Eng. Pat. 12,709, May 29, 1909.

Cross-pins of carbon are attached in any well-known manner to a metallic conductor, the ends of the pins being divided or made in two or more pieces, so that by means of wedges, or the like, they may be pressed outwardly against the sides of the holes in the external carbon blocks. —B. N.

Electro-protector. H. C. Harrison, Lockport, N.Y., Assignor to Electro Metallurgical Co., West Virginia. U.S. Pat. 951,990, March 15, 1910.

The electrode is provided with a protective coating of some salt which is practically chemically inert and non-volatile in the atmosphere existing immediately above the charge in the furnace. This coating, which should extend well into the pores of the electrode, may be composed of sodium chloride or some other suitable salt of an alkali metal.—C. A. W.

Depolarising electrode for electric batteries, and process of manufacture. A. Nobecourt et Cie. Fr. Pat. 406,868, Sept. 8, 1909.

For the preparation of agglomerates, produced under pressure, the various parts of the metallic moulds are separated from the substances by insulating material, thus avoiding all contact with metal during the formation, and preventing the possibility of short-circuits. Suitable agglomerants, such as salts of zinc, are added to the mixture of manganese dioxide and carbon in order to increase the electrical output, and a layer of parchment paper, or white sized paper free from earthy impurities, is interposed between the walls of the outer envelope and the depolariser obtained as above.—B. N.

Catalysis of conducting or non-conducting liquids; Process and apparatus for the electric ——. J. L. F. Larat and Soc. Corbière et Lindeux. Fr. Pat. 407,550, Dec. 30, 1908.

The process is used for the extemporaneous preparation of "metallic ferments," employed in therapeutics, in which the metal is dissolved in a colloidal form. The liquid to be treated is divided into drops, each being acted upon by the electric spark produced between two conducting masses. The apparatus comprises a sleeve, adapted to receive a vessel containing the liquid, the bottom of the sleeve being provided with a movable electrode, rounded in form and perforated, so that the liquid forms on the electrode in drops. The sleeve may be displaced vertically, so that the distance between the electrodes may be regulated. Using metallic electrodes and water, colloidal solutions of metals, or "metallic ferments" are obtained.—B. N.

Process for obtaining hydrogen peroxide. Ger. Pats. 217,538 and 217,539. *See* VII.

Purifying water electrolytically. U.S. Pats. 951,311 and 951,313. *See* XIXb.

XII.—FATS; OILS; WAXES.

Importance of laboratory experiments for judging the character of rapeseed cakes. Jörgensen. *See* XIXa.

Vegetable oil trade of France. Oil, Paint, and Drug Rep., April 4, 1910. [T.R.]

The quantity of copra or cocoanut pulp imported into France during 1909 amounted to 141,080 metric tons, against 169,357 tons in 1908 and 110,008 tons in 1907, practically all of which came to Marseilles. A few thousand tons only were sent to other ports, principally Nantes and Havre. About 40 per cent. of these imports came from the Philippines, 29 per cent. from the Dutch Indies, 9 per cent. from British India, 8 per cent. from Mauritius, and the remainder from various countries. The total value of the product consumed in France during the past year was officially estimated at £2,044,500, the volume of business in the competing articles being valued as follows:—Peanuts (arachides), £4,511,000; linseed, £1,999,800; sesame, £892,000; mustard and Indian rapeseed, £864,000; poppy seed, £399,800; cottonseed (chiefly Egyptian), £262,000.

The following table shows tonnage arrivals of oil seeds at Marseilles:—

	1907.	1908.	1909.
Sesame	68,836	41,749	64,087
Peanuts—			
Shelled	113,219	85,653	170,012
Unshelled	123,304	102,188	155,056
Linseed	21,202	17,085	16,962
Rape and ravison	5,082	2,202	5,795
Poppy seed	4,106	2,334	2,356
Castor seed	16,370	18,111	11,553
Polghère	520	709	1,818
Cottonseed	15,884	14,497	14,249
Niger and kapok	6,351	3,701	5,118
Copra	109,744	163,999	136,655
Palm kernels	4,412	1,675	3,639
Mowrah, illipe, etc.	12,781	11,146	8,856
Totals	501,811	465,049	596,156

The only vegetable oils imported to any considerable extent in Marseilles are cottonseed, olive, and palm oils. The average importations of these oils in the last five years were approximately as follows:—Cottonseed oil, 24,000 tons; olive oil, 22,000 tons; palm oil, 16,000 tons.

There are nine firms in Marseilles engaged in the extraction of copra oil. Their total production in 1909 is estimated at about 85,000 tons, two-thirds of which is used for soap-making and the remainder for the manufacture of cocoa butter. The yield of oil from copra varies from 60 to 66 per cent. The production of cocoanut butter, which has a wide sale in France for cooking purposes, is controlled by three firms located in Marseilles. The exports of cocoanut oil from France in 1909 amounted to 23,840 tons, and the local exports to 22,726 tons, the principal importing countries being England, United States, Switzerland and Austria in the order named.

Patents.

Fats and oils; Method for the decomposition of —— into fatty acids and glycerin. C. C. L. G. Budde and W. Robertson, Edinburgh. Eng. Pat. 5715, Mar. 9, 1909.

The oils or fats are heated, and mechanically agitated with water and sulphurous acid gas, under pressure in a closed vessel or autoclave. The advantages claimed for the process are that the contents of the vessel are free from foreign matter introduced by reagents and need no purification; that the liberated glycerin is in the form of a pure and concentrated solution; that no permanent emulsion is formed; and that the fatty acids are not discoloured. —C. A. M.

Soya-bean oil; Manufacture of ——. L. E. Common, Sutton-on-Hull, and The Hull Oil Manufacturing Co., Ltd., Hull. Eng. Pat. 5797, Mar. 10, 1909.

The solution of the oil in the volatile solvent by means of which it was extracted is treated with a small proportion of sodium chloride or other chloride of an alkali or alkaline earth metal and the residue, after removal of the solvent by distillation with steam is allowed to stand until the oil separates from the brine. The latter will retain the waxes and albuminous substances from the bean, and these may subsequently be separated as a deposit from the brine, the supernatant portion of which may be used again. —C. A. M.

Fatty acids; Process for preparing certain unsaturated —— from natural oils. A. L. Arnaud and S. Posternak, Paris. Eng. Pat. 24,721, Oct. 27, 1909. Under Int. Conv., Dec. 28, 1908.

Oils containing glycerides of unsaturated fatty acids of the oleic acid series (*e.g.* olive or almond oil) are saturated with bromine at a low temperature. The resulting brominated oils are treated with alcoholic potassium hydroxide solution under pressure, the soap (after separation of potassium bromide by treatment with warm alcohol) is dissolved in boiling water, and the stearolic acid liberated by the addition of a mineral acid. This crude acid is purified by being converted into its acid potassium salt, which is recrystallised from alcohol, and finally dissolved in water, and decomposed with a mineral acid.—C. A. M.

Soap-cooling frames. A. G. Bloxam, London. From A. Jacobi, Darmstadt, Germany. Eng. Pat. 9590, Apr. 22, 1909.

Relative change in the position of the cooling plates with respect to the mould frames, is prevented by constructing such plates with projections, or the like, which engage with corresponding cavities in the mould frames. These projections may consist of pieces fixed to the edges of the plates and extending beyond the cooling surfaces, or of a surrounding fillet, or they may be upon the edges of the faces of the plate. It is stated that in this manner mould frames, having comparatively thin walls, may be used without danger of bulging.—C. A. M.

Soaps; Process of preparing scouring and other household —— containing fullers' earth. N. Sulzberger, New York. U.S. Pat. 951,155, March 8, 1910.

The fullers' earth incorporated with the soap is that which has previously been used in deodorising and decolorising cottonseed oil, or in the treatment of other substances of an oily or fatty nature. Emulsions containing soap or unsaponifiable matter may also be incorporated with such spent fullers' earth.—C. A. M.

Fatty acids of the general formula, $C_nH_{2n-4}O_2$; Process for preparing unsaturated —— from natural oils. A. L. Arnaud and S. Posternak. Fr. Pat. 407,412, Dec. 28, 1908.

See Eng. Pat. 24,721 of 1909; preceding.—T. F. B.

Cleansing agents; Process of making ——. A. Kobe, Fr. Pat. 407,371, Sept. 25, 1909. Under Int. Conv., Nov. 26, 1908.

See Eng. Pat. 21,742 of 1909; this J., 1910, 363.—T. F. B.

Vulcanite; Preparation of a substance similar to —— from resins, waxes, etc. Ger. Pat., *See* XIV., 219,305, 1907.

XIII.- PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead ; Preparation of —— from impure lead sulphate. H. Hof. Chem.-Zeit., 1910, **34**, 266.

Impure lead sulphate (or other lead residue) is treated at boiling temperature with magnesium chloride solution, the source of the latter being the final mother liquor of potassium chloride manufacture. A double chloride of lead and magnesium is formed, together with magnesium oxychloride or magnesium sulphate. The double chloride is decomposed by means of a paste of magnesium hydroxide, which has previously been prepared by the action of milk of lime on boiling magnesium chloride mother liquor. The paste is brought into contact with the lead-magnesium chloride, and the mixture is thoroughly agitated, until all the lead chloride has been converted into oxychloride. An equal volume of magnesium hydroxide paste is again added with thorough stirring, and the solution, which is now free from lead, is drawn off. The residue is suspended in water, treated with a current of carbon dioxide, washed with hot water, and yields, when dry, a white powder in the finest state of division.—O. R.

Petroleum derivatives and resinous products ; Determination of —— in turpentine oil. P. Nicolardot and L. Clement. Bull. Soc. Chim., 1910, **7**, 173—176.

Resin acids and other resinous products may be determined in turpentine oil by oxidising the liquid with nitric acid, filtering off the mass that falls to the bottom, and treating it with chloroform. The resulting solution is evaporated, and the residue weighed. Pure fresh oils of turpentine properly prepared, should not yield more than about 10 grms. from 50 c.c. Commercial samples pure, but old, yield from 13 to 18 grms., whilst a freshly-prepared turpentine oil to which had been added 5 per cent. of rosin oil yielded 16 grms., and 22 grms. after an addition of 10 per cent. of rosin oil. A rapid method of determining petroleum products is based upon the oxidation of pinene by mercurous acetate, with the formation of a product which is no longer volatile with steam. The oil of turpentine (50 c.c.) is boiled for one hour under a reflux condenser with a solution of 70 grms. of mercurous acetate in 150 c.c. of glacial acetic acid, after which the liquid is distilled and the volume of hydrocarbons thus separated is measured. This represents the amount of petroleum derivatives present, since the oil of turpentine is completely oxidised. "White spirits," however, are not quantitatively removed, since certain of their constituents combine with the mercurous acetate, but the amount thus fixed is very small.

—C. A. M.

Miscibility curves ; Use of —— in the analysis of oil of turpentine. M. Vezes. Comptes rend., 1910. **150**, 698—700.

The author agrees with Louise (this J., 1910, 438) that aniline is the best reagent to use in the analysis of oil of turpentine by means of the miscibility curve, but claims priority in its use. The curve he obtained with "white spirit" (light petroleum), differs, however, considerably from that obtained by Louise. The difference appears to arise from the variety of products known as "white spirit": the proportion found by this method will therefore, depend to some extent on the standard of "white spirit" taken. It is pointed out that aniline being a base, the degree of acidity of the turpentine has a marked influence on the reciprocal solubility. The presence in turpentine of 5 per cent. of resin (of shade M and having an acidity equal to 163 mgrms. of potassium hydroxide per grm.) caused a displacement of the curve equal (but in the opposite direction) to that caused by an addition of 40 per cent. of "white spirit," the presence of which would thus be masked. It is necessary therefore that the test should not be applied to the turpentine itself, but to one of the fractions obtained in the usual distillation, and the neutrality of which has been ascertained.—A. Sbld.

Patents.

Ultramarine blues ; Manufacture of ——. F. Bellet. Fr. Pat. 407,089, Dec. 21, 1908.

The raw material is subdivided into small parcels, each contained in a bag made of paper or similar substance, before being placed in the retort or muffle. On heating, the paper becomes carbonised and a free passage of air is secured between the various parcels of raw material. This method of packing results in a much more uniform product than when the raw material is simply loaded direct into the retort or muffle. The withdrawal of the product is also rendered easier.—E. W. L.

Lithopone insensitive to light ; Production of ——. Gademann und Co. Fr. Pat. 407,642, Aug. 23, 1909.

Lithopone which remains white when exposed to the action of light is obtained by mixing ordinary lithopone with a phosphate or silicate of an alkaline-earth, together with free alkali, or other alkaline salt or compound. The addition may be made at any stage of the process, or to the finished product. For example, a good lithopone is obtained by adding to the finished product (ordinary lithopone) three per cent. of calcium phosphate or of barium silicate, and two per cent. of sodium carbonate. Sodium or potassium silicate may be added instead of sodium carbonate. The addition of the two ingredients may be made either simultaneously or consecutively.

—E. W. L.

Pastel colours ; Process for fixing ——. E. Froboese Ger. Pat. 218,313, Nov. 13, 1906.

Claim is made for the use of a mixture of gelatin, water, and 96 per cent. alcohol for fixing pastel colours. It is stated that with this medium the shade of the colours is not affected in any way.—A. S.

Inks, drawing inks (Indian ink, etc.) and other water colours ; Process for the improvement of ——. W. Ostwald. Ger. Pat. 218,531, Dec. 23, 1908.

It has been found that by the addition of small quantities (from 1 : 100 to 1 : 1000) of volatile organic compounds of the aliphatic series, which are soluble in water, at least to a small extent, and contain not less than four atoms of carbon, inks, drawing inks, and other water colours are rendered capable of readily marking such surfaces as parchment, ivory, waxed paper, etc. In the case of neutral liquids, an alcohol, ester, or other neutral substance is used, whilst to acid inks, free fatty acids, such as valeric or caproic acid, may be added.

—A. S.

Iron and steel ; Process for painting ——. H. de Seldeneck. Fr. Pat. 407,179, Sept. 20, 1909.

The iron or steel is first coated with a layer of oxide or sulphide, by treatment with iron salts, chromic acid, etc., or with the sulphide of aluminium, magnesium, etc., and the surface is then treated with an organic reducing agent, such as aniline, which on oxidation yields a colouring matter (aniline black) or which yields a colouring matter under the action of sulphur. These reagents may be applied as a paint consisting of the colouring agents, the oxidising agents, and the sulphurising agents together with a medium such as turpentine or linseed oil.—E. W. L.

Varnish ; Manufacture of ——. E. H. Strange and E. R. Burrell, London. Eng. Pat. 4878, Feb. 27, 1909.

In carrying out the process claimed in Eng. Pats. 5402, 5403, and 5404 of 1902 (this J., 1903, 307), the operation is rendered safe and the use of cumbrous apparatus avoided by effecting the solution with only a portion of the excess of solvent required in the finished varnish and at a pressure not exceeding or only slightly exceeding 250 lb. to the square inch. The solvent may consist of a fraction from the distillation of shale oil or petroleum, and the solution may subsequently be rendered sufficiently consistent by the addition of another volatile fraction from the distillation of those oils or by the addition of turpentine or rosin at a lower temperature. The pressure may be kept comparatively low by using a digester with a distilling head-pipe, or the like, which, being left open during the operation, allows distilled solvent to pass off, preferably into a condenser.—C. A. M.

Ultramarine blues; Apparatus for the manufacture of —— and like processes. F. Bellet, Paris. Eng. Pat. 17,277, July 24, 1909.

See Fr. Pat. 403,247 of 1908; this J., 1909, 1320.—T. F. B.

Coating materials [with tung oil]; Process for ——. J. M. Talmadge. Fr. Pat. 406,666, Aug. 31, 1909.

See U.S. Pat. 933,598 of 1909; this J., 1909, 1050.—T. F. B.

Gums, gum resins, resins, and balsams and their compounds; Process for the complete purification or refining of ——. H. W. Johnson. Fr. Pat. 407,074, Sept. 17, 1909. Under Int. Conv., Sept. 30, 1908, and March 23, 1909.

See Eng. Pats. 20,529 of 1908 and 6917 of 1909; this J., 1909, 1148.—T. F. B.

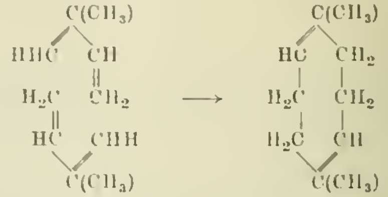
XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Extraction of —— from rubber-yielding plants and parts of plants. E. H. Blüher. Gummi-Zeit., 1910, **24**, 902—903.

The rubber extracted from "Dead Borneo" (pontianac, besk, gutta-jelutong) constitutes a good medium sort. 10 kilos. of unwashed "Dead Borneo" gave 1·165 kilos. of dry rubber melting at 140° C., and containing 4·3 per cent. of resin and 3·7 of ash. In undertaking the extraction, care must be exercised in the selection of the crude product. The main points to be observed are that the section should be perfectly white, with no dark spots, and that the block should be very moist—dry, crumbly blocks yield a valueless product. A block which is light in weight is probably a poor sample. The gum should be kept as moist as possible and stored in a place protected from light. There are a number of other plants which yield a product from which a still better rubber may be obtained by extraction, *e.g.*, Almeldina (Morocco potatoes) Euphorbia, etc. The reason that some of these products are not commonly on the market is said to be that they are absorbed by manufacturers of rubber goods directly connected with the extraction enterprises. —E. W. L.

Caoutchouc; Preparation of —— by artificial means. C. Harries. Chem.-Zeit., 1910, **34**, 315—316.

The author has failed in his attempts to convert isoprene into caoutchouc by the action of hydrochloric acid, neither has he been able to repeat successfully the process described in Heinemann's patent (this J., 1908, 1075). He has found, however, that by heating isoprene with glacial acetic acid at a temperature a little above 100° C., in a sealed tube, a product identical in every respect with natural caoutchouc is obtained. Pure synthetic isoprene is more readily polymerised by this means than is the isoprene obtained by the distillation of rubber. The conditions under which the polymerisation is carried out must be rigidly adhered to, or nothing but oily or resinous products will be formed. At the moment this synthetic rubber is possessed of only scientific interest on account of its high cost of production. The condensation of two molecules of isoprene to form the simple unit of the caoutchouc molecule, resembles the additive reactions between compounds with conjugated double linkages, and may be represented as follows:—



The possibility of the preparation by analogous means of homologes of caoutchouc is also referred to.—E. W. L.

Rubber solutions. F. Ahrens. Chem.-Zeit., 1910, **34**, 266.

To obtain concentrated "solutions" of rubber, of great adhesive power, for practical purposes, small pieces of pure Para rubber are specially picked, cleaned from crust, boiled in water, and dried at 60° C. The dried pieces are then introduced into the solvent and allowed to remain in it, without stirring, until they have absorbed ten times their weight of solvent. After a few days the product is gently and regularly stirred in a mechanical mixer. Such 10 per cent. "solutions" have as great adhesive properties as "solutions" containing 18 per cent. of rubber, previously subjected to prolonged kneading between heated rollers, and are much less susceptible to oxidation. With amyl acetate as solvent, true solutions of Para rubber can, it is stated, be obtained. To that end the rubber, first treated as in the case of the 10 per cent. "solutions" above, is allowed to rest for eight days in amyl acetate, with exclusion of daylight, and in the absence of artificial heat and agitation. A 10 per cent. solution, so obtained, could be filtered through ordinary filter paper, was of a light amber colour, and yielded pure white rubber when treated with alcohol. On evaporation in the dark it yielded films of perfectly normal Para rubber.—O. R.

Caoutchouc; Determination of —— as tetrabromide. G. Fendler. Gummi-Zeit., 1910, **34**, 931—932.

The author points out a probable source of error in the experiments published by Hübener (this J., 1910, 364). In the light of observations by Spence (this J., 1907, 1287) and also by the author, there is no guarantee that the insoluble portion of the rubber brominated by Hübener was free from actual rubber. Spence found that months were required in order to completely free it from rubber, whereas Hübener's separation was completed in 24 hours. It is also pointed out that the author's criticisms (Fendler and Kuhn, this J., 1907, 1288) was directed not against the tetrabromide method itself, but against certain details of Budde's method of carrying it out.—E. W. L.

Patents.

Rubber and resins; Extraction of —— [from "Dead Borneo"]. P. Sausse. Fr. Pat. 407,026, Sept. 15, 1909.

"Dead Borneo" is sheeted, dried in dry air, or in a chamber containing calcium chloride, and is then digested in a closed vessel with a mixture of carbon bisulphide and acetone, until a concentrated extract of the resins is obtained. The resinous liquid is then decanted off, a fresh quantity of solvent added, and the gum again agitated with it. The resins are completely extracted in about two hours and a half. The rubber which remains is washed with water containing a little acetic acid, and is then sheeted, washed with water, and dried in the air. The solvents are recovered and the resins utilised for the manufacture of varnishes. Various essential oils having an odour similar to that of oil of roses may, it is stated, also be extracted from the resins.—E. W. L.

Rubber ; Apparatus for devulcanising ——. E. W. Snyder, Olathe, Kans. U.S. Pat. 951,974, Mar. 15, 1910.

The apparatus consists of a heating chamber on the floor of which are fitted rails or tracks. A frame is mounted on these rails and supports a rotating devulcanising chamber, a door at one end of the heating chamber being provided so that the devulcanising chamber can be introduced into, and withdrawn from, the heating chamber. The shaft on which the devulcanising chamber is mounted connects with a rotating shaft entering the end of the heating chamber opposite to the door.—W. P. S.

Waste [vulcanised] rubber ; Devulcanisation and regeneration of ——. J. C. Bongrand. Fr. Pat. 407,146, Sept. 18, 1909.

One part by weight of finely-ground waste is added to 2 to 3 parts of melted paraffin wax (or other oil or fat), and heated at 130° to 150° C. until it is completely dissolved. Lead acetate, or other suitable salt of a heavy metal, is added to the hot mass, and the mixture is thoroughly agitated, in order to precipitate the sulphur as metallic sulphide. The mass is then either (1) extracted with acetone, which removes the paraffin wax as well as oils, resin, etc., and leaves the regenerated rubber still containing all other loading materials ; or (2) cooled, dissolved in benzine, petroleum ether, or other solvent of unvulcanised rubber and paraffin wax, the solution freed from mineral matter by decantation or filtration, and the rubber recovered after concentrating the liquid at a low temperature, by precipitation with warm acetone. The rubber is washed with boiling acetone and dried, preferably *in vacuo.*—E. W. L.

Vulcanite : Process for the preparation of a substance similar to —— from resins, waxes, and filling materials. C. Heinrichsdorf and R. Zimpel. Ger. Pat. 219,305, April 12, 1907.

Resins (colophony, shellac), waxes (beeswax, ceresin, etc.), and filling materials (cork, cellulose, kieselguhr, chalk, etc.) are mixed, in a finely-divided condition, with wood pitch, the mass is heated to about 130° C., pressed into the desired forms, and then again heated to a temperature not sufficient to cause the mass to liquefy.—A. S.

Vulcanisation of rubber ; Process for the ——. I. Bloch. Ger. Pat. 219,525, Oct. 27, 1908.

The claim is for the cold vulcanisation of rubber by means of hydrogen persulphides (this J., 1908, 748) or solutions of the same, either alone or in presence of substances which accelerate the decomposition of the persulphides. For example the persulphides may be dissolved in carbon bisulphide or acetone, and the solutions may be spread over solid caustic soda, sodium carbonate, magnesia, etc. —A. S.

Rubber ; Utilisation of waste ——. A. Gentzsch, Vienna. U.S. Pat. 951,811, March 15, 1910.

See Fr. Pat. 370,872 of 1906 ; this J., 1907, 265.—T. F. B.

Rubber ; Recovery of —— from vulcanised rubber. R. Hutchinson, R. Milne, R. F. and C. A. Hutchinson. Fr. Pat. 407,000, Sept. 14, 1909. Under Int. Conv., Nov. 6, 1908.

See Eng. Pats. 23,627 and 26,643 of 1908 ; this J., 1909, 1212.—T. F. B.

Elastic foam or a sponge-structure of a volatile solution of rubber or other like substance ; Process for manufacturing an ——. F. Laarmann, Dresden, Germany. Eng. Pat. 13,390, June 8, 1909. Under Int. Conv., June 23, 1908.

See Fr. Pat. 402,996 of 1909 ; this J., 1910, 35.—T. F. B.

Plastic and elastic substances ; Production of ——. L. Berend, Crefeld, Germany, Assignor to Commercial Products Co., Ltd., London. U.S. Pat. 952,724, March 22, 1910.

See Fr. Pat. 402,028 of 1909 ; this J., 1909, 1212.—T. F. B.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Denaturing of salt ; Damage caused to hides by unsuitable preserving agents used for the ——. J. Paessler. Collegium, 1910, 109—110, 114—118.

The most common denaturing agents mixed with salt are petroleum, alum, and sodium carbonate. The presence of alum is very objectionable in salt used for preserving hides. In cases where it has been used, the hide has been found to be marked, both on the flesh and grain side, with flecks of a porcelain-like or pale yellow appearance. Short hair is found to be left in the hide on the grain side in the neighbourhood of these spots, which is only removable with extreme difficulty and damage to the grain. In the tanned leather the defect is apparent in damaged grain and short hairs, and also, in the case of vegetable-tanned goods, in spots of a yellower colour than the surrounding leather. In all cases the presence of alum was detected in the altered portions. The formation of the spots is explained as follows. The alum is imperfectly mixed in crystals among the salt and where a crystal is left in contact with the hide, a tawing action takes place. The alum is not completely washed out in the soaks and on entering the lime liquors, insoluble alumina and calcium sulphate are precipitated in the hide, which hinder the loosening of hair in these places and the grain is damaged by the force which must be used to remove the hair. When placed in a vegetable tanning liquor, a compound of alumina and tannin or "tannin lake" is formed, which causes a spot of a yellower colour than the rest of the leather. It has been suggested that alum may be present in the salt as a natural impurity, but the author is not of this opinion. Alum is not detrimental in salt used for pickling in chrome tanning or tawing. Petroleum and sodium carbonate are suitable denaturing agents, no defects being apparent in goods treated with salt with which these materials have been mixed.
—D. J. L.

Quebracho extract. Comparison of the tanning effect of sulphited and non-sulphited ——. H. Franke. Gerber, 1910, 36, 93—94.

Quebracho wood, on extraction with hot water, yields a turbid liquor, the insoluble portion of which is greatly increased on cooling. Extraction with cold water would be expected to yield a liquor containing only the "easily soluble" tannins, but these for the most part also are only extracted by hot water. It is of great importance to remove the insoluble matter from the liquors before use. Clarifying by allowing to settle gives unsatisfactory results, the liquors being only partly freed from insoluble matter and also much tannin being carried down. A. Redlich has lately prepared a quebracho extract which is freed completely from insoluble matter without undergoing a chemical change as is the case with sulphited extract. Experiments with hide powder show this extract to have much superior weight-giving properties to those of sulphited extract. Equal weights of hide powder tanned in solutions of the two extracts containing the same amount of tannin, showed an increase of weight of 97·25

per cent. in the case of the non-sulphited extract as against 68·53 per cent. with sulphited extract. Experiments with calf skins on the large scale gave analogous results.
—D. J. L.

Tannin; Action of zinc oxide on ——. L. J. Iljin. J. prakt. Chem., 1910, **81**, 327—328.

THE author has previously described a substance obtained by boiling an aqueous solution of tannin with zinc dust for 15-20 hours (this J., 1909, 1151). Its production is stated to be due to the action of the zinc oxide formed. It is more conveniently prepared by vigorously boiling a solution of 100 grms. of tannin in one litre of water with 100 grms. of zinc oxide for four hours. It is extracted from the mixture and purified as formerly described (*loc. cit.*). On evaporating the mother liquors from the purified product, a small quantity of whitish flocks separated; the filtrate from this on evaporation to a syrupy consistence and drying *in vacuo* over sulphuric acid left a bulky brownish residue which resembles tannin in appearance. The concentrated aqueous solution of this substance did not gelatinise at ordinary temperatures. Its reactions resemble those of tannin in many respects, but the substance differs in its general properties.
—A. SBLD.

PATENTS.

Deliming skins; Process for ——. G. Eberle. Fr. Pat. 406,646, Aug. 30, 1909. Under Int. Conv., Aug. 31, 1908.

SKINS are treated at a temperature of 40° C. with anhydrides, lactones or lactides of acids, the calcium salts of which are soluble in water. At this temperature the compounds mentioned are slowly "dissociated," yielding free acid which combines immediately with the lime in the skins. There is thus no harmful effect of free acid upon the skins if excess of the deliming agents is avoided. The following are suitable; anhydrides of acetic, propionic, butyric, and lactic acids, the lactone of γ-hydroxybutyric acid, and the lactide of lactic acid. The last is obtained by heating pure lactic acid to 150°—160° C.; it is insoluble in water but may be suspended in the bath by mixing with kieselguhr or sawdust. As an example, if 100 kilos. of skin are treated with one kilo. of lactide in the drum for two hours, the result obtained is equal to that which would have been obtained with the dung bate.—D. J. L.

Tannin from vegetable materials; Batteries for extracting —— and concentrating by boiling. C. Bourdon. Fr. Pat. 407,504, Oct. 1, 1909. Under Int. Conv., July 9, 1909.

THE material is placed with water, in a vat provided with three inlet-pipes fitted with valves. The inlets are situated at the top, middle and bottom of the vat, and steam is blown in through them and circulation adjusted by opening one or other of the valves. The exit-pipe from the extracting vat communicates with another vessel in which the liquor is evaporated under atmospheric or increased pressure. In the latter case the steam may be used for blowing into the extractor. The evaporator is heated directly by a fire.—D. J. L.

Imitation leather; Manufacture of ——. G. H. Winterbottom and J. A. Egerton, Manchester. Eng. Pat. 12,687, May 29, 1909.

A FABRIC or other material is coated with a composition made from viscose incorporated with, say, about 1 per cent. of rubber, or with an oil or other similar substance to act as a softening agent, and with mineral matter, such as zinc oxide, and (if desired) a pigment. The material is then steamed or aged, and washed with water to remove soluble impurities.—C. A. M.

Artificial leather; Manufacture of a new ——. G. C. L. Forel. Fr. Pat. 407,654, Sept. 23, 1909.

THE product consists of a fabric united by means of an adhesive to a felted mass of fibres of animal or vegetable origin. The fabric is treated with a varnish to fill up the interstices to the extent of one-half of its thickness and coloured in such a way as to give the finished article the appearance of leather. The fibres attached to it are cemented together with caoutchouc, gutta-percha, balata, resins, gums, or gelatin. After calendering, the tissue-side is given the appearance of the grain of leather by printing, after treatment with collodion, linseed oil, gelatin, or caoutchouc.—D. J. L.

Hides or skins; Method of treating ——. C. J. Glasel, Boston. U.S. Pat. 952,703, March 22, 1910.

SEE Fr. Pat. 362,663 of 1906; this J., 1906, 770.—T. F. B.

XVI.—SOILS; FERTILISERS.

Potash; Determination of assimilable —— in soils. Bieler-Chatelan. Comptes rend., 1910, **150**, 716—719.

EXTRACTION of the potash from soils by water charged with carbonic acid gas is recommended as giving results much more in accordance with cultural experience than the usual methods of extraction by acids. A quantity of fine soil (corresponding to 30 grms. of dried soil) is shaken continuously for 10 hours with 500 c.c. of carbonated water, the liquid is filtered, and 400 c.c. of the filtrate (representing 24 grms. of soil) are evaporated to dryness in a platinum dish; the residue is gently incinerated and extracted with hydrochloric acid, the silica rendered insoluble, and the potassium oxide calculated from the platinum black obtained by reduction of the chloroplatinate with formic acid. Extraction of the soil by continuous washing or displacement more closely resembles the action of heavy rain and gives more accurate results than agitation with the carbonated water, but the latter method is more expeditious and indicates with sufficient accuracy whether or not a soil requires potash fertilisers. Excepting in special cases (such as soils rich in potash micas, strongly calcareous soils, exceptional conditions of aeration and drainage) soils of meadows which give less than 0·15 part per 1000 of potassium oxide, or less than 0·20 part per 1000, by the displacement method of extraction, will give decidedly better yields if potash fertilisers are used in addition to phosphatic manures. Calcareous soils give low results by this method owing to absorption of the carbonic acid and several extractions are necessary to extract all the assimilable potash. A single extraction is however said to be sufficient for all general practical purposes.—A. SBLD.

Manuring of heavy soils. Andre. Z. angew. Chem., 1910, **23**, 566—567.

NITROGENOUS manure should be applied in sufficient quantity, but sparingly, an excess being detrimental to the production of cereal grains. Calcium cyanamide is the most suitable manure for this purpose. Phosphoric acid is best supplied in the form of superphosphate. The efficacy of potash manures in heavy soils is not well established, but potash salts appear to be preferable to kainite, as the latter seems to harden the soil. The application of potash salts, in certain proportions and under certain conditions, is very beneficial to clover, but in the case of turnips it is sometimes objectionable, as cows fed on the turnips yield milk having a disagreeable odour and taste. Potash salts decrease the starch-content of potatoes. The lime-content of the soil is of importance and samples of the latter should be analysed from time to time to ascertain the quantity of lime present. Powdered limestone of the requisite degree of fineness may be applied, especially in the case of pasture land where a top dressing of quicklime would be injurious, but otherwise, quicklime is preferable.—W. P. S.

Phosphates; Effect of soluble salts on insoluble ——. J. E. Greaves. J. Biol. Chem., 1910, **7**, 287—319.

Contains a critical review of previous work on the action of various salts used as fertilisers, the increased yield being in part due to the solvent action exerted on the comparatively insoluble phosphorus compounds in the soil. The behaviour of salts in increasing the solubility of phosphates in laboratory experiments is also discussed. Further investigations with a variety of phosphates show that calcium and iron salts render phosphates less soluble; sodium, calcium, and ammonium sulphates, ammonium chloride and nitrate, and magnesium nitrate render phosphates more soluble. Sodium and potassium nitrate increase the solubility of calcium phosphate but decrease that of iron phosphate. Sodium and potassium chloride, magnesium chloride and sulphate have but little influence. The presence of soil with the phosphate causes the solvent to act more vigorously, particularly in the presence of ammonium nitrate.—E. F. A.

Influence of heavy nitrogenous manuring on the quality of beetroots. Strohmer and Fallada. *See* XVII.

Patent.

Fertilisers; Process of preparing mineral ——. E. Pohl, Honnef, Germany. U.S. Pat. 952,278, March 15, 1910.

See Fr. Pat. 381,975 of 1907; this J., 1908, 237.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Beetroots; Influence of heavy nitrogenous manuring on the quality of ——. Strohmer and Fallada. Oesterr-Ung. Z. Zuckerind. Landw., 1909, **38**, 708–729. Deutsche Zuckerind, 1910, **35**, 269—271.

An increased application of nitrogenous manure in the form of Chili saltpetre, ammonium sulphate or calcium cyanamide was found to favour the development of leaves, so that both the actual weight and the dry solid matter of the leaves were increased in greater proportion than in the roots. Even with the present highly cultivated roots the quality had under these conditions deteriorated, the percentage of sugar being lowered, the true quotient of purity being diminished and the amount of nitrogenous matters injurious to sugar manufacture and of inorganic substances increased. The amount of phosphoric acid was also increased.—L. J. de W.

[*Sugar cane*] *Bagasse and bagasse furnaces.* E. W. Kerr and E. M. Percy. Engineering, Feb. 18, 1910, 197—199. Louisiana Bulletin, No. 117.

The results of a number of tests carried out on actual installations in Louisiana and Cuba are fully detailed. Bagasse is comparatively very bulky, occupying some eight or ten times the space of an equal weight of coal. Being very porous, it carries a large amount of air into the furnace, and also holds an excessive quantity of moisture. The exact composition of bagasse depends much on the quality of the cane dealt with and the degree of crushing resorted to. As usually employed it consists of fibrous matter, 33 to 50 per cent.; a small quantity of sugar, about 7 to 10 per cent.; and moisture, from 32 to 56 per cent. by weight. The heating effect of the fibre and the sugar are practically the same, the percentages of carbon being 44·4 and 42·1 respectively, so that the total solid matter contained in the bagasse gives a definite indication of its fuel value, after due allowance is made for ash. This ash varies according to the class of cane, averaging from 1·58 to 2·24 per cent. of the solids contained in the bagasse. The following table, in which *a* refers to cane having 10 per cent. of fibre, and yielding a juice containing 15 per cent. of solids, and represents the conditions in Louisiana, and *b* refers to cane containing 12 per cent. of fibre and juice containing 18 per cent. of solids, and represents Cuban conditions, indicates the effect of varying degrees of extraction and also of the different classes of cane on the heating value of the resulting bagasse. In both cases the air temperature is taken as 80° F., and the chimney temperature as 500° F., and no allowance is made for ash. The net values are obtained by deducting from the total heat the amount absorbed by the gases of combustion and by the free and produced water. An allowance of 5 per cent. for radiation is also included.

		Bagasse.			Heat value per pound, B.T.U.		
						Net value.	
	Degree of extraction per cent. on weight of cane.	Moisture.	Fibre.	Sugar, etc.	Total.	No excess air.	50 per cent. excess air.
		per cent.	per cent.	per cent.			
(*a*)	70	56·7	33·3	10	3626	2209	2090
	75	51	40	9	4100	2666	2528
	80	42·8	50	7·2	4816	3345	3184
(*b*)	70	49·2	40	10·8	4254	2792	2662
	75	42·6	48	9·4	4807	3335	3174
	80	32·8	60	7·2	5628	4092	3906

In order to work satisfactorily with bagasse, the furnaces must have specially large flues and passages to deal with the greater volume of gases involved and specially designed combustion chambers must be used in order to allow these gases to mix thoroughly and ignite before passing to the heating surface of the boiler. This latter is of special importance on account of the very large proportion of moisture in the fuel. In general, there are three forms of furnace used:—The ordinary grate, the hearth, and the Dutch-oven; in addition there are various combinations of these types. The results of the tests do not point to any form or type being more effective than another, provided due care is taken in the proportions of the furnace. Apart from this the results obtained depend largely on the care and skill with which the furnace is operated. Calorimeter tests of the dried bagasse showed relatively small variations for the bagasse from the various plantations. The average values of the Louisiana and Cuban bagasse were 8368 and 8433 B.T.U. respectively, with a variation of 1 to 2·5 per cent. in the two cases. The proportion of ash in the dry bagasse is the chief factor affecting the heat value. Great variation is found in the quantity of fuel burnt per square foot of grate, the difference being from 44 to 197 lb. per hour. The best results were obtained with rates of 100 lb. or more. The average analysis of the flue gases was carbon dioxide, 9·01; carbon monoxide, 0·17; and oxygen, 9·83 per cent. An excess of 50 per cent. of air gives the best results. As a general rule with a lower ratio than 80 to 1 for heating surface to grate surface, an excessive chimney temperature was caused, the practice in the Cuban factories in this respect being better than in the case of Louisiana factories.
L. J. de W.

Saccharane, a definite chemical constituent of caramel. F. Ehrlich. Bull. Assoc. Chim. Sucr. et Dist., 1909, **27**, 140—141.

Saccharane is stated to be a definite chemical constituent of caramel, with an intense and constant colouring power. Its formula is $C_{12}H_{22}O_{11}.2H_2O$. It is obtained by heating sugar, *in vacuo*, in an oil-bath at 200° C. The caramelised mass is then extracted with methyl alcohol until the solvent is no longer coloured. The insoluble residue is taken up with water and evaporated *in vacuo*, after filtration. The yield is about 20 per cent. of the weight of sugar taken. It is proposed to employ saccharane as the standard for determining the colour-value of commercial caramels, by a colorimetric method, expressing the colouring power in terms of saccharane. Saccharane is not precipitated by lead acetate: it is soluble in water, non-hygroscopic and tasteless. Maltose, similarly heated, gives an analogous product of less tinctorial power. Dextrose, lævulose, and starch do not give similar products.—J. O. B.

Inositol in organic mixtures; Detection of ——. G. Meillére and P. Fleury. J. Pharm. Chim., 1910, 348—354.

The isolation of inositol present in organic mixtures, necessitates a preliminary defecation followed by precipitation of the inositol in a state of combination from which it may readily be liberated in a sufficiently pure condition. Basic lead acetate alone does not precipitate inositol completely: this is only effected if the liquid is rendered ammoniacal or if some substance, giving a precipitate with the basic lead acetate (*e.g.*, copper acetate or cadmium nitrate), is added. The detection of inositol is rendered more difficult by the presence of sugars; in such cases, the authors proceed as follows:—The liquid is first diluted to such a degree that its sugar-content (calculated in terms of dextrose) does not exceed 0·5 per cent. It is then defecated, normal lead acetate being used for plant extracts, whereas lead acetate and mercuric acetate are used if the liquid is of animal origin: the defecation is effected in a slightly acid medium (about 3 c.c. of *N*/1 acid per litre). The precipitate is removed by centrifuging or by suction. The filtrate is neutralised and then treated successively with basic lead acetate, cadmium nitrate and ammonia so long as each of these reagents yields an appreciable precipitate, stages which are easily determined if the liquid is cleared by centrifuging. The precipitate contains all the inositol, but it also contains a considerable quantity of sugar; it is collected by centrifuging, washed, and decomposed with sulphuretted hydrogen. The solution thus obtained is freed from sulphuretted hydrogen and neutralised, the inositol then being precipitated afresh with basic lead acetate and cadmium nitrate. The authors have thus been able to recover, almost entirely, and to characterise distinctly, 1 part of inositol present in a solution containing 1000 parts of dextrose. The method is generally applicable to plant and animal juices, fermented liquors, urine, etc., though it sometimes requires modification. *Fermented beverages.*—One hundred c.c. of the liquid (wine or vinegar) are evaporated to dryness on the water-bath, the residue being taken up with 50 c.c. of water and treated with barium hydroxide solution so long as a precipitate is formed. The precipitate is filtered off, the filtrate being freed from excess of barium by a current of carbon dioxide, and filtered again: the filtrate is slightly acidified with acetic acid and treated with lead acetate solution (1 : 3) so long as a precipitate forms. The precipitate is removed by centrifuging, the liquid being exactly neutralised, and precipitated with basic lead acetate and cadmium nitrate as described above. *Animal or vegetable juices or extracts.*—No general rule can be laid down, though for the most part a thorough defecation of the liquid with subtsances that do not precipitate inositol (a judicious application of barium hydroxide, acetates of lead, mercury, and copper) followed by precipitation of the inositol with basic lead acetate alone or in conjunction with cadmium salts, is sufficient.—L. E.

Starchy matter; Coagulation of —— *by freezing.* G. Malfitano and A. Moschkoff. Comptes rend., 1910, **150**, 710—711.

A solution of potato starch, frozen to a solid mass, and then melted, yields the greater part of the starchy matter as a thread-like coagulum in a limpid liquid, the latter containing nearly all the mineral matter in addition to the remaining small quantity of starchy substance. On heating the coagulum (separated by filtration or centrifugally) with distilled water, freezing the mixture, and then melting, practically all the starchy matter is coagulated and the liquid only contains traces of mineral matter. On repeating the process, the liquid contains practically no dissolved matter and only gives a rose colour with iodine. The starchy substance only forms heterogeneous mixtures with water even on warming, and is deposited on cooling. Addition of electrolytes, such as strong acids and bases, to the mixture, however, causes the liquid obtained after freezing to again give a blue colour with iodine; with much larger additions nothing separates. Weaker electrolytes such as neutral salts have a similar but feebler action. The amount of starchy matter remaining in colloidal solution, after freezing depends entirely on the nature and amount of the electrolyte present. The starchy substance can therefore, be regarded as an insoluble body forming colloidal solutions when associated with electrolytes, and the freezing of dilute solutions is the best method of purifying it.—A. Sbld.

Reactions of fermented sugar solutions. C. Neuberg. *See* XVIII.

Detecting sucrose in wine, "Weissbier," etc. Rothenfusser. *See* XVIII.

Patents.

Sugar; Process and apparatus for preventing —— *and other extract solutions from clouding or discolouring when being cooled.* J. Hawley, Ltd., and S. H. Saunders, Liverpool. Eng. Pat. 5438, March 6, 1909.

The solution (of sugar, etc.) is cooled in a partial vacuum. The apparatus comprises a closed container, which may be partly or wholly jacketed, and contains a rotating appliance, through which and also through the jacket a cooling liquid such as water may be passed. The container is connected with means for diminishing the pressure.
—T. H. P.

Heating the beet slices in the diffusion process; Method of ——. H. Steckhan. Ger. Pat. 216,836, Feb. 26, 1908.

The juice in the freshly-charged diffuser is circulated not only through a heater, but also through one or more of the preceding diffusers, and simultaneously, juice is withdrawn from another, say the third, of the preceding diffusers.—A. S.

Carbohydrates into hydrocarbons; Process for converting ——. A. Heinemann. Fr. Pat. 407,204, Sept. 21, 1909.

See Eng. Pat. 13,252 of 1908; this J., 1909, 1157.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Brewing; Practical notes on certain current questions in ——. E. Moufang. Woch. f. Brau. 1910, 27, 157—159.

Regeneration of yeast by phosphoric acid and phosphates.—Phosphoric acid has a markedly favourable effect in purifying degenerated or infected yeast, most of the infecting organisms being killed and the vigorous yeast cells alone surviving. After treatment with phosphoric acid alone, the yeast does not settle readily, and presents considerable difficulty in washing, but this drawback does not attend the use of primary or secondary phosphates. The treatment may be carried out in two stages, thus:— The separated yeast is treated for one hour with a 3·3 per cent. solution of phosphoric acid, or for a longer time with a weaker solution, at a temperature not exceeding 18° C. After pouring off the supernatant acid liquor, the difficulty of washing is overcome by adding to the residue sufficient alkali to form the primary, or at the highest, the secondary phosphate, after which the yeast behaves quite normally in washing. Remarkably satisfactory results have been obtained in practice by this treatment, the attenuating power of the yeast having been considerably increased.

Determination of malting loss from the 1000*-corn weight.*— The determination of the loss of weight which occurs during the malting process, by weighing 1000 corns of the barley and the malt respectively, is only reliable if both the barley and the malt be graded through sieves, and the 1000-corn weights of equally graded corns of each compared together.

Notes on the hot-water steeping process.— Reports on the working of the hot-water steep record an improvement in both colour and flavour, particularly of pale beers, and a considerable diminution of the loss in malting. The undesirable colouring and flavouring principles of the husks are eliminated in the steep waters, and the warm water has a favourable influence on the enzyme-activities in the grain. Less time is occupied in steeping, less time and labour in turning and preparing the couches. The loss of weight in malting is reduced by 1·5—3·0 per cent. calculated on barley dry-weight, with a product of equal quality.

Preparation of pale, well dried malts.—For the preparation of pale malts it is desirable to bring the green malt to the kiln with as little moisture as possible. Barley which has been restricted in the steep requires very careful handling on the floor to prevent premature withering. The author considers that the steeping water may be absorbed in two ways: "active" moisture, which is necessary, and superfluous moisture. With the hot-water steep, the penetration and distribution of the moisture in the interior of the corn are more perfect, and sufficient "active" moisture is absorbed with less total moisture than in the cold-water process. The couches can be set up much drier, and the supersaturation and gelatinisation of the outer layers of the corns are avoided, so that the green malt is more rapidly dried.

Use of barley husk extract as a colour standard.—A dark-coloured barley is steeped for two hours with water at 50°—60° C., with the addition of a few drops of ammonia. The extract is filtered and acidified, and the precipitate is collected, washed, re-disolved in dilute ammonia and re-precipitated with acid. A 0·2 per cent. solution of this substance in dilute ammonia is eminently suitable as a colour-standard, even for "colour" malts.—J. F. B.

Yeast-poison in yeast, peptone and wheaten flour. F. Hayduck. Woch. f. Brau., 1910, 27, 149—151. (See this J., 1908, 85; 1909, 486; 1910, 103).

Further investigations show that the albumoses salted-out from solutions of Witte's peptone by means of zinc sulphate or ammonium sulphate exert a poisonous action on bottom-fermentation beer-yeast in presence of aqueous sucrose solutions. Also, on extracting wheat flour with 0·2 per cent. hydrochloric acid solution and subsequently neutralising the liquid, a precipitate is obtained which is extremely poisonous to bottom yeast; the filtrate from this precipitate, on addition of ammonium sulphate, yields a substance which also exerts an intense poisonous action on the yeast. Further, when yeast (race K), without drying, and composed mainly of living cells, is ground with sand and kieselguhr and extracted with water, the solution, when treated with ammonium sulphate and a small proportion of sulphuric acid gives a precipitate distinctly poisonous to yeast. T. H. P.

Enzymes; Filtration of ——. M. Holderer. Comptes rend., 1910, 150, 790—792.

Catalase like the enzymes previously studied (this J., 1910, 103, 292) does not pass through a porcelain filter if the medium is neutral to methyl orange but passes through easily when the medium is neutral to phenolphthalein. The filter is impermeable to pepsin when the solution is neutral to methyl orange, but permeable in a faintly acid medium or one neutral to phenolphthalein. The addition of salts, for example 1 per cent. of ammonium sulphate to the medium neutral of methyl orange, enables the pepsin however, to pass through the filter without loss of activity. Precipitated emulsin when triturated with water to form an opalescent solution is retained by the filter whatever the reaction of the medium. Solutions in $N/10$ sodium carbonate, subsequently diluted with much water, follow the usual rules; the enzyme passes through the filter in alkaline solution, but is retained in a medium neutral to methyl orange. Contact with the sodium carbonate solution rapidly destroys the enzyme. The precipitation of protein by acetic acid from an aqueous extract of sweet almonds is complete when the medium is neutral to methyl orange. This filtrate passes readily through paper and the enzyme passes through the porcelain filter whatever the reaction of the solution. If however acetic acid is not added to remove the protein, filtration of the enzyme is entirely prevented. In general the addition of alkali favours the solution and filtration of enzymes but in some cases the same result is obtained on using neutral salts or acids.— E. F. A.

Enzymic action; Influence of neutral salts on ——. E. Starkenstein. Biochem. Zeits., 1910, 24, 210—218.

Preparations containing diastase (from the liver) became inactive when dialysed, but their activity was restored, to a certain extent, by the addition of sodium chloride. The activity of preparations of lipase and pepsin was also greatly reduced by dialysis, and naturally in these cases the activity could not be restored by the addition of sodium chloride. The experiments with the diastase indicated that a definite quantity of sodium chloride was required by the molecule of the enzyme in order to attain its optimum activity, and that it was thus not the relative but the absolute amount of the stimulative neutral salt that was of importance. The results also showed that it was only in the case of hydrolytic enzymes that neutral salts had any pronounced stimulative action. From further comparative experiments upon the action of diastase upon rice starch and soluble starch, the author concludes that no chemical combination takes place between the enzyme and the substratum, and that the adsorption of the enzyme by starch in suspension must be regarded as a purely physical phenomenon quite independent of the action of the enzyme.—C. A. M.

Fermented sugar solutions; Reactions of ——. C. Neuberg. Biochem. Zeits., 1910, 24, 430—434.

Solutions of pure dextrose and pure sucrose were fermented with yeast as completely as possible, and the liquids filtered and concentrated. In each case the filtrate was optically active, the rotation sometimes being dextrorotatory and sometimes lævo-rotatory, and corresponding to percentages of dextrose, according to the instrument's indications, lying between − 1·3 per cent. to + 0·9 per cent. (apparent). In no instance did the concentrated liquids reduce Fehling's solution, but occasionally a reduction of alkaline ammoniacal silver solution took place on heating. Contrary to the experience of many observers, the fermented sugar solutions invariably gave the α-naphthol reaction for carbohydrates, but no distinct result was obtained in Tollens' phloroglucinol test. In 5 cases out of 17 there was a positive orcinol reaction, whilst in two instances carbonylic acids could be detected with certainty by the test with naphthoresorcinol, hydrochloric acid, and ether. Lactic acid was usually present. Albumen was not found, although in several of the experiments there was a pronounced coloration in the biuret test. Amino-acids could not be isolated—a fact that supports Ehrlich's statement that they are fermentable by yeast. Purines were precipitated from the liquids by cold ammoniacal silver solution, and phosphoric acid in inorganic and organic combination was found. After successive treatment with phosphotungstic acid, baryta water and lead acetate, a slight reduction of Fehling's solution could be observed in some instances, and after treatment of the liquids with concentrated hydrochloric acid on the water-bath, there was a pronounced reduction, probably due to hydrolysis of reversion products, nucleic acid, etc. The optical rotation of these liquids was also slightly increased in the dextro-rotatory direction. It would appear that the optical rotation of fermented sugar solutions is to be attributed to a complicated mixture of substances, produced partly by synthetical processes during the fermentation, and partly by the autolytic proteolytic decomposition of the cellular substance of the yeast.

—C. A. M.

Immersion refractometer in distillery control ; Uses of the Zeiss ——. A Frank-Kamenetzky. Z. angew. Chem., 1910, **23**, 293—301.

THE Zeiss immersion refractometer is capable of taking as important a place in the control of fermentation industries as the Balling saccharimeter. When provided with the very convenient temperature regulator of Löwe, observations may be made in the distillery itself in a few minutes. Refractometer observations alone, when applied to a wort in fermentation, give an accurate record of the course of attenuation, since the refraction constantly diminishes as attenuation proceeds. Combined observations with saccharimeter and refractometer yield perfectly reliable determinations of the alcohol and residual extract in the wort at any stage. It must be borne in mind that the extracts of different materials have different refractive powers, and the author has constructed the following tables for use with the two instruments. In these tables : (*a*) refers to potato mashes digested under high pressure ; (*b*) to maize mashes digested under high pressure ; (*c*), which is the mean of *a* and *b*, to other cereal mashes.

Table for the Determination of Alcohol and Extract (Actual attenuation) in worts by means of the Saccharimeter and Refractometer at 14 R. (17°·5C.)

Refraction.	—2.00° Bal. =Sp. Gr. 0·992.		—1.00° Bal. =Sp.Gr. 0·996.		0.00° Balling. = Sp. Gr. 1·000.						1,00° Balling. = Sp. Gr. 1·004.					
	Maize mashes.		Maize mashes.		Potato mashes.		Maize mashes.		Mixed potato-maize mashes, etc.		Potato mashes.		Maize mashes.		Mixed potato-maize mashes, etc.	
	b		b		a		b		c		a		b		c	
	Alcohol Vol.-%	Extract ° Bal.	Alcohol Vol.-%	Extract ° Bal.	Alcohol Vol.-%	Extract ° Bal.	Alcohol Vol.-%	Extract ° Bal.	Alcohol Vol.-%	Extract ° Bal.	Alcohol Vol.-%	Extract ° Bal.	Alcohol Vol.-%	Extract ° Bal.	Alcohol Vol.-%	Extract ° Bal.
25	5,96	0,65	4.56	1,00	4.06	1,33	3,16	1,50	3,61	1,41	2,66	1,95	1,76	1,90	2,21	1,92
26	6,34	75	95	10	44	47	54	61	99	56	3,04	2,10	2,14	2,00	59	2,05
27	73	85	5,33	22	83	60	93	72	4,38	66	43	25	53	10	98	17
28	7,11	95	72	33	5,21	74	4.31	83	76	78	81	40	91	20	3,36	30
29	50	1,05	6,10	44	60	87	70	94	5,15	90	4,20	2,52	3,30	30	75	42
30	88	15	48	55	98	2,00	5,08	2,05	53	2,02	58	64	68	40	4,13	55
31	8,27	25	87	66	6.37	14	47	16	92	14	97	76	4,07	52	52	66
32	65	35	7,25	77	75	27	85	27	6,30	26	5,35	88	45	64	90	77
33	9,04	45	64	88	7,14	40	6,24	38	69	38	74	3,00	84	76	5,29	88
34	42	55	8,02	99	52	52	62	49	7,07	50	6,12	12	5,22	88	67	99
35	81	65	41	2,10	91	64	7.01	60	46	62	51	24	61	,00	6,06	3,10
36	10,19	75	79	20	8,29	76	39	71	84	74	89	36	99	12	44	21
37	58	85	9,18	30	68	88	78	82	8,23	86	7,28	48	6,38	24	83	32
38	96	95	56	40	9,06	3,00	8,16	93	61	98	66	60	76	36	7,21	43
39	11,35	2,05	95	50	45	12	55	3,04	99	3,10	8,04	72	7,14	48	59	54
40	73	15	10.33	60	83	24	93	15	9,38	21	43	84	53	60	98	65
41	12,12	25	72	70	10,21	36	9,31	25	76	32	81	96	91	70	8,36	76
42	50	35	11,10	80	60	48	70	35	10,15	44	9,20	4,08	8,30	80	75	87
43	88	45	48	90	98	60	10.08	45	53	55	58	20	68	90	9,13	98
44	13,27	55	87	3,00	11,37	72	47	55	92	66	97	32	9,07	4,00	52	4,09
45	65	65	12,25	10	75	84	85	65	11,30	77	10,35	44	45	10	90	20
46	14,04	75	64	20	12,14	96	11,24	75	69	88	74	56	84	20	10,29	31
47	42	85	13,02	30	52	4,08	62	85	12,07	99	11,12	68	10,22	30	67	42
48	81	95	41	40	91	20	12,01	95	46	4,10	51	80	61	40	11,06	53
49	15,19	3,05	79	50	13,29	32	39	4.05	84	20	89	92	99	50	44	64
50	58	15	14,18	60	68	44	78	15	13,23	30	12,28	5,04	11,38	60	83	75
51			56	70	14,06	56	13,16	24	61	40	66	16	76	70	12,21	86
52			95	80	45	68	55	33	99	50	13,04	28	12.14	80	59	97
53			15,33	90	84	80	93	42	14,38	60	43	40	53	90	98	5,08
54			72	4,00	15,21	92	14,31	51	76	70	81	52	91	5,00	13,36	19
55					60	5,04	70	60	15,15	80	14,20	64	13,30	09	75	30
56					98	16	15.08	69	53	90	58	76	68	18	14,13	41
57							47	78	92	5,00	97	88	14,07	27	52	52
58							85	87			15,35	6,00	45	36	90	63
59											74	12	84	45	15,29	74
60													15.22	54	67	85

Refraction n.	2,00° Balling. Sp. Gr. 1·008.						3,00° Balling. Sp. Gr. 1·012.						4,00° Balling. Sp. Gr. 1·016.					
	Potato mashes. a		Maize mashes. b		Mixed potato-maize mashes, etc. c		Potato mashes. a		Maize mashes. b		Mixed potato-maize mashes, etc. c		Potato mashes. a		Maize mashes. b		Mixed potato-maize mashes, etc. c	
	Alcohol Vol.-%	Extract Bal.	Alcohol Vol.-%	Extract Bal.	Alcohol Vol.-%	Extract Bal.	Alcohol Vol.-%	Extract Bal.	Alcohol Vol.-%	Extract Bal.	Alcohol Vol.-%	Extract Bal.	Alcohol Vol.-%	Extract Bal.	Alcohol Vol.-%	Extract Bal.	Alcohol Vol.-%	Extract Bal.
25	1,26	2,48	0,36	2,30	0,81	2,39												
26	64	62	74	44	1,19	53	0,25	3,02										
27	2,03	76	1,13	58	58	67	63	16			0,18	3,09						
28	41	93	51	71	96	80	1,01	30	0,12	3,13	56	22						
29	80	3,04	90	83	2,35	93	40	44	50	27	95	35	0,00	3,95				
30	3,18	18	2,28	95	73	3,06	78	58	88	40	1,33	48	38	4,09				
31	57	32	67	3,07	3,12	19	2,17	72	1,27	3,52	72	61	77	23			0,32	4,06
32	95	3,46	3,05	19	50	31	55	86	65	64	2,10	74	1,15	37	0,25	4,02	70	20
33	4,34	60	43	31	89	43	93	4,00	2,04	76	49	87	54	51	63	16	1,09	34
34	72	72	82	43	4,27	55	3,32	14	42	88	87	4,00	92	65	1,02	30	47	48
35	5,11	84	4,20	55	66	67	70	28	81	4,00	3,26	13	2,30	79	40	44	86	62
36	49	96	59	67	5,04	79	4,09	42	3,19	12	64	26	69	93	79	58	2,24	76
37	88	4,08	97	79	43	91	47	56	58	24	4,03	39	3,07	5,07	2,17	73	63	90
38	6,26	20	5,36	91	81	4,03	86	70	96	36	41	52	46	21	56	87	3,01	5,04
39	64	32	74	4,03	6,19	14	5,24	84	4,35	48	79	65	84	35	94	5,01	39	16
40	7,03	44	6,13	15	58	25	63	98	73	60	5,18	78	4,23	49	3,33	15	78	28
41	41	56	51	25	96	36	6,01	5,12	5,12	70	56	91	61	63	71	24	4,16	40
42	80	68	90	35	7,35	47	40	26	50	80	95	5,04	5,00	77	4,10	33	55	52
43	8,18	80	7,28	45	73	58	78	40	88	90	6,33	17	38	91	48	42	93	64
44	57	92	67	55	8,12	69	7,17	52	6,27	5,00	72	30	77	6,05	87	51	5,32	74
45	95	5,04	8,05	65	50	80	55	64	65	10	7,10	43	6,15	19	5,25	60	70	88
46	9,34	16	43	75	89	91	93	76	7,04	20	49	54	54	34	63	69	6,09	6,01
47	72	28	82	85	9,27	5,02	8,32	88	42	30	87	65	92	48	6,02	78	47	11
48	10,11	40	9,20	95	66	12	70	6,00	81	40	8,26	76	7,30	60	40	87	86	22
49	49	52	59	5,05	10 04	24	9,09	12	8,19	50	64	87	69	72	79	96	7,24	33
50	88	64	97	15	43	33	47	24	58	60	9,03	95	8,07	84	7,17	6,05	63	44
51	11,26	76	10,36	24	81	44	86	36	96	70	41	6,06	46	96	56	14	8,01	55
52	64	88	74	33	11,19	54	10,24	48	9,35	80	79	20	84	7,08	94	23	39	66
53	12,03	6,00	11,13	42	58	65	63	60	73	90	10,18	31	9,23	20	8,33	32	78	76
54	41	12	51	51	96	75	11,01	72	10,12	6,00	56	41	61	32	71	41	9,16	88
55	80	24	90	60	12,35	86	40	84	50	09	95	52	10,00	44	9,10	50	55	99
56	13,18	36	12,28	69	73	96	78	96	88	18	11,33	62	38	56	48	59	93	7,10
57	57	48	67	78	13,12	6,07	12,17	7,08	11,27	27	72	73	77	68	87	68	10,32	21
58	95	60	13,05	87	50	17	55	20	65	36	12,10	84	11,15	80	10,25	77	70	32
59	11,34	72	43	96	89	28	93	32	12,04	45	49	94	54	92	63	86	11,09	43
60	72	84	82	6,05	14,27	39	13,32	44	42	54	87	7,05	92	8,04	11,02	95	47	54
61	15,11	96	14,20	14	66	50	70	56	81	63	13,26	15	12,30	16	40	7,04	86	65
62	49	7,08	59	22	15,04	61	14,09	68	13,19	72	64	25	69	28	79	13	12,24	76
63	88	20	97	31	43	71	47	80	58	81	14,03	35	13,07	40	12,17	22	63	87
64			15,36	39	81	82	86	92	96	90	41	45	46	52	56	30	13,01	98
65			74	48			15,24	8,04	14,35	99	79	55	84	64	94	39	39	8,09
66							63	16	73	7,08	15,18	65	14,23	76	13,33	47	78	20

Interpolation Table.

Refractometer degrees.	0,05	0,10	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50	0,55	0,60	0,65	0,70	0,75	0,80	0,85	0,90	0,95
Refraction																			
Alcohol + ..	—	0,05	—	0,10	—	0,10	—	0,15	—	0,20	—	0,20	—	0,25	—	0,30	—	0,35	—
Extract + ..	—	0,01	—	0,02	—	0,04	—	0,05	—	0,06	—	0,07	—	0,08	—	0,09	—	0,10	—
Saccharimeter degrees—																			
Alcohol — ..	0,07	0,14	0,21	0,28	0,35	0,42	0,49	0,56	0,63	0,70	0,77	0,84	0,91	0,98	1,05	1,12	1,19	1,26	1,33
Extract + ..	0,03	0,06	0,09	0,12	0,15	0,18	0,21	0,24	0,27	0,30	0,33	0,36	0,39	0,42	0,45	0,48	0,51	0,54	0,57

Various other useful indications may be obtained with the refractometer by distilling off the alcohol, making up the extract to its original volume, and taking the saccharimeter and refractometer values of the solution. For instance, in the case of a normally fermented liquid, the relation between these values will indicate (on reference to a table) the nature of the raw material which has been used, since different extracts have different refractometer values for the same densities. In the case of a wort of known origin, if there be no reason to suspect any abnormal circumstance in the steaming or mashing process, complete correspondence of the saccharimeter and refractometer values with those in the table will indicate a normal, fully attenuated wort, the extract consisting solely of unfermentable non-sugars. If the saccharimeter value corresponds in the table with a refractometer value lower than the actual, the presence of fermentable substances in the wort is indicated, in quantities proportional to the difference between the expected and actual refractions. On the other hand, should the absence of fermentable carbohydrates be ascertained, a similar discrepancy in the values will indicate that something was wrong with the steaming or mashing, and that abnormal unfermentable bodies have been produced. If the observed values correspond with those in the table, in spite of a poor attenuation, the latter is only due to an excessive quotient of the mash. Further, the refractometer may be applied to the examination of raw spirits. If the observed refraction of the spirit be higher than the refraction calculated by Wagner's tables for the alcohol found by density (Windisch's tables), the difference is proportional to the amount of impurities in the spirit. Pure spirits will show identical values for the observed and calculated refractions. Lastly, the refractometer may be used for the valuation of maize, by the determination of the extract in a wort saccharified under standard conditions.—J. F. B.

Beer and beer worts. Temperature corrections in the analysis of —— by the immersion refractometer. V. Stanek and O. Miskovsky. Z. ges. Brauw., 1910, **33**, 145—148.

THE original gravity of a beer is readily determined from the specific gravity and the refractive index as observed by means of a Zeiss immersion refractometer (this J., 1905, 630; also preceding abstract). As, however, the readings of this instrument have to be made at 17·5° C., a slight inconvenience may be felt by some in its use. In order to overcome this difficulty, a table of corrections has been prepared from which the refractive index observed at any temperature between 15° and 25° C. may be converted to its value at standard temperature. Refractometer readings taken at ordinary room temperatures and corrected by the table agree within 0·1 of a degree with those read directly under standard conditions. —R. L. S.

Acetaldehyde in alcoholic media: Circumstances which favour the formation and disappearance of ——. Trillat and Sauton. Bull. Soc. Chim., 1910, **7**, 244—249.

THE authors' experiments show that acetaldehyde is not a normal product of alcoholic fermentation, but must be regarded as an oxidation product, since its formation, though largely dependent on the presence of living yeast, is prevented when air is excluded. If the solution be left in contact with the yeast, the aldehyde is rapidly converted into acetic acid, and ethyl acetate is formed. —F. SODN.

Wines; Sulphurous acid in ——. Influence of the saccharine matters on the content of combined sulphurous acid. X. Rocques. Ann. Falsific., 1910, **3**, 94—99.

WITH regard to the fixing of a maximum limit for the quantity of sulphurous acid which shall be allowed in wine, the author points out that a uniform limit would not be applicable to all wines; a quantity which would be useful in the case of Sauterne wines would be objectionable in dry wines, like Chablis; an average limit would not satisfy the manufacturers of either class of wine. Again, it would be almost impossible to classify wine and to fix limits for each class. It is impracticable to limit the sulphurous acid in proportion to the amount of saccharine matters in wines, since the effective action of the sulphurous acid is not a definite function of the content of saccharine matter. It might, however, be feasible to fix a limit for the amount of free sulphurous acid permissible in a wine, but more evidence should be obtained regarding the minimum quantities of sulphurous acid which are found to be necessary or effective for each class of wine.—W. P. S.

Wine; Removal of sulphites from —— by means of hexamethylenetetramine. Fonzes-Diacon. Ann Falsific., 1910, **3**, 100—106.

THE decomposition of hexamethylenetetramine in wine results in the formation of ammonia, and the presence of an unusual proportion of the latter in any wine is an indication that the former substance has been added to the wine. The detection of the presence of formaldehyde, however, affords more certain evidence that the wine has been treated with hexamethylenetetramine, but the test proposed by Rouillard and Goujon (this J., 1910, 229) is open to the objection that it is a reaction for aldehydes in general and that acetaldehyde would give the coloration. Tests which are characteristic of formaldehyde should be applied to the distillate from the wine.—W. P. S.

Detecting inositol in organic mixtures. Meillère and Fleury. *See* XVII.

PATENTS.

Brewing; Process of filtration for —— and wine-making purposes and apparatus therefor. A. Belgeonne, Forest-Lez-Bruxelles, Belgium. Eng. Pat. 5583, March 8, 1909.

COMPRESSED air or a mixture of air and water is introduced, by means of a system of fixed or movable distributors, above and adjacent to the bottom of the vat during filtration of the liquor, the pressure of the air or mixture being such as to produce a movement of the grain so as to prevent too great a settling without, however, violently agitating and mixing the grains and liquid. The distributors may consist of two bells which are arranged mouth to mouth and into which the air or air and water are supplied, the free space between the bell-mouths being adjustable, so that the air or mixture may be delivered in a thin layer in a horizontal direction. In the application of the process to wine-filters, filter-presses and similar apparatus, the latter are combined with distribution-tubes for the air or mixture issuing into the compartments of the filter and connected with feeding conduits, the distribution-tubes producing a division under uniform pressure of the air or mixture in the different compartments of the apparatus. An apparatus is described for the disaggregation of grain or the like in filter vats, filter presses, mash tuns, etc. —T. H. P.

Wort filter [filter press]. Maschinenbau-Anstalt Humboldt. Ger. Pats. 216,414, Feb. 20, 1908, and 217,504, April 3, 1908.

IN the filtration of wort by means of filter-presses, the cakes never fill the chambers completely, a free space being always left in the upper part, through which, unless special provision be made, the wash water passes unimpeded, without performing any useful function. The present patents are intended to overcome this difficulty. (1). The water inlet and outlet chambers of the press are provided in their upper parts with partitions at such a height that the whole of the wash-water is caused to flow through the cake in the adjacent filter-chambers. In order that the upper surface of the mash in the filter-chambers may be as level as possible, a rotatable rod or bar may be fixed in the upper part of the chamber so as to level the surface. (2). The water inlet chambers or both the water inlet and water outlet chambers are constructed with their upper walls at a lower level than the upper walls of the filter chambers.—A. S.

Sterilising agent; Manufacture of a —— and apparatus for sterilising and cleansing brewers' casks, vats and other vessels contaminated by putrefaction products. A. E. Sherman and L. C. Lutyens, London. Eng. Pat. 7419, March 27, 1909.

A STERILISING agent is made by either (1) gasifying paraformaldehyde by heat and permitting the gas to percolate into liquid ammonia, preferably at a temperature of 47-55°C.; or (2) introducing gaseous ammonia at a temperature of about 65° C. into a solution of paraformaldehyde and allowing the absorption to proceed until crystals of hexamethylenetetramine begin to separate. The apparatus comprises a generator and container for the cleansing agent, and a pump or other device for assisting in discharging the agent to the vessel to be purified. Strongly acid casks are subjected to preliminary treatment with gaseous ammonia, whilst with wine casks, sulphur dioxide is used for this purpose.—T. H. P.

Malting or drying grain or the like; Drum for ——. B. Nissen, Christiania, Norway. U.S. Pat. 951,835, Mar. 15, 1910.

THE drum consists of an outer perforated casing provided with a central perforated tube; both parts are mounted horizontally and are capable of rotating in relation to each other. Four sets of blades are fitted on the outer surface of the central tube, two of the sets being inclined in one direction and the alternate ro in the opposite direction, so that the grain, aced in the space between the central tube and the iter casing, is conveyed outwards and towards the right by ro sets and to the left and also outwards by the other ts of blades. The gas with which the grain is to be eated is admitted through the central tube. W. P. S.

ne ; Manufacture of a non-alcoholic beverage containing all the aromatic constituents of natural —. Rheinische Weinkellerei. Gebr. Wagner. Fr. Pat. 407, 061, Sept. 1909.

he manufacture of non-alcoholic wine by distillation nder reduced pressure is carried out in three stages. n the first stage the temperature of the wine and the egree of vacuum are so regulated that only the highly olatile aromatic constituents are withdrawn, whilst the lcohol is not volatilised. The aromatic vapours are onducted through a receiver containing an absorption quid composed of de-alcoholised wine, grape must and ugar. The first receiver is then cut off, and, in the second tage, the heavier aromatic substances together with a ortion of the alcohol and water are distilled over. The apours of alcohol and water are condensed in a suitable essel, whilst the aromatic substances, which are still lighter han the alcohol, are conducted onwards through a second bsorption vessel. This vessel is next cut off, and the distillation of the alcohol is completed in the ordinary way. The contents of the absorption vessels, charged with the bouquet of the wine, are then mixed with the residue from the still.—J. F. B.

Musts and other liquids ; Automatic apparatus for sulphiting —. V. Martinand and F. Savournin. Fr. Pat. 407,106, Aug. 14, 1909.

An automatic sulphur-burning furnace is described containing a number of superposed trays, each provided with an air conduit immediately over the combustion surface. The ascending pipe, up which the vapours of sulphur dioxide travel, is cooled externally by means of a water-jacket. The vapours are aspirated and brought into contact with the liquid to be treated by means of a small turbine operated by a falling stream of the liquid itself. The turbine is connected externally with a ventilating fan which supplies air to the sulphur furnace. Thus the combustion is regulated automatically by the flow of liquid under treatment.—J. F. B.

Beer ; Elimination of objectionable odours and flavour in the manufacture of —. L. Nathan. Fr. Pat. 407,169, Sept. 18, 1909.

In order to eliminate certain objectionable odours and flavours from the beer, the hot wort is subjected to a special treatment in which a current of carbon dioxide is passed repeatedly through it, and the moisture which is absorbed by the gas is condensed but is not returned to the wort. The aëration of the wort may also be ensured in the same treatment by mixing definite quantities of air with the carbon dioxide during the cooling of the wort.
—J. F. B.

Vinegar from whey ; Process for obtaining table ——. P. Lamouroux. Paris. Eng. Pat. 5562, Mar. 8, 1909.

Whey is submitted to the action of an enzyme, such as invertase, in the presence of citric acid, in order to convert the lactose into dextrose. The solution obtained is then fermented and the alcoholic solution is divided into two portions; alcohol is added to one portion in sufficient quantity to make the solution contain from 5 to 10 per cent. of alcohol, and acetic fermentation is produced in the solution by the addition of *Mycoderma aceti*. This mother liquor is then added gradually to the other portion of the fermented whey, so that the whole of the alcohol present is converted into acetic acid (see also Fr. Pat. 399,991, of 1909 ; this J., 1909, 999).—W. P. S.

Manufacture of tartaric acid. Eng. Pat. 11,694. *See* VII.

XIXA. FOODS.

Yeast ; Rôle of — *in bread making.* L. Lindet. Comptes rend., 1910, **150**, 802—804.

Determinations were made, under various conditions, of the number of yeast cells present in bread dough and the enzymatic power of the yeast towards dextrose after killing it with acetone. In slacker doughs the number of cells increases most but the enzymatic power is a minimum: in denser doughs the reverse is the case. An increase in temperature from 20° to 30° C. favours multiplication but decreases enzyme action. Aeration assists multiplication of the yeast but is not indispensable. When too much yeast is added to a dough, very little multiplication takes place. Thus after 18 hours at 20° C., yeast introduced into dough in the proportion of 1/1000, 2/1000, 4/1000 and 8/1000 had multiplied in the proportions of 8·4, 6·4, 3·7, 1·8 respectively. Pressed yeast contains about 5 million cells in 0·001 grm.; dough normally contains about 1 part of yeast per 1000.—E. F. A.

Fat in foodstuffs ; Determination of —. E. Polenske. Arbb. Kais. Gesundh.-Amt, 1910, **33**, 563—579. Chem. Zentr., 1910, **1**, 1059—1060.

For the determination of fat in vegetable materials, the powdered air-dry substance is well mixed, and 3—4 grms. in the case of flours or meals, or 1—1·5 grms. in the case of substances (cocoa, oil-seeds, etc.) richer in fat, are weighed into a stoppered Erlenmeyer flask, of Jena glass, of 220—250 c.c. capacity, diam. 7 cm.; height up to bottom of neck, about 15 cm.; weight, with stopper, about 55 grms. 25 c.c. of hydrochloric acid (73 grms. of acid of sp. gr. 1·125 per litre) are added, and the flask is fitted with a reflux tube and heated for 20 minutes in a boiling water bath. After cooling, 5 c.c. of ammonia of sp. gr. 0·96, 20 c.c. of 90 per cent. (by vol.) alcohol, and 50 c.c. of ether (measured at 18° C.) are successively added, the flask being meanwhile cooled, and after shaking, 50 c.c. (measured at 18° C.) of petroleum spirit, of b. pt. 50°—55° C., are introduced and the whole well shaken. The flask is now placed in water at 18° C., and after 15—20 mins., 52 c.c. of the clear solution of the fat are pipetted off, and passed through a funnel containing a plug of cotton-wool into a tared distilling flask, the rate of flow being adjusted so that the solution is filtered in about 10 mins. The cotton-wool is washed three times with 2 c.c. of a mixture of ether and petroleum spirit. A few small particles of very finely powdered pumice are added to the liquid in the distilling flask, the solvent is distilled off, and the flask and residual fat are dried for ¾-hour in a water-oven, then cooled and weighed. In the case of animal substances, such as flesh and cheese, the sample is rolled in tinfoil for weighing. 1—1·5 grm. of substance is weighed into the Erlenmeyer flask. In the case of flesh, a mixture of 5 c.c. of concentrated sulphuric acid of sp. gr. 1·81—1·84, and 5 c.c. of water is added, whilst with cheese, 5 c.c. of acid and 10 c.c. of water are used. The flask is then fitted with a reflux tube and in the former case heated in a boiling water bath until solution is effected and then for 10 minutes longer, whilst in the latter case, the contents are boiled gently over a small flame. The acid liquid is diluted with 40 c.c. of water (35 c.c. in the case of cheese), and after cooling, is shaken vigorously for 1 min. first after addition of 50 c.c. of ether (measured at 18° C.) and then after further addition of 50 c.c. of petroleum spirit (see above). After allowing to settle at 18° C., 49·5 c.c. of the solution of fat are pipetted off, and the determination completed as described above. It is stated that the quality of the fat is not appreciably affected by the acid treatment. The method yields results nearly twice as high as those obtained by the usual Soxhlet extraction process in the case of cheeses poor in fat, bread, and lean flesh.—A. S.

Rapeseed-cakes ; Importance of laboratory experiments for judging the character of —. G. Jörgensen. Landw. Vers.-Stat., 1910, **72**, 1—14. Chem. Zentr., 1910, **1**, 1046.

The author re-affirms his view (see this J., 1900, 65) that the mustard oil produced from rapeseed-cake sometimes acts as a poison. The earlier statement that a mustard oil of low nitrogen content is evolved from rapeseed-cake is scarcely accurate. Indian seeds contain from 0·31 to 0·55 per cent. of mustard oil, yielding thiosinamine containing from 16·55 to 21·38 per cent. of nitrogen. Six commercial specimens of rapeseed-cake, which caused illness when used as a cattle-food, all contained considerable quantities of *Brassica juncea* seeds. In many cases it is possible to form an opinion as to the harmlessness or toxicity of rapeseed-cake from the results of laboratory tests. If, on treating a sample of rapeseed-cake with white mustard and water, 0·8 per cent. of mustard oil is produced in 1 hour, and the thiosinamine derived from the mustard oil contains 22·5 per cent. of nitrogen, and if, further, one-half of the mustard oil is developed on treatment with water and thymol for 17 hours at 35° C., then the sample should not be used as a cattle-food. If the nitrogen-content of the thiosinamine is less than 22 per cent., then no injurious effects are to be anticipated, even though about 1 per cent. of mustard oil is developed in 1 hour on addition of white mustard; the lower the nitrogen-content of the thiosinamine, the greater is the permissible quantity of mustard oil. If a considerable quantity (over 0·6 per cent.) of mustard oil is produced, and the thiosinamine contains over 22 per cent. of nitrogen, then care should be exercised in the use of the rapeseed-cake as a cattle-food, especially if active myrosin be present. Rapeseed-cakes yielding a mustard oil containing an unusually high percentage of nitrogen, develop a far more pungent odour than others. If one gram be treated with water and a small quantity of white mustard, and allowed to stand for 1 hour at the ordinary temperature in a tightly closed tube, a much more penetrating and pungent odour is produced in the case of samples likely to prove injurious to cattle.—A. S.

Caffeine in tea and in raw and roasted coffee; Accurate method for the determination of ——. J. Burmann. Bull. Soc. Chim., 1910, **7**, 239—244.

Five grms. of the finely ground coffee or other material, dried to constant weight in the steam-oven, are shaken for 10 minutes with 50 c.c. of petroleum ether (sp. gr. 0·63—0·67), and the ethereal extract is decanted through a filter; the residue is then shaken with a further 25 c.c. of the solvent and is finally washed on the filter with a third portion, also of 25 c.c. The filtrate is evaporated to obtain the fat, and the residue, free from fat, is introduced, when dry, into a stoppered flask and agitated for some minutes with 150 grms. of chloroform; 5 grms. of a 10 per cent. solution of ammonia are then added, and the whole is frequently and vigorously shaken during half-an-hour, after which it is filtered through a porcelain funnel containing a double thickness of filter paper, previously moistened with chloroform, and the filtrate is evaporated on the water-bath. The dried evaporation residue of crude caffeine is dissolved in a very little chloroform and introduced into a test-tube, 15—18 cm. long and 15—18 mm. in diameter, which is constricted to about half the diameter at two points about 20 mm. from either end; after rinsing the whole of the solution into this tube, the chloroform is evaporated on the water-bath and the tube dried at 100° C. or *in vacuo*; a loose plug of asbestos is now adjusted in the lower constriction, the top of the tube is filled with cotton wool, and it is then heated to 210—240° C. in a bath of paraffin reaching to the top of the lower constriction. In about 3 hours all the caffeine sublimes into the centre of the tube, and the lower portion is then cut off and the alkaloid dissolved out with a little chloroform; the solution is received in a tared vessel, and, after evaporation, the purified caffeine is dried and weighed. 2·5 mgrms. (the weight of caffeine dissolved by 100 c.c. of petroleum ether) should be added to the weight obtained.—F. Sodn.

Figs; Chemical composition of ——. R. Paladino. Biochem. Zeits., 1910, **24**, 263—265.

The following results were obtained in the analysis of green figs (*Ficus carica*), and of a large sample of dried figs:—

	Water.	Nitrogenous substances.	Fat.	Sugars.	Cellulose.	Ash.	Mucilaginous substances.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Green figs, pulp	80·00	0·70	0·30	16·20	1·30*	0·70	0·80
Green figs, skin.....	86·00	0·00	0·10	5·40	5·76	—	2·74
Dried figs ...	57·00	4·10	2·20	26·06	8·00	2·52	0·18

* Including seeds.

—C. A. M.

Mushrooms; Distinctive reaction for ——. M. Leewry. Apoth.-Zeit., 1909, **24**, 923.

The aqueous extract of the common edible mushroom gives a violet colour-reaction when floated on strong sulphuric acid. The colour disappears on warming. A large number of other edible and poisonous fungi have been tested thus, including the very dangerous *Amanita phalloides*, which is sometimes mistaken for the mushroom; in no case was the violet colour obtained. The reaction is evdent with various sauces in which mushrooms are an ingredient: it might be used to prove the identity of some commercial preparations of mushrooms, and of the dried fungi employed, on the Continent, for culinary purposes.
—J. O. B.

Colloids; Investigation of the physical alterations of ——. *IX. Alkali-albumin.* W. Pauli and H. Handovsky. Biochem. Zeits., 1910, **24**, 239—262.

There is a pronounced parallelism between the behaviour of alkali-albumin and of acid-albumin (Biochem. Zeits., 1909, **18**, 340). The coagulability by heat or by the addition of alcohol is restored to both, in the former case by the addition of alkali in excess, and in the latter by an excess of acid. An analogous decrease in the viscosity of both compounds also occurs under the same conditions. In both cases these alterations in physical conditions are to be attributed to a common cause, viz., the difference between ionic and electrically neutral albumin, which produces a great difference in the hydration and aggregation capacity of the albumin molecules. With regard to the coagulation of alkali-albumin by heat, the experiments, described in detail, show that coagulability is also restored by the addition of neutral salts, which apparently enter into direct combination with the protein, and that in this respect the salts of metals of the alkaline-earths are greatly superior to alkali salts. In like manner, alkaline-earth salts have a greater effect than alkali salts in reducing the viscosity of alkali-albumin, which the authors attribute to the greater production (in the former case) of electrically neutral particles at the expense of ionic particles. There appears to be an antagonism between alkaline-earth ions and alkali ions as regards a definite combination with albumin, so that small quantities of the former can only be replaced by relatively large quantities of the latter. As was anticipated also, the "swelling" up of alkali-glutin (from gelatin and sodium hydroxide) was checked by the addition of an alkaline-earth salt to a far greater extent than by an addition of an alkali salt. Thus an addition of barium chloride caused a reduction in the "swelling up" (Quellung) of 41·6 per cent., whereas the reduction caused by an equivalent quantity of potassium chloride was only 24·46 per cent.—C. A. M.

Alimentary products; Colours employed in the manufacture of ——. A. Gautier, Pouchet, Thoinot, Mosny, and Béhal. Ann. Falsific., 1910, **3**, 81—87.

The authors, who formed a Government Commission to enquire into the use of colouring matters in the manufacture of alimentary products in view of new regulations which are being framed, report to the Minister of the Interior (France) as follows:—Owing to the toxicity or more or less injurious action of many of the coal-tar dyestuffs, the use of the latter should be prohibited in bread, meats, oils, butter, etc., and in beverages and liquids such as milk, wine, cider, perry, beer, etc., which are consumed daily. The use of caramel, litmus, and cochineal may be permitted for the coloration of brandy, vinegar, cider, etc. On the other hand, some of the coal-tar dyestuffs might be allowed for colouring pastry (under certain conditions), confectionery, and liquids which are not consumed daily, but these dyestuffs must be non-injurious, used only in small quantity, and be commercially pure. Where the dyestuff is a salt, the sodium salt should be employed in preference to the potassium or ammonium salt. The dyestuffs should be sold in packets which must have a label giving both the commercial and chemical name of the article. The following is a list of the dyestuffs of which the use might be permitted for colouring confectionery:—Eosine, Erythrosine, Bengal-Rose, Bordeaux B, Bordeaux S, Ponceau Crystal, New Coccine, Solid Red, Ponceau RR, Scarlet R, Acid Magenta, Orange I, Naphthol Yellow S, Chrysoïne, Auramine O, Malachite Green, Acid Green J, Water Blue 6B, Patent Blue, Paris Violet, and Acid Violet 6B. (For the chemical names of these colours see this J., 1909, 1219.) Black dyestuffs (sulphonated indulines and nigrosines) should not be used, as the commercial articles are usually mixtures without definite chemical composition. The above mentioned dyestuffs may be employed for colouring the sugar decorations on pastry (but the pastry itself should not be so coloured), and the exterior of cheeses. Syrups and such sweets as are likely to be largely consumed by children should not contain coal-tar dyestuffs. The Commission sees no reason to interfere with the practice of colouring sugar with ultramarine or caramel, or with the use of small quantities of cochineal or carmine for colouring pastry, biscuits, etc.—W. P. S.

Sodium benzoate, coal tar colours, and saccharin in food products; Summary of the State and Federal rulings as to use of —— [in U.S.A.]. T. E. Lannel. Amer. Food J.; through Midland Drugg., 1910, **43**, 706.

Sodium benzoate.—The Federal Rule regarding the use of this preservative is as follows:—"It having been determined that sodium benzoate mixed with food is not deleterious or poisonous, and not injurious to health, no objection will be raised under the Food and Drugs Act to its use in food provided that each container or package of such food is plainly labelled to show the presence and amount of sodium benzoate." The following states and territories follow this rule:—Alabama, Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, District of Columbia, Georgia, Hawaii, Idaho, Illinois, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, Oklahoma, Philippine Islands, Porto Rico, Rhode Island, S. Carolina, S. Dakota, Utah, Virginia, Washington, W. Virginia. The use of a limited amount, or only in certain products, is permitted in Florida, Louisiana, Minnesota, New Hampshire, N. Carolina, N. Dakota, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Vermont, Wyoming. In every case where sodium benzoate is permitted, its presence and amount must be stated in type not smaller than 8-point brevier caps. Its use is entirely prohibited in Wisconsin. In Indiana, its use is not specifically prohibited, but the State Food and Dairy Commissioner has ruled it to be inadmissible.

Coal tar colours.—The Federal Rule upon the use of coal tar colours in foods is as follows: "The following, when properly certified under F. I. D. 76 and 77, may be used. *Red shades:* 107, Amaranth; 56, Ponceau 3R.; 517, Erythrosine. *Orange shade:* 85, Orange I. *Yellow shade:* 4, Naphthol yellow S. *Green shade:* 435, light green S.F. yellowish. *Blue shade:* 692, Indigo disulphoacid." The following states and territories follow the Federal rule: Alaska, Arizona, Arkansas, California, Connecticut, Delaware, District of Columbia, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kentucky, Maine, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, N. Carolina, Ohio, Oklahoma, Oregon, Philippine Islands, Porto Rico, Rhode Island, S. Carolina, S. Dakota, Tennessee, Texas, Utah, Vermont, Washington, W. Virginia, Wisconsin. In the following states the use of coal tar colours is permitted when plainly stated on the label: Colorado, Idaho, Kansas, Maryland, Virginia. The use of these colours is prohibited in Alabama, Minnesota, N. Dakota, Wyoming. In Louisiana, the above seven colours may be used when a certificate of freedom from harmful constituents has been filed with the Food Commissioner. In Pennsylvania the use of coal-tar colours is prohibited in syrups for fountain use, but not in other products.

Saccharin.—"The Government has not published any ruling as to the use of saccharin, but it seems to be tacitly understood that it may be used if the fact of its use be plainly stated on the label. It would be well to designate it as 'saccharin, an artificial sweetener.' The type used should not be smaller than 8-point brevier caps." The states which follow the Federal Rule are: Alaska, Arizona, Arkansas, California, Connecticut, Delaware, District of Columbia, Florida, Hawaii, Illinois, Kentucky, Maine, Maryland, Massachusetts, Mississippi, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, Philippine Islands, Porto Rico, Rhode Island, S. Carolina, Tennessee, Texas, Vermont, Virginia. Its use is prohibited in Alabama, Iowa, Minnesota, N. Dakota, Oklahoma, Pennsylvania, Utah, Wisconsin, Wyoming. In the following states, although not specifically prohibited by law, its use has been forbidden by the executive on the ground that it is a deleterious substance:—Colorado, Georgia, Idaho, Indiana, Kansas, Louisiana, Michigan, Missouri, New Hampshire, Ohio, Oregon, S. Dakota, Washington. It may be used in food products in N. Carolina provided its presence is plainly stated on the label.—J. O. B.

Fruit extracts; Australian regulations for ——. Board of Trade J., April 14, 1910. [T.R.]

A Statutory Rule (No. 15 of 1910) dated 11th February last, repeals, with immediate effect, Regulation 109 of the Customs Regulations issued on 26th October, 1909 (Statutory Rules 126 of 1909), and substitutes the following regulation regarding the standard for condensation of fruit extracts and juices:—

"The standard according to which duty shall be charged on extract of raspberry (non-spirituous) is hereby cancelled, and in lieu thereof the following standard for fruit extracts and concentrated fruit juices is substituted:—

"Fruit extracts and concentrated fruit juices (non-spirituous)—Duty shall be charged on the quantity or equivalent of 'fresh' fruit juices into which such fruit extracts and concentrated fruit juices can be converted as shown by chemical analysis, provided that in cases where the manufacturer states a degree of concentration greater than that shown by chemical analysis, duty shall be charged in accordance with the degree of concentration stated by the manufacturer."

PATENT.

Chocolate and cocoa; Dietetic ——. E. Collett and M. Eckardt, Christiania, Norway. U.S. Pat. 952,418, Mar. 15, 1910.

One or more ferments, capable of producing lactic acid from carbohydrates without evolution of gas, are added to the materials contained in commercial cocoa or chocolate. —W. P. S.

XIXb.—WATER PURIFICATION; SANITATION.

Phenols; Increase of the disinfecting power of —— by addition of acids ("phenostal," cresol-oxalic acid). E. Hailer. Arbb. Kais. Gesundh.-Amt, 1910, 33, 500—515. Chem. Zentr., 1910, 1, 1039—1040.

The disinfecting power of phenols is considerably increased by addition of acids. The acids examined may be arranged in the following order with respect to their effect:—Oxalic acid (strongest action), sulphuric acid, acetic acid, tartaric acid, citric acid, boric acid (scarcely any action). Tests with solutions of the acids alone, without phenols, showed that sulphuric acid is superior to oxalic acid in disinfecting power. *o*-Cresol is somewhat less powerful that *m*- and *p*-cresol as a disinfectant. Phenol in "isomolecular" solution proved to be very weak as a disinfectant against *staphylococci*. "Phenostal," and also the compound first described by Claparède and Watson Smith as phenylortho-oxalate (this J., 1883, 345), is regarded by the author not as a phenyl-ester of oxalic acid, but as consisting of oxalic acid with 2 mols. of phenol of crystallisation. On standing in the air, it gradually loses phenol. Oxalic acid in hot solutions can be determined acidimetrically in presence of cresols, but not in presence of phenol. The presence of phenols does not interfere with the determination of oxalic acid by precipitation as calcium oxalate from acetic acid solutions, and subsequent ignition of the precipitate to calcium oxide. Oxalic acid does not interfere with the determination of phenols by titration with potassium bromate or by Koppeschaar's method.—A. S.

Lead arsenate in viticulture. L. Moreau and E. Vinet. Comptes rend., 1910, 150, 787—790.

The quantity of lead arsenate remaining in grapes which have been treated with this insecticide, although only of the order of a few milligrams, is high relative to the small weight of the grapes at the end of May. It is in part eliminated during further growth. Three weeks or a month before gathering, about 0·27 mgrm. of lead arsenate per grape was detected, corresponding to 1·68 mgrms. per kilo. After gathering, a small amount still remains, as it can be detected in the lees. On no single occasion was lead arsenate found in the wine; it is completely eliminated in the lees and possibly also in the marc.—E. F. A.

Patents.

Water; Means for treating ——. W. Jones, Pontypridd. Eng. Pat. 20,933, Sept. 13, 1909.

A portion of the water is treated with the alkaline or softening reagent and then returned to the main body of water. The pressure of the latter, prior to filtration, is reduced by means of valves to a pressure inferior to that of the portion of water leaving the treatment tank, and a non-return valve is provided in the pipe supplying this tank from the main. By this means the necessity for the use of pumps is obviated.—C. A. M.

Water purifying and softening plant. E. A. Andrews, Birmingham. Eng. Pat. 27,164, Nov. 23, 1909.

The patent relates to means for stirring or mixing reagents, such as milk of lime, contained in a tank. For this purpose the water to be treated with the milk of lime is allowed to fall from a tank through a pipe fitted with a valve; this pipe enters the top of an air chamber which has a branch pipe open to the outer air. The water, after falling through the air chamber, passes down a pipe extending nearly to the bottom of a closed tank, and carries with it a considerable volume of air from the air chamber. A baffle-plate fitted to the end of the pipe in the tank causes the air to rise into a cylindrical chamber surrounding the pipe, whilst the water passes below the open end of the cylindrical chamber and fills the tank up to the level of an overflow pipe. As the water rises, the air in the chamber is compressed and is allowed to escape through a pipe into the reagent tank. The air pipe may have several branches in the reagent tank so that the air is bubbled through the whole of the reagent solution. Valves fitted on each branch pipe cause the air to be equally distributed through the pipes.—W. P. S.

Water purifying and softening plant. E. A. Andrews, Birmingham. Eng. Pat. 27,165, Nov. 23, 1909.

The apparatus is intended for delivering definite quantities of chemical reagents to measured volumes of the water to be treated. The water is allowed to flow into a tank which contains a float; this float is connected by means of a chain with a cam, which in turn operates a revolving disc fittted with studs and fins and a sliding weight. A second chain connects the float with a movable pipe provided with a measuring device in the reagent tank. As the water fills the tank containing the float, the latter rises and the cam and disc are operated until the movement of the disc cuts off the supply of water and allows the water in the tank to flow into a mixing chamber, the same movement of the disc, combined with that of the sliding weight, allowing a quantity of the reagent solution to mix with the outflowing water. The descent of the float causes the disc to revolve, opening the inlet valve for the water, the movable pipe in the reagent tank being also operated so as to deliver a further quantity of reagent solution into the discharge pipe.—W. P. S.

Water supply of Toronto; Pollution of the ——. Oil, Paint, and Drug Rep., March 28, 1910.

Owing to the danger of typhoid arising from the condition of the water supply of Toronto, of late, by reason of sewage coming in contact with the intake pipe, the city is treating the water with calcium hypochlorite, using 150 pounds to 35,000,000 gallons of water. The city is extending the intake pipe and also establishing a filtration plant at a cost of £150,000.

Water; Method and apparatus for electrolytically purifying ——. H. B. Hartman, Assignor to McDowell Manufacturing Co., Pittsburg, Pa. U.S. Pats. 951,311 and 951,313, Mar. 8, 1910.

(1) The water is caused to flow between metallic electrodes and there subjected to the action of an alternating current; the current of electricity is allowed to pass, or is interrupted, as the flow of the water is started, or stopped, but the current is interrupted slightly later than is the flow of water. (2) The apparatus consists of a closed box containing aluminium electrodes which are connected with a source of alternating current. The electrical circuit is closed and opened by means of a device which is actuated or controlled by the flow of water through the box, the opening of the circuit being delayed until after the flow of water ceases.—W. P. S.

Alkaloidal insecticides for treating plants. Elsässische Tabakmanufaktur vorm. J. Schaller und Bergmann. Ger. Pat. 220,023, Nov. 30, 1907.

The insecticides consist of alkaloidal extracts, especially tobacco extract, mixed with aluminium salts, *e.g.*, the acetate; the insecticide may be employed either in liquid or powder form, and it may be mixed with a diluting powder in the latter case.—T. F. B.

Disinfectants [compounds of guaiacol and hexamethylenetetramine]; Manufacture of ——. F. Hoffmann-La Roche und Co. Fr. Pat. 406,653, Aug. 31, 1909. Under Int. Conv., Oct. 5, 1908, and Aug. 5, 1909.

See Eng. Pat. 19,805 of 1909; this J., 1910, 373.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Medicinal plants and drugs. [Determination of total alkaloid.] U.S. Dept. of Agriculture, Bureau of Chemistry. Circular No. 52, March 2, 1910, pp. 14—16.

The following methods for the determination of the total alkaloid in medicinal plants and drugs are now proposed in order to replace methods described in previous bulletins. 10 grms. of the drug are shaken for several minutes with 75 c.c. of ether-chloroform mixture (5 to 1 by volume). 5 c.c. of 10 per cent. ammonia solution are added, and the mixture shaken for two hours. As much as possible of the mixture is transferred to a small percolator (25 mm. diameter and 25 cm. long), the neck of which is plugged with cotton wool. The residue of the drug is placed in the percolator and the flask rinsed out with more of the ether-chloroform mixture. The drug is packed down with a piece of cotton wool and percolated with the same mixture until the percolate gives no precipitate when 2 c.c. are evaporated, treated with 2 c.c. of $N/10$ hydrochloric acid, filtered and tested with Mayer's solution. The percolate is evaporated to 10 c.c., the temperature not exceeding 70° C. The residue is treated with 10 c.c. of 2 per cent. sulphuric acid, shaken round for one minute and transferred to a separator. The flask which contained the residue is rinsed out successively with 25 c.c. of ether, 10 c.c. of 2 per cent. sulphuric acid, 25 c.c. of ether, and 5 c.c. of water. The separator is shaken, care being taken that the acid is in excess, and the acid solution filtered into another separator. This operation is repeated three or more times with 15 c.c. portions of the acid, till 10 drops of the last portion give no reaction with Mayer's solution. The acid solution is washed with 10 c.c. of ether-chloroform mixture (1 to 3 by volume), the operation being repeated till no more colour is acquired by the mixture. The combined ether-chloroform washings are shaken with 10 c.c. of water and the water added to the acid solution. The acid solution is made alkaline with ammonia and shaken out with four or more portions of ether-chloroform mixture (1 : 3), until the residue left on evaporating 20 drops gives no reaction with 1 c.c. of $N/10$ hydrochloric acid and 2 drops of Mayer's solution. The ether-chloroform extracts are united, washed with 5 c.c. of water and evaporated at a temperature not exceeding 70° C. 3 c.c. of ether are added to the residue, which is dried till of constant weight at a temperature not above 70° C. Or the residue may be dissolved in 5 c.c. of alcohol and 15 c.c. of water added. It can then be titrated with $N/50$ sulphuric acid, using cochineal as indicator. Instead of dealing with the total extract, an aliquot portion may be used. 15 grms. of the powdered drug are shaken with 150 c.c. of ether-chloroform mixture (5 : 1) and 5 c.c. of 10 per cent. ammonia solution as before. 15 c.c. of water are added to agglomerate the drug, which is allowed to settle, and 100 c.c. of the clear liquid are decanted. This clear solution is then treated in exactly the same way as the total ether-chloroform extract obtained directly from the drug by the first method.—F. Shdn.

Opium: its nature, composition, preparations, and methods of consumption. F. Browne. Report presented to Hongkong Legislative Council. Pharm. J., 1910, **84**, 452—453.

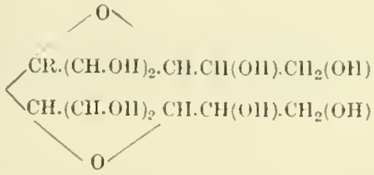
The general composition of opium is :—Morphine, 6—15, average 8 per cent.; narcotine, 4—8; other alkaloids, 0·5—2; meconin, under 1; meconic acid, 3—8, average 4; resin and caoutchouc, 5—10; fat, 1—4; gum and soluble humoïd acid matters, 40—56; insoluble matter and mucus, 18—20; ash, 4—8; and water, 8—30, average 20 per cent. The nature of some of the chief varieties of opium is shown in the following table :—

Kind of opium.	Morphine.	Hot water extract.	Cold water extract.	Water.
	per cent.	per cent.	per cent.	per cent.
Smyrna	12—16	64	—	12·5
Patna (India) ..	6	63	60	26
Benares ,, ..	6	66	61	28
Malwa ,, ..	6	—	60	14
Persian	10—12 (varies)	68	—	14
Kuei-chou (China)	4	—	48	25
Yün-nan ,, .	9	—	59	30
Ssu-ch'uan ,, .	10	—	56	38
Egyptian	7	65	—	15

—A. S.

Disaccharide; Isolation of a —— derived from amygdalin. J. Giaja. Comptes rend., 1910, **150**, 793—796. (Compare Armstrong, this J., 1908, 823.)

By the action of the digestive juice of the snail (*Helix pomatia*) on amygdalin, it is ultimately converted into dextrose, hydrogen cyanide and benzaldehyde. Primarily, however, the dextrose is liberated as a non-reducing disaccharide. Accordingly the extent of hydrolysis, as measured by the amount of dextrose formed, is only ⅓ or ¼ that given by the measurement of hydrogen cyanide. By stopping action at the proper moment the disaccharide may be isolated as a syrup or amorphous powder which does not reduce Fehling's solution or form a phenylosazone, but is hydrolysed to dextrose by mineral acids or by the juice of *Helix pomatia*. The analogy of this disaccharide to trehalose is pointed out and the following formula suggested for amygdalin :—



$$\begin{matrix} CR.(CH.OH)_2.CH.CH(OH).CH_2(OH) \\ CH.(CH.OH)_2\ CH.CH(OH).CH_2(OH) \end{matrix}$$

Where $R{=}C_6H_5.CH(CN).O$ ——

—E. F. A.

Rose oil. R. L. Lee. Z. Riech- u. Geschmackstoffe, 1910, 2, 64—66.

The principal source of rose oil is East Roumelia, the headquarters of the manufacture being in the Kissanlik valley. Rose oil is also distilled in other parts of Roumelia, viz., Karlova, Tschirpan, Philippopolis, Eski-Sagora, etc., though the oil from Kissanlik is regarded as the best. The variety of rose chiefly used is the *Rosa moschata*. (In Southern France the *Rosa provincialis* is used, which yields a better and finer oil.) Roses grown at a higher altitude yield an oil which solidifies more easily, and has a better odour, than that obtained from roses grown lower down. The best yields are obtained in cool rainy weather. 18 to 8 "okka's" of leaves are required to produce a "mitskal" of oil; an "okka" is equivalent to 1·52 or 1·28 litre, and a "mitskal" to 4·5 grms. In spite of care, much of the oil is adulterated with geranium oil, large quantities of which are smuggled into Eastern Roumelia in order to escape the import duty of 200 per cent. *ad valorem*. The Turkish Government levies an export duty of 1 per cent. on otto of roses. The average annual yield of Bulgarian oil is about 3500—3850 lb. In 1866, which was a specially good year, the yield rose to about 6600 lb.—F. Shdn.

Patchouli oil. De Jong. Chem. and Drugg., 1910, **76**, 50—51.

The oils prepared from "fresh," "dried," and "fermented" leaves of Java and Singapore patchouli (this J., 1910, 110), have been examined by two commercial firms. Messrs. Schimmel and Co. state that the three oils from Singapore patchouli differ but little from each other and from commercial Singapore patchouli oil, with the exception that they are rather weaker in odour, and the oil from the "fermented" leaves is rather less soluble. The three Java oils, however, differ considerably from the commercial oil and from each other. The oil from the fresh leaves is heavier and more readily soluble than those from the "dried" and "fermented" leaves, and the odour and optical activity are greatly modified by the fermentation of the leaves. After slight fermentation, a dextro-rotatory oil with a somewhat calamus-like odour is obtained, whilst after stronger fermentation, the oil yielded by the leaves is lævo-rotatory and has a patchouli-like odour. Messrs. Roure-Bertrand fils consider that all the oils are inferior to those distilled in Europe from Penang patchouli leaves. They arrange them in the following order of decreasing merit :—"dried Singapore-leaf" oil, "fresh Singapore-leaf" oil, "lightly fermented Java-leaf" oil, "strongly fermented Java-leaf" oil, "fresh Java-leaf" oil, "dried Java-leaf" oil.—A. S.

Camphor. Chem.-Zeit., 1910, **34**, 320.

The price of camphor was raised by the Japanese Government from M. 2·61 (2s. 6½d.) per kilo. in 1903 to M. 4 (3s. 11d.) per kilo. in 1906 and 1907, whilst at the same time a large output was encouraged by every means.

The result of the high prices ruling in the latter years was to enable German artificial camphor to compete with the natural product successfully, which in turn led to great reductions in the price of the Japanese product, the present price (in Japan) being M. 2·07 (2s. 3d.) per kilo. By this means the Japanese stocks have been diminished, but at the same time camphor is being produced in Japan at a cost of M. 3 (2s. 11d.) per kilo., the cost in Formosa being M. 1·75 (1s. 8½d.). Since March 1909 the production has fallen, and it is to be assumed that the Government intend to limit the output from Formosa, and to raise the price again as soon as they have got rid of their surplus stocks. For these and other reasons the competition of Japanese camphor is not likely to be so serious in the future as the present low prices might seem to indicate.—E. W. L.

d-Pinene nitroso chloride; Action of piperidine on ——. L. Buschujew. J. Russ. Phys.-Chem. Ges., 1909, **41**, 1481—1489. Chem. Zentr., 1910, **1**, 1025.

10 grms. of the nitrosochloride of *d*-pinene (from Russian oil of turpentine) were warmed with 10 grms. of piperidine in 30 c.c. of alcohol, and the reaction product was precipitated with water. The reaction proceeds in two different directions, both *d*-nitrosopinene, $C_{10}H_{15}NO$, m. pt. 131°—132° C., and *d*-pinenenitrolpiperidide, m. pt. 118°—119° C., being formed.—A. S.

Essential oil imports into the United States. Chem. and Drug., April 2, 1910. [T.R.]

The following figures represent the imports of the chief essential oils and balsams, etc., imported into the United States during the fiscal years ended June 30, 1905 to 1909:

—	1905.	1906.	1907.	1908.	1909.
	lb.	lb.	lb.	lb.	lb.
Ambergris	47	10	22	12	2
Balsam—					
Copaiba	217,005	177,661	225,988	372,802	234.257
Fir	31,546	29,615	20,436	8,863	4.673
Peru	29.835	16.747	15,303	28.024	25,843
Tolu	91,381	57,149	23,069	35,585	39,668
All other	36,903	103,249	172,309	45,583	113,561
Civet (oz.)	1,414	5.619	13,478	6.752	2.584
Menthol	—	—	20.665	20,183	23.975
Musk (oz.)	19,962	12,673	18,410	9.295	5,464
,, grain ($)	—	2,731	3,370	3,505	2.208
Oil—					
Almond, bitter	13,785	13,487	21,133	136,437	22,233
,, sweet	124,218	155,661	138,568	96,528	118,704
Amber	19,483	9,888	4,063	9,314	18,059
Aniseed	39,112	30,681	67,677	77,704	99,262
Bergamot.....	64,549	97,917	106,962	94,967	89,958
Cajuput	22,082	34,087	54,659	35,107	12,687
Chamomile ...	56	28	357	45	12
Caraway......	28,269	30,523	31,731	22,893	16,204
Cassia and cinnamon	46,473	92,493	137,191	69,652	133,194
Cedrat	200	182	710	47	297
Citronella	649,113	739.957	820,310	692,257	1,038,838
Croton	4.106	2,447	18	916	150
Fennel	8,517	24.949	51,521	18,421	16.533
Fruit ethers ..	876	642	470	156	627
Jasmine	817	1,001	2,321	3.606	2,339
Juniper	9,988	16,456	18,024	13,950	21,647
Lavender	129,832	182,881	201,244	148,422	255,134
Lemon	310,056	370,270	487,717	440,326	405.695
Lime	5,415	6.695	16,474	6,765	21,995
Mace	4,853	3.645	2,120	1,850	2,200
Neroli	4.995	11,737	8,669	11,271	23,185
Orange	92.077	74,535	112,834	71,224	87,591
Origanum	6,495	6.940	6.053	6,976	2,657
Peppermint ..	16,184	29,206	16,642	2,039	1.239
Rose (oz.)	88,337	85,469	111,594	60,826	102,416
Thyme	54,002	27,438	71,781	43,384	50,117
Vanilla	608,576	857,838	969,031	572.537	1,121,575
Vanillin (oz.) ...	1,331	1.551	100	1,764	361

The exports of peppermint oil from the U.S.A. were: 1905, 36,953 lb.; 1906, 74,151 lb.; 1907, 147,722 lb.; 1908, 141,617 lb.; 1909, 161,811 lb.; and of all other essential oils the exports in 1909 were valued at $274,536, against $214,765 in 1908.

Ketones; New method of synthesising unsaturated ——. G. Darzens. Comptes. rend., 1910, **150**, 707—710.

Friedel and Craft's method of synthesising aromatic hydrocarbons and ketones has been applied by the author to the synthesis of unsaturated ketones, the product of the reaction being submitted to the action of a tertiary base such as diethylaniline. Stannic chloride is recommended as a better reagent than aluminium chloride for effecting the condensation. Hydroacetophenone, for example, is obtained from tetrahydrobenzene, by the action of acetyl chloride in the presence of stannic chloride and carbon bisulphide, decomposing the stannic compound formed with water, and adding diethylaniline: the sulphide is then expelled, the product heated for some hours at 180° C., dried over sodium sulphate and rectified. The yield of pure ketone is 50 per cent. of the theoretical quantity. A number of new ketones both in the fatty and hydro-aromatic series have been prepared.—A. Sbld.

Colloidal solutions of arsenic. Lecoq. *See* VII.

Patents.

Formaldehyde compound [for medicinal purposes]; Process of producing a dry —— *[from malt extract].* Chem. Pharm. Laboratorium "Sahir," Munich, Germany. Eng. Pat. 25,138, Nov. 1, 1909. Under Int. Conv., Dec. 19, 1908.

Five parts of dry malt extract, or an equivalent quantity of the liquid or syrupy extract, are heated to 60° C. with 7·5 parts of a 40 per cent. solution of formaldehyde, and the liquid is evaporated *in vacuo* at a temperature of 60°—70° C. The residue, consisting of a compound of formaldehyde and malt extract, is a pulverisable mass, readily soluble in water, from which all the formaldehyde can be separated at a temperature below 100° C.—J. F. B.

Perfume; A solid ——. A. Stapler. Fr. Pat. 406,577, Aug. 28, 1909.

A perfume which remains solid even at relatively high temperatures, is prepared by employing artificial musk as a base, and incorporating with it various other crystalline or liquid perfumes. The mixture is melted and cast in moulds, a small quantity of some material, such as magnesium or calcium carbonate, which is capable of absorbing oils, being included in the mixture, if necessary, to prevent the exudation of the liquid perfumes.—J. F. B.

Lecithin from dried yolk of eggs; Extraction of pure —— and preparation of a mixture of albumin and lecithin. Soc. anon. les Établissements Poulenc frères. Fr. Pat. 406,634, Dec. 12, 1908.

Dried yolk of egg is extracted in a continuous extraction apparatus by the passage, four or five times, of hot acetone. It is impossible by this treatment to extract the whole of the lecithin of the yolk, but the residue consists of a mixture of albumin and lecithin, containing 10—20 per cent. of the latter according to the extent of the treatment. This mixture constitutes a convenient form of the product in the most favourable condition for preservation. The acetone extract, when cooled to a low temperature, deposits a precipitate of lecithin in an impure form. This precipitate is filtered off and washed, first with cold acetone to remove the fatty impurities, and then with hot acetone to remove the fatty acids, and cholesterol, leaving the lecithin practically pure.—J. F. B.

Glycolmonosalicylic ester; Process for preparing ——. C. F. Boehringer und Söhne. Ger. Pat 218,466, Dec. 3, 1907.

The monoglycol ester of salicylic acid is readily obtained by the action of ethylene halogenides on salicylic acid salts in presence of water, with or without addition of a solvent.—T. F. B.

1-Phenyl-2 3-dimethyl-5-pyrazolone with dialkylglycollic acids or monoalkylglycollic acids, $C_5H_{10}O_3$ and upwards; Process for preparing compounds of ——, soluble in water. J. D. Riedel, A.-G. Ger. Pat. 218,478, Feb. 12, 1909.

1 PHENYL 2.3-DIMETHYL-5-PYRAZOLONE can be caused to combine with molecular proportions of mono- or dialkylglycollic acids, containing five or more carbon atoms, either by melting the components together, or by causing their solutions to crystallise; the resulting compounds are stable and very readily soluble in water, and they possess antipyretic and antineuralgic properties.—T. F. B.

Iron-mannitol-vitellin compounds soluble in water; Process for preparing ——. Dr. Degen und Kuth. Ger. Pat. 218,910, Feb. 21, 1908.

VITELLIN (the nucleo-albumin of egg-yolk) is precipitated as an insoluble iron compound by means of an inorganic iron salt in presence of alkali carbonate solution; this is then treated with mannitol in presence of a further quantity of alkali, and the iron-mannitol-vitellin compound separated either by evaporation to dryness (preferably *in vacuo*, at a temperature not exceeding 40° C.), or by precipitation with alcohol or with dilute acid.—T. F. B.

Camphene and camphene hydrate; Process for preparing mixtures of —— from pinene hydrochloride by means of alkali or alkaline-earth oxides. Chem. Fabr. vorm. Sandoz. Ger. Pat. 218,989, May 3, 1907.

PINENE hydrochloride is heated under pressure with a solution of alkali hydroxide or a suspension of alkaline-earth hydroxide, in presence of polyvalent alcohols or carbohydrates; when alkaline-earth hydroxides are used, such alcohols or carbohydrates are employed which will bring the hydroxide into solution. Suitable substances are glycerol, mannitol, dextrin, dextrose, starch, etc. The product consists of a mixture, free from chlorine, of camphene with its hydrate, which may be converted into camphene by dilute acid. The soluble carbohydrates are completely decomposed and the insoluble ones only partially so, in the reaction; among the by-products formed is lactic acid.—T. F. B.

Hydrogenation or dehydrogenation of organic compounds; Catalysts for the ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 7315, March 26, 1909.

SEE Fr. Pat. 401,876 of 1909; this J., 1909, 1222.—T. F. B.

Pharmaceutical compounds [alkali phenolates of o-oxymercuric salicylic anhydrides]; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,074, April 28, 1909.

SEE Fr. Pat. 404,491 of 1909; this J., 1910, 234.—T. F. B.

Fatty acids; Process for preparing iodine derivatives of ——. A. L. Arnaud and S. Posternak, Paris. Eng. Pat. 24,062, Oct. 20, 1909. Under Int. Conv., Oct. 20, 1908.

SEE Fr. Pat. 404,477 of 1908; this J., 1910, 234.—T. F. B.

Fatty acid anhydrides, principally acetic anhydride; Process for preparing —— from salts of fatty acids. T. Goldschmidt. Fr. Pat. 407,046, Sept. 16, 1909. Under Int. Conv., Nov. 20, 1908.

SEE Eng. Pat. 25,433 of 1908; this J., 1910, 112.—T. F. B.

Esters of oxyamino acids; Preparation of ——. E. Fourneau, Paris. U.S. Pat. 952,006, March 15, 1910.

SEE Fr. Pat. 371,808 of 1906; this J., 1907, 434.—T. F. B.

Esters of dimethylamino-dimethyloxyacetic acid; Process of obtaining acidylic derivatives of ——. E. Fourneau, Paris. U.S. Pat. 952,323, March 15, 1910.

SEE Fr. Pat. 371,808 of 1906; this J., 1907, 434.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Colouring photographic prints and cinematograph films; Processes for ——. R. W. James, London. From Comp. Générale de Phonographes, Cinematographes, et Appareils de Précision, Paris. Eng. Pat. 14,743, June 23, 1909.

PHOTOGRAPHIC prints or cinematograph films are first toned to obtain a suitable monochrome ground colour, and they are then coloured by hand or otherwise. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 10,898 of 1904, 21,584 of 1906, and 15,249 of 1907.)—T. F. B.

Photographs in colour; Process for printing on paper ——. Soc. Anon. "La Photographie des Couleurs." Fr. Pat. 406,616, Aug. 27, 1909.

IN printing photographs in two or more colours, especially in the gum-bichromate process, the colour of the image first applied is liable to be obscured somewhat by the subsequent images, if the colours used are not transparent; in such cases it is proposed to interpose between the negative and paper when printing, a ruled or dotted screen, or to perforate the successive images, so that the subjacent colours may not be obliterated.—T. F. B.

Gum bichromate process in photography; Process for preparing and keeping the substances used in the ——. Soc. Anon. "La Photographie des Couleurs." Fr. Pat. 406,520, Aug. 27, 1909.

SEE Eng. Pat. 27,686 of 1908; this J., 1909, 961.—T. F. B.

Photographic paper; Process which imparts to —— the property of preserving its original dimensions, even after several successive wettings and dryings. Soc. Anon. "La Photographie des Couleurs." Fr. Pat. 406,521, Aug. 27, 1909.

SEE Eng. Pat. 27,687 of 1908; this J., 1910, 174.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives as used in coal mines; Permissible ——. J. J. Rutledge. Eng. and Min. J., 1910, **89**, 670—674.

OWING to numerous disastrous explosions in the coal mines of the United States, which are believed to have been caused, in many cases, by the use of black blasting powder, the manufacture of permissible explosives has increased rapidly in late years. As a result of quite recent mine explosions, and the work of the Pittsburg Testing Station, the use of permissible explosives has been greatly extended in various mining districts. There are three varieties of permissible explosives, viz.: the ammonium nitrate class, the nitroglycerin class, and the hydrated class. A special shot firer is usually employed and the permissible explosives are usually exploded by electric detonators. In cases where fuse and detonators are used, certain devices are employed which are said to prevent spitting of the fuse, and hence ignition of gas. An advantage connected with the use of permissible explosives is the facility with which they can be used in wet or damp holes. One of the most important results of the use of permissible explosives is the absence of smoke when they are properly fired, in suitably prepared drill holes, and according to the author's observations the miners were able to return to the face some 30 seconds after the shot was fired, and in no case was there any discomfort arising from the fumes resulting from the explosion. The objections urged against the use of permissible explosives are as follows: First, they freeze at rather a high temperature; second, they usually cost more per ton of coal produced, than black powder; and third, some of them deteriorate rapidly on exposure to atmospheric conditions.—G. W. McD.

Match industry of Japan. Board of Trade J., April 7, 1910. [T.R.]

The export of matches ranks seventh in value among the principal articles of export from Japan. In 1909 the total quantity of matches exported amounted to 41,407,083 gross, valued at £1,186,738. These figures show an increase of 7,533,119 gross in quantity and £222,152 in value over those for 1908, and of 2,788,571 gross in quantity, and £72,406 in value over the figures for the year 1906, which was the record year for all branches of Japanese industry. At the present time Japan enjoys a practical monopoly of the markets in the Far East. The centres of the match-making industry are at Kobe and Osaka. Safety matches are made chiefly at the former town and phosphorus and sulphur matches at the latter. The total number of factories in Japan is about 150, employing about 25,000 workpeople, of whom more than three-quarters are women. About two-thirds of the production are exported. The number of factories in Kobe and Osaka in 1909 was about 70 and 30 respectively, the majority of which are quite small: only 10 factories in Osaka employed more than 100 hands in 1908. Wax matches are made only to a very small extent, the industry being entirely a home one. There is very little demand for wax matches.

Patent.

Explosive compound. H. Maxim, New York. U.S. Pat. 951,445, March 8, 1910.

A smokeless powder is obtained by incorporating trinitro-anisol with nitrocellulose (with or without the aid of heat) or with pyroxylin, or with "pyronitrocellulose" (to form an amorphous colloid). A smokeless gunpowder may also be prepared by incorporating "pyronitrocellulose" with an ester of picric acid, the materials being meanwhile subjected to heat.—C. A. M.

XXIII.—ANALYTICAL PROCESSES.

Hydrochloric acid solutions; Method for preparing standard ——. G. A. Hulett and W. D. Bonner. J. Amer. Chem. Soc., 1910, **31**, 390—393.

The hydrochloric acid of constant boiling point (see Roscoe and Dittmar, J. Chem. Soc., 1860, 128), was recommended long ago for the preparation of approximately normal solutions. The authors find that by starting with acid of sp. gr. about 1·1, and distilling off three-quarters, then the composition of the following distillate is constant to within 1 part in 10,000, and by diluting a known weight of this to a definite volume, a *N*/1 solution can be obtained directly with an accuracy seldom otherwise obtained, even with very elaborate precautions. From their own experimental results and those of Roscoe and Dittmar, the following values for the composition of the acid of constant boiling point have been calculated, but except for very accurate work, the exact pressure, if in the neighbourhood of 760 mm., need not be taken into consideration.

Pressure.	Hydrogen chloride.	Weight of constant-boiling distillate containing 1 grm.-mol. of HCl.
mm.	per cent.	grms.
770	20·218	180·390
760	20·242	180·170
750	20·266	179·960
740	20·290	179·745
730	20·314	179·530

A. S.

Cobalt and nickel; New direct titration of ——. E. Rupp and F. Pfenning. Chem.-Zeit., 1910, **34**, 322—323.

Cobalt.—The method is based on the formation of a soluble double cyanide, which is decomposed by excess of cobalt ions with formation of insoluble cobalt cyanide. It is similar to that recently proposed for zinc (this J., 1910, 300). A cobalt ion is found to be equivalent to 5 mols. of potassium cyanide. Further investigation is required to definitely ascertain the nature of the reaction, but the following equation is proposed:

$$2K_4Co(CN)_6+O+H_2O=2K_3Co(OH)(CN)_5+2KCN.$$

The determination of cobalt is carried out as follows: 5—25 c.c. of *N*/2 potassium cyanide (without dilution) are titrated with the solution of cobalt sulphate or cobalt-ammonium sulphate (free from acid and diluted to contain 0·02—0·75 per cent. of cobalt), until a permanent brownish turbidity remains. The exact point is easily recognised and the results agree very closely with the calculated quantities. *N*/2 potassium cyanide prepared from pure cyanide can be standardised by *N*/4 or *N*/2 hydrochloric or sulphuric acid: its strength remains constant (1 c.c = 0·0059 grm. of cobalt). *Nickel.*—The same method is applicable to nickel. 10 c.c. of *N*/2 potassium cyanide solution are titrated with a solution of nickel chloride or sulphate (free from acid) until a permanent turbidity is formed. A nickel ion is equivalent to 4 mols. of potassium cyanide: $Ni''+4KCN=K_2Ni(CN)_4+2K'$ (1 c.c. of *N*/2 alkali cyanide = 0·0073375 grm. of nickel). Further addition of the nickel solution causes the following reaction to take place: $K_2Ni(CN)_4+Ni''=2Ni(CN)_2+2K'$. The nickel solution should be diluted to contain 0·04—1·0 per cent. of nickel: any free acid must be first neutralised with dilute alkali, using methyl orange as the indicator. 5—20 drops (20 drops = 1 c.c.) of 10 per cent. ammonia added to the cyanide solution before titration increases the sharpness of the end reaction, but the addition of a much larger quantity (over 5 c.c.) leads to very erroneous results. The method can be reversed. Ten drops of a 1 per cent. phenolphthalein solution are added to a known volume of the neutral or neutralised nickel solution, which is titrated with *N*/2 alkali cyanide until the precipitate formed is dissolved and a red colour obtained (formation of the double cyanide). The end reaction is a double one, a faint rose colour being first observed, and on adding 0·05 c.c. more of cyanide the usual red tint is obtained. This final addition is deducted, unless the cyanide has been standardised accordingly. The results are very good. A third modification is available. An excess of *N*/2 potassium cyanide is added to the neutral nickel solution and the excess determined by titration with *N*/2 hydrochloric or sulphuric acid and methyl orange. The last two methods are not applicable to cobalt. Methods based on the oxidation of cobaltocyanide to cobalticyanide were found to be unsatisfactory. During the investigation it was found that hydrogen peroxide and hydrocyanic acid could react in another way: $HCN+H_2O_2=NH_3+CO_2$, the usual reaction forming oxamide.—A. Sbld.

Titanium; Determination of ——. B. Neumann. Stahl u. Eisen, 1910, **30**, 457—458.

Kaiser, in a Munich Dissertation, gives the following in regard to titanium determination. The metal cannot be completely converted into dioxide by ignition in air. The substance should be heated in a platinum crucible over the blowpipe; then 10 times as much potassium bisulphate is added, the crucible covered, and gently heated over a Téclu burner until the contents are fused—after a few minutes the fused mass becomes clear. The cooled melt is dissolved in 100 c.c. of 1 : 3 or 1 : 5 sulphuric acid (2—3 hours), and any silica filtered off and evaporated with hydrofluoric acid—any residue is titanium dioxide. The solution is neutralised with ammonia, boiled a long while, and a few drops more of ammonia added to complete the precipitation of the titanic acid. The precipitate is washed with water and ammonia, and ignited till of constant weight. This gives the sum of titanium dioxide, ferric oxide, and alumina. A second portion is dissolved as before, 2 grms. of tartaric acid are added to the solution, which is neutralised with ammonia, kept at 60° C., and saturated with hydrogen sulphide; the ferrous sulphide is filtered off and determined. To determine alumina the ignited mixed oxides are fused in a platinum crucible with 20—25 times their weight of sodium carbonate and borax in equal proportions; half as much again of the mixture is added, and after cooling, the mass is placed in cold water. The alumina dissolves as aluminate; the iron and titanium are left undissolved. Newton's volumetric method of determining titanium gives good results. A flask containing 2 grms. of zinc-powder (of known iron-content) has a tap-funnel and gas-delivery tube passing through its cork. The flask is filled with hydrogen, then the titanium fusion with 10 per cent. sulphuric acid is poured into the funnel and allowed to drop upon the zinc, washing it with 10 per cent. sulphuric acid. The flask is warmed, hydrogen meanwhile being passed through, and after all is dissolved, 25 c.c. of 1 : 10 ferric sulphate are added, and the reduced ferrous salt is titrated with permanganate. The hydrogen peroxide colorimetric method also gives good results. —J. T. D.

Titrations with borax in presence of glycerin. N. Tananajew and D. Zuckermann. J. Russ. Phys.-Chem. Ges., 1909, 41, 1469—1481. Chem. Zentr., 1910, 1, 1052.

In addition to caustic alkalis, alkali carbonates can also be titrated with borax in presence of glycerin, if the solution be boiled. The titration can be performed either by running the alkali into the solution of borax and glycerin, or by running a solution of borax into the mixture of alkali and glycerin. Using phenolphthalein as indicator, borax solution and glycerin may be used in place of hydrochloric acid or oxalic acid for the determination of caustic alkali in presence of alkali carbonate as in Winkler's method.—A. S.

Nitric acid; Detection of —— in the presence of compounds of bromine, iodine, and ammonia. S. Goldschmidt. Chem.-Zeit., 1910, **34**, 267.

Four test tubes, A, B, C, and D, are arranged in series. B and C contain caustic soda solution, while D contains a clear solution of starch and potassium iodide. The solution to be examined is introduced into A, a few drops of potassium iodide solution are first added to it, then concentrated sulphuric acid to liberate nitric acid, and after the lapse of one minute, a current of air is passed through the series of tubes. The caustic soda in B and C absorbs halogens and acid substances, and after passing air through the apparatus for some time, a blue coloration in D indicates the presence of a nitrate in A.—O. R.

Carbon dioxide; Determination of —— by means of the calorimetric bomb. E. Grafe. Biochem. Zeits., 1910, **24**, 277—281.

After combustion of the substance in Berthelot's calorimetric bomb, the resulting gases are drawn through a calcium chloride tube and an absorption apparatus containing potassium hydroxide solution or soda-lime, a valve in the bomb being opened for the purpose. From 0·3 to 0·8 grm. of the substance, compressed into pastilles in the usual way, is introduced into the platinum crucible of the bomb, and, in the case of substances containing nitrogen or sulphur, it is also advisable to have 1 or 2 c.c. of water in the bomb to absorb the nitric or sulphurous acids. After the combustion with oxygen in the usual manner, the bomb is allowed to stand for 15 to 30 minutes (or 1 to 2 hours in the case of substances containing nitrogen or sulphur) and a valve then gradually opened, and regulated so that the bubbles pass through the absorption apparatus at the same speed as in ordinary elementary analysis. Finally, after about 3 hours, when there is no further pressure within the bomb, the remainder of the gases from the combustion are expelled by means of a slow current of about 3 to 4 litres of air previously freed from moisture and carbon dioxide. The results thus obtained are in close agreement with those given by the ordinary method. A simultaneous determination of the water produced in the combustion may also be made, provided that the bomb is rendered absolutely dry and that the proportion of moisture in the oxygen used is known. The last traces of water must be expelled from the bomb by heating. Acids will also pass over with the water, but the error due to this cause is slight and may be approximately estimated.—C. A. M.

Nitrogen; Possible source of error in determining —— by Kjeldahl's method. C. Neuberg. Biochem. Zeits., 1910, **24**, 435—436.

When mercury has been used to accelerate Kjeldahl's process, and the amino-mercuric sulphate is subsequently decomposed with sodium thiosulphate, sulphur dioxide may be liberated unless sufficient alkali has been added. This may be obviated by using potassium xanthate, instead of potassium thiosulphate, in the proportion of 1 grm. for 0·4 grm. of mercuric oxide. In alkaline solution this decomposes the mercuric compound as readily as alkali sulphide, and if added to an acid solution yields nothing that can affect the titration.—C. A. M.

Clarification and decolorisation [of solutions for optical examination]. C. Neuberg. Biochem. Zeits., 1910, **24**, 424—430.

Liquor ferri subacetici effects clarification and decolorisation on boiling the liquid to which it has been added, whilst colloidal iron hydroxide solution is still more generally applicable, since it is effective, even in the cold. It gives good results in the clarification of urine and other organic fluids for optical examination, and also in removing fine turbidities due to barium sulphate, calcium carbonate, bacteria, etc. Excess of the reagent may be readily removed by the addition of a small quantity of sodium chloride or magnesium sulphate. In cases where it is desirable not to dilute the liquid, kaolin clay gives good results when precipitable proteins or other colloids are present, but as a rule its clarifying power is inferior to that of kieselguhr. If, in the decolorisation of solutions containing sugar, it is desired for special purposes, to use mercury salts in addition to other precipitants, mercuric acetate is superior in every respect to mercuric nitrate, and, like lead acetate, is best used in the solid form.—C. A. M.

Polarimetry; Sodium flame for ——. C. Neuberg. Biochem. Zeits., 1910, **24**, 423—424.

The light from the sodium flame may be considerably increased by raising the temperature by the use of such sodium salts as emit a large proportion of oxygen when heated in the gas flame. Thus sodium nitrite, nitrate, chlorate, and bromate are well suited for this purpose, and by the use of the first-named, such bodies as *e.g.* osazones, may easily be polarised. The intensity of the light may also be increased by the introduction of a current of oxygen into a sodium flame.—C. A. M.

Naphthoresorcinol reaction. C. Neuberg. Biochem. Zeits., 1910, **24**, 436—440.

The author's experiments, described in detail, show that Tollen's naphthoresorcinol reaction (this J., 1908, 716, 1001) affords, if carefully carried out, an excellent test for carbonylic acids, *i.e.*, compounds containing the grouping, .COH.COOH or .CO.COOH. In order to check the restrictive influence of substances such as dextrose, sucrose, and pentoses upon the reaction it is necessary to add a sufficiently large excess of naphthoresorcinol.—C. A. M.

Bismuth iodide hydriodic acid as a reagent for the precipitation of bases. C. Neuberg. Biochem. Zeits., 1910, **24**, 434—435.

The disadvantages due to the acid in the use of Dragendorff's reagent (bismuth potassium iodide in nitric acid) may be obivated by the use of salts of bismuth iodide hydriodic acid. Bismuth iodide barium iodide may be prepared by dissolving 118 grms. of commercial bismuth tri-iodide in a concentrated solution of 65 grms. of barium iodide ($BaI_2,2H_2O$), and diluting the solution to 500 c.c., after the addition of a few drops of hydriodic or hydrochloric acid. It is a yellowish red liquid the salt in which corresponds to the composition, $4BiI_3.3BaI_2$. The ammonium salt ($2BiI_3.3NH_4I$) is obtained in a solution by introducing 118 grms. of bismuth iodide into a solution of 43·3 grms. of ammonium iodide, adding a few drops of hydriodic or hydrochloric acid, if required, and diluting the solution with water to 500 c.c. After precipitation of bases by means of these reagents, the excess of halogen may be removed by means of lead or silver oxide (which also precipitates the bulk of the bismuth), barium by sulphuric acid, ammonia by baryta or lead oxide, and dissolved bismuth by hydrogen sulphide. The double iodides of the bases may be decomposed with hydrogen sulphide, or with silver oxide or lead carbonate.—C. A. M.

Ultraviolet rays; Paper sensitive to ——. C. Schall. Chem.-Zeit., 1910, **34**, 267.

Paper impregnated with a 2*N*/3 solution of nitro-*p*-phenylenediamine, is sensitive only to ultraviolet radiation between the wave-length limits of 313 and 295 $\mu\mu$, exposure to which colours it a deep blue.—O. R.

Determining thorium in monazite sand. Meyer and Speter. *See* VII.

Determining nickel by dimethylglyoxime. Bogoluboff. *See* X.

Analysis of Babbitt metals, solders, and journal brasses. Demorest. *See* X.

Determination of petroleum derivatives and resinous products in turpentine oil. Nicolardot and Clement. *See* XIII.

Use of miscibility curves in the analysis of oil of turpentine. Vezes. *See* XIII.

Determining caoutchouc as tetrabromide. Fendler. *See* XIV.

Determination of assimilable potash in soils. Bieler-Chatelan. *See* XVI.

Detecting inositol in organic mixtures. Meillère and Fleury. *See* XVII.

Temperature corrections in the analysis of beer and beer worts by the immersion refractometer. Stanek and Miskovsky. *See* XVIII.

Determination of fat in foodstuffs. Polenske. *See* XIXa.

Determining caffeine in tea and in raw and roasted coffee. Burmann. *See* XIXa.

Distinctive reaction for mushrooms. Leewry. *See* XIXa.

Medicinal plants and drugs. [Determination of total alkaloid.] *See* XX.

Patent.

Calorimeter. A. H. Walrath, Davenport, Iowa. U.S. Pat. 951,709, Mar. 8, 1910.

The calorimeter bomb comprises an outer water-tight casing, and an inner combustion-vessel surrounded by an air-jacket. The combustion vessel is closed by a cap which also protects the flange from the water in which the bomb is placed.—A. T. L.

XXIV.—MISCELLANEOUS ABSTRACTS.

Tobacco fermentation, and oxydase and peroxydase in tobacco. M. Betting. Mededeelingen van het Algemeen-Proefstation op Java te Salatiga, [2], No. 20, pp. 2, and No. 27, pp. 12, Chem. Zentr., 1910, **1**, 1043.

By cooling the vapours evolved from a heap of fermenting tobacco, a colourless, strongly alkaline liquid was obtained, of sp. gr. 0·998 at 27·5° C., in which the presence of ammonia, nicotine, ethyl alcohol, and acetone was detected. By cutting out the veins of tobacco leaves, drying them at 40° C., grinding, sifting, and thorough mixing, a homogeneous powder was obtained, with which tests were made as to the presence of oxydase and peroxydase. Weighed quantities of the powder were macerated with a definite quantity of water for a definite period, then filtered, and the filtrate treated with guaiacum tincture in presence and in absence of hydrogen peroxide. When the powder was macerated for only a short time (1 min.) with water, the solution gave the oxydase reaction with guaiacum tincture; when maceration was continued for a longer time, the oxydase reaction failed, but the peroxydase reaction was obtained on addition of hydrogen peroxide. After adding a solution of the "chromogen" isolated from fresh tobacco leaves, the solution again gave the oxydase reaction. The peroxydase was destroyed by heating to 90° C., and became inactive in presence of excess of the "tobacco-chromogen." It is probable that the tobacco does not actually contain an oxydase, for the so-called oxydase reaction could be obtained even at relatively high temperatures (87° C.).—A. S.

Trade Report.

Ceylon; Exports from —— in 1909. Board of Trade J., April 7, 1910.

The report of the Ceylon Chamber of Commerce for the half-year ended 31st December, 1909, contains the following statistics of certain exports from Ceylon in the years 1908 and 1909:—

Articles.		1908.	1909.
Rubber	lb.	912,125	1,492,580
Cinnamon quills	,,	3,233,229	3,509,506
Cinnamon chips	,,	2,785,824	2,941,578
Cocoanut oil	cwt.	670,121	581,478
Copra	,,	768,795	772,032
Plumbago	,,	525,095	627,737
Citronella oil	lb.	1,390,602	1,573,932

French Customs Tariff; New ——. [Cd. 5127.]

The new French Tariff came into operation on April 1st last. The following are the principal items of interest to chemical manufactures, in which the duties have been modified. The produce and manufactures of the United Kingdom are subject to the minimum rates of duty.

——	New Rates.		Old Rates.	
	Genl.	Min.	Genl.	Min.
	Frcs.	Frcs.	Frcs.	Frcs.
Wax—				
crude, bees'	8	8	12	8
bleached	18	12	12	8
Oil seeds—				
colza, rape, poppy	4·50	4·50	Free	Free
niger, soya, cotton (decort.)	2·50	2·50	Free	Free
camelina, ravison, beech-nut	2	2	Free	Free
other kinds	Free	Free	Free	Free
Oils, vegetable—				
olive for soap makers	10	3	—	—
,, edible	25	10	—	—
cocoanut, touloucouna, illipé, palm-kernel	3	1	3	1
castor and pulghère	7·50	5	6	1
cotton, sesame and nut, for soap makers or making edible fats	9	6	15	12
other oils	18	12	15	12
soya, maize for soap-makers	9	6	Not specified	
,, other uses	23	15		
other kinds	23	15		
Edible vegetable fats	35	25		
Perfumes, synthetic, pure or mixed with natural products	20%	15%	Not specified	
Camphor—				
natural crude and in powder	2	Free	2	2
refined	9	6	7·50	6
synthetic	37	25	Not specified	
Mineral waters	20	Free	20	Free
Kieselguhr	2·5	2·5	Free	Free
Mineral wax, paraffin wax	45	30	12	10
Vaseline	42	28	32	28
Bromine, liquid	Free	Free	60	50
Bromides	75	50	60	50
Fluorides	15	10	Not specified	
Acids—				
carbonic, liquid	9	6	—	—

	New Rates.		Old Rates.	
	Genl.	Min.	Genl.	Min.
Acids—*cont.*				
hydrochloric	0·45	0·30	0·37	0·30
citric, crystals	75	50	60	50
hydrofluoric	9	6	—	—
gallic	140	93	110	93
hydrofluo-silicic	6	4	—	—
oleic	1·50	Free	Free	Free
oxalic	19	12·50	15	12·50
phosphoric	30	20	25	20
stearic	13·50	9	10	8
tannic, all kinds	7·50%	5%	5%	5%
tartaric	18	12	12	10
Deglycerinated oils (2 to 5 per cent. fatty matter)	5·50	3·50	Not specified	
Gall, sumac, chestnut extracts and other tannin-containing liquids and vegetable extracts	4·50	3	5	3
Quebracho extract—				
solid	8	5·50	5	3
liquid	5	3·50	5	3
Oxides—				
cobalt pure	525	350	450	350
tin	50	Free	Free	Free
lead (minium)	7·70	5·15	8·50	5·15
,, (litharge and other oxides)	7·95	5·30	8·75	5·30
zinc	4	3	Free	Free
Barium peroxide	15	10	Not specified	
Sodium carbonate—				
crude or refined, not exceeding 33 per cent.	2·85	1·90	2·30	1·90
refined, other kinds	6·15	4·10	—	—
Ammonia salts—				
chloride, crude	12	8	10	8
,, commercially pure	18	12	15	12
sulphate, crude	4·50	Free	Free	Free
other kinds, crude	4·50	3	3	3
,, commercially pure	11·75	7·75	7·75	7·75
Tin chloride	15	10	10	10
Acetates—				
copper, crude	15	10	12	10
,, refined, powder	22	14·50	18	14·50
,, ,, crystal	31·50	21	25	21
iron, concentrated	15	10	12	10
lead	11·40	7·60	11·50	7·60
potassium	33	22	26	22
Methyl alcohol or wood spirit	11·50	11·50	13	9·25
Formic aldehyde (40 per cent. or more)	15	9·50	—	—
,, ,, polymeric or other concentrated forms	36	24	—	—
Alumina, anhydrous	30	20	30	25
,, hydrate	15	10·50	15	13·50
Lead carbonate	9	6	8·50	5
Calcium carbide	9	6	—	—
Chlorinated lime	5·25	3·50	—	—
Liquid chlorine	6	4	—	—
Acetic and sulphuric ether, all strengths	60	40	30	30
Chloroform	113	75	75	75
Collodion	60	40	30	30
Glycerin, crude	10	3·75	4·75	3·75
Lime, nitrate and cyanamide	Free	Free	5%	5%
Thorium and cerium nitrates and other rare earths *kilo.*	12	8	—	—
Lime, pyrolignite	4·50	3	2·50	2
Acetone	22·50	15	—	—
Sulphates—				
aluminium	5·60	3·75	5	3·75
copper	3·0	1·50	4	3
iron	1·20	0·80	1	0·80
,, and copper (double salt)	0·75	0·50	0·60	0·50
sodium, pure, anhydrous 25 per cent. or less	3·30	2·20	2·50	2·20
sodium, pure, anhydrous more than 25 per cent.	13·50	9·0	10	9
sodium, crystal	1·80	1·20	1·50	1·20
sodium, impure, anhydrous 25 per cent. or less	2·60	1·75	2·20	1·75
sodium, impure, anhydrous, more than 25 per cent.	12·35	8·25	10	8·25
sodium, impure, crystal	1·65	1·10	1·50	1·10
zinc	2·40	1·60	2·25	1·60
Sulphides—				
mercury, artificial in lump	47	31	35	31
mercury, artificial, powdered (vermilion)	93	62	70	62
zinc	3·75	2·50	5%	5%
Coal-tar distillates—				
obtained direct, such as phenol, anthracene, benzene, xylene	Free	Free	Free	Free
chemical derivatives	23	15	20	15
Chemical products, not otherwise specified	7·50%	5%	5%	5%
Varnish, spirituous	45	30	40	30
,, oil or mixture	68	45	55	45
Ivory black	7·50	5	6	5
Lampblack, Spanish black	4·50	3	1·50	1·20
Lithopone	3·75	2·50	Not specified	
Glue—				
solid	6	4	Free	Free
liquid or jelly	2	Free	Not specified	
Gelatin, powder	6	4	—	—
Milk sugar	38	25	Free	Free
Aluminium :—				
Ingots or waste	75·00	50·00	200·00	150·00
Rolled forged or cast	112·00	75·00	200·00	150·00
Hammered, in leaves	300·00	200·00	200·00	150·00
Wire	150·00	100·00	200·00	150·00
Foundry and forge pick. cont. less than 15 per cent. manganese	2·25	1·50	2·00	1·50
Spiegel iron cont. 15 per cent. to 25 per cent. manganese	3·00	2·00	2·00	1·50
Ferro-manganese cont. more than 25 per cent. and less than 90 per cent. of manganese ; ferro-silicon cont. more than 5 per cent. and less than 20 per cent. of silicon ; silico-spiegel cont. at least 20 per cent. of silicon and manganese	5·25	3·50	4·75 2·00	3·50 1·50
Ferro-silicon cont. fr. 20 to 90 per per cent. of silicon	7·50	5·00	4·75	3·50
Ferro-chromium fr. 10 to 90 per cent. chromium	12·00	8·00	4·75	3·50
Ferro-titanium fr. 5 to 90 per cent. titanium	30·00	20·00	Not specified	
Ferro-molybdenum fr. 5 to 90 per cent. molybdenum	30·00	20·00	4·75	3·50
Ferro-tungsten fr. 5 to 90 per cent. tungsten	30·00	20·00	4·75	3·50
Ferro-vanadium cont. more than 5 per cent. vanadium, and all other ferro metallic alloys cont. rare metals ; silicon, manganese, chromium, titanium, tungsten and molybdenum metals	7½% ad val.	5% ad val.	5% ad val.	5% ad val.
Special steels cont. more than—				
6 per cent. chromium or tungsten 2 per cent. molybdenum 0·5 per cent. vanadium or titanium.	75·00	50·00	20·00	15·00
Zinc yellow or zinc chromate	28·75	18·50	5% ad val.	—
Crucibles and wares of graphite, plumbago, etc.	9·00	6·00	8·00	6·00
Photographic paper albumenised, not sensitised	150	100	125	100
Papers and films sensitised with silver or platinum salts, in leaves or rolls	300	200	225	200
Carbon paper	75	50	60	50
Paper sensitised with iron salts	45	30	40	30
Cement, slow	0·90	0·60	0·75	0·50
,, quick	0·60	0·40	0·50	0·25

The rates (unless otherwise mentioned) are per 100 kilos.

Cameroon Protectorate ; Commerce of the ——. Z. angew. Chem., 1910, **23**, 560—561.

The exports showed a general decrease during the year 1908 as compared with those of 1907 ; this decrease is attributed to lower prices of the products leading to less production, to increased cost of transport, etc. Rubber was exported to the extent of 1,214,320 kilos., a decrease of 18·7 per cent. as compared with the previous year ; 11,197,693 kilos. of palm kernels were exported, a decrease of 15 per cent.; and 3,043,158 kilos. of palm oil, a decrease of 14·5 per cent. In each case the price obtained for the products was lower than in 1907. There is a considerable local consumption of the products, and a soap factory has been established at Duala. An oil is also obtained from the seeds of the tree, *Mimusops Djave*, 193,697 kilos. having been exported. Kola nuts, 83,469 kilos., gum arabic, 265,753 kilos., and Shea nuts, 60,000 kilos., were also exported. Cotton of very good quality is grown on the marsh-land surrounding Lake Tchad, and an inferior kind is obtained from the interior of the country. The cocoa industry, however, is the most important ; 4822·7 hectares (about 12,000 acres) are productive, yielding, in the year 1908, 2,447,253 kilos. of cocoa. The value of the total trade in all products during the year amounted to M. 28,952,745 (about £1,412,329).—W. P. S.

Japanese Customs Tariff; Proposed new ——. Board of Trade, March, 1910.

THE following table contains extracts from the proposed new Japanese Tariff, together with the rates now in force. Those chemicals, etc., on which the proposed rates do not differ from those at present obtaining, are not included in the table.

Proposed Tariff Classification.	Present rates.	Proposed rates.
	£ s. d.	£ s. d.
Alizarin dyes, aniline and other coal tar dyes	10% *ad val.*	0 7 11½
Oxide of cobalt	7 7 0	4 10 7
Prussian blue	0 17 3½	0 16 0
Ultramarine blue	0 4 11¾	0 5 5¼
White or red lead or lithage ..	0 3 1½	0 3 7½
White zinc	0 3 5½	0 3 7½
Chalk or whiting	0 0 11.21	0 1 1½
Vermilion or cinnabar	2 8 9	2 6 4
Lacquer (juice of *Rhus vernicifera*)	0 10 10¾	0 11 9
Varnishes	1 2 6	1 5 1
Wood tar and coal tar ..	0 1 10¾	0 0 10·37
Pitch and asphalt	0 0 9·34 or 15% *ad val.*	0 0 11·41
Baryta paper, sensitised paper, etc.		
Baryta paper	—	1 13 4½
Albuminised paper	5 13 11	7 8 0
Bromide and platinum paper	9 13 8	11 11 8½
P.O.P.	7 14 7	6 19 2½
Portland, Roman, puzzuolana, and similar hydraulic cements	per ton. 0 2 3	per ton. 0 10 4½
Dolomite and magnesite ..	10% *ad val.*	Free
Linseed oil in can or barrel—		
(*a*) Boiled	0 1 8¾	0 5 2¾
(*b*) Other		0 2 9¼
Castor oil in can, barrel, or jar ..	0 3 5½	0 3 9¾
Olive oil—		
(1) In can or barrel	0 7 1	0 2 11¼
(2) Other	30% *ad val.*	0 16 5
Ground nut oil	0 6 9	0 8 0½
Soya bean oil	20% *ad val.*	0 2 5
Cottonseed oil	0 5 8½	0 7 8½
Wood oil	20% *ad val.*	0 3 3½
Camellia oil	20% *ad val.*	0 8 5¾
Cacao butter	20% *ad val.*	1 12 0
Fish oil and whale oil	30% *ad val.*	0 2 3
Fats, animal—		
Lard	0 10 0½	0 15 6¾
Other	0 2 3¾	0 1 4½
Compound lard	40% *ad val.*	0 13 3¾
Stearin	0 3 7½	0 7 9½
Olein	0 3 5½	0 2 11¼
Paraffin wax—		
Melting point up to 42° C.	0 0 11·29	Free
Other		0 5 11½
Vegetable tallow or wax ..	20% *ad val.*	0 10 4½
Candles	0 3 8½	0 19 0¼
Explosives—		
Gunpowder	0 10 10¾	0 13 11
Dynamite	0 9 8¼	0 10 6½
Detonators	2 12 5	2 4 1
Fuses	1 19 5	3 4 8
Other	25% *ad val.*	30% *ad val.*
Indigo, natural—		
Dry	1 2 5	1 16 8
Liquid or paste	30% *ad val.*	10% *ad val.*
Indigo, artificial—		
Dry	1 2 5	1 18 0
Liquid or paste	30% *ad val.*	10% *ad val.*
Turmeric	0 1 4½	0 1 8¾
Galls, myrobalans, betel nuts, oak bark, mimosa, mangrove, quebracho, and similar tanning materials	(See below)	Free
Galls	0 6 5¾	—
Mangrove bark	0 0 4·15	—
Tan bark and oak bark ..	0 0 8¾	—
Betel nuts	20% *ad val.*	—
Catechu and gambier ..	0 3 5½	0 0 10·38
Balsam	20% *ad val.*	2 3 3
Gum arabic, shellac, rosin, and other gums and gum resins not otherwise provided for (excluding those for medicinal use)	(See below)	Free
Gum arabic	0 5 0½	—
Gum shellac	1 10 11	—
Gum tragacanth	1 6 3	—
Rosin	0 1 0½	—
Gum benzoin, copal, mastic, sandarac	20% *ad val.*	—
Glue	0 4 5½	0 4 8
Gelatin	1 12 4	0 17 7½
Isinglass	20% *ad val.*	3 10 9
Dextrin	15% *ad val.*	0 1 11¼
Sulphur	20% *ad val.*	20% *ad val.*
Iodine	20% *ad val.*	Per lb. 0 2 1
Acid, boric	0 5 0	Per cwt. 0 5 6½
Acid, oxalic	20% *ad val.*	0 3 5¼
Acid, tartaric	1 2 8	1 0 7
Acid, salicylic	10% *ad val.*	1 0 1
Acid, carbolic	0 10 6½	0 10 4½
Acid, picric	20% *ad val.*	20% *ad val.*
Acid, citric	1 2 6	1 11 10
Acid, pyrogallic	Per lb. 0 2 0¾	0 2 2¾
Acid, tannic	1 4 7	1 15 10
Soda, caustic and potash, caustic:		
(1) Refined	See below	0 12 6½
(2) Other		0 1 2½
Caustic soda	0 1 1½	—
Caustic potash	20% *ad val.*	Per cwt. —
Iodide of soda	20% *ad val.*	Per lb. 0 2 4¾
Soda, carbonate—		
(1) Soda ash	Per cwt. 0 0 7¼	Per cwt. 0 0 7¼
(2) Other	(Not specified)	0 1 4½
Soda, bicarbonate	0 0 10¾	0 1 7½
Soda, peroxide	(Not specified)	0 7 11¼
Soda, nitrate, refined	20% *ad val.*	0 3 11¾
Soda, sulphate—		
(1) Refined	Not specified	20% *ad val.*
(2) Other		0 0 9·34
Soda borate (borax)	0 2 3½	0 1 8¾
Soda, silicate	20% *ad val.*	0 0 7¼
Soda, salicylate	1 2 0	1 4 5
Potash, nitrate	0 0 10	0 4 0¾
Potash, sulphate—		
(1) Refined	Not specified	20% *ad val.*
(2) Other		Free
Potash, chlorate	Free	Free
Potash, bichromate	0 4 4½	0 3 1¾
Potash, iodide	10% *ad val.*	Per lb. 0 1 10½
Potash, bromide	0 16 1	Per cwt. 0 17 3½
Barium peroxide	(Not specified)	0 4 4
Magnesium carb.	4 4 8¾	0 4 4
Mercury	0 8 8¾	Free
Alum	0 0 9·13	0 0 9·34
Ferrocyanide, soda	20% *ad val.*	0 3 6½
Ferricyanide, potash		10% *ad val.*
Ferrocyanide, potash		0 4 8
Ferricyanide of soda		0 9 8¾
Bismuth subnitrate	1 15 7	7 0 3
Ammonia, carbonate	0 6 8¾	0 5 11½
Thorium nitrate	not specified	7 10 1
Cerium nitrate		10% *ad val.*
Formalin	0 11 11	0 8 9¾
Wood spirit	0 5 10	0 10 3½
Glycerin	0 11 3	0 5 6½
Chloroform	1 18 0	1 18 7
Iodoform	(Not specified)	Per lb. 0 3 1¾
Milk, sugar	0 15 2½	Per cwt. 0 13 1½
Naphthalene	20% *ad val.*	0 2 7
Borneo camphor and blumea or ngai camphor	0 4 7½	0 0 6
Acetanilide	Per cwt. 0 16 5	Per cwt. 0 19 0
Antipyrin	6 18 3	7 1 9
Santonin	Per lb. 0 4 8¾	Per lb. 0 5 0¾
Quinine hydrochlor. and sulph.	8% *ad. val.*	Per lb. 0 2 1
Morphine hyd. and sulph. ..	0 13 8½	1 0 10
Cocaine hyd. and sulph. ..	1 18 6	1 9 9
Cinchonine hyd. and sulph. ..	Per cwt. 3 6 7	Per cwt. 3 7 1
Creosote carb.	4 10 7	Per cwt. 2 17 9
Guaiacol carb.	8 10 6	5 0 6
Aniline salt	0 6 1¾	0 4 9
Diastase	20% *ad val.*	Per lb. 0 2 2½
Baking powder	30% *ad val.*	Per cwt. 2 7 7
Vanillin, coumarin, heliotropin, and similar aromatic chemicals (n.o.p.)	20% *ad val.*	10% *ad val.*
Drugs, chemicals, and medicines (n.o.p.)	(See below)	20% *ad val.*
Bromide (*excluding pot. brom.*)	10% *ad val.*	„

Proposed Tariff Classification.	Present rates.	Proposed rates.
	£ s. d.	£ s. d.
Quinine (excluding sulph. and hydro chlor.)	8% *ad val.*	20% *ad val.*
All other drugs, chemicals and medicines	20% *ad. val.*	„
Meat extracts	0 13 2	6 5 4
Volatile oils, vegetable –		
(1) Fragrant	See below	Free
(2) Other		Per gallon
(A) Of turpentine		0 0 5·77
(a) In can or barrel ..		
(b) Other		20% *ad val.*
(B) Other		20% *ad val.*
Volatile or essential oils	Per cwt.	
Of cassia and cinnamon ..	3 17 10	—
Of citronella	2 15 10	—
Of lavender and bergamot ..	10 7 6	—
Of turpentine–	Per 10 Imp. gal.	
In cans or barrels	0 6 1½	
In other pkgs.	20% *ad val.*	
All other	30% *ad val.*	
Cod-liver oil	33% *ad val.*	0 17 9½
Soaps–		
(1) Perfumed	New classification	2 9 5
(2) Other		0 9 10½
	Per cwt.	
Soaps, toilet	0 12 1	
Soaps, washing	0 1 8½	
Soaps, other	30% *ad val.*	

Books Received.

METALLOGRAPHY. CECIL H. DESCH, D.Sc., Ph.D. Graham Young Lecturer in Metallurgical Chemistry in the University of Glasgow. Longmans, Green & Co., 39, Paternoster Row, London, New York, Bombay, and Calcutta. 1910. Price 9s. [One of the series of Text Books of Physical Chemistry, edited by Sir Wm. Ramsay, K.C.B., F.R.S.]

8vo volume, containing 416 pages of subject matter, with 108 illustrations, and alphabetical indexes of subjects and names, and a further one of metallurgical systems. The subject matter receives the following classification:—I. Diagram of thermal equilibrium. (*a*) Solid solutions or mixed crystals; (*b*) Ternary or more complete systems; (*c*) Metals which are only partially miscible in the liquid state. II. Practical pyrometry and thermal analysis. III. Preparation of micro-sections. IV. Microscopical examination of prepared sections. V. Crystallisation of metals and alloys. VI. Undercooling and the meta-stable state. VII. Diffusion in the solid state. VIII. Physical properties of alloys. IX. Electromotive force and corrosion. X. Construction of the equilibrium diagram. XI. Molecular conditions of metals in alloys and the nature of intermetallic compounds. XII. The plastic deformation of metals and alloys. XIII. The metallography of iron and steel. XIV. Metallography of industrial alloys. Appendix with list of systems.

DIE THEORIE DES FÄRBEPROZESSES. Von L. PELET-JOLIVET. Professor an der Universität Lausanne. Theodor Steinkopff's Verlag. Dresden. 1910. Price M. 7. Bound, M. 8.

8vo volume containing 321 pages of subject matter, with 14 illustrations, and an alphabetical index of names. The subject classification is according to the following scheme:—I. Historical introduction. II. General properties of the dyestuffs, such as solubility; composition and nature of the basic dyestuffs; electric conductivity of dyestuffs; relations between solubility and colloidal state; action of electrolytes on dyestuffs. III. Quantitative determination of dyestuffs. IV. Adsorption. V. Contact-electrolysis and its results. Influence of acids and bases, etc. VI. Relations between adsorption and contact-electrolysis. Capillary adsorption. VII. General observations on contact-electrolysis and the dyeing operations. VIII. Relative fastness and durability of dyeings. IX. Discussion of the different hypotheses to explain the dyeing process, etc.

SOLID BITUMENS. THEIR PHYSICAL AND CHEMICAL PROPERTIES AND CHEMICAL ANALYSIS, TOGETHER WITH A TREATISE ON THE CHEMICAL TECHNOLOGY OF BITUMINOUS PAVEMENTS. By S. F. PECKHAM, A.M. Chemist to the Department of Finance, City of New York, etc. The Myron C. Clark Publishing Co., New York and Chicago. E. and F. N. Spon, Ltd., 57, Haymarket, London. 1909. Price $5·00 net, post paid.

LARGE 8vo volume containing 317 pages of subject matter, with 29 illustrations, and indexes of subjects and names. The subject matter is subdivided as follows:—I. Geographical distribution of bitumens. II. Their origin. III. Classification. IV. Derivation of natural solid bitumens. V. Chemistry of bitumens. VI. Their composition. VII. Ultimate analysis, and methods. VIII. Proximate and technical analyses of solid bitumens. IX. Miscellaneous methods applied to street mixtures and surfaces, bituminous paving blocks, bituminous concrete, etc. X. Physical properties of solid bitumens. XI. Chemical technology of bituminous streets.

DIGEST OF COMMENTS ON THE PHARMACOPŒIA OF THE UNITED STATES AND THE NATIONAL FORMULARY FOR THE YEAR ENDING DEC. 31, 1906. By. M. G. MOTTER and M. I. WILBERT. Bulletin No. 58, Hygienic Laboratory, U.S. Treasury Dept., Government Printing Office, Washington.

LARGE 8vo volume of 523 pp., the matter of which is subdivided under the following headings:—1. *General comments* (*a*) Legal status and development. (*b*) Scope. (*c*) Non-pharmacopœial standards. (*d*) Analytical data. (*e*) Biologic products. (*f*) Vegetable drugs. (*g*) Pharmaceutical preparations. 2. *International standards* (*a*) International conference for the unification of pharmacopœial formulæ for potent medicaments (Brussels conference). (*b*) Foreign pharmacopœias. (*c*) Comments on U.S.P. VIII., relative to the requirements of the Brussels Conference. 3. *Comments on official articles.*

ROYAL COMMISSION ON CANALS AND WATERWAYS. Vol. IX. REPORTS, BY SIR JOHN WOLFE BARRY AND PARTNERS ON THE COST OF IMPROVING CANAL ROUTES, TO THE ROYAL COMMISSION APPOINTED TO ENQUIRE INTO AND REPORT ON THE CANALS AND INLAND NAVIGATIONS OF THE UNITED KINGDOM. [Cd. 5083.] Price 7s. 8d.

STATISTICAL ABSTRACT FOR THE BRITISH EMPIRE IN EACH YEAR FROM 1894 TO 1908. Sixth number. [Cd. 5094]. Price 1s. 3d.

THIS publication, which has been compiled in the Commercial Department of the Board of Trade, contains statistics of the area, population, and trade of each portion of the Empire with foreign countries and with other portions of the Empire, figures as to shipping, and statements as to the production and consumption of staple articles in the various countries of the Empire.

NEW FRENCH CUSTOMS TARIFF. TRANSLATION OF THE FRENCH CUSTOMS TARIFF AS AMENDED BY THE LAW OF THE 29TH MARCH, 1910; WITH A COMPARISON OF THE NEW AND FORMER RATES OF DUTY. [Cd. 5127.] Price 11½d. See under "TRADE REPORT."

TABLES RELATING TO THE TRADE OF BRITISH INDIA WITH BRITISH POSSESSIONS AND FOREIGN COUNTRIES. 1904—5 TO 1908—9. [Cd. 5109.] Price 1s. 1d.

THIS return contains statistics of the foreign trade of British India during the last five financial years. In 1908—9 the total value of the imports of merchandise (exclusive of Government stores) into British India by sea was £80,843,818, as compared with £86,596,729 in 1907—8; whilst the total value of the exports of merchandise of Indian produce and manufacture (exclusive of Government stores) in 1908—9 was £99,882,633, as against £115,652,151 in the preceding financial year.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

7704. Benninghoff and Klönne. Chamber and retort furnaces.* March 30.

7813. Watkin. Pyrometers, thermometers, &c.* March 31.

8009. Johnson (Philadelphia Textile Machinery Co.). Drying machines.* April 2.

8135. Brandes. Treatment of liquids. April 4.

8142. Stott. Drying machines. April 4.

8174. Benninghoff and Klönne. *See under* II.

8211. Sinding-Larsen and Storm. Separating the components of mixtures of gases. [Appl. in Norway, April 7, 1909.]* April 5.

8303. Cotterell. *See under* XIX.

8443. Berger. Drying apparatus. [Ger. Appl., Dec. 14, 1909.]* April 7.

8545. Malfitano. Apparatus for filtering liquids. [Fr. Appl., April 9, 1909.]* April 8.

Complete Specifications Accepted.

7154 (1909). Wiegand. Evaporating apparatus. April 6.

7769 (1909). Walker. Driers for rotary kilns. April 6.

9072 (1909). Porter. Conveyer mechanism for dehydrating apparatus. April 13.

16,821 (1909). Neubäcker. Evaporating drum. April 6.

21,660 (1909). Maschinenfabr. F. Weigel Nachf., and Spielvogel. Filter press. April 6.

27,582 (1909). Alexander (Reinhardt). Centrifugal separators. April 13.

II.—FUEL: GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

7606. Mendell. Fuel manufacture. March 29.

7704. Benninghoff and Klönne. *See under* I.

7766. Fabry. Recovering ammonia direct from coal-gas.* March 31.

7776. Sandiford and Seccombe. Fuel. March 31.

7786. Doherty. Treatment of combustible gases. [U.S. Appl., March 31, 1909.]* March 31.

7915. Brougham (Solvay et Cie.). Apparatus for removing tar from coal gases.* April 1.

7919. Woodall and Duckham. Continuously working vertical gas retorts. April 1.

8053. Peat, and Head, Wrightson and Co., Ltd. *See under* X.

8174. Benninghoff and Klönne. Gas-fired ovens, especially for the production of coke.* April 5.

8178. Slick. Production of gas.* April 5.

8341 Cervenka. Incandescence filament or body. [Ger. Appl., Oct. 23, 1909.]* April 6.

8379. Lloyd, and Simon-Carves Bye-Product Coke Oven Co. Treatment of coke oven and like gases. April 7.

8404. Ornstein and others. Artificial fuel for heating and lighting. April 7.

Complete Specifications Accepted.

8 9 and 8400 (1909). Jones. Coke ovens. April 13.

8781 (1909). British Thomson-Houston Co. (General Electric Co.). Manufacture of rods or filaments of refractory material for use in electric lamps. April 13.

16,065 (1909). Heinrich. Forming carburised metal filaments for electric lamps. April 13.

19,959 (1909). Koppers. Obtaining by-products in the dry distillation or gasification of fuel. April 13.

III.—TAR AND TAR PRODUCTS.

Applications.

7631. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. March 29.

IV.—COLOURING MATTERS AND DYES.

Applications.

7632. Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene colouring matters. March 29.

7923. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. April 1.

8127. Kalle und Co., A.-G. Manufacture of azo dyes. [Ger. Appl., April 13, 1909.]* April 4.

8239. Johnson (Kalle und Co.). Manufacture of dibromo-isatine.* April 5.

Complete Specifications Accepted.

12,205 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. April 6.

21,578 (1909). Johnson (Kalle und Co.). Manufacture of sulphur-containing vat colouring matters and lakes therefrom. April 6.

2404 (1910). Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of tri- and tetrabromindigo. April 6.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

7748. Pellerin. Purified hydrated cellulose and its manufacture. March 30.

7752. Blake, Blake, and Blake. Treatment of fabrics to produce wall, roof, and similar coverings. March 30.

8539. Bals. Preparation of cellulose and its industrial application.* April 8.

8646. Merckens and Manissadjian. Non-inflammable celluloid-like material. [Ger. Appl., April 13, 1909.]* April 9.

8647. Merckens and Manissadjian. Non-inflammable transparent film. [Ger. Appl., April 13, 1909.]* April 9.

Complete Specifications Accepted.

24,046 (1908). Ellis and Allsopp. Drying wool and other fibrous substances. April 6.

7523 (1909). McNaught. Machinery for drying wool and other fibrous materials. April 6.

8329 (1909). Lake (Garcia). Producing fibres from flax, hemp, and similar plants. April 13.

9840 (1909). Sumner. Manufacture of elastic, non-inflammable coir fibre. April 13.

18,342 (1909). Muller, and Rheinische Kunstseidefabrik. Manufacture of viscous spinning solutions of cellulose. April 6.

20,489 (1909). Langlet. Precipitating organic substances from the black liquors of soda pulp mills. April 6.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

7826. Meister, Lucius, und Brüning. Product for use in alizarin printing and its application. [Ger. Appl., April 3, 1909.]* March 31.

8043. Riley and Co., Ltd., and Riley. Apparatus for treating yarn with dye or other liquids. April 4.

8122. Iwanoff. Manufacture of rollers for printing textile fabrics, &c.* April 4.

8306. Habel. Mercerisation of warp yarns and the like. [Ger. Appl., April 8, 1909.]* April 6.

8344. Simpson. Apparatus for dyeing fabrics. April 6.

Complete Specification Accepted.

11,881 (1909). Togo Spinning Co., and Atack. Apparatus for treating fibrous materials with dye or other liquors. April 6.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

7718, 7719, and 7720. Dieffenbach and Moldenhauer. Manufacture of hydrogen. [Ger. Appls., July 7, Aug. 2, and Sept. 27, 1909.]* March 30.

7746. Sauer. Production of hydrogen. March 30.

7766. Fabry. *See under* II.

7858. Röttger. Splitting up air into oxygen and nitrogen. [Ger. Appl., April 7, 1909.]* March 31.

8006. Edmunds. Apparatus for making sulphurous acid.* April 2.

8093. Ges. f. Chem. Industrie in Basel. Manufacture of oxalates. [Ger. Appl., Aug. 19. 1909.]* April 4.

8094. Dittmar. Manufacture of phosphoric acid. [Ger. Appl., Nov. 6, 1909]* April 4.

8240. Epstein. Treatment of carbonic acid. April 5.

8438. Imray (Soc. Chem. Ind. in Basle). Manufacture of concentrated formic acid.* April 7.

8531. Johnson. Reduction of metallic oxides.* April 8.

Complete Specifications Accepted.

23,209 (1909). Soc. Chim. des Usines du Rhône, and Meyer. Manufacture of zinc sulphide. April 6.

27,126 (1909). Wetter (Riedel). Manufacture of alkali carbonates. April 6.

VIII.—GLASS; CERAMICS.

Applications.

8033. Isherwood and Sharples. Manufacture of stained or coloured glass. April 4.

8534. Baillie. Furnaces for drawing glass. April 8.

8535. Gregory. Furnaces for drawing glass. April 8.

Complete Specifications Accepted.

8594 (1909). Rowart. Apparatus for making glass in continuous sheets. April 13.

28,391 (1909). Burckhardt. Method of forming semi-liquid quartz. April 13.

IX.—BUILDING MATERIALS.

Applications.

7585. Hurll. Construction of Hoffmann kiln for burning bricks and other clay goods.* Mar. 29.

7645. Bocci and Lutz. Artificial stone. [Swiss Appl., March 29, 1909.]* March 29.

8208. Mendham (Simcock). Process for clay drying. April 5.

Complete Specifications Accepted.

113 (1909). Fludder, Fludder, and Fludder. Manufacture of refractory bricks, furnace linings, cement, &c. April 6.

8176 (1909). Gerlache. Process for preserving wood. April 6.

21,901 (1909). Pratt. Gas-fired kiln for burning bricks. April 6.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

7657. Elektrochemische Werke. Improving mechanical properties of copper, brass, and bronze articles. [Ger. Appl., Mar. 30, 1909.]* Mar. 29.

7876. Stobie. Metallurgical improvements. April 1.

8012. Hart. Reduction of tin from cassiterite ores and concentrates. April 2.

8031. British Thomson-Houston Co. (General Electric Co.). Manufacture of tungsten. April 2.

8053. Peat and Head, Wrightson, and Co., Ltd. Cleansing blast-furnace and similar gases. April 4.

8150. Warne. Silver plating solution. April 5.

8156. Brightmore. Flux for use in fusing metals. April 5.

8298. Bowley. Application of electricity to the deposition of metals or alloys, or to making coloured coatings on metals. April 6.

8441. Murex Magnetic Co., Ltd., and Lockwood. Treatment of ores and the like. April 7.

8461. Thompson. Utilisation of slag. April 8.

8530. Johnson. Manufacture of steel. [U.S. Appl., Nov. 15, 1909.]* April 8.

8531. Johnson. *See under* VII.

8644. Dolphin and Casper. Electrolytic deposition or precipitation of metals. April 9.

8650. Sulman and Picard. Selective separation of metals from complex ores or products. April 9.

Complete Specifications Accepted.

7519 (1909). Mackenzie (Stevens). Extraction of metal from ore. April 6.

8682 (1909). Penhale and Mascall. Solvent for precious metals. April 13.

10,381 (1909). Simon. Separation of metals or minerals from their gangues. April 6.

13,552 (1909). Gayley. Operating blast furnaces, converters, &c. April 6.

20,293 (1909). Chenhall. Crucible furnaces. April 13.

XI.—ELECTRO-CHEMISTRY.

Applications.

7589. Gorham. Resuscitating the negative plates of secondary batteries and assisting in their formation. March 29.

8298. Bowley. *See under* X.

Complete Specification Accepted.

11,060 (1909). Johnson (Chem. Fabr. Griesheim-Elektron). Apparatus for producing and maintaining long electric arcs for effecting reactions between gases. April 6.

XII.—FATS; OILS; WAXES.

Application.

7726. Testrup. Treatment of oils, fats, &c. March 30.

Complete Specification Accepted.

15,748 (1909). De Hemptinne. Transforming oils into viscous products and manufacture of lubricating oils. April 6.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

7722. Child. Manufacture of printing ink. Mar. 30.

7922. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter lakes. April 1.

7926. Holtkott. Manufacture of lincrusta. [Ger. Appl., April 8, 1909.]* April 1.

8017. Eckford. Purification or treatment of red or orange lead. [Addition to No. 12,480 of 1909.]* April 2.

Complete Specification Accepted.

21,578 (1909). Johnson (Kalle und Co.). *See under* IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

8042. Bailey, Middleton, and Bailey. Devulcanising indiarubber compounds and reclaiming pure rubber by electro-chemical action. April 4.

8049. Bailey, Middleton, and Bailey. Vulcanising rubber by use of cold electrochemical action under pressure. April 4.

8118. Newton (Bayer und Co.). Manufacture of artificial caoutchouc. April 4.

Complete Specification Accepted.

28,450 (1908). Blum. Manufacture of artificial Para rubber. April 6.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

7734. Napp. Process for obtaining sebacitate of calcium and of barium from glue boiler residues.* March 30.

7819. Evans and Innes-Baillie. Method of tanning hides and skins.* March 31.

8601. Winterbottom and Renshaw. Treatment of glue, glue substitutes, &c., to render them antiseptic and insoluble. April 6.

Complete Specifications Accepted.

10,661 (1909). Spigno. Solutions for treating leather, skins, and hides. April 13.

19,332 (1909). Leach. Leather products and process of making the same. April 6.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

7640. Braasch. Production of yeast. [Ger. Appl., March 31, 1909.]* March 29.

7829. Holzer. Preparation of beer. [Ger. Appl., April 2, 1909.]* March 31.

8652. Forster and Finitzer. Fermenting process. [Ger. Appl., April 10, 1909.]* April 9.

Complete Specifications Accepted.

7806 (1909). Maynard. Fermentation of brewers' worts, &c. April 13.

7989 and 17,113 (1909). Faulkner, Collett, and Collett. Manufacture of malted material. April 13.

10,458 (1909). Braasch. Production of yeast. April 13.

XIX.—FOODS, WATER PURIFICATION; SANITATION.

Applications.

7735. Geistdorfer. Extraction of albumins from plants. March 30.

7842. Tildesley, Ritchie, and Watkins. Process for improving flour. March 31.

7918. Hardy and Gardiner. Preparation of protein products. April 1.

7954. Hewitt. Manufacture of mineral waters or artificial saline waters, cordials, &c. April 2.

8203. Erste Triester Reisschal Fabriks. Rendering proteins or substances containing protein soluble. [Appl. in Hungary, March 1, 1910.]* April 5.

8262. Adams. Water or sewage purification plant. April 6.

8303. Cotterell. Apparatus for distilling water and other liquids. April 6.

Complete Specifications Accepted.

8300 (1909). Henri, Helbronner, and Von Recklinghausen. Sterilising air and other gases. April 13.

18,337 (1909). Collett and Eckardt. Production of dietetic cocoa and chocolate. April 6.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

7669. Henri, Helbronner, and von Recklinghausen. Preparation of tuberculin and serums for tuberculous bacilli. Mar. 29.

7721. Mason. Santalol compounds.* March 30.

7734. Napp. *See under* XV.

8099. Newton (Bayer und Co.). Manufacture of tetramethylenediamine. April 4.

8100. Bayer und Co. Production of aliphatic hydrocarbons with more than one double bond. [Ger. Appl., April 8, 1909.]* April 4.

8339. Marks (Blumberg und Rindskopf). Preparation of aldehyde sulphonates.* April 6.

XXII.—EXPLOSIVES; MATCHES.

Application.

7625. Silberrad. Explosives. March 29.

XXIII.—ANALYTICAL CHEMISTRY.

Complete Specification Accepted.

23,746 (1909). Lovibond. Apparatus for use in estimating the intensity of colours. April 13.

Journal of the Society of Chemical Industry.

No. 9, Vol. XXIX. MAY 16, 1910. No. 9, Vol. XXIX.

Official Notice.

ANNUAL GENERAL MEETING, 1910.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will will be held in the Natural Philosophy Lecture Theatre of the Technical College, Glasgow, at 10.30 a.m., on Wednesday, July 6th, 1910. A programme of the proceedings was contained in the April 30th number of the Journal.

In accordance with the provisions of By-law 72, the Council hereby notifies that it has awarded the Medal of the Society of Chemical Industry to Mr. Thomas Tyrer for his conspicuous services to the Society and to Applied Chemistry.

In accordance with the provisions of By-law 24, Notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Walter F. Reid has been nominated to the office of President under By-law 20; Dr. J. Lewkowitsch, Dr. Russell W. Moore, and Dr. Harvey W. Wiley, have been nominated Vice-Presidents under By-law 21, and President Ira Remsen has been nominated a Vice-President under By-law 20. Mr. Thomas Tyrer has been appointed Hon. Treasurer, and Dr. R. Messel, Hon. Foreign Secretary, under By-law 35.

Members are hereby invited to nominate, on or before May 23rd next, fit and proper persons to fill four vacancies among the ordinary members of the Council under By-law 24. Forms for this purpose can be obtained, on application, from the Secretary of the Society.

By-law 23:—An ordinary member of Council shall be nominated by ten or more members upon Form B in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:

a. The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

b. The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

c. The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

d. The nomination form is not received before or upon the day appointed therefor.

e. The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the Secretary, and shall not be submitted for election.

Charles G. Cresswell,
Secretary.

Canadian Section.

Meeting held at Toronto, on Thursday, 17th February, 1910.

DR. W. LASH MILLER IN THE CHAIR.

MAIZE PRODUCTS, AND MAIZE STARCH AND ITS PRODUCTS.

BY W. P. KAUFMANN, M.D., C.M.

The manufacture of starch and its products from maize, and the by-products which result therefrom, forms a large and actively growing industry in North America. A succinct general description of the processes by means of which the various proximate constituents of maize are separated from one another will perhaps be the best means of showing the characters of these products.

Steeping.—The dry grain from the granaries is conveyed into large hopper-bottomed steeping vats, and water impregnated with sulphur dioxide is run upon it. By means of steam syphons the water is kept in circulation and at the same time heated and maintained at temperatures varying from 120° F. to 140° F. This steeping process is continued for from two to four days according as the corn is more or less amenable to the softening and disintegrating influences, or is required to be less or more friable or "soft" for the process to follow. The steep waters may be run to waste or may be evaporated for the recovery of the soluble material therein for the manufacture of cattle feed.

Milling.—The steeped corn is next run through Foos mills or their equivalent, by which means it is cracked, decorticated, and partially ground, giving rise to a diffluent mass. This, when appropriately diluted with water so that the most finely ground portions form a liquor (separator liquor), is passed through a germ separator—a long large V-shaped tank with a screw conveyor at its bottom and skimming paddles at the top. The oil-bearing germ floats and is skimmed off, and the endospern, starchy and glutinous matter, cortical tissues, bran, and fibre matter pass on. The germ is then conveyed away, washed free from adherent starch, and dried. The dried germ is next ground, "cooked" with live steam, and its oil expressed in hydraulic presses.

The resulting products are:—

Corn oil—used largely in the manufacture of soap.

**Oil cake*—used as a cattle feed. Composition:—

Moisture	9·50
Protein	21·30
Fat	13·29
Carbohydrates	45·64
Fibre	8·27
Ash	2·00
	100·00

The Cortical and Endospermal portions, the most finely ground of which when suspended in water gives rise, as already stated, to the "separator liquor," are next screened by passing them over a vibrating copper sieve. The coarse material separated is led into burr-stone mills with the necessary quantity of water, and is finely ground, the effluent from the burr-stones being combined with the previously separated "separator liquor." This mixture is then pumped over the shakers. The first shakers are vibrating screens covered with silk bolting cloth of rather coarse mesh. By this means the starch "liquor" is separated from the wet "feed" or branny portions of the grain. This latter is conveyed into a stirring tub, agitated with water, and pumped over the second shakers, on which it is washed as free from starch as is possible.

The bran is next conveyed to presses where water is squeezed out of it, and it emanates therefrom as "press feed," an article much used in that state as a cattle feed. Or after being dried in appropriate apparatus it is bagged and sold as "Corn bran," the average composition of which is:—

Moisture	8·93
Protein	10·50
Fat	2·75
Carbohydrates	65·04
Fibre (insoluble)	12·30
Ash	0·48
	100·00

The liquors separated from the shakers and mill are now combined and are known as the "Mill liquor," or "crude starch liquor." They may be passed over another series of fine sieves or shakers to screen out the more or less gritty, glutinous and fibrous residues, or they may be passed immediately over the runs, trays, tables, or gutters, these terms being used synonymously.

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* Called "maize germ cake" in England.

The Runs are gutters about 120 ft. long, 6 or 8 in. deep, and may be from 10 in. to 2 ft. wide, and above all, level, except for a drop of about 4 in. between the ends. Into these the crude starch liquor is run and during its passage through them the starch, more or less free from gluten and celullar matter, is deposited, the glutinous and other residues "tailing off," carrying from 40 to 50 per cent. of starch which, however, cannot be economically recovered as starch. The run tailings are conducted into "continuous settling tanks," where the solids are allowed to subside, while the clear supernatant liquid is syphoned off and run into the sewer.

The run tailings so concentrated are sold as a liquid feed under the name of "Slop" or "Swill," or may be pumped through filter presses, the solid material collected, dried, and sold as gluten meal, the average composition of which is:—

Moisture	9·74
Protein	31·20
Fat	2·35
Carbohydrates	54·67
Insoluble fibre	1·44
Ash	0·60
	100·00

This gluten meal is often mixed with certain proportions of corn bran while both are yet wet, the mixture dried and sold as "Gluten feed," the average composition being:—

Moisture	5·78
Protein	22·80
Fat	1·99
Carbohydrates	62·10
Insol. fibre	6·68
Ash	0·65
	100·00

Those who have made comparisons of the dietetic values of protein-containing cattle feeds have found great advantages in using those feeds obtained as by-products of maize. Professor F. T. Shutt, of the Dominion Government Experimental Farm at Ottawa, considers that maize protein is the most efficient source of nitrogenous food for cattle, swine, etc.

The "green starch" which has been deposited on the "runs," containing about 50 per cent. of moisture and about 0·5 per cent. of protein, is now shovelled off and stirred up with water in the "breaker"; at this point, it may be "converted" by acidulation and subjection to elevated temperatures under a pressure of about 30 lb. per square inch for the necessary period of time. After conversion the resultant liquors are neutralised, filtered, clarified, or otherwise refined, after which they are concentrated into:—

*Glucose.**—A highly refined brilliant thick syrup composed of water, dextrin, maltose, and dextrose and about 0·23 per cent. of ash and nitrogenous derivatives from protein; this is a very pure product and is a perfectly wholesome commodity, being quite as well refined as refined cane sugar. It appears on the market in concentrations varying between 43° and 45° B.

Grape Sugar.†—A more fully converted product with a higher "quotient of purity," *i.e.*, with a greater percentage proportion of reducing carbohydrates (sugars) in relation to the total carbohydrates, and is consequently less dextrinous and more sugary than glucose. Unlike glucose it solidifies into a tough mass on cooling, which has a finely crystalline structure. The syrup for the production of grape sugar may be run into barrels while hot, where it is allowed to solidify, or it may be run into moulds, allowed to solidify, and then chopped into lumps.

Corn Syrup is an admixture of glucose with about 10 per cent. of refined cane syrup and generally flavoured artificially. It is a wholesome and delicious commodity especially adapted for use as a table syrup.

Starch.

The "green starch" instead of being utilised for the production of saccharine products, may be manufactured into different varieties of starch to meet the various industrial and domestic requirements. This "green starch" may be passed over the "runs" a second time, the effect being that its gluten content is lowered from about 0·5 per cent. to 0·3 per cent., and according to the use for which it is destined, it may or may not receive a "chemical" or "alkali" treatment with caustic soda before re-running.

The varieties of maize starch which are found in Canada on the market, may be classified as: (1) Thick boiling starches, (a) "Chemicalled," (b) "Unchemicalled." (2) Thin boiling starches—prepared by (a) the "drying-in process," (b) the "in-suspension" process.

"*Chemicalled*" *Starches.*—The effect of alkali, as used in "chemicalling" starches, is to cause swelling and flocculation of the protein and fibrous, and saponification of the fatty impurities retained by the starch, and to induce these to "tail off" and leave a purer and whiter starch when deposited a second time on the runs.

After passing over the runs, the starch, whether alkalied or not, is shovelled into "breakers," suspended in water to form a liquor of a gravity of about 22° B., and then pumped into cloth-lined perforated boxes—the moulding boxes—which are placed on the "boxing horses." By this means the water drains through the cloths, while the starch remains behind, and is subsequently "broken out" into large cubes of 7 to 8 in. edge. At this stage the starch contains 44–45 per cent. of water. These cubes, after being broken out, are sometimes placed on porous bricks for a short time, water being abstracted from them and causing them to "set," the starch then containing 42–43 per cent. of water. They are then removed to "crust kilns" and heated, which causes them to "sweat" until a browning on the surface ensues, followed by the formation of a thin dry crust all over the cube to a depth of about ⅛ to ¼ of an inch. The lumps are removed from the crusting kilns, the "crusts" scraped off, and the inner scraped portions, containing from 28–30 per cent. of water, are dried slowly or quickly in large cubes wrapped in paper, or may be broken into much smaller and more or less regular sized lumps, so as to produce the various "crystals" and "lumps," which are sold as "domestic laundry starches." When the starch is to be dried quickly it is broken up quite finely before being placed in the kilns, and when dry it is pulverised by grinding and then bolted. It is also put up as a ground or culinary starch; this is less alkaline than the laundry starches, having received a lighter caustic treatment, and better washing with fresh water after it has been treated, the result being a very highly purified commodity.

"*Unchemicalled*" *Starch* may be dried as such more or less slowly and may be ground or not. It is used in the manufacture of baking powder or as a size in the textile industries. It is also used to a small extent by steam laundries.

All the foregoing starches are thick-boiling; that is, when cooked with boiling water they give rise to very viscous pastes which on cooling form somewhat stiff "jellies" which break with a glassy fracture.

Up to this point the manufacture of starch is a relatively simple matter, and the material which results very closely resembles in its properties the starch as it originally existed in the raw grain. On account, however, of the heating and action upon it of water, and of the sulphurous acid during steeping, and the alkaline treatments during its further purification, the viscosities of pastes produced from these starches are slightly less than that of starch obtained from the grain which has not been subjected to these influences. Again, the viscosity of unchemicalled starch is greater than that of chemicalled starch, and that of the scrapings from crusted lumps of chemicalled starch somewhat less than that of the inner portions of the lump.

The other starches which may be mentioned are those forming the so called "thin boiling" or "modified" group. These starches, under so called "standard" conditions and methods for testing, which are arbitrarily chosen by different workers, give rise, on boiling with water, or solution in a caustic alkali solution, to pastes of very much lower viscosities than thick boiling starches. Hence the name. They may be divided into two subdivisions according to the method of their manufacture.

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* In England this is known as Liquid Glucose or Corn Syrup.

† In Engand this is generally termed Glucose or Solid Glucose.

1. *The drying-in process.*—Unchemicalled starch is suspended in water to about 22° B. and a certain quantity of hydrochloric acid is added to the "milk." It is then "boxed" and allowed to drain, the starch—containing 42—43 per cent. of moisture and a small proportion of acid—is broken up and dried; during the drying process, the small proportion of acid partially hydrolyses the starch, causing its viscosity to become less, but in little or no way altering the natural configuration of the starch granules unless temperatures high enough to cause their thorough dextrinisation have been used, or unless they have been heated in the presence of moisture to temperatures above their swelling or gelatinising points—65°—75° C. (149°—167° F.).

2. *The in-suspension process.*—Starch is suspended in water substantially as above, and a certain quantity of sulphuric or hydrochloric acid added. The mass is kept constantly stirred and is maintained at a temperature well below the gelatinising point of starch but yet high enough to accelerate the hydrolytic action of the acid on the starch to a reasonable degree, and so to cause a diminution of the viscosity in direct proportion to the length of time, degree of temperature, and strength of acid, to which the starch is subjected. By inspection, even by means of the microscope, modified or thin-boiling starch cannot be discriminated from unmodified or thick-boiling starch.

These modified or thin-boiling starches are so manufactured as to give rise on boiling with water, to pastes of greater or less viscosity according to their application, which is for the laundry and confectionery trades.

The Laundry.—Before the introduction of thin-boiling starches and modern machinery, the ordinary thick-boiling starches were used in much the same way as they are in private households to-day. However, it was found that in order to cope with the ever increasing volume of work, especially the laundering of shirts, collars, cuffs, and those articles of apparel which demand stiffening, at a reasonable cost, and with expedition, changes had to be made in methods and materials. By a process of evolution mechanical devices for starching the goods were invented and improved, and in order to keep abreast with these contrivances, which are fundamentally used for driving large quantities of starch pastes into and between the folds of the materials to be starched, the starch makers had to alter the boiling properties of the starch supplied to laundries.

Starches from maize, rice, and wheat were used jointly or severally and various combinations were essayed with more or less satisfactory results. The manufacture of maize starch has now been developed to such advantage as to completely replace rice starch, and almost completely replace wheat starch in the laundry trade in North America.

Thick-boiling, *i.e.*, unmanipulated starches from these sources possess some distinctive physical characteristics. Maize starch gives rise to the most viscous pastes, less so wheat, and lastly, rice starch gives the least viscous paste. Hot maize starch pastes tend to revert relatively very slowly, wheat more quickly, and rice starch pastes most quickly. By reversion, I mean the separation of starch substance from their hot pastes on cooling. Again unmodified or thick boiling maize starch pastes when applied to fabrics to be stiffened, cause them to become very stiff, boardlike, and brittle, with but little pliability, while unmodified or thick boiling wheat and rice starch pastes stiffen very much less, but give rise to more pliable work; and in order that their work might possess both stiffness and pliability in a marked degree, and this is their great desire, laundrymen have used various combinations of maize and wheat starches, more or less thin boiling in character, or they have even used mixtures of thick and thin boiling starches to produce the desired results. I have known instances of three or even four different grades and combinations of thick and thin-boiling wheat and corn starches having been used. Complication and complexity in any industry is universally admitted to be a most undesirable feature, and the starch room of a laundry is no exception to this rule, so it is not surprising that efforts were turned towards the solution of the laundryman's starch problem.

To-day, thin-boiling starches are being manufactured from maize starch which are capable of yielding the desired results in the laundry—pliable stiff work of good body which will not crack on being sharply bent. These results are obtained at smaller cost, and without the worries incidental to blending three or four starches, and probably making mistakes by taking two quantities from the same barrel, or omitting some of the ingredients, or both.

While this type of commodity, prepared from maize starch, has been on the market several years, its lack of uniformity in viscosity militated greatly against its general acceptance by the laundry trade, for which uniformity of starch is a vital point. Starch is applied to the goods after they have been washed, and the degree of stiffness in these starched goods is definitely elicited only after drying and ironing. If, after these operations, adding their quota of expense, the goods are not up to the standard, they have to be washed again, through every step, so as to rid them of their "old" starch and render them capable of absorbing starch anew. With every alteration in the viscosity of a starch supplied to a launderer, he must of necessity alter the proportions in which he uses it so as to get his standard result. This keeps him in a constant state of uncertainty, for any hitch in his routine means more work and loss of money; an undesirable combination. Supply him with a starch of uniform viscosity, and his work is greatly facilitated and its quality ensured. The manufacture and the absolute control of viscosity of such a product has been accomplished for some time, and its introduction to the laundry trade has been attended with results gratifying both to the manufacturers and consumers.

While fully 90 per cent. of the steam laundrymen use a modified or thin boiling maize starch of the type portrayed, unmixed with any other starch, a proportion of them still clings to mixtures of thin boiling corn or wheat starches. As a general rule they use mixtures containing greater proportions of wheat than corn in the winter, when starched goods are required to be more pliable than stiff, while, for the converse reason more corn is used than wheat in the summer.

Many manufacturers prepare several starches of varying viscosities to suit the "needs"—I consider them whims—of their various clients; we have found it possible to supply the users of most diverse types of machinery and laundry methods with an absolutely satisfactory starch from one of two degrees of modification, a "Standard" and a "Special." Fully 95 per cent. of them are supplied with the "Standard" viscosity. This very desirable state of affairs has been brought about by studying conditions in all sorts and conditions of laundries, and by manufacturing a grade of starch of such plasticity, which when made into a paste of a certain concentration determined by the requirements of the launderer, while somewhat "thick" or viscous, will yet penetrate into the goods and between its plies, and in which it will remain despite the "rubbing off" process to which they are subjected, before going to the drying room.

To convey some idea of the influence of viscosity and concentration on the character of laundry work, the following results obtained from some small batches of new cuffs which had not been previously laundered (*i.e.*, they contained the original sizing material) will be interesting.

144 cuffs were used for each experiment. The starching paste was made up at a concentration of 13·3 oz. of starch in the "cooked" gallon of paste. The air-dried cuffs were weighed before starching, and again after

starching subsequently to being ironed, and being allowed to stand over night.

	Weight per pair of cuffs.		Increase of weight due to starch.	Character of work.
	Before starching	After starching		
	oz.	oz.	oz.	
1. "Thin thin" . .	1·26	1·36	0·10	Good pliability, fair stiffness and body.
2. "Medium thin"	1·26	1·46	0·20	Good body, pliability, and stiffness.
3. "Thick thin"	1·26	1·41	0·15	Good body and stiffness, poor pliability.

Both thick boiling maize and potato starches are used in textile industries, but to the best of my knowledge no thin boiling starches are used in Canada in these industries.

Confectionery.—Pulverized or ground starch is used in very large quantities for moulding creams for chocolates, marshmallows, jelly beans, jujubes, gum drops, and many other varieties of sweet-meats. The function of this moulding starch is purely physical and mechanical. It is filled into trays, placed under the mould dies, which are embedded in it, and on their withdrawal they leave their impressions (moulds). Into these the various kinds of confectionery are run while hot and more or less limpid, and on cooling they "set," and are conveyed and stacked in the drying rooms—large steam-heated kilns—in which they are left for varying periods up to a week, to dry.

On completion of the drying process the trays and their contents are removed, allowed to cool and then are passed through a machine which separates the starch from the confectionery, brushes them free from starch, and packs the starch afresh into trays. With constant use, this moulding starch becomes "dead," *i.e.*, heavy and "wet" to the touch, compacts easily, and adheres to the mould-dies so that sharp imprints are not obtained. The acquirement of these undesirable characteristics is not due to the retention of water by the starch, but to the gelatinization of the starch granules where they come in contact with the moist, hot, sugary pastes, and especially to the diffusion of saccharine matters from the hot sugary pastes—at least before they "set"—into the starch mass, and to the breaking off and admixture of small particles of the pastes therein. The combination of these circumstances causes the starch to become cloggy and impairs its ability to conduct and so evaporate moisture throughout its mass. The gelatinised granules have no specific function in this process; they have lost for all time the ability to transmit moisture through or upon their substance, and also, on account of the fact that they adhere to the other granules with which they come in contact and form concretions, considerably diminish the extent of opposed surfaces, and to that extent depress capillarity.

Again, the granules becoming sugar-logged and sugar-coated, offer greater resistance to the capillary transmission of water. The following data support this theory:—

	Moisture per cent.
Fresh ground starch as supplied for moulding	12·00
Moulding starch after having been in use	9·00 varying from 6·5 to 10·3 %

Fresh moulding starch contains no soluble or reducing carbohydrate matters, while in every sample of "dead" moulding starch examined, and previously sifted through a 200 mesh bolting silk, I have found not only abundant evidence of reducing carbohydrates, but a faintly sweet taste. In a sample examined quantitatively, I found the material to contain 1·6 per cent. of soluble carbohydrates, calculated as dextrose (after their inversion). The not-inverted aqueous solution also gave rise to osozones on treatment with phenylhydrazine. No attempt was made to discriminate between that of maltose and dextrose.

It must not be thought that a given amount of starch can be used indefinitely for moulding. A considerable quantity of it is lost during the handling, and it is replaced by admixture of fresh starch. In this way the circle above alluded to, is in a measure, but not by any means wholly, guarded against.

The only satisfactory solution to this problem is, to thoroughly wash and purify the "dead" moulding starch, and then dry and grind it. However, I do not believe that it would be financially advantageous to the confectioner to have this "dead" moulding starch worked over by the starch manufacturers. A more profitable means of disposing of it would be, I think, to arrange for its sale to cotton mills, or with paste makers, and to replace it by fresh moulding starch.

When making up a batch of fresh moulding starch from new ground starch, its texture is found to be too "light" or "lively." The moulds made therein lack stability or "body." To combat this, wheat flour is sometimes mixed with it, but the desired consistency is more often given by mixing in some of the "dead" starch. This latter is the better plan, for the presence of gluten in the wheat flour cannot but exaggerate the formation of concretions, etc., when brought in contact with the moist steaming-hot pastes.

Gum-drops, or jujubes, should be composed of sugar, glucose, and gum arabic. Gelatin is also used in some varieties. Then, there are gum-drops that contain no gum, its place being taken by starch. There are enormous quantities of these sold, and when properly made they are a delicious and wholesome form of confectionery. Before the introduction of thin boiling starches into the confectionery trade the ordinary thick boiling starch was used. It was found that a little of this went a long way. The difficulties of "burning" the kettle and of boiling the batches "dry" enough for dropping into the moulds were great, and the resulting product was not invariably uniform. These difficulties were engendered by the thick, heavy, and to use the gum-drop boilers term "livery nature" of the starch. Then the thick boiling starches were used in conjunction with citric or tartaric acid. These ingredients were used to "cut" the starch and thin it down. The melange being of a more limpid consistency it was possible to boil it without "burning" and to get more water out of it in a given time, and so to "dry" it out to better advantage for dropping and for drying out in the dry rooms. However, more or less frequently sticky goods resulted which were of poor "body" and would not "stand up." The apportionment of acid and the regulation of its hydrolytic action on the starch could not be regulated definitely under the conditions existing in the kettles. Then came the thin boiling starches—starches "thinned down" on the same principles as the laundry starches, but to which no "blue" had been added—so as to yield a type of confectionery with a sufficient body, but yet resilient, and not tough, and withal "smooth to the taste." This type of starch has found great favour with the confectioner, as with the launderer. It has solved the problem by enabling him to manufacture his desired product with speed and certainty, and has eliminated the necessity of using citric or tartaric acid. The ingredients as apportioned for making gum drops vary between very narrow limits, the variation being chiefly amongst the apportionment of sugar and glucose, accordingly as he requires a sweet, and slightly more expensive, or a not so sweet and less expensive, product. The percentage of starch in each variety of the commodity is practically constant. Water is merely added to allow of the thorough cooking and incorporation of the other ingredients, and it is evaporated during the boiling and drying of the batch.

The function of the starch is, as we have said before, primarily to yield a material of a certain "body" and "texture." This desideratum is contingent upon two circumstances: The viscosity of the starch used, the proportion of the starch used, and as a corollary to these, the amount of water which the finished product can retain without becoming sticky on the one hand, or tough and rubbery on the other. The percentage amount of starchy ingredient remaining the same, however, the characteristics evidenced during their manufacture while being boiled is, as would be expected, in direct relation to the viscosity of the starch used. The higher the viscosity, the more sluggish is the turn-over of the boiling mass in the kettle, and the longer does it take to boil the batch sufficiently dry for moulding. Again, the palpable consistency and texture of the kiln-dried gum-drop bears the same relation to the viscosity of the starch used in its manufacture, the higher the viscosity of the starch, the more tough and rubbery is the product, and capable of retaining its shape on pressure, and of returning to it when the pressure is relieved. However, the lower the viscosity of the starch used, the more unctuous and "smooth" to the taste is the resulting gum-drop. The amount of moisture retained by this kind of confectionery, after being withdrawn from the drying kilns, just previous to sugaring, is practically constant and varies between 18·5—19·0 per cent. except in the case of starches of very low viscosity, giving rise to almost watery pastes, which retain about 12—14 per cent. of water after drying. It was also observed that in air-dried and kiln-dried commodities from the same batch, the moisture contents at this period closely approximate one another, being respectively 20·5 per cent. and 19·0 per cent. However, there is this difference in their consistency. Those that were air-dried when packed together tended to stick, while those that were kiln-dried exhibited no such disposition, with the exception of those made with the thinnest boiling starch, which were somewhat sticky, but, in the opinion of others as well as myself, much more tasty and delicious.

On examining further into the matter of the air-dried and kiln-dried products, this fact was very evident. Those that were air-dried were practically of the same consistency throughout their mass, while those dried in the kilns showed a well defined and desiccated "skin" on the peripheral portions, which were dried in contact with the starch at kiln temperatures. The bases of the gum drops, which are uppermost in the moulding trays, and are exposed to the air, and not in contact with the starch, show "skinning" to a much less extent than the portions which were contiguous to the starch, so it is apparent that there is an accentuated drying influence brought about in this confectionery by its contact with starch at kiln temperatures.

Another very widespread application is in the poster-sticking industry and also for sticking labels. Starch finds its way into leather-goods not as starch but as its hydrolytic product grape sugar, which is largely used in the tanning industry.

London Section.

Meeting held at Burlington House, on Monday, 4th April, 1910.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE INDIA-RUBBER INDUSTRY.

BY PHILIP SCHIDROWITZ, PH.D.

Introductory and Historical.

The foundations of the rubber industry were laid considerably over a century ago, yet it must, as an industry proper, be regarded as of a comparatively modern and recent origin. Although Samuel Peal in 1791 patented a process for waterproofing cloth by spreading it with hot rubber, Thomas Hancock, of London, and Charles Macintosh, of Manchester, are generally regarded, in conjunction with Charle Goodyear, of New Haven, U.S.A., as being the actual founders of the industry. Macintosh in 1820 produced waterproof garments by a practicable process, and at about the same date Hancock invented a masticating machine and process, thus introducing the manufacture of rubber sheet and much improving the method of making "solution." It was not, however, until after the process of vulcanisation by the combined action of sulphur and heat, had been discovered, by Goodyear in 1839, and independently by Hancock about 1844, that the rubber industry showed signs of becoming of great importance. In 1846 Parkes found that india-rubber may be vulcanised in the cold by the action of sulphur chloride suitably diluted, but this process is only applicable to goods of very moderate thickness. The influence of the discovery of "vulcanisation" on the development of the rubber industry may be judged by the following figures, representing tons of crude rubber imported into the United Kingdom:—1830, 23 tons; 1850, 381 tons; 1870, 7,656 tons; 1890, 13,200 tons; average 1904 to 1908, 29,389 tons. Only a very small proportion of the total passes to the consumer in the unvulcanised state.

Production.—At the present day the total production of raw rubber is probably between 70,000 and 75,000 tons broadly distributed as follows:—Brazil, Peru, and Bolivia, 40,000 tons; other South American Countries, Mexico and Central America, 7000 to 8000 tons; Africa, 17,000 to 20,000 tons; Ceylon, Malaya, Java, Sumatra, and Borneo,* 4000 to 5000 tons; Miscellaneous, 1000 to 2000 tons.

Consumption.—The most important rubber consuming countries are the United States, the United Kingdom, Germany, and France. Italy and Russia also import and manufacture considerable quantities. As a rough approximation it may be said that the United States consume one-third of the world's rubber, the United Kingdom and Germany between them (in approximately equal shares) another third, and other countries the remaining third.

The Industry in the United Kingdom.—The following figures will give a general idea of the importance of the rubber industry in the United Kingdom.

Imports of Rubber (1908).

From	Quantity cwt.	Value £.
Brazil	300,032	5,331,842
Peru	29,622	518,885
French Colonies	58,159	553,615
Other Foreign Countries	112,085	831,819
(Total Foreign)	499,898	7,236,161
British Possessions	75,168	1,135,044
Total 1908 *	575,066	£8,371,205
do. in 1907	667,294	£10,834,759

* 1908, owing to the American financial crisis, was an abnormal year; the totals for the preceding year are therefore also given.

Of the total imports, rather more than one half are re-exported, the average figures for the past five years being:—

I. Exports of Raw Rubber.

	Quantity cwt.	Value £.
Average imports, 1904—1908	587,781	9,302,990
Average re-exports, 1904—1908	334,129	5,858,488
Balance retained for consumption	253,652	£3,444,502

II. Manufactured Goods.

	Exports (1909). Value £.	Imports (1908). Value £.
Miscellaneous goods	1,576,000	482,644
Boots and shoes	205,668	123,381
Waterproofed goods	295,184	6,825
Rubber covered cables, other than telegraph and telephone cables	289,342	103,230
Telegraph and telephone cables	744,140	125,087
Total	£3,110,334	£841,167

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* This does not include inferior grade (very resinous) rubbers, such as "Pontianac" or "Jelutong." The annual production of these is probably some 20,000 to 30,000 tons, the United States alone importing some 12,000 tons annually.

There are no published figures on which an estimate of the value of the manufactured articles consumed in the home trade can be based with any certainty, but it may be safely placed at not less than ten millions sterling, assuming normal rubber prices.

The india-rubber industry as a whole may be conveniently and naturally subdivided into three sections, namely, I. The production of crude rubber; II. Manufacture of articles from and with the aid of the crude material; III. Treatment and utilization of waste rubber.

India-rubber is contained, in the form of an emulsion, in the latex or milk of the laticiferous system of various plants. It also occurs, but not frequently, in the solid state, as a deposit in the woody fibre of certain species, for instance in the Guayule shrub (*Parthenium argentatum*). The laticiferous system* of most rubber bearing species lies between the outer bark and the cambium. By cutting through the outer bark and into the latex cells the latex may be obtained as a white to cream-coloured, more or less viscous liquid. In former days this operation of "tapping," was carried out in a very rough and ready fashion, resulting in injury to the wood and so to the life and yielding capacity of the tree. As regards the "native" or "wild" rubber from large tracts of South and Central America and from Africa this still holds good, since under present conditions of collection, adequate supervision of the natives and methodical working is out of the question. For the correct tapping of a tree, the following factors are of cardinal importance, namely (*a*) the age and species of the tree; (*b*) the method of making the cut; (*c*) the disposition of the cuts and the general contour of the cutting system; (*d*) the season; (*e*) frequency of tapping; (*f*) methods of collection.

Occurrence of indiarubber bearing species.—Rubber bearing species are indigenous to considerable tracts of the tropical and sub-tropical zones. Favourable conditions are a moist climate with high and equal temperatures and a fairly copious rainfall. Although the nature of the soil is of importance, certain species thrive well in soils which would be regarded as poor for planting many other tropical products. Rubber species are very numerous, but the following are of greatest industrial importance:—

1. *Hevea Braziliensis* or Para rubber. This is indigenous chiefly to the area watered by the Amazon and its tributaries. It has been almost exclusively employed in the plantations of Ceylon and Malaya, and largely in Sumatra, Java, Samoa, etc.
2. *Ficus elastica* or "Rambong" is indigenous to Burmah, Ceylon, Malay, Java, India, etc. It has been planted to some extent in the Eastern Dutch colonies and in some parts of the German possessions (New Guinea, etc.). Other *Ficus* species are found in Africa and South America.
3. *Funtumia elastica.*—Indigenous to many parts of Africa, planted experimentally in Uganda, the Cameroons, etc.
4. *Landolphia* species occur profusely in many of the African rubber districts, and yield a considerable proportion of the crude product exported from Abyssinia, the Congo, and from the West and East Coasts.
5. *Castilloa elastica.*—The natural rubber *par excellence* of Mexico and Central America. It has been largely planted in Mexico and experimentally elsewhere.
6. *Manihot Glaziovii*—Indigenous in the State of Cearà (Brazil). Planted experimentally in the East, the Cameroons, etc. Other rubbers of some technical importance are Guayule (*Parthenium argentatum*), the *Sapium* varieties, the *Hancornia* species and resinous rubbers such as *Dyera castulata* or "Jelutong."

Quality and general attributes of different species.—There are very marked differences in the quality of various rubbers, attributable partly to the inherent properties of the various latices and partly to the methods of collection and preparation. Two main factors determine the value of a rubber, namely its chemical purity and its physical properties. The chief impurities are moisture, resins, proteins, ash, matters insoluble in rubber solvents, and such adventitious impurities as mechanically admixed earth, bark, etc. In regard to physical properties the main considerations are strength and vulcanising capacity.

Differences due to inherent properties of the latex.—There is, in regard to chemical composition, in the narrower sense of the term, no very great difference between the latices derived from the more important species; but the physical properties of rubbers prepared from the main species appear to exhibit wider differences than do the chemical properties, but it is probable that improved methods of preparation will tend to minimise these differences also. The best of the ***Funtumia*** and ***Landolphia*** species seem to show the greatest mechanical strength, then follow the *Hevea* and *Ficus* species, and then the *Manihot*, *Castilloa*, and *Sapium* species, although some would perhaps place *Manihot* nearer the head of the list. The differences in regard to physical and physico-chemical properties between the various species are of considerable interest, inasmuch as it would appear from the work of Harries and Gottlob that the complex caoutchouc molecule in some of the African varieties (probably *Landolphia* and *Funtumia* species) is not identical as regards complexity and disposition of the simple molecules with the molecule of the *Hevea* species. In splitting the ozonide derived from *Hevea* rubber certain quantities of leavulinic-aldehyde and leavulinic acid were obtained. The fission products derived from the African species and also from gutta percha, were constant in quantity relatively to one another, but the relation of aldehyde to acid was practically the reverse of that observed in the case of the *Hevea* derived ozonides. There are two main factors which must be taken into consideration in connection with the physical properties of pure caoutchouc. In the first place there may be differences in regard to the molecular complexity, *i.e.*, the state of polymerisation of the molecule itself, and secondly, differences in regard to the colloidal state of the rubber particles, that is, as Spence has recently pointed out, the differences of physical aggregation. These differences may well occur even in rubber of one and the same species. My own work on the viscosity of rubber solutions is confirmatory of the view that from one or several of the reasons given there are specific differences in regard to the actual "caoutchouc" contained in *Hevea*, *Funtumia*, *Castilloa*, and *Sapium* varieties.

Anyone inspecting the various forms of rubber emanating from Africa, Asia, and tropical America, would scarcely believe that most of these are prepared from latices which if properly treated, would yield rubbers differing little in commercial value from fine hard Para on the one hand, or the best plantation products on the other. It is mainly due to the work of the chemist, stimulated by the rise of the plantation industry, which in its turn is mainly due to the efforts of economic botanists that this change in our views and this important addition to our knowledge has come about.

Differences due to methods of preparation.—The bulk of the raw rubber is still prepared in a very crude manner, and this is likely to be the case for some time to come. Practically all "wild" rubbers (rubbers prepared by the natives of the rubber regions without skilled white supervision) contain in addition to a considerable proportion of moisture, a varying quantity of mechanical impurities. Such rubbers have to be thoroughly cleaned before they can be used in the factory. The loss which native or "wild" rubbers show after this process has been completed, generally varies from 10 to 50 per cent. or even more. Frequently native rubbers are wilfully adulterated with sand, stones, and dirt, not to speak of admixture with inferior rubbers. The foregoing applies chiefly to African and native Asiatic rubbers, for the South American rubbers are, on the whole, better prepared, many of those from the valley of the Amazon being of remarkably fine quality. These rubbers have been, ever since the rubber industry has attained to considerable proportions, a standard of quality, and prices of pure plantation rubbers are still referred to fine hard Para, as a standard. The Para rubbers are prepared by coagulating successive films of latex round a core by the combined action of heat and wood smoke. In this way the whole of the non-rubber substances contained in the latex are incorporated.

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* The laticiferous system is quite distinct from, and must not be confused with the cell system bearing the ordinary sap.

The Plantation Industry.

Perhaps the most important occurrence in the rubber industry since the discovery of the process of vulcanisation is the foundation and development of plantations. In 1875 Wickham was commissioned by the Indian Government to obtain from the Amazon valley a supply of *Hevea B.* seeds, and from these and from small quantities obtained from other sources, substantially the whole of the 60 to 100 million trees now growing in the East have been raised. In 1876 the first large batch of seeds was planted in Ceylon, but the following 20 years constituted a purely experimental period, and it was not until some years of the present century had passed that planting on a really industrial scale commenced. The evolution of the industry may be gauged by the following figures:—

*Approximate acreage under Rubber in Ceylon.**

Year.	Acreage.
1890	300
1895	550
1898	1,250
1904	11,000
1907	150,000
1910	190,000

The following is an estimate of the total acreage under planted rubber in various parts of the world.†

Country.	Acreage.
Ceylon	190,000
Malay Peninsula	250,000
Java, Sumatra, and Borneo	90,000
India	25,000
German Colonies	38,000
Mexico, Brazil, Africa, and W. Indies	100,000
Total	693,000

From the experience gained so far, 200 to 250 lb. to the acre appears to be a safe estimate of yield from young, but not immature trees, planted under reasonably favourable conditions. During 1909 the Eastern plantations exported roughly 4,000 to 4,500 tons, of which 2,800 came from Malaya.

Plantation methods.—Wild rubber is generally collected from scattered trees as a rule in forest regions inaccessible except to the natives of the district. In most cases, therefore, skilled superintendence of collection of the latex and preparation of the rubber is out of the question. The planter is able, under favourable circumstances, to produce 250 lb. of pure, dry rubber from a single acre of land, whereas the native collector in the forests of Africa and South America may have to scour 40 or 50 acres, if not more, to obtain the same quantity of, in many cases, an extremely inferior product. The tree which is most generally, in fact, in the East almost exclusively, planted at the present time, is *Hevea Braziliensis*, and it has been found possible and profitable to tap this tree at the end of five years. It would be desirable that tapping should be deferred say till the sixth year in most cases, for early tapping produces a comparatively inferior rubber, and is detrimental to the tree. The question as to whether, assuming tapping is conducted in a reasonable manner, the tree may be tapped indefinitely for a successive number of years may be answered in the affirmative, for there are trees in the various botanic gardens in the East which have been successively and successfully tapped for some thirty years or more, and which show no apparent injury.

Cost of production.—There are two main factors to be considered in this connection, (*a*) cost of bringing into bearing; (*b*) upkeep and manufacture. The cost of bringing into bearing varies from £18 or £20 upwards, the average being about £40 per acre. At 5 per cent. this corresponds to a fixed charge of £2 per annum, or assuming that 240 lb. per acre are produced to 2d. per lb. of rubber. With regard to upkeep and manufacture, etc., the following figures are based on the actual working expense of a Malay estate which produced about 100 tons of rubber in 1908,‡ at 200 lb. per acre, and estimated, when mature, to produce 400 lb. per acre:—

		Per lb. of rubber produced.
General charges (salaries, allowances, quit rent, hospital, contingencies)		2·31d.
Cultivation charges (weeding, roads, drains, supplying, pests, and diseases, etc.)		1·85d.
Upkeep of buildings		0·23d.
Rubber Manufacture:	Tapping and scrapping	3·93d.
	Curing	0·43d.
	Packing	0·33d.
	Marking, utensils, transport, etc.	0·47d.
	Duty	1·19d.
	Manufacture—total	6·35d.
Total working charges		10·74d.

		Per lb. of rubber.
Total charges:	Fixed	2·00d.*
	Working	10·74d. (details above).†
	Total	12·74d.

To place the rubber on the European market a further 3·30d. (freight, brokerage, etc.), must be added, making a total of 16·04d. or 1s. 4d. per lb. The produce from particularly well placed estates may be put on the European market at 10d. to 1s. per lb.; on the other hand there is little doubt that a certain proportion of the planted areas will not show any considerable profit at less than 1s. 6d. to 2s. per lb.—or more.

Methods of Manufacture.—The following essential *desiderata* should be aimed at:—(1) Collection of maximum amount of latex with minimum of injury to the tree. (2) Absolute cleanliness of collecting and transport vessels. Metal containers should be avoided, glass, earthenware or enamelled collecting cups, pails, etc., being preferable. Bare metal certainly affects the colour and possibly other qualities of the finished rubber. (3) The latex to be strained or filtered as soon after collection as possible, so that all mechanical impurities may be removed without delay. (4) To restrict, as far as possible, the formation of "bark scrap."

Coagulation and curing.—The method employed in coagulating the bulk of the plantation rubber consists, substantially, in the addition of a small quantity of acetic acid to the latex after the latter has been strained and preferably reduced to a certain rubber content by mixing of various batches, or by dilution. In most cases, just sufficient acid is added to render the liquid neutral or faintly acid to litmus. After the coagulum has formed it is removed from the mother liquor and passed through the washing rolls, from which the rubber emerges in the form of crêpe, and if this form of rubber is required it passes direct to the drying sheds. If sheet is required the crêpe is passed through a sheeting machine, which consists of rolls revolving at even speed. Intermediate grades obtained by subjecting wet crêpe to the action of even speed rolls are also turned out. In the manufacture of biscuits, now only produced in relatively small quantity, the latex is directly coagulated in circular pans or basins. "Worm" and "lace" rubbers are also produced by passing the coagulum through appropriately designed rolls or dies. In some cases where it is desired to produce rubber of very light colour, the crêpe or sheet is passed, before it goes to the drying rooms, through water heated to about 180° F., a process due to Mr. Kelway Bamber, who discovered that *Hevea* latex contains an enzyme which causes the darkening of the rubber, and which can be destroyed by heating to the temperature mentioned. This does not apply to all other latices. Freshly coagulated *Funtumia* rubber is, for instance, perfectly white and may be boiled for a long time with water, but nevertheless darkening subsequently takes place. In the drying rooms the rubber is placed on perforated shelves, or as in the modern practice, is hung from racks. In all modern drying houses provision is made for passing a current of warm air through the same. Partially dried air is preferable, but it is doubtful whether any drying process for this purpose is economical. Another method of drying is by means of the vacuum dryer, in which rubber may be dried in almost as many hours as it takes weeks in the ordinary fashion. It has been said that vacuum dried rubber is not so satisfactory as air dried, but where inferior results are noticeable they are probably due to imperfect methods of applying the vacuum. Thick crêpe is generally prepared by passing several layers of the thin crêpe through the rollers simultaneously. Block rubber is prepared from crêpe by subjecting it to pressure in a hydraulic press while it is still warm from the vacuum dryer.

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* Wright. *Hevea Braziliensis*, p. 4.

† India-Rubber Journal, January, 1910.

‡ H. K. Rutherford. India-Rubber J., Q. Cent. No. 1909, p. 60.

* Estimated by the writer of this paper.

† According to Rutherford.

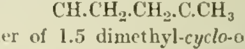
Other coagulants than acetic acid are occasionally used and there are various modifications of the other processes referred to, but substantially the above gives in outline the essential features of the production of Para plantation rubber.

Other varieties.—With regard to the preparation of varieties other than *Hevea* on the plantation system, such differences as occur in the methods employed are the result of the fact that the inherent properties of different latices vary considerably, and it is therefore necessary to modify the method of coagulation. It may be suggested that this is perfectly obvious, but as a matter of fact much trouble has been caused by efforts to apply to different latices methods which have been favourable in the case of *Hevea*.

Guayule rubber.—The production of rubber from the Guayule shrub (*Parthenium argentatum*) is of particular interest, because the problems involved are more intricate than those dealing with the production of rubber from ordinary latex bearing plants, and also because guayule is produced on a very large scale, the amount manufactured during the past year being estimated at roughly 4000 tons. The Guayule shrub, which prefers an altitude of 4000 to 5000 feet is distributed unevenly in a belt of territory from one to a hundred miles in breadth extending roughly from Fort Stockton in Texas to the Tropic of Cancer in Mexico. In this shrub rubber occurs in solid particles dispersed through the mass of the woody fibre. According to M. P. Fox the wood contains from 6 to 18 per cent. of rubber, a similar quantity of resin, and about 10 per cent. of extractive. Two processes are employed to separate the rubber from the wood, one consisting in extracting the rubber by means of solvents, and the other, which consists in disintegrating the woody mass in such a manner as to separate the rubber; a combination of the two processes is also employed. Two main grades of Guayule are prepared, one containing about 30 per cent. of resin, and the other, from which part of the latter has been extracted, containing about 3 per cent. of this impurity. Since the extraction of rubber involves the destruction of the shrub it is estimated that within four years from now practically the whole of the standing shrubs will have been destroyed. For the period 1906 to 1909 some 17,000 tons of rubber were prepared from Guayule, which corresponds on a 7 per cent. basis (for wood containing 25 per cent. of water) to roughly 328,000 tons of shrubs.

Future of the crude rubber industry.—It is perfectly clear that within a measurable period the crude rubber industry will have undergone a complete change. I believe that in a very few years' time manufacturers will refuse to have anything to do with any raw material that is not perfectly clean and practically dry. Therefore the bulk of the wild rubber in the market will have to be prepared in a different manner, or it will be unsaleable. It has already been shown in various parts of the world that the plantation system may, under favourable circumstances, be applied to wild trees, and it seems likely that in time the system of rationally working wild as well as planted trees will be extended over favourable areas. This involves expense in the way of cutting roads and paths, and making arrangements necessary for the transport of latex or rubber bearing wood to central stations. It is obvious that only such areas can be worked as those on which the trees occur in fair number. Probably the most difficult question involved is that of labour. The drawbacks to the rational working of wild rubber are considerable, but on the other hand there are advantages. While it is frequently assumed that the first class of rubber to disappear under the stress of competition will be the inferior African grades, I am by no means sure that this will be the case, because on the whole, the question of labour is not so acute in most of the African rubber zones as in South America, and there are already signs that those interested in the West Coast, the Congo, etc., will take the necessary steps to improve the quality of the rubbers from these regions. With regard to the Para grades the labour problem appears to be a very serious one, and in view of this, and of the extremely unhealthy climate, it is difficult to see how the Amazon valley is indefinitely to maintain its superiority as a producer. Certainly the opening up of the vast forests of Brazil involves the overcoming of apparently insuperable difficulties. The third factor—taking planted and ordinary wild rubber as the two others—in the crude rubber problem, is the preparation of pure high class rubbers from inferior, naturally resinous grades by chemical or other processes. That enormous quantities of resinous rubbers are available is well known. That it is possible economically to purify resinous rubbers appears to be proved beyond doubt by the Guayule industry. I think there is a great future for the subsidiary industries which are likely to arise in this direction.

Chemistry of crude rubber, and the question of "synthesis."—According to the classical work of Harries,* india-rubber is a ring compound, namely:—



$$\begin{array}{l} CH_3.\underset{..}{C}.\quad CH_2.CH_2.CH \\ \qquad\;\; \ddot{C}H.CH_2.CH_2.\ddot{C}.CH_3 \end{array}$$

that is a polymer of 1.5 dimethyl-*cyclo*-octadiene.

I have already referred to the fact that according to the work of Harries,† this polymer exists in at least two isomeric modifications. Although there is no apparent flaw in the chain of Harries' chemical reasoning, one is face to face with the fact that india-rubber has on several occasions been synthesised from isoprene by observers whose work must be regarded as beyond doubt.‡ The synthesis by Euler§ of isoprene makes it apparently certain that this compound possesses the structure:—

$$CH_2 : C(CH_3).CH : CH_2.$$

To reconcile Harries', Euler's, Tilden's, and Bouchardat's work it is necessary to assume that the open-chain compound isoprene in polymerising forms a ring compound, and that at the same time a somewhat unusual intramolecular rearrangement of linkages takes place. At the present time there appear to me to be two main lines of work which are worth following up in this connection, firstly the synthesis from isoprene and secondly that from laevulinic acid or its derivatives.‖ If, as is anticipated, rubber can be obtained ultimately, in practically unlimited quantities, from the plantations and other sources at 1s. to 1s. 6d. per pound, no synthetic process which works at any appreciably higher figure is likely, in the long run, to prove a commercial success. Briefly put, the chemist must be able to produce rubber at something like 1s., otherwise the synthetic product cannot come to stay; such a price does not leave a great margin in the choice of raw material or cost of production. Synthetic indigo is frequently mentioned in discussions of the synthetic rubber problem, but the comparison is misleading from every point of view, but mainly because the lowest price at which natural indigo can be prepared is relatively speaking a very high one. With regard to the synthesis from isoprene, the problem appears to be the production of this substance at a very low cost, for it appears to be not unlikely that a satisfactory conversion of isoprene into rubber will ultimately be achieved. Another factor which may complicate the scientific problem is that it is necessary to produce not only a definite chemical substance, but that, in addition, this substance should have certain definite physical properties. It is, however, possible that these problems may be found to overlap. The differences in regard to mechanical strength which certainly exist as between different species and also as between rubbers of the same species prepared in different ways or derived from different localities, both in the case of the crude and the vulcanised articles, have not yet found a satisfactory explanation. In this direction a great deal of useful work may well be done.

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* C. Harries and others. Ber., 1904, 2708; *ibid.*, 1905, 1195, etc.

† C. Harries and others, Ber., 1905, 3985, and Gummi-Zeit., **22**, 12, 305.

‡ Cf. Tilden. Birmingham Phil. Soc., May, 1892; do. *India, Rubber J.*, 1908, p. 321, and Bouchardat, Comptes Rend., 1879, 1117.

§ Ber., 1897, pp. 1989 et seq. and Habilitations-schift, Leipzig, 1897.

‖ By splitting rubber ozonides Harries obtained laevulinic acid and laevulinic aldehyde.

The Manufacture of Rubber Goods.

The main processes employed in the manufacture of articles from crude rubber are still largely empirical, partly because the industry is comparatively young and partly because the principles governing manufacture are by no means clearly defined.

The india-rubber article in the process of manufacture is subjected to a series of operations which are briefly as follows:—First the crude rubber as it arrives at the factory must be purified, and this is done by the process called washing. The washed rubber is subsequently dried. If ordinary "mechanical" goods are to be made the next process is that of mixing. This consists in incorporating with the rubber the necessary quantity of sulphur and filling materials. The next step as a rule is that of calendering; this consists in rolling out the well mixed and homogeneous dough to sheets of the required thickness. The calendered material passes next to the making-up table where it is cut to suitable sizes either for the hydraulic vulcanising press or prepared for the moulds. The next process is that of vulcanising which consists substantially in subjecting the calendered dough to combined heat and pressure, or heat only, in the press, in a mould, or in the open. In the case of many solid tyres the rubber is not first calendered, but the well mixed dough is forced through an appropriate die. The same applies to squirted tubing. In the case of elastic thread the rubber is mixed with flowers of sulphur and "let down" with a solvent and the mass so obtained spread or calendered on to cloth. The above remarks refer to goods which are made by the hot process of vulcanisation. There is, however, a large class, such as articles made from cut sheet, waterproof goods, and broadly speaking, all articles in which the rubber layer is very thin, which is prepared by the cold process. In this method the rubber is not first mixed with sulphur and then exposed to heat, but is subjected in the form of a thin layer or sheet to the action of a dilute solution of sulphur chloride in a suitable solvent or to the action of sulphur chloride vapours. The cold process cannot be applied to goods of any thickness because the action of sulphur chloride is so powerful that by the time the interior of a piece of rubber of any thickness is properly cured, the outer portions are over vulcanised.

The ordinary process of washing consists in passing the rubber, after it has been cut up and soaked in warm water to render it pliable, through corrugated, fluted or diamond-cut rolls working at uneven speeds, and at the same time subjecting the mass to the action of a stream of water. By this process dirt, sand, bark, etc., are forced out of the rubber, which is obtained in the form of a corrugated sheet of crêpe like texture. It is probable that at no very distant date the process of washing, which involves the use of much power and time, and apart from its actual cleaning effect, is certainly not beneficial to the rubber will be abandoned. It is now well recognised that the less rubber is subjected to mechanical action the better, for the more it is worked the softer and less resilient it becomes. At the present day much of the clean plantation rubber is not washed, but is taken to the mixing rolls after a short preliminary drying. There is no object in washing rubber which is dry and clean and which contains substantially no soluble matter.

Drying.—After the rubber has been washed it must be thoroughly dried, either in well ventilated chambers or in a vacuum dryer; occasionally nowadays the last trace of moisture is removed by passing the goods through hot rolls.

Mixing.—The ordinary mixing rolls are of much the same type as the rolls used on the washing machine, except that they are smooth, and run dry. The rolls are hollow and are heated by means of steam or cooled with water. When the rubber has been reduced to a plastic condition on the mixing rolls, the sulphur and other materials which are to be incorporated are then gradually added. Although many attempts have been made to replace the apparently crude method of mixing by a more scientific process, all such attempts, so far as I am aware, have failed. If the rubber is made into a thin paste with a solvent, there is the cost of the latter and also its removal. Also rubber which has been treated with a solvent always appears to lose strength very badly. It is now generally recognised that the less the rubber is worked with the solvent the stronger the solution will be. The question of the mechanical working of rubber is one which is well worth exhaustive investigation; if means were found to avoid the mechanical working of the mixing process a very great step forward would be gained. Mr. Kelway Bamber proposes to incorporate the sulphur and other matters with the latex or during the process of coagulation, thus avoiding all mechanical working.

Calendering and spreading.—The primary object of calendering is to transform the rubber dough into sheet form. From this sheet various articles are built up prior to vulcanising. The calender is, however, used for other purposes; for instance, to replace the old spreading machine. The spreading machine is a long iron steam chest which is fitted at one end with a horizontal roller above which there is an adjustable iron gauge. The cloth which is to be treated passes between the roller and the gauge, a thin layer of paste (made of rubber and solvent) regulated by the gauge, being applied to the cloth during its passage. The cloth then passes along the steam chest which serves to evaporate the solvent. Hoods communicating with refrigerating plants are frequently fitted for the recovery of the solvent. Of late years the tendency has been more and more to replace this process of spreading by calendering, a special type of calender being used. The advantage of the calender over the spreader is that there is a great saving in regard to solvent, but there is some difficulty in getting an even proofing, particularly when this is to be very thin.

Vulcanising.—The vulcanisation of rubber goods must remain more or less empirical, in spite of the work of Weber, and later of Axelrod, Hinrichsen, etc. Axelrod has recently suggested that there are two main factors in hot vulcanisation, namely the entry of sulphur into the rubber molecule, and a change of the state of polymerisation of the molecule. These factors in a sense work in opposite directions, and attain certain maxima under definite conditions of time and temperature. The term "polymerisation," or "depolymerisation" of rubber* should be used with some caution, for it is probable that some of the physical effects observed are due not to any change in molecular complexity, but merely to modifications in the colloidal aggregate.

The hot vulcanising process is applied more rarely nowadays by means of live steam; the majority of goods are now cured either in a steam-jacketed or ordinary hot air chamber, or in the vulcanising press. Moulded articles, which were formerly vulcanised in live steam or in hot air, are now more generally vulcanised in a mould press. It is becoming recognised that pressure is a factor which is only of secondary importance to time and temperature in the vulcanising process, particularly where goods of any strength are required. Another tendency which is noticeable is that of replacing, particularly in the case of waterproofed goods, the cold by the hot process. Formerly waterproofed goods were invariably made by "frictioning" a thin layer of rubber on to the cloth by means of the calender or spreader, and then passing the cloth with its rubber layer through a trough containing a dilute solution of sulphur chloride in carbon bisulphide. This process requires very great care. Nowadays it has in many works, except for special classes of goods (*i.e.*, those which will not stand heat), been replaced by hot vulcanisation. A well mixed dough of rubber and sulphur, and such other materials as are desired are frictioned on to the cloth, and this is then slowly drawn through a series of rolls in a hot air chamber, the time being so regulated as to obtain perfect vulcanisation.

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* Cf. Spence. *India-Rubber J.*, Q. Cent. No. p. 46.

Substitutes and residuals.

"*Substitutes.*"—Although in the proper sense of the term no substitute for india-rubber exists there is a class of substances which is known in the industry as "substitutes," produced by vulcanising vegetable oils such as colza, rape, maize, and cotton-seed oils, either in the cold with sulphur chloride or hot with sulphur. Substitutes produced by the cold process are generally known as white substitute, those by the hot process as brown or French substitute. They have been produced on a considerable scale for certainly 40 years and a goodly number of patents has been taken out in connection with their manufacture. As the price of these substitutes varies from about 3½d. to 9d. per lb. their use effects a considerable saving in the cost of the rubber article in which they are incorporated. They are employed in order to cheapen the cost of production and where the goods to be produced are to be of low specific gravity. The advantage of the substitute over mineral fillers is that the plasticity of the mixing is not affected to any extent, although the strength, wearing qualities, and elasticity are naturally much influenced. White substitute (which is the more expensive) is generally employed only for cold cured goods, but the brown may be employed for either. Many other substitutes have been suggested and some are used on a considerable scale, particularly in cable mixings. Gums, bitumen, vulcanised bitumen, nitrated oils, nitrated celluloses, ceresin, etc., etc., all find their sphere of utility in cable mixings, in insulating materials, valve rings and so on, but a true rubber substitute has yet to make its appearance.

Residuals.—An enormous quantity of waste rubber finds its way into the market. If we assume that the crude rubber employed in the manufacture of goods in the British market yearly amounts to 12,000 tons, and that this re-appears in the shape of finished rubber articles containing on the average perhaps not more than 30 per cent. of rubber, it is plain that there must be something like 30,000 to 40,000 tons of waste rubber annually. The waste rubber industry is an important one in itself and a special organisation exists for the collection of this material. Broadly speaking, waste rubber is utilised in one of three ways:—(*a*) It is ground up (where the article permits of such simple treatment) and used direct in the ground state by the rubber manufacturer in his mixings for the cheaper varieties of goods; (*b*) it is subjected to one of the reclaiming processes which substantially consists in freeing the rubber from fibre, dirt, and particles of metal, and subsequently removing as much as possible of the free sulphur and non-rubber substances; and (*c*) the rubber is submitted to a re-forming process, by *re-forming* being understood a process which employs substantially only heat and pressure.

Reclaimed rubber.—In the old reclaiming processes the rubber was ground, the metal particles and vegetable fibre removed, and the mass then heated together with mineral oil and subsequently rolled out into homogeneous sheets. By this process no sulphur was removed. The newer processes all involve wet treatment and the removal of sulphur. Some of the reclaimed rubbers so made are of remarkably good quality; indeed, the better varieties, which are made from the best qualities of scrap, fetch appreciably higher prices than some of the inferior crude rubbers. In the oldest of the wet processes fibre is destroyed by means of sulphuric or hydrochloric acid, part of the mineral matter also being removed; the process is chiefly suitable for lightly cured scrap such as that from proofed goods, as very little sulphur is removed. In the alkali process, which is the one most generally adopted by large works in the United States and the United Kingdom, the scrap is first sorted, ground, metallic particles removed by magnetic separation, the ground rubber shaven in perforated trays to get it in an evenly divided state, and subsequently heated under pressure in iron vessels with alkali, washed, and sheeted. It is claimed that in this way the whole of the free sulphur is removed. Another process is that in which neutral sulphites are employed for the removal of sulphur. A number of reclaiming processes have been proposed (some of which are, I think, working) in which after mechanical cleaning, the whole rubber mass is dissolved in a suitable solvent; these solvents are generally of a neutral character and of high boiling points (petroleum, terpineol, etc.). From the solution so obtained the rubber is precipitated by means of a non-rubber solvent such as alcohol. I have not personally come across any reclaimed rubber which does not still contain a very considerable proportion of sulphur.

Re-formed rubber.—During the past few years a number of patents has been taken out by Gare, Immisch, and others, for processes which effect the direct production of moulded articles from ground or flaked scrap mainly by means of heat and pressure. Exceedingly good results are obtained in this way, and it is remarkable that this simple method of dealing with "mechanical" scrap was not discovered at an earlier date. The fact remains, however, that particles of vulcanised rubber in the shape of dust or flakes can be moulded by pressure and heat to a homogeneous mass, which on cooling, is to all intents and purposes indistinguishable from an ordinary moulded article.

DISCUSSION.

The CHAIRMAN said that he would rather compare rubber with camphor than with indigo. A few years ago, when camphor rose to a very high price, the Japanese Government could afford to produce camphor at one-third the price it was being sold at. With regard to rubber the problem was rather different; although they were told it could be produced at 1s. 2d. per lb., he did not think that that price would rule in the market for many years to come; and, in the meantime, the synthetic chemist had some scope for his energies. Mention had been made of the patent by Harries, published a few days ago; there was also another process foreshadowed, that of the Farbenfabriken Elberfeld, claiming a substance very similar to rubber in its properties. From the scientific point of view it was interesting that the latex represented a colloidal solution and if the theory held good that such a solution was in some kind of electrical condition, there might be something in a recent German patent (taken out by an inhabitant of Ceylon) for obtaining the precipitation of india rubber from the latex by an electrical process. Again, there was much work for the chemist in reclaiming indiarubber. He asked why no mention had been made of extraction by means of nitrobenzene; was it that the process had been abandoned already?

SIR GEORGE WATT wrote that with the view of assisting those industries where water-proofing was necessary without an elastic hydrocarbon being required, a large quantity of the milk of *Euphorbia Roylei* was collected. That plant was met with most abundantly throughout the Himalaya, and on the salt mountains of the Punjab. After boiling the milk for 12 hours, a small amount of drier being used, and cooling the mass by throwing it into ice-cold water, a curious paint was obtained which behaved on textiles like good water-proofing material, similar to Afridi wax. In 1896, he had had sent to him, in Calcutta, water bottles, which looked very much like indiarubber, but were made in Raipur, out of the pulp of the ripe fruits of *Phyllanthus Emblica*, the Emblic myrobalan. The fruits were boiled in water until they became soft; they were then pounded, and after the seeds had been removed, the pulp was beaten and worked up, until it assumed the condition of a dark brown sticky thick paint. Cheap earthenware pots (sun-dried) were then painted with several coats of this pulp, and while the coating was still soft the red berries of rati (*Abrus precatorius*) were stuck into the coating, in elaboration of a desired ornamentation. The pots were then allowed to dry, and the earthenware vessels within were broken and removed, leaving the rubber-like vessels behind. These vessels were perfectly waterproof, unbreakable, and could be subjected to considerable heat without being injured. There was further, a native Burmese varnish *thitsi* (from *Melanorrhœa usitata*), largely used for water-proofing purposes, and this varnish deserved, in his opinion, serious attention.

MR. H. K. RUTHERFORD said he remembered the year 1875 when the Para seedlings sent from Kew were first grown in the Botanical Gardens at Peradeniya by Dr. Trimen; their descendants were now all over the East. In 1876 he saw the plants when about two feet high in the

Ceylon Gardens. Notwithstanding Dr. Trimen's opinion that Ceara rubber was more suitable for growth in Ceylon or the East, which had led to several hundred acres being planted, the trees had now all died, and few would be found in Ceylon. Dr. Trimen believed that the Para trees only grew on the alluvial flats of the Amazon. Actually the great mass of the rubber was grown in the Hinterland away from the river side. He believed the extensive cultivation of Para rubber in the East had been delayed for several years owing to a lack of accurate knowledge with regard to the conditions under which it would grow. They had been told until recently that plantation rubber was no good except for making "solution," for which a few thousand pounds would be required; and that wild Para rubber was the only rubber that could be commercially used in large volume. They had also been told in Ceylon that it was a mistake to wash rubber too much. The "solution" question had gone by the board, and doubtless in a few years' time many other opinions held at present with regard to the "curing" of rubber on plantations would be greatly modified.

In the rubber industry they were going on step by step, and had to abandon some of their formulæ. Planters, however, had to be extremely careful in adopting new methods in the preparation of rubber for the market, as an alteration in a process might result in a very serious loss to the grower. The Rubber Growers' Association had sent out chemists to Ceylon and to the Malay States to investigate and study the whole subject of latex treatment and teach them what process could best be applied in order to produce the finest possible quality of rubber.

Mr. Herbert Wright asked whether in the opinion of the author the recent work published by Harries constituted an advance of any commercial importance? It was suggested by the author that the average yield of one ton per ten acres in the future was rather exaggerated. He believed he was the first to adopt the possible minimum estimate of one ton per ten acres; but later results justified an anticipation of a yield of at least 300 lb. per acre of dry rubber. From the time of Goodyear and Hancock to 1900, the main interest centred in the manufacturing industries; but from 1900 to the present time the plantation industry had developed very rapidly; the enormous advances made constituted a record in practical agriculture in the Tropics. In 1900 the trees referred to by Mr. Rutherford were bearing seeds; then he prevailed on several planters to take a few seeds and plant them; and they now saw the result. Few estates had trees of eight years or over at present, and no doubt everybody regretted they had not taken the matter up more earnestly in the past. To-day the planted acreage throughout the East was something like 720,000 acres. In the last four years especially the planting of *Hevea* had gone forward very rapidly. In the plantation industry, British people practically led the way; and it was more than likely they would continue to hold the premier position. The Central Province of Ceylon could produce far more rubber than had been annually turned out from the whole African continent. That shewed what possibilities lay before the plantation industry, the rise of which offered many opportunities for research, of a kind which in former days was impossible. Everything was done to encourage the scientific development of estates so that precautions against possible dangers might be taken. He would be happy to place a large number of subjects before anyone who would investigate them.

Mr. Hamel Smith was particularly interested in what the author had said in connection with the vacuum drier. The question of drying was most important to estates in the Tropics, because of the frequent rains. The vacuum drier enabled the planter to use the same machines for different products, a very great consideration in view of the increasing tendency to plant mixed crops in belts in order to restrict disease and distribute risks. If one was prepared to allow a sufficient time for drying, say two to three hours, the vacuum drier was most suitable for rubber estates. He agreed that the poor classes of rubber from West Africa had had their day, and considered that tropical medicine would greatly help Africa to scientifically develop her resources, as it would enable white men to endure the climate better in the future than in the past, and to penetrate further into the Hinterland than they have hitherto been able to do. The exploitation of the vast forests up-country, by natives under the skilled supervision of white managers, was thus being rendered more possible.

Colonel Birley said that the manufacturers required in raw rubber a maximum of elastic material, and a minimum of resin; and that the resin should be as hard as possible. At present, that combination of qualities was found in the plantation and the Para rubbers. He was in great hopes that the supply from the plantations as well as from Para would give them an article from which they could manufacture the best products. It was his hope that as the knowledge and the practice of scientific collection spread, they would get a superior article to deal with. Whether the inferior rubbers of the present day would ever approach the quality of *Hevea*, he did not know, but hardly thought they would. What was wanted more than anything else was the production of *Hevea* rubber in great quantity at a low price.

Mr. F. L. Rawson said the re-forming of rubber waste had come to the front during the last few years. The great difficulty was to remove all the air from the rubber, as otherwise the particles were granular, and therefore were deficient in strength and elasticity. By adding oil to the waste rubber after it was ground up, and then heating it, a product free from air was obtained which when compressed and heated was of the same class of rubber as the original article. Its resistance to steam was rather greater, possibly because in the ordinary manufacture of rubber articles it was difficult to get a thoroughly uniform mixing with sulphur, but on grinding in the form of a fine powder uniformity was obtained. So far, rubber re-formed in that way appeared to be thoroughly satisfactory. The quantity of waste rubber available for re-formation was probably between 35,000 and 60,000 tons. Each year an increased amount of waste from old articles of the previous year was available. At present, all the waste was ground, re-claimed, and added to new rubber. Ordinary mats contained about 10 per cent. of new rubber, and the rest was old waste ground up. If it were possible to obtain very cheap rubber an enormous demand would come forward; it was now used comparatively sparsely; for example, it would make an excellent carpet for banks, offices, and houses.

Mr. W. F. Reid said some very interesting particulars as to the recovery of waste rubber had been given by the last speaker; but he did not call this "recovery"; it was producing out of rubber articles such as were made previously out of other rubber compositions. He (Mr. Reid) referred to the actual recovery of the rubber material *quâ* rubber from the various waste as put into the market. There were several processes which had not been mentioned. Those who were recovering rubber, were doing a good business, and did not wish to publish those methods which were not patented. There was certainly a great field for a process of de-vulcanisation—not by such crude methods as treating waste with acid or alkali, as in both of those processes the molecule of the rubber itself was acted on, and an inferior quality was produced. There were processes in which an inert solvent was used, by which sulphur was brought into solution and a number of waste products was obtained. In dealing with waste by hundreds of tons a number of products, which were usually considered to be valueless, was obtained; in bulk these were really valuable; for instance there was a large quantity of zinc and antimony and fibre. In an industry with which he was specially connected, the waste had been thrown away, but now a paper manufacturer paid some hundreds of pounds a year for the fibre. There was another method by which the great demand for rubber might be met, and that was by, what he called, a substitute—not what was generally called a substitute, which was rather an adulterant, but a material which in itself would replace indiarubber for many purposes for which it was now used. For instance, why should an elastic substance be used for water-proofing sheeting? It was not at all necessary; but, unfortunately, quantities of rubber were used in that way; and a very inferior material produced which would last only a year at the utmost, and then had to be thrown away. He shared the belief that synthetic rubber would not replace in any way the natural product. He thought the rubber industry might to some extent be compared with the sugar industry; they could synthesise sugar, but nobody thought of doing it commercially. By the time the millions of pounds which were now being put into land for growing rubber came back again, rubber would be so cheap that it would not pay to synthesise it. The difficulty lay in the material from which the chemist began his synthesis. Camphor was made from turpentine; and, so long as turpentine was low and camphor was high in price, some companies made a profit (on paper) by making camphor. But, when turpentine went up and camphor went down, those companies were liquidated; and he thought that would be the case with synthetic rubber companies for a long time to come, if any were formed. Still, he thought there was a future for well thought out substitutes for rubber. They had had a great many, and some of them had been great failures. One named oxoline, was made from oxidised linseed oil, and was very like rubber in appearance, but when kept it oxidised still further, became semi-liquid and ran into a mass. Materials such as that were not real substitutes.

The Chairman asked Mr. Reid if terpineol was the solvent used in recovering rubber.

Mr. Reid said that was one.

Mr. C. Beadle said Colonel Birley stated that certain rubbers of the East Coast were improved by being subjected to plantation methods and were better than rubber treated in the crude fashion; but rather the reverse was thought by some to be true of *Hevea* rubber which was treated in a much cruder fashion in Brazil; for that rubber, even in spite of the great advances which had been made in scientific methods of collection and coagulation on plantations was still somewhat better, he believed, as prepared in Brazil, than the rubber prepared by the plantation methods. It would be difficult to say what made it better. If it were possible to submit the latex collected from the forests in Brazil to one or other of the methods now employed on plantations, a comparative examination of the products might possibly solve the problem. The cause was probably either a difference in the method of collection, or in the habitat of the trees; thus there might be a distinct difference between the latex of a cultivated tree taken out of its natural environment and that of a wild tree which was the result of the survival of the fittest.

Dr. Stevens said he had come to the conclusion that the treatment of rubber latex on the plantations was not scientific. He thought that great improvements could be made in the method of coagulation, and that it mattered a great deal how much acid was added. On many estates coagulation of the latex was in the hands of a native with very little European supervision. The Europeans had not time to look into all those matters; they did not know how much acid to add, nor sometimes what proportion they were adding. The quality of the rubber varied; some of it was excellent rubber, in his opinion equal to fine hard Para, but much of it was vastly inferior. The washing and drying processes, which were scientific, were borrowed from the manfuacturers at home. Reference had been made to the classification of rubbers from the botanical point of view; the basis of this classification, it was pointed out, might vanish after a time, and by special treatment rubber of similar quality might be produced from *Ficus elastica*, from *Funtumia elastica*, and from *Hevea*. That was a problem for the solution of which there was very little data to go upon. He had coagulated the latex from *Ficus elastica* and from *Hevea* under the same conditions; the rubbers showed differences in chemical reactivity, chiefly as to the rate at which they combined with sulphur; the physical qualities of the vulcanised products were also different. The original rubbers contained different proportions of resin, but after careful removal of these resins in the cold the differences persisted. He therefore concluded that the difference in behaviour was not due to admixture of resin but might be one of aggregation in the colloidal state. He was inclined, however, to the view that it was rather a structural difference between the caoutchouc molecules as obtained from the latices of different rubber-yielding trees. He doubted whether the revolution in the ordinary methods of manufacture, due to the re-formed rubber process referred to, would be quite so far-reaching as had been suggested. He understood that the treatment was under pressure in moulds, and consequently the process was confined to mould-made goods.

Mr. H. C. T. Gardner said that coagulation of latex had been referred to as essentially a chemical process, and an analogy had been drawn to the coagulation of the casein in cow's milk. Did it not really depend upon a disturbance of the physical equilibrium of the caoutchouc globules, *i.e.*, it was a physical rather than a chemical process, and as such was not analogous to the coagulation of milk? The lecturer had stated that the paddle used by the natives of the Amazon in curing the latex, was dipped into it by them and then held over the fire. He believed that it was found the hot paddle, if used in this way, affected the latex, and that the modern practice was to dip it out from the containing receptacle by means of cups from which it was poured over the paddle. With reference to drying was it not a fact that before the vacuum drier was used in Ceylon most of the Cingalese rubbers arrived on the market in a very tacky condition; but since its employment they had exhibited a comparative freedom from deterioration due to "tackiness"? Lastly, he should like to know what process Dr. Schidrowitz followed for the estimation of the protein in crude rubber?

Mr. Phillip asked it there were any means of detecting the use of re-formed rubber from the point of view of the user of material who desired to see that he was getting the material he had specified. To put the question in another way, was re-formed rubber indistinguishable from the original rubber from which it had been made?

Mr. Chaston Chapman said that he thought the keynote of the paper to which they had listened was approximation of quality as the result of the application of scientific methods. Manufacturers knew the class of material which gave them the best results, and the inducement to try new grades of rubber was rarely sufficient formerly to induce them to make the troublesome and lengthy experiments necessary. Now, however, partly owing to the high price of rubber, and partly to the far greater attention given to the preparation of many of the lower grades, manufacturers were willing to experiment with products which they would not have looked at a few years ago. Certain of the lower grade rubbers, as the result of improved methods, had much more than doubled in value. He would have liked to have heard something about the effect of protein, resin and other impurities on the quality of certain low-grade rubbers. One of the greatest objections to some of those products was their tendency to become "tacky" on the rolls, or sometimes on exposure to air. Creosote was known to increase the life of these rubbers very considerably: was this due to its direct action on the proteins, or to its bactericidal properties? When the results of the vacuum drying of rubber were not satisfactory, it was chiefly due to the fact that the temperatures had not been properly controlled, and that the trays containing the rubber were not heated by a proper system.

The problem of the synthesis of rubber was a fascinating one, and despite the low price at which they had been informed that plantation rubber could be produced, it was still, even from the commercial standpoint, well worth the attention of chemists.

Mr. Bolton said apparently the by-products made some difference in the cost of production. Could the author give any explanation of what became of the indiarubber nuts, which contained a considerable proportion of oil?

The Chairman said they were wanted for planting.

Dr. Pickles said that during the past year plantation rubber had been prepared in Malay by a process very similar to the Brazilian method. The material obtained was of good quality and the result of the experiments indicated the probability that in the near future the planters in Ceylon and Malay would be able to produce rubber similar in form and equal in quality to the Brazilian product. He could not agree that the Brazilian method of preparation was crude. It was very sagacious and its efficiency was unquestionable. The cultivation of "bitinga" rubber, obtained from the turnip-shaped root of a plant growing in almost rainless districts of Africa, and similar products might extend considerably the area of the rubber producing zone. In regard to synthetic rubber some insecurity might be felt by planters as the result of Prof. Harries' recent work. In synthesising rubber from isoprene, however, the source and production of the isoprene and the yield of rubber from it must be considered. Isoprene could not, at present, be prepared at all cheaply by any process other than by the destructive distillation of turpentine, and even then the yield was extremely small. The use of turpentine oil as the starting point for the production of camphor was too costly. It was therefore hardly probable that it would be practicable to use it for the manufacture of rubber.

Harries' process of converting pure isoprene into rubber by heating it with acetic acid in sealed tubes would be expensive, and if the isoprene fraction from the turpentine decomposition were used, it was probable that the material produced would still be far behind "fine hard Para" in physical properties.

Dr. SCHIDROWITZ, in reply, said that the electrical method of coagulation consisted in electrolysing the latex, on the well-known principle that indiarubber was a negative colloidal solution, and that when the charges on their surfaces were removed, the particles cohered and formed a coagulum. The latex was passed into the cell at one end, and deposited in the form of a thin plate, and finally washed and heated to kill the enzyme and still further to dry it; and it was removed at the end of the apparatus without its having been handled by manual labour. He hoped shortly to see the process at work in Ceylon and to ascertain how far the inventor had succeeded. He should say Harries' recent work constituted no advance of commercial importance; and that Sir William Tilden's work was not at all fairly treated by that author. It was very doubtful whether all the acreage planted was going to yield 200 lb. Good plantations would yield from 400 to 500 lb.; but some others would possibly not yield 50 to 100 lb. He thought 200 lb. a fair average figure. Colonel Birley's remarks on resin confirmed his own views, that a little resin of the right type did no harm in rubber Good, hard resin had no prejudicial effect *per se*, if there were not more than 6 to 8 per cent. He did not think Mr. Beadle quite appreciated the point in connection with scientific coagulation and the improvements which had taken place in African goods. It was unfair to compare plantation rubber with Para and the leading African rubbers on the one hand, and on the other hand with some of the lower grade rubbers. He could not agree that rubber sheeting did not last more than one year; it depended on the quality. The amount of acetic acid added to the latex should be carefully regulated, as well as other factors to which he referred in some detail in the paper. Supervision was very necessary, not only on that point, but on others. Dr. Stevens had prepared rubber from different latices in the same way, and found the products were not the same. Harries himself had come to the conclusion that the actual rubber molecule differed in different species; if the rubber coagulum were regarded from the point of view of pure colloidal chemistry, a great deal might be done in the future to approximate the caoutchouc from the various latices to one another. At present he did not think rubber could be prepared from any latex which would be identical with that from another; from any high-class latex a rubber could be produced which would sell for practically the same price as that from the other latices. He did not regard coagulation as a purely chemical process. An unintelligent native operator in charge of a vacuum drier and allowed to work as he pleased, would get tacky rubber; but, by careful superintendence, excellent rubber could be obtained. The same thing might be said with regard to factory washing. He did not know whether re-formed rubber could be distinguished from ordinary rubber. He thought the effect of proteins in rubber and its responsibility for the tackiness, had been very much over-estimated. If rubber were cured in a cleanly way and cured dry, the protein matter would not have much effect, except that more than a certain quantity was undesirable in vulcanisation. It was by no means certain that tackiness was produced entirely by bacteria; according to Bertrand and others it was due to incomplete coagulation. The rubber when coagulated was not polymerised to so high a state as it should be; it gradually de-polymerised until a soft material which was no longer rubber was formed. He agreed with Dr. Pickles that plantation rubber had little to fear from synthetic rubber.

New York Section.

Meeting held at the Chemists' Club, on Friday, February 25th, 1910.

MR. MAXIMILIAN TOCH IN THE CHAIR.

THE IMPREGNATION OF GROWING TIMBER.

BY DR. LAWRENCE OTTINGER.

The method of impregnating growing timber by the distribution of artificial colouring matter through the fibres of the wood, invented by Mr. Levi S. Gardner, produces results far more satisfactory and much more lasting than those which can be produced by the other simple methods of staining. A kerf is cut around the trunk of a live tree, or around a limb or a branch, or partly around its circumference, of sufficient width to admit the introduction of a colouring substance. The kerf severs the bast fibres and leaves the pores open on the inner side of the kerf. The kerf, or incision, is closed at its outer edge by a packing of a cord of larger diameter than the width of the kerf; then a gimlet hole is made from the outer surface of the tree to the kerf chamber. A nipple is inserted in the outer end of this feed hole, to hold a pipe leading to a vessel containing a colouring matter in liquid form.

The colouring matter is allowed to flow into the timber and will be distributed along the lines of the fibre or pores through which it travels. The colouring matter is applied immediately after the severance of the fibres, and before the withering of the foliage causes it to lose its influence of inducing circulation. The colouring matter is fed into the tree for a period sufficient to affect the colouring of the interior fibres up to the desired height, which can be determined by lateral tapping of the tree. The period of feeding will vary with different trees of different species, and also according to the atmospheric conditions. The product of this process is a wood containing within its cellular structure naturally distributed artificial colouring matter. The heart of the tree remains unaltered. That section of the tree below the point where a kerf has been taken out becomes coloured in regular rings, the soft rings only being affected. The trunk of the tree above the kerf is solidly coloured, however. If a small incision is made into the tree, the colouring matter will only follow the course of the fibres which have been severed, and will not diffuse into the other section of the tree. If a preservative liquid is fed with the colouring matter the life of the resultant lumber is greatly enhanced.

One would think that any sufficiently liquid matter would be taken up by the tree, but this is not so. One liquid may readily be fed to a beech, bay, or poplar, and the same liquid will not travel at all in the pine, hickory, or gum tree. Most of the aniline dyes are taken up readily, but others are rejected. Owing to the well-known fact that anilines fade under severe exposure to heat and light, they are not used to a great extent for this purpose; oxidising agents and bark extracts are used principally. It is probable that some of the colouring matter is injected into the bast fibres by means of capillary attraction, but the majority of the colours which are absorbed are carried by means of the travelling sap. We have in the case of the *Nitella* the example of circulating chlorophyll which is almost analogous to the circulation of red corpuscles in the human body, and if a circulation takes place in vegetable growth, there is no reason why it cannot be carried out by means of various pigments. The trees seem to have an aversion for tannin, no matter how well it is dissolved, and even in extremely weak solutions. Various acids and fluxes, especially acetic acid, are found to accelerate the action. If allowed to remain a sufficient length of time, the entire foliage of the tree becomes coloured.

The cost of this method is much lower than that of using pressure. Colouring by pressure through the wet log produces effects more uniform and consequently less beautiful.

COMPARATIVE ANALYSES OF IRISH BOG PEAT.

BY DR. W. E. EVERETTE.

Meeting held at the Chemists' Club, on Friday, March 25th, 1910.

MR. MAXIMILIAN TOCH IN THE CHAIR.

NEW CELLULOSE DERIVATIVES OF LOW NITROGEN CONTENTS.

BY JASPER E. CRANE AND CLARENCE M. JOYCE.

The nitration of cellulose with mixed sulphuric and nitric acid, containing from 0 to 22 per cent. of water, has been carefully and widely studied, and the literature on the subject is very extensive. The various cellulose nitrates produced, which contain 9 to 14 per cent. nitrogen and still retain the fibrous appearance of unaltered cellulose, are of great technical importance and familiar to all chemists under the name of guncotton, soluble pyroxylin, etc. Very little, however, has been published about nitration with more dilute mixed acids, which yield gelatinous products. A product of this nature and of peculiar characteristics was discovered by Dr. B. Herstein and patented by him (1). It was investigated by the chemists of the Arlington Company in 1905 and 1906, and with Dr. Herstein's approval we now present this paper on the subject, giving the results of our investigations.

These cellulose derivatives are spongy, structureless, colourless substances, containing 3·5 to 4·5 per cent. of nitrogen, insoluble in all nitrocellulose solvents, but readily soluble in solutions of caustic alkalis. This is their characteristic property, that alkaline solutions are easily made of all degrees of viscosity from a thin liquid to a stiff dough, and the solutions may be set by several reagents as later described, thus making possible the formation of films, transparent masses, etc. These derivatives are formed when cellulose is treated with mixed acid, containing 57—67 per cent. of sulphuric acid, 16—6 per cent. of nitric acid, and 25—27 per cent. of water. The reaction, which must be carried on at low temperatures (0 to 20° C.) and for a short time (5 to 30 minutes) causes complete gelatinisation of the cellulose to a soft, pasty, transparent mass, which is then plunged into cold water and washed, giving the product described.

A. Voigt (2) obtained a gelatinous product by immersing cellulose in 97 parts of sulphuric acid and 3 parts of nitric acid, at 2·3° C., and then nitrated the product in concentrated nitric acid to a cellulose nitrate of high nitrogen content. While somewhat similar to our gelatinised derivative, his intermediate product was not thoroughly examined, and is but a step in a nitrating process to obtain a special pyroxylin.

Knecht (3) describes unstable cellulose nitrates, obtained by treating cellulose with nitric acid of various strengths, sp. gr. 1·1 to 1·415. The products contain 3·0 to 35·8 per cent. of combined nitric acid, which is equivalent to 0·7 to 8·0 per cent. of nitrogen. The highest of these, obtained with nitric acid of sp. gr. 1·415 (69 per cent. HNO_3) is stated to have a gelatinous appearance. None of them was an entirely gelatinised product, and no statement is made as to their solubilities.

Preparation.—The cellulose used in our experiments was of several kinds, purified cotton yarn, high grade cotton tissue paper, and Swedish filter paper. The latter was found to be the most suitable as it retained less acid when drained and was easier to handle. The product, however, was not quite as homogeneous as when thinner paper was used, due undoubtedly to the removal of nitric acid during the penetration of the mixed acid through the thick paper as pointed out by Hake and Bell (4). Several different compositions of mixed acid were tried and the most suitable was found to be 65·5 per cent. of sulphuric acid, 9 per cent. of nitric acid, and 25·5 per cent. of water, obtained by mixing 82 lb. of 61° B. sulphuric acid and 18 lb. of 35° B. nitric acid. This was used in the majority of the nitrations.

The following process was used for preparing the derivatives:—A cylindrical sheet iron vessel, with a hinged circular bottom of ½ in. wire mesh and a strong handle at the top was placed in a large battery jar and filled nearly to the top of the cage with cooled mixed acid, fully one hundred parts of acid for one part of cellulose. The paper, cut up in small pieces, was quickly immersed in the acid, and the cage lifted as quickly as possible from the acid and allowed to drain for different lengths of time. The cellulose immediately begins to lose its structure and becomes gelatinous, and the extent to which this dissolving action continues, depends upon the temperature of the acid and the atmosphere, and upon the time of draining, which are the most important considerations in preparing these derivatives. Increase in the temperature of the acid or time of draining increases the softness and gelatinisation of the mass, until extreme conditions of temperature or time cause complete dissolving of the cellulose in the acid to a thin solution, from which no precipitate is obtained on dilution with water. In this case the cellulose is entirely decomposed to soluble products, dextrins, sugars, etc., in the same manner as cellulose is resolved in concentrated sulphuric acid, as investigated by Stern (5). On the other hand, decrease in temperature or time decreases the gelatinising action on the cellulose. These considerations were investigated in a series of nitrations, noting the physical state of the masses and determining the percentages of nitrogen in the products. At 5° C. and 12 minutes draining a stiff mass was obtained, disclosing a number of hairs of cellulose under the microscope, and containing when washed and dried 4·0 per cent. of nitrogen on the anhydrous product. At 10° C. and 12 minutes the mass was very soft and thoroughly gelatinised, and the product contained 4·4 per cent of nitrogen. Further increase in temperature or time gave buttery products, which were partly miscible with water, indicating a breaking down of the cellulose molecule. The action of the acid on cellulose within these limits of temperature and time of draining gave soft masses, which did not run through the screen but peeled off it with difficulty. The acid retained in the mass after draining was 12 to 16 lb. of acid per 1 lb. tissue paper or 8 to 10 lb. of acid per 1 lb. filter paper. This mass was then plunged into cold water, by opening the hinged bottom, and broken up thoroughly, giving a white curd-like precipitate, which was washed in cold water till neutral. The curds were freed from water by wrapping in cheesecloth and pressing in a hand press, the product containing about 65 per cent of water. The yields, calculated on anhydrous cellulose and derivatives varied considerably, but averaged about 110 grms. for 100 grms. of cellulose, against a theoretical yield of 119 to 121 grms. from a consideration of the analysis of the product (see later), showing considerable loss by solution in the acid. The curds dried very slowly in air to semi-transparent chips of slightly brownish colour.

Purification.—To obtain the cellulose derivative in a pure state, the curds were dissolved in dilute caustic soda to a thin solution, filtered, and precipitated by adding dilute hydrochloric acid to the filtrate until slightly acid. The extremely gelatinous, bulky, white precipitate was washed by decantation and on a muslin filter, and the product pressed and air-dried. Again the curds were extracted with organic solvents to remove substances soluble therein, and also the product reprecipitated from caustic soda solution was similarly extracted. It was found that methyl and ethyl alcohols and particularly acetone extracted a small amount of substance which gave a sticky residue on evaporation. No other organic solvents extract anything from the curds, but ethyl ether was used to wash the substance after extraction with alcohol, to facilitate drying.

Alcohol-ether extraction.—50 grms. of curds, nitrated at 5° for 12 minutes and containing 4·0 per cent. of nitrogen on the anhydrous substance, were boiled in a flask with reflux condenser with 150 c.c. of ethyl alcohol for 20 hours and filtered. The operation was repeated and the substance washed with ethyl ether and dried by heating at 50° C., and by desiccation over sulphuric acid *in vacuo*. The purified product was found to contain 3·5 per cent. of nitrogen, a loss of 0·5 per cent. by the extraction. The extracted substance had lost about 6 per cent. (anhydrous) of its weight, and was a hard, pure white powder. The alcohol extract, the first portion yellow and the second colourless, was evaporated to dryness, giving a small amount of yellow, sticky residue which charred if heated further at 80° C. This consists of nitrated by-products, soluble in alcohol and of higher nitrogen content than the main body of the product.

Acetone extraction.—50 grms. of curds from the same nitration as the above were extracted in a Soxhlet apparatus with acetone for 10 hours, filtered, and dried as before. The product was the same as from the alcohol-ether extraction and had lost about 4 per cent. (anhydrous) of its weight. The acetone extract gave on evaporation a small amount of sticky brown residue, which turned black and had a faint odour of caramel. Each of these two samples of extracted substance was examined by ultimate organic analysis.

Analysis of derivatives.—Besides carbon, hydrogen, oxygen, and nitrogen, the derivatives were found to contain small amounts of sulphur. This was determined by the method of Hake and Lewis (6). The nitrogen was determined by the Dumas method. Determinations with the Lunge nitrometer gave incorrect results owing to the extreme slowness of solution, but proved that the nitrogen is present in the form of nitrate-nitrogen. Thus one sample gave 4·20 per cent. of nitrogen by Dumas' method, and 3·48 per cent with the nitrometer. Carbon and hydrogen were determined by the ordinary combustion method, oxygen by difference. All determinations were made on samples dried at 50° C. and desiccated over sulphuric acid *in vacuo* to constant weight.

The two samples, purified as described above, gave results as follows :—

	Alcohol ether extracted.	Acetone extracted.	Mean.
	Per cent.	Per cent.	Per cent.
Carbon	36·60	36·90	36·75
Hydrogen	5·32	5·51	5·41
Oxygen	53·57	53·10	53·34
Nitrogen	3·50	3·51	3.51
Sulphur	0·34	—	0·34
Ash	0·67	0·64	0·65

Sulphur is present in small amount as combined sulphuric acid (see later). Calculating these results on the sulphur-free and ash-free substance to an assumed molecule with 12 carbon atoms, we obtain :—

	Per cent.	Atoms.
Carbon	37·12	12·00
Hydrogen	5.46	21·03
Oxygen	53·87	13.06
Nitrogen	3·55	0·98

The cellulose derivative therefore has the empirical formula $C_{12}H_{21}O_{13}N$, and is a mono-nitrate on the C_{12} formula.

Determinations of nitrogen and sulphur in a derivative obtained with an acid temperature of 10° C. (instead of 5° as above) and the same time of draining, 12 minutes, gave the following numbers :—4·5 per cent. of nitrogen and 0·17 per cent of sulphur, or 1 per cent. more nitrogen and only one half the amount of the combined sulphuric acid.

A determination of nitrogen in the product purified by solution in caustic soda solution, precipitation with acid, and washing, as described above, gave 3·1 per cent. nitrogen. This is a loss of 0·4 per cent. nitrogen, undoubtedly due to slight saponification of the derivative by caustic soda.

Properties and reactions.—The solvent action of a very large number of inorganic and organic compounds, including at least one representative of almost every class of compound, was tried, with the result that these cellulose derivatives were found to dissolve in the following groups of compounds :—

1st, strong acids; sulphuric, hydrochloric, nitric, and formic acids.

2nd, strong bases; potassium and sodium hydroxides, and trimethylamine.

3rd, certain phenols; phenol, resorcinol, pyrogallol, etc.

4th, the cellulose solvents; Schweitzer's reagent, zinc chloride solutions, etc.

Sodium sulphide dissolves the curds to a green solution, which suddenly reverts and becomes solid. The cellulose nitrate dissolves readily in sodium hydroxide to slightly brown solutions of great viscosity. They decompose on long standing or heating to a dark brown liquid, which may be diluted with water without precipitation and is not precipitated by the addition of acid. In other words the cellulose molecule has been resolved to soluble products. From a fresh solution in caustic soda the cellulose nitrate may be precipitated by addition of acids, salts, alcohol, and most readily by formaldehyde. Concentrated hydrochloric acid dissolves the compound to brownish viscous solutions, which are precipitated by dilution with water. Concentrated sulphuric acid dissolves it with decomposition of the cellulose molecule and formation of water-soluble products. Concentrated nitric acid easily forms a yellow solution, from which dilution with water precipitates a cellulose nitrate, soluble in ether-alcohol and acetone. A viscous solution in 87 per cent. nitric acid was poured into 95 per cent. sulphuric acid, the precipitate drained on a platinum cone for 45 minutes, washed with boiling water till neutral, and dried. It contained 13·22 per cent. nitrogen, was soluble in acetone, but only very slightly in ether-alcohol, and was therefore recognised as guncotton. This is the product described in Voigt's patent, referred to above.

The anhydrous cellulose nitrate was insoluble in acetic anhydride, but on adding a few drops of water and warming slightly, vigorous reaction set in. The acetic anhydride boiled so that the flask was cooled under the tap, and when a clear solution was obtained it was poured gradually into water. The precipitate was thoroughly washed, dried, and desiccated. It was very easily soluble in acetone, incompletely soluble in chloroform. It contained 2·32 per cent. of nitrogen, indicating that it was the completely-acetylated derivative of the cellulose nitrate of the empirical formula $C_{22}H_{31}O_{18}N$. Berl and Smith (7) later described cellulose nitro-acetates of similar solubilities, but prepared from nitrocellulose of higher nitrogen content.

Further properties of these derivatives are the following: blue coloration with iodine, reduction of Fehling's solution, and fixation of basic dyes. This increased reactivity of the cellulose molecule as well as the physical state of the derivatives shows that they are hydrates. See discussion of cellulose hydrates by Cross and Bevan (8), Ost and Westhoff (9), and C. G. Schwalbe (10).

Formula of derivatives and mechanism of reaction.—It is as yet impossible to accurately show the structural formula of cellulose nitrates, as the molecular weight of cellulose is unknown. Moreover nitration of cellulose is a progressive phenomenon and we cannot establish definite steps for the reaction, but the general formula is $C_{6n}H_{10n-x}O_{5n-x}(NO_3)_x$, or $C_{12n}H_{20n-x}O_{10-x}(NO_3)_x$ From the analytical data the following formula with a C_{12} unit may be assigned to the derivative analysed

$$C_{12}H_{19}O_9.NO_3H_2O.$$

i.e., it is a hydrated cellulose nitrate of the general formula, $C_{12n}H_{20n-x}O_{10n-x}(NO_3)_x(H_2O)_n$. In these derivatives the value of x is very low, equivalent to or slightly greater than the value of n, and they are the lowest nitrates of cellulose directly prepared which have been described. In character they more closely resemble cellulose hydrates than nitrates, and an explanation of their formation may be obtained by considering the separate action of mineral acids of various concentrations on cellulose and in particular the formation of cellulose hydrates. The following gives a digest of the results of other investigations and our own experiments along these lines.

Concentrated sulphuric acid (90 to 100 per cent. H_2SO_4) dissolves cellulose with formation of cellulose sulphuric acids of the general formula $C_{12n}H_{20n-x}O_{10n-x}(HSO_4)_x$ as investigated by Cross and Bevan and by A. L. Stern. More dilute sulphuric acid (60 to 70 per cent. H_2SO_4) dissolves cellulose, forming cellulose hydrates without combination of sulphuric acid, of the formula

$$C_{12}H_{20}O_{10}H_2O \quad (11)$$

and named amyloid. This reaction is made use of in the preparation of parchment paper, and a patent has been taken out (12) for the production of artificial silk by dissolving cellulose treated with 65 per cent. sulphuric acid in caustic soda solutions. Sulphuric acid of yet lower strength (40 per cent.) disintegrates cellulose with formation of hydrocellulose, $C_{12}H_{22}O_{11}$, in which the cellulose molecule has probably been altered.

Concentrated nitric acid (85 to 100 per cent. HNO_3) nitrates cellulose without much change in its physical appearance, the products being soluble in alcoholic solvents and having the general formula

$$C_{12n}H_{20n-x}O_{10n-x}(NO_3)_x.$$

These reactions were investigated by Vieille (13). 70 to 80 per cent. nitric acid dissolves cellulose, but much more slowly than does sulphuric acid, the products being hydrated and low nitrated cellulose (14) 60 per cent. nitric acid partly dissolves cellulose and the product is slightly hydrated and contains a trace of combined nitric acid. More dilute nitric acid (50 per cent. HNO_3) disintegrates cellulose, forming hydrocellulose, $C_{12}H_{22}O_{11}$. Concentrated hydrochloric acid (40 per cent. HCl) forms hydrocellulose, and this reaction has been investigated by Girard (15), and by Cross and Bevan (16).

From the foregoing it is evident that the important factor in the action of acids on cellulose is the percentage of water which they contain, 20 to 40 per cent. of water forming hydrates and 50 to 60 per cent. causing hydrolytic action and formation of hydrocellulose. When a mixture of sulphuric and nitric acids is allowed to act on cellulose the result is that, in the words of Hake and Bell (17), "each acid endeavours to carry out its characteristic function, the sulphuric acid to dissolve, and the nitric acid to form nitrates." We add to this the statement that the water endeavours to carry out "its characteristic function" of hydration or hydrolysis, depending upon the amount present in the mixed acid. Lunge states (18) that the amount of water in the acid determines the nature of the nitration, applying this to nitrations with concentrated acids. The foregoing explains the principle of this action and it is more clearly shown by a consideration of our nitration with dilute mixed acid, containing 25 to 27 per cent. of water. Considering each of the constituents of this acid mixture separately, the mechanism of the reaction is as follows :—The sulphuric acid dissolves the cellulose, forming sulphuric esters. These are decomposed into hydrates by the water and are also converted into nitrates by the nitric acid. The progress of this reaction is indicated by the increased percentage of nitrogen and the decrease of combined sulphuric acid in the product obtained with an acid temperature of 10° C. over that nitrated at 50° C., analyses of which have been given above. Increase of the rate of reaction causes a decrease of the intermediate product and tends towards a completion of the formation of the final product, the hydrated cellulose nitrate.

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(1) U.S. Patent 879,871 of Feb. 25, 1908 (this J., 1908, 353).
(2) U.S. Patent 855,869 of June 4, 1907 (this J., 1907, 780).
(3) Ber. 1904, **37**, 549 (see this J., 1904, 335).
(4) This J., 1909, **28**, 460.
(5) A. L. Stern : Thesis for D. Sc. of London University, 1894.
(6) This J., 1905, **24**, 376.
(7) Ber., 1907, **40**, 903 (see this J., 1907, 273).
(8) Cellulose, 1895.
(9) Chem. Zeit., 1909, **33**, 197 (this J., 1909, 325).
(10) Z. angew. Chem., 1909, **22**, 197 (this J., 1909, 216).
(11) Compt. rend., **108**, 1258.
(12) French Pat., 323,475 (this J., 1903, 508).
(13) Compt. rend., **95**, 132 (this J., 1882, 516).
(14) J. Chem. Soc., **47**, 183.
(15) Compt. rend., **81**, 1105 and **88**, 1322.
(16) Proc. Chem. Soc., 1904, **20**, 90 (this J., 1904, 557).
(17) This J., 1909, **28**, 458.
(18) J. Am. Ch. Soc., 1901, 527 (this J., 1901, 1021).

A NEW SYSTEM OF TRICHROMATIC PHOTOGRAPHY.

BY FREDERIC EUGENE IVES.

The only processes of colour photography which have or promise to have any practical value are trichromatic. There are three general divisions of these processes, but in each case the photographic process serves only to record and select the colours which appear in the finished result. The first division includes the methods of optical synthesis represented by the photochromoscope and triple lantern projection, in which three separate photographic colour records in the form of transparencies are illuminated by light of the respective primary colours and blended together by optical means to form a single image in colours.

The second division, now called screen plate colour photography, is represented by the Ducos Duhauron, Joly, MacDonough, and Lumière processes, in which the principle is much the same as in the processes of the first division, except that there is all through the process only a single image, which is a linear or granular mosaic of the three separate images, and requires no optical instrument to reproduce the colours to the eye.

The third division starts out like the first, with a three-image photographic negative which by differences in the light and shade of the images constitutes a record of the natural colours in terms of the three primaries. From these negatives, positives are made which, instead of being black and white, like the photochromoscope and triple lantern positives, are each of a colour complementary to the primary light colour represented by the respective negative, and these three transparent colour prints are superposed to make a single composite colour print.

Each of these three kinds of trichromatic processes has characteristic advantages and limitations. The first can be made to most completely fulfil theoretical requirements, and has never been equalled for fidelity of reproduction, but it does not meet the popular requirement for colour photographs complete in themselves. The second was never anything but an interesting experiment until the Lumières substituted coloured starch grains for coloured ruled lines, and boldly compromising in the matter of theoretical requirements which might otherwise have been better met, converted the negative image into a positive in its original position upon the coloured starch grain surface. In one sense, this is direct colour photography, because the original plate is converted into a finished colour photograph, but in another sense, it is no more direct than the others, because the process only makes a black and white image which selects the colours from artificially dyed starch grains.

Its most obvious disadvantages are that it produces only transparencies, and that these transparencies are not transparent enough to permit of successful projection in the lantern to a given size except with a light about eight times as powerful as would be required for ordinary lantern slides projected to the same size ; that the granularity is offensively manifest in stereoscopic transparencies when viewed in a stereoscope, and that it is not a duplicating process. The best photographs by this process have a painter-like quality, which, while it is not exactly nature reproduced, is distinctly pleasing, and the process, in spite of its obvious limitations, has come to stay, with a field of its own. A most interesting peculiarity of this process is that by virtue of a tendency to pink the light shades, particularly of yellows, it will give a healthy complexion to a sallow subject.

In the third division, we have the three-colour halftone process which I originated in 1881, and which is now very extensively used in book and periodical illustration, nd various methods of making coloured transparencies nd prints on paper, all capable of giving excellent results n skilled hands, but too complicated and tedious and ncertain to be really commercial.

I have always believed that if the methods belonging o this division could be made sufficiently simple and eliable in operation, they would occupy much the same elation to the screen plate processes that modern negative nd print making does to the obsolete processes of making mbrotypes and tintypes. Striving in this direction, I devised and patented several cameras for making he three negative images on one plate at one exposure, nd a method of producing transparencies which has been quite successful in the hands of a few, but is still not quite ommercial according to American ideas.

My object here is to briefly describe a new simplification f the negative and transparency making process which ndoubtedly lifts them out of the almost into the quite practical and commercial class, and extends the field f colour photography by meeting several recognised requirements outside the limitations of the screen-plate processes. It started with a remarkable improvement in the transparency-making process which I originated in 1889, and published in a paper printed in the Journal of the Camera Club, London, in April, 1894, as follows :—"The examples which I shall show were made from photochromoscope negatives. . . . Bichromated gelatine films on clear celluloid were exposed from the back by electric light, developed like carbon prints, the images cut apart and each dyed to a suitable depth by immersion in a solution of its proper printing colour," etc. These prints were superposed in register between glasses to make lantern slides. The idea was all right :—One triple negative at one exposure, and one triple print, cut apart and dyed, then superposed in register ; but the film had to be sensitized the night before printing, the development was slow, the dyeing was still slower and never under very perfect control, the gelatine prints did not dry very sharply unless wetted and re-dried two or three times, and the relief was so high that it was necessary to cement them up with Canada balsam for satisfactory use in the lantern. It required about a day's time from start to finish, and the exercise of a good deal of skill and care to get a good result, and although many hundreds, perhaps thousands, of lantern slides have been made by this process with a slight modification of my own, since it was first exploited commercially in England by a former assistant, I never regarded it as truly commercial. The recent improvement seems a trival one on first statement, involving the change of only two words in the original description,—but it has enabled me to reduce the time from hours to minutes, making perfectly clear, microscopically sharp transparencies by a procedure which anybody can work successfully, simply following printed instructions.

The sensitive film used is bichromated fish glue on amyl-acetate collodion film. It develops in cold running water in ten seconds when the film is fresh, makes a relief so low that it is almost invisible when dry, and if first treated with dilute chromic acid dyes in from two to five minutes and then dries after blotting off in two or three minutes. It seems like a miracle to have the operations go through so quickly and perfectly after having had experience with the gelatine process. Of course, in order that the prints may all dye to the right depth in the same number of minutes, suitable dyes have to be used and the strength of the dye baths standardised, and so with everything that is used. This is an important part of the time-consuming work which has to precede the commercial exploitation of such a process, and as everything depends more or less upon everything else, and some compromises have to be made, the perfecting of these details is a progressive process which may extend over a good deal of time before coming to really final conclusions. Already the process is practical, since if for any reason the composite print proves to be out of key, either of its elements can be readily reduced or strengthened.

The dyes are mordanted by chromic oxide and discharged by alkalis, and for this reason, combined with the remarkable tenuity of the glue relief, local treatment can be given with extraordinary facility. Any colour which is in excess may be discharged gradually, without destroying the photographic gradation, by means of a brush containing water to which ammonia has been added in the proportion of one drop to a pint of water, and the reduction can be stopped instantly by applying a blotter. Hues are changed and brightened by discharging one of the colours,—thus, a blue can be given a brighter and more peacock hue by discharging some of the colour in the magenta print, or made a more violet shade by discharging some colour in the peacock print, or made purer and more brilliant without alteration of hue by discharging any colour which may be present on that part of the yellow print. The artistic photographer can instil individuality to his heart's content, and this constitutes one of the most valuable and exclusive features of the process.

My first transparencies by the new process were naturally made from photochromoscope camera triple negatives, of which I have a large stock, and there could be no better way of making small negatives for this purpose but for the fact that these cameras are complicated and costly, liable to get out of order with inexpert handling, and limited to the production of triple negatives. It was obviously worth while to try to devise a simpler and more versatile camera.

"One plate, one exposure" has always been my war cry, but I have now compromised by using three plates which are put up in a pack so that they are handled like a single plate, the pack opening only to expose and develop, in each case automatically. Although a special camera is required, it is remarkably compact and neat in appearance, and is always available, without change, for ordinary photography, time or instantaneous, plates or films.

The plate pack is taken out of the box of plate packs like a single plate, laid in the plate holder, and the back closed. When it is put in the camera and the slide drawn out, the first plate in the pack, blue-sensitive, falls forward in the camera to a position at right angles to the others, and then, by a lever, a 45° yellow glass reflector is brought into position to reflect an image from its first surface downward upon this plate. The green and red rays pass through the reflector to the green and red sensitive plates, which are pressed together face to face, making a reversed green record and an unreversed red record. After exposure, the B plate is turned back in the holder before inserting the slide, and afterwards in the dark room the pack is still handled as a unit, being placed in a developing rack in which it opens like a book, is locked open, and then the rack inserted in a tank for development. The operations are in every way as simple as photography with the spool film, except that time exposures must always be given. With the plates and developer I am now using, the rule for exposures is exactly the same as for autochrome plates. Greater speed may be attained with other plates, or with the same plates with less perfect colour selection, or with other developers ; but so much depends upon quality of negatives that I much prefer to sacrifice something in speed to gain in quality and reliability. One of the three plates in the pack, the emulsions being different, may show more tendency with age to develop chemical fog, and therefore I use a developer that is on the safe side in this respect.

The most obvious objection to this method of negative making is the fact that three different kinds of plates must be found which besides being quite differently and suitably colour-sensitive, can be brought to identical exposure time when used in this manner, and finally yield approximately equal densities and gradations. The extraordinary advantages of the scheme in every other respect justified the effort to meet these requirements, and I have after much experiment made a very good combination out of plates of recognised standard manufacture, but do not doubt that the plate-makers will eventually help me to more exactly meet these special requirements. The high degree of precision which it is admittedly most desirable to attain in the negative making process is nevertheless of less critical importance with a transparency process that so readily lends itself to alterations in the relative depth of individual colour prints, and to local treatment.

In conclusion, some of the advantages which this system of colour photography offers may be briefly summarized. The plate packs cost half as much as autochrome plates, and keep better, so that a tourist who is some months away from home is reasonably sure that his plates will develop all right after his return. It is a duplicating process; any number of colour transparencies can be made from the original triple negative. The transparencies transmit almost as much light as ordinary lantern slides, and are free from granularity so that they can be made for and used in the stereoscope. The same negatives can be utilized by the three-colour half-tone process printer, with a colour transparency from them to guide the etcher and printer. They can also be used for making prints on paper by the carbon or pinatype processes, though it yet remains to provide a simple and reliable process for paper. The new system combines in a remarkable degree the qualities of simplicity and versatility, and stands alone in its capacity for meeting certain well recognised requirements.

MOUNTED CUBIC FOOT BOTTLE FOR CALIBRATING VOLUMETRIC GAS TESTING APPARATUS.

Erratum.

This J., Feb. 28, 1910, p. 197.

This apparatus (stated to have been shown by Mr. E. C. Uhlig) was really shown by Dr. E. G. Love, and described by him.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—
English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.
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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

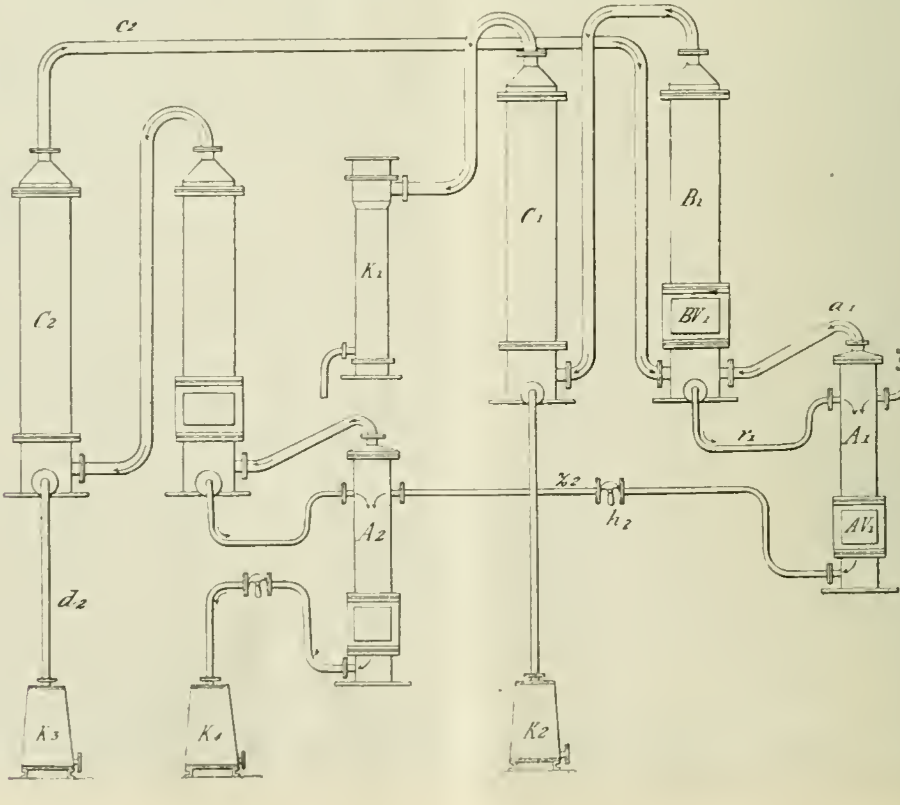
I.—GENERAL PLANT; MACHINERY.

Chimney; Repairing a concrete ——. *See* IX.

Patents.

Rectifying liquids by distillation. F. W. Ilges, Cologne-Bayenthal, Germany. Eng. Pat. 3302, Feb. 10, 1909. Under Int. Conv., Feb. 12, 1908.

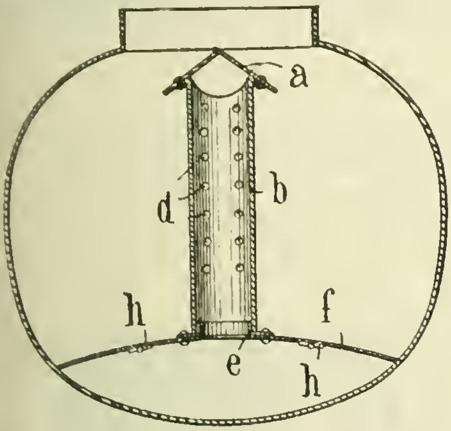
The claim is for a process of continuously separating a mixture of liquids having different boiling points. The final products obtained consist of nearly but not quite pure bodies. As an example, a mixture of four of such liquids would be treated as described below. The mixture is fed through the pipe, z_1, in a stream regulated by the indicating valve, h_1, into the first column-still, A_1, down which it flows and is partially vaporised by the ascending vapours given off in the heating chamber, AV_1, where the liquid is heated by high-pressure steam. The vapours pass by the pipe, a_1, to the first rectifying column, B_1, provided with a heater, BV_1, and thence to the second rectifying column, C_1. From C_1, the vapours pass to the



cooler, K$_1$. The liquid condensed in C$_1$, flows to the cooler, K$_2$, and that from B$_1$, returns by the pipe, e_1, to the still, A$_1$. That portion of the mixture which is not volatilised in A$_1$, flows by the pipe, z_2, provided with the valve, h_2, to the second still, A$_2$, where the process is repeated, any vapour uncondensed in the rectifying column, C$_2$, being returned by the pipe, c_2, to the column, B$_1$. The supply of the mixture, the heating, and the outflow of the non-volatilised portions are so regulated that nearly pure products are obtained. The constituent having the lowest boiling point is discharged from the cooler, K$_1$, that with the next lowest boiling point, from K$_2$, that with the next lowest, from K$_3$, and that with the highest boiling point, from K$_4$.—W. H. C.

Boiling jet for stills. P. Chaussier and N. Goedert. Fr. Pat. 406,718. Sept. 2, 1909.

A PERFORATED false bottom, *f*, provided with hinges, *h*, to facilitate its introduction and removal, is placed within the still, and a perforated cylinder, *b*, provided with a conical cap, *a*, is fixed as shown. The apparatus prevents the solids in the liquid distilled from coming into contact with that part of the still which is exposed to the fire and consequently prevents any unpleasant flavour of the distillate due to overheating of the solids.—W. H. C.



Filtering apparatus. P. C. C. Isherwood, Leytonstone. Eng. Pat. 4358, Feb. 22, 1909.

THE claim is for a process of filtering solutions which crystallise when a reduction of the temperature or pressure at which they are made occurs. The finely divided material, together with the solvent, is put into a vessel provided with an agitator and having a round bottom and an open top and supported on hollow trunnions. A filter-plate covered with suitable filtering material is placed across the open top and then a domed cover provided with a tap is bolted on. The vessel is heated from below and pressure is, if necessary, applied through the hollow trunnions. When solution is complete, the vessel is reversed and the insoluble matter rests on the filter-plate. The liquor passes through the plate and is discharged through the tap which now occupies the lowest position.—W. H. C.

Filter-press. Maschinenfabr. F. Weigel Nachf. Akt.-Ges. and W. Spielvogel, Mittelneuland, Silesia. Eng. Pat. 21,660, Sept. 22, 1909.

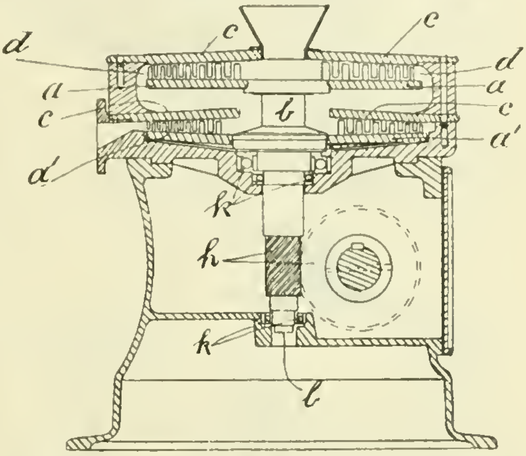
THE claim is for a method of closing the press plates which consists in providing two non-rotating spindles, one placed horizontally on either side of the press. The spindles bear against the ends of a cross-bar which passes through the movable end-plate. They are moved forward and backward by two worm wheels mounted on a transverse shaft which gear with screw threads on the surface of sleeves surrounding the spindles.—W. H. C.

Filtering apparatus for liquids; Composite ——. W. Lehmann, Berlin. Eng. Pat. 27,599, Nov. 26, 1909.

A PERCOLATION sand filter, provided with a stirrer for cleansing the sand when the flow of liquid is reversed, is fixed over a vessel containing a plate-filter. The liquid passes first through the percolation filter and then through the plate-filter. The latter is cleansed by brushes carried on a frame and rotated against the faces of the plates.—W. H. C.

Disintegrator; Centrifugal ——. R. and C. H. Wallwork, Manchester, and R. C. Child, London. Eng. Pat. 6496, Mar. 18, 1909.

IN that type of disintegrator in which rows of projecting pegs carried on a revolving disc revolve between rows of similar pegs on a stationary disc, the spindle carrying the revolving disc is driven by spiral or worm and wheel mechanism. In the fig. the discs, *a*, a_1, fixed upon the spindle, *b*, are rotated by the worm and wheel mechanism, *h*. The pegs, *d*, on the rotating discs *a*, *a′*, pass near the pegs on the stationary discs, *c*, *c*. Ball-bearings are provided at *k*, *k*, to diminish friction.—J. W. H.



Cooling and condensing gases, vapours, and the like. Kirkham, Hulett and Chandler, Ltd., London, and E. W. Blake, South Croydon. Eng. Pat. 6557, March 18, 1909.

THE gas is passed through a chamber or a series of chambers in which a number of hollow plates are arranged vertically. The gas passes between the hollow plates and is cooled by water which flows down the interior of each hollow plate. The cooling water collects in a tank in the lowest chamber and the bodies which are condensed out of the gas are collected in a trough or gutter which is placed transversely below the plates.—W. H. C.

Evaporating drum. P. Neubäcker, Dantzic, Germany. Eng. Pat. 16,821, July 19, 1909.

IN apparatus in which the liquid is evaporated on the surface of an interiorly heated rotating drum, the liquid is slowly fed into the lowest part of a shallow trough, one edge of which nearly touches the lowest part of the drum. From this edge the trough extends some distance horizontally in the direction in which the drum rotates, the distance between the surface of the drum and the trough progressively increasing. A curved plate which presses against the drum is attached to that extremity of the trough which is in contact with the drum and extends backwards in a direction contrary to that in which the drum rotates. This plate prevents any steam or vapour from coming into contact with the dried material. —W. H. C.

Evaporating and cooling liquids and moistening air or other gaseous fluid. W. Tattersall, Manchester. Eng. Pat. 21,418, Sept. 20, 1909.

A current of gas or air is passed in the direction shown by the arrows through the apparatus, which consists of a casing, *a*, having a liquid reservoir below and a rotary drum, *h*, driven by the shaft, *e*, and provided with a number of short pipes, *d*, *d*, arranged as shown. The gas inlet and outlet pipes are placed excentrically to the rotating drum. As the drum rotates, the pipes, *d*, become wetted with the liquid as they dip into the reservoir below and the current of gas or air passes through the wetted tubes as they emerge from the liquid.—W. H. C.

FIG 1

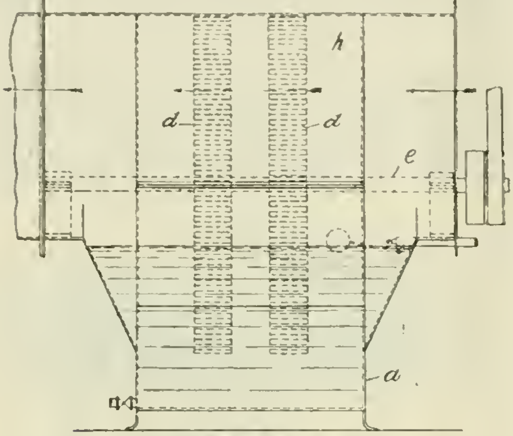
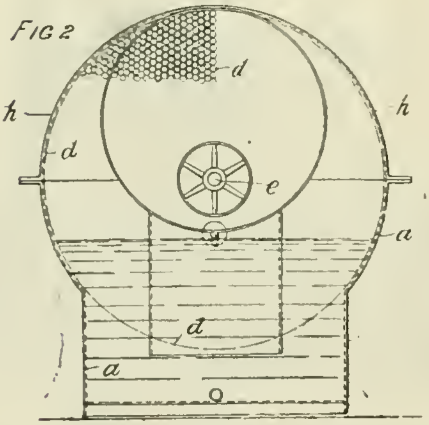


FIG 2



Vaporizing fluids; Apparatus for ——. G. H. Benjamin, New York. U.S. Pat. 953,682, April 5, 1910.

The patent is for an evaporator in which a heating chamber immersed in the liquid to be evaporated comprises a box lined with firebrick and fitted with a burner and with a waste-flue surrounding the gas and air supply pipes. The gas and air are supplied by pumps, the gas being drawn from a producer.—A. T. L.

Concentrating soda lyes and other liquids by evaporation. J. Matter. Fr. Pat. 406,997, Sept. 14, 1909.

The liquid to be evaporated is caused to flow over a series of inclined troughs with corrugated bottoms placed within a chamber and heated from below. The troughs are provided with cross partitions which cause the liquid to take a circuitous path.—W. H. C.

Concentrating solutions without heating. A. Faragó. Fr. Pat. 406,843, Sept. 7, 1909.

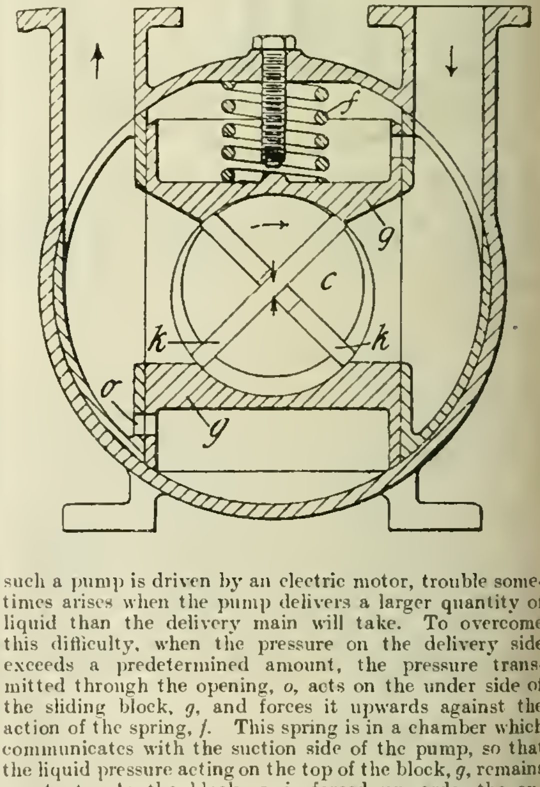
The solution to be concentrated is circulated in one direction through the innermost of a system of concentric pipes and a concentrated solution of calcium chloride or other salt is circulated in the opposite direction through the annular space between the pipes. The inner pipe is formed of porous earthenware in the pores of which a finely divided precipitate of, for preference, copper ferrocyanide has been deposited. The water of the weak solution passes by osmose through the porous wall and the weak solution becomes concentrated. —W. H. C.

Kiln. E. Anderson, Caney, Kans. U.S. Pat. 954,243, April 5, 1910.

A low wall divides the floor of a kiln, which is rectangular in plan, longitudinally into two parts, and an open channel in the floor runs along each side of the wall. A series of transverse flues beneath the floor lead from the channels to vertical flues outside the walls of the kiln, and a diagonal flue runs from the centre of each of the outermost transverse flues to a recess in the adjacent end of the floor, this recess being covered by a grating. These diagonal flues serve to create a draught at the ends of the kiln. —A. T. L.

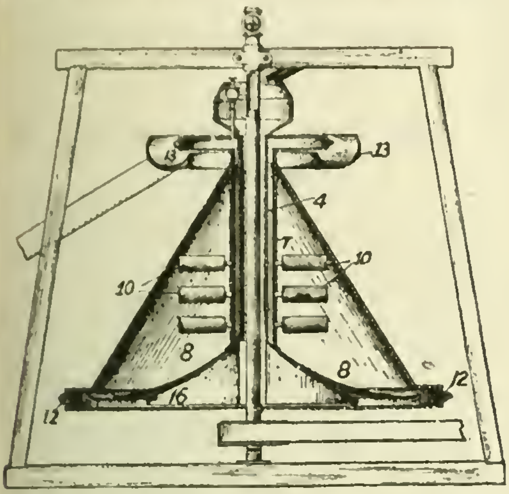
Rotary pumps. Siemens Bros., London. From Siemens-Schuckertwerke, Ges. m. b. H., Berlin. Eng. Pat. 2291, Jan., 29, 1910.

The pump consists of an excentric-drum, *c*, having slides, *k*, rotated in the direction indicated by the arrow. When such a pump is driven by an electric motor, trouble sometimes arises when the pump delivers a larger quantity of liquid than the delivery main will take. To overcome this difficulty, when the pressure on the delivery side exceeds a predetermined amount, the pressure transmitted through the opening, *o*, acts on the under side of the sliding block, *g*, and forces it upwards against the action of the spring, *f*. This spring is in a chamber which communicates with the suction side of the pump, so that the liquid pressure acting on the top of the block, *g*, remains constant. As the block, *g*, is forced upwards, the excentricity of the drum, *c*, decreases and the quantity of liquid pumped also diminishes.—W. H. C.



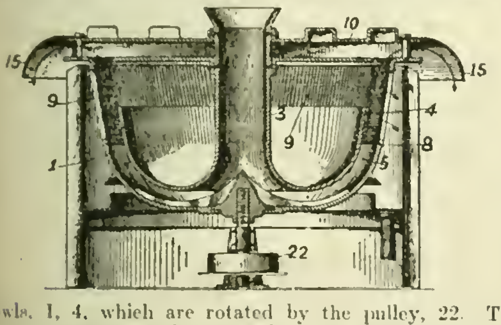
Separating solids from liquids. L. C. Trent, East Auburn, Cal. U.S. Pat. 952,590, March 22, 1910.

The mixture to be separated is fed into the chamber, 16, of the conical centrifugal machine through the pipe, 4. The centrifugal force throws both solids and liquid toward he periphery, from which the former are discharged hrough valves, 12, controlled by springs. The liquid collects in the central chamber, 8¹, whence it passes through the filters, 10, into the annular tube, 2¹, and is discharged through valves into the trough, 13.—W. H. C.



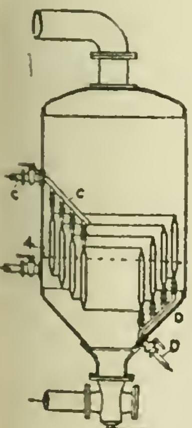
Centrifugal separating apparatus. L. C. Trent. Auburn, Cal. U.S. Pat. 952,653, March 22, 1910.

The mixture to be separated is fed through the central tube, 3, into the space, 5, between the two concentric bowls, 1, 4, which are rotated by the pulley, 22. The mixture passes upwards, and the liquid is discharged through the perforated straining wall, 9, which forms the upper part of the outer cylinder. The solids pass upwards into the upper rotating chamber, 10, which is provided with fan blades to assist in discharging the solids under the lip, 15.—W. H. C.



Vacuum pans; Radiator for ——. A. Gräntzdörffer, Magdeburg, Germany. U.S. Pat. 953,607. Mar. 29, 1910.

The contents of a vacuum pan are heated by means of a series of hollow annular shells arranged within each other as shown in the illustration. Steam is supplied to each shell by a pipe, C, and the water of condensation is carried away by the pipe, D.—J. W. H.



Dryer. F. R. Wiltson, jun., Worthington, Ohio, Assignor to the Jeffrey Manufacturing Co., Ohio. U.S. Pat. 953,653, Mar. 29, 1910.

A number of polygonal tubes are carried by means of end plates upon a longitudinal spindle from which they are equidistant. The set of tubes is mounted to rotate within an inclined flue through which hot gases are made to pass. Means are provided for continuously charging the tubes with the material under treatment, and discharging the dried material.—J. W. H.

Kiln. T. M. Wilson, Philadelphia, Pa. U.S. Pat. 952,777, March 22, 1910.

The claim relates to the arrangement of longitudinal and cross flues formed below the sole of the kiln and divided into groups. Each group is connected to a separate stack. A number of stacks are arranged both at the sides and ends of the kiln.—W. H. C.

Easily inflammable liquids; Arrangement for storing —— without danger of explosion. Maschinenbau-Ges. Martini und Hüneke m. b. H. Fr. Pat. 406,527, Aug. 27, 1909. Under Int. Conv., Nov. 23, 1908.

The liquid is stored in an underground reservoir which is connected to a gas holder containing an inert gas, so that that portion of the reservoir which is not occupied by the liquid is always filled with the inert gas. The pump and pipes by which the liquid is withdrawn from the reservoir are all jacketed and so arranged that in the event of a leak occurring in any part of the system the pump ceases to work.—W. H. C.

Inflammable liquids stored beneath a protecting gas; Process for safeguarding installations for transporting ——. Maschinenbau-Ges. Martini und Hüneke m. b. H. Fr. Pat. 406,529, Aug. 27, 1909. Under Int. Conv., Nov. 27, 1908. (See preceding abstract.)

In order that the supply of inert protecting gas may at all times be sufficient to ensure the protection of the inflammable liquid, the generator of the inert gas and the motor driving the pumps by which the gas and liquid are moved, are coupled together in such a manner, that the motor can only work when the generator is producing gas, so that the necessary supply of gas is always ensured. —W. H. C.

Non-oxidising gas for protecting easily inflammable liquids; Process for producing and collecting ——. Maschinenbau-Ges. Martini und Hüneke m. b. H. First Addition, dated Aug. 27, 1909 to Fr. Pat. 359,018, Oct. 31, 1905. Under Int. Conv., Nov. 27, 1908. (See preceding abstracts.)

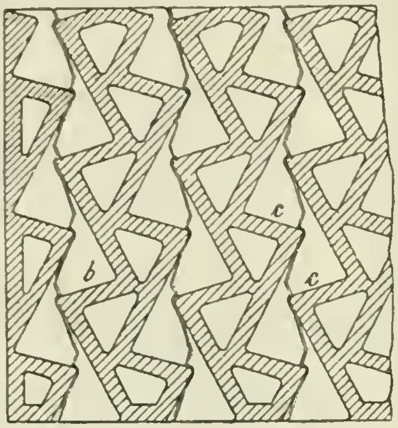
In order to ensure the production of inert protective gas of constant composition, the motor or gas-engine, driving the pumps by which the gas mixture to be burned to produce the inert gas is made, is driven either by the explosion of this mixture, or has its charge ignited by the flame of the combustion of the mixture in a separate chamber. —W. H. C.

Recovering finely divided matter from gases, vapours and smoke. K. Maxaner. Fr. Pat. 406,978, Sept. 13, 1909. Under Int. Conv., Sept. 14, 1908.

The dust-laden gas is drawn axially into a fan provided with paddle-blades at its periphery and is intimately mixed with a spray of water also introduced axially into the fan. The particles of dust are wetted and are discharged from the periphery of the fan along with the gas into a conduit in which are placed a number of adjustable baffle-plates against which they impinge. The wetted particles of dust fall along with the water to the bottom of the conduit and the purified gas passes on.—W. H. C.

Packing material for reaction-towers, heat-exchanging apparatus and the like. A. Wilhelmi. Ger. Pat. 219,759, Aug. 6, 1907.

The form of the packing material is shown in the figure. When it is disposed vertically in the reaction-tower or the like, the projections, c, of triangular section, protrude alternately in opposite directions, and form with the sides



of the adjacent piece of packing material, reaction-spaces, *b*, of triangular section.—A. S.

Emulsifying liquids; Apparatus for ——. W. Fette. Ger. Pat. 219,973, June 16, 1909.

The apparatus comprises a chamber provided with a central shaft around which a number of rotating mixing-screws revolve. The blades of the mixing-screws are perforated and are disposed in right- and left-handed directions on alternate screws. The outer edges of the blades of the screws come in direct contact, on the one hand, with each other, and on the other hand, with the wall of the chamber.—A. S.

Evaporating apparatus. W. Wiegand, Merseburg, Germany. Eng. Pat. 7154, March 25, 1909.

See Fr. Pat. 400,860 of 1909; this J., 1909, 1077.—T. F. B.

Concentrating apparatus. J. Matter, Laacken, Germany. Eng. Pat. 20,822, Sept. 11, 1909.

See Fr. Pat. 406,997 of 1909; preceding.—T. F. B.

Dehydrating apparatus; Conveyor mechanism for ——. D. Porter, Lewiston, N.Y., U.S.A. Eng. Pat. 9072, April 16, 1909.

See Fr. Pat. 402,151 of 1909; this J., 1909, 1185.—T. F. B.

Inflammable liquids; Production of non-oxidising protective gas for use in conjunction with ——. Maschinenbau-Ges. Martini und Huneke, Berlin. Eng. Pat. 19,694, Aug. 27, 1909. Under Int. Conv., Nov. 27, 1908. Addition to Eng. Pat. 10,948 of 1906, dated May 15, 1905.

See Addition of Aug. 27, 1909, to Fr. Pat. 359,018 of 1905; preceding.—T. F. B.

Slime separator; Centrifugal ——. J. T. Lindahl, Stockholm, Assignor to Göteborgs Nya Verkstadsaktiebolag, Gottenborg, Sweden. U.S. Pat. 954,528, April 12, 1910.

See Eng. Pat. 23,866 of 1909; this J., 1910, 477.—T. F. B.

Separating liquids [from slime]; Centrifugal apparatus for ——. J. T. Lindahl, and Göteborgs Nya Werkstadsaktiebolag. Fr. Pat. 408,302, Oct. 26, 1909. Under Int. Conv., Oct. 30, 1908.

See Eng. Pat. 23,866 of 1909; this J., 1910, 477.—T. F. B.

Mixing apparatus; Centrifugal ——. A. Furowicz, Fastov, Russia. U.S. Pat. 954,951, April 12, 1910.

See Eng. Pat. 12,252 of 1908; this J., 1908, 969.—T. F. B.

Distillation process; Continuous ——. A. G. Waterhouse and T. F. Bourne. Fr. Pat. 408,737, Nov. 8 1909.

See U.S. Pat. 939,361 of 1909; this J., 1909, 1322.—T. F. B

IIa.—FUEL; GAS; MINERAL OILS AN WAXES.

Mineral oils; The optically active constituents of ——. J. Marcusson. Mitt. Königl. Materialprüfungsamt, 1910, 28, 143—155.

The author refers to his previous communication on the optical activity of mineral oils (Mitt. Königl. Materialprüfungsamt, 1907, 124), in which he described the preparation of optically active lubricating oil from non-mineral sources. In the present paper he describes the successful preparation of an active "naphtha," containing the lighter and more volatile fractions common to mineral oils, by the distillation of the unsaponifiable matter of wool-fat under pressure. It was found that the optical activity was lowest for the lightest fraction, and increased as the volatility of the fractions decreased, this being in all respects analogous with Engler's observations on the optical properties of mineral oils. When cholesterol was slowly and repeatedly distilled, the distillate showed invariably dextro-rotation as in the case of the majority of mineral oils; when the distillation took place rapidly, the distillate was partly lævo-rotatory. Fractionation of this distillate gave rise successively to lævo-rotatory, inactive, and dextro-rotatory constituents, corresponding in all essentials with the fractions of certain mineral oils from Borneo and Java. Cholesterol compounds have been prepared from bituminous shales and from certain mineral waxes, and the dextro-rotatory fractions of cholesterol distillation yielded a series of colour reactions, analogous with those obtainable from mineral oils. The author concludes that mineral oils are derived from optically active animal and vegetable organic matter, to which their rotatory powers are due, the chief animal sources being the group of cholesterol compounds, and the chief vegetable sources, the terpenes and resins.—O. R.

Galician petroleum industry; Economic bases and markets of the ——. J. Mendel. Petroleum, 1910, 5, 687—691.

The crisis in the Galician petroleum industry, due to the failure to develop the traffic facilities in proportion to the increased output, has now been ameliorated, largely by the action of the State. For the future, whilst it is impossible to predict the producing life of the oilfields already proved, much may be done to prevent premature exhaustion, by ceasing to put down boreholes too close to existing wells. The output of crude oil in 1909 amounted to 2,150,000 metric tons, an increase of 400,000 tons over the previous year, and of about a million tons over 1907. Whereas in 1890, the consumption of petroleum throughout the country was 169,500 tons, and the output of crude oil only 91,650 tons, the production at present is considerably in excess of the consumption (the latter being about 350,000 tons in 1909). The chief centres of production are in East Galicia, and the relative importance of the several fields has changed in the course of time, the output of the Tustanowice field, for example, having increased from 1·41 per cent. of the total Galician in 1903 to 81 per cent. in 1909, whilst that of the Boryslaw district has declined from 64·18 per cent. to 11 per cent., the diminution in the remainder of the producing districts being from 34·41 per cent. to 8 per cent. The various refineries treating Galician oil produced 254,100 tons of oil for home consumption in 1907, as compared with 162,400 tons in 1891. The total petroleum exports in 1909 amounted to 504,353 tons, of which 51,558 tons were crude oil, 290,915 tons refined oils, 100,716 lubricating oils, 32,528 petroleum spirit, and 28,636 tons gas oil. After fluctuating considerably up to 1902, the exports have increased steadily in all grades, with the exception of petroleum spirit which did not show any appreciable increase until 1908. The largest proportion, in all grades, is exported to Germany, which country took 156,870 tons of lamp oil, 53,333 tons of lubricating oil, and 16,170 tons of spirit in 1909 in addition to the 48,066 tons, 14,893 tons and 1,740 tons respectively, consigned to Hamburg. Switzerland took 23,148 tons of lamp oil, 4.362 tons of lubricating oil and 5,968 tons of spirit; France 33,851 tons, 4,362 tons and 7,139 tons respectively; and Turkey 15,782 tons of lamp oil. Italy, Holland and Belgium were also buyers, the last-named taking 7,945 tons of lubricating oil.—C. S.

Baku petroleum fractions: Formation of dibasic fatty acids of the oxalic acid series by oxidising —— with nitric acid. W. F. Herr. Trudy Bak. Imp. Russ. Techn., 1909, [5—6]. Petroleum, 1910, **5**, 692—693.

The best yield of crystalline oxidation products is obtained from the fractions boiling between 80° and 82°, 98° and 102°, and 102° and 106° C., the proportions being 16, 24—28 and 15 per cent. respectively, the yield declining rapidly (to 1·5 per cent.) in the higher fractions, as those containing octonaphthene are approached. The acids of the first-named fractions are chiefly composed of adipic acid, accompanied by glutaric acid or succinic acid, or both. The mixed crystals melt between 142° and 168° C. The higher fractions, boiling at 114°—122°, 133°—137° and 144°—146° C. yielded chiefly succinic acid, with small quantities of malonic acid, this explaining the low yield. All the acids were obtained pure. The fractions boiling at 144°—150° C. differed from the rest in their behaviour on oxidation, the crystalline substances yielded thereby consisting of unknown hydrocarbons.—C. S.

[*Bitumens*] *Carbenes; Studies on the ——.* K. G. Mackenzie. J. Ind. Eng. Chem., 1910, 2, 124—127.

The name "carbene" is applied to the constituents of bitumen soluble in carbon bisulphide but insoluble in carbon tetrachloride. Their amount furnishes an indication of the amount of weathering to which natural asphaltums have been subjected: they are also produced on submitting asphaltum to a high temperature. The precipitate produced on adding carbon tetrachloride to the carbon bisulphide solution of the bitumen is of a colloidal character, and the mixture should be allowed to stand at least four days for the complete coagulation and precipitation of the carbenes. The amount of carbenes is very largely increased by the action of light; indeed carbenes as usually determined consist of two kinds of hydrocarbons: those which are precipitated in a tetrachloride solution in the dark on standing 12 hours—the pure carbenes; and those which are precipitated by the action of light and require more than 12 hours standing. These latter are termed pseudo-carbenes: the total carbenes are the sum of these two. Light causes bitumen in carbon tetrachloride solution to decompose, the tetrachloride giving hydrochloric acid which in turn combines with unsaturated hydrocarbons and precipitates them. Only bitumens which have been more or less superheated can bring about this phenomenon; during superheating, decomposition products are formed which react with tetrachloride. At present asphaltums high in carbenes are rejected for pavement making.—E. F. A.

Mineral oil industry at Baku in 1909. Board of Trade J., April 21, 1910. [T.R.]

The production of petroleum at Batoum was very low at the commencement of 1909, but after February it increased, and in the second half of the year was greater than for several years past. A feature of the oil production was the increased yield of wells situated on old oil territories at Balakhani, Sabunchi, and Romani. The Maikop oilfields are fast coming to the front; a prolific gusher commenced to flow in August last, the petroleum from which went to waste owing to no provision for storage having been made. Boring operations at Baku were carried on with less activity in 1909 than in 1908. The quantity of petroleum products transported by the Caspian Sea to Astrakhan was 1,221,805,410 gallons in 1909, as against 1,140,121,955 gallons in 1908. The shipments of petroleum products from Batoum during 1909 amounted to 173,823,585 gallons, as against 155,706,540 gallons in 1908. The bulk of the decrease in exports of oil during the past few years has been in the exports of kerosene to Far Eastern markets. The total production of crude oil at Baku in 1909 was 2,146,225,952 gallons, an increase of about 100,625,000 gallons on the preceding year. The year was completely free from labour troubles. Consequently, in spite of the decrease in drilling activity in 1908 and the consequent small number of new wells brought in in 1909, there was a marked increase in the production. In 1909 there was a further decrease, only 182 new wells being commenced, as compared with 217 in 1908, which will mean a correspondingly less number of new wells to be brought in in 1910; an increase in production should not, therefore, be looked for this year. The equivalent of gas reckoned in gallons of oil produced on the Surachany gas field in 1909 was 22,548,969 gallons, to which must be added 1,312,619 gallons of white oil and 7,509,455 gallons of dark crude oil. There are now 11 wells producing gas, three wells producing white oil, three wells producing dark crude oil, 26 wells being drilled, and 10 wells being deepened and repaired. Since the beginning of 1910 a large spouter of light crude oil has been struck, which is still producing. At Binigady drilling still continues, and the production this year is reckoned at some 35,000,000 gallons. The oil found in the Island of Tcheleken is of a very high quality, containing from 7 to 10 per cent. of pure paraffin. A large spouter, which produced 5,250,000 gallons of oil, was brought in and corked last year. A new field is being opened near Shemakha, about 40 miles from Baku. Of the principal oil companies, 14 paid in 1908 an average dividend of 12 per cent., 16 worked at a profit which was written off to depreciation and no dividend declared, and seven worked at a loss—three of the last being British undertakings.

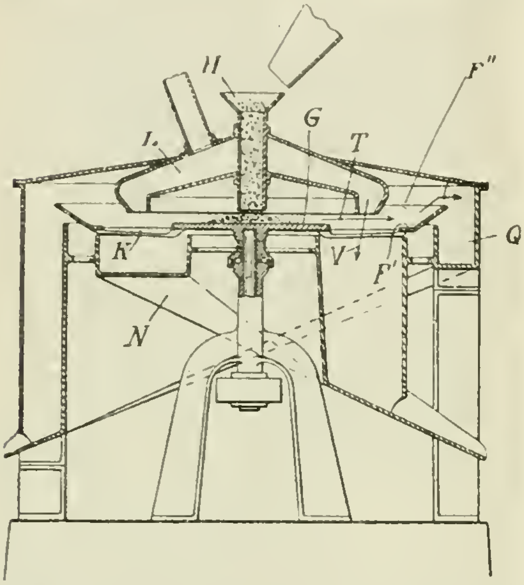
Patents.

Extracting water or liquid from washed coal and the like; Apparatus for ——, more particularly applicable for treating washed fine coal for coking. C. Burnett, Durham. Eng. Pat. 13,097, June 3, 1909. Addition to Eng. Pat. 10,062, April 30, 1907 (this J., 1908, 152).

The perforated drainage chamber into which the washed coal is forced as described in the principal patent, is made narrow compared with its depth, the end adjacent to the ram being tapered so as to connect the ram cylinder with the narrow chamber. The mass is thus more uniformly drained by being brought nearer to the drainage apertures. A number of cylinders may be arranged side by side, the rams being worked from cranks set at equal angles, so as to render the load more uniform. The drainage may be effected in stages, the material being delivered from one perforated chamber into the hopper of a second cylinder. If desired the perforated chambers may be of greater length, or they may be replaced by nozzles or tapered chambers with perforated walls.—A. T. L.

Separators for dry coal and other substances: Centrifugal ——. S. E. Page, London. From The Coal and Coke By-Products Co., Pittsburg, Pa., U.S.A. Eng. Pat. 23,313, Oct. 12, 1909.

The materials to be separated are fed into the central hopper, H, from which they descend to the rotating plate, G, and are thrown radially outwards by the centrifugal force. The rotating plate consists of an inner plate, G, and an outer plate, F′, connected by radial ribs leaving an open space, K, between them. The outer plate, F′, has an edge F″, inclined upwards. The particles of coal and shale or dirt, which are previously screened, are projected across the open space, K, in the direction indicated



by the arrow, T. A blast of air from the casing, L, is blown downwards in the direction of the arrow, V. The lighter particles of coal are blown out of the horizontal path and are discharged into the coal shoot, N, and the heavier particles of shale and dirt pass across the space, K, on to the outer plate, F', over the upper edge of which they fall into the "spoil-shoot," Q.—W. H. C.

Coke ovens. W. Zirfas, London. Eng. Pat. 6279, Mar. 16, 1909.

In a regenerative oven of the type in which gas and air are supplied to each of the vertical flues in the heating wall between two retort-chambers, the waste gases escaping at one end into a down-take leading to a sole-flue, the sole-flue is constructed with a number of openings along its length, so that the waste gases pass downwards from these openings through vertical flues adjacent to flues conveying the air-supply direct to the heating wall. —A. T. L.

Coking coal; Process of ——. S. B. Sheldon, Buffalo, N.Y. U.S. Pat. 953,351, Mar. 29, 1910.

The coal to be coked is heated to a temperature below that of coking and then transferred to a metal "precoking" passage, where it is subjected to pressure and coked superficially while being advanced into the coking retort, where the operation of coking is completed. The gases given off are withdrawn through the walls of the "pre-coking" passage.—J. W. H.

Retorts; Working of vertical coal-gas ——. A. Wilson, Glasgow. Eng. Pat. 6419, Mar. 18, 1909.

Means for withdrawing a measured quantity of coke at intervals from the bottom of the retort comprise a horizontal sliding door or doors separating the retort from a measuring chamber beneath it. This chamber is closed at its lower and smaller end by a hinged water-sealed cap, the cap and the door or doors being operated by power cylinders. Alternatively, the sliding doors may be dispensed with, the coke being delivered, by means of the hinged cap, into a trolley placed beneath it which serves to measure the quantity withdrawn.—A. T. L.

Gas producers; Process and apparatus for the production of gas and recoverable ammonia from bituminous fue in ——. Masons Gas Power Co., Ltd., Manchester, Q. Moore, Glasgow, J. Cunningham, Banbury, and J. W. B. Stokes, Tollcross, Lanark. Eng. Pats. 28,053 and 28,054, Dec. 24, 1908.

(1). The producer is of the type having three zones of different temperatures, *viz.*, a combustion zone lined with firebrick, an intermediate zone above it, and a cool zone at the uppermost part of the producer, the supply of raw fuel and the removal of ash taking place continuously. The arrangement is such that the uppermost zone acts as a condenser for the more volatile hydrocarbons, whilst the intermediate zone is kept at 400°—475° C., being about half the temperature of the combustion zone, so that the heavier tars are condensed on the coal therein and are carried down with it and converted into fixed gas in the combustion zone. The producer is elliptical or rectangular in plan, and increases in cross-section from top to bottom. The intermediate zone, which is water-jacketed, is about 8 ft. high, or twice the height of the combustion zone. The uppermost zone which may be air-cooled or water-cooled is of less height than the combustion zone. The total height of the producer is great compared with its cross-section. The producer is blown with air and a large quantity of steam, the steam being obtained from the water-jacket and also by a jet of water playing on the ashes. (2). In a producer similar to that described above, the temperatures of the three zones are kept at 800°—1000° C., 300°—450° C., and 80°—150° C. respectively. By this means the excess of steam necessary to prevent destruction of ammonia in the producer is reduced, over 60 per cent. of the steam used being decomposed. The gases leaving the producer are cooled in surface condensers and the ammonia extracted without the use of acid, by washing with water.—A. T. L.

Gas producer. W. Thomas, Vancouver, B.C. Eng. Pat. 15,661, July 5, 1909.

The patent relates to producers of the kind described in Eng. Pat. 11,533 of 1908 (this J., 1908, 1142), in which the lower part of the producer chamber is divided by a vertical partition into two or more chambers provided at the lower end with separate air inlets and gas outlets, so that the gases pass up through one chamber and down through the adjacent chamber to an outlet, the currents being reversed at intervals. To adapt the producer for fuels having a high percentage of moisture, such as saw-mill refuse, air inlets are provided in the upper part of the producer, at about the level of the top of the vertical partition, so that a sufficiently high temperature is maintained in the upper part of the producer to expel the moisture and volatile constituents from the raw fuel.—A. T. L.

Producer-gas apparatus. H. P. Hill, New York. U.S. Pat. 952,739, Mar. 22, 1910.

A producer for use with bituminous fuel comprises a body-portion mounted above a water-trough, and a central rotatable support for the fuel-column. The upper part of the producer-chamber is divided by an inclined partition into a distillation-chamber for the raw fuel from the feeding hopper, and a gas-outlet chamber. Tarry products, soot, etc., from the upper part of the distillation chamber are carried with the charge through the fuel bed, by means of a pipe delivering part of the blast into the distillation chamber. The rotation of the support on which the fuel-bed rests, brings the incandescent fuel from beneath the distillation-chamber to the region beneath the gas-outlet chamber.—A. T. L.

Gas; Method of making fixed ——, *from liquid hydrocarbon fuels.* H. A. Grine, Assignor to F. C. Nelles, Los Angeles, Cal. U.S. Pat. 952,989, Mar. 22, 1910.

A bed of incandescent fuel is maintained in a producer by effecting the partial combustion of liquid fuel continuously in the upper part of the producer, so as to deposit carbon on the fuel bed. The process of gas-making is intermittent. At one period sufficient air is supplied to maintain the heat of the fuel-bed, producer gas being formed by the downward passage of the gaseous products from the liquid fuel, and in the next period the supply of air is reduced and steam is admitted with the hydrocarbon fuel, whereby an excess of carbon is deposited and an illuminating gas is obtained.—A. T. L.

Gas producer. J. C. and J. A. Swindell, Pittsburg, Pa. U.S. Pat. 953,497, Mar. 29, 1910.

The upper cover of a gas producer rotates and carries a fuel-supply pipe and hollow, water-cooled pokers which project into the fuel at different angles. The fuel-supply pipe is made gas-tight by means of a water-seal, the water from which circulates through the pokers and then passes into a basin formed by the upper cover.—J. W. H.

Gas producer. C. A. Harvey, Chicago, Assignor to Producer Gas Utilities Co., Illinois. U.S. Pat. 953,614, Mar. 29, 1910.

The gas is withdrawn from the producer through an annular casing mounted in the brickwork. The inner wall of this casing is conical, and extends below its lower annular wall which is provided with a number of ports through which the gas is drawn into the annular passage of the casing. This annular passage is directly connected to the eduction pipe of the producer.—J. W. H.

Gas generator. G. A. Heckert, Munich, Germany. U.S. Pat. 954,099, April 5, 1910.

The producer is fitted with a grate comprising separate bars some of which are higher than others. The bars are mounted on guides and can be withdrawn laterally from the generator.—A. T. L.

Suction gas-producer. J. B. Catteau. First Addition, dated Oct. 1, 1909, to Fr. Pat. 375,656, March 13, 1907 (this J., 1907, 919).

The vaporiser consists of a short vertical tube of large diameter arranged in the gas outlet pipe. This tube is contracted at its lower end, to which is connected the conduit leading the air and steam to the lower part of the the producer. The cover of the vaporiser consists of an annular plate, with a box-shaped cap over the central orifice held down by a bridge-piece or clamp. The water-supply is delivered into an annular trough on the cover of the vaporiser, the walls of this trough being formed by an outer vertical ridge or flange on the annular plate and by the perforated side of the central cap. The water passes through the perforations, and is delivered in drops on to a spreading cone which is suspended within the vaporiser and leads the drops of water on to its walls.—A. T. L.

Gas-producers. G. Gautier. Fr. Pat. 407,200, Sept. 20, 1909.

The apparatus is for the simultaneous production of producer-gas suitable for engines, a gas rich in hydrogen suitable for lighting, and high-pressure steam. The producer proper comprises an unlined metal shell arranged centrally within an outer cylindrical casing having the usual boiler fittings, the body of the producer being surrounded by water. The producer consists of three superposed parts. The lowest part is of large diameter to provide space for a ring of vertical or inclined water-tubes around the fuel column. These tubes are open at both ends to the water-space of the boiler and permit of the rapid generation of steam from the heat of the lower part of the fuel column, which is blown with air only. Steam from the boiler is passed through a reducing valve and admitted to the producer chamber at a point near the top of the water-tubes, so as to pass up through the fuel in the middle part of the producer. This part comprises a chamber with porous walls through which the hydrogen formed from the steam passes readily by diffusion into an annular chamber provided with a gas-outlet. The remainder of the gases passes through the upper part of the fuel column to a second gas-outlet near the charging hopper. —A. T. L.

Gas-producers. A. H. du Thil. Fr. Pat. 407,516, Oct. 2, 1909.

The producer, which is suitable for traction purposes, is of the down-draught type. The air is heated before entering the fire, by passing upwards through an annular chamber around the body of the producer. The hot air enters the top of the producer chamber at a point beneath the charging hopper and adjacent to a fuel-spreading cone which directs the fuel towards the walls of the producer chamber. Water is admitted in drops from a pipe which passes into the upper part of the producer chamber, so that the water falls on the fuel near the periphery of the fuel column. The air and steam pass downwards through the fuel-column and the gas leaves the fuel-column at a point about midway of the height of the producer, and passes up to the gas-outlet through an annular chamber surrounding the producer-chamber. The lower part of the producer is provided with a conical grate which is oscillated and rotated by means of two pinions mounted excentrically on a horizontal shaft beneath the grate. Steam or water is admitted to the lower part of the producer, and passing up through the lower part of the fuel-column, forms water-gas. Suitable means are provided for regulating the supplies of water and fuel to the producer.—A. T. L.

Gas-producers. A. H. du Thil. Fr. Pat. 407,662, Oct. 2, 1909.

The patent is for the use of various testing appliances in order that a gas-producer may always be worked under the best conditions. The installation is provided with a pyrometer in the gas-outlet of the producer, or in the producer-fire; a gas-pressure gauge for showing the vacuum at the gas-outlet of the producer; a "thermo-dynamometer," consisting of a burner which consumes a constant quantity of gas at a constant pressure, the temperature of the flame as indicated by a pyrometer forming a measure of the calorific power of the gas; a barometer; thermometers in the scrubbing water, and in the gas outlet from the purifier; a thermometer registering the atmospheric temperature; and, finally, for a producer worked with air under pressure, a gauge for showing the pressure of the blast.—A. T. L.

Montan wax; Process for refining crude ——. F. Nathanson, i. F. Berliner Ceresin-Fabrik Graab und Kranich. Ger. Pat. 220,050, Nov. 20, 1906.

The purification of crude montan wax by treatment with alcoholic alkali has hitherto only been possible after a preliminary treatment with sulphuric acid. According to the present patent, the crude wax is dissolved in a suitable solvent, such as petroleum benzine or melted paraffin wax, and then treated with alcoholic alkali. After separation of the saponified matter, the wax is treated with concentrated sulphuric acid at a temperature not exceeding 100° C. It is stated that the treatment with alcoholic alkali produces a chemical change in the wax. Whilst in the case of the crude wax it is necessary to use 20 per cent. of sulphuric acid and to heat to 200° C., in order to obtain effective action: only a small quantity, at the most 5 per cent., of acid is required for the treated wax, and the heating must be restricted to a short period at a temperature not exceeding 100° C.—A. S.

Gas; Manufacture of —— by continuous dry distillation. A. Zindler, New York. Eng. Pat. 13,796, June 11, 1909.

See Fr. Pat. 404,554 of 1909; this J., 1910, 206.—T. F. B.

Gas analysis apparatus. U. S. Pat. 953,482. *See* XXIII.

Deodorising petroleum and transforming it into an oil having the properties of turpentine. Fr. Pat. 406,862. See XIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

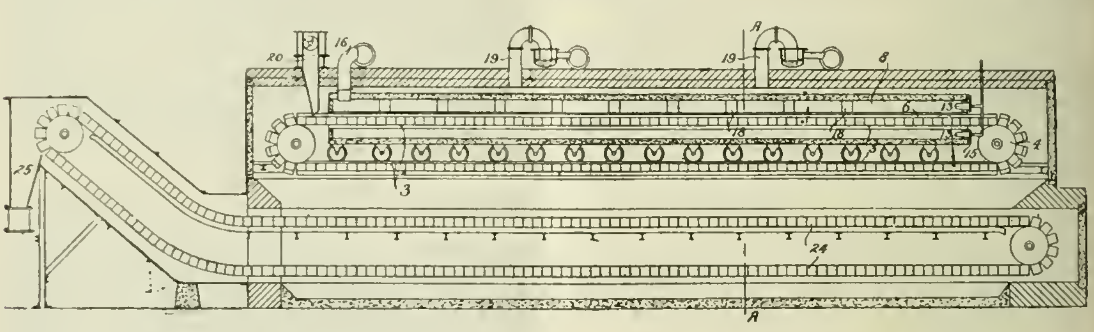
Detecting methyl alcohol in presence of ethyl alcohol. Denigès. *See* XVIII.

Vapour pressures and boiling points of mixtures of saturated alcohols and water. Doroszewski and Polianski. *See* XVIII.

Patents.

Coal; Apparatus for the distillation of —— and the recovery of the products. R. S. Richards, Wraysbury, Bucks, and R. W. Pringle, Richmond, Surrey. Eng. Pats. 15,643, and 22,290, July 5 and Sept. 30, 1909.

The coal is fed from a hopper, 20, into trays carried by an endless conveyor, 3, and the trays pass through a distilling chamber, 6, constructed of boiler-plate, and arranged within a heating flue, 8. This flue is provided with burners, 13, at one end and an outlet, 16, for the heating gases at the other end, so that the coal is heated gradually during its passage through the chamber, 6. The gases from the coal are led to the hydraulic main through passages, 18, arranged at intervals along the length of the chamber, 6, and through pipes, 19. The coke is discharged at the right-hand end of the conveyor on to a second conveyor, 24, and is allowed to cool before it is discharged from the apparatus at 25. The heating flue, 8, is formed as a separate structure carried on wheels, and can be removed entire.—A. T. L.



Acetic acid [wood distillation]; Apparatus for the production of ——. M. J. and B. R. Lyster, Whitefield, N.H. U.S. Pat. 952,540, Mar. 22, 1910.

In a wood-distilling apparatus a chamber is interposed between the retort and the condenser. This chamber is provided with means for condensing vapours at definite temperatures, and is depressed at its further end into a well, which communicates with two worm condensers. Spaced, open-ended flues are disposed at the further end of the chamber, above the well, and communicate at both ends with the outer atmosphere.—O. R.

Distillation; Process of ——. H. O. V. Bergström, Stockholm, Sweden. U.S. Pat. 953,019, Mar. 29, 1910.

The gaseous products from the distillation of wood, peat, etc., are passed through the heating element of a vacuum boiler containing liquid products of the distillation. The condensed liquids from the heating element of the vacuum boiler are taken to vessels in which the constituents separate by gravity, the various fractions being further treated in the vacuum boiler. The gases and vapours from the boiler itself may be led through the heating element of a second vacuum boiler or they may be passed through milk of lime and afterwards through a condenser.—A. T. L.

Electric incandescence lamps; Manufacture of metallic filaments for ——. Cie. Française pour la Fabrication des Lampes Électriqués à Incandescence. Fr. Pat. 406,981, Dec. 18, 1908.

The filaments are formed from esters obtained by the action of a polyhydric alcohol such as glycerol on a salt of tungstic acid or on a mixture of such salts, the filaments being freed from organic matter and reduced by heating in hydrogen in the ordinary manner.—A. T. L.

Electrodes for electric arc lighting; Process for making ——. Gebr. Siemens und Co. Fr. Pat. 408,075, Oct. 19, 1909. Under Int. Conv., Nov. 19, 1908.

See Eng. Pat. 33,171 of 1909; this J., 1910, 79.—T. F. B.

Candle-foot photometer. U.S. Pat. 953,765. *See* XXIII.

III.—TAR AND TAR PRODUCTS.

Patents.

Tar; Process for the continuous distillation of ——. J. Artmann. Fr. Pat. 407,906, Oct. 15, 1909.

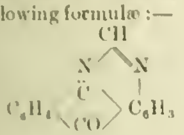
Dehydrated tar is passed through a series of tubes heated by the furnace gases from the stills; it then passes, at a temperature of about 350° C., to a still, where the lighter oils and the naphthalene oils separate; it is then run into a second still, where it is freed from the heavy oils, and lastly to a third still, where the remainder of the volatile substances is separated. The distillates are run through condensers and collected separately. —T. F. B.

m-Aminobenzaldehyde and o-aminobenzaldehyde; Process for the simultaneous production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 408,184, Oct. 22, 1909. Under Int. Conv., Nov. 12, 1908.

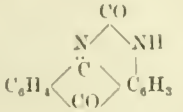
The mixture of *o*- and *m*-aminobenzaldehydes (obtained by reducing the mixed nitrobenzaldehydes formed by nitration of benzaldehyde, and containing about 25 per cent. of the *o*-amino-compound) can be separated by treatment with sufficient acid to convert the *o*-compound into its anhydride, $NH_2.C_6H_4.CH:N.C_6H_4NH_2$, which separates on cooling, whilst the *m*-compound remains in solution, and is isolated in the usual manner. For example, 2190 grms. of the mixed nitro-compounds are reduced by boiling with 10 kilos. of sodium hydrosulphite and 100 kilos. of water. After cooling to 50° C., sufficient hydrochloric acid to neutralise all the bases is added, and the mixture is heated to remove the sulphur dioxide, and finally cooled.—T. F. B.

Anthrapyrimidines and anthrapyrimidones; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 220,314, March 24, 1908.

By the action of amides of organic acids on *a*-aminoanthraquinones and their derivatives, anthrapyrimidines are produced; if instead of using organic amides, the amides of carbonic acid (excluding urethanes) are used, anthrapyrimidones are obtained. The simplest products have the following formulæ:—



Anthrapyrimidine.

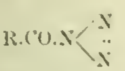


Anthrapyrimidone.

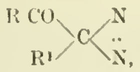
By the action of two mols. of organic amides on *a*-diaminoanthraquinones, anthradipyrimidines are formed.
—T. F. B.

Ketenes and isocyanates and their transformation products; Process for preparing ——. G. Schroetter. Ger. Pat. 220,852, Sept. 16, 1908.

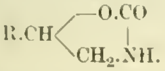
ACYLAZIDES, acidyldiazomethanes, and other compounds containing either of the groupings,



or



when warmed with indifferent solvents, lose one molecule of nitrogen, and the intermediate compounds undergo molecular rearrangement, with formation of isocyanates or ketenes, RN : CO or RR′C : CO. Thus benzazide is converted into phenylisocyanate and azibenzil into diphenylketene when their solutions in benzene are heated. If the azide also contains an alcoholic hydroxyl group, the ketene first formed undergoes further rearrangement, forming a closed ring compound, which is a cyclic urethane of hydroxyethylamine,



—T.F.B.

Anthracene derivatives; Manufacture of ——. P. A. Newton, London, From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,932, May 20, 1909. Addition to Eng. Pat. 2702, Feb. 4, 1909.

SEE Addition of May 21, 1909, to Fr. Pat. 400,653 of 1909; this J., 1910, 81.—T. F. B.

1.8-*Diaminonaphthalene-4-sulphonic acid; Process of making* ——. J. Mögenburg, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 953,049. March 29, 1910.

SEE Eng. Pat. 6831 of 1909; this J., 1909, 1082.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Brominated indigotins. E. Grandmougin. Ber., 1910, **43**. 937—941. (Compare this J., 1910, 14.)

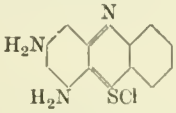
4 : 5 : 7 : 5′ : 7′-PENTABROMOINDIGO, prepared by brominating Indigo in presence of concentrated sulphuric acid, dyes cotton in greenish blue shades. Spectroscopic observations give: λ = 615·0 (in xylene) and 621·3 (in chloroform). On oxidation it gives a mixture of di- and tri-bromoisatin and these when distilled with potassium hydroxide yield 2 : 4-dibromoaniline and 2 : 4 : 5-tribromoaniline respectively, thus proving the above constitution. 4 : 5 : 7 : 4′ : 5′ : 7′-Hexabromoindigo, prepared by brominating Indigo in presence of chlorosulphonic acid, dyes cotton in very greenish bright blue shades. Spectroscopic observations give λ = 616·2 (in xylene) and 623·6 (in chloroform). On oxidation it yields 4 : 5 : 7-tribromoisatin which, on distillation with potassium hydroxide, furnishes 2 : 4 : 5-tribromoaniline, thus proving its constitution as given above.—J. C. C.

p-Toluenesulphinic acid. A. Heiduschka. J. prakt. Chem., 1910, **81**, 320—327.

PHENOLS or naphthols when heated with benzene and *p*-toluenesulphinic acid to 150°—180° C., yield dyestuffs, which are distinguished from those given by the amines, by being easily reduced and by their solubility in alkalis. *o*- and *p*-Dihydroxybenzene are exceptions; they either yield no dyestuff or one with different properties. A very beautiful carmine red dyestuff is obtained with resorcinol at 225° C.—A. SBLD.

Thiazines. R. Mitsugi, H. Beyschlag, and R. Möhlau. Ber., 1910, **43**, 927—934.

THE diaminophenazothionium chloride which was prepared by Kehrmann (Ber., 1900, **32**, 2601) by condensing picryl chloride with o-aminothiophenol hydrochloride in presence of sodium acetate, reducing the resulting dinitrophenthiazine, and oxidising the product has, from its analogy to the homologue which has now been prepared by the present authors, probably the constitution (I).

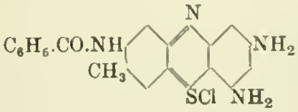


I.

Trinitrophenyldibenzoyldiaminotolyl sulphide (III) is

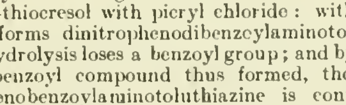
$$CH_3.C_6H_2(NH.CO.C_6H_5)_2.S.C_6H_2(NO_2)_3$$

III.



IV.

prepared by condensing the sodium salt of dibenzoyl-*m*-diamino-*m*-thiocresol with picryl chloride: with alcoholic soda this forms dinitrophenodibenzoylaminotoluthiazine, which on hydrolysis loses a benzoyl group; and by reducing the monobenzoyl compound thus formed, the resulting diaminophenobenzoylaminotoluthiazine is converted, by oxidation, into diaminophenobenzoylaminotoluazothionium chloride (IV). The iron double salt is obtained as black violet prisms and the free base dissolves in ether with a brown red colour. Its diacetyl derivative is transformed by aniline into 2 : 4-diacetyldiamino-3-anilinophen-7-benzoylamino-6-toluazothionium chloride which on boiling with hydrochloric acid yields the corresponding 2 : 4-diamino-compound (V). This dyestuff is a blue black crystalline powder which dissolves in alcohol with a blue violet colour.



(V)

—J. C. C.

Dyestuffs; Phenomena of electrical cataphoresis in solutions of certain ——. L. Vignon. Comptes rend., 1910, **150**, 923—925.

EXPERIMENTS are described showing that on passing currents of less than one milliampère between electrodes of platinum wire immersed in aqueous solutions of dyestuffs, in all cases where the dyestuffs were such as form colloidal solutions (see this J., 1910, 412), the particles of the dyestuff wandered towards the anode, leaving a liquid of much weaker colour, or sometimes colourless, surrounding the cathode. In the case of true solutions of dyestuffs, no such phenomena were observed, although in some cases changes of colour due to ionic reactions (electrolysis) were produced. Of the dyestuffs examined, Congo Red, Diamine Black BH, Diamine Blue 3R, Saint-Denis Red, Diamine Green, Diphenylamine Blue, Alkali Blue 3B and 6R formed colloidal solutions.—A. S.

Chemical actions of light. V. Photochemical phenomena in solutions of dyestuffs. II. F. Weigert. Ber., 1910, **43**, 951—955. (Compare this J., 1910, 267.)

In continuation of previous work the author finds that when a neutral or an alkaline solution of Uranine is subjected to the action of light as previously described, carbon dioxide is produced (as shown by the analysis of the gas obtained by subsequently boiling the solution). The absorption of gas (which was previously mentioned) is increased by the presence of alkali.—J. C. C.

Patents.

Dyestuffs of the Gallocyanine series; Manufacture of violet blue ——. G. B. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle, Switzerland. Eng. Pat. 11,736, May 18, 1909.

In the same way as described in Eng. Pats. 6270 and 6272 of 1909 (this J., 1909, 879, 832). Gallocyanine is condensed with the sodium salt of 2-naphthol-6-sulphonic acid (Schaeffer salt) or 2-naphthol-3 : 6-disulphonic acid (R salt). The dyestuffs give violet blue shades on chrome-mordanted cotton or wool.—J. C. C.

Tri- and tetrabromindigo; Manufacture of ——. G. B. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle, Switzerland. Eng. Pat. 2404, Jan. 31, 1910.

If in the working of the process described in Eng. Pat. 5122 of 1907 (this J., 1907, 71) a special diluent, namely diethyloxalic ester, is employed, it is possible to obtain directly and with an excellent yield, highly brominated indigo derivatives which without further treatment are ready for use in preparing vats. Example—2·3 parts of bromine are added, whilst stirring, to 1 part of indigo suspended in 10 parts of diethyloxalic ester. The bromination at once begins and the temperature rises to about 45° C. After an hour's stirring the mass is gradually heated under a reflux condenser to 110°—115° C. and this temperature is maintained for three hours, the mixture being constantly agitated. By this time the tribromo-indigo will have separated out in nearly quantitative yield as a finely divided thick paste. After cooling, the product is filtered off, washed with alcohol, and dried. It forms a blue, amorphous powder which when suspended in dilute sodium hydroxide solution with its own weight of "sodium hydrosulphite conc." at 65°—70° C., rapidly yields a clear pure yellow vat. The tetrabromo-indigo is formed in a similar manner by using a larger quantity of bromine.
—P. F. C.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,205, May 24, 1909.

New azo dyestuffs for wool are obtained by combining the diazo-compounds of aminoarylsulphonamides or their derivatives with pyrazolones or their substitution products, analogues, and homologues. The new dyestuffs dye wool in shades which are very fast to fulling and washing. Example. The diazo-compound from 27·8 parts of o-anisidine-p-sulphonanilide ($OCH_3 : NH : SO_2NH.C_6H_5 = 1 : 2 : 4$) is added to an aqueous solution, containing an excess of sodium carbonate, of 25·5 parts of 1-p-sulphophenyl-3-methyl-5-pyrazolone. After the combination is complete, common salt is added and the mixture is heated to about 60° C. The dyestuff is then filtered off and dried. It dyes wool from acid baths in yellow shades. The sulphonic acids of these dyestuffs can be obtained by first combining the diazo-compound with pyrazolones containing no sulphonic groups and subsequently sulphonating the dyestuff obtained.—P. F. C.

Azo dyestuffs; Brown ——. M. Herzberg and F. Runkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 953,033, 953,034, and 953,035, March 29, 1910.

Claim is made for the three dyestuffs obtained (1) by combining diazotised o-amino-*p*-chlorophenylethersulphonic acid with 2-phenylamino-8-naphthol-6-sulphonic acid, (2) by combining diazotised *p*-amino-*p′*-chlorophenylether with 2-benzylamino-8-naphthol-6-sulphonic acid, and (3) by combining diazotised o-aminophenylethersulphonic acid with 2-phenylamino-8-naphthol-6-sulphonic acid. The dyestuffs give brown shades on wool.
—J. C. C.

Mono-azo-dyestuffs especially adapted for use in the form of their lakes; Manufacture of ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim Elektron, Frankfort on Maine, Germany. Eng. Pat. 14,316, June 18, 1909.

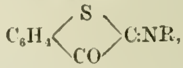
By combining a diazo-compound of mono-, di- or trichloroaniline or their sulphonic acids with 2 : 5 - or 2 : 6-*β*-naphthylaminesulphonic acid or 2 : 3 : 6-or 2 : 5 : 7-*β*-naphthylaminedisulphonic acid, new dyestuffs are formed which yield bright orange lakes of great colouring power when they are subjected to the usual process for making pigment colours. Example—16·2 parts of 2 : 5-dichloro-1-aniline are ground with 20 parts of water and 46 parts of hydrochloric acid of 20° B. and are then diazotised with 28 parts of a solution containing 25 per cent. of sodium nitrite. The filtered diazo-solution is run into a neutral solution of 36 parts of the sodium salt of 2-naphthylamine-3 : 6-disulphonic acid. When the reaction is complete, 17 parts of anhydrous sodium carbonate are added, the liquid is heated to boiling and the dyestuff is then salted out.—P. F. C.

New compounds and of colouring matters [dyestuffs] therefrom; Manufacture of ——. G. W. Johnson, London. From Kalle und Co., Akt.-Ges., Biebrich-on-the-Rhine, Germany. Eng. Pat. 21,580, Sept. 21, 1909.

When 3-oxy-1-thionaphthene is heated with a diketone, compounds are obtained which when treated with alkalis are converted into dyestuffs. Example: 7·3 kilos. of isatin and 7·5 kilos. of 3-oxy-1-thionaphthene are boiled under a reflux condenser with 60 litres of alcohol until the whole has dissolved. On cooling, the product is collected and dried. On treating this with sodium carbonate a red dyestuff is produced. This operation may be conveniently performed after printing the intermediate product, using British gum as a thickening material. In this way a red pattern on a white ground is obtained.—J. C. C.

Vat dyestuffs; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 218,992, April 16, 1908.

New vat dyestuffs are obtained by condensing acenaphthenequinone with derivatives of 2.3-diketodihydro-(1)-thionaphthene of the general formula,



$$C_6H_4\left\langle\begin{array}{c}S\\CO\end{array}\right\rangle C{:}NR,$$

where R represents a simple or substituted aryl, alkyl, or aralkyl group.—T. F. B.

Azo body colours insoluble in oil; Process for preparing ——. K. Merz. Ger. Pat. 219,499, Oct. 16, 1906.

If, in the process described in Fr. Pat. 382,191 (this J., 1908, 219), the diazotised anthranilic acid is replaced by the diazo derivative of a *m*- or *p*-aminobenzenecarboxylic acid, the dyestuffs obtained form lakes insoluble in oil.
—T. F. B.

Sulphide dyestuff; Process for preparing a moss-green ——. C. Jäger, Ges. m. b. H. Ger. Pat. 220,065, March 31, 1909. Addition to Ger. Pat. 220,064, Feb. 13, 1909.

p-Phenylenediamine and acetyl-*p*-phenylenediamine are melted with sulphur in presence of benzidine or thiobenzidine. The dyeings on cotton are at first clearer and more reddish brown than those produced by the dyestuff prepared without benzidine; on exposure to air, the dyeings are converted into yellowish-green shades. —T. F. B.

Indigo sulphide; Process for preparing brominated ——. L. Cassella und Co. Ger. Pat. 220,321, Jan. 30, 1909.

Bromo-derivatives of indigo sulphide (containing one atom of sulphur to one mol. of indigo) are obtained by heating indigo in a suitable solvent or suspension with bromine and not more than one mol. of sulphur chloride, to temperatures above 160° C. The dyeings produced by these products are clearer than those given by indigo, and are also faster to light and chlorine. (See also U.S. Pat. 920,156 of 1909; this J., 1909, 595.)—T. F. B.

Colouring matters for vat dyeing; Manufacture of sulphur-containing —— *and lakes therefrom.* G. W. Johnson, London. From Kalle und Co., Biebrich on Rhine Germany. Eng. Pat. 21,578, Sept. 21, 1909.

See Fr. Pat. 407,224 of 1909; this J., 1910, 482.—T. F. B.

Lac-dye; Process of extracting ——. G. J. Fowler. Urmston. U.S. Pat. 954,949, April 12, 1910.

See Eng. Pat. 12,877 of 1908; this J., 1909, 614.—T. F. B.

Gallocyanines; Derivatives of —— *and process of making.* C. Barbezat, Assignor to Dye Works, formerly L. Durand, Huguenin, et Cie., Basle, Switzerland. U.S. Pat. 955,040, April 12, 1910.

See Eng. Pat. 25,752 of 1909; this J., 1910, 413.—T. F. B.

Yellow dye and process of making same. P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 955,080, April 12, 1910.

See Eng. Pat. 17,546 of 1909; this J., 1909, 1026.—T. F. B.

Anthracene dye and process of making. R. Scholl, Gratz, Austria-Hungary, and M. H. Isler, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 955,105, April 12, 1910.

See Ger. Pat. 218,162 of 1909; this J., 1910, 482.—T. F. B.

Dyestuffs; Process for producing direct cotton ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 408,183, Oct. 22, 1909. Under Int. Conv., Nov. 3, 1908.

See U.S. Pats. 951,046, 951,047, 951,048, and 951,049 of 1910; this J., 1910, 412.—T. F. B.

Dyestuffs of the anthraquinone series; Process for preparing ——. F. Ullmann. Fr. Pat. 408,489, Oct. 30, 1909. Under Int. Conv., March 2, 1909.

See Eng. Pat. 12,653 of 1909; this J., 1910, 267.—T. F. B.

Errata.—This J., 1910, 411; col. 1, line 1, *read* "hydrosulphite." Also this J., 1910, 412; col. 1, line 22, *for* "dimethylpyranthose" *read* "dimethylpyranthone."

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Textile fibre; A new ——. R. Schwarz. Oesterr. Chem.-Zeit., 1910, 13, 4—5.

The author revives the question of utilising the bast fibre of the ordinary nettle, Urtica dioica, the ultimate fibre having the dimensions, length 25—30 m.m., diameter, 0·05 m.m. The harvested plant is air dried, rough-scutched, to remove leaves, and the stems treated with caustic soda solution. The separated bast is further treated with alkaline bleaching agents. The yield is stated to be 13 per cent. of the weight of the dry stems, and the cost of production half the selling value of medium raw cottons.—P. F. C.

Cellulose; Quantitative determination of —— *by Lange's and Simon and Lohrisch's methods.* L. Scheunert and E. Lötsch. Z. physiol. Chem., 1910, 65, 219—231.

In 1904 Simon and Lohrisch published a modification of Lange's method for the determination of cellulose in foodstuffs, etc. According to the proposed method, the solution containing the cellulose partially dissolved, after heating with concentrated potassium hydroxide, is not acidified, as in the original method, but is treated with hydrogen peroxide until practically colourless, and the cellulose is precipitated by alcohol. The authors have endeavoured to utilise this method, but have arrived at the conclusion that it is quite unsuitable for quantitative purposes. Lange's original method is by no means a satisfactory quantitative method, since the cellulose is always more or less attacked and modified by the action of the hot concentrated alkali. But when hydrogen peroxide is also used, the attack on the cellulose proceeds very much further and is far less under control, so that the proposed method is useless.—J. F. B.

Acetate-silk; Properties of the new ——. A. Herzog. Chem.-Zeit., 1910, 34, 347—349.

Under the microscope the single fibres appear as uniform cylinders with occasional band-like thickenings; the transverse section is oval or circular with relatively large notches, the thickenings appearing as irregular rectangles. The average diameter is 42·3 μ, with a variation of about 2·9 per cent., the average area of the cross-section is 0·001234 sq. mm. (=1234 sq. μ). Acetate-silk is feebly doubly refractive. Its refractibility is about the same as that of lemon oil in which it becomes practically invisible (the older makes showed splinter-like impurities having a strong double refraction). The strength of a thread of 18 single fibres was found (by a Schopper testing machine) to be equal to 226·25 grms. when dry and 128·85 grms. when wet (= 10·22 and 5·8 kilos. respectively per 1 sq. mm. of cross-section). Acetate-silk is soluble in cold acetic acid; it is not soluble in ammoniacal copper hydroxide; it is coloured yellow by iodine and sulphuric acid, also by zinc chloride and iodine. It burns quickly, giving off a disagreeable odour and leaving a puffed-up charcoal. Gelatin-silk is the only other artificial silk having an equal uniformity of fibre and likewise not showing any dichroïsm when dyed with Congo Red. Acetate-silk is distinguished from all other artificial silks by its very low density (1·251), by not swelling in water, and by its greater strength when wet.—A. Sbld.

Sulphite cellulose; Pyrites [dust] burning for the manufacture of ——. L. J. Dorenfeldt. Z. angew. Chem., 1910, 23, 591—595.

The author reviews various points connected with the preparation of sulphur dioxide and sulphite liquors for the manufacture of sulphite-cellulose, and urges the importance of a thorough system of regeneration of the escaping sulphurous gases. He condemns the use of tanks containing milk of lime, and favours towers containing limestone, for the purpose of absorption. A modified form of pyrites-burner of the Herreshof type, specially adapted for burning small and dusty mineral, is described in detail. Its essential features are: an automatic, shaking feeder, which delivers the pyrites dust in regular, small portions, on to an elevator, which conveys the material into a preliminary warming chamber, situated on the top of the oven. From this chamber the dried material falls through a hopper into the Herreshof burner, which is constructed as follows: The edges of the platforms, on which the burning pyrites falls, are provided with rims, so that the material accumulates on the platforms. Each of the latter contains two or three openings of considerable size, through which the rotating arms push the material on to the platform below, twice during each revolution of the shaft. The periodical fall of the pyrites, from stage to stage in the form of heaps, minimises the dust trouble, which occurs when the material is always moving in a finely-divided state. The products of combustion are drawn out of the furnace by means of a fan, and are forced through washing towers, cooling boxes, and thence into the absorbers. Instead of ordinary washing towers, appliances spraying water under pressure through the gases, may be used with advantage for their purification. —O. R.

Sulphite wood pulp industry; Absorption processes in the ——. A. Frohberg. Wochenbl. Papierfab., 1910, **41**, 1179—1182.

In the sulphite wood pulp industry, two of the main processes are dependent on absorption: the absorption of the sulphur dioxide gas in the preparation of the lye, and the absorption of the dissolved sulphur dioxide by the wood. In both cases the absorption processes are accompanied by chemical reactions, but these reactions are promoted by, and conducted under the influence of the absorption. The absorption of the gas by the water of the lye is regulated, according to Dalton's law, by the pressure of the gas, and the partial pressure due to the sulphur dioxide is proportional to its concentration. The solubility of sulphur dioxide is very greatly diminished by increase of temperature; moreover, at higher temperatures the limestone in the absorption towers dissolves more rapidly, so that the proportion of free sulphur dioxide in the lye is further reduced. Equilibria are established very readily in this process, and the composition of the lye is constant for any given combination of temperature, pressure and richness of the gases. In the digestion process, absorption of the free sulphur dioxide from the lye takes place at the surfaces of contact between solid and liquid phases; the calcium sulphite is not absorbed by the wood, and accumulates in the lye. The rapidity of the digestion process, given a constant limit for the temperature of the digestion, is controlled solely by the concentration of the free sulphur dioxide. This is of course, modified by the diluting tendency of the moisture already present in the wood. In order to hasten the digestion process, dry wood and lyes rich in free sulphur dioxide should be used. But at a concentration of 4 per cent. of free sulphur dioxide a limit appears to be reached. The sulphur dioxide in combination with the base plays no direct part in the digestion process, at first. The calcium sulphite merely acts as a regulator, combining by double decomposition with the ligninsulphonic acids produced, and furnishing a further supply of free sulphur dioxide for absorption. It is irrational to specify any fixed proportion (*e.g.* 70 per cent.) of free to total sulphurous acid in a lye. The working strength of the liquor is only increased by an increase in the concentration of the free sulphur dioxide, and is not increased if the concentration of combined sulphur dioxide be raised in the same proportion.—J. F. B.

Partial hydrolysis of proteins by sulphuric acid. Skraup and Krause. *See* XIXA.

PATENTS.

Fibrous material; Process of treating [*degumming*] ——. R. R. Roberts, Washington, D.C., Assignor to W. J. Robinson, New York. U.S. Pats. 952,996 and 953,010. Mar. 22, 1910.

THE fibrous material is degummed by working it in a boiling solution containing caustic alkali, sodium borate, and "sal soda" with the optional addition of a hydrocarbon or vegetable oil or both. The fibres are then treated with a solution of an organic acid and are finally immersed in an alkaline bath.—P. F. C.

"*Floss*" *silk, cotton, linen or hemp; Process for treating fibres of* —— *to give them a silky appearance.* S. Torii. Fr. Pat. 407,345, Sept. 24, 1909.

THE fibres are treated with "a solution of cellulose in alcohol."—P. F. C.

Woollen felts; "*Quinonised*" *or* "*tanned*"——. J. Binet. Fr. Pat. 407,358, Sept. 25, 1909.

IN order to strengthen felt, the woollen fibres from which it is made are treated with a solution of quinone or one of its derivatives.—P. F. C.

Artificial fibres from cuprammonuim cellulose solutions; Process for preparing ——. Hanauer Kunstseidefabrik. Ger. Pat. 220,711, July 25, 1907.

IN order to avoid the use of capillary orifices and the necessity for pressure and low temperatures in preparing fibres from cuprammonium cellulose solutions, the latter are mixed with substances which increase their viscosity, *e.g.*, sodium ricinoleate, glycerin, or gelatin. For example, a solution suitable for direct spinning is obtained by mixing together 200 kilos. of an eight per cent. solution of cuprammonium cellulose and 1·6 kilos. of sodium ricinoleate dissolved in 3 litres of warm water.—T. F. B.

Vegetable matter; Process of treating —— *for separation of fibre therefrom.* J. E. Podmore, Jersey City, N.J., Assignor to Consolidated Railway Industrial Straw Paper Co., New York. U.S. Pat. 953,287, March 29, 1910.

STRAW or other vegetable matter is treated with a weak alkaline solution in the presence of steam under high pressure, the liquid is removed by the aid of a vacuum, and the fibres are beaten, washed and dried.—J. C. C.

Cellulose from straw and other vegetable matter; Manufacture of ——. A. Deiss and C. J. Fournier. First Addition, dated Sept. 2, 1909, to Fr. Pat. 403,518, May 12, 1909 (this J., 1910, 84).

THE application of the process described in the main patent to such materials as white and coloured woods, and ligneous matter in general, is now claimed. The materials are given a preliminary treatment of cutting, grinding or rasping and are then submitted to the operations described in the original patent, an addition of bisulphite being made to the alkaline lyes.—F. M.

Mercerised cellulose [*Preparation of wood cellulose*]; *Process for precipitating the organic substances contained in the dark coloured lyes obtained in the preparation of* ——. N. A. Langlet. Fr. Pat. 406,744, Sept. 3, 1909. Under Int. Conv., Sept. 24, 1908.

BY electrolysing the black lyes obtained by treating wood with a solution of sodium hydroxide, the greater part of the dissolved impurities are deposited at the anode. If the cathode be separated from the anode by a porous partition, the liquor in the cathode compartment becomes richer in sodium hydroxide during the electrolysis. The best results are obtained if the black lye is warmed to about 65° C. before electrolysis, as the precipitate obtained at the anode is then in a more suitable state for filtration. To increase the conductivity of the lye it is advisable to add to it 10—20 per cent. of hydrated sodium sulphate. After electrolysis, the anode solution is filtered, causticised, mixed with the cathode solution and used again for treating further quantities of wood.—P. F. C.

[*Wood*] *Pulp.* C. W. Roberts, Lockport, N.Y., Assignor to Forest Land and Mill Co., Tupper Lake, N.Y. U.S. Pat. 954,209, Apr. 5, 1910.

WOOD shavings are cut into a uniform size, then subjected to a cooking process and are afterwards strongly compressed in all directions. This causes the individual pieces o rub against and disintegrate one another, thus producing a homogeneous mass of softened wood cells, which s finally ground and refined.—P. F. C.

Effluent gases of soda- and sulphate-cellulose works ; Process for rendering the —— odourless by means of gaseous oxidising agents. C. G. Schwalbe. Ger. Pat. 218,314, March 20, 1908.

The effluent gases are mixed with gaseous oxides of itrogen.—A. S.

Papers ; Manufacture of adhesive "art" or coated ——. W. S. Passmore and R. Gilroy, London. Eng. Pat. 9340, Apr. 20, 1909.

Enamelled paper, for lithographic and label work, which is also adhesive, is prepared from a suitable body paper, sized in the pulp with about 6 per cent. of a size made up of 1 per cent. of glue and 5 per cent. of rosin. The reels of paper are afterwards coated, on one or both sides, with a composition containing about 20 parts of glue, 80 parts of water, 30 parts of "*blanc fixe*" and 50 parts of "satin white." In the case of a double-coated paper, one side is used for printing and the other side as adhesive ; in the case of a single-coated paper, the coated side is adhesive. If desired, the printing surface of the coated paper may be made perfectly non-adhesive by the application of a solution of casein and formaldehyde.—J. F. B.

Paper ; Manufacture of ——. H. S. Rinker. Fr. Pat. 407,100, July 15, 1909.

Arrangements are described for maintaining the water employed for the manufacture of paper, as nearly as possible in a closed circuit, so that no loss of dissolved or suspended materials can take place. For this purpose a large "save-all," consisting of a tray with a narrow, channel-shaped, sloping bottom, is arranged under the whole length of the machine, to collect the water draining through the wire, the water from the suction-boxes, and the spraying water used for cleaning the wire on its return. All these waters run down into a pit at the lowest extremity of the "save-all," and are elevated by a pump to a large "back-water" storage cistern. The water in this cistern is used both for furnishing the beaters and for diluting the pulp at the machine. The upper edge of the cistern is provided with an overflow, which is guarded by an extremely fine sieve, so that only clear water can flow away ; this sieve is cleaned occasionally by jets of steam directed inwards to the cistern. The pulp from the beater-chest is diluted in a small chest which also contains the strainers ; the diluting water is delivered to this strainer-chest from a second small chest, at a higher level, which is supplied with water from the large cistern. Any overflow from both these chests runs down into the "save-all" pit and is elevated by the pump to the cistern.—J. F. B.

Plastic material [from vegetable fibres] ; Improved ——, and process for producing same. S. Morimura, Tokyo, Japan. Eng. Pat. 27,266, Nov. 23, 1909.

Straw or similar fibrous vegetable matter is chopped into short lengths, boiled with alkali, washed, and soaked in a solution of tannic acid ; the fibrous product is dried, mixed with a small percentage of animal hair or hemp fibre, the mixture boiled with glue and alum and to this resin soap is added and the pulp obtained is moulded to the required shape. The material is finished by treating it with formaldehyde, drying and soaking in a solution of gelatin and glycerin. After hardening it is again treated with formaldehyde and finally dipped into a solution of glue and potassium bichromate. The material may also be waterproofed by varnishing or fireproofed by treatment with a solution of borax, boric acid and ammonium chloride, coating with sodium silicate, repeating the process and finally applying a coating of powdered asbestos and re-coating with sodium silicate.—J. C. C.

Cellulose ; Process of manufacture of viscous spinning solutions of ——. O. Müller, and Rheinische Kunstseide-Fabrik A.-G., Cologne, Germany. Eng. Pat. 18,342, Aug. 9, 1909.

See Fr. Pat. 405,571 of 1909 ; this J., 1910, 417.—T. F. B.

Black liquors of soda pulp mills ; Process for precipitating organic substances from the ——. N. A. Langlet, Gothenburg, Sweden. Eng. Pat. 20,489, Sept. 7, 1909. Under Int. Conv., Sept. 24, 1908.

See Fr. Pat. 406,744 of 1909 ; preceding.—T. F. B.

Plastic masses [from cellulose] ; Manufacture of ——. L. Collardon, Leipzig, Germany. U.S. Pat. 953,319, March 29, 1910.

See Fr. Pat. 372,584 of 1906 ; this J., 1907, 539.—T. F. B.

Cellulose formate. S. von Kapff, Aachen, Germany. U.S. Pat. 953,677, March 29, 1910.

See Fr. Pat. 405,293 of 1909 ; this J., 1910, 417.—T. F. B.

Cellulose formate. S. von Kapff, Aachen, Germany. U.S. Pat. 955,082, April 12, 1910.

See Fr. Pat. 405,293 of 1909 ; this J., 1910, 417.—T. F. B.

Acetylcellulose-coated material ; Process of producing ——. L. Lederer, Sulzbach-Oberfalz, Germany. U.S. Pat. 954,310, April 5, 1910.

See Fr. Pat. 320,885 of 1902 ; this J., 1903, 160.—T. F. B.

Celluloid ; Process for making flexible, non-inflammable ——. B. G. Buchstab. Fr. Pat. 408,406, Oct. 28, 1909.

See Ger. Pat. 214,398 of 1908 ; this J., 1909, 1221.—T. F. B.

Preventing coagulation of solutions containing albuminoid compounds and formaldehyde. Ger. Pat. 220,493. *See* XIII.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Vat dyestuffs upon the cotton fibre ; Reactions of the ——. A. G. Green and G. H. Frank. J. Soc. Dyers and Col., 1910, 26, 83—86.

The vat dyestuffs at present known are all members of one of the two following classes :—*a. The anthracene class* comprising the Indanthrene and most of the Algole series. These dyestuffs are complex derivatives of anthraquinone containing usually two anthraquinone residues combined with other atomic groups. They do not give colourless leuco-compounds on reduction but usually products of a deeper shade which are rapidly re-oxidised to the original colour on exposing the fibre to air. On heating the dyed fibre the dyestuffs do not sublime or form coloured vapours. *b. The indigoid class* comprising indigo and its derivatives, the Thioindigo series, the Ciba series and the Helindone series. These dyestuffs are all constituted upon a similar type to indigo and when reduced on the fibre they are converted into pale yellow or nearly colourless leuco-compounds which upon exposure to air are slowly re-oxidised to the original colour. The members of this class with the exception of Ciba Green and Helindone Brown can be sublimed from the vegetable fibre forming coloured vapours. For the identification of these two classes of vat dyestuffs and their differentiation from each other, the dyed fibre is subjected to the following tests. (1.) For reduction it is boiled for about a minute with "Hydrosulphite X," a reagent which is prepared by dissolving 50 grms. of Rongalite in 125 c.c. of hot water, adding 1 grm. of precipitated anthraquinone, previously finely ground and mixed to a paste with some of the Rongalite solution, heating the mixture for a minute or two to 90° C., then diluting with cold water to 500 c.c. and finely adding 1½ c.c. of glacial acetic acid. (2.) The sublimation test for indigoid dyestuffs is best carried out by heating the material in a dry test-tube and then looking down the length of the tube against a white background. (3.) For identifying individual products, the behaviour with concentrated sulphuric acid is useful. Tables are given describing the behaviour of cotton dyed with the different dyestuffs when subjected to these tests. —P. F. C.

Tendering of cotton dyed with sulphide colours; Process for preventing the ——. G. E. Holden. J. Soc. Dyers and Col., 1910, 26, 76—78.

The author confirms Pilling's conclusion (this J., 1906, 216) that the tendering after dyeing of cotton dyed with sulphide dyestuffs is due to the presence of free sulphuric acid which arises from the oxidation of the dyestuff or from the oxidation of sulphurous acid coming from outside sources. This liberation of sulphuric acid is accelerated by heat, and by exposing samples of cotton dyed with various sulphide dyestuffs to a temperature of 120° C. for twenty hours, a loss of strength of the material varying from 39—78 per cent. was produced, whilst the amount of free sulphuric acid liberated varied from 0·027—0·078 per cent. on the weight of the cotton. All methods for preventing tendering rely for their efficiency either on assisting the oxidation of the dyestuff, as for example by a treatment with bichromates and acetic acid, or on after-treating the dyed material with salts capable of neutralising free mineral acids. The methods belonging to the latter class possess a common disadvantage in that the compound used for impregnating the dyed material is soluble in water. The author finds that this drawback is avoided by precipitating calcium tannate on the dyed material (see Eng. Pat. 3087 of 1909, this J., 1910, 346). —P. F. C.

Tendering of cotton goods dyed with sulphide blacks. L. E. Vlies. J. Soc. Dyers and Col., 1910, 26, 79—81.

About 50 grms. of a typical sulphide black were well washed, dried, and finely ground and then exposed, apart from a small amount required for the estimation of free sulphur, to the action of a current of moist air at a temperature of 60°—70° for 20 hours. The dyestuff was then extracted with distilled water and an analysis of the colourless extract revealed the presence of 2 per cent. (on the weight of the washed sulphide black) of free sulphuric acid, unaccompanied by organic sulphonic acids. The amount of free sulphur in the dyestuff before and after exposure to air was then estimated; it was 0·686 and 0·72 per cent. respectively. The whole of the sulphuric acid must therefore have arisen from the oxidation of the dyestuff. The author suggests that the dyestuff molecule contains loosely connected organic sulphur groups which on exposure to air are oxidised, first into complex unstable thiosulphonic acids and afterwards into sulphuric acid.—P. F. C.

Tin-resists in diazo-naphthol dyeing. F. Binder. Sealed Note No. 1041, dated Aug. 1, 1898, and Report thereon by R. Federmann. Bull. Soc. Ind. Mulhouse, 1910, 80, 50—51.

Much purer whites or clearer colour effects are obtained on fabrics dyed with naphthol and a diazotising solution, by the addition of glucose to the stannous chloride resist. The glucose prevents or greatly lessens the fixation by the tin of decomposition products formed by the action of stannous chloride on the diazo-compound. A very weak colour is obtained from a yellow resist of Persian berries and stannous chloride to which glucose has been added, owing to the small amount of tin fixed. Glucose, however, does not weaken the colour obtained with resists in which tin is not essential for the formation of a lake. A distinct improvement of the whites is found also to result from an addition of glycerin or chloride of magnesium, calcium or aluminium to the resist.—A. Sbld.

Blue prints on cotton obtained by the combination of nitrosodimethylaniline with tannin or gallic acid. E. Bechtel. Sealed Note No. 1053, dated Sept. 23, 1898, and Report thereon by E. Stalder. Bull. Soc. Ind. Mulhouse, 1910, 80, 52—55.

A deep blue colour is obtained by printing on calico a mixture of nitrosodimethylaniline with tannic or gallic acid, steaming and then passing through a bichromate bath. It is similar to the colour obtained with the nitroso-compound and resorcinol. Gallic acid gives better results than tannin, which gives duller shades. The gallic acid solution required is prepared by dissolving 50 grms. of gallic acid in 250 c.c. of acetic acid and adding 50 grms. of British gum. The proportions for the colour mixture are:—20 grms. of the nitroso salt M (M. L. & B.), ½ litre of acid starch thickening, ⅕ litre of the gallic acid solution, and 120 c.c. of oxalic acid solution (100 grms. per litre). After printing the cloth is steamed for 3—4 minutes and then passed through a bichromate bath. A beautiful and very fast blue is obtained. Further steaming dulls the colour very little: coloured effects can therefore be obtained with other steam colours, which is not the case with the blue obtained with resorcinol. Deeper shades are obtained by fixing with chromium acetate instead of passing through a bichromate bath, but the fastness is not increased. The combination on the fabric of nitrosodimethylaniline and gallic acid should form gallocyanine, but the shade obtained is duller and redder. It is supposed that the nitroso-salt is partly reduced to dimethylparaphenylenediamine. The latter mixed with gallocyanine (1 : 4) gives a colour very similar to that obtained by condensation on the fibre. The method is very similar to that employed by Brandt for the production of deep greys from nitrosodimethylaniline (this J., 1909, 1121).—A. Sbld.

Dizinc-formaldehydesulphoxylate. Becker. *See* VII.

Patents.

Washing machine; A continuous ——, permitting of the easy recovery of the products removed from the material. G. Malard. First Addition, dated Sept. 7, 1909, to Fr. Pat. 381,097, Aug. 20, 1907. Under Int. Conv., June 30, 1909.

The washing liquor is contained in several compartments and is forced up and distributed upon the material as it is carried over the compartments on an endless perforated belt. The sprays are placed at the front end of each trough and the liquors percolate through the material and fall back into the same trough, unless by the removal of liquor from the preceding trough the level in this has fallen. In this case, by the action of a float, a plate which is supported on a horizontal hinge just behind the washing pipe is drawn forward, and the liquor falling upon the inclined surface is projected forward, and passes through the material into the tank in front of that from which it was drawn. The washing is thus carried out on the counter-current principle.—F. M.

Wool scouring. Schmid Frères. Fr. Pat. 407,596, Jan. 4, 1909.

Instead of treating the material with a solution of soap, with or without the addition of alkali, it is proposed to submit it to the action of the froth or lather, produced by boiling a soap solution to which an alkali or other degreasing agent may have been added. The degree of felting is said to be less, there is less loss of wool fibre, and the time required for thorough cleansing is diminished. —F. M.

Fibrous materials with dye or other liquors; Apparatus for treating ——. The Togs Spinning Co., Ltd., and J. J. Atack, Patricroft, Lancs. Eng. Pat. 11,881, May 20, 1909.

A suction chamber, provided with injector, ejector, and one or two floats, is connected by a pipe with a series of perforated spindles on which are wound the cops to be dyed, the whole series being mounted on a suitable carrier. A movable dye-vat, which can be raised or lowered is placed beneath the carrier and a number of fixed tanks containing the dyestuff solution or other liquor are arranged near to and are connected with the suction chamber and the dye-vat by suitable pipes, which are provided with stop-cocks. In operation the liquor is drawn from the movable vat through the fibres into the suction chamber by means of the ejector until the chamber is full. The floats then operate by closing the ejector and opening the injector. At the same time they close the suction pipe and open the pipe connecting the solution chamber with the stationary tank which is in use. The liquor in the chamber is then driven out by the injector into the stationary tank, whilst a fresh supply of liquor flows therefrom into the movable vat. The operation is repeated until the liquor becomes exhausted, when another of the stationary tanks is substituted in the system for the exhausted one and the operation is continued.—P. F. C.

Dyeing, bleaching and washing fabrics in closed vessels; Apparatus for ——. Erckens und Brix. Fr. Pat. 407,383, Sept. 27, 1909. Under Int. Conv., April 21, 1909.

The patent refers to a form of jigger suitable for dyeing piece goods with vat and sulphide dyestuffs. To prevent oxidation of the dye-liquors, air is excluded by means of a well-fitting cover, and the height of the liquor is such that throughout the operations, all the rollers are completely immersed. The jig rollers are supplied with short lengths of material to which the ends of the cloth to be dyed are attached, and the cloth is wound from one roller to the other, passing over a guide roller placed at a higher level between the two. This guide roller revolves freely upon an axle, to which is firmly fixed a stirrup, extending the whole length of the roller, at such a distance from it that the cloth passes easily between the two. When the end of the cloth is reached however, means are provided whereby the stirrup actuates the reversing gear and the direction of the cloth is automatically reversed. The construction and action of the machine are described in detail, with reference to numbered drawings.—F. M.

Dyeing fabrics at width; Machine for ——. J. Garnier. Fr. Pat. 407,638, July 23, 1909.

The ends of the pieces being sewn together they are drawn through the dye-bath (which is shallow and pivoted so that it may be oscillated if desired) and delivered by means of a "cuttling" arrangement on to a travelling bed above the machine. As the bed travels forward the pieces are drawn down into the dye-bath and the course continued until the dyeing is completed. The speed of the various parts of the machine is regulated so that there is no fraying or dragging of the pieces and no liability to the formation of "crimps."—F. M.

Artificial fibres, etc.; Process for increasing the affinity of —— for dyestuffs. Fürst Guido Donnersmarck'sche Kunstseiden- und Acetatwerke. Ger. Pat. 219,848, Oct. 11, 1908.

Artificial fibres, which have been treated with aldehydes (formaldehyde) followed by the action of acids or other dehydrating agents, and then washed and dried, have little affinity for dyestuffs. They may, however, be readily dyed if they are first treated with solutions of alkali hydroxides, with or without addition of oxidising agents, such as hypochlorites. The caustic alkali solution may vary in strength from 1 to 35 per cent., the duration of the action depending on the strength used, but it is preferable to use the more dilute lyes, since the stronger ones cause shrinkage of the fibres unless they are kept under tension during the process.—T. F. B.

Goffering effects on yarns, fabrics, etc., by means of albuminous substances; Process for producing —— permanent towards ironing and moisture. E. A. F. Düring. Ger. Pat. 218,566, April 4, 1908. Addition to Ger Pat. 206,901, May 4, 1907 (see Fr. Pat. 387,564 of 1908; this J., 1908, 854).

The goods are moistened with a solution of albumin, casein, etc., dried at the lowest possible temperature, and the albuminoid coagulated by hot calendering with suitably engraved rolls, or by pressing; it is advantageous to complete the process by a treatment with steam or a chemical coagulating agent. By this means it is possible to obtain glossy effects, quite unaffected by steam, on wool or half-wool goods. (See also Ger. Pat. 217,679; this J., 1910, 346.)—T. F. B.

Washable coating; Method of providing linen and the like with a ——. M. Friedländer and P. Tuebben, Gross-Lichterfelde, Germany. Eng. Pat. 23,547, Oct 14, 1909. Under Int. Conv., Mar. 15, 1909.

Celluloid and a small quantity of white wax are dissolved in a suitable solvent, such as acetone, and the solution is applied to the material by any convenient method. The solvent is then allowed to evaporate leaving a washable coating which does not crack.—P. F. C.

Fibrous materials or cellulose; Process for treating [waterproofing] ——. J. H. Ketcheson. Fr. Pat. 407,616, Oct. 6, 1909.

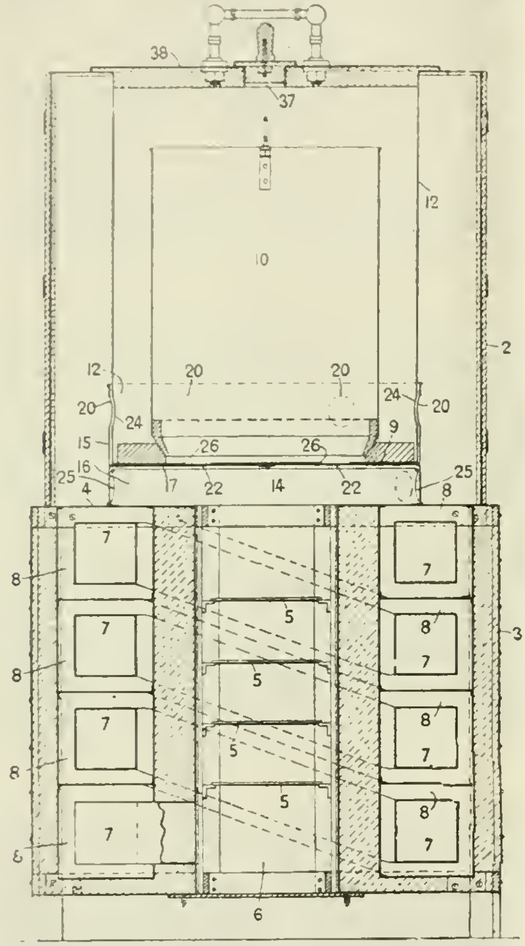
The material is worked under vacuum in a solution of caoutchouc or some other similar substance and is afterwards exposed to a current of air, steam or gas under pressure to remove all traces of the solvent. These operations are repeated as often as may be necessary.
—P. F. C.

Drying wool and other fibrous materials; Machinery for ——. W. McNaught, Rochdale. Eng. Pat. 7523, Mar. 29, 1909.

This machine consists of a number of sections arranged in series. The wool to be dried is led into the first section by feeding rollers which momentarily hold it in a blast of air discharged from an air nozzle and then release it. It is then carried by the air blast into a chamber of such size that the velocity of the blast drops sufficiently to allow the partially dried material to fall and be immediately carried out of the chamber by delivery rollers which feed it into the second section of the machine. Each chamber is provided with means for at once withdrawing the moistened air from the machine without allowing it to come into further contact with the material.—P. F. C.

Drying of wool and other fibrous substances. H. S. Ellis and C. E. Allsopp, Bradford, Yorks. Eng. Pat. 24,046 of 1908; date of application, May 8, 1909.

The apparatus, which is used to dry fibrous materials preparatory to ascertaining their absolute dry weight, consists of two compartments, 2 and 3, separated by a horizontal partition, 4. The lower compartment, 3, is provided with an electrical heating device, 5, situated inside a channel, 6, communicating with the compartment, 2, by a central opening in the partition, 4. Air enters at the top of the compartment, 3, through a pipe, 7, contained within another spiral pipe, 8, and enters the heating channel, 6, near the bottom of the apparatus. The drying compartment, 2, contains a receptacle, 10, for holding the material to be dried. It is supported on and makes an air-tight joint with the bottom, 9, of an outer cylinder, 12, suspended from the top of the compartment; a space, 14, being left between the bottom, 9, and the partition, 4. Round the cylinder, 12, closely fits a sleeve, 15, enclosing the cylindrical ring, 16, which surrounds the space 14, and is fastened to the partition, 4. The sleeve, 15, is formed with a horizontal partition, 17, fitting against the bottom, 9, of the cylinder, 12. Lateral openings are made in the sleeve both above and below the partition, 17 which is itself provided with openings, 22. Corresponding openings, 24, 25 and 26 are arranged in the cylinder, 12, the ring, 16, and the bottom, 9, respectively. These valve openings are so arranged that when the partition valve is open, the upper sleeve valve is also open and the lower sleeve valve closed, so that the waste heated air that has passed through the material in the receptacle, 10, can pass away through the annular space between the pipes, 7 and 8. When, however, the valve in the partition is closed, the upper sleeve valve is also closed, but the lower sleeve valve is open and the heated air passes into the annular space between the cylinder, 12, and the walls of the compartment, 2. In operation, air is drawn through the pipe, 7, into the central channel, 6, where it is heated to the desired temperature. It then passes into the space, 14, through the holes, 22 and 26, in the valve-plate, 17, and the bottom, 9, respectively, and afterwards through the material contained in the receptacle, 10, which is freely suspended from the arm of a balance through a hole, 37, in the cover 38. After passing through the material, the air passes into the cylinder, 12, and through the holes, 24 and 20, into the outer compartment, 2, whence it travels into the pipe, 8, and out of the machine.—P. F. C.



Bleaching fabrics, threads, and other material; Process for ——. A. Margotin, Reims, France. Eng. Pat. 19,776, Aug. 28, 1909. Under Int. Conv., Sept. 18, 1908.

SEE Fr. Pat. 403,245 of 1908; this J., 1909, 1311.—T. F. B.

Dyeing thread on bobbins; Process of ——. F. H. Daniell and J. C. Hebden. Fr. Pat. 408,508, Nov. 2, 1909. Under Int. Conv., Nov. 10, 1908.

SEE U.S. Pat. 942,166 of 1909; this J., 1910, 209.—T. F. B.

Bowking vegetable fibres dyed with vat dyestuffs; Process for ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 407,787, Oct. 11, 1909. Under Int. Conv., Dec 24, 1908.

SEE Ger. Pat. 218,254 of 1908; this J., 1910, 419.—T. F. B.

Printing plates; Process for preparing half-tone ——. H. Strecker-Aufermann. Fr. Pat. 408,259, Oct. 5, 1909. Under Int. Conv., Nov. 25, 1908.

SEE Eng. Pat. 3699 of 1909; this J., 1910, 269.—T. F. B.

Prints, etc.; Process of making fast grey ——. G. Engi, Assignor to Soc. Chem. Industry in Basle, Basle, Switzerland. U.S. Pat. 954,273, April 5, 1910.

SEE Eng. Pat. 20,312 of 1909; this J., 1909, 1246.—T. F. B.

Printing-plates; Process for preparing —— *in grain manner.* H. S. Aufermann, Munich, Germany. U.S. Pat. 954,412, April 12, 1910.

SEE Eng. Pat. 3699 of 1909; this J., 1910, 269.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Iron-pyrites; Analysis of ——. W. Vilstrup. Chem.-Zeit., 1910, **34**, 350—351.

SULPHUR and iron are best determined by Lunge's usual method in about 0·5 grm. of the dried finely ground ore and the other important constituents as follows: 12·5 grms. of the ground ore are moistened (in a tall Jena glass beaker) with 10 c.c. of water and 1 c.c. of concentrated sulphuric acid, and concentrated nitric acid added until frothing ceases. The mixture is evaporated to a pulpy consistence and then extracted with boiling water; the liquid is decanted, and the residue, after heating with *aqua regia* and expelling the excess of acid, is washed into the liquid which is made up to 250 c.c., and filtered through a dry filter. Lead is determined in the residue, by washing with water, boiling with concentrated ammonium acetate, filtering the solution and precipitating the lead with dilute sulphuric acid. Of the filtered liquid, from the 250 c.c. flask, 200 c.c. (=10 grms. of ore) are taken and sulphuretted hydrogen passed through until the precipitated sulphides mat together; the precipitate is filtered off and washed, and the filtrate and washings made up to 500 c.c. From the mixed sulphides of copper, arsenic, and occasionally antimony, arsenic is extracted by ammonium carbonate, and precipitated from the solution by sulphuric acid. The precipitation is only quantitative if sulphuretted hydrogen is passed into the acid liquid. The arsenic sulphide is washed into a Gooch crucible, washed with alcohol and carbon bisulphide, dried at 100° C. and weighed. The residual copper (and antimony) sulphide is boiled for a few minutes with freshly prepared concentrated ammonium sulphide solution, the mixture filtered, and the precipitate washed with boiling water. The wet filter and copper sulphide are burnt, ignited, and the copper oxide weighed. Of the filtrate from the mixed sulphides (made up to 500 c.c.), 50 c.c. (=1 grm. of ore) are taken, boiled to expel sulphuretted hydrogen, the iron oxidised with nitric acid and then precipitated by ammonia in the presence of ammonium chloride. The precipitate must be dissolved in hydrochloric acid and reprecipitated 4 times to ensure that it is free from zinc. Alternatively the precipitated ferric hydroxide can be dissolved in hydrochloric acid, the solution neutralised with ammonia, and the iron precipitated by ammonium nitrite or ammonium acetate. The united filtrates from the iron are made strongly ammoniacal, heated to boiling, and the magnesium and denum precipitated with ammonium phosphate and a tle ammonium carbonate. The mixture is stirred for minutes, allowed to settle, the liquid filtered off into a orcelain dish and well boiled, until all the ammonia is pelled. The mixture is filtered, the precipitated zinc-ammonium phosphate well washed with boiling water, he wet filter and precipitate carefully burnt, ignited, and he zinc pyrophosphate weighed. Nickel and cobalt, if resent, would be precipitated with the zinc as phosphate. that case the filtrate from the iron is acidified with etic acid and sulphuretted hydrogen passed through. fter 24 hours the sulphides are filtered off, washed, and xtracted with cold N/1 acid, the filtrate boiled to expel lphuretted hydrogen, then carefully neutralised with mmonia and the zinc precipitated with ammonium hosphate. The above method is based on methods roposed by Nahnsen, Schirm and Voigt (this J., 1887, 84, 1909, 1008, 1253).—A. Seld.

itric acid from air ; Manufacture of ——. F. Haber. Z. angew. Chem., 1910. 23, 684—689. (Compare Bernthsen, this J., 1909 706 ; Eyde, this J., 1909, 1214).

he quantity of fixed nitrogen required yearly is 5×10^6 ons. Actually more than 10^8 tons are received on the rface of the earth from the rainfall in the form of nitrates roduced by electric discharges in the atmosphere. But his is too dilute to be of value to agriculture. To produce tric acid or nitrates commercially from atmospheric itrogen it is essential (1), that the nitrogen compounds roduced per unit of electric energy shall have a considerbly greater value than the cost of the energy ; (2), the oncentration of the nitrogen compounds formed must be elatively high ; (3), the apparatus must be relatively imple though at the same time capable of dealing with rge volumes of air. In Germany the price of power erived from coal per kilowatt-year is M. 210 (£10 5s. 7d.), hereas the fixed nitrogen produced per unit is only worth . 168 (£8 4s. 6d.). The cost of water power is only . 30—40 (£1 9s. 4d. to £1 19s. 2d.) per kilowatt-year. y the various processes the yield of nitric acid per kiloatt-year varies from 500 to 630 kilos. The highest oncentration of nitric oxide at present obtained technically 2·5 per cent. : it varies from 1 per cent. to 2½ per cent. he proportion of nitric oxide depends on an ever varying quilibrium and is greater the higher the temperature. he lower the temperature the less readily the oxide ormed decomposes again. On this hypothesis the colder he arc the less should be the yield of nitroso products, ut this is contrary to experience. With a cool arc a oncentration of 9 per cent. of nitric oxide has been btained in laboratory experiments. When the pressure lowered a maximum concentration of nitric oxide is eached at 150 mm. of mercury, and this maximal concenration is greater the stronger the current employed. t is suggested that the electric discharge first of all brings bout an electrical equilibrium between nitric oxide, itrogen and oxygen in which more nitric oxide is present han in the chemical equilibrium, but the difference etween the electrical and chemical equilibria can only be naintained so long as the rate of thermal decomposition f nitric oxide is not too rapid. The more the temperature reduced the more chance therefore of maintaining a igh proportion of nitric oxide. Technical difficulties ave so far stood in the way of making use of an apparatus ith a cool arc, whereas three processes are working satisactorily with the uncooled arc. Schönherr's process at resent gives the best yield of nitric oxide. It is not yet lear whether the decomposition of nitric oxide during ooling is a pure function of temperature and concentration r whether other more complicated causes are at work. hen a flame is burnt under 8—9 atmospheres pressure, xides of nitrogen are produced and a 10 per cent. solution f nitric acid may be obtained by burning hydrogen in a 0 per cent. oxygen-nitrogen mixture.—E. F. A.

itric acid and nitrates ; New, very sensitive colour-reaction for ——. J. Schmidt and H. Lumpp. Ber., 1910, 43, 794—797.

he new reagent is the solution in concentrated sulhuric acid of di-9 : 10-monohydroxyphenanthrylamine, $(C_{14}H_8{\cdot}OH)_2NH$; 0·1 grm. of the diamine is dissolved in a litre of pure concentrated sulphuric acid. Into 2 or 3 c.c. of this solution is introduced a minute fragment of the substance to be tested, when, if a nitrate is present, the blue solution becomes wine-red. If the substance is an aqueous liquid it should be mixed with an excess of concentrated sulphuric acid before adding it to the reagent, as water destroys the delicacy of the reaction. Other oxidising agents, save nitrites when in considerable quantity, do not produce the same coloration. Other derivatives of phenanthrene, viz., 9-hydroxyphenanthrene, di-9-phenanthrylamine, di-3-bromo-9-phenanthrylamine—also give colourations with various oxidising reagents, a table of which is given in the paper.—J. T. D.

Hydrates ; Non-dehydration of —— by absolute alcohol. F. A. H. Schreinemakers. Chem. Weekblad, 1910, 7, 211—216. Chem. Zentr., 1910, 1, 1316.

In a system composed of water, alcohol, and an anhydrous salt, in which a hydrate is formed, two mixtures of alcohol and water exist which possess the character of saturated solutions. The author names the one poorer in alcohol the "lower saturated solution," and the one richer in alcohol the "upper saturated solution." Aqueous alcohol of lower concentration than the "lower saturated solution" hydrates the anhydrous salt and leaves the hydrate unaltered ; aqueous alcohol of higher concentration than the "upper saturated solution" dehydrates the hydrate and leaves the anhydrous salt unaltered ; aqueous alcohol of intermediate concentration leaves both the hydrate and anydrous salt unaltered. The compositions of the two saturated solutions vary with the temperature, but for a given temperature can be ascertained graphically. If in a triangle of which the corners, Z, W, A, represent the anhydrous salt, water, and alcohol respectively, a point, H, on the side, ZW, represent the hydrate of the salt and a point, *x*, inside the triangle represent the composition of the solution in equilibrium with the hydrate and the anhydrous salt, then the points of intersection of lines drawn from Z and H through *x* with the side, WA, represent the composition of the "lower saturated solution" and the "upper saturated solution" respectively. The "lower saturated solution" is formed at all temperatures at which the hydrate is stable, but the "upper saturated solution" only when the point, *x*, falls within the triangle, HWA. If *x* fall within the triangle, HZA, then the hydrate cannot be dehydrated by absolute alcohol, but only by a solution of the anhydrous salt in absolute alcohol containing more of the salt than corresponds with the point of intersection of a line drawn from H through *x* with the side, ZA. Experiments were made with the hydrates : $BaCl_2 2H_2O$; $BaCl_2 H_2O$; $Li_3SbS_4.10H_2O$ (or $9H_2O$) ; $Li_3SbS_4.8\frac{1}{2}H_2O$; $CuCl_2, 2H_2O$, and $CuSO_4.H_2O$. The results show that the hydrates, $CuCl_2.2H_2O$ and $CuSO_4.H_2O$, at 30° C., and the hydrate, Li_3SbS_4 $10H_2O$ (or $9H_2O$) at 10° C., cannot be dehydrated by absolute alcohol. The hydrate, $Li_3SbS_4.8\frac{1}{2}H_2O$, can be dehydrated by absolute alcohol at 30° C., and the two hydrates of barium chloride both at 30° and at 60° C.

—A. S.

Potassium sulphate ; Solubility of —— in concentrated solutions of non-electrolytes. J. J. Fox and A. J. H. Gauge. Trans. Chem. Soc., 1910, 97, 377—385.

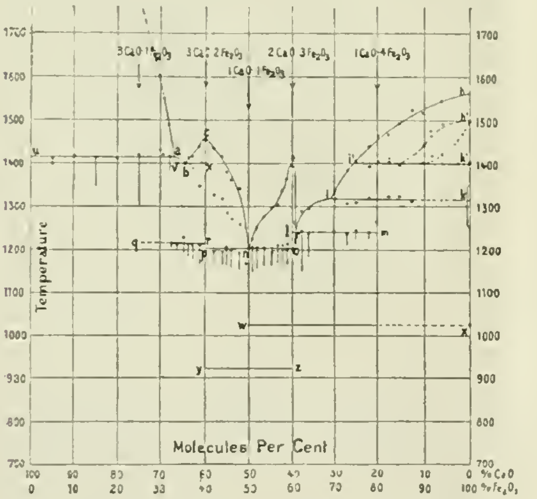
It has already been shown (this J., 1909, 521) that the solubility of potassium sulphate in water at 25° C. is decreased to a marked extent by the presence of potassium acetate and that the rate of decrease is greatest with dilute acetate solutions. The effect of certain non-electrolytes at the same temperature on the solubility of potassium sulphate, has now been tried. The substances selected were ethyl alcohol, ethyleneglycol, glycerol, mannitol, chloral hydrate, sucrose, acetone, and pyridine. In all these cases the solubility is depressed, although the effect is less pronounced with potassium acetate ; as a rule, also, the rate of decrease is greatest with the dilute solutions. Plotting the solubilities against the percentage composition of the aqueous solution, it is found that, as the number of hydroxyl groups in the molecule increases, the precipitating effect of the non-electrolyte decreases. Thus, alcohol and chloral hydrate are of much more influence than glycerol or sucrose. The greatest precipitating effect is possessed by acetone.—F. SODN.

Perborates ; The assay of ——. E. K. Farrar. J. Soc. Dyers and Col., 1910, **26.** 81—82.

A KNOWN weight of the perborate in the solid condition is added to an excess of a solution of ferrous-ammonium sulphate in water, which has been acidulated with sulphuric acid. Potassium thiocyanate is next added as an indicator and the ferric iron is estimated by titrating the solution with a standard solution of titanous chloride. An alternative method of analysis consists in adding a known amount of the perborate to a known amount of titanous chloride solution, which must be in excess (the operation being performed in an atmosphere of carbon dioxide). The excess of titanous chloride is then estimated by means of a standard solution of iron alum, again using potassium thiocyanate as indicator.—P. F. C.

Calcium ferrites. E. J. Kohlmeyer and S. Hilpert. Metallurgie, 1910. **7.** 225—245.

IN continuation of previous work (see this J., 1910, 85), an equilibrium diagram was obtained from the cooling curves of the fused products of forty-four mixtures of lime and ferric oxide, containing from five to ninety-five per cent. of lime (see fig.). The melted product was analysed in each case. The formation of five calcium ferrites is indicated by the diagram, corresponding to the following compositions, $3CaO,Fe_2O_3$; $3CaO,2Fe_2O_3$; CaO,Fe_2O_3; $2CaO,3Fe_2O_3$; and $CaO, 4Fe_2O_3$. The first and last of these were not fusible without decomposition. All the ferrites evolved oxygen when strongly heated, the loss increasing with time and temperature as well as with the ferric oxide content. The compound, $CaO.Fe_2O_3$, had the lowest melting point. 1200°C., and crystallized in needles. The commencement of the melting point curves was as a rule at the eutectic point, and the formation of ferrite began before the melting point was reached. The latent heat of fusion was greater when the lime was in excess, than when the ferric oxide predominated. The specific gravity did not increase proportionally to the ferric oxide content. From pure ferric oxide to the equimolecular composition, the specific gravity was very little less than the value for ferric oxide, and from this composition it fell rapidly till that of lime was reached. It was found that the ferrites were attacked by solvents with greater difficulty than the corresponding silicates. The melting point of the mixture corresponding to CaO, Fe_2O_3, SiO_2, was 1220° C. The temperature of reduction of ferric oxide by hydrogen was found to be 293° C., and the effect of an increase in the lime content was to raise the temperature in some cases, and to lower it in others, without being in any way in accord with the equilibrium diagram. —A. H. C.



Bromine ; Colorimetric determination of small quantities of ——, in the presence of large quantities of chlorine and small quantities of iodine. W. J. Dibdin and L. H. Cooper. Analyst, 1910, **35,** 159—161.

THE process depends on the liberation of bromine and iodine by the interaction of free chlorine with a bromide and an iodide. The authors have found that bromine and iodine are not so soluble in a strongly acid aqueous solution of chlorine, as in chlorine water *per se*, but that iodine is the more soluble in the acid solution. The method is based on this difference of solubilities. A convenient quantity of the sample is placed in a Nessler glass of 100 c.c. capacity, 10 c.c. of sulphuric acid (50 per cent. by vol.) are mixed thoroughly with the sample, and a saturated aqueous solution of chlorine is added gradually until a maximum coloration is obtained. In a number of estimations made thus, using known quantities of bromides and iodides, figures were obtained for bromide found with an error of from + 0·013 to − 0·0003 grm. per litre, and it is pointed out that the error varies with the amount of iodine present ; in a solution containing half as much iodine as bromine, the results are fairly accurate, and when the solution contains one-third as much iodine as bromine, the results are very accurate.

Iodine may be determined in a similar manner, using instead of chlorine-water, bromine-water, prepared by dissolving 2 c.c. of bromine in 200 c.c. of concentrated hydrochloric acid, and diluting 20 c.c. of the solution to one litre.—E. C. V-E.

Sulphides ; Action of sulphur-solvents on metallic ——. E. Jordis and E. Schweizer. Z. angew. Chem., 1910, **23**, 577—591.

METALLIC sulphides were prepared in the wet and in the dry way, and extracted with carbon bisulphide, benzene and ethyl alcohol, in a modified form of Soxhlet extractor. The authors conclude that : (1). Sulphides corresponding with the formula, MS_n, are exceptional and obtainable only under special conditions by igneous synthesis. (2). When prepared in the wet way, sulphides always contain water, even after drying at 100° C., and nearly always contain sulphate, which is only partly due to oxidation ; SH-groups are common, and the sulphides usually contain more than their equivalent amount of sulphur. (3). The amount of free sulphur is not equivalent to the amount that would be produced from hydrogen sulphide by the reduction of "metalli-sulphide" to "metallo-sulphide," as was formerly supposed ; nor does its amount increase with rising temperature, as it should according to the old theory ; on the contrary it decreases. (4). The results of the interaction of metals and sulphur at high temperatures depend on the temperature, time, and pressure, and are different for each metal. (5). Most sulphides lose sulphur, when extracted with a sulphur-solvent, the degree of desulphurisation varying with the method of preparation and previous history of the sulphide. Sulphides, prepared in the wet way, and certain minerals, lose more sulphur the higher the boiling point of the solvent used for extraction, the above-mentioned sulphides being at times very considerably decomposed. The amount of sulphur left in a sulphide after extraction, is usually less than the equivalent amount, but the appearance of the sulphide remains practically unaltered. (6). In the case of multivalent metals, the lower sulphides are more stable than those that contain more sulphur relatively to metal, the mineral marcasite, which is very stable, being an unexplained exception. (7). More sulphur is lost when the extraction takes place in the presence of water, certain precipitated sulphides being quantitatively decomposed with formation of hydroxides. The hydroxidation, however, is not brought about by the action of the water as such, but is due to constitutional peculiarities of the sulphides in question. (8). All the observations tend to prove that sulphur does not quite lose its physical roperties, more especially its vapour pressure, when in ombination with metals ; in the case of sulphides prepared the wet way, the chemical properties of the solutions, pecially those of the OH- and SH-groups, also come into lay. (9). The sulphides can be ranged in a series of creasing stability, the extremes being very easily decom- osed on the one hand, and very stable on the other. 0). Sulphides, which form colloidal solutions with hydro- n sulphide, yield colloids containing more sulphur than e original solid sulphides. (11). When sulphides of the avy metals are precipitated for analytical purposes, e actual composition of the precipitates must be deter- ned, for which purpose the author recommends his ethod of extraction, the process being also applicable r determining the vapour pressure of the sulphur present sulphur-containing compounds.—O. R.

lkali formates ; Reducing action of —— on certain inorganic compounds. M. Vournasos. Comptes rend., 1910, **150**, 922-923

continuation of his work on the reducing action of the scent hydrogen produced on heating alkali formates his J., 1910, 351), the author has found that a mixture alkali formate and boron nitride yields amorphous ron and a gaseous mixture of hydrogen, ammonia, and drogen boride, which burns with a greenish flame. orates and metaborates are not reduced on heating ith alkali formate. Most metallic compounds, according the author, are reduced to the metal, this being the se for example with alkali tungstates, molybdates, nadates, and uranates, and the chlorides of tungsten, olybdenum, vanadium, and uranium. The method ay be used for the toxicological detection of mercury. he substance is heated with sodium formate, and the drogen gas liberated, charged with mercury vapour, ignited, the flame being directed against a plate of glazed porcelain ; the mercury produces a black stain. eduction of metallic nitrates by sodium formate some- mes takes place explosively.—A. S.

rbon bisulphide ; Change of —— into a gaseous product condensable and explosive near the temperature of liquid air. J. Dewar and H. O. Jones. Proc. Roy. Soc., 1910, **A83**, 526—529.

HE authors find that, when a rapid current of carbon sulphide vapour, at a pressure of about 1 mm., is bmitted to the action of the silent electric discharge, is partially decomposed into sulphur and a new volatile lphide of carbon, probably carbon monosulphide ; is is condensed, along with unchanged carbon bisulphide, the temperature of liquid air, and polymerises at a ghtly higher temperature with explosive violence, to ve a brown solid which is apparently identical with the own polymeric form of carbon monosulphide (this J., 10, 487). The new gas is not completely destroyed passing the gaseous mixture from the ozoniser pidly through a short length of red hot tube ; it quickly lymerises at the ordinary temperature, even at low essures and in the presence of a large excess of carbon sulphide.—F. Sodn.

rrous compounds of nitric oxide. W. Manchot and F. Huttner. Annalen, 1910, **372**, 153—178.

HE amount of nitric oxide taken up by ferrous sulphate s been determined in a special apparatus under various nditions. Ferrous sulphate solution was tried at different ncentrations, then with the addition of varying amounts sulphuric or hydrochloric acids, also of certain organic lvents. Under none of these circumstances was it found ssible to make compounds containing for one atom iron more than one molecule of nitric oxide. When cohol is added to a concentrated solution of the compound ferrous sulphate with nitric oxide, a dark brown crystal- e substance is precipitated. It has the composition, eSO_4, NO, $13H_2O$, but loses nitric oxide on standing. It ystallises in small quadrangular tablets. A solution of rous sulphate was saturated with nitric oxide and allowed drop into ice-cold, concentrated sulphuric acid. Small red crystalline leaflets separated out, which had the composition, $FeSO_4,NO$. The author points out that in the ferrous sulphate test for nitrates, concentrated sulphuric acid and a considerable excess of ferrous sulphate must be used.—F. Sodn.

Coke ; The action of —— on solutions of ferric chloride. A. Tingle. J. Amer. Chem. Soc., 1910, **32**, 540—541.

The author's observation (this J., 1909, 522) of the removal of iron from ferric chloride solution by means of coke has been extended to coke carefully freed (by boiling with *aqua regia*) from sulphur compounds. No iron was taken up by coke thus purified, from an approximately N/10 solution of ferric chloride under a variety of conditions, though a part of the salt was reduced to the ferrous condition.—W. H. P.

Silicates ; Chemistry of metallic ——. E. Jordis and P. Lincke. J. prakt. Chem., 1910, **81**, 289—314. (See also this J., 1906, 1043 ; 1908, 334.)

The authors have investigated the reaction between solutions of ferric chloride and sodium silicate. The chief result is the proof obtained of the importance of time as a factor in the reaction, in addition to the effects produced by variations in the concentration and temperature. The course of the reaction can be followed by quantitative analysis. The colloidal phenomena, which are typical ones, were closely studied. In all cases it was found that the gel formed was not simply a colloid existing previously as a sol, but that the difference is a chemical and not a physical one.—A. Sbld.

Corrosive sublimate and calomel ; The system ——. W. P. A. Jonker. Chem. Weekblad, 1909, **6**, 1035—1038. Chem. Zentr., 1910, **1**, 1417.

Mercuric chloride melts at 277° C. and boils at 301° C. On gradual addition of mercurous chloride, the melting point sinks to 271° C., the eutectic point ; the eutectic contains less than 12 per cent. of mercurous chloride. If so much mercurous chloride be added that on boiling, a portion remains behind in the solid form, the b.pt. of the solution is 304° C., and it contains 12 per cent. of the mercurous compound. Mercurous chloride appears to sublime at 373° C.—A. S.

Chlorides of boron and arsenic ; Reduction of —— by means of hydrogen and the silent electric discharge. A. Besson and L. Fournier. Comptes rend., 1910, **150**, 872—874.

The authors have subjected the chlorides of arsenic and boron in the presence of hydrogen to the action of the silent electric discharge (see this J., 1910, 151). In the case of arsenic a mirror is formed and a black powder. The product has approximately the composition, $As_{11}Cl$. When heated in a vacuum it is decomposed into arsenic trichloride and metallic arsenic. When boron trichloride and hydrogen are passed through the apparatus, sparking takes place. Free boron was obtained, but there was no evidence of the formation of a subchloride.—F. Shdn.

Dizinc-formaldehydesulphoxylate. W. Becker. Ber., 1910, **43**, 856-857.

Eighty grms. of zinc dust were mixed with 400 grms. of water, and the mixture saturated with sulphur dioxide, being cooled during the operation. The calculated quantity of formaldehyde, in aqueous solution, was then added, and the solution filtered, and allowed to stand for two days at a temperature of 6°—8° C. Crystals were thus obtained which, after purification with water, alcohol, and ether, had the composition and reducing power of Bazlen's dizinc-formaldehydesulphoxylate, $ZnSO_2$, CH_2O, $H_2O + 2H_2O$. By warming the original solution, after filtering, on the water-bath, for one hour, crystals of the compound, $ZnSO_2,CH_2O,H_2O$, were obtained. The anhydride, $Zn_2S_2O_7,C_2H_6$, mentioned by Bazlen (Ber., 1909, 42, 4635), could not be obtained from the last-mentioned compound even by slow dehydration *in vacuo*. Both of the zinc compounds prepared are stable in the air at the ordinary temperature, but decompose at 50° C.—A. S.

Ionisation of gases and chemical change. H. Brereton Baker. Royal Institution, March 11, 1910. From separate copy presented by author.

Since it has been shown that the so-called ionisation of gases by the action of Röntgen rays, radium, etc., is different from the ionisation or electrolytic dissociation taking place in electrolysis, the author suggests the name electromerism for the former process, the electron being termed the negative electromer. Experiments were made as to the influence of electromerism in inducing or accelerating chemical change. When oxygen was introduced into a mercury vapour lamp from which the current had just been cut off, mercuric oxide formed, although the temperature (about 150° C.) is far lower than that at which combination of ordinary mercury vapour with oxygen would take place. In other experiments, mixtures of hydrogen and nitrous oxide were heated in tubes of Jena glass, one containing some lime, which is known to produce electromers in a gas when heated, whilst the other contained an equal quantity of powdered Jena glass. In the first five minutes after the temperature of interaction was reached, the rate of combination in the tube containing lime was about five times as great as in the other tube. When heated in presence of about 2 mgrms. of radium bromide, the gases combined with explosive violence. It is known that hydrogen sulphide and sulphur dioxide do not interact at the ordinary temperature unless liquid water is present. The two gases were dried by means of calcium chloride, which leaves about 4 mgrms. of water vapour per litre in the gas, and were then mixed and left in contact with an open silica tube containing about 2 mgrms. of radium bromide. After six hours, on opening the containing vessel, there was an inrush of air, and the contents were almost odourless. On heating the silica tube a large quantity of water was driven off and a copious sublimate of sulphur was observed. It appeared that the whole of the gaseous mixture had condensed in the small tube containing the radium bromide. It is probable that water vapour was condensed on the electromers produced by the radium bromide, and that the chemical action took place in the drops of liquid water thus formed. The author has observed that although radium salts are not deliquescent, the crystals remaining quite sharp-edged on exposure, water collects in tubes containing them when exposed to undried air; thus 1·5 mgrms. of water were deposited on 10 mgrms. of radium bromide exposed to an atmosphere saturated at 0° C.—A. S.

Helium; Gases containing ——, from the German potash deposits. E. Erdmann. Ber., 1910, 43, 777—782.

In one of the Leopoldshall workings a blower of inflammable gas has been issuing, at a depth of 450 metres, since August, 1904. The gas contains 83·6 per cent. of hydrogen, 4·4 of methane, and 12 of other gases, including helium and neon. The helium greatly preponderates over the neon, but the two together form about 0·17 per cent. of the original gas, or nearly 1 per cent. of the gas after removal of the hydrogen. The author calculates that at least 12 cb. m. of the above gases have escaped since the blower was tapped. He attributes the existence of the helium to the degradation of radium salts originally contained in the waters of the sea which furnished the deposits, and he regards the hydrogen as resulting from the radioactive decomposition of water, the equivalent oxygen having disappeared in converting ferrous into ferric salts in the carnallite.—J. T. D.

Nitrides and oxides extracted from aluminium which has been heated in the air. Kohn-Abrest. *See* X.

Tannage with the residues of monazite after the extraction of the thorium. Parenzo. *See* XV.

Volumetric analysis of barium salts. Selvatici. *See* XVII

Determination of sulphuric acid by the benzidine method especially in presence of chromium. v. Knerre. *Se* XXIII.

Determination of free bromine and chlorine, combine iodine, and oxidising agents. Perkins. *See* XXIII.

Patents.

Sulphuric acid; Process and apparatus applicable to th manufacture of ——. H. Klencke. Harburg a/d Elbe, Germany. Eng. Pat. 25,027, Oct. 30, 1909 Under Int. Conv., Nov. 7, 1908.

To enable fluoriferous material to be utilised in the manufacture of sulphuric acid by the chamber process, th furnace gases are first passed through a tower, down whic Glover acid is trickling, but which is void of filling material The gases, thereby cooled below the melting point of lead are then passed through denitrating towers, filled wit perforated lead plates, down which nitrated acid trickles Both towers, or sets of towers, stand on lead trays, an are provided at the bottom with cleaning holes, seale by the liquid in the trays, through which gelatinous silic and other obstructing deposits can be convenientl removed.—O. R.

Sulphuric acid; Process for the manufacture of —— i lead chambers. Scherfenberg und Prager. Ger. Pat 219,789, May 30, 1908.

The chambers are provided with perforated, uprigh partitions, the sides of which are arranged stepwise, s that the cross-section of the partitions diminishes fron below upwards. The faces of the partitions are provide with corrugations, projections, etc., in order to increas the surface, and the water required for the productio of the sulphuric acid is sprayed against these partitions. —A. S.

Oxalic and other carboxylic acids; Manufacture of —— A. Deiss and C. J. Fournier. Fr. Pat. 406,722, Sept. 2 1909.

Waste cellulose, derived from waste paper, wood pulp, o vegetable fibres of any kind, is treated with causti alkali of 35° to 40° B. strength, and the mixture is subjecte to the action of air and superheated steam in an autoclave The most suitable temperature for the production o oxalic acid is from 220° to 230° C., other vegetable acid being formed at lower temperatures.—O. R.

Nitric acid; Apparatus for the manufacture [distillation of ——. F. L. Nathan and J. M. and W. T. Thomson Fr. Pat. 406,806, Sept. 6, 1909. Under Int. Conv. April 29, 1909.

Sodium nitrate, or waste acid containing nitric acid, i distilled with sulphuric acid in a cast iron retort, and th vapours are passed through stoneware connections all the joints of which are vertical, into a system o upright condensing worms. The vapours enter th condensers at the bottoms of the worms and pass in a upward direction, the condensers being situated radiall about the vertical, main, stoneware pipe, conveying th vapours. The latter pipe terminates in a receiver, whic is placed immediately under the branches connecting wit the condensers. The worms are cooled, in a decreasin degree downwards, by means of cold water jets, whic impinge on the upper coils and drip slowly on to the lowe coils. Nitric acid is thus condensed hot, the more volatile lower nitrogen oxides being only very partially condensed and escaping for the most part at the tops of the condensers where suitable provision is made for their removal b suction.—O. R.

Nitrous gases; Preparation of concentrated —— from dilute nitric acid. Salpetersäure Ind.-Ges. m.b.H. Fr. Pat. 407,133, Sept. 15, 1909.

NITRIC acid vapours are heated above the dissociation temperature of nitrogen peroxide, say above 600° C., and the resulting mixture of gases is suddenly cooled, with or without the admixture of an inert gas, such as air admitted at as low a temperature as possible.—O. R.

Acetic acid from calcium acetate; Process for obtaining —— by decomposition with sulphuric acid. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 220,705, Aug. 14, 1907.

CALCIUM acetate is heated to about 130° C., and the containing-vessel is exhausted until the pressure is about ⅓ atmos. A mixture of concentrated sulphuric acid (about 55 per cent. of the weight of the acetate) with an equal volume of concentrated acetic acid, is run in; distillation of the acetic acid commences at once. The distillate is colourless, and contains only small quantities of sulphur dioxide. The yields are stated to reach 94 to 95 per cent. of the theoretical yield.—T. F. B.

Alkali carbonates; Manufacture of ——. J. Wetter, London. From J. D. Riedel Akt.-Ges., Berlin. Eng. Pat. 27, 126, Nov. 22, 1909.

ARTIFICIAL zeolites are first prepared by fusing aluminium silicates with an alkali carbonate, and are converted into ammonium-zeolites by means of ammonium carbonate solution, alkali carbonates being at the same time regenerated. The ammonium-zeolites are re-converted into alkali-zeolites by treatment with the solution of a salt, such as the chloride, sulphate, etc., of an alkali metal, and are then again used for the manufacture of alkali carbonates.—O. R.

Ammonia; Process for obtaining —— from atmospheric nitrogen by leading air and steam over peat or other carboniferous materials at temperatures below 500° *C.* G. Jones and P. Suarez. Ger. Pat. 220,670, June 29, 1909.

IN the manufacture of ammonia by passing air and steam over peat heated to a temperature below 500° C., a portion of the resulting gases, after the removal of tar, ammonia, acetic acid, etc., and consisting essentially of carbon dioxide, nitrogen, and steam, is introduced into the lower portion of the reaction-chamber, below the peat, where it is mixed with the necessary amount of air, and again passed over the peat. The pipes leading the gas from the purifying plant back to the reaction-chamber are protected to prevent loss of heat. It is stated that by this method of working, not only is there a considerable saving of steam, but also the temperature of the reaction-chamber can be more easily regulated.—A. S.

Sodium-aluminium fluoride; Production of ——. A. Humann and E. O. Teisler, Dresden, Germany. Eng. Pat. 27,231, Nov. 23, 1909.

AN intimate mixture of very finely divided alumina, or other aluminous material, sodium silicofluoride, and sodium carbonate, is heated to about 100° C. in the presence of water, with the formation of sodium-aluminium fluoride and silica, the reaction being expressed by the equation,

$$2Na_2SiF_6+Al_2O_3+Na_2CO_3=Al_2F_6,6NaF+CO_2+2SiO_2.$$

—O. R.

Waterglass [alkali silicate]; Process for the production of a solution of ——. K. von Schmoll, Vienna. Eng. Pat. 29,669 of 1909; date of application, Dec. 18, 1908.

SILICIOUS material, such as kieselguhr, kaolin, etc., is heated with a flux, such as boric acid, and the fluxed product, whilst still hot, is acted on by a cold ammoniacal solution of an alkali chloride. Alkali silicate is found in the resulting solution after cooling, and a further quantity can be obtained from the residue by lixiviation.—O. R.

Antimony compounds; Process of making ——. P. Boessneck, Assignor to M. B. Vogel, Leipzig, Germany. U.S. Pat. 952,704, March 22, 1910.

ANTIMONY oxide is dissolved in sulphurous acid in the presence of an alkali fluoride.—O. R.

Ammonia-saturator. H. Koppers, Essen-on-Ruhr, Germany. U.S. Pat. 953,960, April 5, 1910.

THE inlet pipe for the ammoniacal gases ends in an annular distributing pipe provided with inclined ducts.—O. R.

Lead hydride; Use of magnesium for the preparation of metallic hydrides, particularly ——. M. M. J. Bouffort. First and Second Additions, dated Sept. 9, 1909, to Fr. Pat. 401,473, April 1, 1909 (this J., 1909, 1126).

(1). MERCURY hydride is prepared by immersing magnesium in a mixture of magnesium acetate and mercuric acetate solutions. (2). Aluminium is immersed, first in a mixture of ammonium and sodium acetate solutions, and then in a solution of lead acetate, with formation of lead hydride.—O. R.

Cyanamide; Process and apparatus for treating —— to form ammonia and ammonium sulphate. Comp. pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. Fr. Pat. 407,164, Dec. 22, 1908.

CALCIUM cyanamide is treated with waste ammoniacal liquors, and the mixture is subjected to steam distillation under pressure in a vertical autoclave. Ammonia is evolved, and passes out of the top of the autoclave, through two condensing worms fitted with regulating valves. The two worms terminate in a common delivery pipe, which leads the ammonia into a vessel containing sulphuric acid, and the tops of the two condensers are cooled to below 100° C., so that condensed water flows back into the autoclave. Towards the end of the operation the speed of distillation is increased, so as to ensure the maximum possible evolution of ammonia from the residual slimes.—O. R.

Hydrogen peroxide or solutions of the same; Process for the preparation of pure —— by distillation. Chem. Fabr. Flörsheim H. Noerdlinger. Ger. Pat. 219,154, Dec. 14, 1906.

SOLUTIONS of hydrogen peroxide are distilled at temperatures below 85° C. with the aid of a powerful current of an inert gas, preferably air.—A. S.

Nitrites; Process for the conversion of —— into nitrates by means of nitric acid. Badische Anilin und Soda Fabrik. Ger. Pat. 220,539, Feb. 16, 1909.

NITRITES or mixtures of nitrites and nitrates such as are obtained in processes for the utilisation of atmospheric nitrogen, are treated with nitric acid, and the nitrous vapours produced are mixed with such a quantity of oxygen, or a gaseous mixture containing oxygen, that the atomic ratio of the total oxygen to the combined nitrogen is as nearly as possible 5 : 2. The gases can then be absorbed in water (or aqueous solutions) in a relatively small absorption apparatus, yielding concentrated nitric acid. In using the process in connection with the manufacture of nitric acid and nitrates from atmospheric nitrogen, the oxygen is added in the form of the gaseous mixture obtained by the combustion of atmospheric nitrogen, and the solution of nitrite and nitrate obtained in a later stage of such manufacture is used for the absorption of a part of the nitric acid, and is then added to another portion of the nitrite-nitrate mixture in order to convert it wholly into nitrate.—A. S.

Hydrocyanic acid; Process of producing ——. O. Dieffenbach and W. Moldenhauer, Darmstadt, Germany. U.S. Pat. 954,080, April 5, 1910.

SEE Fr. Pat. 389,469 of 1908; this J., 1908, 981.—T. F. B.

Sulphuric anhydride ; Catalytic apparatus for making ——. Société de la Fabrique de Produits Chimiques de Tentelewa. Fr. Pat. 407,914, Oct. 15, 1909.

See Eng. Pat. 23,419 of 1909 ; this J., 1910, 422.—T. F. B.

Sulphuric acid manufacture ; Process for avoiding irregularities, corrosion, and obstruction arising from the presence of fluorine in pyrites furnace gases, in towers and chambers used in ——. H. Klencke. Fr. Pat. 408,417, Oct. 29, 1909. Under Int. Conv., Nov. 7, 1908.

See Eng. Pat. 25,027 of 1909 ; preceding.—T. F. B.

Barium compounds [hydroxide] ; Process of making ——. C. Rollin, and Hedworth Barium Co., Ltd. Fr. Pat. 408,677, Nov. 6, 1909. Under Int. Conv., Dec. 18, 1908.

See Eng. Pat. 27,587 of 1908 ; this J., 1910, 151.—T. F. B.

Ammonia from atmospheric nitrogen ; Process of making —— by passing air and steam over heated peat. J. G. Jones and P. Suarez. Fr. Pat. 408,771, Nov. 9, 1909.

See Ger. Pat. 220,670 of 1909 ; preceding.—T. F. B.

Antimony ; Compounds of ——. J. Wetter, London. From M. B. Vogel, Leipzig-Lindenau, Saxony. Eng. Pat. 22,384, Oct. 1, 1909.

See U.S. Pat. 952,704 of 1910 ; preceding.—T. F. B.

Zinc sulphide ; Manufacture of ——. Soc. Chim. des Usines du Rhône (formerly Gilliard, P. Monnet, et Cartier), Paris, and J. C. A. Meyer, Lyons, France. Eng. Pat. 23,209, Oct. 11, 1909. Under Int. Conv., Nov. 19, 1908.

See Fr. Pat. 396,541 of 1908 ; this J., 1909, 600. (Reference is directed to Eng. Pat. 10,225 of 1907 ; this J., 1908, 335.)—O. R.

Ammonium sulphate from gas ; Process of recovering ——. H. Koppers, Essen on Ruhr, Germany. U.S. Pat. 953,959, April 5, 1910.

See Eng. Pat. 2399 of 1908 ; this J., 1908, 742.—T. F. B.

Calcium carbide ; Process for treating —— to make it into briquettes or blocks. C. C. Wakefield. Fr. Pat. 407,988, Sept. 25, 1909. Under Int. Conv., Jan. 20, 1909.

See Eng. Pat. 1424 of 1909 ; this J., 1910, 277.—T. F. B.

Aluminium-sodium fluoride ; Process for preparing ——. Humann und Teisler. Fr. Pat. 408,134, Oct. 20, 1909.

See Eng. Pat. 27,231 of 1909 ; preceding.—T. F. B.

Sodium peroxide ; Process for removing objectionable gases, especially carbon dioxide, from ——. D. E. Parker. Fr. Pat. 408,476, Oct. 30, 1909.

See U.S. Pat. 935,542 of 1909 ; this J., 1909, 1126.—T. F. B.

Concentrating soda lyes by evaporation. Fr. Pat. 406,997. *See* I.

VIII.—GLASS ; CERAMICS.

Glass and porcelain ; Decoration of ——. O. Parkert. Sprechsaal, 1910, **43**, 200—201.

New possibilities in decorating glass and ceramic ware have been opened up by the use of reduction colours. If a silver mirror be formed by dipping a piece of ware in a solution of a silver salt and reducing with sugar and tartaric acid, many varieties of red and blue can be obtained by treating it with potassium permanganate solution for varying periods. If the permanganate be applied only in places, iridescent effects are obtained. Similar colours are given by gold, which is best applied in the form of the chloride dissolved in a solution containing 10—15 grms. of sodium chloride per litre. The ware should be dried in a dark room. It is over-glazed and fired in a muffle. The colour effects are quite permanent.—H. H. S.

Stoneware ; Painting on ——. E. Büttner. Sprechsaal, 1910, **43**, 179—180.

The best paste for mixing with the stains is made up of 3 parts of the glaze of composition,

$0{\cdot}3\ K_2O,\ 0{\cdot}2\ MgO,\ 0{\cdot}5\ CaO,\ 0{\cdot}5\ Al_2O_3,\ 3{\cdot}85\ SiO_2$;

and 1 part of the frit of formula,

$0.5\,PbO, 0.2\,CaO, 0.2\,Na_2O, 0.1\,K_2O, 0.2\,Al_2O_3, 1.5\,SiO_2, 0.4\,B_2O_3$.

The paste is applied with a paint-brush, and, to save a second firing, an over-glaze of various colours is carefully applied over the design. The stains which the author suggests should be mixed with 100 parts of the colourless over-glaze are :—(a), molybdenum trioxide, 0·5 ; cobalt oxide, 1·0 ; chromic hydroxide, 1·0 ; metastannic acid, 0·5 ; rutile, 8·0 grms. ; (b), molybdenum trioxide, 1·0 ; rutile, 1·0 ; ferric oxide, 2·0 grms. ; (c), molybdenum trioxide, 1·0 ; rutile, 10·0 ; copper oxide, 2·0 grms. ; (d), molybdenum trioxide, 1·0 ; cobalt oxide, 2·0 ; rutile, 10·0 grms. ; (e), molybdenum trioxide, 2·0 ; cobalt oxide, 4·0 ; rutile, 15·0 grms. ; (f), rutile, 15·0 ; nickel carbonate, 0·5 ; manganese oxide, 1·0 ; antimony trioxide, 1·5 grms.—H. H. S.

Stoneware ; A cheap enamel for ——. R. T. Stull. Trans. Amer. Ceram. Soc., 1909, **11**, 605—618. Sprechsaal, 1910, **43**, 199—200.

The author, continuing his previous work (this J., 1908, 1060), finds the most promising enamel, better than any obtained in the former experiments, to be one with the composition—

$0{\cdot}33\ Na_2O,\ 0{\cdot}33\ MgO,\ 0{\cdot}33\ ZnO,\ 0{\cdot}43\ Al_2O_3,\ 3{\cdot}4\ SiO_2$.

The soda was introduced as soda felspar, the magnesia as Grecian magnesite. The enamel matures at cone 8. Magnesia has as good an opacifying effect as the same molecular quantity of zinc oxide.—H. H. S.

Patents.

Glass-heating furnace. T. W. Frech, jun., Assignor to The National Electric Lamp Co., Cleveland, Ohio. U.S. Pat. 952,517, Mar. 22, 1910.

A circular table, which moves up and down on a vertical axis, and carries the glass articles to be heated, forms, when in its upper position, the floor of a bottomless muffle-furnace ; the table is fitted with an overlapping flange, which serves to seal the muffle.—O. R.

Glass in continuous sheets ; Apparatus for the manufacture of ——. E. Rowart, Auvelais, Belgium. Eng. Pat. 8594, April 8, 1909.

See Fr. Pat. 397,505 of 1908 ; this J., 1909, 795.—T. F. B.

Glass ; Mode and means for manufacture of sheet ——. F. M. Oppermann, St. Servais, Belgium. U.S. Pat. 954,457, April 12, 1910.

See Eng. Pat. 20,975 of 1907 ; this J., 1908, 124.—T. F. B.

Ceramic colour. Schmidt, Kasseker, und Co. Fr. Pat. 407,954, Oct. 16, 1909.

See Eng. Pat. 23,852 of 1909 ; this J., 1910, 278.—T. F. B.

IX.—BUILDING MATERIALS.

Wood ; Behaviour of fluorides in the preservation of ——. R. Nowotny. Oesterr. Chem.-Zeit., 1910, **13**, 81—84.

Experiments made by various methods on the impregnation of wood (telegraph poles, etc.), with solutions of fluorides, with special reference to selective absorption, show that, when wood is steeped in a solution of zinc hydrogen fluoride, $ZnF_2.2HF$, containing free hydrofluoric acid, the solution is absorbed as a whole, no change in composition being observed. The surface of the treated wood becomes brown, but its quality does not suffer in any way. If, however, the solution be forced through the green wood by hydrostatic pressure, as in Boucherie's method, the ratio of zinc to fluorine in the liquor becomes greater, showing that fluorine is extracted from solution by the wood; the free hydrofluoric acid is extracted to a greater extent than the combined acid. Using a mixture of zinc chloride and sodium fluoride solutions (in proportions to give a clear solution), impregnation at the ordinary temperature by Boucherie's method again shows a change in the composition of the liquor as it passes through the wood, sodium fluoride being taken up, as shown by the increased ratio, Zn/F, and a similar result is obtained by forcing the solution into the well-dried wood by pneumatic pressure, at the ordinary temperature, the fluorine content of the liquor after use being less than in the original, though the percentage of zinc remains unchanged; this is shown in the following table:—

Content of the impregnating liquid.

Zinc.		Fluorine.	
Before.	After.	Before.	After.
per cent.	per cent.	per cent.	per cent.
1·03	1·03	1·02	0·91
0·91	0·89	0·75	0·61
0·71	0·70	0·04	0·86

—F. Sodn.

Trass; Testing of ——. M. Gary. Mitt. Königl. Materialprüfungsamt, 1910, **28**, 155—160.

Trass (powdered tuffstone) is passed through a sieve containing 900 meshes per sq. cm., dried at 98° C. to constant weight, and raised to a red heat for 30—40 minutes, to determine the combined water of hydration, which should be at least 7 per cent. The commercial product should leave not more than 20 per cent. residue on the above-mentioned sieve. 1 volume of trass, mixed with 1 volume of normal sand and 1 volume of "standard lime," should have a tensile strength of at least 14 kilos. per sq. cm. after 3 days in damp air at 15°—20° C. and 25 days under water. "Standard lime" is prepared by carefully burning the purest obtainable limestone, picking the burnt lime, slaking with water, rejecting the lowermost 25 per cent. of the slaked product, and sealing in air-tight vessels. To make briquettes for tensile tests, 1 kilo. of trass is mixed with 1·4 kilos. of "standard lime," which has previously been made into a paste and squeezed out until it retains about 43—46 per cent. of water, and the mixture is kneaded in a normal, edge-running, trass-gauging apparatus, 50 turns being employed. 1·5 kilos. of normal sand are then added, and the mixture is given 25 more turns in the edge-runner. The mortar is then taken out and dried to "earth-damp" consistence, *i.e.* till it can just be "balled" by hand. It is then rammed into moulds and subjected to 150 blows from a Böhme and Martens normal hammer.—O. R.

German sea water commission [action of sea water on cements and mortars]; Results of the ——. A. Dyckerhoff. Chem.-Zeit., 1910, **34**, 419.

Of Portland cements, those rich in lime and silica and poor in alumina were found to have the greatest resistance to sea water. Of mortars containing cement and sand, cement and trass, and trass, lime, and sand, the latter mixture was found to be the least resistant to sea water; it showed signs of disintegration after a few weeks in a sea water bath, and trass-lime-sand mortars consequently take the longest time to acquire sufficient hardness to allow of their being exposed to the influence of sea water with impunity.—O. R.

Portland cement; Behaviour of —— *in sea water.* A. Foss. Chem.-Zeit., 1910, **34**, 419.

A series of trial samples were frozen and thawed 3500 times without suffering appreciable damage. A mortar containing equal parts of cement and sand withstood the mechanical disintegration of sea water considerably better than a mortar containing 1 of cement to 3 of sand. In experiments extending over 8½ years, the following mixtures gave the most durable concretes: Cement, sand, and gravel, in the ratios of 1 : 2 : 4, and 1 : 2 : 5½, respectively.—O. R.

Slag-cement-concrete and cement-concrete; Action of German bog soils on ——. C. Goslich. Chem.-Zeit., 1910, **34**, 419.

The author states that German bogs contain up to "26 per cent. of hydrogen sulphide and ferrous sulphate," in consequence of which such soils have a very destructive action on Portland cement concrete. The latter is moreover appreciably affected, above the level of the bog surface water, by the oxidation of the sulphides formed. The author exposed Portland cement and slag-cement to the action of hydrogen sulphide for 28 days, and found that the content of calcium sulphide was thereby increased from 0·07 to 5·7 per cent. in the former, and from 2·46 to 9·24 per cent. in the latter. The oxidation of calcium sulphide to sulphate was also proved by analysis, and the author demonstrates how boggy soil causes cement to exhibit calcium sulphate swelling.—O. R.

Portland cement and slag-cement; Effect of the sulphur contained in ——. Goslich. Chem.-Zeit., 1910, **34**, 419.

The author prepared rods of Portland and slag-cement, and measured the expansion brought about by the oxidation of calcium sulphide to sulphate in each case. After 2—3 years the expansion noted in slag-cement was "nearly two to three times" as great as that observed in the case of Portland cement.—O. R.

Chimney; Repairing a concrete ——. Times Eng. Supp., April 7, 1910, 18.

An interesting piece of repair work has been carried out on a concrete chimney belonging to a small arms factory in New Haven, U.S.A. The foundations of the chimney formed part of a power house building, and rose to a height of 80 ft. above the foundation. The greater part of the intermediate length was cylindrical, with walls 4 in. thick. The chimney had developed longitudinal cracks of such a size as to allow the smoke to escape, while at other times air entered in such quantities as to render the draught insufficient. A 5 in. jacket of concrete, reinforced by 32 steel rods enclosed by horizontal hoops 6 in. apart, has recently been placed over the chimney above the foundation, and this was accomplished on the cylindrical portion of the chimney by means of a form consisting of a cylinder of 16-gauge iron braced with angle iron. This cylinder was 5 ft. high with an inside diameter of 5 ft. 8 in., and was composed of three sections divided vertically. A platform was also provided at the top of each section. The sections were placed round the chimney and bolted together, and the complete form was suspended by ropes and blocks from the overhang of the chimney. A length of 5 ft. of the chimney was then wrapped with asbestos felt to act as an expansion joint between the old and the new work, and concrete was filled into the space between the form and the chimney and closely stamped about the reinforcement. The following day the steel and asbestos were extended, and the form was taken apart and reassembled 4 ft. 10 in. higher up, leaving a lap of 2 in. This process was repeated until the whole chimney had been repaired.

Patents.

Kiln ; Gas-fired —— for burning bricks. J. W. D. Pratt, Oldbury. Eng. Pat. 21,901, Sept. 25, 1909.

In a continuous, gas-fired, chamber kiln, a series of gas inlets extends completely across one side, and a corresponding series of outlets extends completely across the opposite side of each chamber, a third set of apertures affording direct communication between adjacent chambers. In the upper part of the walls, which separate adjacent chambers, longitudinal flues are disposed for the admittance of cold air, these flues communicating with the third set of apertures by way of a series of downtake passages.—O. R.

Wood-preserving apparatus, and process of creosoting wood. P. F. Dundon, San Francisco, Cal. U.S. Pats. 952,887 and 952,888, Mar. 22, 1910.

(1). The apparatus comprises a main tank, which is connected with two receivers by means of pipes fitted with valves. The main tank and one of the receivers are provided with systems of enclosed pipes, which convey steam from a boiler for heating purposes, a branch from the boiler being also provided for passing steam directly into the receiver. An air-pump supplies the means of creating pressure in the other receiver, and of introducing liquid into the tank or that receiver alternately. (2). Water is extracted from the cells of wood, contained in a retort, by the application of steam and radiant heat. The material is then subjected to the successive actions of a vacuum, the preservative liquid at a temperature of 220° F. under pressure, and finally a vacuum again.—O. R.

Rotary kilns [for cement, etc.] ; Dryers for——. H. Walker, Misterton, Notts. Eng. Pat. 7769, April 1, 1909.

The slurry is fed by shoots from a store tank into a number of parallel troughs arranged above a series of parallel flues through which the hot gases from a rotary kiln pass on their way to the stack. The slurry is moved along the troughs towards the kiln by a chain scraper or a push-plate conveyor and the moisture is evaporated. From the far end of the troughs the dried slurry is fed into a rotary kiln by a screw conveyor.—W. H. C.

Cement ; Process of making hydraulic ——. J. M. Carreré, Assignor to Blanc Stainless Cement Co., Allentown, Pa. U.S. Pat. 953,258, Mar. 29, 1910.

Limestone is mixed with a natural "alkaline clay," and the mixture, which contains approximately 23 per cent. of silica, 9 per cent. of alumina, 3 per cent. of potassium oxide, and 64 per cent. of lime, is clinkered and pulverised. —O. R.

Mortar for use in building the linings of kilns for burning cement and the like. J. H. Schütt. Ger. Pat. 220,383, Dec. 12, 1908.

The mortar claimed is composed of cement clinker, cement, and slaked lime.—A. S.

Wood ; Process for preserving ——. J. Gerlache, Brussels. Eng. Pat. 8176, April 5, 1909.

See Fr. Pat. 396,235 of 1908 ; this J., 1909, 476.—T. F. B.

Cement ; Process of manufacturing ——. R. Tornyay-Schossberger, Budapest. U.S. Pat. 954,658, April 12, 1910.

See Fr. Pat. 396,600 of 1908 ; this J., 1909, 602.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Steels ; Definition of ——. Times Eng. Suppl., April 27, 1910.

On April 18 an important meeting of Sheffield steel manufacturers, convened by the Cutler's Company, was held for the purpose of considering the proposals of the Committee of the International Association for the Testing of Materials in regard to the definitions of iron and steel. It is considered that the proposals will lower the *status* of the higher classes of Sheffield products and will tend to facilitate fraud. The principal item in the committee's report which affects Sheffield is the recommendation that the term " blister steel," which has hitherto been given in the Sheffield trades to cemented Swedish wrought iron, or other wrought iron of similar quality, should in future be held to cover " steel made by carburising wrought iron, by heating it in contact with carbonaceous matter, which may also be made by carburising a low carbon steel." Prof. Arnold addressed the meeting, and pointed out how the proposal would permit inferior grades of material to be introduced into the trade with impunity. He showed how the proposal affected blister steel itself, and how ultimately it would involve the quality of both shear and crucible steel. It was stated that the report was now under revision, and that Committee No. 24 of the International Association had asked for comments. The following committee was appointed to watch over the interests of the crucible steel trade and to make all necessary communications to the International Committee :—The Master Cutler, Sir Joseph Jonas, Messrs. W. F. Osborn, Sydney J. Robinson, W. F. Beardshaw, and J. Rossiter Hoyle.

Carbon monoxide in presence of catalytic agents and in the blast-furnace ; Decomposition of ——. F. Zimmermann. Met. and Chem. Eng., 1910, **8**. 182-184.

Carbon monoxide, with or without admixed carbon dioxide, was heated in the presence of a finely divided metal or metallic oxide, to act as a catalytic agent, in a closed laboratory apparatus, for the purpose of determining the conditions which govern the decomposition of carbon monoxide into carbon dioxide and carbon. When finely divided metallic nickel, cobalt, or iron was used, practically the whole of the carbon monoxide present was converted into carbon dioxide and carbon, at temperatures between 300° C. and 445° C., but contrary to expectations the oxides of these metals did not act catalytically, the only reaction taking place being their partial reduction to metal. At 445° C. the carbon dioxide reacted with the metallic iron, forming iron protoxide and carbon monoxide, the latter in turn being decomposed by more metallic iron to carbon dioxide and carbon, and so on until practically no gas remained, the metallic iron becoming oxidised and solid carbon deposited. This oxidising action of carbon dioxide, however entirely ceased above 780° C. and the ordinary reducing action of carbon monoxide proceeded. The copious deposit of carbon occassionally occurring in the blast-furnace is thus explained by a sudden cooling of the zone of reduced iron to a temperature below 780° C., whereby the iron is oxidised and carbon liberated. An illustrated description is given of the apparatus used for the research.—F. R.

Iron ; Action of water and aqueous solutions on [rusting of] ——. III. E. Heyn and O. Bauer. Mitt. Königl. Materialprüfungsamt, 1910, 28, 62-137.

Whereas mild steel, wrought and cast iron show no appreciable differences as regards rusting in still water, differences arise when the water is in motion. In this case cast iron is on the whole more strongly attacked than malleable iron. The seeming advantage of mild steel over cast iron in this respect is, however, discounted by the fact that the former is attacked in a very irregular manner by running water, whereas cast iron rusts much more uniformly. The differences in the degrees of rusting of mild steel, wrought and cast iron, are less marked in a one per cent. solution of sodium chloride than in pure water. The degree of rusting depends on the velocity of the moving water, increasing with the latter up to a certain point, and then falling off again. Local variations in the rusting of iron in running water are due to the fact that it is impossible to cause the liquid to flow past every portion of the sample at the same rate. The result of this is, that the iron will contain portions having different electric potentials with regard to water, the parts in contact with the more quickly moving fluid having the higher potentials. These potential differences set up local, external, electrical action, which increases the rusting process still further, the phenomenon being more marked in the case of malleable than of cast-iron. The greater the velocity of the water, the deeper is the colour of the rust in all classes of iron, ferric hydroxide apparently predominating over ferrosoferric hydroxide in the rust which is formed. Rusting increases with the temperature of the water up to about 80° C., above which point the diminishing quantity of dissolved oxygen tends to retard the rusting more than the increased temperature accelerates it. The same more or less holds good for various aqueous solutions, the marked increase in the rusting action of sodium chloride solution between 18° and 40° C. (throughout this range the amount of rusting is nearly doubled) explaining the greater corrosion of iron in sea-water in tropical compared with temperate climates. In distilled water at 100° C., practically free from dissolved oxygen, iron is not perceptibly attacked. Very dilute solutions of sodium carbonate attack iron locally at high temperatures (95° C.)—O. R.

Electrolytic iron and some steels; Magnetic properties of ——. C. F. Burgess and J. Aston. Met. and Chem. Eng., 1910, **8**, 191-194.

In continuation of the research on the properties of electrolytic iron for electrical work (see this J., 1909, 1134 and 1201), data are given of a series of tests on the magnetic quality of various electrolytic irons, both as deposited and after subsequent melting and forging. A considerable variation of quality existed in the forged bars before annealing, not accountable by differences of purity, but when they were heated to 675° C. and slowly cooled, a practically uniform high quality resulted. Annealing at 1000° C. improved the quality for the lower ranges of magnetising force to a certain extent, but was less satisfactory than annealing at 675° C. Quenching from 900° C. caused slight deterioration for all magnetising forces. Data are also given of similar tests on various commercial steels, showing that refining improves the magnetic qualities but that the amounts of impurities generally met with in commercial practice do not result in serious deterioration of the quality. The heat and mechanical treatment is, however, of extreme importance and a comparatively low-grade steel may be greatly improved by judicious annealing.—F. R.

Steels; Hardness of quenched ——. A. Portevin and H. Berjot. Rev. Metallurgie, 1910, **7**, 61-75.

The authors have determined the hardness of various kinds of quenched steel by means of the Brinell ball method (ball 10 mm., pressure 3,000 kilos.) and the scleroscope devised by Shore. With suitable experimental precautions, more particularly the prevention of atmospheric oxidation of the samples during their thermal treatment, the determinations were made on the polished faces of cylindrical test-pieces, 22 mm. in diameter and 20 mm. in height. With cementation steels, the authors conclude that the results indicated by the Brinell apparatus are dependent on both the superficial hardness and the depth of carburisation, those obtained by the Shore instrument being independent of the latter factor, provided the amount of superficial carbon present exceeds 0·8 per cent. Taken together, the indications of the two instruments afford a good idea of both the depth of carburisation and the subsequent thermal treatment of the sample. The authors also find that, for ordinary cementation steels, (with water quenching) the maximum superficial hardness is reached by quenching at 725° C., the temperature for similar steels containing about 2 per cent. of nickel being 700° C. The extent of any subseqent heating may be accurately gauged—both as to the actual temperature attained, and the time of its duration—by means of the Shore apparatus. With regard to the measurement of the depth of carburisation of cementation steels, the authors conclude that microscopical methods are useless in the case of steels which have been heated subsequent to their manufacture.—W. E. F. P.

[Steel]. Phenomena of decantation in the electric furnace. C. Clausel de Coussergues. Rev. Metallurgie, 1910, **7**, 1-5.

According to Howe, one of the advantages of the electric furnace for the manufacture of steel is that the charge can be maintained in a molten condition for some hours after the addition of the usual deoxidants, "in order to allow the impurities to separate out" before tapping. This view is criticised by the author. While Howe appears to regard the impurities (oxides of iron, silicates, etc.) as solids held in suspension in the metallic bath, the author is of opinion that these materials exist therein in a state of solution, and that the time elapsing between the addition of the deoxidants and the tapping of the charge has no material influence in the quality of the product obtained. From his own observations, he concludes that the blow-holes, slag inclusions, etc., frequently present in steel castings, are produced during the solidification of the metal in the moulds: that there is an intimate relation between the blow-holes and the internal oxidation of the metallic bath; and that the settling of the deoxidised molten metal has no beneficial effect, since, if covered by a slag comparatively free from metallic oxides, it may be tapped at once with satisfactory results (being nearly chemically pure iron), while if the covering slag contains a notable proportion of metallic oxides, the metal will remain oxidised irrespective of the length of time allowed for settling.—W. E. F. P.

Electric steel furnaces; Alleged lack of uniformity in the charges of —— heated by induction. V. Engelhardt. Stahl u. Eisen, 1910, **30**, 663—666.

The author replies to statements by Grönwall (Met. and Chem. Eng., 1910, **8**, 34) who holds that as a result of a permanent difference in temperature between different parts of the bath, irregularities are found in the quality of the steel produced in electric furnaces. The temperature-variation in induction furnaces is attributed to alteration in resistance due to differences in the rate of consumption of the charge. The author argues that local heating can never be more than temporary, for if it were permanent, the metal at that point would soon be raised to its boiling point and the current would be interrupted. Further it is shown that in such furnaces there is a considerable amount of motion due to currents in the molten charge. These are due to electro-dynamic rather than thermal causes but they are quite sufficient to prevent local superheating in a molten charge. No lack of uniformity would be expected if the whole charge were run off and mixed in a large vessel before pouring into the moulds. In some cases however this is not done and only a portion of the charge is dealt with. The author is able to show however, from Harbord's analyses, that in these cases no appreciable difference in composition is obtained when (1), samples from different portions of the charge, and (2), different samples from the same portion are compared with properly taken average samples. In conclusion the author quotes written testimony to the uniformity of the product supplied by firms producing steel by induction furnace methods.—W. H. P.

Silicon-steels; Cementation of ——. L. Grenet. Comptes rend., 1910, **150**, 921—922.

Experiments were made with a soft steel containing 0·09 per cent. of carbon, 0·11 of silicon, 0·27 of manganese, 0·015 of phosphorus, and traces of sulphur; and a silicon-steel containing 0·05 per cent. of carbon, 3·2 of silicon, 0·19 of manganese, 0·03 of phosphorus, and 0·02 of sulphur. The silicon-steel could not be carburised to any considerable extent by means of wood charcoal, but after heating for 6 hours in contact with potassium ferrocyanide at 950°—1000° C., the outer layer (0·5 mm.) was found to contain 1·05 per cent. of carbon, as compared with 1·43 per cent. in the carbon-steel carburised under similar conditions. Neither of the carburised specimens contained graphite. The carburised silicon-steel could be heated for ½ hour at 800° C. without any separation of graphite. —A. S.

Titanium alloys; Application of —— in the steel industry. W. Venator. Stahl u. Eisen, 1910, **30**, 650—654.

THE author has prepared samples of steel on the large scale in a basic Siemens-Martin furnace, and has compared the behaviour of samples containing a very small percentage of titanium with those free from this metal. The samples received similar treatment except that half of each charge received an addition of high-percentage titanium alloy giving three specimens containing 0·14, 0·092 and 0·038 per cent. respectively. Careful analysis showed that the addition had practically no effect on the percentages of carbon, manganese, silicon, and phosphorus present. Mechanical tests however showed that the titanium had greatly improved the quality of the metal. A slight but decided increase in tensile strength was observed, while the results of various bending tests were all greatly in favour of the titanium steel. There was a remarkable difference in the fracture, the ordinary steel showing the usual granular section, while the titanium steel had a characteristic jagged stringy fracture, pointing to a much greater tenacity. The steel seems to be admirably suited for rails, for which purpose it is already largely used on American railways and also for such other purposes as bridge construction. The action of the titanium is evidently a purifying one and not essentially one of alloy formation. The author thinks its effect is largely reducing, though it may also be efficacious in removing deleterious traces of nitrogen.—W. H. P.

Silver amalgams. H. C. Jones. Trans. Chem. Soc., 1910, **97**, 336—339. (See also this J., 1893, 983.)

WHEN mercuric chloride acts on silver or an amalgam of silver and mercury, each atom of either metal combines with a molecule of the salt to form a double chloride, such as the compound, $AgHgCl_2$, and by reducing this with ferrous oxalate the metals may then be liberated together. In this way, by progressive treatment, a series of homogeneous amalgams of definite molecular composition are obtained, and those containing the metals in the proportions indicated by the formulæ, $AgHg$, $AgHg_3$, $AgHg_7$, $AgHg_{15}$, $AgHg_{31}$, and $AgHg_{63}$, have been prepared by the author. The double chloride, $AgHgCl_2$, reacts with an excess of sodium sulphite solution giving another amalgam of the composition represented by the formula, Ag_2Hg, and from this, by alternate treatment with mercuric chloride and ferrous oxalate, as above, a further series of amalgams, indicated by the formulæ, $AgHg_2$, $AgHg_5$, $AgHg_{11}$, etc., may be prepared. Granular silver, as obtained by the reduction of silver salts by means of zinc in acid solutions or by dextrose in the presence of alkali hydroxide, reacts most readily with mercuric chloride, and the double salt may be prepared by shaking the aqueous mixture and allowing it to stand; the reduction by ferrous oxalate (prepared by pouring 1 volume of a saturated solution of ferrous sulphate into 6 volumes of a saturated solution of potassium oxalate) is almost instantaneous. The amalgam, $AgHg$, when dried over sulphuric acid, is a grey non-adherent powder which can be easily burnished into a metallic film; its sp. gr. at 20° C. is 12·8099. When this amalgam is acted upon by mercuric chloride, a double chloride of the empirical composition, $AgHg_3Cl_4$, is obtained. This is a white powder resembling the chloride, $AgHgCl_2$; it is easily reduced to the amalgam, $AgHg_3$, which is an adherent powder, from which mercury may be separated by squeezing through wash-leather.—F. SODN.

Copper slags; Notes on the metal losses in ——. C. A. Grabill. Eng. and Min. J., 1910, **89**, 776—779. (See also this J., 1909, 1136.)

THE metal losses in slags may be divided into two classes, mechanical, and chemical. The former are mainly caused by admixture of matte with the slag through the use of inadequate settlers, or more rarely through insufficient difference between the specific gravities of the matte and slag, such as in the case of heavy barium slags or highly zinciferous mattes in the presence of highly ferruginous slags, or to the flotation of particles of matte caused by adhering bubbles of gas. Chemical losses include the solution of metals or metallic sulphides in the slag in addition to the slagging of metallic oxides. The flotation of particles of matte frequently occurs in slags from low-grade mattes, but only to a very small extent, except in the first tapping after a furnace has cooled somewhat through a temporary suspension of working, but under favourable conditions and with settlers of large capacity, mechanical losses should be very slight. Chemical losses are discussed in relation to the solubility of copper, gold and silver in the several constituents of the slag, and formulæ, illustrated by a curve, are given for approximately determining the amount of copper left in the slag with mattes of varying richness. In slags from low-grade mattes the copper occurs as dissolved metal and copper sulphide, while in slags from rich mattes and black copper it occurs as metal and oxide. Assays are given of a series of mattes and slags obtained from the same smelter under different conditions.—F. R.

Tin; Electrolytic deposition of ——. B. Pasztor. Elektrochem. Zeits., 1910, **16**, 281—285.

A SILVER white coherent deposit of tin was obtained in about thirty minutes by the electrolysis of a solution of stannic ammonium chloride, in which the anode was a rotating platinum plate, and the cathode a rotating cylinder of platinum gauze, which had been previously coated with an electro-deposit of copper, and using a current of eight ampères for a cathodic surface of 100 sq. cm. The electrolyte had a volume of 120 c.c. and contained about 0·2 grm. of tin, 4 to 6 grms. of tartaric acid, 2 grms. of ammonium acetate, and 1 grm. of hydroxylamine sulphate, and was at a temperature of 80° C. In eight experiments the error only varied between −0·0014 and +0·0003 grm. It was also found that tin sulphide was soluble in a hot solution of ammonium chloride in concentrated hydrochloric acid. This solution was neutralized by ammonium hydroxide and then freed from hydrogen sulphide, when the solution of tin ammonium chloride was electrolysed in a similar manner, after the addition of tartaric acid and hydroxylamine sulphate, with a loss of only 0·0005 grm. of tin. Formic acid was also used instead of tartaric acid with equal success.—A. H. C.

Nitrides and oxides extracted from aluminium which has been heated in the air. E. Kohn-Abrest. Comptes rend., 1910, **150**, 918—921.

WHEN aluminium powder is heated in air it increases in weight owing to absorption of oxygen and nitrogen. At 600° C. there is a relative maximum in the absorption of oxygen (8·8 per cent. in 2 hours), but practically no absorption of nitrogen. The product obtained was analysed by the method previously described (see this J., 1909, 839, 941). The oxide produced was not attacked by acids; it resembled alumina in its properties, but differed from the latter in composition, containing 16 of oxygen to 23·95 of aluminium. The unoxidised metal yielded a chloride, in which the ratio of metal to chlorine was 0·2630, and thus differing in composition from aluminium trichloride, in which the ratio is 0·2548. At 800° C. an appreciable quantity of nitrogen (in addition to oxygen) is absorbed by aluminium powder. At 1100° C., both oxygen and nitrogen are absorbed readily; after 6 hours no metallic aluminium is left, and the weight remains constant on further heating. Above 800° C., the absorbed nitrogen is gradually partly displaced by oxygen. Aluminium powder heated in an atmosphere of nitrogen at 900° C. absorbed 12·21 per cent. of the latter, and the product was not further altered by heating at 1100° C. in nitrogen. The nitride thus obtained differs from the compound, AlN, already known, the ratio of aluminium to nitrogen being 2·14 as compared with 1·92 for the latter.

When heated in air at temperatures above 800° C., it is converted into a white oxide containing less oxygen than alumina.—A. S.

Aluminium; Action of heat on —— in vacuo in presence of carbon. E. Kohn-Abrest. Bull. Soc. Chim., 1910, **7**, 277—283.

Carbon has an action upon aluminium similar to that of silicon when heated in contact with it to 1100° C. *in vacuo* (see this J., 1910, 217). An intimate mixture of aluminium filings and pure carbon was heated in a boat of alumina contained in an iron tube for 35 hours. A loss in weight equal to 27 per cent. of the aluminium used was observed, the residue consisting of a gray powder containing iridescent crystals. On treatment with acid a mixture of black opaque laminated crystals and clear brilliant ones was obtained, consisting apparently of a carbide of aluminium.—H. H.

Aluminium; Action of mercuric chloride and of water upon ——. E. Kohn-Abrest. Bull. Soc. Chim., 1910, **7**, 283—286.

The presence of a very small quantity of mercury in aluminium, such, for example, as may be brought about by the immersion of the metal in a solution of a mercury salt, is sufficient to cause complete oxidation of the metal in water. Thus an aluminium plate weighing 0·7517 grm. was oxidised in water to the extent of four-fifths of its weight in 30 hours after it had been dipped 14 times, for 6 seconds each time, in a 1 per cent. solution of mercuric chloride, the total quantity of mercury amalgamated being 0·001 grm. A flocculent mass of hydrated alumina was produced in the water, the method being suitable for the practical preparation of this substance. The quantity of mercury which amalgamates with the aluminium depends strictly upon the concentration of the mercury salt solution and the length of the immersion, and may reach as much as 15 to 20 per cent. of the weight of the aluminium, when a plate of the latter is immersed for 6 minutes in a saturated solution of mercuric chloride. In this case a coating of mercury forms on the surface of the aluminium but becomes detached in the form of globules when the plate is immersed in water. The rate of oxidation of the metal in water is also affected considerably by the length of immersion and the concentration of the mercuric chloride. After oxidation the greater part of the mercury is found as oxide incorporated with the alumina; the author therefore suggests that the mercury may act as an oxygen carrier to the aluminium. Oxidation may be prevented by dipping the amalgamated metal in nitric acid.—H. H.

Bismuth lead ore; Smelting —— at Sinaloa, Mexico. S. E. Bretherton. Eng. and Min. J., 1910, **89**, 773—774.

Details are given of the test run of a blast-furnace, at the Bismuth King Mine, for the recovery of bismuth, gold and silver, from an ore containing 2 per cent. of bismuth, 33 of iron, 31 of silica, 12·5 of alumina, 2 of magnesia, 1 of zinc, 9 of copper, and traces of lime, arsenic, and sulphur. An argentiferous galena, containing 50·7 per cent. of lead and some metallic lead were used for the lead supply. Varying amounts of lead were used, and it was found that with about 10 per cent. of lead to 1 per cent. of bismuth in the charge, a good recovery was made of bismuth, gold, and silver. In order to economise lead, the bismuth was subsequently concentrated in the lead bullion by cupellation, and the litharge thus formed was used in place of metallic lead in the blast-furnace, with improved results. The author considers that 80 per cent. of the bismuth in a 2 per cent. ore, can be recovered by smelting it with a minimum of 10 per cent. of lead, in conjunction with suitable dust catchers, as bismuth has a greater tendency to be carried over with the flue dust than lead. The recovery of gold and silver was very complete.—F. R.

Bismuth; Electrolytic refining of ——. F. Foerster and E. Schwabe. Z. Elektrochem., 1910, **16**, 279—281.

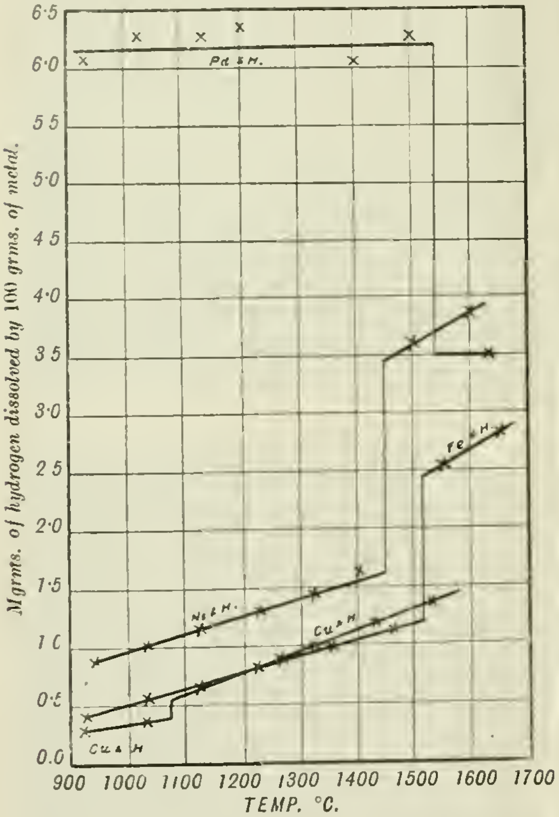
In the anode slime produced in the electrolytic refining of lead by the Betts process (see this J., 1909, 529), the most valuable constituents are silver and bismuth. Some laboratory experiments by the authors with a silicofluoride electrolyte indicate that it will be possible to deposit electrolytically bismuth free from lead from this anode slime, at the same time concentrating the lead in the solution and the silver in the anode slime. Using as electrolyte a solution containing 60—80 mgrms. of bismuth per litre, prepared by warming basic bismuth carbonate with silicofluoric acid of sp. gr. 1·3, as anodes two plates cast from commercial bismuth, and as cathode a thin copper plate, uniform and dense deposits of bismuth were obtained with current densities up to 2 ampères per sq. dcm., at a temperature of 60°—70° C., when the electrolyte was vigorously agitated. In silicofluoride solutions, there is a difference of about 0·41 volt between the equilibrium potentials of bismuth and lead, or nearly as much as between copper and silver in nitrate solutions. There should hence be no great difficulty, in principle, in separating the bismuth and lead electrolytically. A solution containing 4·5 grms. each of lead and bismuth per 100 c.c. was electrolysed with a current of 0·4 ampère per sq. dcm., using anodes of commercial bismuth, until the cathode deposit was about 1 mm. thick. In 1 grm. of this deposit, no lead could be detected. In actual practice, it would not be necessary to enrich the solution in lead to so great an extent as this. At a certain stage the lead could be precipitated with sulphuric acid, and basic bismuth carbonate added to the solution to restore it to its original concentration.—A. S.

Gases; Solubility of —— in metals and alloys. A. Sieverts and W. Krumbhaar. Ber., 1910, **43**, 893—900.

The volume of the gas absorbed by a number of metals and alloys when heated to various temperatures was determined both when the metal was in the liquid and solid state, and under varying conditions of pressure. For temperatures up to 1100° C. a quartz flask was used, being heated by a platinum resistance furnace, for temperatures up to 1300° C. a glazed porcelain tube heated in a Heræus furnace, and for higher temperatures a specially designed furnace was employed in which a biscuit porcelain tube containing the metal was placed, and which withstood a temperature of 1650° C. at the ordinary pressure, 1550° C. at 500 mm. and up to 1400° C. when evacuated, without collapsing. It was found that nitrogen was not soluble in cadmium at 400° C., in thallium, zinc, lead, and bismuth at 600° C., in tin and antimony at 800° C., in silver and gold at 1300° C., and in copper, nickel, and palladium at 1400° C., the expansion of the gas being quite regular for the rise of temperature in each case. Aluminium reacted at about 800° C., and iron absorbed nitrogen at 1200° C., which gas was not evolved again in a vacuum, showing the probable formation of a nitride. Neither solubility nor chemical reaction took place between copper and carbon monoxide at 1520° C., but both solid and liquid nickel absorbed carbon monoxide which was not evolved again in a vacuum. Sheet cobalt evolved large quantities of gas at 1400° C., but this was not analysed. Liquid silver dissolved oxygen, while gold did not. Experiments were carried out on the system copper-sulphur dioxide in relation to the solubility under varying pressures and temperatures. Liquid copper when solidifying retained 80 per cent. of the sulphur dioxide absorbed, and which was all evolved in a vacuum, and it was shown that the quotient $\frac{\sqrt{p}}{m}$ was constant, where m is the mass of the gas absorbed by 100 grms. of the metal. Hydrogen was not absorbed by the metals cadmium, thallium, zinc, lead, bismuth, tin, antimony, silver, and gold. The solubility in copper, nickel, iron, and palladium is shown in the following table and graphic curve diagram.

Copper.		Nickel.		Iron.		Palladium.	
Temp. (°C.)	Hydrogen (mgrms.)	Temp. (°C.)	Hydrogen (mgrms.)	Temp. (°C.)	Hydrogen (mgrms.)	Temp. (°C.)	Hydrogen (mgrms.)
919	0·287	929	0·938	929	0·392	922	6·11
1021	*0·360*	1026	1·003	1031	0·521	1022	6·21
1123	0·608	1123	1·142			1123	6·24
1225	0·781	1225	1·321	1250	0·776	1200	6·32
1327	0·951	1314	1·408	1350	0·940	1300	6·18
1420	1·097	*1400*	*1·537*	*1450*	*1·079*	1400	6·03
1520	1·350	1500	3·585	1550	2·501	*1500*	*6·29*
		1600	3·858	1650	2·794	1600	3·52

N.B.—The figures in italics represent the solubility at the melting point of the metals.



The curves show that the solubility increased regularly with the temperature up to the melting point and then suddenly increased, the solubility in the liquid metal then increasing regularly in the same manner. With palladium, however, the solubility was independent of the temperature up to the melting point and then diminished to one-half, and in the liquid metal was again independent of the temperature. On cooling, copper retained 20 per cent. and nickel 8 per cent. of the hydrogen absorbed, and in the case of iron, the evolution of gas was so violent on solidification that the tube was blown to pieces leaving a spongy regulus. The following tables show the influence of pressure, which in the case of copper, nickel, and iron follows the law $\frac{\sqrt{p}}{m}$ = constant.

Liquid copper and hydrogen.
1123° C.

Pressure (p) mm. of mercury.	Hydrogen (mgrms.) (m)	$\frac{\sqrt{p}}{m}$
1046	0·745	43·5
971	0·705	44·2
883	0·680	43·7
775	0·610	45·1
606	0·549	45·1
403	0·443	45·3
281	0·380	44·2

Liquid nickel and hydrogen.
1500° C.

(p) mm. of mercury.	Hydrogen (mgrms.) (m)	$\frac{\sqrt{p}}{m}$
973	4·127	7·55
758	3·585	7·67
616	3·284	7·57
480	2·874	7·64

Liquid iron and hydrogen.
1550° C.

(p) mm. of mercury.	Hydrogen (mgrms.) (m)	$\frac{\sqrt{p}}{m}$
922	2·703	11·2
738	2·501	10·9
568	2·120	11·3

In experiments with alloys it was found that the addition of gold lowered the solubility of oxygen in silver. The copper alloys and hydrogen formed three groups, (*a*) those in which the solubility was not influenced, such as silver, (*b*) those in which the solubility was lowered, such as gold, tin, aluminium, (*c*) those in which the solubility was higher than that accounted for by the copper content, such as nickel and platinum. The solubility in copper alloys was proportional to the square root of the pressure, and the view that occlusion was due to adsorption is untenable, and although the authors hold the view that adsorption did not exist at high temperatures, they do not express any opinion about low temperature conditions, and they put forward the view that gases and metals form solid and liquid alloys, the solubility of which does not follow Henry's law, but is expressed by the formula $\frac{\sqrt{p}}{m}$.—A. H. C.

Nitrogen and metals at high temperatures; Interaction of ——, and electric conductivity of some metal-nitrogen alloys. I. Shukow. J. Russ. Phys.-Chem. Ges., 1910, **42**, 40—55. Chem. Zentr., 1910, **1**, 1220—1221.

In continuation of his previous work (this J., 1908, 942), the author has made a series of determinations of the dissociation pressures of metal-nitrogen alloys. In the case of chromium, at 1100° and 1200° C., and manganese, at 910° and 1175° C., the dissociation pressure of the alloys increased continuously with the nitrogen content; hence the alloys can only be solid solutions, not chemical compounds. In the case of aluminium, on the other hand, the existence of a compound is indicated, the dissociation pressure being constant for a given temperature and independent of the nitrogen content. Determinations were also made of the electrical resistance of compressed, powdered metal-nitrogen alloys. The resistances of the manganese, chromium, and titanium alloys were of about the same order as those of the pure metals. The resistance of the compounds, AlN, Ca_3N_2, and Mg_3N_2, on the other hand, amounted to over 2×10^6 ohms. These results confirm the view expressed previously (*loc. cit.*) that nitrogen forms only solid solutions and not chemical compounds with manganese, chromium, and titanium.
—A. S.

Boiling points of metals; Influence of pressure on the ——. H. C. Greenwood. Proc. Roy. Soc., 1910, **A83**, 483—491

Previous work by the author (this J., 1909, 886) has been extended and confirmed by experiments made to ascertain the relationship between boiling point and pressure. The metals used were of a high degree of purity, and the heating was carried out as previously described, except that the furnace was slightly modified, so that it could be enclosed in a suitable envelope in which the necessary vacuum or pressure was maintained. At high pressures, which were obtained by means of hydrogen, sublimation below the boiling point was rather pronounced; the distillation of zinc, under these conditions, is unlike that of the other metals, in being more of the nature of a very rapid sublimation than of actual ebullition. The boiling points of all the metals studied, when expressed on the absolute scale, were found to conform fairly closely to Ramsay and Young's law, being similarly affected by pressure. Ordinary barometric fluctuations have no appreciable influence on the boiling points. Curves are given in the paper, and the following results were obtained:—

	Pressure.	Boiling point, °C.	Gas in sighting tube.	
Bismuth	102 mm.	1200	Nitrogen	
	257 ,,	1310	,,	
	1 atm.	1420		
	6·3 ,,	1740		
	11·7 ,,	1950		
	16·5 ,,	2060		
Copper	100 mm.	1980	,,	
	257 ,,	2180	,,	
Lead	105 ,,	1320 (1310)	,,	(hydrogen)
	260 ,,	1420 (1400)	,,	(,,)
	1 atm.	1525		
	6·3 ,,	1870		
	11·7 ,,	2100		
Silver .	103 mm.	1660 (1660)	,,	(,,)
	263 ,,	1780	,,	
Tin .	101 ,,	1970	,,	
	262 ,,	2100	,,	
Zinc .	6·3 atm.	1120		
	11·7 ,,	1230		
	21·5 ,,	1280		
	53 ,,	1510		

—F. Sodn.

Bacterial activity as a corrosive influence in the soil. R. H. Gaines. J. Ind. and Eng. Chem., 1910, 2, 128—130.

The corrosion of underground iron and steel structures is in part due to bacterial activity. The attack is sometimes due to the direct action of a specific microbe, some genera such as *Crenothrix*, *Cladothrix*, and *Heptothrix* containing ferric oxide in their cell walls. An acid product is first eliminated by which the iron is dissolved and then each individual forms a pit by corrosion of the metal. Indirectly, certain bacteria cause corrosion by creating acid conditions in the soil owing to their peculiar methods of absorption and elimination of sulphur compounds. In presence of calcium sulphate the nascent methane set free by the anaerobic bacteria which decompose cellulose reduces the sulphate to sulphuretted hydrogen. The remedies proposed are free drainage to carry off quickly the acid solutions formed, or, where this is impracticable, slaked lime should be packed about the metal to neutralise the acids formed.—E. F. A.

Calcium ferrites. Kohlmeyer and Hilpert. *See* VII.

Titration of ferrous salts in presence of hydrochloric and phosphoric acids. Hough. *See* XXIII.

Copper production of the World. H. R. Merton and Co. Eng. and Min. J., April 16, 1910. [T.R.]

The following is an estimate of the world's copper production in 1909, together with figures for 1907 and 1908:—

	1907.	1908.	1909.
	long tons.	long tons.	long tons.
United States	392,520	423,300	490,310
Mexico	56,565	39,990	56,240
Canada	25,615	28,570	24,105
Newfoundland	1,730	1,430	1,380
Cuba	......	3,000	2,675
North America	476,430	496,290	574,710
Argentina	220	225	600
Bolivia	2,500	2,500	2,000
Chile	26,685	38,315	35,785
Peru	10,575	15,000	16,000
South America	39,980	56,040	54,385
Austria	920	1,575	1,615
England	700	700	700
Germany..................	20,490	20,200	22,455
Hungary	125	2,240	4,505
Italy	3,300	2,975	2,725
Norway	7,010	9,190	9,080
Russia	15,000	20,085	17,750
Spain and Portugal	49,675	52,585	52,185
Sweden	2,000	2,000	2,000
Turkey	1,250	1,050	800
Europe	100,470	112,600	113,815
Japan	18,935	43,000	47,000
Africa	6,800	6,880	14,945
Australasia	41,250	39,500	34,400
Total	713,865	754,310	839,255

Of the Spanish production in 1909 the Rio Tinto Co. is credited with 35,370 tons. In Germany the Mansfeld deposits produced 18,715 tons; in Norway the Sulitelma Co. reports 4795 tons. The African estimate contains 6945 tons from the Cape Copper Co. and the Namaqua Co.

Mineral production of New Caledonia. Board of Trade J., April 21, 1910. [T.R.]

The stocks of nickel ore in New Caledonia on 31st December, 1909, were 122,000 tons; 79,995 tons were shipped during the year, but the production was about 120,000 tons. A number of contracts have been made during the past year for forward delivery, and all nickel ore produced has become the property of smelters. The result of the first reduction of nickel ore by the electrolytic process at Tau is awaited with interest. By this process, it is claimed, nickel can be produced at a cost which will enable the selling price to be reduced to £100 per ton. The chrome industry is confined for the present to one mine, and the export for 1909 was 32,136 tons, 14,344 tons less than in 1908. The price of this mineral has reached £1 2s. per ton for 50 per cent. ore in bulk at mines, or £1 14s. 6d. for 50 per cent. ore in sacks f.o.b. Noumea. The stock of chrome existing in the colony on 31st December, 1909, was about 21,000 tons. There is no demand for cobalt, and producers have now closed down the mines. The stocks in the colony are probably 400—500 tons. The copper mines at Pilou are producing a quantity of ore, and smelting should begin shortly. The quality of the ore is said to be good, and reports indicate a large production in the near future.

Patents.

Ores; Concentration of ——. H. L. Sulman, H. F. K. Picard, and J. Ballot, London. Eng. Pat. 28,173, Dec. 24, 1908.

The powdered ore is mixed with slightly acidified water (*e.g.* 0·2 to 0·5 per cent. sulphuric acid) containing in solution a minute quantity of an alcohol such as amyl alcohol (*e.g.* 0·01 to 0·002 per cent.), the mixture (heated or not) is agitated so as to bring the ore particles into contact with air, and the froth so formed, which contains the sulphides, is separated. Methyl, ethyl, propyl, or butyl alcohols may be used instead of amyl alcohol, or mixtures of them may be employed.—H. H.

Metals or minerals from their gangues; Method and apparatus for the separation of ——. A. Simon, London. Eng. Pat. 10,381. May 1, 1909.

A DEVICE is attached to the reciprocating trays, tables or belts usually employed in the concentration of ores, whereby the same may be very rapidly oscillated (from 2500 to 5000 times per minute) by means of a pneumatic or like percussive tool.—W. E. F. P.

Electroplating tubes and rods; Apparatus for ——. S. O. Cowper-Coles, London. Eng. Pat. 12,469, May 26, 1909.

THE rods or tubes are supported on bearers having one end higher than the other, each pair of bearers being relatively inclined in plan, so that, as the rods roll down the supports, contact is made at different points on the surfaces to be plated. The bearers are made in the form of inverted T-shaped metal bars, located between blocks of wood which carry anode plates, the latter being insulated from the bearers. Anode plates may also be arranged, in addition, above the rolling rods or tubes.—B. N.

Lead; Process of making filamentous ——. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co., New Jersey. U.S. Pat. 953,196, March 29, 1910.

A FINE stream of supermolten lead (*e.g.* at 200° C. above its melting point) is subjected to the action of a jet of compressed inert gases in a closed receptacle, whereby lead in a filamentous condition is produced. The inert gases may be derived from the prior passage of air through the lead material.—H. H.

Smelting-furnace. C. A. Wettengel, Caney, Kans., Assignor to American Zinc, Lead, and Smelting Co., Boston, Mass. U.S. Pat. 953,405, March 9, 1910.

A SMELTING furnace having a bank of inclined retorts, with an ash-shoot in front, is fitted with an apron secured below the lowest tier of retorts and a movable pan having a flange inclined upward and adapted to fit under the apron. When the pan is in place, the apron and pan together close the ash-shoot. The retorts are supported by clamp blocks.—H. H.

Alloy; [Iron ——]. J. T. H. Dempster, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 953,412, March 29, 1910.

THE alloy contains iron, tellurium, and silicon, with or without manganese, the iron being largely in excess of the other metals (*e.g.*, more than 75 per cent.).—H. H.

Manganese steel; Method of making ——. H. D. Hibbard, Plainfield, N.J. U.S. Pat. 954,185. April 5, 1910.

THE manganese in manganese steel scrap is utilised by melting the latter in an electric furnace under suitable conditions, and then adding sufficient manganese alloy to give the product the desired percentage of manganese.
—W. E. F. P.

Manganese steel; Process of making ——. H. M. Howe, Bedford, N.Y., Assignor to Taylor Iron and Steel Co., High Bridge, N.J. U.S. Pat. 954,188, April 5, 1910.

THE process consists in the addition of successive portions of manganese steel scrap to a superheated bath of molten iron, maintained in such condition as to prevent loss of manganese. The product is finally brought to the desired composition by the addition of ferromanganese.
—W. E. F. P.

Metals, especially iron and steel; Process and furnace for the refining of —— *by the electrothermal method.* O. Mulacek and F. Hatlanek. Ger. Pat. 220,251, Sept. 27, 1907.

THE patent relates to an electric furnace for the refining of metals, in which the charge forms part of a current-circuit and becomes heated in consequence of the resistance it offers to the passage of the current. The current is conveyed to the charge through electrodes embedded in the refractory lining of the furnace, this lining being composed of a conductor of the second class, *i.e.*, of a substance which is a conductor only when heated. The preliminary heating is effected by providing one or more induction troughs or channels communicating with the working hearth of the furnace. The working hearth and the induction trough are first filled with metal, which is heated in the known manner by induction, until the lining of the working hearth becomes sufficiently hot to act as a conductor, when communication between the hearth and the induction trough is cut off. Preferably the floor of the working hearth is arranged at a lower level than that of the induction trough, and after the preliminary heating by induction, only sufficient metal is charged into the furnace to fill the working hearth, but not the induction trough, so that the refining is effected by resistance-heating alone.—A. S.

Pyrophoric alloys. Treibacher Chemische Werke. Fr. Pat. 407,117, Sept. 3, 1909. Under Int. Conv., April 3, 1909.

ALLOYS of the earth metals, rich in cerium, are reduced to powder and compressed into blocks. The blocks are heated to incipient redness in a closed vessel, the quantity of air present being insufficient for the alloy to be melted by the rapid oxidation which takes place. The blocks thus obtained are covered with a thin film of suboxide and are more highly pyrophoric than the original alloy.
—A. T. L.

Metal from ore; Process for extracting ——. J. W. Mackenzie, London. From C. A. Stevens, New York City. Eng. Pat. 7519, March 29, 1909.

SEE Fr. Pat. 401,443 of 1909; this J., 1909, 1142.—T. F. B.

Pyrophoric masses [alloys]; Manufacture of ——. A. G. Bloxam, London. From Treibacher Chemische Werke Ges. m.b.H., Treibach, Austria. Eng. Pat. 8163, April 5, 1909.

SEE Fr. Pat. 407,117 of 1909; preceding.—T. F. B.

Blast furnaces, converters, and the like; Method of operating ——. J. Gayley, New York. Eng. Pat. 13,552, June 9, 1909.

SEE U.S. Pat. 935,628 of 1909; this J., 1909, 1140.—T. F. B.

Air for blast-furnaces and converters; Apparatus for extracting moisture from ——. J. Gayley, New York. U.S. Pat. 953,525, March 29, 1910.

SEE Fr. Pat. 344,399 of 1904; this J., 1904, 1095.—T. F. B.

Ores; Apparatus for desulphurising or otherwise treating ——. R. Hübner, New York. Eng. Pat. 14,541, June 21, 1909.

SEE U.S. Pat. 934,532 of 1909; this J., 1909, 1141.—T. F. B.

Smelting-furnace; Electric ——. E. A. A. Grönwall, A. R. Lindblad, and O. Stålhane, Ludvika, Sweden. U.S. Pat. 953,029, March 29, 1910.

SEE Eng. Pat. 1658 of 1907; this J., 1907, 622.—T. F. B.

Furnace; [Electric] transformer ——. E. A. A. Grönwall, A. R. Lindblad, and O. Stålhane, Ludvika, Sweden. U.S. Pat. 953,030, March 29, 1910.

SEE Eng. Pat. 6193 of 1907; this J., 1907, 878.—T. F. B.

Antimony ores; Apparatus for treating ——. H. L. Herrenschmidt, Paris. U.S. Pat. 953,142, March 29, 1910.

SEE Fr. Pat. 386,107 of 1907; this J., 1908, 756.—T. F. B.

Ore concentration ; Apparatus for ——. T. J. Hoover, Assignor to Minerals Separation, Ltd., London. U.S. Pat. 953,746, April 5, 1910.

See Eng. Pat. 4911 of 1909 ; this J., 1910, 432.—T. F. B.

Ore concentrating and separating apparatus. F. Dallemagne, Irun, Spain. U.S. Pat. 953,900, April 5, 1910.

See Fr. Pat. 378,895 of 1907 ; this J., 1907, 1203.—T. F. B.

Ores : Concentration of ——. H. L. Sulman, Assignor to Minerals Separation, Ltd., London. U.S. Pat. 955,012, April 12, 1910.

See Eng. Pat. 2359 of 1909 ; this J., 1910, 496.—T. F. B.

Arsenide ores ; Treating ——. F. P. Dewey, Assignor to Dewey Ore Reduction Corporation, Washington. U.S. Pat. 954,264, April 5, 1910.

See Fr. Pat. 404,675 of 1909 ; this J., 1910, 285.—T. F. B.

Retorts of zinc and other furnaces ; Apparatus for charging the ——. E. Dor-Delattre. First Addition, dated July 20, 1909, to Fr. Pat. 391,812, June 30, 1908. Under Int. Conv., May 18, 1909.

See Eng. Pat. 17,103 of 1909 ; this J., 1910, 360.—T. F. B.

Manganese steel ; Process for treating —— *to obtain rolled articles.* Manganese Steel Rail Co. First Addition, dated Oct. 30, 1909, to Fr. Pat. 396,871, Nov. 28, 1908.

See Eng. Pat. 24,729 of 1909 ; this J., 1910, 497.—T. F. B.

Smelting ores, residues, etc., for the extraction of copper or other metals, and furnaces therefor. B. de Saint Seine, and Thwaites Bros., Ltd. Fr. Pat. 407,990, Sept. 27, 1909.

See Eng. Pat. 23,179 of 1908 ; this J., 1910, 94.—T. F. B.

Calcining furnaces. W. J. Willis. Fr. Pat. 408,231, Oct. 25, 1909. Under Int. Conv., March 11, 1909.

See Eng. Pat. 5901 of 1909 ; this J., 1910, 496.—T. F. B.

Metals ; Process for refining ——. J. H. Reid. Fr. Pat. 408,306, Oct. 26, 1909. Under Int. Conv., Feb. 3, 1909.

See U.S. Pat. 937,387 of 1909 ; this J., 1909, 1208.—T. F. B.

Metallic alloys. G. Hartmann. Fr. Pat. 408,331, Oct. 26, 1909.

See U.S. Pat. 938,422 of 1909 ; this J., 1909, 1256.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Cadmium normal cell ; An improved form of ——. E. Cohen and H. R. Kruyt. Z. physik. Chem., 1910, 72, 38—42.

The authors have shown previously (Z. physik. Chem., 1909, **65**, 359) that the temperature-correction used for the E.M.F. of the Weston normal cell cannot be correct. By using an amalgam containing 8 per cent. of cadmium in contact with a solution of cadmium sulphate saturated in regard to $CdSO_4.8/3H_2O$, as solid phase, a normal cell can be constructed, for which a definite temperature-correction formula should hold strictly between—4° and +40° C. (compare Bijl, this J., 1903, 704). The authors have succeeded in constructing such a cell which can be transported safely without its E.M.F. being affected, and they invite the "Reichsanstalten" to subject the cell to a thorough investigation over a long interval of time with a view to proclaiming it as a "normal element." The shape of the cell and the method of charging it are described.—A. S.

Electrolytic determination of zinc. Spear and others. *See* XXIII.

Cause of high results in electrolytic determination of zinc. Spear. *See* XXIII.

Patents.

Long electric arcs ; Production and maintenance of —— *for effecting reaction between gases.* G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort-on-Maine, Germany. Eng. Pat. 11,060, May 10, 1909.

The gases are supplied continuously to the electric arc over its whole length, by means of a series of slits arranged after the manner of "louvres," through which the gases issue under pressure in constant amount, and at a constant acute angle against the electric arc.—B. N.

Insulation of metallic threads, wires and bands. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 18,193, May 13, 1909.

The metallic threads or wires are covered with cotton, paper, etc., and then treated with solutions of acetylated cellulose.—B. N.

Ozone [for medical purposes] ; Production of ——. Ozonai, Ltd., and E. L. Joseph, London. Eng. Pat. 24,945, Oct. 29, 1909.

Oxygen passes from a cylinder of the compressed gas, fitted with a reducing valve, through a preliminary heating device, preferably of an electrical nature, through a combined ozonising and heating apparatus, and out through a delivery nozzle, which takes the form of a hypodermic needle. The combined ozonising and heating apparatus contains a series of electrodes, each of which consists of a flat sheet of aluminium gauze, sheets of mica, or the like non-conducting material being interposed between successive sheets of metallic gauze. The pile of electrodes and dielectrics is enclosed in a metal chamber, which is lined at the top and at the bottom with mica, and around the sides with asbestos or the like. This chamber constitutes the cover of the heating apparatus, which consists of one, or preferably two, suitable insulated electrical heating units. The apparatus further comprises a transformer, and is adapted for use with the alternating currents ordinarily supplied. The switch, which controls the supply of current to the heating units, can be adjusted so as to regulate at will the temperature of the gas flowing into the ozonising apparatus.—O. R.

Vacuum resistance furnace. A. O. Appelberg, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 953,774, April 5, 1910.

The furnace comprises an air-tight chamber, with a tungsten screen enclosing a heating space having tungsten walls, and containing a conductor forming a refractory heating member of compressed powder of substantially pure tungsten, in contact with tungsten blocks as terminals. Means are provided for continuously exhausting air from the chamber, and for supporting the material to be heated in proximity to the heater.—B. N.

Filaments for electric incandescence lamps. Fr. Pat. 406,981. *See* IIb.

Precipitating the organic substances contained in the dark coloured lyes obtained in the preparation of mercerised cellulose [wood cellulose]. Fr. Pat. 406,744. *See* V.

XII.—FATS; OILS; WAXES.

Cod liver and menhaden oils; Some constants for ——. W. K. Alsop. J. Amer. Leather Chem. Assoc., 1910, **5**, 204—208.

The detection of menhaden oil in cod oils is very difficult unless the extent of the addition is about 30 per cent., and experience is of great value in interpreting the analytical figures obtained. The author gives a long table of "constants" yielded by several kinds of cod oils and menhaden oils, and also of a few other oils which might possibly be added to cod oil, and a summary of these results is also given. It is assumed that the word "pure" as applied to "domestic" oils implies the absence of mineral and menhaden oils. White and light-coloured cod oils usually have a higher specific gravity and a lower acid value than dark or brown oils. It is also noted that the specific gravity, saponification value and iodine value are all, on the average lower, and the acid value much higher, in cod oils than in menhaden fish oils. Unless actual unsaponifiable oil has been added, the estimation of unsaponifiable matter is regarded as useless. Colour tests are also stated to be valueless since the colours given by cod oils vary so much. The following tables are a summary of the figures given :—

Cod oils.

	Sp. gr.	Acid value.	Sapon. value.	Iodine value (Hübl.).
Minimum	0·922	11·9	180	132
Maximum	0·9279	39·4	195	160
Average.......	0·9245	24·8	184—190	135—145
Brown oils ...	0·9235—0·9255	—	—	—

Menhaden oils.

	Sp. gr.	Acid value.	Sapon. value.	Iodine value.
Minimum	0·928	3·53	189·6	145
Maximum	0·9349	11·74	198	170
Average.......	0·929—0·931	5—8	190—195	150—160

—A. T. H.

Etholides of the Coniferæ. Juniperic and sabinic acids. J. Bougault. Comptes rend., 1910, **150**, 874—876.

The constitution of juniperic and sabinic acids has now been determined (see this J., 1909, 802). They have been obtained by the saponification of etholides (esters of alcohol acids) present in the "waxes" of certain *Coniferæ*. The acids were converted into the corresponding iodides by the action of iodine and phosphorus. The iodide of juniperic acid (16-iodopalmitic acid) melts at 76° C., and when reduced is converted into palmitic acid. Sabinic acid in a similar manner yields 12-iodolauric acid, m. pt. 63°—64° C., which is converted into lauric acid on reduction. When oxidised with chromic acid, dibasic acids are produced. Sabinic acid gives decamethylenedicarboxylic acid, melting at 127° C. Juniperic acid yields a tetradecamethylenedicarboxylic acid, thapsic acid, melting at 124° C.—F. Shdn.

Patents.

Waxes, fats and oils; Extracting and purifying ——. S. Wijnberg, Amsterdam. Eng. Pat. 16,148, July 10, 1909.

The solution of the oils, fats, or waxes obtained by extracting the material with a suitable solvent is passed through a filtering medium of bleaching substances (such as fullers' earth or bone-black) contained in the vessel in which the extraction was made.—C. A. M.

Fatty, resinous and oleaginous substances containing impurities; Apparatus for the recovery and complete purification of ——. L. Ducos. Fr. Pat. 407,445, Sept. 29, 1909.

The impure substance is melted in a vessel heated by any suitable means and communicating by means of a narrow channel with a lower receptacle into which the impurities can be drawn off through decantation-tubes arranged at suitable levels which are indicated by outside tubes. The lower receptacle, the capacity of which is about one-tenth of that of the upper vessel, is also heated in any suitable way, and water under pressure may be introduced into the apparatus in order to bring the zone of separation of the impurities within the level of the decantation tubes.—C. A. M.

Wood oil; Process for treating —— *in order to prevent it coagulating at high temperatures.* A. Weinschenk. Ger. Pat. 219,715, July 21, 1909.

The oil is heated with a powdered metal, such as zinc dust, which has a strong reducing action. The treated oil alone dries only slowly or not at all, but dries satisfactorily when mixed with a small quantity of a siccative.—A. S.

Waste oils and fats; Process for the purification of dirty oils and —— *by oxidation.* C. Stiepel. Ger. Pat. 219,716, Feb. 20, 1909.

The oils or fats are dissolved in petroleum spirit of b. pt. up to 65° C. or of b. pt. 100° C. and over, which solvents only dissolve relatively small quantities of the gummy and coloured impurities, and the solutions are filtered and then subjected to the usual oxidation process.—A. S.

Soap paste; Apparatus for the preparation of ——. J. Bauer. Fr. Pat. 406,917, Sept. 10, 1909.

A soap paste is prepared by injecting steam and a current of a heated oil simultaneously into a solution of sodium carbonate, so that thorough admixture results. The apparatus for this purpose may consist of three superposed vessels, the uppermost of which serves as the oil reservoir, the middle as the mixing tank, and the lowest for storing the soap paste. The steam on its way to the mixing tank may be used to heat the oil, and the lower part of the steam pipe may be constructed in the form of a perforated coil. Or the top and middle vessels may have a wall in common, so that heat is communicated from the latter to the former. Means may also be provided for preventing overheating, and for carrying off the injected steam in a direction tangential to the axis of the mixing vessel, and thus effecting a more thorough admixture of the contents.—C. A. M.

Oils; Process for transforming —— *into viscous products and its application to the manufacture of lubricating oils.* A. de Hemptinne, Gand, Belgium. Eng. Pat. 15,748, July 6, 1909.

See Fr. Pat. 440,843 of 1909; this J., 1910, 222.—T. F. B.

Saponaceous compound. E. Weiss, Weiden, Germany. U.S. Pat. 954,486, April 12, 1910.

See Fr. Pat. 366,547 of 1906; this J., 1906, 981.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Ultramarine blue; Note on the analysis of ——. E. R. Andrews. Analyst, 1910, **35**, 157—158.

The method is designed to facilitate the examination of the pigment with regard to the possible presence of foreign additions insoluble in acid; an operation not easily performed when the sample is analysed by decomposition with acid. The process depends on the oxidising action of bromine, and the subsequent complete solution of the products, when the pure pigment is thus treated. 1 grm. of the ultramarine is placed in a wide-mouthed flask of 150 c.c. capacity, and thoroughly wetted with 5 to 10 c.c. of water. About 30 c.c. of an aqueous saturated solution of bromine are added, and the contents of the flask agitated until the colour of the bromine begins to disappear. More bromine-water is added gradually until the blue colour of the ultramarine disappears, and an excess of bromine remains. The flask is set aside for 15 minutes, and the contents are then filtered quickly. The residue is washed with water, ignited and weighed. The filtrate is acidified with 10 c.c. of strong hydrochloric acid, and evaporated to dryness. The silicic acid is filtered off, and the filtrate adjusted to a known volume. Aliquot portions of this solution are taken for determining the alumina, sulphur, etc. The weighed residue is boiled with sodium carbonate, filtered, and reweighed, the loss in weight being due to the invariable presence of a little silicic acid in the insoluble residue. The amount of silica thus found, (usually about 1·5 per cent.) is added to that of the bulk of the silica in the main filtrate. Analyses of samples of ultramarine are given, in which the matter insoluble in bromine-water is shown to vary from 2·4 to 4·4 per cent. and is stated to consist of clay.—E. C. V-E.

Patents.

Ultramarines and analogous colours: Process for the preparation of ——. Schlesisches Laboratorium für Tonindustrie, F. Singer. Ger. Pat. 221,344, July 17, 1909.

Ultramarines and analogous colours are prepared by treating zeolites or similar substances, under suitable conditions, with the sulphides, polysulphides, oxysulphides, or hydrogen-sulphides of the alkalis or alkaline-earths, of inorganic or organic ammonium, phosphonium, arsonium, or stibonium bases, or of organic radicals. A simple zeolite has the composition, $Al_2O_3,Na_2O,2SiO_2,2H_2O$, and a simple ultramarine, $3(Al_2O_3,Na_2O,2SiO_2),Na_2S$. In the zeolite, the alumina can be easily replaced by ferric oxide, manganese sesquioxide (Mn_2O_3), chromic oxide, vanadium trioxide, boric anhydride, etc.; the soda, by potash, lithia, lime, strontia, and numerous other metallic oxides; and the silica by titanium dioxide, stannic oxide, lead dioxide, etc., so that the way is opened for the production of a large variety of colours of a composition analogous to that of ultramarine. Numerous examples are given briefly in the specification.—A. S.

Paints and like coating compositions. J. R. Boosé, London. From I. Stern and F. H. Boosé, Cape Town. Eng. Pat. 6573, Mar. 19, 1909.

A paint, particularly suitable for coating exposed iron and steel work, is obtained by adding raw linseed oil or turpentine to the powdered South African mineral psilomelane, which has the following composition:—Manganese oxide, 17 to 52; silica, 10 to 40; iron oxide, 8 to 9; alumina, 6 to 9; cobalt oxide, 0·08; and nickel oxide, 0·32 per cent. Small quantities of natural ochres, siennas and umbers may also be used in the paint.—C. A. M.

Paint composition. N. B. Arnold, Westfield, N.J. U.S. Pat. 952,863, Mar. 22, 1910.

A finishing paint composition is prepared from a mixture of 70 per cent. of pigment and 30 per cent. of a vehicle of oil or varnish, the pigment consisting of lithopone (say, about 73 per cent.) with an "extender" (say, 27 per cent.) of calcium sulphate and calcium carbonate.—C. A. M.

Oil colour with magnesium base; Manufacture of an ——. J. Meurant. Fr. Pat. 406,927, Sep. 11, 1909. Under Int. Conv., Nov. 9, 1908, April 1 and June 10, 1909.

Compounds of magnesium, such as the oxide, or hydroxide, or salts of magnesium, may be used in place of lead salts in the preparation of oil colours, varnishes, etc.—C. A. M.

Composition for coating hulls of ships. Fabr. de Vernis et Prod. Chim. Soc. Anon., Vernier, Switzerland. Eng. Pat. 24,001, Oct. 19, 1909. Under Int. Conv., Nov. 17, 1908.

The composition consists of a waterproof varnish (240 kilos.) a pigment such as red ochre (70 kilos.), and an amalgam of 20 parts of copper and 4 parts of mercury (60 kilos.), the whole being mixed together in a roller grinding mill. The above proportions may be varied, according to the quality of the paint. This composition is said to effectively prevent the accumulatioo of molluscs and algæ on ships' bottoms, the toxic action of the amalgam being due to the fact that as soon as the protective coat of varnish is disintegrated by molluscs, etc., the particles of amalgam decompose the sea-water in contact with them, yielding cuprous chloride and mercuric chloride. These two salts together form a double salt of great toxic power.—E. W. L.

Paint for ships or submarine structures. W. Schoeller and W. Schrauth. Ger. Pats. 219,966 and 219,967, June 16, 1908, and July 20, 1909.

(1). The claim is for the addition to paints of anhydrides or salts of hydroxymercuri-carboxylic acids (see Ger. Pat. 208,634; this J., 1909, 543), for example calcium hydroxymercuri-acetate, copper hydroxymercuri-butyrate, lead hydroxymercuri-salicylate, etc. These compounds are stated to be almost insoluble in sea water and to exhibit a powerful toxic action on the lower animal and vegetable organisms. (2). Salts or anhydrides of hydroxymercuri-phenols or hydroxymercuri-arylamines or their sulphonic acids may be used in place of the salts or anhydrides of hydroxymercuri-carboxylic acids.—A. S.

Resins and oils from wood; Obtaining ——. C. P. Ogilvie, Manningtree, and G. Mitchell, London. Eng. Pat. 5978, Mar. 12, 1909.

The wood is disintegrated and treated with a solvent consisting of the light oils obtained from wood, which are volatile in steam. The heavy oil and resins are thus removed from the wood, and are subsequently separated from the solvent by distillation in the current of steam, when the light oils pass over into a distillate and can be utilised for a similar purpose again. The quality of the heavy product—termed 'oleo-resin'—is dependent upon the temperature at which the steam distillation is carried out. The higher the temperature, the darker is the colour of the product. At a comparatively low temperature (215° F.) the colour of the oleo-resin is a pale yellow; at 400° F. the product is a dark viscid mass. The light solvent is also recovered from the extracted wood by distillation with steam.—E. W. L.

Resins and natural gums; Substitute for ——. Comp. Générale d'Electricité. Fr. Pat. 406,686, Sept 1, 1909.

A substitute for resins and natural gums is obtained by the condensation of phenols with formaldehyde in the presence of zinc chloride or aluminium chloride, and treatment of the resulting product with an acid. The substance thus obtained may be heated without becoming porous.—C. A. M.

Petroleum: Deodorising —— *and transforming it into an oil having the properties of turpentine.* V. J. Kuess. Fr. Pat. 406,862, Sept. 8, 1909.

The petroleum is deodorised by the fermentation of a vegetable substance, such as lupin seeds, in contact with it. The seeds are first heated with water in an autoclave, and then crushed. After adding yeast to the liquor, the petroleum is run in and allowed to float on the fermenting liquid until its characteristic odour disappears. To transform the deodorised oil it is distilled over quicklime which has been slaked by exposure to the air. If desired the distillate may be mixed with 5 per cent. of oil of turpentine.—A. T. L.

Solutions containing albuminoid compounds and formaldehyde ; Process for preventing the coagulation of ——. W. Stadler. Ger. Pat. 220,493, April 18, 1909.

By the addition of aromatic hydroxy-compounds or their derivatives to solutions of albuminoids containing formaldehyde, etc., concentrated solutions may be obtained which will not coagulate even after long standing. For example, 80 parts of a 35 per cent. solution of protalbin are heated with 10 parts of β-naphthol to 30°—40° C. for 24 hours. By this process, clear solutions of albumin may be obtained, suitable for use as lacquers, or in the preparation of celluloid substitutes, photographic papers, etc.—T. F. B.

Zinc sulphide resistant to the action of light and air, and its manufacture. Soc. Chim. des Usines du Rhône, and J. C. A. Meyer. Fr. Pat. 407,788, Oct. 11, 1909. Under Int. Conv., Nov. 6, 1908.

See Eng. Pat. 23,645 of 1909 ; this J., 1910, 166.—T. F. B.

Condensation product from phenols and formaldehyde ; Insoluble ——. L. H. Baekeland. First Addition, dated Jan. 22, 1909, to Fr. Pat. 386 627, Jan. 28, 1908.

See Eng. Pat. 21,566 of 1908 ; this J., 1909, 374.—T. F. B.

Lacquers, varnishes, and other substances suitable for painting and containing nitrocellulose ; Process of making ——. B. G. Buchstab. Fr. Pat. 407,862, Oct. 13, 1909. Under Int. Conv., Jan. 30, 1909.

See Ger. Pat. 216,307 of 1909 ; this J., 1909, 1320.—T. F. B.

Oleo-resins, turpentine oil, oils, and wood spirit from wood ; Process for extracting ——. C. P. Ogilvie and G. Mitchell. Fr. Pat. 407,927, Oct. 16, 1909. Under Int. Conv., March 12, 1909.

See Eng. Pat. 5978 of 1909 ; preceding.—T. F. B.

Mono-azo dyestuffs especially adapted for lakes. Eng. Pat. 14,316. *See* IV.

Azo colours insoluble in oil. Ger. Pat. 219,499. *See* IV.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber production in Asia ; Dangers, mistakes and improvements connected with ——. D. Sandmann. Tropenpflanzer, 1910, 14, 117—140 and 180—206.

In speaking of the dangers attendant upon the extension of cultivation of rubber-bearing plants, root fungus is referred to as the principal disease to be fought. Insufficient nourishment is probably responsible for this disease, and close planting from this point of view is an evil. Interplanting with other crops has not the same effect, since the food required is different, even in the case of different species of rubber. White ant is at present fought by fumigation with sulphur dioxide and arsenic. A possible line of advance lies in the selection of seed so as to produce trees of large latex-yielding capacity. Individual trees differ markedly in this respect. The question of weeding is of great importance. The interplanting of ground crops such as *Passiflora fœtida*, *Crotalaria striata*, *Mimosa pudica*, *Desmodium triflorum*, etc., serves a double purpose, in keeping down weeds and in increasing the nitrogen-content of the soil. In addition it prevents the washing away of soil on sloping ground. The treatment of the tree both before and during tapping is considered. Topping the trees is now being given up generally, because the horizontal boughs are more liable to be broken down by wind. There is scope for advance in methods of tapping. The use of the pricking-wheel in conjunction with the tapping knife is to be recommended, but the use of the pricker alone is of doubtful advantage ; the bark is not uniform in thickness, and damage may easily be done to the cambium. The possibility of a system of mechanical tapping is mooted. The time of day most suitable for tapping is without doubt the early morning ; the intervals between successive tappings depend upon a number of local factors, and must be left to individual planters to decide. The necessity for absolute cleanliness in the collecting channels and cups is insisted upon. The most satisfactory are bamboo channels and glass or porcelain cups. It should be remembered that the instant the latex leaves the tree it becomes subject to decomposition ; it should therefore be protected from germ-laden dust, and should be kept as cool as possible to check fermentative changes. In dealing with the preparation of latex for coagulation, the use of a horse-hair sieve for straining is recommended, and the necessity for adding an antiseptic to the latex before coagulation is insisted upon. Protein-content and resin-content are kept low by dilution of the latex before coagulation, and in the case of *Funtumia* and *Castilloa*, prolonged washing of the latex is necessary to remove those constituents which hinder coagulation. The methods of coagulation referred to are acetic acid, centrifugal action, spontaneous acid production in the latex, formic acid, creosote and fluorine compounds—in particular "Purub" (hydrofluoric acid). The washing should be as complete as possible while the coagulum is in a spongy state, and before it is passed between rollers. When an antiseptic is employed it is safe to leave from 9 to 10 per cent. of moisture in the rubber, but otherwise the moisture must be reduced to 0·5 per cent. Drying is preferably carried out in well-ventilated rooms, screened by means of blue, yellow or red glass from direct sunlight, and scrupulously clean. A fact worthy of note is that the "scrap" rubber on some plantations amounts to as much as 40 per cent. of the total production.—E. W. L.

Caoutchouc ; Determination of —— *as nitrosite.* G. Fendler. Gummi.-Zeit., 1910, 24, 1000.

The high results frequently obtained by the author with the nitrosite method (this J., 1904, 1117) cannot be due to the insolubility in petroleum ether of the nitrosites of resinous substances contained in the rubber, as suggested by Harries, since in the author's estimations by that method the resinous substances were previously removed by extracting the caoutchouc with acetone for six hours in a Soxhlet apparatus.—R. V. S.

Patents.

Rubber and similar products ; Apparatus for drying and storing ——. T. G. Marlow, London, and A. A. Marlow, Mitcham. Eng. Pat. 3617, Feb. 13, 1909.

The rubber, or other material to be dried, is suspended in a closed (dark) chamber, or chambers, well-insulated, and forming part, preferably, of a closed system, through which air is caused to circulate under the following conditions. Assuming the chambers to contain warm, moisture-laden air, this is drawn from them through a series of ducts by means of an exhauster, and passed on through a refrigerating chamber, cooled, for example, by means of a system of pipes through which cold brine is flowing—, and through a heating chamber—heated by means of steam coils or by waste gases, etc.—into a well-insulated "equalising chamber" of considerable capacity. In this chamber the dried, warm air is allowed to become of a uniform temperature throughout, before being passed, by means of an air-blower, back into the chambers in which the rubber or other material is being dried. In operating the plant, the drying chambers are exhausted to a vacuum of about 2 inches of water, and the exhauster is then cut out and the blower inserted in the circuit ; warm, dry air is now driven into the chambers until a positive pressure of about 2 inches is reached, when blowing is stopped and the chambers again exhausted, the process being repeated until the rubber, etc., is dry. If necessary a germicide may be sprayed into the refrigerating chamber in order to keep the air sterile.—E. W. L.

Rubber and other gums; Apparatus for extracting —— from plants, barks, fibres, etc. L. Guiguet, Lyon-Villeurbanne, France. Eng. Pat. 9064, April 16, 1909.

The plant, bark, etc., are passed into a crusher (comprising a fixed plate provided with teeth in front of which rotates a similar plate) where they are reduced to pulp; the pulp passes into an agglomerator or agglomerators in communication with the crusher, and is there subjected to the action of water and heat, by which means the rubber is kneaded together into a mass, whilst the organic and other impurities are washed away by the water. The rubber next passes into a rotating drum, in which further washing and separation are effected, and finally into another agglomerator where, in the presence of a stream of water it is worked up into large masses, impurities having now been completely removed. Each agglomerator consists of a cone provided with helical ratchet-like grooves, working within a hollow conical sleeve which is provided with similar grooves on its inner surface. The helices of the sleeve are of opposite sign to those of the internal cone. In these agglomerators the mass is first torn apart at the points of the teeth, and is then compressed, rolled and flattened between the sides of the teeth. The hollow walls of the sleeve permit of the circulation of steam or hot water through them to facilitate the agglomerating process.—E. W. L.

Para rubber; Manufacture of artificial ——. J. Blum, Brussels. Eng. Pat. 28,450, Dec. 30, 1908.

See Fr. Pat. 399,345 of 1909; this J., 1909, 995.—T. F. B.

Indiarubber; Process for devulcanising ——. M. Körner, Grünau, Germany. U.S. Pat. 953,094, March 29, 1910.

See Fr. Pat. 358,635 of 1905; this J., 1906, 326.—T. F. B.

Rubber; Machine for reducing vulcanised —— to powder. T. Gare. First Addition, dated Oct. 28, 1909, to Fr. Pat. 389,210, April 14, 1908. Under Int. Conv., Oct. 28, 1908.

See Eng. Pat. 22,893 of 1908; this J., 1909, 1051.—T. F. B.

Rubber in sheets; Manufacture of ——, and application of rubber to fabrics, etc. T. Gare. First Addition, dated Oct. 13, 1909, to Fr. Pat. 399,192, Feb. 6, 1909.

See Eng. Pat. 20,303 of 1908; this J., 1909, 1149.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Chrome tanning; A new development in ——. R. W. Griffith. J. Amer. Leather Chem. Assoc., 1910, **5**, 222—225.

If chrome stock is dried after tanning it will not re-absorb moisture, thus it is necessary to keep it wet; also, neutralisation must not take place too quickly, but the goods must be piled so that the chromium base may become fixed, and the "tan salts" will not wash out in subsequent processes. The advantages of "ageing" or "crusting" alum- and vegetable-tanned leathers are noted, and it is urged that this process would improve chrome leather, which will easily re-absorb water if treated with lactic acid. The author's method is as follows:—After tanning, the unwashed goods are "horsed up" over night, set out, shaved, and then drummed for ten minutes in a solution of lactic acid, using 4 lb. of lactic acid of 22° B. and sufficient water for each 100 lb. of wet leather. After this treatment the goods may be dried out and stored in the crust until required, when they readily re-absorb water. In combination tannages the method is recommended as a preliminary to the vegetable tannage, the fixation of the latter being brought about more intimately.—A. T. H.

Monazite; Tannage with the residues of —— after the extraction of thorium. M. Parenzo. Collegium, 1910, 121-124.

Garelli (this J., 1907, 978) has shown that the residues resulting from the extraction of thorium from monazite, possess the power of tanning, and that this power is possessed to a remarkable degree by cerium salts—of which the residues contain at least 50 per cent. as carbonate—and to a lesser extent by the salts of thorium, didymium, lanthanum, zirconium, and iron, which are also present. The tanning action is analogous to that of alum, more especially in the case of the salts of trivalent metals, which yield a white leather of better quality, and more resistant to water than alum-leather. One particularly interesting fact is that monazite is feebly radio-active, and the skins tanned with it also show slight radio-activity. It is suggested that these facts may be of practical application in tanning, since there is an enormous over-production of crude cerium salts in the manufacture of incandescence mantles, and this residual matter can be bought at a very low price, as no industrial use has yet been found for it. The quantitative work was done with hide-powder, both neutral and basic solutions being used. Garelli had already proved that the hide fixed about 5 per cent. of sesquioxide from the nitrates of these rare metals, and that the presence of sodium chloride improved the product. The author has determined the effect of concentration and the influence of salt, on the fixation of sesquioxides from the nitrates and chlorides of these metals, by estimating the amount present in solution before and after treatment with hide-powder, by precipitation with ammonia and subsequent ignition. From the tables given it is concluded that when using nitrates, the more dilute the solution, the greater is the percentage (on the amount present) of salts fixed, and the presence of sodium chloride favours the absorption of basic salts or sesquioxides, just as in the alum tannage. Chlorides show less absorption by the hide, and the addition of salt has no decided effect; the addition of nitrate ions, however, increases the absorption. The results show that a proportionately greater quantity of salts is deposited on the fibre from the more dilute solutions. —A. T. H.

Demineralised gelatin; Preparation and some physico-chemical properties of ——. C. Dhéré and M. Gorgolewski. Comptes rend., 1910, **150**, 934—936.

Gelatin may be practically completely freed from mineral impurities either by prolonged dialysis (1½—3 months) first in distilled water and finally in conductivity water at 0°—2° C.; or by freezing a 0·5 per cent. solution, when flocks of gelatin almost free from mineral matter separate and may be collected on a platinum or nickel filter-cone; these flocks show a remarkable fibrous structure under the microscope. In the purification by dialysis, some ether is added to the water to prevent decomposition of the gelatin. Whilst commercial gelatin travels towards the cathode under the influence of an electric current, demineralised gelatin travels towards the anode. Since gelatin containing as little as 0·05 per cent. of mineral matter still travels towards the cathode, it is evident that at a certain stage of the purification, the gelatin is electrically neutral. Demineralised gelatin forms opalescent solutions between certain limits of concentration. At about 2 per cent. concentration, the solution is strongly opalescent; it is nearly clear at about 8 per cent., and completely so at 10 per cent. concentration. The opalescence is diminished or destroyed by addition of traces of alkali; acids are not so effective in this respect, and salts still less so, except when they are hydrolysed. In solutions of less than 1 per cent. concentration, at temperatures not above 15° C., coagulation gradually takes place, until finally there are obtained opalescent flocks suspended in a perfectly clear liquid. The demineralised gelatin forms jellies, although not so readily as ordinary gelatin. The formation of jellies is improved by addition of traces of acids, alkalis, or salts, even of such salts as potassium iodide, which hinder the gelatinisation of ordinary gelatin.—A. S.

Some constants for cod liver and menhaden oils. Alsop. *See* XII.

Precipitation of proteins by acetone. Weyl. *See* XIXa.

Partial hydrolysis of proteins by sulphuric acid. Skraup and Krause. *See* XIXa.

Patents.

Leather products and process of making the same. P. F. Leach, New York. Eng. Pat. 19,332, Aug. 23, 1909. Under Int. Conv., Feb. 17, 1909.

Untanned skin or hide, either in scraps or whole, is freed from hair, preferably by the ordinary liming process, and then shredded into fine particles by any suitable means. These fibres or particles are tanned, pressed together and dried, the pressing and drying being repeated if required. If desired, other materials, such as hair, mineral matter, oils, etc., may be incorporated with the mass, or substances (*e.g.*, calcium carbonate) may be added and subsequently removed by treatment with a solution of lactic acid or other solvent, so as to render the product more porous. —C. A. M.

Tanning process. C. A. Jensen, London. From The Fitzroy Tanning Co., Ltd., New Plymouth, New Zealand. Eng. Pat. 2499, Feb. 1, 1910.

The hides are washed twice in water for 24 to 36 hours, and then soaked in a weak lime bath for 36 hours. They are then placed in a lime and sodium sulphate bath for six days, after which they are soaked in water at 80° F. for five or six hours, unhaired in the usual way, fleshed and "scutted" in clean water. Bating follows, the bate being composed of fowl-dung and water at 80° F., in which the hides are paddled for about four hours, when they are "scutted" to remove dirt and lime, and then placed in a lactic acid solution in a paddle-pit for about two hours. After this preliminary treatment, the hides are drummed for ten minutes twice with successive quantities of borax solution at about 110° to 120° F., and are then washed in the drum with water at 80° to 90° F. In this way the hides are thoroughly cleaned and the pores opened to take the tanning solutions. The hides are drained and treated in the drum with a solution of common salt, alum and sodium pyrophosphate at 100° to 110° F., the solution being added in two portions, and the drum rotated for 30 minutes after the addition of the first portion, and for 15 minutes after the second. The solution is then transferred to another vessel and the hides soaked in it for three or four hours or longer, when they are removed and allowed to drain for 12 hours. When drained they are washed in the drum with borax solution, and then treated in the drum with a solution of alum, common salt and sodium pyrophosphate, together with a solution of crude gambier and quebracho. For leather such as sole and harness leather, the hides may be treated with the above mixture in a tanning pit for about two days, a small quantity of oak extract being added in this case. Finally the hides are soaked in a pit with borax solution for two hours, and then drained and curried in the usual way. The solutions employed are as follows:—First tanning solution: 25 lb. of alum, 15 lb. of common salt, 5 lb. of sodium pyrophosphate, 24 galls. of water. Borax washing solution: 2 lb. of borax, 4 galls. of water. Second tanning mixture: 5 lb. of alum, 2½ lb. of common salt, 1½ lb. of sodium pyrophosphate in 8 galls. of water, added to 12 to 15 lb. of gambier and 10 lb. of quebracho in 22 galls. of water. Final borax solution: 5 lb. of borax in 500 galls. of water.—E. W. L.

Skins; Machines for carroting ——. L. Vannereau. Fr. Pat. 407,892, Oct. 15, 1909.

The machine consists essentially of two brushes working in opposite directions on the periphery of an open drum which carries the skins. One brush works against the grain of the skins and brushes up the hair to receive the impregnating mixture (mercury nitrate and nitric acid), whilst the other smooths the hair down, and expresses excess of the liquid applied. Both operations are thus carried out on one machine, which was not formerly the case.—A. T. H.

Unhairing skins; Process for —— by means of hydrochloric acid. I. Molhant. Fr. Pat. 408,440, Jan. 23, 1909.

The unhairing is effected by suspending the hides in salt solution to which hydrochloric acid has been added. Suspension and handling extend over several days, and the pits are strengthened by the addition of more acid. —A. T. H.

Glue substitute; Process for the manufacture of a ——. F. Lehmann and J. Stocker. Fr. Pat. 408,240, Oct. 25, 1909.

Marine algæ are soaked until swollen, in a solution of alum, which is then decanted. The mass thus obtained is boiled until all soluble matter is dissolved, and is then filtered. To the filtrate is added acetic acid, and dextrin or tannin, and after solution, the ordinary method for the manufacture of glue is followed. The product is insoluble in cold water. To prevent friability, glycerin or glucose is added, and resistance to water may be augmented by the addition of chrome alum or formaldehyde.—A. T. H.

Gelatin sheets; Process and device for separating —— from glass plates or the like. Langheck und Co. Ger. Pat. 220,138, Feb. 17, 1909.

The difficulty experienced in removing gelatin sheets of over 0·3 mm. thickness, from the glass plates on which they have been formed, is greatly diminished by the use of hot knives. For this purpose, a circular blade may be attached to the end of a soldering iron, so that it may be kept warm for a considerable time.—T. F. B.

Curd; Process for the manufacture of a solid body by means of ——. L. Erasmus. Fr. Pat. 408,402, Oct. 28, 1909.

Moist curd is heated for some time at the temperature of boiling water, but without the addition of the latter. Heating is continued until the mass has passed the viscous state, and has a granular aspect. The product is then compressed and treated with formaldehyde.—A. T. H.

Casein; Process for preparing a plastic product from ——. F. Lebreil and R. Desgeorge. Fr. Pat. 408,592, Jan. 27, 1909.

A pliable product may be obtained from casein by treating it in an autoclave, at a high temperature, with acetone and its homologues. The quality of the product may be modified by previous treatment with nitric acid or benzene. —A. T. H.

Solutions particularly adapted to be used in connection with the treatment of leather, skins, and hides [*Deliming glue and gelatin solutions*]. G. B. M. Spigno, Genoa, Italy. Eng. Pat. 10,661, May 5, 1909.

See Fr. Pat. 397,804 of 1908; this J., 1909, 896.—T. F. B.

Skins; Machine for carrotting ——. L. Beaulieu, Limoges, France. Eng. Pat. 27,536, Nov. 26, 1909. Under Int. Conv., Dec. 16, 1908.

See Fr. Pat. 397,904 of 1908; this J., 1909, 882.—T. F. B.

Leather; Process for treating ——. O. Silberrad. Fr. Pat. 408,298, Oct. 26, 1909. Under Int. Conv., Oct. 27, 1908.

See Eng. Pat. 22,867 of 1908; this J., 1909, 1262.—T. F. B.

Tannin-containing extracts of plants, particularly of mangrove bark; Process for treating ——. H. Damköhler and H. Schwindt. Fr. Pat. 408,448, Oct. 29, 1909.

See Eng. Pat. 24,899 of 1909; this J., 1910, 365.—T. F. B.

Plastic material ; Process of producing objects from ——. Z. Olsson, Upsala, Assignor to G. S. A. Appelqvist, Stockholm. U.S. Pat. 954,991, April 12, 1910.

See Fr. Pat. 369,719 of 1906 ; this J., 1907, 330.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Drainage. An effect of —— [*on the fertility of soils*]. Bieler-Chatelan. Comptes rend., 1910, **150**, 884—886.

Two meadows near Geneva were dressed with potassium salts and the increased yield of grass was noted. The one meadow at Macheiry showed an increase of 17 per cent. on previous crops, whilst the other meadow at Colovrex gave an increase of 6 per cent. On analysis the soil from Macheiry was found to contain 1·9 per cent. of potash soluble in cold concentrated hydrochloric acid, and 0·108 per cent. of potash soluble in water containing carbon dioxide. The figures for the soil from Colovrex were respectively 1·6 and 0·090 per cent. Although the soil at Macheiry was richer in potash, it responded in a greater degree to the potash dressing. This unexpected behaviour was due to the fact that the soil at Macheiry was badly drained and compact, whilst at Colovrex it was more open and had been tilled more deeply.—F. Shdn.

Phonolith meal [*potassium silicate*], *a new potash manure.* P. Krische. Chem.-Zeit., 1910, **34**, 387.

Phonolith meal is a mixture of sanidine and nepheline containing 9 per cent. of potash of which about 3 per cent. is soluble in hydrochloric acid. Field experiments made by Wein in 1905—08 indicate that this meal is equal or superior to the soluble potash salts. The pot experiments made by Wagner led him to a contrary conclusion and several experimenters have recently confirmed the statement that phonolith meal is greatly inferior to potash salts. This opinion is generally held in spite of more recent pot experiments made by Wein in which he finds phonolith meal equal in effect to soluble potassium salts but ascribes this action to still unknown influences.—E. F. A.

Phosphates ; After effects of certain —— *on limed and unlimed lands.* H. J. Wheeler. J. Ind. Eng. Chem., 1910, **2**, 133—135.

Practical tests show striking differences in the ability of different varieties of plants to utilise the different phosphates and also the dependence of this ability upon the character of the soil as affected by liming. Experiments with millet showed that liming rendered more of the phosphorus available. On plots where a great lack of lime and of available phosphoric acid existed at the outset, liming liberated sufficient phosphoric acid to render the addition of phosphates unnecessary for at least three years. Liming had no beneficial effect in conjunction with raw iron and aluminium phosphates but it much increased the availability of the roasted phosphates. "Floats" (finely ground tri-calcic phosphate rock) were lower in efficiency than all the other better known phosphatic fertilisers. Experiments with potatoes showed that liming was highly beneficial in connection with all of the phosphates and that it tended to increase the yield of tubers of large size. Even when no phosphate was used, the yield was three times as great on the unlimed plot. "Floats" were found to be as efficient as acid phosphate on unlimed land, doubtless owing to their tendency to correct the acid condition of the soil.—E. F. A.

Fertilisers ; Bacteriological methods for determining the available nitrogen in ——. J. G. Lipman. J. Ind. Eng. Chem., 1910, **2**, 146—148.

Measurements have been made of the relative availability of nitrogenous materials by determining the amounts of nitrates and ammonia produced from them in a suitable culture medium. The data obtained bear out the supposition that substances which yield ammonia easily also readily yield nitrates. An exception to the general rule is afforded by cottonseed meal with which, though nitrates are readily formed, ammonia is produced only to a relatively small extent. In the tests the nitrogenous materials were mixed with 100 grms. of soil and 1 grm. of calcium carbonate. Uniform moisture conditions were maintained. Ammonia determinations were made at the end of six days, and nitrate determinations after four weeks.—E. F. A.

Chemical study of the lime-sulphur wash. Van Slyke and others. *See* XIXb.

Concentrated lime-sulphur mixtures. Parrott. *See* XIXb.

Patents.

Nitrogen-fixing organisms ; Use of —— *in agriculture and horticulture.* W. B. Bottomley, London. Eng. Pat. 11,365, May 13, 1909.

A culture is prepared of nitrogen-fixing organisms obtained from the root tubercles of leguminous plants ; another culture is also prepared by adding ordinary cultivated soil to a nutrient medium containing 20 grms. of mannitol, 1 grm. of potassium phosphate, 0·5 grm. of magnesium sulphate, and 0·5 grm. of calcium carbonate per litre ; the brown scum appearing on the surface of the liquid in about 7 days is removed and cultivated on agar plates containing nutrient medium of the above composition. Drops of both cultures are then mixed with a little water and the mixture of organisms thus obtained is added to a solution containing 15 grms. of maltose, 10 grms. of mannitol, 1 grm. of potassium phosphate and 0·5 grm. of magnesium sulphate per litre. The inoculated solution is kept at a temperature of from 22° to 28° C. for 48 hours and the milky fluid produced is used for moistening seeds or, after dilution, for watering plants. For purposes of transportation, sterilised soil may be impregnated with the milky fluid and dried at a low temperature, or 2 per cent. of agar may be added to the solution in which the organisms are grown, so as to produce a solid culture. —W. P. S.

Manure ; Manufacture of a ——, *from Thomas meal and an ammonium salt.* Gewerkschaft Deutscher Kaiser Hamborn. Fr. Pat. 407,565, Oct. 4, 1909.

Thomas meal is added to a concentrated solution of an ammonium salt containing sufficient sulphuric acid to combine with the free lime present in the Thomas meal. The mixture is then dried, and ground.—W. P. S.

Nitrogenous fertiliser ; Process for the preparation of a —— *from the product obtained by the action of nitrogen on alkaline-earth carbides or on mixtures capable of producing the same.* Stickstoffwerke, Ges.m.b.H. Ger. Pat. 219,932, Aug. 27, 1908.

Crude alkaline-earth cyanamides, such as "Kalkstickstoff," etc., are intimately mixed with acid salts of alkali or alkaline-earth metals, such as bisulphates, nitre cake, polysulphates, bicarbonates, etc. It is stated that the crude cyanamides are thereby converted into non-hygroscopic products, which do not easily fall to dust, the free lime present being converted into sulphate or carbonate. Moreover the cyanamide is partially converted into ammonium salts and thus rendered directly available as a plant food.—A. S.

Fertiliser from bog-peat ; Process for preparing a ——. J. Wolters. Ger. Pat. 220,213, June 5, 1909.

Bog-peat is converted into a useful fertiliser by adding alkaline-earth carbonates, or other neutral substances which will neutralise acids. The use of limestone is said to give better results than lime or secondary alkali phosphates, because the nitrogen-fixing bacteria are most active in neutral media. Experiments are described showing that the yields of crops when using peat mixed with calcium carbonate, were 30 per cent. higher than when peat and lime were used, and over 40 per cent. higher than with peat alone.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

Beets and diffusion juice; Proportions of dry substance and non-sugar in ——. H. Claassen. Z. Ver. deutsch. Zucker-Ind., 1910, 323—326.

The keeping of a record of dry substance, in beets, diffusion juice and waste products, is of considerable importance in the accounts of a sugar works. The work is somewhat laborious, but 3 or 4 determinations weekly of average samples of each material are sufficient. The beet chips are reduced to a coarse pulp by means of the rasping machine: the pulp is sampled and 20—25 grms. are weighed out in a flat-bottomed glass dish, together with a stirring rod which is used occasionally to break up lumps. The material must then be subjected to a preliminary drying process for 2 hours at 70° C., in order to avoid decomposition during the final drying, which is effected at 106°—108° C. in a vacuum drying oven. In the determination of dry substance in diffusion juices, it is absolutely necessary to use a large proportion of sand in order to arrive at constant weights. The juice must be mixed with at least 40 grms. of sand per 1 grm. of dry substance:—12—15 grms. of the juice are mixed in a glass dish with 80 grms. of sand and dried, first at 70° C., as in the case of beet pulp, and finally at 103°—105° C. under vacuum. The author tabulates the results obtained during 3 seasons in the control of a sugar mill, all diffusion wash-waters being returned to the diffusers. In the 3 seasons, in spite of great climatic variations, the sum of exhausted beet pulp and non-sugar showed very small variations. On the other hand, the quantities of non-sugar passing over into the diffusion juice varied somewhat widely from one season to another.—J. F. B.

Sugar in beetroot; Influence of optically active non-sugars on the determination of ——. K. Andrlík and V. Staněk. Z. Zuckerind. Böhm., 1910, **34**, 385—399.

The authors show that if 500 c.c. of the juice obtained by the ordinary method of hot, aqueous digestion (twice the normal weight of pulp with 10 c.c. of basic lead acetate solution, made up to 401·4 c.c.), are concentrated to about 50 c.c. on the water-bath, made up to 100 c.c., and filtered, the polarisation is decreased by an amount, corresponding on the average, to about 0·2 per cent., calculated on the beetroot. This decrease is not due to the formation of invert sugar. Pure sucrose solutions are similarly affected when treated with basic lead acetate and concentrated. It is also shown that the direct polarisation of the concentrated digestion juice is generally higher (by an average of 0·11 per cent. on the roots, in the cases investigated) than the percentage of sugar found by Clerget's method; expressed and diffusion juices present similar differences, and the authors attribute these differences to the presence of optically active non-sugar in the juice clarified with basic lead acetate, a view which is confirmed by the fact that the differences are much less when the juice has previously been submitted to the lime treatment and saturation. The process of heating the juice with lime, and subsequent saturation, decreases the polarisation, from which it is concluded that the optically active non-sugars are precipitated, or altered in respect of rotatory power.—L. E.

Aldoses and ketoses [sugars]; Diagnosis of —— with bromine water. E. Votoček and J Němeček. Z. Zuckerind. Böhm., 1910, **34**, 399—402 (see this J., 1910, 168).

The authors show that for the diagnosis of ketoses and aldoses, the oxidation with bromine water should be effected at the ordinary temperature; lævulose is not attacked at this temperature, though at high temperatures (60° and 100° C.) it is slowly oxidised. The following procedure is recommended:—0·5 grm. of the pure sugar under investigation is dissolved in less than 10 c.c. of water, treated with 40 c.c. of bromine-water (saturated at the ordinary temperature), the whole being made up to 50 c.c. with water. After the lapse of 24 hours (at 21° C.), the sugar in 25 c.c. of the solution is determined by Allihn's method. If 60—95 per cent. of the sugar has been oxidised, the sugar is proved to be an aldose; if practically none of the sugar is oxidised, it is a ketose. The authors also point out that the isolation of ketoses from a mixture of aldoses and ketoses, may be facilitated by destroying the bulk of the aldoses with bromine-water.—L. E.

Sugar; Determination of —— volumetrically, using Fehling's solution. W. Clacher. Internat. Sugar J., 1910, **12**, 184.

One hundred c.c. of Fehling's solution are diluted to 1 litre, 50 c.c. of the dilute solution being standardised against a 0·1 per cent. solution of invert sugar. The end-point of the reaction is taken to be that at which the cuprous oxide first granulates, and is detected by pouring a small quantity of the solution into a small flat porcelain dish when, if the end-point is reached, the precipitate will appear granular within 3 seconds. Although it does not indicate complete precipitation of the copper, the end-point is exact to within 0·1 c.c. The concentration of the sugar solution under investigation should be such that 20—35 c.c. are required to precipitate 5 c.c. of Fehling's solution (*i.e.*, 50 c.c. of the diluted Fehling's solution).—L. E.

Barium salts; New method for volumetric analysis of ——. E. Selvatici. Bull. Soc. Chim. Sucr. et Dist., 1910, **27**, 862—864.

Garelli and Ravenna have proposed a method for the volumetric determination of barium salts which depends on the use of potassium bichromate. The author describes the application of the method to the determination of barium hydroxide in the boiling solution used for desaccharifying molasses. Fifty c.c. of the boiling solution are removed with a special pycnometer provided with a ground glass stopper, and transferred to a 500 c.c. flask, the pycnometer being rinsed out with boiled, distilled water. The cooled solution is made up to 500 c.c., mixed, and allowed to stand until the insoluble matter is deposited. Twenty c.c. of the clear liquid are transferred to a 100 c.c. flask, treated with a few drops of acetic acid, and then with 60 c.c. of a solution containing 4·66 grms. of potassium bichromate per litre, the whole being made up to 100 c.c., mixed and filtered. Fifty c.c. of the filtrate are treated with 10 c.c. of a 10 per cent. solution of potassium iodide and 5 c.c. of a 10 per cent. solution of hydrochloric acid. The iodine set free is titrated with a solution containing 23·567 grms. of crystallised sodium thiosulphate per litre (1 c.c. of this solution is equivalent to 1 c.c. of the bichromate solution). The number of c.c. of the bichromate solution corresponding to the 50 c.c. of the filtrate used (*i.e.*, 30 c.c. of the bichromate solution) diminished by the number of c.c. of thiosulphate solution required for titration, represents the weight, in centigrams, of hydrated barium hydroxide, $Ba(OH)_2+8H_2O$, in 1 c.c. of the original, boiling solution. If the solution under investigation contains sulphide, it must be boiled with a small quantity of acetic acid until free from sulphuretted hydrogen. Since barium sulphide dissolves in water with the formation of hydroxide and hydrosulphide in equimolecular proportions, the amount of hydroxide in such a solution is found by dividing the result obtained by the above method by 2.—L. E.

Patents.

Adhesive powder; Process for the preparation of an ——. F. Beckmann. Ger. Pat. 219,651, July 5, 1908.

The adhesive consists of a mixture of 50 parts of gum arabic, 5 of wheaten flour, 2 of gum tragacanth, 25 of dextrin, 15 of sugar, and 3 of magnesium sulphate, all in a finely powdered condition.—A. S.

Adhesive powder; Process for making an ——. F. Beckmann. Fr. Pat. 408,254, Sept. 11, 1909.

See Ger. Pat. 219,651 of 1908; preceding.—T. F. B.

Sugar solutions; Apparatus for concentrating ——. T. Suzuki. Fr. Pat. 467,989, Sept. 27, 1909.

See U.S. Pat. 937,114 of 1909; this J., 1909, 1185.—T. F. B.

Fodder composed of peat and molasses. Eng. Pat. 23,660. See XIXa.

XVIII.—FERMENTATION INDUSTRIES.

Barley; Transformation of the proteins in —— during malting. H. Schjerning. Compt. Rend. Labor. de Carlsberg, 1910, 8, 169—395.

The research has been carried out on malts grown and kiln-dried in the laboratory in special apparatus and not upon technical malts. The methods of estimating the protein constituents, and their degradation products, are those previously employed by the author in his research on the ripening of barley (this J., 1906, 1109), which he maintains are perfectly adequate. In the course of germination the insoluble proteins are partly converted into the soluble albumin II. (*loc. cit.*) which is further changed into albumin I., and finally, entirely or partially, into proteoses and peptones, amino-acids, and ammonia. When the protein conversion is proceeding normally, the proteolysis is equal to the protein solution and no albumin II. is present in the malt. For the subsequent germination of the barley to be normal it is essential that the steeping which it receives should be continued as long as possible without detriment to the vitality of the corn. A barley which has reached the maximum of germinating energy after six hours steeping at 18°—20° C. is unfit for malting purposes, and barleys which require less than 24 hours are of doubtful utility. Under- or over-steeping weakens all the processes of proteolysis and also changes their inter-relation. The proteolysis is also affected by the temperature at which germination is conducted. The optimum temperature for normal and complete conversion lies between 13° and 17° C.; from 17° to 20° C. the proteolysis is quantitatively different but qualitatively unaltered; above 20° C. the action is abnormal. Temperatures below 13° C. tend markedly to weaken the root growth. In general the greater part of the decomposition and transformation, both as regards carbohydrates and proteins, is accomplished during the first four days of germination. The velocity of the changes is affected by the temperature. Over-germination causes reversal of some of the normal transformations. Excess of moisture during germination favours growth of the acrospire but restricts root growth and oxidation processes, while dryness appears to impair the proteolysis and oxidation and to a less degree the root growth. Insufficient aeration tends to impair all the processes of protein conversion quantitatively and qualitatively, so that neither proteolysis nor albumin transformation is completed. Ungerminated barley contains both peroxydases and true catalases, but of these the former, only, increases in amount during germination, while both decrease during kilning. The peroxydases occur in the periphery of the corn and in the germ, but not in the endosperm; they are found in large quantity in the rootlet but are absent from the acrospire. Experiments on the kiln-drying of malt, already dried at a low temperature to 6—8 per cent. of moisture, show that at temperatures above 60° C., albumin II., if present, may be transformed into albumin I., which is itself coagulated at 90° C. The peptic and tryptic actions are weakened by temperatures of about 100°C. The amount of extract yielded does not fall off appreciably below 100°, and no loss of dry substance by oxidation occurs under 105° C. During storage no noticeable loss by oxidation takes place, and the peptic action and the yield of extract increase somewhat; in a period of 174 days during which the moisture in the malt rose from 5·8 per cent. to 13·7—called by the author " moist " storage, albumin I. showed a tendency to be transformed into albumin II., but in a subsequent period of 159 days, during which the moisture fell to 10·9 per cent., " an amount which approximates to that of a normally matured malt," the reverse process took place. A perfectly normal and complete protein conversion has been secured in a malt if (1) at least 33 per cent. of the total nitrogen passes into solution during mashing, (2) at least 19 or 20 per cent. of the total nitrogen of the malt occurs in the wort as tryptic decomposition products, and (3) at least 5 or 6 per cent. of the total malt nitrogen is found in the wort as albumin I. A well germinated malt should give at least three parts of rootlet to each hundred parts of malt. R. L. S.

Amylase; Researches on ——. T. Chrzakzez and S. Pierozek. Z. Spiritusind., 1910, 33, 66—67; 81; 98—99; 132—133; 145—146.

The contradictory opinions held by various observers as to the presence of one or more enzymes in starchy seeds seem to be due to the uncertainty of the results yielded by different methods for determining the starch-liquefying power of amylase. The present papers deal with an investigation of the methods generally employed, and of the conditions under which the processes yield trustworthy results. The temperature most favourable for the starch-liquefying action of amylase lies between 60 and 65° C.; although the enzyme, in aqueous solution, is injuriously affected by a temperature of 65° C. and upwards, the presence of starch has a protective influence and diminishes the injury, so that the enzyme acts effectively between temperatures of 55° and 75° C. provided starch be present. Whilst amylase by itself is destroyed at a temperature of 75° C., in the presence of starch its action only ceases at 85° C., and, if an excess of the enzyme be present, some starch is liquefied even at 90° C. The starch-liquefying action of amylase is met with both in raw and malted grains; the action is the same in both cases, the only difference being that it is more pronounced in malted grains owing to the presence of larger quantities of the enzyme. (See also this J., 1910, 103.) Of the methods which have been proposed for determining the starch-liquefying power of amylase, the Lintner-Solleid process (this J., 1903, 826) is one of the most trustworthy and is particularly suitable for technical purposes; Pollack's process (this J., 1903, 1370) is accurate, as is also a viscosity method proposed by the authors (Z. Spiritusind, 1909, 535). In the latter process, the viscosity of the starch paste is determined both before and after treatment with amylase under definite conditions. The results obtained are accurate, but the method is somewhat tedious.—W. P. S.

Ammonium persulphate; Use of —— in [brewing] practice. K. Lenze. Allgem. Z. Bierbrau. u. Malzfabr., 1910, 38, 187—188 (Cp. Thevenot, this J., 1909, 1157; Schönfeld and Hardeck, this J., 1910, 37).

The author has made experiments, both in the laboratory and in the brewery, on the use of ammonium persulphate for purifying infected yeast, with special reference to sarcina infection. The experiments show that though yeast may be purified by this treatment without suffering appreciable injury, the fermentation obtained with the treated yeast is unsatisfactory in certain respects. The author concludes that, instead of washing with ammonium persulphate solution, it is preferable to continue using the yeast, under strict control, until careful biological examination indicates that a change of yeast is required. —L. E.

Brewing plant; A comparison of English and foreign ——. F. M. Maynard. J. Inst. Brew., 1910, 16, 222—234.

The malt mills in general use in Germany are of the four-roller type which is slowly coming into use in England. In these mills the grist after passing the first pair of rolls is separated, by shaking sieves or preferably by beaters, into husk and grits which latter alone pass through the second rolls. In the decoction methods of mashing, the goods never rise, so that the mash tun rakes have to be more powerful than those employed in England; many types of these are used, frequently of such a pattern as to allow of raising or lowering to any desired extent in the tun

The spend pipes from the mash tun are better arranged and are often so fitted that steam or hot water can be blown through them into the goods. The mash tun is sometimes fitted with a steel-mercury thermometer registering in some convenient position. On the Continent the wort coppers are universally covered, so that the steam may be conveyed above the roof of the building; this also has the advantage that the boiling is not checked by cold air currents and so conduces to an economy in fuel. Wort pumps are usually of the centrifugal or rotary types instead of the insanitary three-throw type affected by many English brewers. Coolers are of sheet iron or steel abroad, as compared with cast iron, wood or the more expensive copper used in England. Fermenting vessels of wood lined with copper which are so common in England are unknown on the Continent where wood either varnished or paraffined is usual, but within the last few years fermenting and storage vats have been made of concrete coated internally with paraffin, while the use of glass enamelled steel is becoming common. The general impression conveyed is that, compared with English, Continental brewery plant is essentially practical, by no means so costly, and yet of good design.—R. L. S.

Lager beer, raw materials, and malting. C. Rühl. J. Inst. Brew., 1910, **16**, 247—258.

In contradistinction to top-fermentation brewing which is of immemorial antiquity, bottom-fermentation brewing cannot be traced further back than the end of the fifteenth century. At the present time top-fermentation beer has almost been ousted from the German Empire by the bottom-fermentation or lager beer. The barley employed is almost always of the two-row type, *Hordeum distichum, erectum*, or *nutans*. It is common to buy barley under a guarantee that it does not contain more than a stated amount of nitrogen, as, *cæteris paribus*, that with the lowest nitrogen will yield the highest extract. In malting the use of warm (100°—120° F.), water in the steep is coming into vogue, especially in North Germany, to reduce the time necessary and to promote chitting. Lime or sulphuric acid are frequently added to the steep water, the latter to remove any mustiness of the barley. The flooring lasts in Germany seven or eight days, in Austria 10—12 days. The malt kilns are built with two floors, the upper for drying and the lower for curing the malt. For pale, or Pilsener malts, the moisture is removed quickly at a low temperature and the malt dropped to the lower floor with 4—5 per cent. of moisture and finished off at heats up to 190° F. For Münchener malts where colour is required, the green malt is stewed on the upper floor and not allowed to dry too rapidly. It is then dropped to the lower floor with 18—20 per cent. of moisture at a temperature of about 110° F. and cured finally at 212° F.—R. L. S.

Sucrose in wine, "Weissbier," etc. Detection of ——. S. Rothenfusser. Z. Untersuch. Nahr. u. Genussm., 1910, **19**, 261—268. (See this J., 1909, 956.)

Sucrose is much less readily adsorbed than invert sugar, etc., by the precipitate obtained on treating casein solution with a lead salt. The author utilises this fact for the detection of small quantities of sucrose in wine, etc. The following reagents are required :—(1) An ammoniacal solution of casein, prepared by rubbing to a uniform paste, 10 grms. of casein with about 30 c.c. of a mixture of 10 c.c. of ammonia of sp. gr. 0·965, and 90 c.c. of water, and then slowly adding a further 70 c.c. of the dilute ammonia; if the solution is required for immediate use, it is heated to 30°—35° C. on the water-bath, but otherwise, it is allowed to stand, with frequent shaking, until homogeneous. It is best to use the freshly prepared solution. In some cases, a 5 per cent. solution of casein is required; in preparing this, 5 c.c. of ammonia of sp. gr. 0·965, and 95 c.c. of water, are used. (2) A solution of 500 grms. of normal lead acetate in 1200 c.c. of water. (3) Ammonia of sp. gr. 0·944 at 15° C. (4) A diphenylamine reagent prepared by mixing 10 c.c. of 10 per cent. alcoholic diphenylamine solution with 25 c.c. of glacial acetic acid and 65 c.c. of hydrochloric acid of sp. gr. 1·19. *Sucrose in country wines.*—The wine is rendered neutral or very faintly acid by addition of $N/1$ sodium hydroxide, and 20 c.c. are mixed with 10 c.c. of the 5 per cent. casein solution, the whole is treated with 6 c.c. of a mixture of 4 c.c. of the lead acetate solution and 2 c.c. of ammonia of sp. gr. 0·944, and at once shaken thoroughly. After 10 minutes, the mixture is filtered, a portion (*e.g.*, 3 c.c.) of the clear colourless filtrate being heated with an equal volume of the diphenylamine reagent for 10 minutes in boiling water; the use of boiling water for heating is an essential condition. Even with wines containing so little as 0·03 per cent. of sucrose, the colourless solution soon begins to turn blue, and, in 5 or 10 minutes, presents a fine blue colour, whilst with wines free from sucrose, no coloration, or only a slight one, occurs. If control tests are made, the presence of 0·01 per cent. of sucrose may be detected. Simultaneously with the above-described test, another portion (about 5 c.c.) of the undiluted filtrate is heated with Fehling's solution in the water-bath. With normally fermented wines (*i.e.*, containing about 0·1 per cent. of invert sugar), and even with wines containing about 0·3 per cent of invert sugar, the filtrate shows no reducing power. With wines containing about 0·5 per cent. of invert sugar, the filtrate shows slight reducing power; in such cases, the sucrose test is modified, in that 20 c.c. of the neutralised wine are treated with 15 c.c. of the 5 per cent. casein solution and 9 c.c. of a freshly prepared mixture of 6 c.c. of the lead acetate solution and 3 c.c. of ammonia (sp. gr. 0·944). If the diphenylamine test gives a distinct, positive result, and the reduction test gives a negative result, the wine must contain sucrose, since the dextrin, as the author shows, and the reducing sugars, are removed by the method of treating the wine. The diphenylamine test is not conclusive, however, unless the filtrate shows no reducing power. *Sweet wines.*—It is advisable to dilute the wine with water (1 : 4 or 1 : 7), and to add an alkali palmitate or stearate to the casein solution; in many cases, the use of ammoniacal basic lead acetate gives good results. Thus, a mixture of 20 c.c. of sherry (1 : 4), 20 c.c. of casein-soap (10 per cent. casein solution treated with 1 per cent. of sodium stearate), and 10 c.c. of ammoniacal basic lead acetate (2 vols. of basic lead acetate solution + 1 vol. of 10 per cent. ammonia), was thoroughly shaken, and filtered after about 10 minutes. The filtrate did not reduce Fehling's solution, but gave an intense blue colour with the diphenylamine reagent within 10 minutes. Owing to the dilution with water, prior to treatment, it is not necessary to neutralise sweet wines. "*Weissbier.*"—Mixtures of "Weissbier" diluted with water (1 : 1), 20 c.c., casein solution (10 per cent.), 10 c.c., ammoniacal lead acetate solution, 9 c.c., were treated as above described. This treatment was found to effect the removal of maltose and dextrin, and to be suitable for the detection of small quantities of sucrose in "Weissbier."—The author also describes the procedures for detecting sucrose in samples of lactose adulterated with the former sugar, and for detecting sucrose in fruits.—L. E.

Wines; Presence of boron in Algerian ——. M. Dugast. Comptes rend., 1910, **150**, 838—839.

The author has found that boron is present in a large number of samples of Algerian wines of authenticated purity. Furthermore he has observed the presence of boron in many of the organs of the vine, notably in the ash of the vines, and in the skins and pips of the grapes. In the skins and pips the proportion of boron is comparatively large. The tests were made by the official French method: incineration at a low temperature and distillation of the ash with methyl alcohol and sulphuric acid, the boron being recognised by the coloration of the flame on burning the distillate.—J. F. B.

Hexamethylenetetramine [urotropine] in musts and wines, Detection of ——. E. Voisenet. Comptes rend., 1910, **150**, 879—882.

For the purpose of detecting the presence of urotropine in wines the following reagents are necessary: nitrous hydrochloric acid, prepared by adding 0·1 c.c. of a solution containing 3·6 grms. of potassium nitrite in 100 c.c. of water to 200 c.c. of pure hydrochloric acid, sp. gr. 1·18; and a 10 per cent. solution of egg albumin. Twenty-five c.c. of the wine are acidified with two drops of sulphuric acid, and distilled in a 50 c.c. flask provided with a condenser. The cooling length of the condenser must be 20 cm. The liquid must be distilled slowly and the second 5 c.c. collected, the first 5 c.c. being rejected. This is treated with 1 c.c. of the albumin solution and 18 c.c. of the nitrous hydrochloric acid. If formaldehyde derived from the urotropine is present, this mixture develops a violet colour on heating to 50° C. for a few minutes. This test will shew the presence of 0·1 mgrm. of urotropine in a litre of wine containing 350 mgrms. of sulphur dioxide.—F. Shdn.

Rums; Analyses of various ——. K. Micko. Z. Unters. Nahr. Genussm., 1910, **19**, 305—322.

The following results were obtained on the analysis of samples of different rums, the figures, except in the case of the sp. gr., expressing grms. per 100 c.c.:—

Description.	Colour.	Sp. gr. at 15° C.	Alcohol.	Total solids.	Total acid.	Volatile acid.	Ash.	Esters (as ethyl acetate).
					(as acetic acid).			
Cuba rums.								
Soledad Cuba	yellowish	0·8706	61·7	0·036	0·065	0·043	0·002	0·057
Los Cannos B. Cuba	clear brown	0·8794	59·1	0·134	0·067	0·039	0·004	0·051
Los Cannos Cuba	yellowish	0·8812	58·5	0·070	0·091	0·046	0·004	0·116
Demerara rums.								
Z. Demerara R.	brown	0·8742	62·1	1·868	0·115	0·023	0·040	0·062
P.M. Demerara R.	,,	0·8747	61·7	1·044	0·106	0·029	0·024	0·101
Jamaica rums.								
Jamaica rum S.P.	brown	0·8773	59·1	0·314	0·070	0·033	0·008	0·229
,, ,, M.N.F.	,,	0·8775	59·7	0·476	0·079	0·039	0·008	0·220
,, ,, Anas.	,,	0·8765	60·7	0·856	0·132	0·093	0·004	0·590
,, ,, C.	,,	0·8745	60·7	0·576	0·110	0·062	0·008	0·739
,, ,, L.F.	,,	0·8781	59·7	0·602	0·108	0·060	0·010	0·831
Concentrated Jamaica rum	,,	0·8678	62·4	0·300	0·670	0·426	0·010	2·390
Batavia arrack.								
Batavia arrack O.G.L.	yellowish	0·9138	47·6	0·603	0·137	0·087	0·007	0·194
,, ,, K.W.	,,	0·9134	47·7	0·072	0·142	0·093	0·006	0·251
Artificial rums.								
Genuine Cuba rum	brown	0·9312	41·2	—	0·019	0·006	—	0·135
Finest rum of Trinida de Cuba	,,	0·9137	47·6	—	0·010	0·002	—	0·040

The spirits were also examined as to the presence of typical aromatic substances (see this J., 1909, 255). From each sample, either directly on fractional distillation or after aromatic esters had been hydrolysed, aromatic substances could be separated which were characteristic of the different classes of spirits. As up to the present time no substance has been discovered which could be added to artificial rums to give the latter the characteristic odour of the genuine spirit, the detection or recognition of the aromatic substance peculiar to each class of spirit affords a means of detecting sophistication.—W. P. S.

Fusel oil in spirits containing [lubricating] oil; Determination of ——. E. Dunke. Z. Spiritusind., 1910, **33**, 150.

It sometimes happens that distilled spirits contain appreciable quantities of lubricating oil, the contamination having taken place in the distillation plant. Such spirits remain perfectly clear while concentrated, but become turbid on the addition of water. The determination of fusel oil in such spirits yields too high a result when the Röse-Herzfeld process is employed, the chloroform extracting the oil as well as the higher alcohols from the spirit. It is possible, however, to remove the oil, without decreasing the quantity of fusel oil, by diluting the spirit until the alcoholic strength is reduced to about 30 per cent. (by volume), then adding a small quantity of a 10 per cent. solution of aluminium sulphate, and neutralising the mixture with sodium hydroxide. The precipitated aluminium hydroxide carries down all the oil present, but the fusel oil remains in solution. After filtration, the perfectly clear solution is diluted to the proper strength and the determination of the fusel oil is carried out as usual.—W. P. S.

Methyl alcohol; Detection of ——, *especially in presence of ethyl alcohol.* G. Denigès. Comptes. rend., 1910, **150**. 832-834.

The test is based on the fact that, under certain conditions, potassium permanganate oxidises ethyl alcohol solely to acetaldehyde, and methyl alcohol to formaldehyde, and the latter may be detected in presence of the former by means of Schiff's reagent, provided the liquid be strongly acid (this J., 1910, 451). The method of procedure is as follows: 0·1 c.c. of the alcohol to be tested is placed in a wide test-tube with 5 c.c. of a 1 per cent. solution of potassium permanganate and not more than 0·2 c.c. of pure sulphuric acid. After two or three minutes, 1 c.c. of an 8 per cent. solution of oxalic acid is added and the mixture is shaken. Decolorisation is completed by the addition of 1 c.c. of pure sulphuric acid. Immediately afterwards, 5 c.c. of bisulphite-magenta solution are added, and if methyl alcohol be present, a violet coloration should appear in a few minutes. The coloration is appreciable if the proportion of methyl alcohol amounts to one per 1,000, but still smaller quantities may be detected by distilling the alcoholic liquid and testing the first fraction. For the detection of methyl alcohol in aqueous solutions, the presence of a little ethyl alcohol is advantageous, since it produces an acetal of formaldehyde which reacts more readily. Three c.c. of the solution, containing not more than three or four per cent. of methyl alcohol, are mixed with 0·1 c.c. of pure ethyl alcohol and 2 c.c. of a 2·5 per cent. solution of permanganate and tested as described above.—J. F. B.

Alcohols and water: Vapour pressures and boiling points of mixtures of saturated ——. I. A. Doroszewski and E. Polianski. J. Russ. Phys.—Chem. Ges., 1910. **42**. 109-134. Chem. Zentr., 1910, 1. 1226-1228.

THE authors determined the boiling points of mixtures of water with methyl, ethyl, and propyl alcohol respectively at three different pressures. The results for methyl and ethyl alcohols are given in the following table :—

Percentage of alcohol by weight.	Boiling points of mixtures of methyl alcohol and water at :			Boiling points of mixtures of ethyl alcohol and water at :		
	700 mm.	760 mm.	800 mm.	700 mm.	760 mm.	800 mm.
	°C.	°C.	°C.	°C.	°C.	°C.
0	97·72	100	101·44	97·72	100	101·44
10	89·51	91·72	93·14	89·28	91·47	92·86
20	83·97	86·16	87·57	84·89	87·05	88·43
30	80·00	82·17	83·56	82·42	84·58	85·94
40	76·97	79·10	80·48	81·00	83·13	84·49
50	74·44	76·54	77·91	79·78	81·91	83·26
60	72·17	74·29	75·65	78·92	81·04	82·38
70	69·98	72·08	73·44	78·03	80·14	81·47
80	67·77	69·87	71·22	77·22	79·32	80·64
90	65·32	67·40	68·75	76·46	78·54	79·86
100	62·53	64·57	65·92	76·26	78·35	79·66
95·57	——	——	——	76·16	78·23	79·54

With the aid of their results the authors have tested Ramsay and Young's rule (Z. physik. Chem., 1887, **1**, 249) that the ratio of the boiling points of two chemically allied substances, measured on the absolute scale of temperature, at equal pressures is nearly constant. In the case of the alcohol-water mixtures examined, the ratios were found to be constant up to the fourth decimal place. The values were :—

$$\frac{T_{760}}{T_{700}} = 1{\cdot}0066, \ \frac{T_{760}}{T_{800}} = 0{\cdot}9962, \ \frac{T_{800}}{T_{700}} = 1{\cdot}0099\,;$$

they were independent of the composition of the mixtures. By the aid of this rule, therefore, if the ratios of the boiling points (abs.) of the pure components for a wide interval of pressure be known, and the boiling point (abs.) of a mixture of these components at atmospheric pressure be determined, the vapour pressure of the mixture for any given temperature can be calculated.—A. S.

Copper oxychloride as a preservative against mildew in vines. Chuard. *See* XIXB.

PATENTS.

Yeast; Production of ——. H. Braasch, Neumünster, Germany. Eng. Pat. 10,458, May 3, 1909. Under Int. Conv., May 5, 1908.

SEE Fr. Pat. 404,183 of 1909; this J., 1910, 104.—T. F. B.

Fermenting organic nitrogenous substances; Process of ——. J. Effront, Brussels. U.S. Pat. 953,025, March 29, 1910.

SEE Fr. Pat. 382,689 of 1907; this J., 1908, 241.—T. F. B.

Alcohol [fermentable sugar] from lignocellulose or sawdust; Process for producing ——. M. F. Ewen and G. H. Tomlinson. Fr. Pat. 408,299, Oct. 26, 1909.

SEE U.S. Pat. 938,308 of 1909; this J., 1910, 38.—T. F. B.

XIXA—FOODS.

Milks; Comparison of results given by the determination of acidity in, and by the "catalasimetry" of ——. J. Sarthou. J. Pharm. Chim., 1910, 1, 387—393.

CATALASIMETRY, *i.e.*, the determination of the oxygen liberated from hydrogen peroxide by the milk, furnishes valuable data in the control of the freshness of samples. The determination is made by measuring the volume of oxygen evolved, at the normal temperature, by a mixture of 10 c.c. of milk and 10 c.c. of hydrogen peroxide; the reading being made 10 minutes after mixture. The volume of gas obtained increases directly with the age of the sample, but varies considerably, in actual amount, in different specimens of milk of the same age. In four samples examined side by side, from four different cows, the oxygen evolved measured from 0·2 to 0·3 c.c. half an hour after milking. In 42 hours it increased to 1·2 and 1·8 c.c.; and in 66 hours, to 3·6 and 5·7 c.c. But no relationship was found to exist between this amount of oxygen, and the acidity of the milk. The above figures relate to laboratory samples. Specimens of the same milks drawn from the actual churns in which they were taken to market, showed greatly increased oxygen-liberating activity. In these, the maximum volume of oxygen evolved 48 hours after milking amounted to 41·8 c.c. and the minimum to 20·5. The acidity of the samples showed no practical increase over that of those kept in the laboratory. Moreover, the milk giving off the maximum amount of oxygen, could still be boiled without clotting while another, liberating only 5 c.c. of oxygen by the catalasimetric test, coagulated when boiled. This difference is due, as shown by A. Jorns, to the infinitely greater catalytic activity of the bacteria of the cowshed, over those of the laboratory. When the physiological catalytic power of a milk is known, the determination of the volume of oxygen it evolves gives a useful indication of its age. During the whole period of lactic incubation, the acidity of the milk does not vary. Increase of the temperature at which milk is kept increases its catalytic action.
—J. O. B.

Proteins; Precipitation of —— *by acetone.* T. Weyl. Z. physiol. Chem., 1910, **65**, 246—250. (See this J., 1910. 446.)

OTHER proteins, besides casein, which are precipitated by acetone are: egg albumin, serum albumin, excelsin, vitellin, glue. The nitrates of serum albumin, casein and casein protalbumose are not precipitated, but the nitrates of the other proteins mentioned above are insoluble in acetone. The presence of only a slight trace of ammonia is sufficient to prevent the precipitation of most of the proteins by acetone; the presence of acids, on the other hand, has no effect. The following amino-acids (0·25 grm. in 3 c.c. of water) are precipitated by acetone: glycocoll and glycocoll ester hydrochloride, *dl*-valine, *d*-alanine, *d*-leucine, *d*-cystine and *l*-tyrosine. Also the following polypeptides: glycyl-*d*-alanine, *dl*-leucyl-alanine and silk-peptone. Further: dextrose (1 per cent. solution), precipitate syrupy; lactose (1 per cent. solution) precipitate crystalline; creatinine (0·2 grm. in 5 c.c. of water), precipitate amorphous.—J. F. B.

Proteins; Partial hydrolysis of —— *by sulphuric acid.* Z. H. Skraup and E. Krause. Monatsh. Chem., 1910, **31**, 143—148.

THE authors have studied the prolonged action of moderately concentrated sulphuric acid on various proteins at the ordinary temperature. Preliminary experiments showed that the rapidity and degree of the reaction varied considerably, both with the concentration and the relative quantity of the acid. In the further experiments, 22 grms. of the air-dry proteins were shaken by a machine with 200 c.c. of 58·5 per cent. sulphuric acid. After various periods of action, portions of the liquids were withdrawn, diluted with an equal volume of water and nearly neutralised with ammonia. The quantity of ammonium sulphate so produced was sufficient to give half-saturated solutions, and the precipitates of albumoses obtained correspond with "saltings-out" at that concentration. These precipitates, with the exception of that from gelatin, could generally be separated by filtration, and were drained on porous plates without washing, and dried at 100° C. The different proteins gave different yields of albumose after equal periods of action. Silk-gum and silk-fibroin are most rapidly hydrolysed, and whilst they yielded considerable proportions of albumoses at the early stages, the residues obtained after 78 hours only amounted to 5 and 14 per cent. respectively. Gelatin is rather more resistant, but still may be classed among the readily hydrolysed proteins; it yielded 21 per cent. of albumose after 78 hours and 16 after 198 hours. The other proteins studied: casein, gliadin, serum-globulin, edestin from hemp- and cotton-seeds and egg albumin, form a more resistant group, in which the yield of albumose after 198 hours ranged from 41 in the case of casein to 58 per cent. in the case of cotton-seed edestin. With these proteins the rate of hydrolysis is slow, and large proportions of albumose are precipitated in the earlier stages (39 hours). In all cases the hydrolytic action of the sulphuric acid tends to arrive at a state of equilibrium in the course of time, and the decreases in the yields of albumose which occur between the stages of 126 and 198 hours are not very large. In order to study this aspect of the reaction, the dried albumoses, obtained from the more resistant proteins after 198 hours' hydrolysis, were again subjected to the same treatment. They were found to be susceptible to further hydrolysis, but the action again slowed down, and yields of 60—65 per cent. of resistant albumose were obtained after 89 hours.—J. F. B.

Coffee; Contribution to the knowledge of——. *III.* K. Gorter. Annalen, 1910, **372**, 237—246.

A FURTHER examination of Liberia coffee showed the presence of citric acid in addition to chlorogenic and other acids (see this J., 1908, 242, 464). The liquors left after removing potassium-caffeine chlorogenate and coffalic acid were found to contain a basic substance, which crystallised from alcohol and ether in fine white needles melting at 150° C. The gold salt melted at 248°—249° C. The base is very probably identical with trigonelline found by Polstorff in Arabian coffee (this J., 1910, 43). In the West Indies the coffee berries are allowed to ferment in water, when the parchment-like covering of the seeds becomes loosened and can be washed off. This loosening is due to the production of lactic acid during the fermentation.—F. Shdn.

Ilicioides mucronata; Fruit of——. C. Wilcox. Chem. News, 1910, **101**, 169.

THE red berries of the mountain holly, *Ilicioides mucronata*, turn brown when dried and resemble currants in appearance and taste. A sample of the dried fruit contained 21·6 per cent. of sugars (fructose) and 1·9 per cent. of a thick light yellow oil with an odour recalling that of castor oil. The nitrogen amounted to 0·63 per cent., and the ash to 2·18 per cent. Oxalic and tartaric acids were present, but no tannic or gallic acid was detected.
—C. A. M.

Determination of cellulose. Scheunert and Lötsch. *See* V.

Patents.

Centrifugal [*cream*] *separators.* C. W. Dawkins, London. From C. McLeod, Toronto, Canada. Eng. Pat. 3924, Feb. 17, 1909.

THE claim is for constructing a cream separator having the bowl vertically adjustable, so that the skim-milk and cream outlets of the bowl may be brought into proper relationship with the discharge pipes.—W. H. C.

Milk and similar liquids; Process for desiccating——. J. M. Gabler-Saliter. First Addition, dated Dec. 30, 1908, to Fr. Pat. 385,166, Dec. 18, 1907 (this J., 1908, 587).

BEFORE being delivered on to the drying drum described in the principal specification (*loc. cit.*), the milk is concentrated at a moderate temperature under reduced pressure until it has a density of from 9° to 15° B.; it is then cooled to below 15° C. and aerated so as to form a foamy mass which is delivered on to the heated drum. The current of air supplied to the space between the drum and its cover is admitted tangentially through a series of jets and may contain a suitable proportion of ozone or carbon dioxide; an exhaust pump is supplied for reducing the pressure in this space. The dried milk removed from the drum is cooled by means of a current of air.—W. P. S.

Milk and other liquids; Process and apparatus for condensing and drying——. M. Töpfer. Fr. Pat. 407,389, Sept. 27, 1909.

THE milk is introduced into a closed cylindrical vessel in which are mounted two hollow rotating rollers or drums, one above the other. The lower roller is heated and its lower part is immersed in the milk collecting at the bottom of the cylinder; as the roller rotates, a film of milk collects on its surface, and is partially dried. A scraper is fixed between the two rollers; this removes the film from the lower roller and transfers it to the upper one, which is heated to a lower temperature. Before the upper roller has made a complete revolution, the film of dried milk is removed by means of a scraper and delivered into a shoot leading from the cylinder. The drying of the milk is aided by currents of air admitted to the cylinder. The milk may be separated into cream and skim-milk before being dried. In this case, the skim-milk is introduced into the cylinder as before and partially dried on the lower roller, the film being then transferred by means of the scraper to the upper roller the surface of which is coated with a layer of partially dried cream; the cream is separately delivered to the surface of the upper roller at a point between the final scraper and the place where the film of partially dried skim-milk is transferred. The two films intermix on the upper roller and are dried together.—W. P. S.

Fat in milk; Process, reagents and apparatus for the volumetric determination of——. E. V. Muloteau. Fr. Pat. 406,743, Dec. 14, 1908.

THE apparatus consists of a narrow graduated glass tube provided at each end with a bulb; each bulb has an opening at the side which may be closed with a rubber stopper. Fourteen c.c. of the milk are introduced into the tube, the opening of the lower bulb having been closed, and 7 c.c. of a reagent are added. This reagent is prepared by mixing sodium hydroxide, 10 grms.; amyl alcohol, 14 c.c.; ethyl alcohol, 4 c.c.; denatured alcohol 62 c.c.; and ammonia, 18 c.c., and diluting 80 c.c. of the mixture with 20 c.c. of water. After closing the upper bulb, the contents of the tube are mixed and heated gradually to nearly the boiling point; during the heating the mixture is shaken continuously and when the yellow colour changes to brown, the tube is removed from the source of heat, the separated fat is brought into the graduated part of the tube, and its volume is noted. The graduations show the quantity of butter-fat per litre of milk. A second reagent is described, the use of which enables the fat to be determined without the aid of heat: this reagent is prepared by adding denatured alcohol, 50 c.c., and ether, 40 c.c., to 10 c.c. of a mixture consisting of potassium hydroxide, 4 grms.; sodium hydroxide, 6 grms.; amyl alcohol, 15 c.c.; ethyl alcohol, 10 c.c.; ammonia, 32 c.c.; and 90 per cent. denatured alcohol, 40 c.c. The bulbs at the ends of the graduated tube may be of several shapes, two of which are illustrated.—W. P. S.

Cereals; Utilisation of the waste products of milled or ground——. E. Mislin, Prag-Weinberge, Austria. Eng. Pat. 10,445, May 3, 1909.

THE residues (bran, hullings, etc.) from the grinding of cereals are mashed with solutions of diastatic enzymes at a temperature not exceeding 60° C. until the carbohydrates have been dissolved and converted into maltose. The resulting solution is filtered and the filtrate evaporated to obtain pure maltose, or fermented to obtain alcohol or lactic or acetic acids. The residue from the press is freed from carbohydrates by lixiviation with water and dried, and the fat removed by means of a suitable solvent and recovered, the final residue thus consisting of valuable vegetable protein.—C. A. M.

Disintegrating apparatus [*Flour milling*]. F. J. Brougham, London. From Mühlenbauanstalt und Machinenfabr. vorm. Gebr. Seck, Dresden. Eng. Pat. 25,114, Nov. 1, 1909.

THE invention consists of three modifications of that form of disintegrator in which a conveyor worm forces the material through a perforated wall. The apparatus is adapted for breaking up the small scales produced in the grinding of grits or middlings in the manufacture of flour. In the first arrangement, a conveyor worm forces the material being ground, against a wall and a weighted flap, causing the latter to rise slightly and form a slit through which the material passes. In the second arrangement the wall is replaced by a roller rotated by gearing, whilst in the third arrangement, the wall is formed into a trough in which a worm or wire spiral is rotated, whereby more perfect mixing and disintegration are said to be secured.—J. W. H.

Maize rice and the like ; Preservation of —— during storage or transportation. T. A. Clayton, Paris. Eng. Pat. 18,108, Aug. 5, 1909.

The grain is treated with air containing 4 to 12 per cent. of sulphur dioxide and trioxide, or with air containing 4 to 12 per cent. of sulphur dioxide and about 6 mgrms. of sulphur trioxide per litre of sulphur dioxide. It is claimed that this process removes moisture and destroys micro-organisms without injuring the vitality of the seed. —C. A. M.

Fodder composed of peat and molasses ; Process of manufacturing ——. E. Joseph, Berlin. Eng. Pat. 23,660, Oct. 15, 1909.

The peat is rendered slightly alkaline by the addition of soda lye before being incorporated with the molasses, etc. The liquid may be removed from the alkaline peat after the addition of the alkali, so as to separate the salts formed in the neutralisation.—C. A. M.

Cocoa ; Manufacture of ——. L. Greiser, Berlin. Eng. Pat. 23,765, Oct. 16, 1909.

Moisture and volatile bodies that affect the flavour are removed in a uniform manner by heating the finely ground cocoa (with or without the addition of sugar) in a vacuum at, say, 70° to 90° C. Or the mass may first be boiled in a vacuum, then melted with a suitable proportion of sugar, and again boiled *in vacuo*.—C. A. M.

Liquids ; Method of sterilising ——. T. Nogier, Lyons, France. Eng. Pat. 30,512, Dec. 30, 1909. Under Int. Conv., Feb. 17, 1909.

Clear alimentary liquids, or water, freed from colloidal substances, are sterilised by exposure to light rays of short wave length (violet and ultra-violet rays) from mercury vapour lamps, the latter being placed either in or outside the liquid.—A. S.

Water ; Process for the purification of —— before and after biological treatment. K. Imhoff. Ger. Pat. 219,992, March 2, 1909.

In the usual biological treatment of water, the latter is passed through mechanical filters before and after treatment in the contact beds. According to the present patent the course of the water is changed at intervals, so that each mechanical filter is used in turn for the preliminary treatment and the after-treatment of the water.—A. S.

Coffee and coffee-beans ; Extracting caffeïne from ——. H. Trillich, Munich, Germany. U.S. Pats. 953,073 and 953,074, March 29, 1910.

(1). Raw coffee beans are placed in a closed vessel and submerged in a solvent of caffeïne, which leaves undissolved the aromatic and other valuable constituents of the beans. Heat is then applied in order to vaporise the solvent, creating a pressure of 1—2 atmospheres. By this means the solvent is caused to penetrate the beans and dissociate the caffeïne from the tannin-containing substances. Extraction of the caffeïne is then conducted in the same vessel in the ordinary way. (2). Whole coffee beans are treated with acetic acid, whereby the cellulose is softened and the sparingly soluble combinations containing the caffeïne are converted into readily soluble products. The caffeïne is then extracted from the treated beans by means of acetic ether (ethyl acetate), and the residues of the solvent and of the acid are removed from the beans.—J. F. B.

Yolk of egg ; Process of manufacturing soluble, powdered ——. C. Gottsleben. Fr. Pat. 406,766, Sept. 4, 1909.

Yolk of egg is mixed with its own weight of soluble starch ; the mixture is then dried at a temperature between 30° and 40° C., and powdered.—W. P. S.

Cocoa and chocolate ; Process for the production of dietetic ——. E. Collett and M. Eckardt, Christiania. Eng. Pat. 18,337, Aug. 9, 1909. Under Int. Conv., Aug. 10, 1908.

See U.S. Pat. 952,418 of 1910 ; this J., 1910, 513.—T. F. B.

Cacao ; Process for purifying ——. L. Greiser. Fr. Pat. 407,916, Oct. 15, 1909.

See Eng. Pat. 23,765 of 1909 ; preceding.—T. F. B.

Coffee ; Process of treating ——. L. Seisser, Munich, Germany. U.S. Pat. 953,643, March 29, 1910.

See Fr. Pat. 396,930 of 1908 ; this J., 1909, 622.—T. F. B.

Bran ; Process of rendering —— digestible. D. Finkler, Bonn, Germany. U.S. Pat. 953,946, April 5, 1910.

See Fr. Pat. 382,686 of 1907 ; this J., 1908, 243.—T. F. B.

Bleaching agents [for flour] ; Apparatus for storing, diluting, and applying ——. J. A. Wesener, Chicago. U.S. Pat. 954,835, April 12, 1910.

See Eng. Pat. 27,218 of 1908 ; this J., 1909, 379.—T. F. B.

Fish-flesh ; Process of treating ——. K. Schwickerath, Bonn, Germany. U.S. Pat. 954,050, April 5, 1910.

See Fr. Pat. 375,028 of 1907 ; this J., 1907, 887.—T. F. B.

XIXb—WATER PURIFICATION ; SANITATION.

Sterilisation of large quantities of water by means of ultra-violet rays. V. Henri, A. Helbronner, and M. de Recklinghausen. Comptes rend., 1910, **150**, 932—934.

Starting from the results obtained by Henri and Cernovodeanu (this J., 1910, 171) as to the bactericidal action of ultra-violet rays, the authors have constructed an apparatus capable of dealing with 125 cb. m. of water per hour, an amount corresponding to the water-supply of a town of 20,000 inhabitants. The apparatus comprises a reservoir, a centrifugal pump, a water-meter, and a pipe curved in zig-zag fashion, in each of the four bends of which is placed a Westinghouse Cooper-Hewitt lamp, suspended from a float, at a distance of 2 cm. below the level of the water ; a reflector is provided for each lamp. With the water flowing at the rate of 36 cb. m. per hour, water infected with *Bac. coli* was completely sterilised after passing the second lamp, *i.e.* with an expenditure of 36 watt-hours per cb. metre.—A. S.

Sanitary inspection versus sanitary analysis [of water]. R. B. Dole. Annual Report of Amer. Public Health Assoc.

The author concludes from the results of chemical and bacteriological analyses made in different parts of U.S.A. (typical cases of which are given in detail) that laboratory methods cannot always be relied upon to detect pollution of a water supply.—C. A. M.

Copper oxychloride as a preservative against mildew in vines. E. Chuard. Comptes rend., 1910, **150**, 839—841

THE standard means for protecting vines from mildew at the present time is copper sulphate, used in the form of a paste obtained by precipitating an aqueous solution of the salt with lime or an alkali carbonate. Besides he drawback involved in the necessity of preparing his paste on the spot, there is the further objection that elatively large proportions of copper have to be employed. Pastes prepared with 2—3 per cent. of copper sulphate are regularly used. In the vineyards of France alone, over 12,000 tons of copper are thus consumed annually. In addition to the serious burden thus imposed, there is reason for a feeling of some anxiety as to the result of the accumulation of copper in the surface soil, which must be taking place over a period of years. A soil taken from a Lausanne vineyard, which had been under treatment for 20 years, was found to contain 35 mgrms. of copper per kilo. Attempts to reduce the quantity of copper employed, by the application of more soluble forms of the metal, have failed on account of the deficient power of adhesion of the soluble salts. The author has now found, in the oxychloride, a form of copper which is very effective. Copper oxychloride is a by-product of the manufacture of alkalis by Grenier's electrolytic process. It is insoluble in water and presents remarkable properties of adhesion. On exposure, it is gradually dissociated, with the liberation of small quantities of soluble cupric chloride. It contains about 50 per cent. of copper. In an aqueous mixture containing 500 grms. per hectolitre, it has uniformly given results at least as good as those obtained in the case of a copper sulphate paste containing 2 per cent. of that salt.—J. F. B.

Lime-sulphur wash; Chemical study of the ——. L. L. Van Slyke, C. C. Hedges, and A. W. Bosworth. New York Agric. Exper. Stat., Bull. No. 319, 1909.

WHEN sulphur and lime are boiled together in water, two compounds are usually formed, namely, calcium pentasulphide (CaS_5) and calcium tetrasulphide (CaS_4); at the same time, a third compound is produced, calcium thiosulphate (CaS_2O_3), which, on boiling, is converted into calcium sulphite and free sulphur. The calcium sulphite is oxidised to calcium sulphate on exposure to the atmosphere. The proportion of these compounds varies with the relation of the amounts of sulphur and lime used. Preparations made with 125 lb. of sulphur and 52, 60, and 65 lb. of lime, respectively, were analysed and the results showed that the sp. gr. of the solutions and the amounts of dissolved sulphur and lime increased with the quantity of lime used; with the largest proportion of lime, the compound present was almost entirely calcium tetrasulphide, whilst with the smallest proportion of lime, calcium pentasulphide was formed. The largest amount of soluble sulphides was formed when the mixture was boiled for 1 hour, and, generally, increased time of boiling decreased the amount of thiosulphate and increased the quantity of sulphite. The amount of sediment increased with the duration of boiling, owing to increased formation of calcium sulphite, etc. If lime be added to a diluted lime-sulphur solution, the amount of sulphide sulphur is decreased, whilst thiosulphate is increased, with the formation of free sulphur; the higher sulphides of calcium are decomposed with the formation of compounds containing less sulphur. The changes thus produced may seriously diminish the insecticidal properties of the mixture. When pure lime is employed, the sediment obtained in the manufacture of lime-sulphur wash may be added to the lime and sulphur used in making a further quantity of the wash. Magnesium oxide does not form sulphides when boiled with sulphur, and when magnesium oxide is present in lime, it tends to decompose the calcium sulphides. Hydrogen sulphide is thus produced and renders the product objectionable to handle. Analyses of several samples of each of four different brands of lime-sulphur solutions showed that the sulphide compounds present were tetrasulphide and pentasulphide, the proportions varying somewhat; on an average, the two compounds were present in approximately equal quantities, and the amount of the two together varied from 16·5 to 25·6 per cent. —W. P. S.

Lime-sulphur mixtures; Concentrated ——. P. J. Parrott. New York Agric. Exper. Stat., Bull. No. 320, 1909.

DURING recent years lime-sulphur washes have been used extensively in several fruit-producing districts in the State of New York for the purpose of combating certain injurious insects and plant diseases. Thorough spraying with these mixtures has generally given satisfactory results in the case of scale and blister-mite, and experience has shown that the commercial brands of the wash are as effective as the home-made product. Analyses of samples of commercial washes showed, however, that the composition varies to some extent; the density of the clear solution ranged from 26·8° to 33·9° B., whilst the quantity of sediment present varied from nothing to 19·42 per cent. Field experiments have demonstrated that the sediment possesses little, if any, insecticidal properties as regards the San José scale, and that the effective principle of the washes consists of the soluble lime-sulphur compounds. Certain manufacturers have established a standard strength for their lime-sulphur solutions; *viz.*, that they should consist of a clear reddish liquid, free from sediment and with a density between 32° and 34° B. One gall. of the solution diluted with from 8 to 11 galls. of water forms an effective remedy in cases of San José scale, the stronger solution being used in orchards where the scale is not thoroughly controlled; the weaker solution may also be used against blister-mite. In spraying for scale or blister-mite the addition of an ordinary arsenical (calcium arsenite) wash to the dilute lime-sulphur solution yields a mixture which is usefull for protection against the bud-moth and casebearers.—W. P. S.

Formaldehyde; Determination of —— in formalin-soap products [*"Lysoform," "Formosapol," and "Morbicide."*] O. Allemann. Z. anal. Chem., 1910, **49**, 265—269.

THE author finds that whilst the iodometric and permanganate methods of determining formaldehyde give consistent results, those obtained by titration with ammonia and by gas-evolution are from 2 to 3 per cent. too low. In formalin-soap mixtures the soap must be removed before titration, which can best be effected by precipitation with sulphuric acid or barium chloride, followed by filtration or distillation; in the latter case the residue must again be distilled with a little water, or the results are too low. The method is carried out as follows: 50 c.c. of the solution are diluted with 4 to 5 times the volume of water, precipitated with a slight excess of the soap-precipitant and diluted with water to 500 c.c. In the case of "Morbicide" it is better to dilute with 20 volumes of water. After settling, the liquid is filtered. To 5 c.c. of the filtrate, 40 c.c. of $N/10$ iodine solution are added and are followed by strong sodium hydroxide solution, drop by drop, until the colour changes to light yellow. The mixture is then allowed to stand for 10 minutes. The liquid is now acidified with sulphuric or hydrochloric acid and the excess of iodine titrated with $N/10$ thiosulphate solution. The percentages of formaldehyde found were: "Lysoform" (original package), 5·94 per cent.; "Lysoform" (open), 5·77 per cent.; "Formosapol," 4·51 per cent.; "Morbicide," 13·52 per cent.—E. F.

Arsenic; Toxicity of metallic ——. Lecoq. Comptes rend., 1910, **150**, 887—888.

EXPERIMENTS with a colloidal solution of metallic arsenic containing 0·00078 grm. per c.c. and free from arsenious acid, showed that the toxicity of metallic arsenic is less than that of arsenious acid.—F. SHDN.

PATENTS.

Water; Method for purifying ——. J. Roche and A. Oliver. Assignors to Oliver-Roche Co., New York. U.S. Pat. 952,842, Mar. 22, 1910.

THE water is allowed to flow slowly and continuously through filtering material which is placed in layers between horizontal screens constructed of different metals. The water itself acts as an electrolyte and is purified by the current of electricity passing between the screens. (See also Eng. Pat. 27,271 of 1908; this J., 1909, 1268.) —W. P. S.

Sludges; Process and apparatus for solidifying and drying liquid ——. F. Abt, E. Diehl, and A. Bayer. Fr. Pat. 406,837, Sept. 7, 1909.

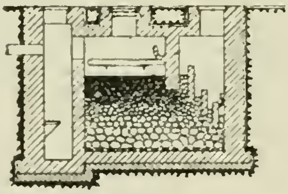
A considerable number of slightly conical tubes are mounted so as to form the cylindrical surface of a drum. Two of the drums thus constructed are fitted end to end with a closed space between them. The larger ends of the tubes open into this space whilst the other ends of the tubes are closed. The tubes are perforated and may be covered with filter-cloth. The drums are mounted on a hollow shaft so that the tubes in their lowermost position dip into the sludge contained in a tank; the air is exhausted from the space between the two drums, an exhaust pump attached to the hollow shaft serving this purpose, and a layer of sludge is thus caused to adhere to the surface of the tubes. As the drums rotate, the liquid portion of the sludge is drawn through the filter-cloth and tubes into the central space from which it is removed as required. When the drum has almost completed one revolution, the open ends of the tubes are cut off from the exhaust chamber and pass in front of a pipe supplying compressed air; the layer of dry sludge is thus forced off the surface of the tubes and falls into a conveyor.—W. P. S.

Sewage, liquids, etc., of all kinds; Treatment of —— [*purification by means of metallic aluminium*]. E. Bonjean and É. Kohn. Fr. Pat. 407,018, Sept. 14, 1909.

Aluminium plates or the like are amalgamated with mercury, the excess of the latter is removed, and the plates are then brought into contact with the liquid or other substance to be purified. The amalgamated plates may be treated with nitric acid, when necessary, and washed.—W. P. S.

Oxidation bed for sewage purification plants. H. Liebeld. Ger. Pat. 220,060, Sept. 25, 1908.

The cross-section of the bed increases from above downwards. The chamber containing the oxidation- or contact-material is closed on one or more sides by partitions arranged stepwise as shown in the figure, but not reaching to the bottom of the chamber. The spaces between the partitions are filled with coarse material, so that air can penetrate readily into the oxidation bed at different heights. —A. S.



Water; Process for removing iron from —— *and for regenerating the materials used for purification.* R. Gans, Pankow, Germany. Eng. Pat. 21,184, Sept. 16, 1909. Under Int. Conv., Dec. 10, 1908.

See Fr. Pat. 405,990 of 1909; this J., 1910, 449.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Gnoscopine (racemic narcotine). P. Rabe and A. McMillan. Ber., 1910, **43**, 800—804.

Gnoscopine can be made by heating narcotine with absolute alcohol under pressure or by boiling narcotine with 50 per cent. alcohol. The base melts at 232°—233° C. (this J., 1910, 371), and is optically inactive. In its general reactions it resembles narcotine. Both bases yield cotarnine when oxidised with nitric acid. Meconin and hydrocotarnine are produced when either base is heated with water under pressure. Narcotine methylbromocamphorsulphonate was made by the interaction of narcotine methiodide and silver bromocamphorsulphonate. The salt decomposes at 231° C., and has $[\alpha]_D = +101°$ at 23° C. in absolute alcohol. The corresponding gnoscopine derivative was made and precipitated in two separate fractions. The optical rotations of these fractions differed from each other. —F. Shdn.

Camphor; Artificial ——. E. Darmois. Comptes rend., 1910, **150**, 925—927.

The author has succeeded, by working at a relatively low temperature, in preparing synthetic camphor having an optical activity only slightly less than that of natural camphor. Oil of turpentine is freed from the portion distilling above 165° C., and is then converted into pinene hydrobromide. The latter is converted into borneol by means of its magnesium derivative; in this operation some dibornyl, $(C_{10}H_{17})_2$, is also formed, but being much less volatile than borneol, the latter may be separated by distillation with steam. The borneol is purified by recrystallisation from petroleum spirit, but is not a homogeneous substance, the rotatory powers of the crystals removed from the mother liquor after different intervals of time differing considerably. Starting with turpentine from the Aleppo pine (this J., 1909, 1050) the borneol obtained is mainly a mixture of *d*-borneol and *l*-isoborneol, which on oxidation yields a camphor having the rotatory power $[\alpha]_J = +49°$ ($[\alpha]_J$ of natural camphor $= +57°$). From French oil of turpentine, in a similar manner, a campho having the rotatory power $[\alpha]_J = -45°$ is produced. It is possible that by working at a lower temperature, a product entirely identical with natural camphor could b obtained.—A. S.

Iodoform; Compounds of —— [*with bases, substances containing sulphur, and bases containing both sulphur an nitrogen*]. G. Cohn. Pharm. Zentralh., 1910, **51** 145—150.

Iodoform unites with many organic bases and sulpho compounds, forming definite chemical crystalline compounds, many of which possess antiseptic or othe therapeutic properties, but have not the characteristi penetrating odour of iodoform. *Iodoform-ammonia* $CHI_3.NH_3$, is formed as a white crystalline powder stable up to —23° C. by treating iodoform with liquefied ammonia. *Iodoform-trimethylamine-hydroiodide* $CHI_3(CH_3)_3N.HI$ forms pale yellow shining needles, ver sparingly soluble in chloroform; m. pt. 200° C., bu showing slight decomposition at 175° C.; decomposed b water and ether into its constituents. *Iodoform-hexamethylenetetramine*, $CHI_3.C_6H_{12}N_4$, is a colourless crystallin powder, melting at 178° with violent decomposition. It i known commercially as "iodoformin." *Iodoform-ethy hexamethylenetetramine hydroioide*, $CHI_3.C_6H_{12}N_4.C_2H_5I$ may be obtained in dark yellow needles, m. pt. 128° Its trade name is "iodoformal." An isomeric forr has been obtained in pale yellow needles, m. pt 171° C. *Iodoform-methylhexamethylenetetramine hydroiodide* $CHI_3.C_6H_{12}N_4.CH_3I$, is obtained by treating "iodoformin" with methyl iodide in amyl acetate solutio *Iodoform-methylene-dihexamethylenetetramine hydroiodide* $CHI_3.(C_6H_{12}N_4)_2.CHI_2$, forms pale yellow felted needle m. pt. 174° C. *Iodoform-ethyl hexamethylenetetramine hydrobromide* $CHI_3.C_6H_{12}N_4.C_2H_5Br$; sulphur yellow har needles or prisms, m. pt. 114° C. *Iodoform-triethy trimethylenetriamine hydroiodide*, $CHI_3.(CH_2N.C_2H_5)_3.H$ forms warty groups of crystals, m. pt. 133—134° *Iodoform - trimethyltrimethylenetriamine hydroiodid* $CHI_3.(CH_2N.CH_3)HI$, needles, m. pt. 125°. *Iodoforn quinoline*, $CHI_3(C_9H_{17}N)_3$, large colourless transpare needles; m. pt. 65° C. *Iodoform-strychnine*,

$$CHI_3.(C_{21}H_{22}N_2O_2)_3,$$

forms long prismatic needles. It is unstable, cannot crystallised from alcohol, and is decomposed by water below 100° C. It turns quite black at 130° C. *Iodoform sulphide*, CHI_3S_8, is obtained in large, pale yellow prisms by mixing solutions of the constituents in carbon bisulphide. It is stable in the air; coloured red by light: m. pt. 93°. *Iodoform-triethylsulphonium iodide*, $CHI_3.(C_2H_5)_3SI$, obtained as a crystalline precipitate from alcoholic solutions of the constituents; m. pt. 142° C. *Iodoform-triethylsulphonium chloride*, $CHI_3.(C_2H_5)_3SCl$; the additive product, obtained by mixing alcoholic solutions of iodoform and triethysulphonium hydroxide, is treated with alcoholic hydrochloric acid; m. pt. 96° C. *Iodoform-triethylsulphonium bromide*, $CHI_3.(C_2H_5)_3SBr$, forms yellowish white prismatic columns; m. pt. 124° C. *Iodoform-trimethylsulphonium iodide*, $CHI_3.(CH_3)_3SI$, pale yellow needles; m. pt. 162° C. *Iodoform-dimethylethylsulphonium iodide*, $CHI_3.(CH_3)_2(C_2H_5)SI$, forms a crystalline magma, m. pt. 136° C. *Iodoform dimethylethylsulphonium bromide*, $CHI_3.(CH_3)_2(C_2H_5)SBr$, m. pt. 125° C. *Iodoform-iodethylethyldisulphide*, $CHI_3.(C_2H_5)_2I-SI(C_2H_5)_2.CHI_3$, forms hard plates m. pt. 123°. *Iodoform-iodethyldiethylsulphidemethane*, $CHI_3.(C_2H_5)_2SI-CH_2-SI(C_2H)_2.CHI_3$, m. pt. 125° C. *Iodoform iodethylallylsulphide*. $CHI_3.(C_3H_5)_2(C_2H_5)SI$, m. pt. 98° C. *Iodoform-allylsulphide-isopropyl iodide*, $CHI_3.(C_3H_5)_2(C_3H_7)SI$, m. pt. 129°. *Iodoform-iodomethyl mercaptol*, m. pt. 130°. *Iodoform iodomethyl perbromomethyltrisulphide*: m. pt. 120° C. *Iodoform-mercury mercaptide*, $CHI_3.(C_2H_5S{-}Hg{-}SC_2H_5)_2$ forms pale yellow long needles, m. pt. 85·5°.

Iodoform-carbothialdine, $CHI_3.C_5H_{10}N_2S_2$, forms yellow stellate needles, m. pt. 105 to 107° C. with decomposition. Iodoform combines under different conditions with albumins, the compounds formed having generally much less odour than iodoform itself. Such a compound, known commercially as "iodoformogen" is obtained by adding an alcohol-ether solution of iodoform to an aqueous solution of albumin, containing some alcohol. The precipitate obtained, dried at 120° C., forms an orange yellow powder.—J. O. B.

Ferripyrine [ferric chloride-antipyrine compound]; Determination of ——. A. Astruc and J. Bouisson. J. Pharm. Chim., 1910, **1**, 395—397.

Ferripyrine is readily soluble in water, giving a deep coloured solution from which the iron is precipitated quantitatively by sodium hydroxide, as ferric hydroxide, and the amount may be determined by direct alkalimetry using phenolphthalein as indicator. Six molecules of alkali are equivalent to one of ferripyrine, $Fe_2Cl_6.(C_{11}H_{12}N_2O)_3$. If it be desired to determine the antipyrine iodometrically, by Bougault's method (this J., 1898, 386; 1900, 269), the above neutralisation is indispensable, since the end reaction is otherwise invisible in the coloured solution. After neutralising with alkali and separating the ferric hydroxide by filtration, the direct iodometric determination gives exact results. Six atoms of iodine are equivalent to one mol. of ferripyrine. The antipyrine in ferripyrine may also be determined by means of picric acid, as follows:—A weighed quantity of ferripyrine is dissolved in water, neutralised with sodium hydroxide solution, the volume adjusted to 100 c.c., and the solution filtered. Fifty c.c. of the filtrate are then treated with 50 c.c. of $N/_{20}$ solution of picric acid. After a few minutes agitation, the antipyrine is completely precipitated as picrate. After filtering, the excess of picric acid in the solution is determined by means of $N/_{20}$ sodium hydroxide solution. Three molecules of picric acid are equivalent to 1 molecule of ferripyrine.—J. O. B.

Aniline-arsenic "emetic" [Aniline arsenic tartrate]. P. Yvon. Comptes rend., 1910, **150**, 834—835.

A double tartrate of aniline and arsenic is prepared by the action of one molecular proportion of aniline bitartrate in aqueous solution on a half-molecular proportion of arsenious acid. The mixture is evaporated to a syrup, and the double salt crystallises out on cooling in the form of hexagonal plates which are generally slightly coloured. The crystals are anhydrous, but when heated at 100° C. they rapidly lose 1 mol. of water, being converted into the anilide. Aniline-arsenic "emetic" has a composition corresponding with the formula, $C_4H_5O_6.AsO,C_6H_7N$. It is dextro-rotatory in aqueous solution, and the solutions present the peculiarity of showing considerably diminished specific rotatory powers as they become more dilute. This is due to the dissociation of the compound in dilute solutions. The specific rotatory power is constant and attains its maximum value of + 68·77° in solutions of 20—30 per cent. concentration. The double salt is readily soluble in water, and its solubility increases very considerably as the temperature rises. It is fairly soluble in alcohol.—J. F. B.

Alcohols; Mechanism of the dehydration of —— *by means of various catalytic metallic oxides*. P. Sabatier and A. Mailhe. Comptes rend., 1910, **150**, 823—826.

Various metallic oxides, such as thoria, alumina and the blue oxide of tungsten exert a catalytic dehydrating action on alcohols at a temperature of 300°—350° C. with the production, almost exclusively, of the ethylenic hydrocarbons. In some cases the dehydration may be restricted at lower temperatures and the ether-oxides may be formed. The mechanism of this reaction is strictly analogous to the dehydration of alcohols which is effected by sulphuric acid. In the latter case the acid sulphuric ester is produced as a definite intermediate product. In practice, however, sulphuric acid does not act catalytically because it becomes diluted with the water produced in the reaction. In the case of the metallic oxides, it is assumed that these oxides react at their surface with the alcohols in virtue of their acid function, yielding at first as intermediate products the corresponding esters, *e.g.*, in the case of thoria, a compound having the formula, $ThO(OC_nH_{2n+1})_2$; these esters are then decomposed with formation, according to the temperature, of the ether-oxides or the ethylenic hydrocarbons, and regeneration of the metallic oxide. The latter is indifferent towards the water produced, and the reaction may therefore be continued indefinitely. The analogy between certain metallic oxides and sulphuric acid, in their relations towards the alcohols, is further illustrated in their behaviour as catalysts of esterification in presence of an organic acid. If a mixture of ethyl alcohol and acetic acid in the form of vapours be passed over titanic oxide heated at 300° C., a considerable quantity of ethyl acetate is produced. Further, ammonia reacts with the acid sulphuric esters yielding amines, and the same reaction takes place if ammonia and an alcohol be passed over heated thorium oxide. Lastly it has been found that when sulphuretted hydrogen and alcohols are treated in a similar manner, thiols are produced by a similar catalytic action.—J. F. B.

Nicotine salts; French import duty on ——. Board of Trade J., April 28, 1910. [T.R.]

A French Law, dated April 13th, provides for the following addition to the French Tariff (see this J., 1910, 520):—

Tariff No.	Tariff Classification.	Rates of Duty.	
		"General" Tariff.	"Minimum" Tariff.
		Frs. cts. Per 100 kilos.	Frs. cts. Per 100 kilos.
252 *bis*	Salts of nicotine or non-alcoholic solutions of such salts containing at least 100 grammes of nicotine per litre and having a density equal to or less than 1·3	0 50	0 25

Erratum. This J., 1910, page 371, col. 1., 3 lines from top. *Reverse the words* "theobromine" *and* "caffeine."

Patents.

Anhydrides of fatty acids, principally acetic anhydride; Process for preparing —— from salts of fatty acids. T. Goldschmidt. First Addition, dated Oct. 16, 1909, to Fr. Pat. 407,046, Sept. 16, 1909 (see Eng. Pat. 25,433 of 1908; this J., 1910, 112).

Anhydrides of fatty acids are obtained by treating fatty acid salts with dry chlorine in presence of sulphur, at temperatures below 0° C.; the sulphur may be replaced by a metallic compound containing sulphur, such as ferrous sulphide.—T. F. B.

Borneol, isoborneol, and terpineol; Process for preparing the propionic and butyric esters of —— by means of the hydrochlorides obtained from oil of turpentine. Soc. Le Camphre. Fr. Pat. 408,065, Jan. 14, 1909.

The product obtained by the action of dry hydrochloric acid gas on oil of turpentine is boiled for some hours with an alkali, alkaline-earth, or metallic butyrate or propionate, in presence of excess of butyric or propionic acid. The products may be separated by distillation or by precipitation with salt, etc. The mixed esters thus produced are washed with sodium carbonate solution and water, and dried over anhydrous sodium sulphate. —T. F. B.

Borneol, isoborneol, terpineol, and fenchol esters; Process for preparing —— by the action of propionic or butyric acid on terpenes or substances containing terpenes. Soc. Le Camphre. Fr. Pat. 408,106, Jan. 15, 1909.

Terpenes or products containing terpenes, such as oil of turpentine or of camphor, are heated to about 160° C. with one to three volumes of propionic or butyric acid, with or without the aid of a suitable condensing agent. The excess of acid and the unconverted terpene are separated by fractionation, and the esters purified either by distillation in steam or by washing with a solution of alkali carbonate. —T. F. B.

Ether; Apparatus for the continuous production of ——. D. Annaratone. Fr. Pat. 408,089, Oct. 19, 1909. Under Int. Conv., March 2, 1909.

The apparatus consists of an underground reservoir for alcohol, a pump to convey the alcohol through a steam-heated heating apparatus, to the base of an etherifier, which contains a number of balls or other device to form a large surface of liquid. A sulphuric acid reservoir conveys the acid into the upper part of the etherifier, and a siphon removes the spent acid. The etherifier is surmounted by a column in which the ether is freed from sulphuric acid. A tube now carries the ether to the base of a column divided by plates, in which it is washed by sodium carbonate solution which flows down the column: this column is surmounted by a rectifying column and dephlegmator, where the water vapour is removed, and this in turn is connected with a second rectifier, where the alcohol is separated. The ether finally passes through a condenser and into a reservoir. A system of auxiliary pumps is supplied to ensure continuous circulation, and to return the unconverted alcohol to the underground reservoir. —T. F. B.

Indolinones; Process for preparing —— from β-acidyl-m-tolylhydrazides. C. F. Boehringer und Söhne. Ger. Pat. 218,477, June 20, 1908.

When β-acidyl-*m*-tolylhydrazides are heated with lime to a high temperature, indolinones are produced. Generally, a mixture of two isomerides is obtained, which can be separated by fractional crystallisation from benzene, etc. The products possess antipyretic and antineuralgic properties. (See also Ger. Pat. 218,727; this J., 1910, 410.) —T. F. B.

Tannin-silver-albumin compound insoluble in the gastric juice and soluble with difficulty in the intestinal fluid; Process for the preparation of a ——. R. Weil. Ger. Pat. 218,728, July 2, 1908. Addition to Ger. Pat. 198,304, Aug. 16, 1906.

According to the main patent a compound was prepared by treating an aqueous solution of albumin with an aqueous solution containing tannin and silver nitrate, and exposing the mixture to diffused daylight, with agitation, until a uniform grey precipitate was produced. The mother liquor from this product contains considerable quantities of silver and albumin, and according to the present patent, it is treated with tannin so long as a precipitate is produced. The precipitate is then treated as described in the main patent. The new product contains less silver than that described in the main patent.—A. S.

Compounds containing sulphur (thiozonides); Process for preparing ——. P. Koch. Ger. Pat. 219,121, Dec. 5, 1908. Addition to Ger. Pat. 214,950, March 19, 1908 (see this J., 1909, 1326).

By the addition of alkali thiozonates, M'_2S_4, during or after the preparation of thiozonides from terpene alcohols or their esters, or ethereal oils rich in these substances, stable products are obtained. The presence of thiozonates assists the formation of the thiozonides at lower temperatures, and also protects the freshly prepared products from oxidation.—T. F. B.

Metabolic glands; Process for obtaining solutions suitable for injection, of the colouring matters of ——. E. Diesing. Ger. Pat. 220,776, March 7, 1909. Addition to Ger. Pat. 217,853, Nov. 15, 1908.

When metabolic glands are extracted by the process described in the principal patent (this J., 1910, 452), the whole of the colouring matter is not removed; extraction may be completed if the glands, after the treatment with ether, are extracted with absolute alcohol and finally with chloroform. The extracts are evaporated and the residues dissolved in soap solution as previously described. —T. F. B.

Bornylene from dextro-pinene; Process for the manufacture of ——. I. Kondakow, Jurjew-Dorpat, Russia. Eng. Pat. 7322, March 26, 1909.

See Fr. Pat. 397,161 of 1908; this J., 1909, 745.—T. F. B

Salts of lactalbumen; Preparing ——. J. A. von Wülfing, Berlin. Eng. Pat. 25,773, Nov. 8, 1909. Addition to Eng. Pat. 6179, March 19, 1908.

See Ger. Pat. 216,581 of 1908; this J., 1910, 234.—T. F. B

Quinine; Process of producing a sulphur compound of —— F. W. S. Valentiner (A. V. Richter, Administrator) Assignor to Valentiner und Schwarz, Leipzig-Plagwitz, Germany. U.S. Pat. 953,187, March 29, 1910.

See Fr. Pat. 400,631 of 1909; this J., 1909, 1062.—T. F. B

Tannin, silver, and albumin; Process for preparing compound of ——. R. Weil. Fr. Pat. 407,872, Oct. 14, 1909.

See Ger. Pat. 218,728 of 1908; preceding.—T. F. B.

Formaldehyde; Process for preparing a dry compound of —— Chem. Pharm. Laboratorium "Sahir." Fr. Pat. 407,936, Oct. 16, 1909. Under Int. Conv., Dec. 19 1908.

See Eng. Pat. 25,138 of 1909; this J., 1910, 516.—T. F. B

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic developers; Action of potassium bromide in ——. A. L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1910, 1, 148—151.

Soluble bromides, other than potassium bromide, increase the contrasts produced by alkaline developers in the same manner as does potassium bromide; hydrobromic acid, bromine water, bromal, and bromoacetophenone act similarly, but in these cases it is probable that their action is due to their conversion into bromide. Alkali chlorides, iodides, and fluorides, and other substances which retard development (alkali sulphates, bisulphites, ferro- and ferri-cyanides, and mineral acids other than hydrobromic acid) do not increase contrasts, neither do they prevent fog. By adding small quantities of sodium bisulphite to non-alkaline developers (*e.g.*, diaminophenol), development is accelerated and contrasts decreased, but further addition retards development and increases contrast: on the other hand, potassium bromide, when used in the proportion of 0·5—1·0 grm. per 100 c.c. of the normal developer, increases contrasts strongly, but outside these limits its action is inappreciable.
—T. F. B.

Patents.

Drying [photographic] films; Machine for ——. F. B. Thompson. Fr. Pat. 408,554, Oct. 26, 1909.

The machine consists of a framework carrying two sets of horizontal rollers, each roller in one set being directly above a roller in the other set. A continuous band passes over this system, only one of its surfaces coming in contact with the rollers; the band passes several times round each vertical pair of rollers (the turns being kept apart by suitable guides) before passing to the adjacent pair. A roller held on a movable arm at one end of the machine helps to keep the band taut, and this is further assisted by similar rollers which are placed within the turns of the band. The machine is suitable for drying cinematograph films and similar long films after they have been coated.—T. F. B.

Screen consisting of four sets of selective elements, for the photography of colours, and its manufacture. L. Dufay, and Soc. Anon. des Plaques et Produits Dufay pour la Photographie des Couleurs. Fr. Pat. 408,552, Jan. 26, 1909.

A support coated with gelatin is printed with a series of lines, dots, etc., in fatty ink, to cover one-half of its surface; the remaining half is stained with a primary colour, and the whole is then varnished with a composition which is insoluble in a solvent of the ink, and which contains a resin soluble in a substance which will not dissolve the ink. The ink is now removed and the remainder of the surface stained with a second primary colour, after which the varnish is removed. The same series of operations is now repeated, but using the third primary colour and its complementary binary colour. In this manner a homogeneous screen is obtained suitable for colour photography. When it is desired to use the screen for photographs to be viewed by reflected light, the intensity of the colours may be reduced by suitable chemical or mechanical means. (Compare Eng. Pats. 11,698 and 18,744 of 1908; this J., 1909, 383, 1105.)
—T. F. B.

Colour photography; Process for preparing three-colour screens for ——. F. Faupel. Ger. Pat. 220,154, Nov. 22, 1907. Addition to Ger. Pat. 216,610, Nov. 22, 1907.

A support is coated with a bichromated gelatin film, which is exposed to light under a black and white line-screen; it is then stained in a bath containing a red dye which will dye the exposed parts only and a green dye which will affect only the unexposed parts (*e.g.*, 1 part of a 1 per cent. solution of Crystal Ponceau mixed with two parts of a 1 per cent. solution of Naphthol Green). The gelatin, which is now coloured with red and green lines, is again sensitised by bichromate, and exposed under a line screen, the lines being inclined at a suitable angle to the existing lines. The screen is then treated for about 15 minutes in a 10 per cent. aqueous solution of alcohol, and the colourless spaces are finally stained blue, *e.g.*, with a 1 per cent. solution of Brilliant Azurin.—T. F. B.

Colour photography. J. Sury, Wyneghem, and E. Bastyns, Antwerp, Belgium. Eng. Pat. 21,281, Sept. 17, 1909.

See Fr. Pat. 406,616 of 1909; this J., 1910, 517.—T. F. B.

Gelatin film. O. Moh, Flörsheim, Germany, Assignor to Defender Photo Supply Co., Rochester, N.Y. U.S. Pat. 953,175, March 29, 1910.

See Ger. Pat. 204,868 of 1906; this J., 1909, 110.—T. F. B.

Preventing coagulation of solutions containing albuminoid substances and formaldehyde. Ger. Pat. 220,493. *See* XIII.

XXII.—EXPLOSIVES; MATCHES.

Explosives, etc., in Greece; Consumption tax on ——. Board of Trade J., April 28, 1910. [T.R.]

A Greek Law, dated March 19th, imposes a consumption tax on explosives, etc., produced in Greece or imported from abroad, as follows:—

		Drs.	Lepta*	Per ton. £	s.	d.
Blasting powder................	Oke*	0	25	8	0	0
Smokeless powder	Kilo.	10	00	402	0	0
Black gunpowder of every kind	Oke	3	00	96	0	0
Dynamite of the first category	„	1	00	24	0	0
Explosives not containing nitroglycerin, *e.g.*, Cheddite, Favier powder and the like	„	0	90	21	12	0
Dynamite of the second category (Forcite or black dynamite) ..	„	0	70	16	16	0
Shot	Kilo.	0	50	20	7	3

*Oke = 2·8 lb. 100 lepta = 1 drachma = 9·6d.

The following are exempted from the consumption duty:—Fulminate of mercury and fulminating mixtures employed in the manufacture of caps; gunpowder and explosives ordered for the use of the Greek army or navy, or employed in the manufacture of ammunition for those services. The law also increases the Customs duty on filled cartridges (the contents not being subjected to the consumption tax on gunpowder) from 30 to 40 drachmæ (metallic) per thousand, and provides for the admission of chlorate of potash and chlorate of soda into Greece free of Customs duty under No. 103*a* of the tariff. The law is to be brought formally into operation at a date to be fixed by Royal Decree, but, in virtue of the Greek Customs Law, the foregoing tariff alterations were put into force on the introduction of the measure.

Patents.

Safety powder for blasting. G. M. Peters, Cincinnati, and M. F. Lindsley, Kings Mills, Ohio. U.S. Pat. 953,798, April 5, 1910.

A safety powder is prepared from a mixture of ammonium nitrate, nitrocellulose (*e.g.* nitrated wood fibre) and a solution of asphaltum in a nitro-hydrocarbon (*e.g.* mirbane oil).—C. A. M.

Railway-signal fusees; Compound for ——. I. Niditch, Dorchester, Mass., Assignor to American Fog Signal Co., Pittsburg, Pa. U.S. Pat. 954,330, Apr. 5, 1910.

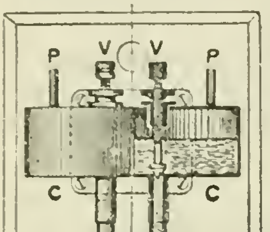
A compound not liable to spontaneous combustion and which, when used in a "time-burning" signal fusee, burns with a strong and brilliant flame, is obtained by mixing together specified proportions of a nitrate of a metal, sulphur, a carbohydrate, and a perchlorate such as potassium perchlorate.—C. A. M.

Explosive composition. L. Gray. Fr. Pat. 408,648 Nov. 5, 1909.

See Eng. Pat. 25,553 of 1909; this J., 1910, 235.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Manometer; A sensitive two-fluid ——. J. A. Smith. Victorian Inst. Engineers. Engineer, April 8, 1910, 366.



The pressure-gauge described is filled with two liquids of but slightly different specific gravities. It consists of an inverted glass siphon, S, of $\frac{1}{8}$—$\frac{1}{4}$ in. bore, to the open ends of which are attached two cisterns, C, C, the cross-sectional area of which is about 100 times the bore of the siphons. The cisterns are about 2 ins. deep, and are provided with pressure connections, P, P, and stop-valves, V, V. One of the liquids is poured into one cistern until both limbs of the siphon are nearly full, and the other liquid is then poured into the second cistern, until the junction of the two liquids is at a point, such as Z, convenient for observation. The depth of the liquids in the cisterns should not be less than $\frac{1}{2}$ in. The heights (h_1, h_2) of the two columns of liquid in equilibrium above the point Z, will be inversely proportional to their specific gravities (w_1, w_2), *i.e.*, $w_1h_1=w_2h_2$. If a small difference, p, be made between the pressures in the two cisterns, the columns of liquid will move until $w_1h'_1+p=w_2h'_2$, so that $p=w_2h'_2-w_1h'_1$. Owing to the relatively large diameter of the cisterns compared with that of the siphon-tube, the heights, h_1 and h_2, are always approximately equal, and hence $p=(w_2-w_1)\ h'_1$, so that the delicacy of the gauge is practically the same as that of one filled with a liquid of sp. gr. w_2-w_1. Two liquids used by the author are kerosene of sp. gr. 0·82—0·83, and alcohol coloured with an aniline dyestuff, and diluted with water to any desired specific gravity. With a gauge of this kind of suitable relative dimensions, differences of pressure corresponding to 1-800th part of an inch of water, or 0·000045 lb. per sq. in., can be observed. By connecting two closed receivers of as large dimensions as possible, with the two cisterns by means of tubes of as small a bore as possible, a differential gas thermometer can be constructed by means of which a scale on which 1° F. is represented by a distance of 15 ins. is attainable.—A. S.

Sulphuric acid; Determination of —— by the benzidine method, especially in the presence of chromium. G. v. Knorre. Chem.-Zeit., 1910, **34**, 405—407.

The statement made by Friedheim and Nydegger (this J., 1907, 116), that ferric salts have but little disturbing effect on the determination of sulphuric acid by the benzidine method, is only true if pure benzidine be employed; and in any case it is found best to add hydroxylamine hydrochloride as previously recommended by the author (this J., 1905, 106). The addition of the same reagent also renders possible the determination of sulphate in the presence of chromate (*cf.* "the determination of tungsten," this J., 1908, 812). 10 c.c. of $N/1$ hydrochloric acid are added before precipitation, and the solution should not contain appreciably more than 0·1 grm. of chromic anhydride, nor above 1 part of chromic anhydride to 1 part of sulphur trioxide; the benzidine solution is mixed with about 0·4 grm. of hydroxylamine hydrochloride, and sufficient is used, not only to precipitate the sulphuric acid, but also for the conversion of the chromic acid into benzidine chromate. In the presence of trivalent chromium, the determination may be accurately made by boiling with an excess of sodium acetate or ammonium formate, before precipitating with the benzidine solution (which may be added directly to the hot liquid), and the mixture is allowed to stand for about a day at the room temperature before filtering. Solutions containing chromic acid may also be reduced by acidifying with a little hydrochloric acid and heating with hydrazine hydrochloride, and then, after carefully neutralising with ammonia (until a slight precipitate is produced), boiling the liquid with excess of ammonium formate and precipitating the sulphate with benzidine.—F. Sodn.

Ferrous salts; Titration of —— in the presence of hydrochloric and phosphoric acids. G. J. Hough. J. Amer. Chem. Soc., 1910, **32**, 539—540.

The author finds that potassium permanganate is a reliable reagent for titrating ferrous iron in hydrochloric acid solution, if phosphoric acid is also present. The method was originally proposed for estimating iron in bone-black but is readily applicable to iron orea if a few precautions are taken. A minimum amount of hydrochloric acid (not more than 5—10 c.c. of concentrated acid) must be used, titration must be carried out in a cold solution of about 300 c.c. volume, and reduction with stannous chloride must be avoided. Sodium sulphite, aluminium, zinc dust and lead are suitable reducing agents, lead being particularly advantageous where the presence of much hydrochloric acid cannot be avoided.—W. H. P.

Bromine and chlorine, combined iodine, and oxidising agents; Gravimetric determination of free —— by means of metallic silver. C. C. Perkins. Amer. J. Science, 1910, **29**, 338—340.

The method already described for the determination of iodine (this J., 1909, 834) may be applied to the determination of free bromine and chlorine by adding the solution to be examined to an excess of potassium iodide, acidulated with hydrochloric acid, and then finding the weight of iodine liberated by shaking with metallic silver in an atmosphere of hydrogen. For the determination of combined iodine, excess of an oxidising agent, such as potassium nitrite or hydrogen peroxide, is added, and, after acidifying with hydrochloric acid, the determination is finished as before. Conversely, oxidising agents, such as permanganate, bichromate, hydrogen peroxide, and ferric chloride, which liberate iodine quantitatively from potassium iodide, may be determined by adding an excess of potassium iodide, acidified with hydrochloric acid, and shaking the mixture with silver.—F. Sodn.

Zinc; Electrolytic determination of ——. E. B. Spear, E. E. Wells, and B. Dyer. J. Amer. Chem. Soc., 1910, **32**, 530—533.

Over 200 electrolytic determinations of zinc under varying conditions, from solutions containing (1) sodium acetate and acetic acid, (2) potassium oxalate, and (3) sodium or potassium hydroxide, gave results from 0·5 to 2·5 per cent. too high, the greatest errors being obtained with the loose, coarse-grained deposits. Some of these on analysis yielded nevertheless figures averaging only about 88 per cent. of zinc. The delicacy of the various reagents for determining small quantities of zinc at the end of the reaction was investigated. Ammonium sulphide is unsatisfactory, and hydrogen sulphide is rendered less delicate by presence of ammonia or salts of organic acids. Potassium ferrocyanide however in acid solution at 50°—70° C. will detect 0·5 mgrm. of zinc per litre.
—W. H. P.

Zinc ; Causes of the high results in the electrolytic determination of ——. E. B. Spear. J. Amer. Chem. Soc., 1910, **32**, 533—538.

See preceding abstract. The author shows by direct experiment that no liquid is enclosed in the zinc, and that no salt is deposited with it. On boiling the deposit with mercury no gas is evolved, showing that no hydrogen is adsorbed or combined, and finally no trace of sodium or other foreign metal can be detected in the deposit. The non-metallic appearance of the deposit from alkaline solution, as compared with that from sulphuric acid solution suggests the presence of zinc oxide or hydroxide, and although this theory cannot be proved by reduction of the deposit in hydrogen (owing to the volatility of zinc), it is supported by other experimental evidence. It is also quite clear that the oxidation takes place during, and not subsequent to the electrolysis. It is not possible to remedy the error by making the solution so strongly alkaline that no formation of hydroxide is possible. If this is done the rapidity of evolution of the hydrogen prevents the formation of a good deposit, and the strong alkali also attacks the zinc and prevents its complete precipitation.—W. H. P.

Palladium ; Determination and separation of ——. A. Gutbier and F. Falco. Z. anal. Chem., 1910, **49**, 287—295.

Palladium is determined by the authors in acid solution as follows :—an amount of the substance containing not more than 0·1 grm. of palladium is dissolved in very dilute hydrochloric acid, diluted with water to at least 150 c.c., and mixed at boiling temperature with a boiling aqueous hydrazine sulphate solution. The beaker is then covered and placed on the water-bath. A mirror of palladium first forms on the sides of the beaker ; this is loosened by the gas evolution which then takes place, and finally all the palladium collects in shining flakes at the bottom of the beaker. After 20 minutes the precipitation is always complete and the supernatant liquid perfectly clear. It is now boiled for half an hour, allowed to cool slightly, decanted through a filter, the residue washed by decantation with hot water till free from chlorine and finally washed on the filter. It is then dried at 105° C., the filter separately ignited in a weighed Rose crucible or porcelain boat, the main precipitate added and the metal ignited gently, first in air, then in hydrogen and finally in carbon dioxide free from oxygen, in which it is cooled. This process is repeated till the weight is constant. In ammoniacal solution the authors determine palladium as follows :—the substance is dissolved in very dilute aqueous ammonia, the clear liquid diluted with water and, whilst boiling, precipitated with a boiling aqueous solution of hydrazine sulphate. The estimation is then continued in exactly the same manner as in the determination in acid solution, as above.—E. F.

Determination of cellulose. Scheubert and Lötsch. *See* V.

Reactions of the vat dyestuffs on the cotton fibre. Green and Frank. *See* VI.

Analysis of iron pyrites. Vilstrup. *See* VII.

New colour-reaction for nitric acid and nitrates. Schmidt and Lumpp. *See* VII.

Ferrous compounds of nitric oxide. Manchot and Huttner. *See* VII.

Assay of perborates. Farrar. *See* VII.

Determination of bromine in presence of chlorine and iodine. Dibdin and Cooper. *See* VII.

Testing of trass. Gary. *See* IX.

Analysis of ultramarine blue. Andrews. *See* XIII.

Bacteriological methods for determining the available nitrogen in fertilisers. Lipman. *See* XVI.

Proportions of dry substance and non-sugar in beets and diffusion juice. Claassen. *See* XVII.

Influence of optically active non-sugars on determination of sugar in beetroot. Andrlik and Stanek. *See* XVII.

Diagnosis of aldoses and ketoses [sugars] with bromine water. Votocek and Nemecek. *See* XVII.

Determination of sugar volumetrically. Clacher. *See* XVII.

Volumetric analysis of barium salts. Selvatici. *See* XVII.

Detecting sucrose in wine, "Weissbier," etc. Rothenfusser. *See* XVIII.

Detecting hexamethylenetetramine [urotropine] in musts and wines. Voisenet. *See* XVIII.

Determining fusel oil in spirits containing [lubricating] oil. Dunke. *See* XVIII.

Detecting methyl alcohol, especially in presence of ethyl alcohol. Denigès. *See* XVIII.

Comparison of results given by the determination of acidity in, and by the "catalasimetry" of milk. Sarthou *See* XIXa.

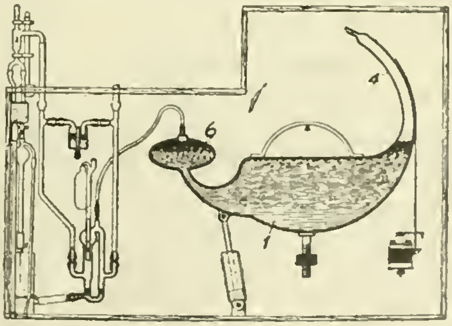
Determining formaldehyde in formalin-soap products ("Lysoform," "Formosapol," and "Morbicide"). Allemann. *See* XIXb.

Determination of ferripyrine. Astruc and Bouisson. *See* XX.

Patents.

Gas analysis apparatus. S. D. Merton, St. Louis, Mo. U.S. Pat. 953,482, Mar. 29, 1910.

A hollow vessel, 1, containing the absorbing liquid is mounted so that it can rock as shown. One end of this vessel, 4, open to the atmosphere, is lengthened out and contracted ; the other end is enlarged to form the bulb, 6, into which a given volume of the gas to be examined is forced. The angle to which the vessel inclines indicates the amount of absorption of gas which has taken place.
—J. W. H.



Photometer ; Candle-foot ——. W. D'A. Ryan, Lynn, Mass., Assignor to General Electric Co., New York. U.S. Pat. 953,765, April 5, 1910.

A portable photometer comprises a box fitted with a standard lamp movable relatively to the device by which the light intensities are compared. This device consists of adjacent prismatic blocks of diffusing material with light-transmitting surfaces at right angles to one another, directed towards the source of light and the standard lamp respectively, and a third surface at right angles to the other two having light-transmitting slots illuminated through those two surfaces.—A. T. L.

Pyrometers. C. E. Foster, Rochester, N.Y. U.S.A. Eng. Pat. 30,478, Dec. 30, 1909. Under Int. Conv., Feb. 10, 1909.

See U.S. Pat. 933, 543 of 1909; this J., 1909, 1066 —T. F. B.

Gaseous mixtures; Process and apparatus for measuring and analysing ——. B. C. Hinman. Fr. Pat. 408,803, Nov. 10, 1909. Under Int. Conv., Dec. 8, 1908

See Eng. Pat. 26,561 of 1908; this J. 1910, 116 —T. F. B.

Volumetric determination of fat in milk. Fr. Pat. 406,743
See XIXA.

XXIV.—MISCELLANEOUS ABSTRACTS.

Autoxidation of aliphatic amino- and-polyhydroxy-compounds [in alkaline copper solutions]. W. Traube. Ber., 1910, **43**, 763—772.

The author and Schönewald (this J., 1906, 203) have shown previously that metallic copper is dissolved by aqueous solutions of primary amines and amino-acids in presence of oxygen, just as by ammonia solution, the amino-compounds becoming oxidised to aldehydes during the process. It is now found that solutions of fixed alkalis, containing polyhydroxy-compounds (glycerol, mannitol, ethyleneglycol) also dissolve copper in presence of oxygen, the hydroxy-compounds being oxidised, in the cases examined, to formic acid. From 80 grms. of copper cuttings, 5·6 grms. were dissolved in 38 hours by a solution of 12 grms. of glycerin in 200 c.c. of 10 per cent. caustic soda, in presence of oxygen. Using "copper wool," 12·5 grms. were dissolved from 50 grms. in 16 hours by a solution of 12 grms. of glycerin in 100 c.c. of 10 per cent. caustic potash, and 17 grms. from 50 grms. in 16 hours by a solution of 5 grms. of mannitol in 100 c.c. of 10 per cent. caustic potash. The mechanism of the reaction is discussed and it is shown that the oxidation phenomena are quite distinct from the solution of the copper. The oxidation only takes place in presence of a sufficient proportion of hydroxylions, and is considered to be due to the autoxidation of complex copper compounds of the amino- or hydroxy-compounds.—A. S.

Books Received.

The Smokeless Combustion of Coal in Boiler Plants, with a chapter on Central Heating Plants. By D. T. Randall and H. W. Weeks. Department of the Interior United States Geological Survey Bulletin 373. Government Printing Office, Washington, 1909.

8vo volume, containing 186 pages of subject matter, 40 illustrations, and an alphabetical index. The subject matter is classified under the following heads :—I. Investigation of industrial plants. II. Tests by Geological Survey. III. Representative boiler plants burning coal without smoke. IV. Plants with mechanical stokers. (*a*), Overfeed stokers, (*b*). Underfeed stokers. V. Smoke prevention at boiler plants with great variations of load. VI. Hand-fired furnaces. VII. Smoke observations at Geological Survey fuel-testing plants. VIII. Comparison of methods of supplying air for combustion. IX. Influence of volatile matter in fuel on the smoke problem. X. Horse-power from different coals. XI. Central heating stations. XII. General conclusions on smoke abatement. XIII. Bibliography. (See also this J., 1910, 201.)

Kurze Uebersicht über Sämtliche Legierungen. Von Dr. Ernst Jänecke. Dr. Max Jänecke's Verlag. Hannover, 1910, Preis broschiert M.3.90; in Ganzleinen gebunden M.4.80.

Small 8vo volume, containing 98 pages of subject matter, with 47 illustrations, and an alphabetical index of names. The subject matter is classified as follows :—Introduction. The phase-rule in its application to alloys. The graphic method in the case of binary alloys. I. Binary alloys. Alloys of types I., II., III., IV., V., VI., and VII. II. (i.) Ternary alloys. (ii.), Application of the phase rule in systems of three constituents. (iii.), Method of presenting results. (iv.), Ternary alloys with one solid phase (complete or full isomorphism). (v.). Ternary alloys with three solid phases. (vi.), Ternary Eutectics. (vii.), Ternary systems in which two layers of molten metal are formed. (viii.), Ternary alloys containing chemical compounds. (ix.), Ternary alloys with sulphur as a constituent. (x.), Ternary alloys with Fe-C as a constituent (special steels). (xi.), Quarternary alloys.

Radiochemistry. By A. T. Cameron, M.A., B.Sc. Lecturer in Physiological Chemistry, University of Manitoba, etc. J. M. Dent and Sons, Limited, 29 and 30, Bedford Street, Covent Garden, London, 1910. Price 2s. 6d.

Small 8vo volume, containing frontispiece (Madame Curie), and two portraits in the text (Profs. Ramsay and Rutherford), 163 pages of subject matter, 8 pages of Bibliography and an alphabetical index. The subject matter receives the following classification :—I. Historical introduction. II. Radio-active methods illustrated by the thorium series of elements. III. Radiations from radio-active elements. IV. Life of a radio-active element. V. Classification of the radio-active elements—their physical and chemical properties. VI. Methods of work with radium emanation—the life period of radium. VII. The atomic weight of the emanation—Liquid and solid radium emanation. VIII. Chemical effects produced by the radiations. IX. Production of helium during radio-active changes, and its identity with the α-particle. X. Recent attempts at transmutation. XI. Chemical evidences of transformation. XII. Radio-geology. XIII. Medical application of the radiations.

Patents, Designs, and Trade Marks. Twenty-seventh Report of the Comptroller-General, with Appendices, for the year 1909. Wyman and Sons, Fetter Lane, London, E.C. Price 2½d.

This report deals with the work of the Patent Office during the year 1909. The number of applications for patents and for registration of design and trade marks during that year, as compared with the two preceding years, is shown by the following table :—

——	1907.	1908.	1909.
Patents—			
Applications	28,915	28,598	30,603
Specifications—			
Provisional	19,568	19,495	21,553
Complete	18,829	17,746	18,705
Sealed	16,272	16,284	15,065
Designs—			
Applications	24,928	24,907	26,412
Registered	24,039	24,389	25,754
Trade Marks—			
Applications	10,796	10,645	10,880
Registered	6,255	5,965	6,112

Manufacture of Denatured Alcohol. By H. W. Wiley, with the collaboration of H. E. Sawyer, L. M. Tolman, A. H. Bryan. A. Given, and H. W. Berger. U.S. Dept. of Agriculture, Bureau of Chemistry. Bulletin No. 130.

8vo volume of 166 pages, containing a description of the processes used in making denatured alcohol, with a brief account of the chemistry of the subject. The work is based on the operations of the experimental still erected at Washington. A number of lectures on various branches of the subject is also included.

Mineral Resources of the United States, 1908. U.S. Geological Survey, Washington.

This work, which is issued in two volumes, "Part I., Metallic Products," and "Part II., Non-metallic Products," gives a description of the production and treatment of the various mineral substances obtained in the United States in 1908.

*New Books.

Aufhäuser, Dr.: Vorlesungen üb. Brennstoffkunde. 1. Tl. der Vorlesgn. üb. "Brennstoffkunde u. techn. Feuerg.," geh. in Hamburg 1908 vom Verein f. Feuerungsbetrieb u. Rauchbekämpfg., gemeinsam m. der thermochem. Prüfungs- u. Versuchs-Anstalt Dr. Aufhäuser. (VIII, 76 S.) gr. 8°. Hamburg, Boysen & Maasch, 1910. M. 2.

Auskunft, chemisch-technische. Zeitschrift des internationalen Institutes f. Techno-Bibliographie. [Aus: "Techn. Auskunft."] 2. Jahrg. 1910. 24 Hefte. (1. Heft. 8, 11, 64, 8, 16, 16 u. 8 S.) gr. 8°. Berlin, Bibliograph Zentral-Verlag. M. 24.

Beauverie: Les Bois industriels. In-12 avec 53 fig. Encyclopédie scientifique. Bibliothèque de botanique appliquée. Doin, Paris, 1910. 5 fr.

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Capaun-Karlowa's, C. F.: Chemisch-technische Spezialiaten u. Geheimnisse m. Angabe ihrer Zusammensetzung nach den bewährtesten Chemikern. In 5., vollständig umgearb. verm. Aufl. zusammengestellt von M. v. Waldheim. (IV, 264 S.) 8°. Wien. A. Hartleben, 1910. M. 2.50; cloth, M. 3.30.

Dole, R., Bryant. The quality of surface waters in the United States. Pt. 1, Analyses of waters east of the one hundredth meridian. Wash., D. C., United States, Office of the Superintendent of Documents, 1909 [1910]. 123 pp. 8° (water-supply paper). (Add. Superintendent for price.)

Dubbel, Heinr.: Grossgasmaschinen. Ihre Theorie, Wirkungsweise u. Bauart. (VII, 167 S. m. 400 Fig. u. 6 Taf.) Lex. 8°. Berlin. J. Springer. 1910. Cloth M. 10.

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Fernald, Rob. Heywood: Recent development of the producer-gas power plant in the United States. Wash., D.C., United States, Office of the Superintendent of Documents, 1909 [1910]. 82 pp. fold. maps (in pocket), diagrs., 8° (United States, Geological Survey, bulletin). (Add. Superintendent for price.)

Fleming, L.: A. Practical tanning: A hand-book of modern processes, receipts, and suggestions for the treatment of hides, skins and pelts of every description, including various patents relating to tanning, with specifications. 2d. ed., in great part rewritten, thoroughly revised and much enl.; il. by 6 full-page plates. Phil., Henry Carey Baird & Co., 1910. c. 630 pp. 8°. Cl. $6 net.

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Grünwald (Jules): La Technique de l'Émaillerie moderne. L'Émaillage de la tôle et de la fonte. In-8. Dunod et Pinat. Paris. 1910. 4 fr. 50.

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Handbuch der Kaliwerke, Salinen u. Tiefbohrunternehmungen. Handbuch der Petroleum-Industrie. Jahrg, 1910. (XV, 676; IX, 204 u. 8 S.) gr. 8°. Berlin, Finanzverlag G.m.b.H. Cloth M. 12.

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Harries, Prof. C.: Ueber den gegenwärtigen Stand der Chemie des Kautschuks. Vortrag. [Aus: "Gummi-Ztg."] (16 S.) 8°. Berlin, Union, Zweigniederlassung. 1910. M. 1.

Hartwich, Dr. C.: Die menschlichen Genussmittel ihre Herkunft, Verbreitg., Geschichte, Bestandteile Anwendg. u. Wirkg. Mit ca. 24 Taf. in Autotypie, mehreren Karten sowie zahlreichen Abbildgn. im Text. (In ca. 16 Lfgn.) 1. Lfg. (64 S. m. 4 Taf.) Lex. 8°. Leipzig, Ch. H. Tauchnitz. 1910. M. 2.

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Hoffmann, Dr. M. K.: Lexikon der anorganischen Verbindungen. Mit e. Rechentaf. v. Prof. Dr. A. Thiel. (In deutscher, engl., französ. u. italien. Sprache.) Lex. 8°. Leipzig, J. A. Barth.

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Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

8713. Marks (Badische Maschinenfabr. u. Eisengiesserei). Separation and pulverisation of materials.* April 11.

8718. Savary. Furnaces. [Fr. Appl., Dec. 20, 1909.]* April 11.

8724. Siemens. *See under* IX.

8793. Hoofnagle. Dis-associating and removing vapour from aqueous liquids.* April 12.

8883 and 8884. Tattersall. Apparatus for cooling, evaporating, and moistening fluids. April 13.

9089. Maschinenbau-Anstalt Humboldt. Rotary drying drums. [Ger. Appl., April 24, 1909.]* April 14.

9162. Bour. Obtaining concentrated solutions. April 15.

9168. Cotterell. Apparatus for distilling water and other liquids. April 15.

9205. Haddan (Internat. Clarifying Co.). Centrifugal separators.* April 15.

9388. Barker. Roasting or drying furnaces. April 18.

9467 and 9718. Epstein. Distillation. April 19 and 21.

10,057. Chance. Apparatus for separating solids from liquids. April 25.

10,146 and 10,147. Macfarlane. Centrifugal drying machines. April 26.

10,344. Simon and Sons, Ltd., and Simon. Rotary drying machines. April 27.

10,418. Franke. Treatment of substances to be dried by pressing. [Ger. Appl., Dec. 27, 1909.]* April 28.

10,609. Campbell. Containers or cylinders for compressed or liquefied gas.* April 29.

10,610. Irwin, and Johnson and Co., Ltd. Filter presses. April 29.

Complete Specifications Accepted.

9276 (1909). Soc. d'Exploitation de Procédés Evaporatoires. Apparatus for concentrating liquids. April 20.

19,285 (1909). Nuttall. Means for passing steam or other fluids into rotating cylinders. May 4.

23,534 (1909). Siemens. Regenerative gas re-heating furnaces. April 20.

23,552 (1909). Schroder. Cooling or drying apparatus. April 20.

23,981 (1909). Justice (International Continuous Filter Press Co.). Filter presses. April 27.

24,402 (1909). Arbuckle and Osborne. Separating pulverised ore or other comminuted solid matter from liquid. April 27.

24,403 (1909). Arbuckle. *See under* X.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

8664. Heckel. Process of binding coal-dust.* April 11.

9076. Gebr. Siemens und Co. Electrodes for arc lamps. [Ger. Appl., May 14, 1909.]* April 14.

9086. Feld. Extraction of tar and tar constituents from gases. [Ger. Appl., April 14, 1909.]* April 14.

9119. Pease. Obtaining power gases and sulphate of ammonia from refuse materials. April 15.

9196. Lander. Binders for use in making artificial fuel. April 15.

9297. Burstall, and British Pure Fuel, Ltd. Purification of fuel and carbonaceous substances. April 16.

9408 and 9409. Dempster and Sons, Ltd., and others. Gas retorts. April 19.

9487. Thompson (Soc. Anon. Ital. per la Combustione degli Idrocarburi). Apparatus for burning hydrocarbon and their derivatives.* April 19.

9610. Lake (Tait Producer Co.). Gas producers.* April 20.

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[*] Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works and dissertations in the preceding lists can be obtained.

9892. Knottenbelt. Impts. in petroleum and other hydrocarbon oils. [Comprised in No. 12,001, May 21, 1909.] April 22.

10,224. Von Groeling. Apparatus for distilling petroleum oil or other hydrocarbons or for condensing natural gases. April 26.

10,226. Dawson. Apparatus for producing an explosive or combustible mixture of liquid fuel and air. April 26.

10,239. Boult (Rikinosuke). Manufacture of mineral oil.* April 26.

10,329. Ellison and Fletcher. Preparation of charges of coal for coke ovens. April 27.

10,371. Godelmann. Incandescent gas mantles. April 27.

10,400. Campbell. Suction gas producers. April 28.

10,550. Cory (Crochet). Briquetting of fuel.* April 29.

10,598. Tessier. Apparatus for making gas for heating, lighting, and power. [Belg. Appl., Oct. 7. 1909.]* April 29.

Complete Specifications Accepted.

7400 (1909). Gower. Production of semi-water gas. April 20.

9445 (1909). Soc. Anon. d'Ougrée-Marihaye, and Floy. Coke ovens. April 27.

9468 (1909). Withers. Gas producer plants. April 27.

10,482 (1909). Schniewind. Burners for coke ovens. May 4.

10,486 (1909). Schniewind. Coking ovens, retorts, etc. May 4.

12,714 (1909). Birch, Dudley, and Doxey. Bunsen burners. May 4.

17,348 (1909). Westgate. Apparatus for making gas by burning solid matter in a current of air or other gas. May 4.

20,158 (1909). Tozer. Distillation and carbonisation of coal and other carbonaceous materials. April 27.

24,611 (1909). De Fontaine. Gas generators. April 27.

III.—TAR AND TAR PRODUCTS.

Applications.

9086. Feld. *See under* II.

9213. Barlen. Upright retorts for distilling tar, oils, etc. [Ger. Appl., April 16, 1909.]* April 15.

9219. Hodgkinson. Method of condensing hydrocarbons. April 16.

9358. Newton (Bayer und Co.). Manufacture of octadionol and its homologues. April 18.

9477. Flurscheim. Manufacture of nitro-derivatives of aniline. April 19.

9743. Kalle und Co. Manufacture of a new amino-oxynaphthalene sulphonic acid. [Ger. Appl., May 11, 1909.]* April 21.

9955. Zimmer. Increasing the resistance of tar pitch, mineral resins, etc., to heat.* April 23.

IV.—COLOURING MATTERS AND DYES.

Applications.

8722. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of mordant azo dyestuffs.* April 11.

9173. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of disazo dyestuffs.* April 15.

9284. Soc. pour l'Industrie Chim. à Bâle. Manufacture of dyestuffs of the anthracene series. [Fr. Appl., April 15, 1909.]* April 16.

9359. Newton (Bayer und Co.). Manufacture of vat dyestuffs. April 18.

9497. Meister, Lucius, und Brüning. Manufacture of a monoazo dyestuff. [Ger. Appl., April 27, 1969.]* April 19.

9620 and 9621. Newton (Bayer und Co.). Manufacture of azo dyestuffs. April 20.

9633. Meister, Lucius, und Brüning. Manufacture of yellow monoazo dyestuffs. [Ger. Appl., Oct. 16, 1909.]* April 20.

9744. Kalle und Co. Manufacture of azo dyestuffs. [Ger. Appl., May 12, 1909.]* April 21.

9968. Imray (Soc. Chem. Ind. in Basle). Manufacture of yellow to orange-red azo dyestuffs. April 23.

10,053. Newton (Bayer und Co.). Manufacture of and dyeing with anthracene dyestuffs. April 25.

10,331. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of yellow disazo dyestuffs.* April 27.

Complete Specifications Accepted.

10,461 and 10,462 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 4.

11,356 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. April 27.

11,929 (1909). Newton (Bayer und Co.). Manufacture of acid wool dyestuffs. April 27.

12,568 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. April 20.

14,314 (1909). Imray (Soc. Chem. Ind. in Basle). Manufacture of brown vat dyestuffs of the indigo series. April 20.

16,799 (1909). Newton (Bayer und Co.). Manufacture of disazo dyestuffs. April 20.

19,086 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. April 27.

20,905 (1909). Newton (Bayer und Co.). Manufacture of a dyestuff of the oxazine series and its leuco-derivative. April 20.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

8688. Silberrad. Manufacture of paper and allied materials. April 11.

9866. White. Removal of the yolk or suint from wool. April 22.

10,075. Castle. Combination for sizing and finishing. April 25.

10,186. Wilkinson, and Bradford Dyers' Assocn., Ltd. Manufacture of textile fabrics. April 26.

10,211. Weertz. Apparatus for use in making artificial threads. April 26.

10,229. Petsche. Separating pulp fibres from pigments and other impurities.* April 26.

10,320. Clément. Manufacture of celluloid. [Fr. Appl., April 29, 1909.]* April 27.

10,328. King's Norton Metal Co. and others. *See under* VIII.

Complete Specifications Accepted.

8829 (1909). Fox. Washing inflammable fabrics. April 20.

13,672 (1909). Erste Triester Reisschal-Fabriks, and Donauer. Manufacture of sizing or finishing media. April 27.

14,112 (1909). Friedrich. Production of durable solutions for spinning and other purposes. April 20.

15,658 (1909). Stine. Treatment of silk. April 27.

20,645 (1909). Palmer. Imparting lustre to yarns, fabrics, etc. April 20.

25,587 (1909). Schneider. Water purifying apparatus for paper and like factories. May 4.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

8733. Johnson (Badische Anilin und Soda Fabrik). Production of discharge effects on the fibre. April 11.

9028. Bell. Mordants and reducing agents for dyeing and printing. April 14.

9090. Krokert. Printing woven fabric.* April 14.

9269. Wickel. Producing coloured coatings on paper and fabric. [Ger. Appl., April 17, 1909.]* April 16.

9270. Wickel. Embossing in gold, silver, etc. [Ger. Appl., April 17, 1909.]* April 16.

9272. Wickel. Coating paper, etc., with metallic and body colours. [Ger. Appl., April 17, 1909.]* April 16.

9321. Cox. Printing warps and the like. April 18.

9369. Müller. Bleaching process. [Ger. Appl., April 16, 1909.]* April 18.

9982. Herzog. Apparatus for bleaching yarn, yarn bobbins, cops, etc. [Austrian Appl., April 28, 1909.]* April 23.

10,053. Newton (Bayer und Co.). *See under* IV.

10,075. Castle. *See under* V.

10,503. Green. Dyeing and printing with aniline black. April 29.

Complete Specifications Accepted.

10,170 (1909). Jahn and Grunhut. *See under* IX.

11,024 (1909). Hoffmann and Decoster. Rapid impregnation of vegetable fibres, especially in the cold. May 4.

27,432 (1909). Cox. Apparatus for bleaching, dyeing, etc., textile materials. April 27.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

8734. Dieffenbach and Moldenhauer. Manufacture of hydrogen. [Ger. Appl., Jan. 10, 1910.]* April 11.

9119. Pease. *See under* II.

9177. Bueb, and Deutsche-Continental Gas-Ges. Manufacture of ammonium carbonate.* April 15.

9265. Pollitt. Manufacture of zinc chloride from zinc ores or zinc oxide. April 16.

9375. Johnson (Deuts. Gold- u. Silber-Scheide Anstalt). Manufacture of sodium cyanide. April 18.

9391. De Stucklé. Manufacture of dehydrated zinc sulphide. [Ger. Appl., Sept. 6, 1909.]* April 18.

9834. Fricker. Manufacture of zinc oxide. April 22.

9848. Ges. f. Chem. Industrie in Basel. Manufacture of anhydrous hydrosulphites. [Ger. Appl., Nov. 26, 1909.]* April 22.

9869. Justice (Duron and Hartmann). Manufacture of sulphuric acid.* April 22.

9884. Salpetersäure Ind.-Ges., and Pauling. Manufacture of nitrites and nitrates.* April 22.

10,066. Sarason. Development of oxygen. [Ger. Appl., April 26, 1909.]* April 25.

10,378. Hall. Apparatus for making and manipulating solid carbon dioxide. April 28.

10,441. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. April 28.

Complete Specifications Accepted.

10,170 (1909). Vender. *See under* XXII.

20,192 (1909). Girtin. Electrolytic production of salt solutions. May 4.

VIII.—GLASS; CERAMICS.

Application.

10,328. King's Norton Metal Co., Ltd., and others. Process for coating glass, paper, metals, etc., with a metal. April 27.

Complete Specification Accepted.

2672 (1910). Soc. Anon. de Verreries et Manufacture des Glaces d'Aniche. Manufacture of window-glass. April 20.

IX.—BUILDING MATERIALS.

Applications.

8724. Siemens. Rotary cement kilns, calcining or roasting furnaces, etc. [Addition to No. 23,534 of 1909. Ger. Appl., May 28, 1909.]* April 11.

9608. Lake (Davit, and De Groot and Lane Co.). Art of waterproofing wood.* April 20.

Complete Specifications Accepted.

10,170 (1909). Jahn and Grunhut. Dyeing of wood. May 4.

13,068 (1909). Perpignani and Candlot. Lime and cement kilns. April 27.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

9003. Martin. Concentration and separation of sulphide and other ores. April 14.

9070. Murex Magnetic Co., Ltd., and Lockwood. Treatment of copper ores. April 14.

9082. Cowper-Coles. Electrodeposition of iron. April 14.

9108. Lucertini. Production of armour plates and other steel articles without case-hardening.* April 14.

9129. Walker and Seaman. Apparatus for electroplating. April 15.

9208. Cowper-Coles Electrodeposition of iron. April 15.

9266. Pollitt. Extraction of lead from ores, etc. April 16.

9397. Bradley. Electrodeposition of metals. April 18.

9406. Richardson. Manufacture and treatment of steel. April 18

9511. Jones and Mitchell. Decarburising armour plates.* April 19.

9648. Murex Magnetic Co., Ltd., and Lockwood. Treatment of ores. April 20.

9665. Ballingall and Ballingall. Copper alloy. April 21.

9818. Gutensohn. Recovery of zinc from ores, waste, etc. April 22.

9819. Mayes. *See under* XI.

9874. Vautin. Recovery of metals from slags. April 22.

9900. Cowper-Coles. Coating iron and steel with zinc. April 23.

9901. Cowper-Coles. Hot galvanising. April 23.

9976. Auchinachie. Treatment of ores of vanadium, uranium, chromium, etc., and manufacture of vanadium and other iron and steel. April 23.

10,199. Thiel. Manufacture of steel or the like. April 26.

10,328. King's Norton Metal Co., Ltd., and others. *See under* VIII.

10,647. Cook and Cook. Electrolytic apparatus for plating small articles. April 30.

Complete Specifications Accepted.

7101 (1909). Ford. Extraction of gold. May 4.

8903 (1909). Newton and Billington. Crucible furnaces. April 20.

9397 (1909). Levy. Extraction of values from tin-containing materials. April 27.

9654 (1909). Bailey. Solder for aluminium or aluminium alloy. May 4.

9955 (1909). Brand. Extraction of zinc. April 27.

11,863 (1909). Fennell and Sackett. Furnaces for treating metals and metalliferous ores. May 4.

18,349 (1909). Hargreaves. Production of iron or steel, direct from iron ore. April 27.

24,402 (1909). Arbuckle and Osborne. *See under* I.

24,403 (1909). Arbuckle. Separating comminuted solid matter such as pulverised ore from liquids. May 4.

24,841 (1909). Langbein-Pfanhauser Werke. Production of ductile electrolytic iron. May 4.

XI.—ELECTRO-CHEMISTRY.

Applications.

8711. Petersson. Electric resistance furnaces. [Addition to No. 6035 of 1910.]* April 11.

9176. Newlands and Parkinson. Preparation for use in making electrolyte for primary batteries. [Addition to No. 11,926 of 1909.]* April 15.

9459. Reid. Electric induction furnaces.* April 19.

9474. Marsden. Ferro electrodes. April 19.

9819. Mayes. Rendering aluminium more suitable for electric conductors. April 22.

9858. Reid. Manufacture of material for electric insulation. April 22.

9897. Härden. Electric furnaces. April 23.

9964. Estelle. Manufacture of electrodes. [Appl. in Sweden, May 13, 1909.]* April 23.

10,175. Woltereck. Secondary batteries. April 26.

Complete Specifications Accepted.

9796 (1909). Williams, Bradley, and Bradley. Electrolytic cells. April 27.

12,677 (1909). Benkö. Carbon electrodes for galvanic elements. April 27.

20,192 (1909). Girtin. *See under* VII.

25,118 (1909). Imray (Soc. Chem. Ind. in Basle). Continuous electrolysis of aqueous solutions. April 20.

XII.—FATS; OILS; WAXES.

Applications.

9213. Barlen. *See under* III.

10,127. Hargreaves. Manufacture of detergents. April 26.

10,429. Stadley. *See under* XIX.

Complete Specifications Accepted.

10,616 (1909). Dörner. *See under* XV.

14,119 (1909). Mills (Arabol Manufacturing Co.). Emulsifier, emulsifying process, and emulsion. April 27.

14,750 (1909). Lever Bros., Ltd., and Edwards. Extraction of crude glycerine from the salt produced during concentration of soap or other lye. April 27.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

9391. De Stucklé. *See under* VII.

9625. Wright. *See under* XIX.

Complete Specifications Accepted.

8495 (1909). Tidman and Pope. Mixing and straining or sifting paints, etc. April 20.

13.679 (1909). Hopkins and Barnett. Recovery of the ingredients of oily inks. April 27.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

9523. Neefe. Treatment of crude rubber. April 19.

9579. Von der Heyden and Jorgens. Manufacture of an elastic caoutchouc-like substance. [Ger. Appl., Jan. 29, 1910.]* April 20.

9588. Elsner and Meyer. Manufacture of pure rubber from crude rubber, guttapercha, &c. [Ger. Appl., Nov. 18, 1909.]* April 20.

9609 and 9616. Plinatus. Production of elastic or resilient masses. [Ger. Appl., Sept. 6, 1909.]* April 20.

9636. Schmmell. Artificial indiarubber. April 26.

9686. Gall. Treatment of indiarubber, guttapercha, balata, &c. April 21.

10.056. Rankin. Treatment of the latex obtained from rubber and like trees. April 25.

10.486. Peachey. Separation of rubber from resin in resinous products containing rubber. April 29.

Complete Specifications Accepted.

17.327 (1909). Gardner. Machine for reducing rubber or similar material to powder. April 27.

1207 (1910). Smith. Rubber compounds. April 27.

XV.—LEATHER: BONE: HORN: GLUE.

Complete Specifications Accepted.

10.616 (1909). Dörner. Extraction of glue, gelatin, and fats from bones and skins. May 4.

16,087 (1909). Lauro. Tanning apparatus. April 20.

24,508 (1909). Griffith. Treatment of chrome-tanned leather. April 27.

XVI.—SOILS; FERTILISERS.

Applications.

9258. Coates. Production of fertilisers. [U.S. Appl., April 26, 1909.]* April 16.

9260. Coates. Fertilisers. [U.S. Appl., April 26, 1909.]* April 16.

9275. Coates. Production of anti-toxin materials and their application to soils. [U.S. Appl., April 26, 1909.]* April 16.

9279. Coates. Production of fertilisers. [U.S. Appl., May 14, 1909.]* April 16.

10.511. Stock. Fertiliser, insecticide, and fungicide. April 29.

Complete Specification Accepted.

23.238 (1909). Ginster. Manufacture of manure and fertilisers. May 4.

XVII.—SUGARS; STARCHES; GUMS.

Application.

9083. Melhuish. *See under* XVIII.

Complete Specifications Accepted.

9148 (1909). Grière. Direct conversion of sugar syrups into crystallised sugar. April 20.

17,937 (1909). Patent-Press-Kartoffel-Industrie H. Gumpel. Treating raw potatoes to obtain a durable product. May 4.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

9083. Melhuish. Preparation of lactose for use in brewing or priming ale, beer, and stout.* April 14.

9777. Kuhn. Etherification of fermented beverages. April 21.

9980. Steffen. Manufacture of alcohol and concentrated fodder from potatoes. [Austrian Appl., April 26, 1909.]* April 23.

Complete Specifications Accepted.

5042 (1909). Maloney. Blending, colouring, and maturing wines, spirits, etc. April 27.

18,028 (1909). Cie. Indus. des Alcools de l'Ardèche. Separating apparatus for use in the manufacture of alcohol. April 27.

21,173 (1909). Löloff. Manufacture in the form of grains of cultures of bacteria or microbes producing lactic fermentation. April 27.

XIX.—FOODS. WATER PURIFICATION; SANITATION.

Applications.

8936. Mongrell. Manufacture of solid and liquid extracts of meat and meat powders.* April 13.

8948. Chitty and Jago. Treatment of wheat for flour milling purposes. April 13.

8964. Ellis. Separation of oily and other impurities from water. April 13.

9625. Wright. Recovery of carbon as lamp black or vegetable black from sewage sludge and filter-pressed cake. April 20.

9672. Ashton. Apparatus for drying sewage sludge. April 21.

9980. Steffen. *See under* XVIII.

10,394. Jones. Apparatus for purifying water and other liquids. April 28.

10,429. Stadley. Edible fat. April 28.

Complete Specifications Accepted.

26,477 (1908). Perrett and Perrett. Purifying oily or greasy water or condensed steam. May 4.

9440 (1909). Ikeda and Suzuki. Method of making a nutritive and flavouring substance. April 27.

17,649 (1909). Dodd and others. Lactic acid bacterial preparations and their production. April 20.

17,937 (1909). Patent-Press-Kartoffel-Industrie. *See under* XVII.

21,173 (1909). Löloff. *See under* XVIII.

25,587 (1909). Schneider. *See under* V.

26,007 (1909). Cabanné. Fermentation of milk. April 20.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

10,227. British and Continental Camphor Co. Conversion of pinene into camphene. [Fr. Appl., May 7, 1909.]* April 26.

10.361. Ostwald and Ostwald. Regulation of changes in organic bodies due to auto-oxidation and polymerisation.* April 27.

Complete Specifications Accepted.

17,928 (1909). Newton (Bayer und Co.). Manufacture of a pharmaceutical compound. April 20.

24,009 (1909). Einhorn. Manufacture of carboxyalkylsalicylosalicylic acid April 20.

24.595 (1909). Chem. Fabr. auf Actien, vorm. E. Schering. Manufacture of curative agents. April 27.

29.439 (1909). Richter. Alkaline salts of acetylsalicylic acid. May 4.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

8761. Palmer. Photographic colour screen plates. April 11.

9166. Forbes. Colour photography. April 15.

XXII.—EXPLOSIVES; MATCHES.

Applications.

8769. Nobel's Explosives Co., Ltd. (Wilson). Explosives. April 12.

9379. Wheelwright. Igniting compositions for matches. April 18.

10.433. Flurscheim. Explosive mixtures. April 28.

Complete Specifications Accepted.

18.279 (1909). Vender. Manufacture of smokeless gunpowder. April 27.

18.280 (1909). Vender. Denitration of acid mixtures and recovery of the constituents. May 4.

18.622 (1909). Wester. Explosives. May 4.

XXIII.—ANALYTICAL CHEMISTRY.

Complete Specifications Accepted.

10.102 (1909). Arndt. Air pycmeters, applicable also to apparatus for measuring the specific gravity of gases. April 27.

11.099 (1909). Macdougald. Apparatus for estimating the specific gravity of liquids. May 4.

462 (1910). Arndt. Testing air or other gases for particular kinds of gases. April 27.

Journal of the Society of Chemical Industry.

No. 10, Vol. XXIX. MAY 31, 1910. No. 10, Vol. XXIX.

Official Notices.

SPECIAL MEETING OF COUNCIL, HELD AT PALACE CHAMBERS, ON THURSDAY, MAY 12TH, 1910.

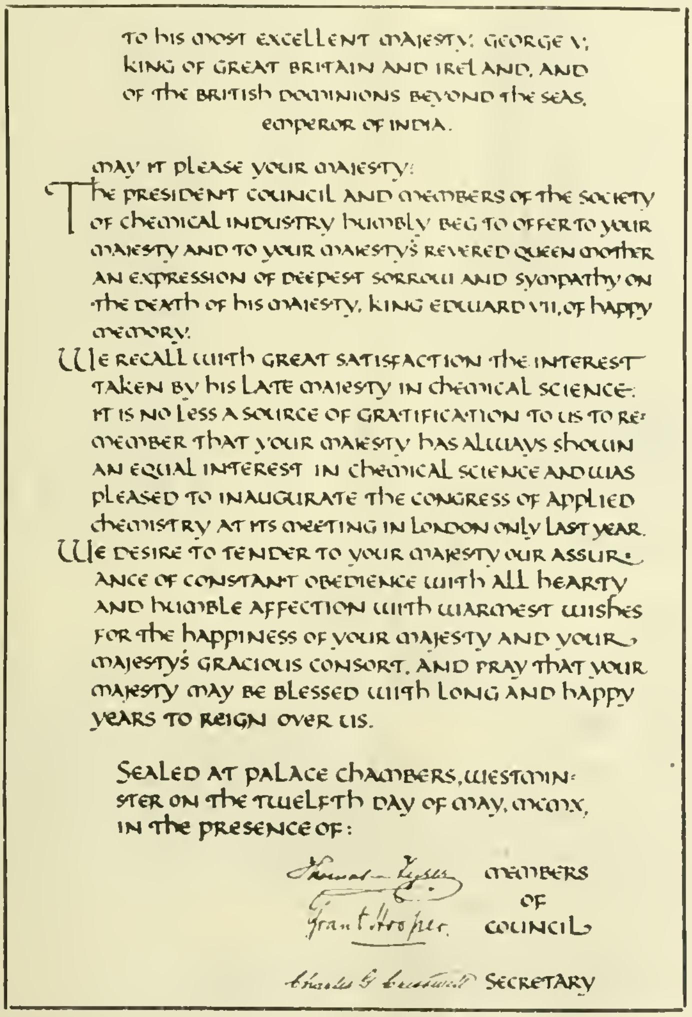
Précis of Minutes.

Mr. Thomas Tyrer in the Chair; nine members and the Secretary present. Four apologies for non-attendance.

Read requisition signed by seven members of the Council, under By-law 27, calling a special meeting to consider ae presentation of an address on the occasion of the death of King Edward VII.

Resolved "That a loyal Address be presented to H.M. King George V., that it be engrossed on parchment, nd duly sealed and signed by Messrs. Tyrer and Hooper."

Resolved: That the Address read as follows:—



TO HIS MOST EXCELLENT MAJESTY, GEORGE V;
KING OF GREAT BRITAIN AND IRELAND, AND
OF THE BRITISH DOMINIONS BEYOND THE SEAS,
EMPEROR OF INDIA.

MAY IT PLEASE YOUR MAJESTY:

THE PRESIDENT COUNCIL AND MEMBERS OF THE SOCIETY OF CHEMICAL INDUSTRY HUMBLY BEG TO OFFER TO YOUR MAJESTY AND TO YOUR MAJESTY'S REVERED QUEEN MOTHER AN EXPRESSION OF DEEPEST SORROW AND SYMPATHY ON THE DEATH OF HIS MAJESTY, KING EDWARD VII, OF HAPPY MEMORY.

WE RECALL WITH GREAT SATISFACTION THE INTEREST TAKEN BY HIS LATE MAJESTY IN CHEMICAL SCIENCE: IT IS NO LESS A SOURCE OF GRATIFICATION TO US TO REMEMBER THAT YOUR MAJESTY HAS ALWAYS SHOWN AN EQUAL INTEREST IN CHEMICAL SCIENCE AND WAS PLEASED TO INAUGURATE THE CONGRESS OF APPLIED CHEMISTRY AT ITS MEETING IN LONDON ONLY LAST YEAR.

WE DESIRE TO TENDER TO YOUR MAJESTY OUR ASSURANCE OF CONSTANT OBEDIENCE WITH ALL HEARTY AND HUMBLE AFFECTION WITH WARMEST WISHES FOR THE HAPPINESS OF YOUR MAJESTY AND YOUR MAJESTY'S GRACIOUS CONSORT, AND PRAY THAT YOUR MAJESTY MAY BE BLESSED WITH LONG AND HAPPY YEARS TO REIGN OVER US.

SEALED AT PALACE CHAMBERS, WESTMINSTER ON THE TWELFTH DAY OF MAY, MCMX, IN THE PRESENCE OF:

Thomas Tyrer
Frank Hooper
MEMBERS OF COUNCIL

Charles G Cresswell SECRETARY

ANNUAL GENERAL MEETING, 1910.

In accordance with the provisions of By-law 64, notice hereby given that the Annual General Meeting will ill be held in the Natural Philosophy Lecture Theatre of ae Technical College, Glasgow, at 10.30 a.m., on Wednesay, July 6th, 1910. A programme of the proceedings is ontained in this number of tho Journal.

In accordance with the provisions of By-law 72, the ouncil hereby notifies that it has awarded the Medal the Society of Chemical Industry to Mr. Thomas Tyrer r his conspicuous services to the Society and to Applied hemistry.

In accordance with the provisions of By-law 24, otice is hereby given that those members whose names e printed in *italics* in the list of Council will retire om their respective offices at the forthcoming Annual eeting.

Mr. Walter F. Reid has been nominated to the office of President under By-law 20; Dr. J. Lewkowitsch, Dr. Russell W. Moore, and Dr. Harvey W. Wiley, have been nominated Vice-Presidents under By-law 21, and President Ira Remsen has been nominated a Vice-President under By-law 20. Mr. Thomas Tyrer has been appointed Hon. Treasurer, and Dr. R. Messel, Hon. Foreign Secretary, under By-law 35.

Mr. Julian L. Baker, Dr. Edward Divers, Dr. Milton L. Hersey, Mr. G. T. Holloway, Mr. G. Cecil Jones, Mr. Wm. J. Leonard, Mr. D. J. Playfair, Mr. Harry Silvester, Dr. L. T. Thorne, and Mr. Jos. T. Wood have been nominated under By-law 26 to fill four vacancies among the Ordinary Members of Council.

A Ballot List, an addressed envelope and a Member's Ticket are contained in this number of the Journal.

Charles G. Cresswell,
Secretary.

THE SOCIETY OF CHEMICAL INDUSTRY.

INCOME AND EXPENDITURE ACCOUNT FOR YEAR 1909.

EXPENDITURE.

	£	s.	d.	£	s.	d.
To Journal — Editorial and Sundry expenses—						
Editor's Salary	542	16	0			
Do. Expenses	30	0	11			
Do. Assistant	104	0	0			
Abstractors	599	14	7			
Sub-Editor's Salary	150	0	0			
Indexing Journal, &c.	102	18	0			
Foreign Journals	23	5	8			
Sundry Journals	21	1	8			
French and U.S.A. Patents and Specifications	69	13	11			
Insurance of Stock	6	10	0			
	1650	0	9			
Publishing expenses	2483	6	10			
				4133	7	7
,, Sectional expenses—						
Boston	75	0	0			
Birmingham and Midland	63	5	5			
Canadian	30	0	0			
Liverpool	26	6	7			
London	122	8	2			
Manchester	47	0	0			
Newcastle-on-Tyne	18	6	6			
New York	150	0	0			
Nottingham	43	16	0			
Scottish	33	12	3			
Sydney	12	0	6			
Yorkshire	37	9	1			
				659	4	6
,, Annual Meeting expenses				206	16	4
,, Working expenses—						
Secretary's Salary	300	0	0			
Assistant in Office	200	0	0			
Honorarium to Treasurer's Assistant and Clerical Assistance	77	10	0			
Rent, Lighting and Cleaning	198	1	5			
Stationery and Binding	77	4	1			
Postage, Bank Charges, Telephone, and Sundry expenses	164	10	5			
				1017	5	11
,, Law Costs and other expenses in connection with Transfer of Stocks, &c.				41	2	4
				6057	16	8
,, Excess of Income over Expenditure —1909				1092	7	10
				£7150	4	6

INCOME.

	£	s.	d.	£	s.	d
By Entrance Fees	286	13	0			
,, Life Composition Fees	76	12	3			
				363	5	3
,, Annual Subscriptions				5247	13	6
,, Journal—						
Advertisements	324	10	1			
Sales	624	16	4			
				949	6	5
,, Collective Index—Subscriptions				6	12	0
,, Decennial Index—Sales				40	5	0
,, Dividends and Interest on Investments— £ s. d.						
4476 9 2 Metropolitan 3% Consolidated	127	0	5			
1000 0 0 New Zealand 3% (1945)	28	7	6			
1277 4 8 New South Wales 3% (1935)	24	19	1			
1231 0 10 Consols 2½%	29	2	2			
600 0 0 Gas Light and Coke 3% Debentures	17	1	3			
1084 13 4 North British 3% Consolidated	30	16	7			
1696 0 0 Midland Rly. 2½% Perpetual Preference	40	3	10			
1500 0 0 Great Eastern Rly. 4% Irredeemable	57	4	4			
673 0 0 South Eastern Rly. 4½% Preferred	28	14	1			
1000 0 0 Metropolitan Water Board 3% Debentures	28	7	6			
200 0 0 Nottingham Joint Station 3% Debentures	5	13	9			
1250 0 0 Great Western Rly. 5% Guaranteed	59	4	11			
800 0 0 Great Northern Rly. 3% Debentures	22	15	0			
450 0 0 Nottingham and Grantham Canal 4½% Consolidated	17	5	7			
Interest on Deposits	17	6	4			
				534	2	4
				£7150	4	6

Manchester Section.

Meeting held at Manchester, on Friday, April 1st, 1910.

MR. R. H. CLAYTON IN THE CHAIR.

THE EXTRACTION OF SULPHUR COMPOUNDS FROM COAL GAS.

BY RAYMOND ROSS, F.I.C., F.C.S., AND JOSEPH RACE, F.I.C.

Some time ago the chairman of this Section brought to our notice an apparatus used by the United Gas Improvement Co., of Philadelphia, for the control of oxide purification by means of the iodometric titration of the sulphur contents of the gas.

The apparatus consists of a modified Bunte burette in which a given volume of gas is titrated with an iodine solution, each c.cm. of which is equivalent to 100 grains of sulphuretted hydrogen per 100 cub. ft. of gas. Certain inaccuracies evidently attended its use, as the patentees point out that even with gas entirely free from sulphuretted hydrogen, an appreciable amount of iodine solution is required to colour the starch solution a permanent blue. To overcome this they recommend that "a certain constant, previously determined on each fresh bottle of starch solution, should be subtracted from all readings."

Having by a series of determinations confirmed the fact that these discrepancies existed, and further found that they were not constant, but variable, we endeavoured to elucidate the true cause of them. It was of course perfectly evident from the first that they could not be due to the starch solution, and therefore that they must be due to some constituent of the gas other than sulphuretted hydrogen that was present in varying quantities.

Determinations of the amounts of iodine solution acted upon by coal gas and carburetted water gas, after deduction of the total sulphur as determined by the referee's test, showed that the latter contained more gases which acted on the iodine solution than did coal gas. This is clearly shown by the following figures.

	Coal gas.	Carburetted water gas.
Iodine test, H_2S in grains, per 100 cub. ft.	5·3 to 22	98·4 to 166·3
Referee's test sulphur in grains per 100 cub. ft.	6 to 8	6·6 to 9·3

The coal gas figures are on the purified gas and the carburetted water gas figures on gas which had passed the scrubbers and washer.

From these figures it is obvious that the difference in absorption is not due to sulphur compounds. We, however, thought it advisable to determine to what extent, if any, iodine solution is acted upon by various substances known to be present in illuminating gas and which from their chemical constitution might be expected to react with this reagent.

Ethylene.—Pure ethylene when treated with an excess of N/100 iodine solution was practically unacted upon. With strong iodine solution (in potassium iodide) it was very gradually absorbed, forming ethylene di iodide, but weeks were required to complete the reaction.

THE SOCIETY OF CHEMICAL INDUSTRY.

BALANCE SHEET, 31st DECEMBER, 1909.

Dr.

	£	s.	d.	£	s.	d.
To Sundry Creditors.				674	16	4
„ Subscriptions received in advance.				168	13	4
„ Accumulated Fund—						
Balance—31 December, 1908	15,615	8	11			
Add—Excess of Income over Expenditure, 1909	1092	7	10			
				16,707	16	9
				£17,549	6	5

Cr.

£	s.	d.		£	s.	d.	£	s.	d.
			By Sundry Debtors (Publishers, &c.)				402	13	1
			„ Arrears of Subscriptions (received January and February, 1910)				72	10	0
			„ Cash at Bank—						
			On Deposit	700	0	0			
			On Current Account	153	10	10			
			„ Cash in hand (Secretary)	20	7	6			
							873	18	4
			„ Investments; as last year—						
4476	9	2	Metropolitan 3% Consolidated......	4163	2	1			
1000	0	0	New Zealand 3% (1945)	870	0	0			
485	4	8	New South Wales 3% (1935)........	422	3	1			
1231	0	10	Consols 2½%	1031	15	4			
600	0	0	Gas Light and Coke 3% Debentures ..	507	0	0			
1084	13	4	North British 3% Consolidated	900	5	6			
1696	0	0	Midland Rly. 2½% Perpetual Preference	1187	4	0			
1509	0	0	Great Eastern Rly. 4% Irredeemable	1629	14	5			
673	0	0	South Eastern Rly. 4½% Preference ..	747	0	7			
1000	0	0	Metropolitan Water Board 3% Debentures	922	10	0			
200	0	0	Nottingham Joint Station 3%	166	0	0			
1250	0	0	Great Western Rly. 5% Guaranteed ..	1762	10	0			
800	0	0	Great Northern Rly. 3% Debentures ..	696	0	0			
450	0	0	Nottingham and Grantham Canal 4½% Consolidated	495	0	0			
				15,500	5	0			
			Add—						
792	0	0	New South Wales 3% (1935), purchased in 1909	700	0	0			
							16,200	5	0
							£17,549	6	5

We have examined the above Balance Sheet, dated 31st December, 1909, and have verified the Investments and the balance at the Bankers. In our opinion the Balance Sheet shows correctly the position of the Society at 31st December, 1909.

9, Old Jewry Chambers, London.
21st May, 1910.

NORTON, FEASEY & SLADE,
Chartered Accountants.

Acetylene.—This gas when shaken for 15 minutes with N/100 iodine solution showed no appreciable absorption. After 12 hours the amount was only equivalent to 52·8 grains of sulphuretted hydrogen per 100 cub. ft., or 0·08 per cent. by volume of acetylene, assuming acetylene di-iodide to be formed.

Benzene, carbon bisulphide and thiophene did not react with either N/10 or N/100 iodine solution.

Mercaptans have been shown to react quantitatively with iodine solution, but their absence in any but the most minute quantities is proved by the small amount of total sulphur found by direct determination. With a view to determining the nature of the reacting substance, gas was passed through various reagents, including potassium hydrate, Nordhausen sulphuric acid and sulphuric acid. By the two former all the reacting substance, and by the latter nearly all, was removed. For the purposes of this experiment the gas was bubbled slowly through the selected absorbent. The natural deduction from these experiments is that the substance in question is a hydrocarbon so unsaturated as to react easily with dilute iodine solution in the cold.

An attempt to procure some of this hydrocarbon (mixed with others) was made by passing gas through tubes surrounded by a freezing mixture, but without success. Resort was therefore had to the formation of bromine compounds in the following manner:—Partially purified gas, from which most of the sulphuretted hydrogen had been removed, was passed into bromine covered with water until all the bromine was decolorised.

The oily liquid produced was washed with dilute sodium carbonate solution, then with water and finally dried over calcium chloride. The first 50 c.c. obtained in this manner were fractionated under atmospheric pressure but some decomposition undoubtedly took place. The principal fraction gave on analysis the following result:—

Fraction	110—120° C.
	Per cent.
Carbon	30·44
Hydrogen	3·65
Bromine	65·90

from which no definite conclusions can be drawn.

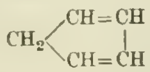
A further quantity of the oil in question (200 c.cms.) was fractionated under reduced pressure (about 200 mm.) and the table below gives the results obtained.

Temp. ° C.	Pressure mm.	Sp. gr. at 15·5° C.	Refractive index ND at 20° C.	Bromine per cent.	Molecular weight.
68—70 ..	230		1·50838		
80—84 ..	210		1·51532	65·04	204·5
87—89 ..	190	1·780	1·52388	72·2	183·4
91—95 ..	190	1·883	1·52772	76·01	207·2
96—99 ..	200	1·951	1·53039	* 103·0 † 77·2	205·3
‡93—99 ..	180	1·981	1·53125	79·9	201·0
99—108 .	190	1·999	1·53321	79·88	211·2
108—120	190	1·950	1·53432	85·1	214·6

Total bromine before fractionation = 73.23 per cent.
* Carius. † Lime. ‡ Direct flame.

The bromine was determined in a sealed tube by the method of Carius. In the case of the fifth fraction an impossible result was obtained and in addition to silver bromide a considerable deposit of metallic silver was observed. A repetition confirmed this result. The bromine in this fraction was therefore determined with lime, when normal results were obtained.

Cyclo-pentadiene.—The fifth fraction heated in a sealed tube for 6 hours to 240° C. with 0·880 ammonia and silver nitrate gave a deposit of silver and a distinct mirror; a blank with ammonia and silver nitrate gave no reduction. The only substance with which we are acquainted which would be likely to be present and which would give these reactions is cyclo-pentadiene.



This substance was found by Leather and Ross to be present in considerable quantities in the liquid obtained on the compression of oil gas, and it has also obtained from the crude benzene from coal tar. (Berichte, 22—916.) Its probable presence in illuminating gas may therefore be inferred. Many of the compounds of cyclo pentadiene were investigated by Thiele (Annalen, 314, 296) and for the cis modification of the dibromide he gives the specific gravity as 1·9443 at 14°—4°. The results from the fifth fraction given in the above table, although not in complete agreement, principally as regards the amount of bromine present are sufficiently so when taken in conjunction with the other results obtained to confirm the presence of cyclo pentadiene.

The other fractions are probably mostly dibrom-derivatives of hydro-carbons of the ethylene series. From the residue left after distillation a small amount of a crystalline substance was obtained by extraction with alcohol. A sufficient quantity could not be obtained for analysis, but it may possibly be the trans-modification of dibrom-cyclopentadiene. M.P. 45°—46° C.

The first runnings of the light oils obtained on distillation of the anthracene oil used for the extraction of naphthalene from the gas, gave, when precautions had been taken to remove all traces of sulphuretted hydrogen, a liquid which reduced warm ammoniacal silver nitrate freely, indicating the presence of cyclopentadiene. Another substance which might be present and would react with iodine solution is isoprene. This does not, however, as far as we are aware, reduce ammoniacal silver nitrate solution. It boils at 37° C., and its dibromide has a boiling point 90°—94° C. at 760 mm.

The foregoing results indicate to what extent the iodine process may be used for the control of the elimination of sulphur in oxide purification.

Its presence in carburetted water gas was well shown under the following conditions of experiment. The gas was passed through toluene kept at a very low temperature by means of liquid ammonia. The toluene was then placed in a distillation flask connected with a receiver and U tube cooled to − 15° C. On warming the flask (precautions being taken to eliminate sulphuretted hydrogen) to about 60° C., a distillate was obtained which when warmed with ammoniacal silver nitrate strongly reduced it with the formation of a silver mirror.

Lime purification.—The extraction of sulphur by the oxide purifiers proceeds according to our observations quite normally, showing a gradual decrease in the amount of sulphur taken up from commencement to finish, providing that there is no change in temperature due to external causes. Lime purification is by no means so regular in its action, being more affected by the composition of the gases passing through and also considerably by the amount of moisture present.

Daily tests were made at the lime purifiers of the Burnley Corporation Gas Works for carbon dioxide and sulphuretted hydrogen during a period of three months, and the spent lime from each box was subsequently sampled and analysed. The tables expressing these results would occupy too much space, but some typical analyses of spent lime may not be without interest, although we were quite unable to derive any definite information on the theory of lime purification from the results obtained up to this point.

	1	2	3	4	5
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Sulphur by bromine	2·31	2·24	2·46	2·51	2·24
Sulphur as SO_3	0·19	0·15	0·16	0·20	0·16
Sulphur as CNS	0·84	0·92	1·05	1·46	1·04
Sulphur as sulphide (?) ..	0·36	0·48	0·49	0·32	0·16
Free sulphur	1·26	0·44	0·60	0·50	0·41
Sulphur by xanthate	2·48	2·57	2·87	2·93	2·54
Sulphur by Carius	2·53	2·55	2·90		

All these limes were thoroughly spent, and did not contain any free lime. The amount of calcium carbonate varied from 63 per cent. to 70 per cent.

Lime purification is, owing to the number of reacting gases present and their variations in amount, necessarily complex. Butterfield (The Chemistry of Gas Manufacture) suggested that the reactions involved might be best understood from a study of the action of each gas individually.

This suggestion we have in some measure attempted to carry out. A certain amount of work in this direction has already been carried out especially by Divers and Shimidzu (J.C.S., 1884, p. 270) and Veley (J.C.S., 1885, p. 478) who made a careful study of the compounds produced by the action of sulphuretted hydrogen on calcium hydroxide. The main points of their experiments may be summarised as follows:—

(1) By the action of sulphuretted hydrogen on calcium hydroxide in the cold with nearly three parts of water, $Ca(SH)_2 6H_2O$ is formed which is decomposed on warming even in an atmosphere of sulphuretted hydrogen.

(2) Ca(SH)(OH) is obtained when more water is added.

(3) CaS is formed when sulphuretted hydrogen is passed over heated calcium hydroxide, and is soluble in water, forming Ca(SH)(OH).

(4) Sulphur reacts with Ca(SH)(OH) to form polysulphides which decompose in the presence of oxygen to form thiosulphates.

(5) Carbon bisulphide has no action on calcium sulphide.

Following these lines we have, using commercial lime, repeated some of the above experiments.

Dry sulphuretted hydrogen was passed through precipitated calcium hydrate suspended in about four parts of water and maintained at a temperature of 40° C. till no further increase in weight was observed. Precautions were of course taken to prevent loss of moisture in this and in all subsequent experiments. A percentage increase in weight of 36·4, calculated on the amount of calcium hydrate taken, was obtained. Theory for Ca(SH)(OH) would require 45·8 per cent. Carbon bisulphide was then passed through the above until no further increase in weight was obtained. The amount taken up was equivalent to 24·4 per cent. of the calcium hydroxide originally taken. During the passage of carbon bisulphide some sulphuretted hydrogen was evolved. The solid and liquid remaining in the tube were separated and analysed with the following results:—

Liquid portion which was of a reddish colour:—

	Per cent.	
Total solids	15·0	
Sulphur by bromine	35·3	of total solids.
Sulphur by Carius	51·3	,, ,,
Sulphur as sulphide..........	26·0	,, ,,
Calcium as CaO.	52·6	,, ,,

Solid portion:—

Sulphur	0·77
Free sulphur	0·30

Remainder, calcium hydroxide.

We have proved experimentally that oxidation by bromine does not affect carbon bisulphide therefore the difference between the bromine and Carius methods is due to carbon bisulphide. This is confirmed by the results obtained by the xanthate method.

The amount of sulphuretted hydrogen absorbed showed that 3·8 grams of Ca(SH)(OH) were present in the solution. From the fact that 0·959 grm. of carbon bisulphide were absorbed by this solution, and assuming that it was all converted to a basic thiocarbonate, one would expect to get either 2·33 grms. or 3·74 grms., according to which of the two following is formed.

$$Ca(OH)_2,2CaCS_3 \text{ or } 2Ca(OH)_2,CaCS_3$$

These compounds are probably formed according to one of the following equations :—

$$(1)\ 3Ca(SH)(OH) + CS_2 + H_2O = 2Ca(OH)_2CaCS_3 + H_2S$$
$$(2)\ 4Ca(SH)(OH) + 2CS_2 = Ca(OH)_22CaCS_3 + Ca(OH)_2 + H_2S$$

From equation 1 it follows that 3·8 grms. of Ca(SH)(OH) or its equivalent of $Ca(SH)_2$ should absorb 1·06 grms. of carbon bisulphide. From equation 2, 1·6 grms. should be absorbed. The results obtained are therefore in accordance with the first equation, being only very slightly lower than the theory.

Three somewhat similar experiments were conducted, in which the amount of water present with the calcium hydrate was varied. They may be summarised as under, the results being expressed as percentage increases on the weight of calcium hydrate taken.

	1	2	3
Percentage of moisture	3·4	12·2	29·5
Temperature of experiment	15° C.	15° C.	60° C.
Increase, per cent., after passing sulphuretted hydrogen for			
two hours	14·5	16·8	25·1
" " eight hours	14·8	17·4	30·7
" " thirty-six hours ..			63·9
Carbon bisulphide per cent. absorbed	0·4	0·6	—4·2

With calcium hydroxide containing 10 per cent. of water, the variations in the amounts of sulphuretted hydrogen absorbed are slight. The reaction is at first energetic but rapidly decreases in intensity. It is further shown that with more water more sulphuretted hydrogen is absorbed, especially at somewhat elevated temperatures.

According to Veley, dry calcium hydroxide gives at 60° C. with sulphuretted hydrogen, the theoretical yield of calcium sulphide. This is probably, to a certain extent, merely a question of the amount of water present.

Thus $CaS + H_2O = Ca(SH)(OH)$ and

$$Ca(SH)(OH) + H_2S \rightleftarrows Ca(SH)_2 + H_2O.$$

The point of equilibrium must therefore depend on the amount of water and sulphuretted hydrogen present. Further than this, the absorption of carbon bisulphide depends likewise on the amount of water present. The reasons for this are fairly obvious, viz., calcium sulphide does not absorb carbon bisulphide, calcium sulphydrate can only absorb so long as water is present, and Ca(SH)(OH) can be formed.

During this reaction water would be gradually removed from the sphere of influence and no further CS_2 absorbed ; this is well illustrated in the case of example 3.

There is an actual loss of weight probably due to the fact that $Ca(SH)_2.Aq.$ is decomposed, with the evolution of sulphuretted hydrogen, when an inert gas is passed through it. (Divers.)

It is probable that thiosulphates are not formed in the presence of water alone but that oxygen is also required as shown by Divers.

When carbon dioxide is passed for three days through calcium hydroxide containing 12 per cent. of water, which has been treated with sulphuretted hydrogen until it contains the equivalent of 14 per cent. of sulphur, the sulphur is reduced to 6·9 per cent. A similar experiment with Ca(SH)(OH) solution gave approximately the same result. This shows that although most of the sulphuretted hydrogen can be driven off by carbon dioxide, nevertheless the whole of it could not be eliminated. This points to the probable formation of a stable sulphur compound. That such substance is formed in both the solid state and in solution shows that it must be soluble and suggests some such formula as $Ca(SH)(HCO_3)$ corresponding to a substituted calcium bicarbonate.

Divers mentions that calcium carbonate can be decomposed by sulphuretted hydrogen. We find that when this gas is passed through dry precipitated calcium carbonate for six hours, the final product contains 1 per cent. of sulphur. Although this amount at first sight seems very small its influence may not be without significance, for if the action of carbon dioxide on the sulphides were not to some extent reversible, none of these could be found in the spent lime.

In conclusion we beg to acknowledge the assistance rendered by Mr. Frank Mandsley, B.Sc., F.I.C.

Discussion.

The **Chairman** did not consider the question of the purification of gas by lime had been dealt with as fully as it should have been in the past. In gas works the method was largely one of rule of thumb. He thought the process of purification by lime was doomed, on account of its greater expense and because the question of sulphur compounds in gas was not now so important owing to the use of the incandescent burner. He, himself, had obtained very good results in eliminating sulphur compounds by passing gas through aniline, the Pippig and Trachmann process, though this also was too expensive a method. With regard to purification by oxide, the apparatus mentioned was one he had seen used in Philadelphia. It was a small apparatus, and though, perhaps, not giving strictly accurate but only comparative results, it was sufficiently simple to put in the hands of a man who had no chemical knowledge, and could be used by an intelligent purifier foreman. The principle of the apparatus consisted in titrating 100 c.c. of gas with a standard solution of iodine until the blue starch colour was obtained. He did not think purifiers were tested so much as they should be. They were frequently dropped when they were still working with as much as 80 per cent. of their efficiency, because of small traces of sulphuretted hydrogen passing out of the last box.

Dr. **Gilbert Fowler** said it occurred to him, when Dr. Ross was describing the iodine method for determining sulphuretted hydrogen in the gas, whether better results could not be obtained by the method which was used for for determining small quantities of sulphur in steel, where a series of dilute standard solutions of lead acetate was used. It was found that one of the solutions became saturated with lead sulphide before another one became decolorised, and consequently by reading off the number of tubes which were blackened, or partially blackened, a good idea of the amount of sulphuretted hydrogen could be obtained. He enquired whether the hydrocarbon mentioned possessed explosive properties owing to cyclopentadiene being present.

Mr. **Buckley** agreed with the Chairman that purifiers should receive greater attention than was usually given them.

Mr. F. S. **Sinnatt** inquired if the authors of the paper had found any compounds of ferric hydrate similar in composition to hydroxy-sulphydrates of calcium. It was possible that the oxide purifier also removed carbon bisulphide, with the formation of compounds similar to the lime compounds.

Mr. **Race**, in reply, agreed with the Chairman that the removal of sulphur compounds, other than sulphuretted hydrogen, was not so important as formerly, on account of the smaller quantity of gas used by incandescent burners. In the case of coal gas the amount of carbon bisulphide present might vary up to 15 or 20 grains per 100 cubic feet. There was no reason to suppose that carburetted water gas contained any, so that in most works where a reasonable percentage of water gas was used (up to 25 or 30 per cent.) the amount would be reduced to an almost negligible quantity. With regard to the constant for the oxide purifier for coal gas, if 15 grains were subtracted from all readings, results would be obtained which would be exact enough for all practical purposes. For carburetted water gas the test was valueless. The present tendency was to pass the coal gas through oxide purifiers without lime, and to pass the carburetted water gas, which contained a much higher percentage of carbonic acid, through lime purifiers only. The small amount of sulphuretted hydrogen which was present in this gas would be removed by the lime, unless worked to its full carbonating power. The Chairman had referred to the practice of engineers and managers taking off the first taker of oxide purifiers, when the second taker just commenced to show sulphuretted hydrogen by the lead paper test. There was another point to be taken into account. When the second taker commenced to show sulphuretted hydrogen the first taker rapidly showed an increase in pressure. A box 900 sq. ft. in area and passing two million cubic feet per day gave one inch of back pressure when in good working condition, but when sulphuretted hydrogen was passing the second taker, three and four and sometimes as much as nine inches of back pressure were obtained.

In reply to Dr. Fowler, the colorimetric test for sulphuretted hydrogen in coal gas was very old, but lead sucrate was used instead of the suggested lead acetate solution. The gas was passed into the solution until a standard tint was obtained. Harcourt's carbon bisulphide test was on the same lines, platinised asbestos heated to 400° F. being used to reduce the carbon bisulphide. It was certain that cyclopentadiene was explosive, but such a gas as that obtained from the compression of oil gas would contain many other hydrocarbons which were also explosive.

Mr. **Race** stated that they had not investigated the point raised by Mr. Sinnatt, but that ferric sulphydrates were probably formed in the same way as those of calcium and that these would react with carbon bisulphide, thus accounting for the slight loss of carbon bisulphide invariably found in oxide purification.

The authors then described in detail an apparatus for the estimation of carbonic acid in air or gas, and with which they had made some thousands of analyses whilst investigating the air in the schools of Burnley; the chief constituent of the apparatus was a self-filling pipette.

Yorkshire Section.

Meeting held at York, on Monday, April 25th, 1910.

PROF. W. M. GARDNER IN THE CHAIR.

THE SYNTHESIS OF A GLAZE, GLASS OR OTHER COMPLEX SILICATE.

Part V.—The Triple-oxide Mixtures of Soda, Lime, Alumina and Silica.

BY JOHN W. COBB, B.SC.

The double oxide mixings in the synthesis of $Na_2O.CaO.Al_2O_3 10SiO_2$ were discussed in Parts I.—IV. (this J., 1910, pp. 69, 250, 335, 399) and the next step was the investigation of the triple-oxide mixings, in accordance with the scheme explained in Part I. The possible triple-oxide mixings were $Na_2O+CaO+Al_2O_3$,

$$Na_2O+CaO+10SiO_2,\ Na_2O+Al_2O_3+10SiO_2 \text{ and } CaO+Al_2O_3+10SiO_2,$$

and they were taken in that order.

Soda, lime and alumina ($Na_2O+CaO+Al_2O_3$).—This mixing was made up as $Na_2CO_3+CaCO_3.+Al_2O_3$, from alumina and the carbonates of soda and lime; it was heated, extracted, and analysed, and the results are collected in Table XIII.

The methods of heating, extracting, and analaysis already explained were again used, and the headings for the tables were employed with the same meanings.

From Table XIII. it is seen that a little soluble aluminate had formed at 800° C., that at 1100° the whole mass had become completely soluble in normal hydrochloric acid, and that at the highest temperature, 1300°, a little of the alumina had again become insoluble. Generally, the interaction was such as might have been expected from the results previously obtained for $Na_2O+Al_2O_3$, and $CaO+Al_2O_3$; the mass was endowed with no new property by its triple-oxide composition. A soluble aluminate mass formed completely at 1100°, and slightly dissociated at 1300°, as found with the $Na_2O+Al_2O_3$ mixing; the volatilisation of soda in quantity also occurred, amounting to about half that originally present in the long period heating. In that heating again, the feebleness of alumina as an acid in this combination was evident from the presence of 16·3 per cent. of sulphur trioxide, absorbed from the furnace gases. The mixing throughout was only slightly coherent; there was no fusion. The soda would fuse at 850° and the melt would dry up as the much less fusible aluminates formed.

Soda, lime and silica.—The triple oxide mixture examined was $Na_2O+CaO+10SiO_2$ and it was made up as $Na_2CO_3+CaCO_3+10SiO_2$, heated and extracted The analyses are collected in Table XIV. and Curves 6, 7, and 8, display graphically the principal results for this and following triple-oxide mixtures.

Following the course of interaction from Table XIV.: at 800° C. a little soluble silicate had formed but some of the lime, and nearly half the soda, had become insoluble, indicating at this very early stage the commencing formation of an insoluble silicate mass containing soda and lime; the mixing was hardened. As the temperature rose, the soluble silica did not increase, but remained at about the same figure throughout: the lime and soda, however, rapidly became insoluble; at 1000° only one-sixth of the lime, and one-twentieth of the soda remained soluble, and at 1150° these were reduced to the small proportions of 0·1 per cent. lime, and 0·2 per cent. soda, with the mass in stony fusion and honeycombed. Heating further to 1300° made little difference. The long period heating was also almost completely insoluble; it contained more soluble lime than the short period heatings from 1150° upwards, probably because some of it was converted into sulphate in the early stage of the burn by the furnace gases, and the formation of silicate from that compound was slower than from lime or the carbonate. There was no sulphur trioxide left in the heating at the end of the burn.

The significance of these results can only be gauged by comparing them with those already obtained for the double-oxide mixings, $Na_2O+10SiO_2$ and $CaO+10SiO_2$. The mixing, $Na_2O+CaO+10SiO_2$, may be regarded as formed by the addition of any one of the oxides to the double oxide mixing of the other two. The introduction of soda to the mixing, $CaO+10SiO_2$, caused the lime, even at the lower temperatures of heating, to become partially insoluble, and at the higher temperatures completely so, whereas in $CaO+10SiO_2$ it was completely soluble throughout. The soluble silica at the higher temperatures was also eliminated, and the mass as a whole was rendered much more fusible. The lime was brought into combination with the mass of silica (and soda), whereas in $CaO+10SiO_2$ the chemical union of lime and silica had been restricted to the small proportions represented by the non-resistant compound, $CaO.SiO_2$, the mass of the silica being left free (this J., 1910, Part II., 254). That the addition of so soluble an oxide as soda should be the means of imparting the quality of high insolubility is rather curious.

Addition of lime altered the $Na_2O+10SiO_2$ results in a significant manner by stopping the conversion of soda into the soluble silicate, $Na_2O.4SiO_2$, and substituting the formation of an insoluble compound of lime and soda with silica; the fusibility was also increased.

The $Na_2CO_3+CaCO_3$ mixture was rendered resistant to acid attack and non-volatile by the introduction of silica. No comparison between $Na_2O+CaO+Al_2O_3$ and $Na_2O+CaO+10SiO_2$ is necessary.

The properties of the triple-oxide mixing (heated) were so different from those of any double-oxide mixing, or from any average property of double-oxide mixings and oxides, that the formation of a triple-oxide compound of soda, lime, and silica, was strongly suggested, a compound with all the properties of a glass or glaze with which this study is concerned, viz., non-volatility and fusibility when hot, and resistance to acid when cold.

Further evidence was obtained by heating a mixture of the formula, $Na_2SO_4+CaSO_4+10SiO_2$, in a current of dry air (as already described, Part I.) to determine the temperature of evolution of sulphur oxides; that temperature was found to be 930—950 C. The temperatures

TABLE XIII.

Soda, lime and alumina ($Na_2CO_3+CaCO_3+Al_2O_3$).

$Na_2CO_3+CaCO_3+Al_2O_3$ contains: Na_2O 20·1 per cent., CaO 18·2 ,, Al_2O_3 33·1 ,, CO_2 28·6 ,,

$Na_2O+CaO+Al_2O_3$ contains: Na_2O 28·2 per cent, CaO 25·4 ,, Al_2O_3 46·4 ,,

Where heated.	Time (hours).	Temp.	Soluble.			Total Insoluble	Appearance.	Notes.
			Na_2O	CaO	Al_2O_3			
		blank	20·2	17·8	—	33·0		
				17·5				
		,,		17·5		32·8		
						34·6	Slightly coherent	Contained CO_2.
Muffle	1	800	21·6	19·3	traces	33·1		
Injector	1	1100	21·8	29·1	50·0	none	,, ,,	No CO_2 or SO_3. Crucible slightly glazed above mixing.
,,					49·6	none		
,,	1	1300	22·2		49·7	0·8	,, ,,	Insol contained Al_2O_3 with traces of CaO and Na_2O.
Works Furnace	24	1150	11·9	20·0	38·9	13·6		Insol. contained Al_2O_3 with traces of CaO and Na_2O. SO_3 16·3 p.c. Total soluble = 87·1 p.c.

TABLE XIV.

Soda, lime and silica ($Na_2CO_3+CaCO_3+10SiO_2$).

$Na_2CO_3+CaCO_3+10SiO_2$ contains: Na_2O 7·7 per cent., CaO 6·9 ,, SiO_2 74·4 ,, CO_2 11·0 ,,

$Na_2O+CaO+10SiO_2$ contains: Na_2O 8·6 per cent., CaO 7·8 ,, SiO_2 83·0 ,,

Where heated.	Time (hours)	Temp. ° C.	Soluble in HCl.			SiO_2 in Na_2CO_3	SiO_2 total soluble.	Total soluble.	Total insoluble *	Appearance.	Notes.
			Na_2O	CaO	SiO_2						
		blank	7·2	6·8	—						
Muffle	1	800	4·0	5·8	trace					hardened	contained CO_2.
			4·0	5·8	0·8	2·1	2·9		83·4		duplicate extraction
Injector	1	1000	0·4	1·1	—	1·8	1·8	3·3	95·9	stony fusion much shrunk	no CO_2.
,,	1	1150	0·2	0·1	—	1·3	1·3	1·6	98 3	stony fusion slty. honeycombed.	
			0·2	—							
,,	1	1300	0·2	0·1	trace	1·4	1·4	1·7	98·5	stony fusion slty. honeycombed.	
			0·2	—							
Works furnace	24	1150	0·2	0·9	trace	1·1	1·1	2·2	98·5	stony fusion honeycombed	no SO_3.

* Determined by direct weighing.

TABLE XV.

Soda, alumina, and silica ($Na_2CO_3+Al_2O_3+10SiO_2$).

$Na_2CO_3+Al_2O_3+10SiO_2$ contains: Na_2O 7·7 per cent., Al_2O_3 12·6 ,, SiO_2 74·2 ,, CO_2 5·5 ,,

$Na_2O+Al_2O_3+10SiO_2$ contains: Na_2O 8·1 per cent., Al_2O_3 13·4 ,, SiO_2 78·5 ,,

Where heated.	Time (hours).	Temp. ° C.	Soluble in HCl.			SiO_2 in Na_2CO_3	SiO_2 total soluble.	Total soluble.	Total insoluble.	Appearance.	Notes.
			Na_2O	Al_2O_3	SiO_2						
		Blank	6·1	—	0·3	—	0·3	6·4	93·6		Na_2O less than theoretical.
Muffle	1	800	6·9	0·2	0·5	3·6	4·1	11·2	88·8	hardened.	
,,	1	1000	0·8	1·0	0·6	0·9	1·5	3·3	96·7* 96·7†	hardened	*by difference. †determined No CO_2.
,,	1	1150	0·6	0·8	0·6	0·8	1·4	2·8	97·2	very hard, not fused.	
,,	1	1300	0·6	1·8	1·3	0·7	2·0	4·4	95·6	stony fusion.	
Works furnace	24	1150	1·0	0·4	0·2	0·6	0·8	2·2	97·8* 97·2†	stony fusion, slightly honeycombed	*by difference. †determined. SO_3 = 0·4 per cent.

for the double oxide and triple-oxide mixings may be compared thus :—

$Na_2SO_4+CaSO_4$ evolved sulphur oxides at 1080—1100° C.
$Na_3SO_4+10SiO_3$ „ „ 1080—1100° C.
$CaSO_4+10SiO_3$ „ „ 1000—1020° C.
$Na_3SO_4+CaSO_4+10SiO_2$ „ „ 930—950° C.

The low temperature recorded in the last case. indicated an affinity of silica for a mixture of soda and lime, greater than that displayed for soda or lime separately. and so confirmed the formation of a real triple-oxide compound : it suggested also stability as a property of the compound formed.

In the mixtures heated and extracted (Table XIV.), the soda and lime were present as carbonates, and the formation of the triple oxide compound at a much lower temperature than with the sulphates is easily understood and has been explained earlier in the paper (Part I.).

Soda, alumina and silica.—The next triple-oxide mixing for investigation was $Na_2O+Al_2O_3+10SiO_2$; it was made up in the form $Na_2CO_3+Al_2O_3+10SiO_2$, heated, extracted, and analysed. The results on analysing the extract are collected in Table XV.

Following the course of interaction from Table XV., a little soluble silicate had formed at 800°, but at 1000° this was lessened, the mass hardened, free from carbon dioxide, and almost insoluble. The change was radical and higher temperatures did not make anything like the same chemical difference ; there was at those higher temperatures no further quantity of soluble silicate, or aluminate, formed, but a little persisted, about 3 per cent. ; the soluble matter was rather higher than for $Na_2O+CaO+10SiO_2$.

The heating was very hard at 1150°, and in stony fusion at 1300°. The long period heating at 1150° was also in stony fusion and honeycombed somewhat in addition. It contained only 2·2 per cent. of soluble matter, but rather more soluble soda than the other heatings above 1000°. The explanation is probably the same as in the case of $Na_2O+CaO+10SiO_2$, *viz.*, the formation of sulphate at an early stage, more slowly decomposed than the carbonate later. This triple oxide mixing showed the same marked characteristics as $Na_2O+CaO+10SiO_2$; it formed an almost insoluble mass hardened but not fused at an early stage of the heating, which persisted and fused at a later stage, and no soluble silicate or aluminate formed in quantity at any time. It had qualities essential for a glaze, which all the double-oxide mixings lacked.

Considering the results for $Na_2O+Al_2O_3+10SiO_2$ systematically, the first mode of regarding it as formed from $Al_2O_3+10SiO_2$, by the introduction of Na_2O, displays the quality of fusibility, at something like glazing temperatures, as conferred by the soda. Another alteration induced was the formation of a small quantity of soluble compounds of alumina and silica with soda, which diminished rapidly on further heating. The addition of alumina to $Na_2O+10SiO_2$ was chemically as important as that of lime, previously discussed, and caused the same changes, the formation of soluble sodium silicate was prevented, and a stable resistant mass was formed at a comparatively low temperature, and persisted. The fusibility was also increased.

The addition of silica in quantity to $Na_2O+Al_2O_3$ conferred upon it the desired qualities of fusibility and stability, with resistance to acid attack. Comparing with $Na_2O+CaO+10SiO_2$ the mixing, $Na_2O+Al_2O_3+10SiO_2$, again established the triple-oxide compound as a complete glaze unit, although in the latter case, the resulting melt was not quite so chemically resistant.

It is interesting to note that the common salt glaze, as formed by the action of volatilised salt on clay surfaces, is the industrial counterpart of the resistant fusible mass obtained from soda silica, and alumina in the experiments just described. Confirmation of the existence of a triple oxide compound was obtained as in the case of $Na_2O+CaO+10SiO_2$ by determining the lowest temperature of evolution of sulphur oxides from a mixture, $Na_2SO_4+Al_2O_3+10SiO_2$; it was found to be much lower than any corresponding temperature for the constituent double oxide mixtures, thus :—

Na_2SO_4 evolved sulphur oxides at 1200°—1220° C.
$Na_2SO_4+Al_2O_3$ „ „ 1110°—1130° C.
$Na_2SO_4+10SiO_2$ „ „ 1110°—1130° C.
$Na_2SO_4+Al_2O_3+10SiO_2$ „ 935°—955° C.

The high chemical affinity indicated by the considerable lowering of the decomposition temperature of sodium sulphate, was taken as confirming the formation of a stable triple oxide compound ; it could not be explained by the direct action of either the silica or alumina on the sulphate.

Lime, alumina and silica.—The triple oxide mixing $CaO+Al_2O_3+10SiO_2$, was made up in the form, $CaCO_3+Al_2O_3+10SiO_2$, heated and extracted ; the results of analysis are collected in Table XVIA.

From Table XVIA it is evident that interaction commenced feebly about 800°, and up to 1200° was marked by a steadily growing formation of non-resistant compounds of lime with silica and alumina, the total quantity of soluble matter rising and the mass hardening slightly. The 1300° heating showed a great change ; the soluble lime, silica, and alumina had practically disappeared and the mass had become insoluble to the extent of 99·7 per cent. and gone into sugary fusion.

Assuming that all the lime in the 1200° heating had gone into combination, which seems justifiable since about three-fourths of the calcium sulphate in the sulphate mixing (v. Table XVIB following) was decomposed at that temperature, a formula may be calculated for the soluble matter, as $1{\cdot}4CaO{\cdot}0{\cdot}2Al_2O_3.SiO_2$. Calculation from the long-period heating at 1150° gives

$$1.1CaO\ 0{\cdot}16Al_2O_3.SiO_2$$

as the formula of the soluble matter, which is evidently of a highly basic composition, compared with the original mixing, and resembles the products of lime with silica and with alumina in double-oxide mixings.

The introduction of lime into the $Al_2O_3+10SiO_2$ mixing had effected the early formation of some non-resistant silicate and aluminate, which disappeared later, and had endowed the mass with much greater fusibility at higher temperatures. Boudouard (J. Iron and Steel Inst., 1905, 374) determined the cone fusion points of mixtures, $CaO.Al_2O_3$, $CaO.6SiO_2$, and $CaO.Al_2O_3.6SiO_2$, as 1590°, 1780°, and 1470° C. respectively, which marks plainly the fluxing effect of introducing any one oxide into the mixing of the other two.

The addition of silica to the mixing, $CaO+Al_2O_3$, lessened the amount of calcium aluminate formed at any stage, and resulted at 1300° in the production of a resistant and fused, instead of a non-resistant and unmelted, mass. More striking was the effect of alumina brought into the $CaO+10SiO_2$ mixing. Up to 1200° C. there was some soluble aluminate formed along with the soluble silicate, but nothing more noteworthy. At 1300°, however, the lime, instead of being completely soluble and combined with silica as the non-resistant compound, $CaO.SiO_2$, was found completely insoluble, together with equally insoluble alumina and silica. It became evident that a triple oxide compound had formed with this, as with the two preceding triple oxide mixtures, but at a much higher temperature ; this triple oxide compound of lime, alumina, and silica had the qualities of non-volatility, when hot, and resistance to acid when cold, but was not sufficiently fusible for a glaze or glass at the temperatures employed in works practice.

Comparing $CaO+Al_2O_3+10SiO_2$ with

$$Na_2O+Al_2O_3+10SiO_2$$

the former did not begin to form its characteristic triple oxide compound until a very much higher temperature was reached, and consequently the lime persisted in the soluble condition much longer than the soda of the latter. The mass ultimately formed was resistant in both cases, but from $CaO+Al_2O_3+10SiO_2$ was much less fusible. A comparison with similar results could be made with $Na_2O+CaO+10SiO_2$.

The results for the long period heating of

$$CaO+Al_2O_3+10SiO_2$$

at 1150 showed that the triple oxide-compound had not formed, and so the soluble lime compounds, with silica and alumina, persisted.

Table XVIa.

Lime, alumina, and silica ($CaCO_3 + Al_2O_3 + 10 SiO_2$).

$CaCO_3 + Al_2O_3 + 10SiO_2$ contains
CaO 7·0 per cent.
Al_2O_3 12·7 „
SiO_2 74·8 „
CO_2 5·5 „

$CaO + Al_2O_3 + 10SiO_2$ contains
CaO 7·4 per cent.
Al_2O_3 13·4 „
SiO_2 79·3 „

Where heated.	Time (hours).	Temp. ° C.	Soluble in HCl.			Total soluble	Total insoluble	Appearance.	Notes.
			CaO	Al_2O_3	SiO_2				
Muffle	1	800	7·0	0·8	2·6	10·4	89·6	No change.	
Injector	1	1100	6·9	1·6	2·2	10·7	89·3	Very slightly hardened.	
„	1	1200	6·2	1·5	4·8	12·5	87·5	Slightly hardened.	Soluble matter can be calculated to formula :— CaO 0·14 Al_2O_3 0·7 SiO_2 or 1·4 CaO·0·2 $Al_2O_3SiO_2$.
„	1	1300	—	0·2	0·1	0·3	99·7	Sugary fusion.	
Works furnace	24	1150	5·5	1·5	5·3	12·3	87·7	Slightly hardened.	Soluble matter calculated to :— 1·1 CaO 0·16 $Al_2O_3.SiO_2$.

All contained a slight trace of SiO_2 soluble in Na_2CO_3.

Calcium sulphate, alumina, and silica
($CaSO_4 + Al_2O_3 + 10SiO_2$).

A series of heatings, extractions, and analyses was made next, supplying the lime as sulphate instead of as carbonate. The results are collected in Table XVIb.

From Table XVIb it was evident that the formation of soluble silicate had been delayed by supplying the lime as sulphate; there was some soluble silica at 1100° but no soluble alumina excepting in the long period heating at 1150°. Calculation from the soluble silica and lime at 1200°, allowing for the sulphur trioxide present gave the formula, $2CaO.SiO_2$, for the soluble silicate of lime formed. As bearing on this result, silica had been found to begin decomposing calcium sulphate at 1000°—1020° but alumina not until 1100°—1120°. It may be mentioned here that Theussner (Metallurgie, 1908, **5**, 657—6; this J., 1908, 1207) working on the constitution of blast furnace slags concluded that calcium aluminates formed only when the lime present exceeded that necessary for the formation of $2CaO.SiO_2$. At 1300° the insoluble triple-oxide compound had formed as in the carbonate heating and it was decidedly insoluble. As before, a sulphate mixing,

$CaSO_4 + Al_2O_3 + 10SiO_2$,

was heated to determine the temperature of evolution of sulphur oxides and the temperature compared with those obtained from double oxide mixings. The temperatures obtained were :—

$CaSO_4$ evolved sulphur oxides at 1220°—1230° C.
$CaSO_4 + Al_2O_3$ „ „ 1110°—1130° C.
$CaSO_4 + 10SiO_2$ „ „ 1000°—1020° C.
$CaSO_4 + Al_2O_3 + 10SiO_2$ „ „ 1000°—1020° C.

These figures indicated that the temperature of incipient interaction was the same for the lime-alumina-silica, and lime-silica mixings. A conclusion already drawn from the analyses in Tables XIV, XV, and XVI, was that the temperature of formation of the triple-oxide compound of lime, alumina and silica was much higher than that of the soda-alumina-silica or soda-lime silica compounds and this result confirmed it; the interaction indicated by the evolution of sulphur oxides was presumably that of lime and silica.

Summary for triple-oxide mixings.—The investigation of the triple oxide mixtures in the synthesis led to important conclusions. The change from two to three constituent oxides was accompanied, in three out of the four possible mixtures, by the appearance of new compounds endowed with those qualities of a glaze or glass with which this study is immediately concerned, and which were noted in the introduction (Part I, this J., 1910, 70) as non-volatility and fusibility when hot, and resistance to acids when cold. One triple-oxide mixture $Na_2O + CaO + Al_2O_3$, did not give such a compound but $Na_2O + CaO + 10SiO_2$, $Na_2O + Al_2O_3 + 10SiO_2$, and $CaO + Al_2O_3 + 10SiO_2$, *i.e.*, each of the three triple-oxide mixings containing silica in quantity, gave a non-volatile and resistant mass, owing to the formation of a non-volatile and resistant triple-oxide compound. Silica in quantity was evidently an essential constituent oxide. Fusion was not necessary for the formation of the insoluble triple-oxide compounds. The two mixings containing soda, *i.e.*, the soda-lime-silica and the soda-alumina-silica

Table XVIb.

Lime, alumina, and silica ($CaSO_4 + Al_2O_3 + 10SiO_2$).

$CaSO_4 + Al_2O_3 + 10SiO_2$ contains
CaO 6·7 per cent.
Al_2O_3 12·2 „
SiO_2 71·6 „
SO_3 9·5 „

$CaO + Al_2O_3 + 10SiO_2$ contains
CaO 7·4 per cent.
Al_2O_3 13·4 „
SiO_2 79·3 „

Where heated.	Time (hours)	Temp. ° C.	Soluble in HCl.				Total soluble	Total. Soluble	Appearaace.	Notes.
			CaO	Al_2O_3	SiO_2	SO_3				
Muffle	1	800	6·2	·3	·1	9·4	16·0	84·0	Unchanged.	
Injector	1	1100	6·2	·2	·5	7·2	14·1	85·1	Slightly hardened.	
„	1	1200	5·6	·1	2·1	2·8	10·6	89·4	Slightly hardened.	$\frac{CaO}{SiO_2} = 2·0$.
„	1	1300	—	·1	0·2	trace	0·3	99·7	Sugary fusion.	
Works furnace	24	1150	6·4	1·5	6·5	0·4	14·8	85·2	Slightly hardened	

All contained a slight trace SiO_2 soluble in Na_2CO_3.

mixings began to give resistant compounds at the lower temperatures (800°–1000°), and at higher temperatures, within the range of glass or glaze making, each yielded a mass fused, non-volatile, and resistant; they had the necessary glaze qualities.

The lime-alumina-silica mixture formed no insoluble triple-oxide compound until a temperature of 1300° was attained, and it was not then fusible at the temperatures in use for making glass or glazes, although for very high temperatures it may be a perfect glaze; soda is therefore necessary for fusibility.

Summarising, it may be said that in this synthesis the formation of a glaze unit, with the specific qualities of fusibility, and non-volatility, within working ranges of temperature, and resistance to acids when cold, was confined to the triple-oxide mixings containing silica in quantity, and soda, with lime or alumina; these were $Na_2O+CaO+10SiO_2$ and $Na_2O+Al_2O_3+10SiO_2$. No double oxide mixing or other triple oxide mixing was satisfactory.

It may be pointed out here that other factors of importance, such as the co-efficient of expansion and tendency to devitrification, are outside the defined range of this study; it is also of interest that the ordinary salt glaze is formed from soda, alumina, and silica, and so is a triple-oxide glaze, also that $Na_2O.CaO.6SiO_2$ is the accepted formula for plate glass.

A point of general theory may here be touched. A feature of the formation of triple oxide compounds was the high degree of chemical affinity brought into play, as evidenced by the considerable lowering of the decomposition point of the calcium or sodium sulphate, when the base was supplied in that form. Also noticeable was their resistance to acid attack and general stability. Since, moreover, two basic oxide molecules and a comparatively large number of silica molecules must go to make up one of these compound molecules, the molecular complexity of the triple oxide compound must be much higher than that of the non-resistant double oxide compounds. It may be surmised that the internal forces brought into existence in a complex molecule formed so energetically, may render comparatively ineffective the external decomposing forces of more attenuated matter such as an ordinary dilute acid. If so, the high chemical affinities causing formation and the great molecular complexity, are associated as the cause of the resistance to acid attack by which these compounds, and also glazes, glasses, and such minerals as the felspars, are characterised.

Rôle of Alumina.—It is noticeable from the preceding that, in $Na_2O+CaO+10SiO_2$ two bases, with silica were sufficient to form a triple-oxide compound, stable and insoluble, and also that compounds with the same distinctive properties were formed in the case of

$$Na_2O+Al_2O_3+10SiO_2 \text{ and of } CaO+Al_2O_3+10SiO_2$$

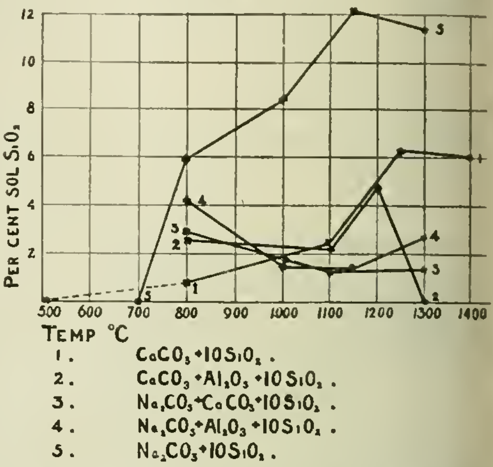
from one base plus alumina, and silica. That is to say, the chemical behaviour of alumina in forming the resistant triple oxide compound containing silica was not to be distinguished from that of a decided base, although at lower temperatures, before the triple oxide compound formed in quantity, it behaved probably as an acid in forming a little soluble matter with lime and soda. Since alumina could take the place of lime in $Na_2O+CaO+10SiO_2$ the question suggested itself as to whether it could take the place of silica in the same mixture. A mixing, $Na_2CO_3+CaCO_3+10Al_2O_3$, was heated at 1300° and extracted. It contained 1·4 per cent. soda, 1·4 per cent. lime, and 0·9 per cent. alumina soluble in normal hydrochloric acid with 96·3 per cent. insoluble; it was only slightly coherent. Thus in the absence of silica, alumina was a fairly satisfactory acid oxide from a purely chemical point of view.

The conclusion was drawn that alumina plays the part of a base in the triple oxide compounds, containing silica, and there seems to be little reason for placing it in a mid way position in such a glaze formula as

$$\left.\begin{array}{l}0\cdot5\ Na_2O\\0\cdot5\ CaO\end{array}\right\}Al_2O_3.10SiO_2$$

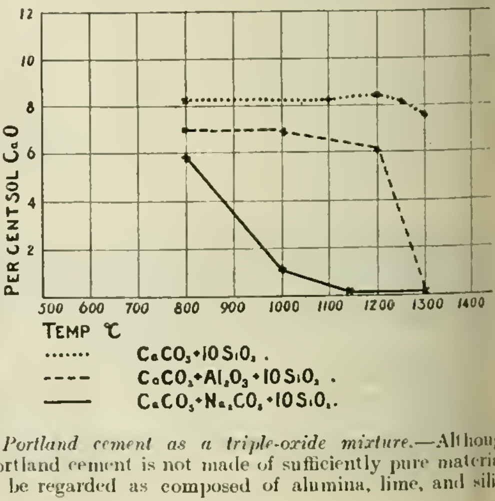
although that, the usual plan, was adopted from the outse in this synthesis.

CURVE 6.
SILICATE SYNTHESIS
SILICA.



In the curves Nos. 6, 7, and 8 the chief results obtaine from the high-silica mixtures of the synthesis have bee collected; percentages of soluble substance have bee plotted vertically, and temperatures horizontally. Thes results are presented in graphic form allowing the growt of insolubility in the lime or soda constituent, and th passage to insolubility, through an intermediate stag of partial solublity, in the silica constituent, to be readil followed, as the mixings pass from the double-oxide to th triple-oxide composition. Curve No. 7, for example particularly when studied in conjunction with the corres ponding silica lines in Curve No. 6, shows plainly th delaying of insolubility in the lime-alumina-silica mixtur until the temperature of 1300° C. is reached.

CURVE 7.
SILICATE SYNTHESIS
LIME.

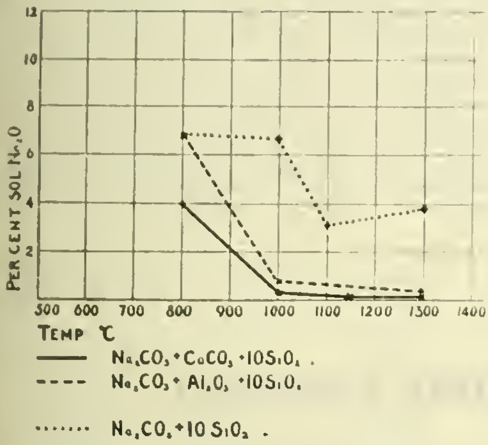


Portland cement as a triple-oxide mixture.—Althoug Portland cement is not made of sufficiently pure material to be regarded as composed of alumina, lime, and silic alone, it was thought interesting to examine the behaviour of a mixing, $9CaO+Al_2O_3+SiO_2$, which contained these oxides in nearly the same proportions as the Portland cement in common use. The high proportion of base to silica offered new possibilities. The mixture was made up in the form, $9CaCO_3+Al_2O_3+3SiO_2$, and was heated, extracted, and analysed as usual. The results are collected in Table XVII.

CURVE 8.

SILICATE SYNTHESIS

SODA.



From Table XVII it was evident that interaction had just commenced at 850° C., as shown by a little soluble silica and alumina. Raising the temperature increased combination, and at 1200—1250° practically all the silica and alumina had become soluble, *i.e.*, had gone into combination with the lime to form soluble silicates and aluminates. This "heating" was not, however, a cement and contained much free lime; the development of the necessary cement qualities was evidently a further process with which this study could not concern itself. A mixture, $9CaSO_4+Al_2O_3+3SiO_2$, was heated at 1250° C., and extracted to get a formula for the soluble compounds formed. The analysis was:—Insoluble, 10·3 per cent.; silica soluble in hydrochloric acid, 9·2 per cent. silica soluble in sodium carbonate, 0·7 per cent. Total silica soluble, 9·9 per cent. Alumina, 6·8 per cent. Lime, 41·5 per cent. Sulphur trioxide, 31·5 per cent. From this analysis, allowing for the sulphur trioxide combined with lime, it can be calculated that the lime had gone into soluble combination with silica and with alumina to the extent represented by $2{\cdot}1CaO.0{\cdot}4Al_2O_3.SiO_2$. Comparison with results obtained from $3CaSO_4+SiO_2$ (Part II. this J., 1910, 252—3) and from $CaSO_4+Al_2O_3+10SiO_2$ (Table XVIB earlier in this paper, is interesting; the results from these and the other mixings of lime alumina; and silica, do not suggest the formation of any non-resistant triple-oxide compound; they all bear the simpler explanation that the non-resistant substance is a mixture of silicate and aluminate of lime. A non-resistant triple-oxide compound has, however, been described by Boudouard (*vide* below); very high temperatures, and a basic mixing were used in its preparation.

The long-period heatings of $9CaCO_3+Al_2O_3+3SiO_2$ were interesting as pointing to the liability of such a basic mixing to take up sulphur oxides from the furnace gases; as much as 17·0 per cent. of sulphur trioxide was present in the 1150° heating, and nearly all this had been taken up before passing 800° C. The maintenance of a reducing atmosphere would prevent this formation of sulphates, according to the explanation made in Part II of this study or a sufficiently high temperature would decompose any sulphates formed. The use of a fuel free from sulphur would be an obvious preventative.

Silica brick.—A silica brick is supposed to be silica cemented at a high temperature with lime. If it were so, then according to this study (Part II, this J., 1910, p. 251) the lime would only be combined with silica to the extent of $CaO.SiO_2$, and would be dissolved out of the brick by normal hydrochloric acid. This is not the case, as the following analyses exemplify:—

	Complete analysis per cent.	Extracted. per cent.
Silica (by difference)	95·38	Silica in normal HCl. 0·33 } Total Silica in Na_2CO_3 1·00 } 1·33
Alumina	2·05	Alumina, 1·0.
Oxide of iron	1·07	Oxide of iron, 0·4.
Lime	1·50	Lime, 0·5. Total extracted, 4·53.

The explanation is not difficult. The preceding study of triple oxide mixtures has shown that the introduction of alumina or soda, small in quantity compared with the silica, to a lime-silica mixture, can alter the interaction by the formation of a resistant compound, in which much more of the silica is brought into combination. The mixtures, $CaO+Al_2O_3+10SiO_2$ and $Na_2O+CaO+10SiO_2$, are relevant. Such impurities are always present in the raw material of silica brick, so that some part of the lime and other bases may always form resistant compounds in firing, and become insoluble in normal hydrochloric acid.

Other work.—Although the author has not succeeded in finding published matter dealing directly with the primary

TABLE XVII.

Portland Cement Mixture.

Lime, alumina, and silica ($9CaCO_3+Al_2O_3+3SiO_2$).

$9CaCO_3+Al_2O_3+3SiO_2$ contains {CaO 42·7 per cent., Al_2O_3 8·6 ,, CO_2 33·5 ,, SiO_2 15·2 ,,

$9CaO+Al_2O_3+3SiO_2$ contains {CaO 64·1 per cent., Al_2O_3 13·0 ,, SiO_2 22·9 ,,

Where heated.	Time (hours)	Temp.	Soluble in HCl.		SiO_3 in Na_2CO_3	Total soluble SiO_2	Insol.	SO_3.	Appearance.	Notes.
			Al_2O_3	SiO_2						
Muffle	1	850		1·7	0·7	2·4		—	Unchanged	CaO in insoluble = 0·7 %
Works furnace	24	850	1·5	2·3	0·4	2·7		15·2		
Injector	1	1000	0·6	2·5	trace	2·5	32·5			
Works furnace	12	1050	9·5	7·2	0·8	8·0			Unchanged.	
Works furnace	24	1150		13·1	0·8	13·9		17·0	Slightly coherent.	
Injector	1	1200	10·4	13·5	·19	15·4				CaO in insoluble = 0·9 %
,,	1	1200 to 1250	12·9	18·4	3·6	22·0	3·5		Unchanged.	

subject of this part of the paper, various triple-oxide compounds have been described.

Boudouard (Comptes rend., 1907, **144**, No. 19), prepared $2CaO.Al_2O_3.SiO_2$ by heating together the ingredients. He picked out crystals and found by chemical analysis that they had a composition corresponding with that formula. The mixing, $2CaO+Al_2O_3+SiO_2$, gave more over a melting point maximum at 1510° C. Microscopic examination was confirmatory.

S. Weyberg (Trans. Eng. Cer. Soc., **8**, Part II., p. 41), obtained crystals of $2CaO.Al_2O_3.SiO_2$ and $Li_2O.Al_2O_3.SiO_2$, by the action of calcium and lithium salts on kaolin at high temperatures, and also prepared, $4K_2O.4Al_2O_3.7SiO_2$, $K_2O.Al_2O_3.SiO_2$, and $2K_2O.Al_2O_3.3SiO_2$.

Rieke (Stahl und Eisen, 1908, **28**, 16—19; see this J., 1908, 123), studied the fusibilities of lime-alumina-silica mixtures, and found a maximum point corresponding with $CaO.Al_2O_3.2SiO_2$, the formula for the mineral anorthite, and a minimum corresponding with $3CaO.Al_2O_33SiO_2$, the formula of a pure lime alumina garnet. Zoellner (Sprechsaal, 1908) lays stress upon crystals of sillimanite $Al_2O_3.SiO_2$, as an essential constituent of well-fired hard porcelain, not arising from devitrification but from chemical change of the ingredient kaolin. Sillimanite is not a triple-oxide compound but may be mentioned here. Heath and Mellor (Trans. Eng. Cer. Soc., **7**, p. 80), foun sillimanite in a body fired in the china biscuit oven.

The thanks of the author are again tendered to th directors of the Farnley Iron Co., and to his chief assistan Mr. C. A. King, M.Sc.

Discussion.

Mr. T. **Fairley** asked if care had been taken to u only perfectly pure substances in the experimenta sinc small quantities of impurities lowered the fusion points substances. In manufactures pure substances were no the rule and the work done on these would therefo have to be further developed and adapted to meet the cases if it was to be of value commercially.

Mr. J. W. **Cobb**, in reply, agreed that small quantiti of impurities were in certain cases of much importance many of his own experiments in the earlier stages had bee rendered useless by the occurrence of 1 per cent. of alumi in the silica used and had been repeated. There was wide field in the determination of the influence of vario materials in several directions, but the work in hand w deliberately confined to a few chosen materials as pure possible with the object of establishing the fundament interactions. This seemed to be the first necessit whether for scientific or commercial purposes.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lan London, W.C.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Lubrication and lubricants. C. F. Mabery. J. Franklin Inst., 1910, **169**, 317—328.

After briefly discussing various lubricants and lubricant tests, the author describes a series of tests carried out with the Carpenter tester on the lubricating value of water and various oils, both alone and with 0·5 per cent. of Acheson's deflocculated graphite, or about one cubic inch of graphite in three gallons of liquid. In this machine the quality of the oil is measured by the frictional resistance, the temperature of the oil, and the endurance of the oil film after the supply of oil has been cut off. A number of curves are given by which the addition of the small amount of graphite mentioned is clearly shown to greatly increase the endurance of the oil film. The most characteristic effect of the graphite appears to be that of equalising the metallic depressions and projections on the surfaces of the bearing and journal.—A. H. C.

Patents.

Desiccating apparatus. J. S. Merrell, Assignor to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 954,451, April 12, 1910.

The liquid to be desiccated is discharged as a spray into a chamber. The spraying jet is surrounded by a cooling jacket and the latter is protected by a heat-insulating covering and then surrounded by an air chamber through which heated air is forced into the chamber along with the atomised liquid.—W. H. C.

Refrigerating or drying apparatus. Altonaer Margari Werke Mohr und Co., Ges. m.b.H. Fr. Pat. 408,03 Oct. 14, 1909.

The apparatus consists of a round hollow table wh rotates horizontally. A refrigerating or heating mediu is passed through the hollow spindle of the table to mai tain it at a suitable temperature. The material to treated is delivered upon the surface of the table midw between its centre and periphery, and is immediate evenly distributed by means of a roller arranged radiall As the table rotates, the material becomes frozen or dri and is finally removed by means of a scraper fixed at t back of the support carrying the roller.—J. W. H.

Kiln. M. Ittner, Swansea, Ill. U.S. Pat. 954,6 April 12, 1910.

The kiln has two sets of flues, one of which connects combustion chamber with the air and with the sta whilst the other set of flues passes below the sole of t kiln and connects a drying floor with the air.—W. H. C.

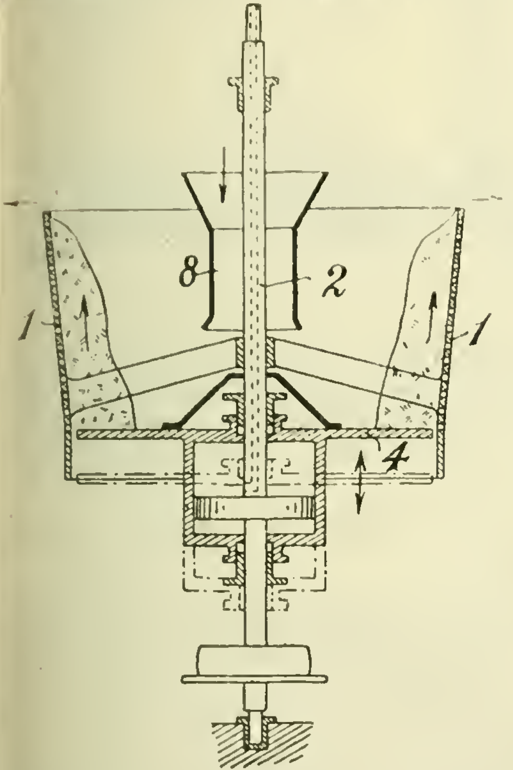
Rotary kiln. Soc. Auxiliare du Commerce et de l'Indust Fr. Pat. 407,752, Oct. 9, 1909.

A horizontal cylindrical metal shell lined with refract material is mounted on rollers and rotated by exte gearing. A horizontal cylindrical crucible chamber refractory material is supported on projections wit the outer shell. The apparatus is heated by a mixt of gas and air supplied through a system of pipes situa at one end of the apparatus and which burns in the annu space between the shell and the crucible. The produ

combustion pass away through channels formed in the fractory lining of the outer vessel to a collecting channel hich surrounds one end of the latter. A perforated pipe sses axially through the inner vessel to provide means r the introduction or discharge of air or gases.
—W. H. C.

parators ; Centrifugal ——. P. S. H. Alexander, London. From K. Reinhardt, Dortmund, Germany. Eng. Pat. 27,582, Nov. 26, 1909.

HE material to be treated is charged through the hopper, into the drum, 1. The bottom, 4, of the latter is ovable in the direction of the axis of the drum by means the rod, 2. When the machine is at work, the movement the plate, 4, pushes the solid matter upwards in the ection shown by the arrows and some of it passes over he upper edge of the drum. On the return stroke of he plate, 4, a space is left below the solid matter for resh material.—W. H. C.



istilling apparatus with means for preventing the contents from boiling over. F. Kauffmann. Fr. Pat. 407,675, Oct. 7, 1909.

A VERTICAL perforated cylinder of less diameter than he still is placed within the latter. The liquid in the nterior of the cylinder is maintained at a lower temerature than that in the space between the cylinder nd the side of the still by circulating a current of water hrough a coil placed within the perforated cylinder.
—W. H. C.

Distillation columns. O. Perri er. Fr. Pat. 408.75, Jan. 30, 1909.

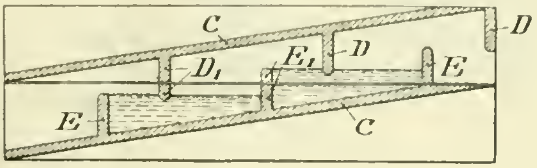
THE trays of a distillation column are covered with beds f beads through which the liquid and vapours pass in pposite directions.—J. W. H.

Ejector or elevator for liquids or semi-liquids. J. Horowitz. Fr. Pat. 407,775, Jan. 7, 1909.

THE valves controlling the supply of compressed air, and the exhaust pipe, are actuated by a beam supported in the centre, and from each end of which a float or bucket is suspended. One float is situated near the bottom of the vessel just above the level of the discharge pipe and the other near the top of the vessel in an inner chamber through the bottom of which it communicates with the liquid by a pipe provided with a perforated cap. As soon as the liquid rises sufficiently in the vessel to fill the upper float or bucket, the beam overbalances, closes the exhaust and admits the compressed air. When the liquid level falls below the lower bucket, the beam overbalances again and the air valves are reversed.—W. H. C.

Column apparatus for absorbing gases by liquids. O. Walter. Fr. Pat. 407,792, Oct. 11, 1909.

A SPIRAL partition, C, is arranged within the column provided with radial baffles, E, D, on both the upper and lower sides. The liquid flows downwards over the weirs, E, and the gas as it passes upwards is forced to bubble through the liquid by the baffles, D D_1.—W. H. C.



Evaporating apparatus for the concentration of crystallisable or pasty products. Soc. d'Exploitation de Procédés Évaporatoires (Système Prache et Bouillon). Fr. Pat. 408,452, Oct. 29, 1909.

A HORIZONTAL drum, provided with a stirring apparatus, receives a supply of material to be concentrated. It is connected at one end at its lowest point by means of a cross pipe, with two tubular heaters inclined at an angle of less than 30°, through which the material to be concentrated circulates. Steam is admitted to the jacket common to these heaters, the condensed water flowing away by means of a pipe. The circulating liquid next returns to the drum by a pipe, the vapour given off leaving the apparatus through other suitable pipes. An agitator is provided in the horizontal part of the cross-pipe (already referred to, and connecting drum and tubular heaters) to prevent choking. The treated liquid is finally withdrawn by a pipe, though, if necessary the apparatus may be worked continuously.—J. W. H.

Vacuum-pan. F. Tiemann, Tucuman, Argentina. U.S. Pat. 955,483. April 19, 1910.

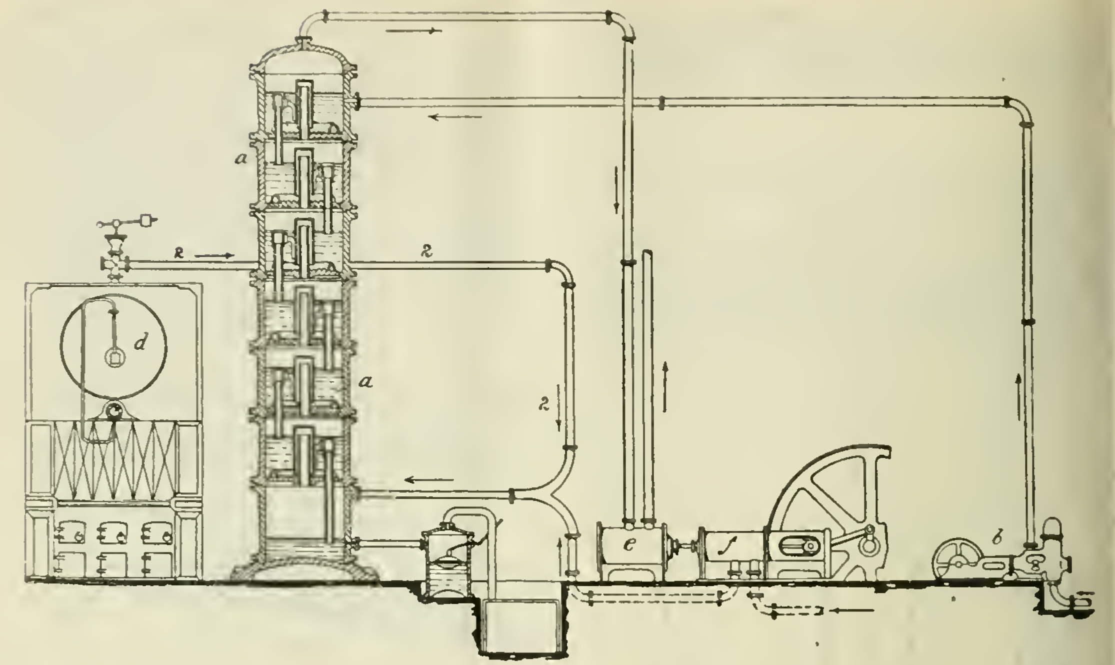
SEE Fr. Pat. 386,957 of 1908 ; this J., 1908, 795.—T. F. B.

Concentrating solutions by freezing ; Apparatus for ——. E. Monti, Turin, Italy. U.S. Pat. 955,659, April 19, 1910.

SEE Fr. Pat. 390,085 of 1908 ; this J., 1908, 1008.—T. F. B.

Absorption of a gas contained in a gaseous mixture ; Method and apparatus for the efficient ——. R. Koepp und Co. Fr. Pat. 408,419, Oct. 29, 1909.

IN utilising gases it is often necessary to get rid of or extract one important constituent, *e.g.*, carbon dioxide, and in the process, compression or heating of the whole of the mixed gases is necessary. The work done in compressing or heating the main proportion of gas is usually wasted. According to the present patent it is proposed to utilise



this energy to help to drive the pumps which compress the gas. In the example (referring to the Fig.) the absorbing liquid, an alkali or alkaline-earth in solution or suspension, is pumped into the absorbing column, *a*, by means of a pump, *b*. Steam is passed into the column by means of a pipe, 2, from the boiler, *d*. The gaseous mixture to be treated is pumped into the column by means of the air-pump, *f*, worked by the expansion in the cylinder, *e*, of the exit gases from the column, *a*.—J. W. H.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Unit ——, and composition of coal ash. S. W. Parr and W. F. Wheeler. University of Illinois Engineering Experiment Station. Univ. Illin. Bull, 37, 1909, 1—67.

As the result of the examination of many varieties of American coal, the authors conclude that, for any given deposit or region, the composition of the actual coal-substance (unit coal) is very uniform, as shown by the constancy of heat values when calculated to such unit substance. In determining the percentage of the latter, the volatile constituents of the inorganic matter (such as combined water, pyritic sulphur, carbonic anhydride, and chlorine) have to be considered, since they are not included in the ash obtained by the ordinary methods of analysis. The authors find that a factor for hydration is necessary, amounting to 8 per cent. of the ash as determined, minus the ferric oxide resulting from the decomposition of the iron pyrites; while if the amount of carbon dioxide and chlorine present in the coal together approximate to 0·5 per cent., the ash must be determined at a temperature sufficiently high to expel these constituents, and afterwards corrected by adding the amount of carbon dioxide and chlorine found. The necessary corrections are embodied in the following formulæ:—

(*a*) For coals free from carbonates and chlorides:

$$\text{Unit B.T.U.} = \frac{\text{Indicated Dry B.T.U.} - 5000\ \text{S}}{1{\cdot}00 - (1{\cdot}08\ \text{Ash} + {}^{22}/_{40}\ \text{S})}$$

(*b*) For coals with carbonates and chlorides:

$$\text{Unit B.T.U.} = \frac{\text{Indicated Dry B.T.U.} - 5000\ \text{S}}{1{\cdot}00 - [(\text{Ash at high temp.} + CO_2 + Cl)\ 1.08 + 22/40\text{S}]}$$

Referring to the occurrence of calcium carbonate in coal, the authors point out that, as this substance is decomposed in calorimeters of the Mahler type, the heat values so obtained are lowered by about 40 B.T.U. for each 5 per cent. of calcium carbonate present; this circumstance may necessitate a further correction in certain cases.
—W. E. F. P.

Crude benzol; Applicability of —— for internal combustion engines. A. Spilker. Chem.-Zeit., 1910, **34**, 478—479.

Attempts to use crude benzol in place of petroleum spirit as fuel in internal combustion engines have failed owing to the separation of resinous impurities, but refined 90 per cent. benzol is free from this disadvantage and, with suitable modification of the engine, especially of the carburettor, forms an efficient substitute for petrol. The author attributes the failure of crude benzol mainly to the presence therein of cyclopentadiene (see this J., 1896, 443), which readily polymerises, forming resinous substances. Examination of a number of crude benzols when freshly prepared and after standing for several months showed that the residue left on evaporation increased from an average of 0·64 grm. per kilo. to 1·16 grm. after 1 month, and to 1·86 grm. per kilo. after three months. In the same period, the sp. gr. increased from 0·878 to 0·880, whilst the portion distilling over up to 100° C. fell from an average of 91 per cent. to 90 per cent. Refined 90 per cent. benzol, on the other hand, left no weighable residue on evaporation, even after standing for 3 months, and besides contained considerably less sulphur than the crude product.
—A. S.

Petroleum from Russian Turkestan; Analysis of ——. E. Ackermann. Chem.-Zeit., 1910, **34**, 440.

A sample of a viscid, brownish-black, crude petroleum from Russian Turkestan had a sp. gr. of 0·8925 at 37° C., and an efflux velocity (for 40 c.c.) in Engler's viscosimeter of 42 seconds at 25° C., 35 seconds at 37° C., and 30 seconds at 45° C. It yielded the following fractions on distillation:—Between 20° C. and 150° C., 6·16; 150° C. to 180° C., 6·05; 180° to 270° C., 14·45; and 270° to 310° C., 11·68 per cent. Total 38·34 per cent. The amount of paraffin wax separated from the residue was 6·15 per cent. A second sample, which had been exposed throughout

09 to the sun in an open vessel, had become very thick. had a sp. gr. of 0·920, and on distillation yielded only ·67 per cent. of distillate (between 20° C. and 10° C.). Its efflux velocity (for 40 c.c.) was 3 min. 45 conds at 25° C., 3 min. at 37° C., and 1 min. 10 seconds t 45° C. The crude oils from this district yield but little erosene, but, on the other hand, a correspondingly greater mount of products suitable for lubricants and fuel. —C. A. M.

ineral oils; Changes in the asphaltic constituents of dark-coloured ——. G. Meyerheim: Chem.-Zeit., 1910, 34, 454—455.

xperiments, extending over 8 months, showed that dium rays were quite without effect on the formation f asphaltic substance from mineral oils.—J. F. B.

e of naphthenic acids for the detection of copper and cobalt. Charitschkoff. *See* XXIII.

cottish oil industry. Chem. Trade J., April 30, 1910. [T.R.]

ractically all of the Scottish mineral oil companies have uring the past two years been extending their productive apacity, and two of them, the Pumpherston Oil Company nd the Oakbank Oil Company, are just completing xtensions which represent the doubling of the plant. rospecting work has resulted in the discovery of extensive eposits of shale as rich as anything that had ever been orked, close to the producing works. Last year the utput of shale was nearly 3,000,000 tons, and the deposits re sufficient to ensure supplies for many years to come. he average yield of oil per ton of shale may be taken at 3 gallons, and on that basis the total output last year as over 68,000,000 gallons. Out of this the Scottish ompanies obtained about 22,000,000 gallons of lamp or urning oil, which sells at from 5½d. to 6d. per gallon; ,000,000 gallons of motor spirit, at from 10d. to 1s. 1d. er gallon; 40,000 tons of gas or intermediate oils, at ½d. to 3d. per gallon; 40,000 tons of lubricating oils, t £4 10s. to £6 per ton, according to gravity and quality; 0,000 tons of sulphate of ammonia, selling at £12 10s. er ton; and 25,000 tons of solid paraffin wax, at from d to 2½d. per pound.

Patent fuel briquettes, and of grease; Report on the manufacture of ——. Home Office, May 9, 1910. [T.R.]

A report has been issued by H.M. Medical Inspector of Factories, on the occurrence of ulceration of the skin and pitheliomatous cancer among persons employed in the manufacture of patent fuel (briquettes) and in the manufacture of grease. This report points to the necessity for regulations under Section 79 of the Factory and Workshop Act, 1901, but before proceeding formally to issue draft regulations the Home Secretary would be glad to consider any observations with regard to the recommendations contained in the report. These should reach him not later than the 20th June next.

Patents.

Coke ovens. A. O. Jones, Whitley Bay, Northumberland. Eng. Pat. 8399, April 7, 1909.

The patent relates to vertical ovens of the type in which the sole-plate can be lowered on to a wheeled cradle and removed from beneath the retort for discharging. The mechanism for lowering and raising the sole-plate is carried by the cradle and comprises two transverse bearer bars movable vertically in guides by means of links connected to crank-arms on two transverse rock-shafts. These rock-shafts are actuated by means of toothed sectors engaged by worms on a longitudinal shaft. The bearings for the rock-shafts are movable, against the pressure of springs, in horizontal guides, to prevent jamming if there is an obstruction between the sole-plate and its flange. The one cradle can be used for the several ovens of a battery. The cradle is provided with a series of transverse bars on to which the sole-plate is lowered. The sole-plate has a flange projecting outwards for forming an air-tight luting with clay around the lower edge of the oven. —A. T. L.

Coke ovens. A. O. Jones, Whitley Bay, Northumberland. Eng. Pat. 8400, April 7, 1909. Addition to Eng. Pat. 11,660, May 18, 1906 (this J., 1906, 1138).

In a vertical oven of the kind described in the principal patent, in which independent superposed horizontal heating-flues extend along one side of the oven from front to back, across the back, and along the other side to the front, where they open into a common vertical outlet flue extending across the front of the oven, vertical air-heating flues are provided in the front wall of the oven, so that the air-supply is heated by the waste gases. The air enters at the base of the oven and passes up one flue and down through a second flue which is between the first flue and the outlet flue. This second air-flue is provided with separate valve-controlled outlets leading to the combustion flues, each of which is fitted with a burner. The passage of gases from each combustion-flue to the outlet flue is controlled by a valve, and an inspection passage with transparent cover is provided for observing the state of combustion in each heating flue.—A. T. L.

Coke oven, or oven with inclined coking chambers. W. Müller. Fr. Pat. 407,835, Oct. 13, 1909.

In an oven with inclined coking chambers and a series of vertical heating flues in each dividing wall, the distribution of gas and of air, and the passage of the products to the regenerator, is effected in each case by means of two superposed flues controlled by dampers. The two flues communicate at intervals by openings controlled by dampers, so that the passage of gases through each opening corresponds to the flow through a group of four or five of the vertical heating flues.—A. T. L.

Gas-separator. W. McArthur, Tenino, Wash. U.S. Pat. 954,454, April 12, 1910.

A separator for use in the manufacture of gas from lignite comprises a horizontal cylindrical casing, with an axial pipe open at both ends for the passage of a cooling medium. Gas inlet and outlet pipes are fitted at the upper part of the casing, and valved discharge and siphon pipes at the lower part.—A. T. L.

Distilling hydrocarbon oils; Apparatus for ——. J. S. Lang, Boston, Mass. U.S. Pat. 954,575, April 12, 1910.

The apparatus comprises a furnace and a heating or distilling coil arranged in successive sections to each of which corresponds a definite temperature. The vapours from the heating coil pass to a coil condenser, and return pipes are provided from successive coils of the condenser to the heating coil, each pipe returning through a section of the condenser in which the vapour is at a higher temperature. The return pipe from the first section of the condenser comprises a section exposed to the heat of the furnace gases. A retort is provided in the furnace chamber, connected with the first section of the heating coil, and return pipes are provided from the various sections of the heating coil to the retort.—A. T. L.

Mineral oils; Process for the distillation of ——. J. Kusch K. Teubner, and Deutsche Erdölwerke Ges. m.b.H. Ger. Pat. 220,657, March 15, 1908.

The still is in the form of a long tube (see fig.), provided in its upper part with a collecting trough, D (Figs. 1 and 2), for the vapour, which passes through the tube, F, to the condenser. The vapour passes into the trough through the narrow spaces between the edges of the

Fig 1

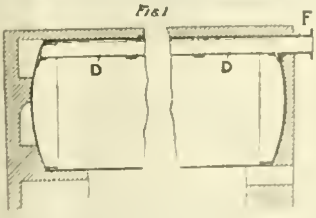
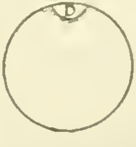


Fig 2



latter and the wall of the still, any entrained particles of liquid falling back into the still.—A. S.

Coke ovens. Soc. Anon. d'Ougrée-Marihaye, Ougrée-Lez-Leige, and L. Eloy, Flémalle-Grande, Belgium. Eng. Pat. 9445, April 21, 1909.

See Fr. Pat. 401,451 of 1909; this J., 1909, 1116.—T. F. B.

Gas; Manufacture of ——. A. Zindler, New York. U.S. Pat. 956,019, April 26, 1910.

See Fr. Pat. 404,554 of 1909; this J., 1910, 206.—T. F. B.

Removing hydrogen sulphide from gases. Ger. Pat. 220,632. *See* VII.

Gas analysis apparatus. Fr. Pat. 408,038 *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Bye-products; Process of obtaining —— in the dry distillation or gasification of fuel. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 19,959, Aug. 31, 1909. Under Int. Conv., Sept. 1, 1908. Addition to Eng. Pat. 20,870, Sept. 28, 1904 (this J., 1905, 1103).

In the process described in the principal patent, a dilute "saline solution of fixed ammonia" is separated with the tar before the gas enters the saturation apparatus for the production of sulphate. The improvement consists in adding the vapours obtained by distilling this liquor, to the crude gas before, or in, the tar separator.—A. T. L.

Ammonia, tar and like products from industrial organic substances; Apparatus for obtaining —— by distillation at a low temperature in a current of gases. M. Ferrari, J. Robert, and E. Mégret. Fr. Pat. 408,703, Jan. 30, 1909.

An apparatus for carrying out the process described in Fr. Pat. 396,738 (this J., 1909, 594) comprises a vertical distilling chamber with thick firebrick walls, provided at its upper end with a charging hopper and a gas outlet pipe. The distilling chamber is heated by the passage through it of gases from a producer chamber beneath it. The residue from the distillation passes partly into the producer chamber, the excess not required as fuel passing into a discharge chamber at the back of the producer chamber. An inlet is also provided at the base of the distilling chamber for any suitable gas or vapour for carrying off the products of distillation.—A. T. L.

Incandescence mantles; Process for the manufacture of ——. J. Visseaux. Fr. Pat. 408,807, Jan. 30, 1909.

The fabric is impregnated in the usual manner, and then dipped into a solution of pure sodium hypochlorite at a temperature not exceeding 5° C. The salts in the fabric are thus precipitated as hydrated peroxides. The fabric is washed in distilled water, and finished in the usual manner.—A. T. L.

Electric lamps; Manufacture of rods or filaments of refractory material for ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 8781, April 13, 1909.

Rods, wires, or filaments of tungsten, molybdenum, or other refractory metal, are prepared by bringing together a solution of a compound of the metal, *e.g.*, ammonium tungstate, and a trihydroxy- or trihydroxymonocarboxyl derivative of benzene, *e.g.*, pyrogallol, gallic acid, or tannic acid, and precipitating by heating with acid or alkali. The plastic mass so obtained, with or without the addition of finely powdered metals or metalloids, is worked into the desired shape, dried, and baked. When a good conductor has been added in the powdered form, simple drying is sufficient to render the material conducting; otherwise it must be baked in a vacuum or reducing atmosphere. The filaments, etc., are finally gradually heated to a white heat by the electric current. When no metallic powder has been added, a shrinkage of 75 per cent. occurs during heating, so that filaments of 0·0125 mm. diameter can be prepared without great difficulty. The amount of shrinkage can be regulated by the addition of more or less powdered metal, etc.—H. H.

Electric lamps; "Forming" carburised metal filaments for ——. W. Heinrich, Berlin. Eng. Pat. 16,065, July 9, 1909.

The process of removing the organic binding material from metallic filaments by heating in an atmosphere of coal gas or illuminating gas is open to the objection that the carbon is not completely eliminated and that a coating of graphite is formed on the filament. This difficulty is obviated by admitting a small quantity of ammonia gas to the container after the latter has been washed out with illuminating gas and exhausted to a pressure of 5 mm. of mercury. The quantity of ammonia to be added depends on the percentage of heavy and light hydrocarbons contained in the illuminating gas, but is always less than the total quantity of illuminating gas present.—H. H.

Metal-filament lamps; Process for improving the quality of ——. H. Kužel. Fr. Pat. 408,624, Nov. 4, 1909. Under Int. Conv., Dec. 21, 1908.

In order to ensure a more perfect vacuum in the lamp bulbs, precautions are taken to avoid the introduction of mercury vapour from the mercury pump whilst pumping out the air. This may be effected by cooling the connecting tubes to 1° or 2° C. or by interposing between the pump and the bulbs a vessel, preferably cooled, containing a metal which will absorb mercury vapour, as large a surface as possible being exposed.—A. T. L.

Ultra-violet rays; Process for transforming invisible —— into visible rays. O. Vogel. Ger. Pat. 221,489, March 4, 1909.

In order to convert ultra-violet rays (*e.g.* those from mercury-vapour lamps) into visible rays of high wave length, the light is passed through an evacuated apparatus of quartz, fluorspar, etc., which contains an oxide of scandium, thorium, lanthanum, gadolinium, beryllium, samarium, or zirconium, together with a trace of a salt of phospho- or arseno-molybdic or -tungstic acid; one of the above named oxides may form the base of the salt. Other substances may be added to modify the properties of the resultant light, *e.g.*, tungstates of calcium, lead, barium, sodium, strontium, or potassium, or such substances as chlorophyll, aesculin, anthracene, or phenanthrene. —T. F. B.

Filaments for incandescent lamps; Method of manufacturing ——. J. W. Howell, Newark, N.J., Assignor to General Electric Co., New York. U.S. Pat. 955,461, April 19, 1910.

See Eng. Pat. 6959a of 1904; this J., 1905, 721.—T. F. B.

Pyrophoric alloys. Addition to Fr. Pat. 407,117. *See* X.

Refractory metal product for the manufacture of incandescence mantle supports. Fr. Pat. 407,838. *See* X.

III. TAR AND TAR PRODUCTS.

Applicability of crude benzol for internal combustion engines. Spilker. *See* IIa.

PATENTS.

Chlorobenzene from benzene and chlorine; Process for preparing ——. Saccharinfabrik A. G., vorm. Fahlberg, List, und Co. Ger. Pat. 219,242, Oct. 5, 1907.

CHLORINE is passed into benzene in presence of a mixture of finely-divided iron and ferric chloride; before the whole of the benzene has been chlorinated, the introduction of chlorine is stopped, and the product is distilled at a temperature not exceeding 80° C. By this process the catalytic agent used requires no treatment before re-use. —T. F. B.

Phenylglycine-o-carboxylic acid; Process for preparing halogen substitution products of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 220,839, Dec. 13, 1908.

HALOGEN derivatives of anthranilic acid are treated with formaldehyde and hydrocyanic acid or its salts, either simultaneously or separately, and the resulting halogenated ω-cyanomethylanthranilic acid is converted into the corresponding halogenated phenylglycine-o-carboxylic acid, either directly by saponification, or after its conversion into the ω-sulphomethyl compound.—T. F. B.

Acidylaminophenylsulphaminic acids and their homologues; Process for preparing ——. H. Weil and K. Weisse. Ger. Pat. 221,301, Jan. 9, 1909.

WHEN the acidyl derivatives of *p*-nitraniline or its homologues are treated with bisulphites in aqueous solution, the nitro-group is converted into a sulphamino-group. The new acidylaminophenyl-sulphaminic acids are crystalline compounds, readily soluble in water; boiling with alkalis removes only the acidyl group, anilinesulphaminic acid resulting.—T. F. B.

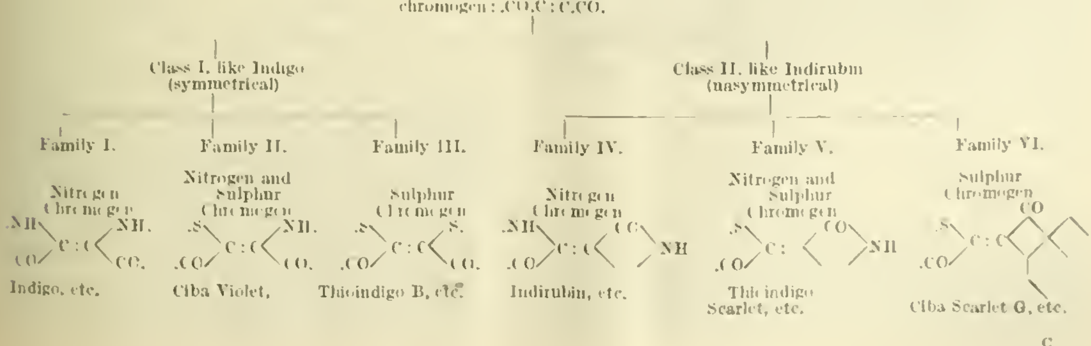
IV.—COLOURING MATTERS AND DYES.

Vat dyestuffs; Progress in the field of the ——. R. Bohn. Ber., 1910, **43**, 987—1007.

UNTIL the year 1901 the only known vat dystuffs were those belonging to the Indigo group. In that year Indanthrene and Flavanthrene were discovered and at the present time the number of vat-dyestuffs, ranging over all the colours of the spectrum, extends to hundreds. The author distinguishes between two principal classes, namely, the Indigoid dyestuffs and those derived from anthraquinone. The former consist of two kinds, namely, symmetrical and unsymmetrical and these divisions each fall into three classes which are characterised by containing nitrogen, sulphur or both elements in the chromogen. The following table illustrates this.

Of the first family, 5:5′-dichloro- or dibromo-indigo is similar in shade to Indigo, but when the halogen atoms are in the 6:6′-position the dyestuff is reddish violet. 5:7:5′:7′-Tetrachloro- and tetrabromo-indigo (Ciba Blue) are much brighter and clearer than Indigo and faster to washing and light. The introduction of still more halogen atoms leads to greener shades. In connection with the third family attention is specially directed to Münch's new method of synthesis of dyestuffs of this group (this J., 1908, 197). The introduction of halogens into dyestuffs of this class renders the shade bluer (Ciba Bordeaux B), but when two alkyloxy-groups are in the para-position to the CO group, a bright orange dyestuff results which on halogenation becomes scarlet. A dyestuff of the latter colour is also produced when the alkyloxy-groups in the para-position to the CO group are displaced by alkylthio-groups. By varying the substituents, brown orange, dark violet blue and black derivatives of Thioindigo are obtained. To this class belong Helindone Orange R, Helindone Fast Scarlet R, Helindone Scarlet S, Heliodone Red B and 3B, Thioindigo Red 3B, BG and R, Thioindigo Scarlet S, Thioindigo Orange R, and Thioindigo Brown G. The simplest representative of family II. is Ciba Violet A. Its halogen derivatives are known as Ciba Violet, Thioindigo Heliotrope, and Thioindigo Violet. Only one representative of the fourth family is on the market, namely, a tetrabromo-derivative, Ciba Heliotrope. Of the fifth family the simplest member is Thioindigo Scarlet R: its dibromo-derivative, Thioindigo Scarlet G, and Ciba Red G also occur. Only one representative of family VI. occurs, namely the dyestuff produced by the condensation of oxythionaphthene with acenaphthenequinone, involving for the first time the technical utilisation of acenaphthene.

The dyestuffs of the anthraquinone series are subdivided as follows: Indanthrene, Flavanthrene, the dyestuffs of the benzanthrone series, the anthraquinoneimides and the acyl deriviatives of the aminoanthraquinones. The effect of introducing halogens into the Indanthren-molecule is to render the shade greener and to increase the fastness to chlorine. Indanthrene Blue GC is a bromo-derivative, Indanthrene Blue GCD is a chloro-derivative and Algol Blue CF, K and 3G and Algol Green B also belong to this class. Flavanthrene (Indanthrene Yellow) is prepared technically by treating 2-amino-anthraquinone with antimony pentachloride in boiling nitrobenzene solution. It gives a violet blue vat from which cotton is dyed in the same shade, which however soon turns to a bright yellow on exposure to the air. Pyranthrene (Indanthrene Gold Orange) an analogue of Flavanthrene, is rendered redder by the introduction of halogens: the dibromo-derivative is the reddest. Benzanthrone is the first vat dyestuff to consist solely of carbon, hydrogen and oxygen. To this class belong Indanthrene-Dark Blue, -Violet and -Green. If a fabric dyed with a nitro- or amino-indanthrene Dark Blue is treated with chlorine, a very fast deep black is obtained. To the fourth group, the anthraquinoneimides, belong Indanthrene Bordeaux, Indanthrene Red, Algol Orange, Algol Bordeaux and Algol Red. Among the acyl derivatives of the amino-anthraquinones are Algol Yellow, one of the Algol Reds

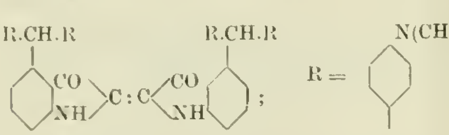


Algol Rose and Algol Scarlet. Finally the following dyestuffs belong to the anthraquinone series but their constitution is not yet known with certainty: Indanthrene Maroon, Indanthrene Gray, Indanthrene Brown, Indanthrene Orange, Indanthrene Copper, Indanthrene Olive, Cibanone-Yellow, -Orange and -Brown, Leukol Brown and Dark Green, Algol Gray and Helindone Brown.

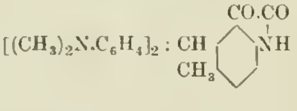
—J. C. C.

Indigo group; Combination of triphenylmethane dyestuffs with those of the ——. F. Reitzenstein and W. Breuning. Annalen, 1910, **372**, 257—286.

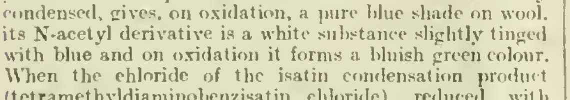
THE authors have prepared a number of condensation products of dyestuffs of the triphenylmethane series with those of the Indigo group, with the view of ascertaining whether an increase in the number of chromophoric groups in the molecule proportionally increases the intensity of colour, or if the action of such chromophoric groups is negatived or suppressed owing to the increasing size of the molecule. The compounds which have been prepared have the general formula



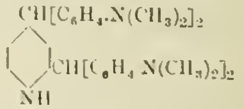
in which it will be seen that two triphenylmethane residues are condensed together in one Indigo molecule. The method of preparation was to condense tetramethyldiaminodiphenylcarbinol with isatin in sulphuric acid solution, to convert the product into the chloride by means of phosphorus pentachloride and then to combine two molecules of this by means of reduction just as isatin chloride is converted into Indigo. The leuco-compounds thus produced differ from those of the Indigo series in that they cannot be oxidised by the air: 3 molecules of lead peroxide must be used. From a comparison of the properties of the dyestuffs described, the authors find that an increase in the number of chromophoric groups introduced into the molecule renders the dyestuff purer and brighter in shade. The shade is deepened only in those cases where a methyl group has been introduced into that benzene ring which is directly united with the new chromophore. The condensation product from *p*-methylisatin and tetramethyldiaminodiphenylcarbinol



is a reddish brown substance which gives a green solution on oxidation. When *o*-methylisatin is used instead of the para-compound, a yellowish brown substance is obtained, which on oxidation produces an intense blue colour, with a slightly reddish shade, on wool. The yellowish brown powder obtained when isatin is similarly condensed, gives, on oxidation, a pure blue shade on wool. its N-acetyl derivative is a white substance slightly tinged with blue and on oxidation it forms a bluish green colour. When the chloride of the isatin condensation product (tetramethyldiaminobenzisatin chloride) reduced with zinc chloride or dextrose, di (tetramethyldaminodiphenylmethane) di-indoxyl,



is obtained as a yellowish brown substance; the oxidised base dyes tannin-mordanted cotton in weak, pale blue shades, but produces very bright deep blue tones on wool. The corresponding di-*o*-methylindoxyl compound is a bluish substance which on oxidation dyes wool in bright violet shades, and the *p*-derivative is a green powder which on oxidation gives dark grass green shades on wool. Octamethyltetra-aminotetraphenyl-4-amino-*m*-xylene,

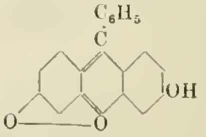


is prepared by oxidising the condensation product of tetramethyldiaminodiphenylisatinmethane (from isatin and tetramethyldiaminodiphenylcarbinol: see above) and dimethylaniline with chloranil in alcoholic solution and reducing the product with zinc dust and acetic acid. It is a white crystalline powder and on oxidation gives an intense blue solution with a pale reddish tinge.

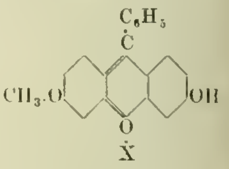
—J. C. C.

Xanthene and triphenylmethane. F. Kehrmann. Annalen, 1910, **372**, 287—355.

IN a previous paper (this J., 1902, 767) the author suggested that the Pyronine, Rosamine and Rhodamine dyestuffs were to be regarded as amino- or hydroxy-derivatives of carboxonium compounds and the object of the present work was to find experimental evidence as to the relation of these dyestuffs to the simple carboxonium and especially to the xanthonium salts. The hydroxyphenylfluorone prepared by Kehrmann and Dengler (this J., 1908, 1106) was assigned the formula (I.)

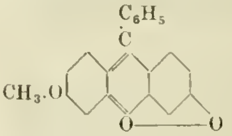


(I.)

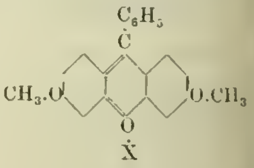


(II.)

and in order to prove the presence of the linked oxygen atoms in this, the action on it of methyl sulphate has been studied. The first product is a salt of hydroxymethoxyphenylxanthonium (II.) which spontaneously loses water to form methoxyphenylfluorone (III.)

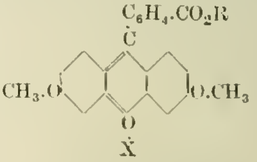


(III.)

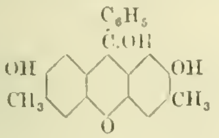


(IV.)

This in its turn unites with methyl sulphate to form a salt of 3 : 6-dimethoxyphenylxanthonium (IV.). Further by double methylation the esters of Fluorescein are converted into salts of 3 : 6-dimethoxyphenylxanthoniumcarboxylic esters,



which behave as salts of strong bases and resemble the acridine salts in that they are strong dyestuffs which give gold yellow to orange yellow shades on tannin-mordanted cotton, fast to washing and soaping. Alkylation therefore converts the fairly strongly acid Fluorescein, the basic properties of which are only feebly developed, into strongly basic compounds which do not contain nitrogen. Applying these observations to the case of the Pyronines, Rosamines, Rhodamines, Phthaleins, etc., the author concludes that the basic character of these dyestuffs is not due to the presence of the amino-group or the nitrogen atom. In order to throw further light on the basic character of ygen in these compounds, the authors have extended he work of Green and King (this J., 1907, 1133) and ave prepared the phthaleins and benzeins of the various ydroquinones. The author discusses at considerable ngth Baeyer's non-quinonoid theory of the constitution f colouring matters but considers that the weight of vidence is in favour of his own quinonoid theory. He hinks that, through the latter, a comprehensive theory o include all doubtful cases may ultimately be developed y the aid of the theories of partial and subsidiary valencies ue to Thiele and Werner. When acetylaminophenylluorone is treated with methyl sulphate in nitrobenzene olution, the methosulphate of 3-acetylamino-6-methoxyphenylxanthonium (compare III. above) is formed. alts of this base dye tannin-mordanted cotton in orange ellow shades. The physical and chemical properties f a large number of benzeins and phthaleins of hydrouinone are described, of which toluhydroquinonebenzein,



(in the form of its chloride) dyes tannin-mordanted cotton n intense orange brown shades which are fast to washing.
—J. C. C.

Patents.

Brown vat dyestuffs of the indigo series; Manufacture of——. O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 14,314, June 18, 1909.

Brown vat dyestuffs are obtained by treating 4 : 4′-aminoindigo with halogens or substances yielding halogens. The brominated compound is a brown powder giving a bright yellowish brown vat from which cotton is dyed in bright reddish brown tints; on soaping these become redder and are very fast to washing. The chlorinated diaminoindigo furnishes full brown shades which are considerably redder than the dyeings produced by means of the original compound.—J. C. C.

Dyestuff of the Oxazine series and of its leuco-derivative; Manufacture of——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,905, Sept. 13, 1909.

The Gallocyanine prepared from nitrosodiethylaniline and gallic acid (this J., 1910, 412) and its leuco-compound, when treated by the processes described in the case of the Gallocyanine derived from nitrosodimethylaniline (this J., 1907, 960; 1908, 71, 744) give analogous results. The new dyestuff, thus containing no carboxyl group, dissolves in hydrochloric acid with a blue colour and is purer in shade than that from which it is derived.
—J. C. C.

Dyestuffs of the anthracene series; Process for preparing brown ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 220,032, Jan. 12, 1909.

The nitramines or nitronitramines obtained by the nitration of aminoanthraquinones or their derivatives, when treated with acids and then with water, are converted into fast brown wool dyestuffs, soluble in alkalis.—T. F. B.

Tetrachloroindigo and process of making same. P. Julius, V. Villiger and P. Nawiasky. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. U.S. Pat. 955,410, April 18, 1910.

4 : 4′ : 5 : 5′-Tetrachloroindigo is prepared by saponifying and oxidising an ester of 4 : 5-dichloroindoxylcarboxylic acid. It is a greenish blue powder which dyes cotton in very greenish blue shades.—J. C. C.

Alkali compounds of polyhalogen-indigos; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 219,732, Feb. 5, 1908. Addition to Ger. Pat. 158,625, Oct. 27, 1903.

Alkali compounds of polyhalogen indigos are obtained by treating tetra-, penta-, or hexa-halogen indigos with caustic alkali solutions, or by treating with air alkaline solutions of the corresponding polyhalogen-indigo whites. The products are dark green in colour, and are re-converted into polyhalogen-indigos by acids. They are more stable than the alkali compounds of the non-halogenated indigos.
—T. F. B.

Anthracene series; New products of condensation of the ——, new dyestuffs derived from them, and their application in dyeing and printing. Badische Anilin und Soda Fabrik. Fr. Pat. 408,787, Nov. 9, 1909. Under Int. Conv., April 7, April 19, and Aug. 11, 1909.

Halogen derivatives of anthraquinones, or their derivatives, are condensed with *o*-amino-, *o*-hydroxy-, or *o*-thiooxybenzoic acids, their salts, esters, or substitution products. New dyestuffs of the anthracene series dyeing wool in an acid bath, are obtained by treating these products containing one or more sulphonic groups with condensing agents, or the latter may act at the same time as sulphonating agents, or the compounds may be sulphonated after treatment with condensing agents. The dyestuffs are treated with reducing agents in presence of an alkali, and the material dyed in the vat thus obtained. They may be applied in printing, with or without a reducing agent, with addition of alkali, and subsequent steaming, or the material may be printed with a reducing agent, with after-treatment by alkali.—B. N.

Thioindigo vat dyestuff. A. Schmidt and K. Thiess, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 955,699, April 19, 1910.

Claim is made for the dyestuff produced by heating pentabromothioindigo with aniline. It is a blue powder and dyes cotton and wool from the hydrosulphite vat in violet blue shades which are very fast.—J. C. C.

Monoazo dyestuff; Process for preparing a yellow ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 219,846, April 28, 1909.

By combining diazotised 2.4-dinitraniline with phenylmethylpyrazolone, a greenish yellow dyestuff is formed, which is insoluble in water and oil, fast to alcohol, and extremely fast to light. It may be used eqnally well for dyeing fabrics or for making printing colours or oil colours.—T. F. B.

Monoazo dyestuffs; New ——, and new lakes with these dyestuffs as base. Act.-Ges. für Anilinfabr. Fr. Pat. 407,903, Oct. 15, 1909.

The diazo derivative of an aromatic amino compound, of the general formula, $C_6H_2 : CH_3 : NH_2 : X : NO_2 = 1 : 2 : 3 : 5$, in which X represents an atom of a halogen, is combined with β-naphthol. The compounds may be transformed into coloured lakes by any of the well known methods.—B. N.

Sulphide dyestuff; Process for producing a —— dyeing moss-green shades. C. Jäger, Ges. m.b.H. Ger. Pat. 220,064, Feb. 13, 1909.

A mixture of *p*-phenylenediamine and acetyl-*p*-phenylenediamine is heated with sulphur to a high temperature (230°—250° C.). The resulting dyestuff dyes cotton brown shades, which become moss-green on exposure to air. The mixture of the dyestuffs produced by heating *p*-phenylenediamine and its acetyl compound, respectively, with sulphur, dyes cotton in feeble green tones, which do not alter in air, but become grey on treatment with bichromate, copper sulphate, and acetic acid, whereas the dyeings obtained with the new dyestuff are unaltered by this treatment. (See also Ger. Pat. 220,065; this J., 1910, 555.)—T. F. B.

[*Azo*] *dyestuffs; Manufacture of acid wool* ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,929, May 20, 1909. Addition to Eng. Pat. 7820, April 1, 1909.

See Addition of May 22, 1909, to Fr. Pat. 402,546 of 1909; this J., 1910, 81.—T. F. B.

Colouring matter of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,568, May 27, 1909.

See Ger. Pat. 218,162 of 1909; this J., 1910, 482.—T. F. B.

Disazo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 16,799, July 19, 1909.

See Fr. Pat. 405,178 of 1909; this J., 1910, 267.—T. F. B.

[*Triphenylmethane*] *dye; Orange-red to violet* ——. M. Weiler. Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 950,359, Feb. 22, 1910.

See Addition of July 13, 1909, to Fr. Pat. 404,800 of 1909; this J., 1910, 412.—T. F. B.

Azo dye and process of making same. W. Herzberg and M. Ronus, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 955,068, April 12, 1910.

See Fr. Pat. 407,903 of 1909; preceding.—T. F. B.

Vat dye [*from carbazole*] *and process of making same; Blue* ——. R. Herz, Frankfort, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 956,348, April 26, 1910.

See Ger. Pat. 218,371 of 1908; this J., 1910, 482.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Sisal hemp from Mauritius. Bull. Imp. Inst., 1910, 8, 9—10.

A specimen sample, well prepared, white, of fair lustre, and rather finer than the average commercial fibre, gave the following results:—Moisture, 8·6; ash, 0·5; α-hydrolysis (loss), 7·8; β-hydrolysis (loss), 10·1; acid purification (loss), 0·5; and cellulose, 83·0 per cent. Comparison of these figures with the results given by samples of sisal hemp from East Africa, Nyasaland, and Uganda showed that the Mauritius product was the best of the four, since it contained more cellulose and lost less on hydrolysis. It was valued at about £30 per ton.—C. A. M.

Kapok fibre from Mauritius. Bull. Imp. Inst., 1910, 8, 9.

The fibres were fairly clean and of a light golden-brown colour, and had a good lustre. They varied in length from 0·7 to 1·0 inch, and in diameter from 0·0005 to 0·0015 inch, the average being 0·00096 inch. The sample was slightly darker and more uneven in colour than a standard commercial sample. It was valued at about 4½d. to 5d. per lb. in London.—C. A. M.

Cellulose hydrates; Adsorption of sodium hydroxide by ——. J. F. Briggs. Chem.-Zeit., 1910, 34, 455.

Vieweg (this J., 1908, 418) proposed to measure the "degree of mercerisation" of cotton cellulose by determining its adsorption capacity for sodium hydroxide from 2 per cent. aqueous solution. It was shown that the adsorption was greater, the greater the concentration of the alkali by which "mercerisation" had been effected. The author points out that an increased adsorption capacity is characteristic of hydrated celluloses generally by whatever method the hydration may have been induced and that the increase in adsorption may, in strictly comparative cases, be taken as a measure of the "degree o hydration." He also shows that small differences in th degree of hydration may be measured on a magnifie scale by determining the adsorption of the alkali i alcoholic media, instead of in aqueous solutions. Th percentage of sodium hydroxide adsorbed by cellulos from 2 per cent. solutions is very much greater in alcoholi media, and it increases with the alcoholic strength. Th author finds that maximum adsorptions of 14—15 per cent of sodium hydroxide, calculated on the dry weight of th cellulose, are recorded in the case of artificial silks i presence of 93 per cent. alcohol of approximately N/ alkalimetric strength. By working in 93 per cent. alcohol it is possible to show differences in the degree of hydratio of cellulose fibres which have been hydrated by mechanica means only in the papermaker's beating engine.—J. F. E

Patents.

Coir fibre; Manufacture of elastic, non-inflammable ——. R Sumner, Horton, Bucks. Eng. Pat. 9840, April 26, 1909.

The fibre is detached from the beard by beating, an washed until the water is clear of suspended matte It is then boiled, allowed to cool for 24 hours, and re-boiled The hanks of fibre are then dried by heat and spun int strands which are in turn spun into ropes which cu upon themselves in springy coils. The coiled rope i boiled with a solution of 1 lb. of alum and 1 oz. of sod crystals in 6 galls. of water, for one hour, drained, completely dried, and the unpicked rope teased by hand or by carding machine. The finished fibre is stated to be non-inflammable, highly elastic and curly, and to be an excellen substitute for horse-hair, etc., for stuffing mattresse and other types of upholstering.—R. C. P.

Solutions for spinning and other purposes; Production c durable ——. P. Friedrich, Berlin. Eng. Pat. 14,11 June 16, 1909.

The keeping properties of an ammoniacal solution of coppe oxide are found to be improved by the addition c mannitol or other multivalent alcohols.—F. M.

Combs; Product for the manufacture of —— *and othe applications.* Soc. Industrielle de Celluloid. Fr. Pat 407,846, Jan. 8, 1909.

Celluloid is mixed with maltodextrin, obtained from th fermentation of dextrin by the aid of malt. Befor being added, to the celluloid, the maltodextrin is preferabl neutralised by the addition of a suitable amount of weak alkali, such as borax, and the water separated b evaporation.—B. N.

Vessels for mixing, grinding, bleaching, etc. [*Beatin engines.*] Maschinenbau-Akt.-Ges. Golzern-Grimma Fr. Pat. 408,277, Oct. 20, 1909. Under Int. Conv July 27, 1909.

See Eng. Pat. 24,903 of 1909; this J., 1910, 483.—T. F. I

Plastic compounds; Manufacture of ——. S. Morimura Tokyo. U.S. Pat. 955,421, April 19, 1910.

See Eng. Pat. 27,266 of 1909; this J., 1910, 557.—T. F. I

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Patents.

Inflammable fabrics; The washing of ——. C. J. Fox London. Eng. Pat. 8829, April 14, 1909.

The patentee claims the use of ammonium phosphate as a ingredient in the liquors used in washing, blueing or starching inflammable goods.—F. M.

ndigo and analogous compounds; Process for reducing ——. Badische Anilin und Soda Fabrik. Second Addition, dated Oct. 21, 1909, to Fr. Pat. 348,360, Nov. 29, 1904 (this J., 1905, 495 and 1223). Under Int. Conv., July 22 and Aug. 6, 1909.

ndigo, indirubin, thioindigo, or their homologues, nalogous compounds, or substitution products are treated ith ferrous oxide, or a mixture of this with metallic iron, presence of an alkali. The ferrous oxide and the iron, r the mixture, may in certain cases have been previously eated with an acid.—B. N.

entrifugal machine for dyeing, bleaching, washing, nitrification, etc., principally of textile products. E. Müller, Fr. Pat. 408,082, Oct. 19, 1909.

he material to be treated is subjected to an alternating ow of liquor so as to prevent the formation of channels hich would give rise to uneven results. This alternate ow is obtained by arranging the wire cage of a hydroxtractor inside a closed chamber, both the cage and the hamber being rotatable. The cage is constructed with central funnel-shaped opening communicating with he space between the walls of the cage and the wall of the uter chamber. The liquor for the treatment flows from reservoir along a pipe which is mounted on swivel bearings, o that the liquor can either be delivered on to the material ontained in the cage or down the central opening directly nto the outer chamber. In the first case, the machine eing in motion, the liquor will travel radially through he material into the outer chamber. In the second case, he liquor on falling down the central opening on to the loor of the outer chamber, is at once thrown by centrifugal force to the wall of the chamber and is forced by the ressure of the liquor behind it, up the space between the all and the outer wall of the cage and afterwards through he material in a direction opposite to the centrifugal rce. To lessen the risk of channel formation, the cage s divided into compartments.—P. F. C.

yeing machine. J. T. Psarski. Fr. Pat. 408,307. Oct. 26, 1909.

his apparatus comprises a vat having a perforated false ottom on which the material to be dyed is placed and ressed down by means of a cover perforated near its eriphery. In order to ensure even dyeing, a distributing rrangement consisting of a perforated drum is arranged n the false bottom. The vat is provided with three pipes, wo entering below the false bottom and the third above he perforated cover. These pipes are in connection with a centrifugal pump by means of which the dyeiquor, heated by a steam pipe arranged beneath the alse bottom, is made to circulate through the perforations n the false bottom and the distributor into the material to be dyed, and afterwards through the perforated cover and the exit pipe back to the pump. Since the perforations in the false bottom and the distributor have a greater elivering capacity than the perforations in the cover, the dyeing operation is conducted under pressure and more uniform results can therefore be obtained.—P. F. C.

op tube for dyeing yarn in the form of cops or balls. F. H. Daniell. Fr. Pat. 408,400. Oct. 28, 1909.

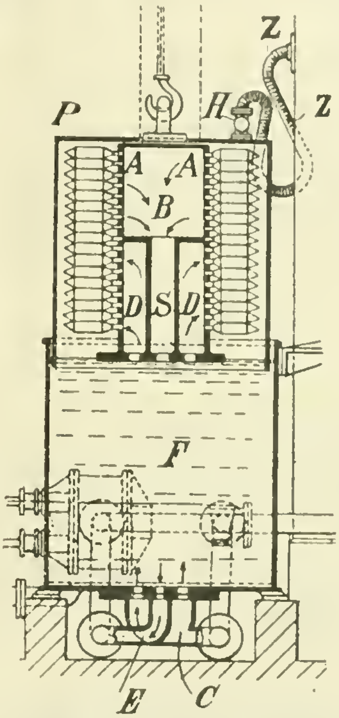
The yarn is wound round a tube consisting of a sleeve of some suitable fabric of loose or porous texture, inside which is inserted a metallic spiral support which distends the sleeve. Since the metallic support can act as a spring, the cop tube thus obtained is compressible along its length. —P. F. C.

Dyeing yarn in cops and balls; Method of —— and method of winding yarn on cops for dyeing. F. H. Daniell and J. C. Hebden. Fr. Pats. 408,424, Oct. 29, 1909, and 408,480, Oct. 30, 1909.

1). A number of cops or balls wound on tubes which are longitudinally compressible (see preceding abstract) are placed end to end and tightly pressed together, the central openings of the tubes being kept in line by means of a mechanical contrivance. The dye-liquor or other fluid used in the process is then pumped into the openings and forced radially through the cops. (2). The cop or ball of yarn is wound round a tube consisting of two flat perforated helical supports, one of which is so arranged inside the other that it fills up the space between the successive coils of the outer spiral and thus forms with it a perforated tube compressible along its length. A claim is made for any other combination which will produce a compressible tube. P. F. C.

Dyeing machine having a circulating bath. Textil-Maschinenfabrik B. Cohnen. Fr. Pat. 408,488, Oct. 30, 1909. Under Int. Conv., Nov. 2, 1908.

The spindles on which the material to be dyed is wound are mounted on a carrier, A, the interior of which is a hollow cylinder divided into two parts by the tube, S, so that when the carrier is lowered into the vat, F, the tube, S, falls over and connects with the pipe, E, whilst the other section of the cylinder is placed in connection with the pipe, C, both these pipes being in communication with a pump of reversible flow. Above and around the carrier, A, is arranged a bell, P, connected to a vacuum apparatus by a pipe, Z, which is provided with a stop-cock, H. This stop-cock is opened just as the carrier is being lowered into the dye-liquor contained in the vat, F, and in this way all air is aspirated from the material. After the dye-liquor has been sufficiently circulated through the material, the bell and the carrier are raised from the vat, but owing to the vapours which the bell contains, the hot dyed material is not brought too suddenly into contact with cold air.—P. F. C.



Printing roller. S. Torii. Fr. Pat. 407,725, Oct. 5, 1909.

A hollow glass cylinder provided on its inner surface with projections, is fitted by means of a suitable binding material round a core of cement, the projections being imbedded in the cement to prevent the glass from slipping. The core is provided with an axial opening for the insertion of the central spindle.—P. F. C.

Impermeable and washable linen with a coating of acetylated cellulose and nitrocellulose; Process for the manufacture of ——. Mdme. Roggenkämper. Fr. Pat. 407,952. Oct. 16, 1909.

The linen is first placed in a solution of acetylated cellulose, and after drying, is subsequently given a coating of nitrocellulose.—B. N.

Threads or other analogous substances; Process for giving lustre to ——. A. J. Palmer. Fr. Pat. 408,303, Oct. 26, 1909. Under Int. Conv., Sept. 9, 1909.

The moistened material is compressed strongly at a high temperature, by passing it between strongly-heated cylinders at a speed sufficiently great to leave the material still wet after treatment.—B. N.

Threads; Brilliant —— with metallic lustre. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 408,370, Oct. 27, 1909. Under Int. Conv., March 1, 1909.

The threads, of whatever source, are covered with a solution of cellulose acetate containing bronzes or metallic powders, with or without the addition of colours or pigments. —B. N.

Sizing and impregnating paper, wood and other analogous materials; Process for ——. A. Kuldkepp and H. Graf. Fr. Pat. 408,555, Oct. 28, 1909.

Resin, casein or other analogous albuminoid compounds, or a mixture of resin and casein, either hot or cold, are mixed with a silicate, the alkali of which is neutralised later on by any appropriate reagent. The material is treated with the alkaline mixture, thus giving, with the alkali contained in the silicate, after neutralising as above mentioned, compounds which are insoluble in water. —B. N.

Silk [for dyeing, etc.]; Process for treating ——. M. Stine, New York City. Eng. Pat. 15,658, July 5, 1909.

See Fr. Pat. 404,862 of 1909; this J., 1910, 209.—T. F. B.

Sizing or finishing media; Manufacture of ——. Erste Triester Reisschäl-Fabriks A.-G., and G. Denauer, Trieste, Austria. Eng. Pat. 13,672, June 10, 1909. Addition to Eng. Pat. 29,130, Dec. 30, 1904.

See Addition of June 19, 1909, to Fr. Pat. 349,074 of 1904; this J., 1910, 420.—T. F. B.

Yarns, fabrics, and the like; Process for imparting lustre to ——. A. J. Palmer, London. Eng. Pat. 10,645, Sept. 9, 1909.

See Fr. Pat. 408,303 of 1909; preceding.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphur exports from Sicily. Oil, Paint, and Drug Rep., April 25, 1910. [T. R.]

The exports of sulphur from Sicily during the last two years in tons of 1,000 kilos., were as follows:—

	1908.	1909.
Great Britain	20,119	19,374
France, South	86,896	82,000
France, North	6,933	5,831
Holland	8,775	7,184
Belgium	11,410	16,536
Germany	30,399	28,788
Austria-Hungary	32,501	34,829
Russia	19,060	19,366
Scandinavia and Denmark	27,609	18,703
Spain	6,125	5,928
Portugal	12,894	14,797
Italy (mainland)	60,551	50,602
Greece, Turkey, and Balkans	27,812	21,131
Africa, North	4,670	5,143
Africa, South	4,685	5,741
United States and Canada	18,006	19,491
South America	3,056	2,953
Asia	4,127	5,948
Australia	5,445	3,694
Other countries	1,093	889
Totals	376,066	358,919

Stocks of sulphur in Sicily amounted last year to 640,000 tons. French sulphur consumption is about 195,000 tons, nearly all imported, the output of the three French sulphur mines being only 2,000 tons. Viticulture in France takes about 70,000 tons. 20,000 tons are absorbed in such industries as carbon bisulphide, ultramarine, bleaching cellulose, etc., and the remainder in making sulphuric and sulphurous acids, etc. Sicily supplied all France's foreign sulphur until 1905, but now a large amount comes from the United States.

Sulphur ores; Use of —— for the manufacture of sulphuric acid. G. Oddo. Gaz. chim. ital., 1910, 40, I., 217—312.

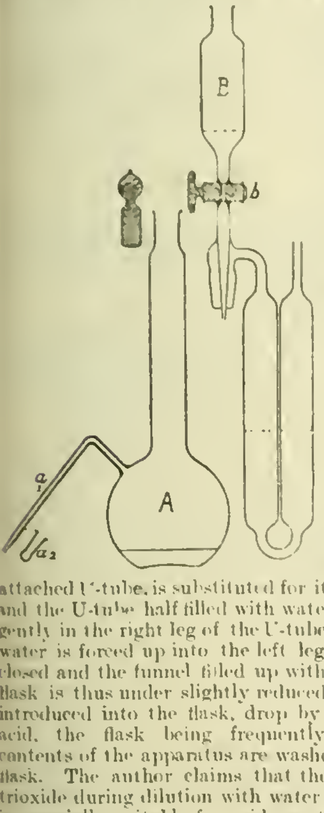
The author has proposed previously (this J., 1908, 222; see also Bruhn, this J., 1909, 1086) the use of Sicilian sulphur ores in place of pyrites for the manufacture of sulphuric acid. In the present papers he describes the analysis of a large number of representative samples of sulphur ores and discusses the origin of the sulphur-bearing deposits, and the relative advantages and disadvantages, from the technical and economic standpoints, of the use of sulphur ores for the production of sulphuric acid. More than one-quarter of the total production of the Sicilian and Italian sulphur-bearing deposits consists of material containing at least as much combustible sulphur (40—50 per cent.) as pyrites, but the sulphur-content is very variable, even in one and the same deposit. For the sulphur ores to compete effectively with pyrites it will be necessary to prepare ore-conglomerates or briquettes of uniform sulphur-content, say 50 per cent. Since the sulphur and the gangue differ in friability, it should be possible by crushing and concentration to separate them into portions richer and poorer in sulphur. Further the finer portions or "sterri" may be heated to the melting point of sulphur without loss and then on compressing and cooling, yield compact masses which can be transported without injury. It will thus be possible by mixing portions of sulphur ore of different sulphur-content to prepare briquettes or conglomerates of any desired richness. The author has constructed a sulphimeter by means of which the sulphur content of an ore can be readily determined with sufficient accuracy by extracting with carbon bisulphide under prescribed conditions and then determining the density of the solution with a special hydrometer. The furnaces previously described (this J., 1908, 222), if suitably modified, may be used for the manufacture of fused sulphur from the portions of the ore too poor to be used for the production of sulphuric acid. By using such furnaces the sulphur dioxide produced during the process may be collected and utilised and the large loss of sulphur which is experienced at present avoided. By selling 600,000 tons of ore-conglomerate (50 per cent. of sulphur) annually, corresponding to about 900,000 tons of sulphuric acid, or a little less than one-quarter of the total production, the whole of the annual over-production of Sicilian sulphur would be disposed of, and also, within 6 years, the whole of the unsold stocks (see this J., 1909, 1086). To place this proposed industry on a sound footing, the cost of railway transport and the port charges for the ore-conglomerate would have to be reduced to the rate which is enforced for such low-grade merchandise as the anthracite of Val d'Aosta, and various modifications in the financial relations between the mine owners and the "Consorzio" would have to be effected. In conclusion it is pointed out that the establishment of works near the sulphur mines for the manufacture of sulphuric acid would probably lead further to the establishment of other works, *e.g.* for the production of superphosphate, etc.—A. S.

Sulphuric acid; Determination of —— and determination of sulphur in pyrites. M. Huybrechts. Bull. Soc. Chim. Belg., 1910, 24, 174—175 and 177—197.

The precipitation of sulphuric acid by barium chloride is best effected in a dilute solution containing 0·7—1·0 per cent. of hydrogen chloride (*i.e.* 20—30 c.c. o 5 N hydrochloric acid for a total volume of 500 c.c.), and, for these quantities of acid, an excess of barium chloride, amounting to 5—7·5 c.c. of a $N/1$ solution, should be used. The boiling solution of barium chloride, diluted to 100 c.c., is rapidly mixed with the boiling sulphate solution, diluted to about 375 c.c., the gas flame being momentarily withdrawn, and the mixture is then boiled down to half its bulk. Next day, the precipitate, which forms slowly, is filtered off and washed (not by decantation); being crystalline, this is readily effected, and the precipitate shows no tendency to "creep"; occluded impurities are reduced to a minimum and are found to balance almost exactly the loss due to solubility. The presence of ammonium chloride, or sodium chloride, even in large quantities, has no appreciable effect on the results. For the determination of sulphur in pyrites, the solution containing sulphuric acid is rendered alkaline with alkali carbonate, and then, after adding hydroxylamine hydrochloride (which should restore the yellow colour to the solution) and warming, to reduce the iron to the ferrous state, the liquid is acidified and the precipitation completed as above. The determination of sulphuric acid with barium chloride according to Lunge's well-known method, is found to give low results.—F. Sodn.

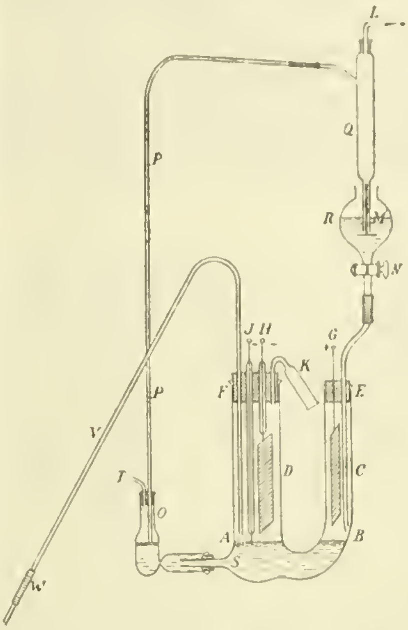
Fuming sulphuric acid; A new apparatus for the determination of sulphur trioxide in ——. G. Finch. Z. ges. Schiess- und Sprengstoffw., 1910, **5**, 167—168.

For weighing off sulphuric acid for analysis the author proposes the use of the apparatus shown in the figure. The small side tube, a_1, sealed into the bulb of the flask, A, has a ground surface at the point, and is provided with a cap, a_2, ground to fit tightly. The flask is dried and weighed, and the point of the side tube is then immersed in the sample of acid. By gentle suction, at the mouth of the flask, from 10—30 grms. of acid are drawn in. The cap is then placed on the side tube and the solid stopper in the mouth of the flask. The flask and its contents are then weighed. The stopper in the mouth of the flask is then removed, and the funnel, B, with attached U-tube, is substituted for it. The tap, *b*, is opened, and the U-tube half filled with water, and then by blowing gently in the right leg of the U-tube, the greater bulk of the water is forced up into the left leg. The stopper is then closed and the funnel filled up with water. The air in the flask is thus under slightly reduced pressure, and water is introduced into the flask, drop by drop, to mix with the acid, the flask being frequently cooled. Finally the contents of the apparatus are washed out into a graduated flask. The author claims that there is no loss of sulphur trioxide during dilution with water and that the apparatus is especially suitable for acids containing over 40 per cent. of sulphur trioxide, where other forms of apparatus, such as the Lunge-Rey pipette, are unsatisfactory.—G. W. McD.



Sodium and potassium hydroxide solutions; Preparation of concentrated —— free from carbonates, by means of electrolysis. W. P. Jorissen and H. Filippo, jun. Z. angew. Chem., 1910, **23**, 726—727.

The apparatus here shown enables solutions of caustic alkalis quite free from carbonates to be prepared. It consists of a U-shaped tube, which is filled with mercury to the level, A, B. The limb, C, is charged with commercial sodium or potassium hydroxide solution, whilst boiled distilled water is placed in the other limb, D, and the apparatus is tightly closed by means of the rubber stoppers, E and F, sufficient space being left for the escape of oxygen. The electrodes, G and H, consist of platinum foil, the cathode, H, being bent at the bottom so as to be parallel with the surface of the mercury. The tube, K, contains soda-lime, whilst J is a platinum wire passing through a glass tube and dipping into the mercury. The tube, L, is connected with a water-pump; M is a valve consisting of a piece of glass rod and an indiarubber disc; and the tap, N, is intended to regulate the slow stream of mercury. When the mercury reaches a certain level in O, some of it is drawn up into P and falls into Q, whence when it reaches a certain weight it passes through the valve, M, into R, and so back into B. The tube, S, connecting the U-shaped tube with the vessel, O, has a constricted end not shown in the figure, whilst the outlet tube, T, is connected with a drying tower containing a little water at the bottom and soda-lime above. At the beginning, and before the mercury is made to circulate, the wire, J, is used as the cathode and G as the anode. Then, when a sufficient quantity of amalgam has been formed, H is used as the cathode, whilst between J and the negative pole of the battery the resistance is so regulated that the current passing through J is only a few tenths of an ampère. In this way the formation of mercurous oxide is prevented. Finally the alkali solution is drawn off through the siphon, V, which is provided with a pinch-cock at W.—C. A. M.



Solubility-curve of potassium iodide in methyl alcohol. M. Centnerszwer. Z. physik. Chem., 1910, **32**, 431—438.

The solubility of potassium iodide in methyl alcohol has been determined from 0° C. to 266° C., the latter being the critical temperature of the saturated solution. The experiments were carried out in sealed tubes at constant volume, but the value for constant pressure would be nearly the same. The solubility gradually increases up to about 68° C., then rises much more rapidly to a maximum at 192° C. and finally falls suddenly till 266° C. is reached. The same type of curve is obtained for other halogen salts with high melting points.—W. H. P.

Metallic carbonyls; Some new ——. L. Mond, H. Hirtz, and M. D. Cowap. Trans. Chem. Soc., 1910, **97**, 798—810.

Further experiments on the action of carbon monoxide, under high pressure and at temperatures up to 450° C., upon finely-divided (pyrophoric) metals (see this J., 1908, 1017) have led to the preparation of a new cobalt carbonyl, $Co(CO)_3$, and carbonyls of molybdenum and ruthenium, and the investigation of these and other carbonyls has given results which are summarised in the table below

They all have very similar chemical properties; they decompose, when heated, into carbon monoxide and the respective metals, which are deposited as mirrors, and they are not attacked by non-oxidising acids, though quickly dissolved by oxidising acids, and especially by aqueous solutions of the halogens, with the evolution of carbon monoxide. They are more or less soluble in the usual organic solvents, but are insoluble in water. The compounds are regarded by the authors as of molecular rather than atomic constitution, resembling in this respect the hydrates of salts. Attempts to prepare the carbonyls of manganese, chromium, tungsten, palladium, and rhodium have been unsuccessful.

Formula.		Sp. gr.	Melting point, C°.	Boiling point, C°.	Vapour pressure.	Colour.	Formation.	Decomposition.
Empirical.	Molecular.							
$Ni(CO)_4$	$Ni(CO)_4$	1·32446 at 14°C	—25	43/751 mm.	238 mm. at 15° C.	Colourless liquid.	Nickel and carbon monoxide at ordinary pressure.	To nickel and carbon monoxide (partial) at 0° C. in a vacuum, and at 50° C. under ordinary pressure.
$Co(CO)_4$	$Co_2(CO)_8$	1·73	51	Decomposes above 52	0·072 mm. at 15° C.	Orange crystals.	Cobalt and carbon monoxide at min. of 40 atmos. and 150° C.	To cobalt and carbon monoxide (complete) above 60° C.; to compound, $Co(CO)_3$, and carbon monoxide between 50° and 60°C.
$Co(CO)_3$	?	?	Decomposed above 60		—	Black crystals.	From cobalt tetracarbonyl at 60° C.	To cobalt and carbon monoxide above 60° C.
$Fe(CO)_5$	$Fe(CO)_5$	1·4664 at 18° C.	—21	102·8/749 mm.	25·9 mm. at 16·1°C.	Yellow liquid.	Iron and carbon monoxide at high press. and temp. From compound, $Fe_2(CO)_9$, by distilling in carbon monoxide.	To compound, $Fe_2(CO)_9$, and carbon monoxide by light; to iron and carbon monoxide by heating vapours.
$Fe_2(CO)_9$	?	2·085 at 18° C.	Decomposed at 100		Not measurable.	Gold coloured crystals.	Iron pentacarbonyl by light. From iron and carbon monoxide by light.	To iron pentacarbonyl and carbon monoxide and iron by heating to 100° C.; to iron tetracarbonyl and pentacarbonyl by heating solution to 95° C.
$Fe(CO)_4$	Very high	1·996 at 18° C.	Decomposed at 140—150		—	Green crystals.	From compound, $Fe_2(CO)_9$, by heating in solution at 95° C.	To iron and carbon monoxide by heating to 150° C. or above.
$Mo(CO)_6$	?	1·96 at 15° C.	Volatilises before melting.		?	White crystals.	Molybdenum and carbon monoxide at minimum of 130 atmos. and 200° C.	To molybdenum and carbon monoxide by heating to above 150° C.
Ru ?	?	?	?		?	Rose to orange.	Ruthenium and carbon monoxide at minimum of 400 atmos. and 300° C.	To ruthenium and carbon monoxide on heating.

—F. Sodn.

Sulphur for agricultural purposes; Proposed method of analysis of ——. A. Bruno. Ann. Falsific., 1910, 3, 129—131.

The three varieties of sulphur used for agricultural purposes are:—(1) Sublimed sulphur or flowers of sulphur; this contains 98·5 per cent. of actual sulphur, 0·5 per cent. of ash, and 0·5 per cent. of moisture; when treated with carbon bisulphide, from 12 to 33 per cent. of the sample remains insoluble. (2) Powdered sulphur; the commercial article should contain at least 97 per cent. of sulphur and not more than 2 per cent. of ash, and 0·5 per cent. of moisture. (3) Precipitated sulphur; this ought to contain within 2 per cent. of the guaranteed percentage of actual sulphur. The moisture should be determined by drying 5 grms. of the sample at a temperature of 90°—95° C. for 2 hours; the quantity of ash present is obtained by igniting the dried portion of the sample. The percentage of free sulphur is found as follows:—1 grm. of the powdered sample is placed in a flask, 10 c.c. of sodium hydroxide solution of 36° B. and 20 c.c. of water are added, and the mixture is boiled for 5 minutes. The particles of sulphur adhering to the sides of the flask are then washed down with a little hot water and the boiling is continued for a further 15 minutes. After cooling, the mixture is diluted to a volume of 100 c.c., filtered, and 25 c.c. of the filtrate are treated at the boiling temperature with 5 successive quantities of 5 c.c. of a solution prepared by mixing 2 c.c. of bromine with 10 c.c. of sodium hydroxide solution (36° B.) and 20 c.c. of water. The mixture is then rendered strongly acid with hydrochloric acid, boiled to expel the liberated bromine, cooled, and diluted to 100 c.c. Forty c.c. of this solution are treated with barium chloride solution and the precipitated barium sulphate is collected and weighed in the usual way; the sulphur is then calculated from the weight of barium sulphate obtained. If sulphates be present in the sulphur their quantity must be determined separately and deducted from the total sulphur found.

It is important to examine flowers of sulphur under the microscope in order to ascertain the presence or absence of powdered sulphur. Mounted specimens of the two varieties, or of mixtures of the same, should be examined at the same time and the best results are observed when the preparations are mounted in a mixture of glycerol and acetic acid.—W. P. S.

Sulphur for agricultural purposes; Analysis of ——. E. Collin. Ann. Falsific., 1910, 3, 132—138.

Although contradictory opinions are held as regards the efficacy of different forms of sulphur as insecticides, it is important that means should be available for detecting the presence or absence of any one variety of sulphur in another specimen, as the commercial articles have different prices. A microscopical examination of a sample is of considerable value for this purpose, and if a mixture is detected, some indication of the quantity of the respective components may be ascertained by comparison with mixtures containing known amounts of the different kinds of sulphur. A determination of the quantity of matter insoluble in carbon bisulphide affords some indication of the purity of a sample of flowers of sulphur; when freshly prepared, about 33 per cent. of the sulphur remains insoluble in this solvent, but the solubility increases with time, so that not more than 12 per cent. may be insoluble. A sample of flowers of sulphur yielding less than 12 per cent. of sulphur insoluble in carbon bisulphide, probably, but not necessarily, contains one of the other varieties of sulphur.—W. P. S.

PATENTS.

Burner-gases; Apparatus for treating ——. J. B. F. Herreshoff, Assignor to General Electric Co., New York. U.S. Pat. 955,067, April 12, 1910.

THE apparatus comprises a stand-pipe for burner gases, provided with an inlet and outlet for the gases, and having an annular or other form of liquid inlet located near the top, above the gas outlet and adjacent to the inner surface of the pipe, so as to produce a flowing film therein: there is a liquid outlet at the bottom and a gutter for carrying the liquid past the opening through which the gases pass, and means may also be provided for passing a cooling fluid along the outer surface of the stand-pipe, the fluid moving from both ends towards an intermediate point. —F. SODN.

Sulphuric acid; Process of manufacturing —— by means of towers. Chem. Fab. Griesheim-Elektron. First Addition, dated Oct. 4, 1909 (under Int. Conv., April 15, 1909) to Fr. Pat. 406,641, Aug. 30, 1909 (this J., 1910, 487).

THE towers, in which sulphurous acid is oxidised, are maintained between the temperatures of 35° and 65° C., thus preventing the escape of ineffective nitric acid through distillation.—O. R.

Lime; Method of hydrating ——. L. T. Leet, Reading, Pa., Assignor to T. Reid, New York. U.S. Pat. 955,814, April 19, 1910.

LIME is treated with a slight excess of water in a closed vessel, the water being admitted slowly and the excess kept, by the heat of reaction, in the form of superheated steam, under high pressure, until all the lime is hydrated, when the still superheated steam is discharged; during hydration the material is agitated, by subjecting it, for instance, to the grinding action of more durable bodies. —F. SODN.

Cuprammonium solution; Process for producing ——. V. E. Mertz, Manchester. U.S. Pat. 954,981, April 12, 1910.

A small percentage of an organic hydroxy-compound, such as potassium sodium tartrate, and a little ammonium persulphate or other oxidising agent are added to a cuprammonium solution, with the object of rendering it stable.—F. SODN.

Barium carbonate; Processes for the manufacture and purification of ——. Soc. pour l'Utilisation de l'Air et de ses Dérivés. Fr. Pat. 408,357, Jan. 21, 1909, and First Addition thereto, dated Jan. 22, 1909; also Fr. Pat. 408,358, Jan. 21, 1909.

(1). BARIUM sulphate (natural or artificial) is treated, under pressure, with a large excess of potassium carbonate solution. A mixture of finely divided barium sulphate (100 parts), potassium carbonate (150—200 parts), and water (about 200 parts) is, for example, heated for ½—1 hour in an autoclave provided with a stirrer, a pressure of about 5 atmospheres being maintained. A product containing 97 per cent. of barium carbonate is thus obtained, and the potassium carbonate, after separating most of the potassium sulphate, may be used again. 2). Sodium carbonate may be substituted for potassium carbonate, a larger excess being used. 260 parts of sodium carbonate are found to be equivalent to about 175 parts of potassium carbonate. (3). Barium carbonate, obtained as above or in other manner, may be purified by treating it first with a boiling solution of ammonium chloride and then, after freeing the solution of barium chloride obtained, from all soluble impurities which are capable of giving an insoluble carbonate (by adding barium hydroxide, for instance), precipitating the barium as carbonate again, by bubbling through the cold solution the mixture of carbonic acid and ammonia produced during the first stage of the process; the ammonium chloride is thus regenerated.—F. SODN.

Lead sulphate residues; Treatment of —— with a view to their industrial utilisation. R. Lhuilier and A. Marion. Fr. Pat. 408,430, Jan. 22, 1909.

THE impure lead sulphate obtained as a residue in various industrial processes is washed, to remove soluble impurities, and treated with alkali or other carbonates or bicarbonates; it is thus converted into lead carbonate which, after careful washing, is treated with hydrochloric or nitric acid, so as to obtain a solution of the corresponding lead salt in a pure state; this is then crystallised as such or converted into lead chromate.—F. SODN.

Ammonium nitrate; Process for the manufacture of ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 408,506, Nov. 2, 1909. Under Int. Conv., Nov. 4, 1908.

SOLUTIONS of calcium nitrate and ammonia are mixed, in any desired proportion, and the mixture is treated with carbonic acid; calcium carbonate is thereby precipitated and ammonium nitrate obtained in solution.—F. SODN.

Ammonium chloride; Process of manufacture of —— making use of sodium or potassium bisulphate. A. Nouvelle. Fr. Pat. 408,814, Nov. 10, 1909.

SODIUM bisulphate is neutralised by ammonia, in a vessel fitted with a stirrer, and (if preferred, after separating the sodium sulphate by crystallisation) the solution is treated with sodium chloride, so as to convert the ammonium sulphate into ammonium chloride; the sodium sulphate is then separated from this salt by fractional crystallisation. Potassium bisulphate may be utilised in a similar manner.—F. SODN.

Hydrogen sulphide from gases; Process for removing ——. K. Burkheiser. Ger. Pat. 220,632, Feb. 9, 1909.

THE gas containing hydrogen sulphide is divided into two portions in the proportion 1 : 2. The smaller portion is mixed with the requisite quantity of oxygen (or air), passed over a contact substance such as ferric oxide, in order to oxidise the hydrogen sulphide to sulphur dioxide, and then mixed with the larger portion of the gas, whereupon the hydrogen sulphide and sulphur dioxide interact to form sulphur and water. Or the smaller portion of the gas and a current of air may be passed alternately over the ferric oxide, the air being subsequently washed to remove sulphur dioxide, and the sulphurous acid solution thus obtained used for removing hydrogen sulphide from the larger portion of the gas. By using two separate chambers containing ferric oxide and two washers, the process can be made continuous. In another form of carrying out the process, the whole of the gas is passed over the ferric oxide for a definite time and then passed for twice this length of time through a washer containing the sulphurous acid solution obtained by washing the air used for revivifying the spent ferric oxide.—A. S.

Air; Continuous process of liquefying —— and separating it into its elements. E. Jänecke. Fr. Pat. 407,852, Oct. 12, 1909.

AIR, previously cooled by the issuing, cold gases, is compressed in tubes surrounded by the boiling liquefied air, and by the boiling liquefied oxygen produced in a later stage of the process. From these tubes it passes, at atmospheric pressure, into a receiver surmounted by a fractionating apparatus, and the cold produced by its ebullition serves to liquefy a further quantity of air. The latter is admitted through narrow tubes, fixed inside the first-mentioned tubes, into a worm condenser situated inside the receiver.—O. R.

Sulphur; Process and apparatus for producing molten ——, which can be cast into moulds. A. Boude et Fils. Fr. Pat. 408,512, Nov. 2, 1909.

SULPHUR is distilled in a cast iron retort, and the vapours are passed through a cast iron pipe into a cast iron condenser, which is surrounded by a fire space. The latter communicates with the distilling furnace, and the molten, condensed sulphur, passes from the first condenser into a second condenser, from which it flows into the moulds. The first condenser also contains a hopper for admitting solid sulphur, which melts in the molten, condensed material.—O. R.

Sulphur and sulphuric acid from gases containing sulphuretted hydrogen and sulphur dioxide; Process of obtaining ——. W. Feld. Fr. Pat. 408,253. Aug. 30, 1909. Under Int. Conv., July 13, 1909.

SEE Eng. Pat. 3061 of 1909; this J., 1910, 352.—F. SODN.

VIII.—GLASS; CERAMICS.

Glass; Microchemical tests for the recognition of different kinds of ——. F. Mylius and E. Groschuff. Sprechsaal, 1910, 43, 217—218.

THE properties of any particular kind of glass depend upon its composition, which can be quickly determined, with a few milligrams of material, by the following scheme of microchemical analysis. If quartz glass is moistened with an ethereal solution of iodeosin, the solution, washed off with ether, remains colourless, whereas the solution from a glass containing bases is coloured red. A drop of a 10 per cent. solution of hydrofluoric acid immediately produces cloudiness in glasses rich in earthy or heavy metal oxides, but not in glasses poor in metals. Boron, sodium, and potassium can be recognised by the green, yellow or violet colour imparted to a Bunsen flame, when a platinum wire moistened with the hydrofluoric acid solution of the glass is introduced into it. Lead and antimony can be recognised by the colour produced on addition of sulphuretted hydrogen water to the solution. Without breaking the glass object, a thin layer, say 0·1 mm. thick, is dissolved off with a drop of 10 per cent. hydrofluoric acid, and washed into a platinum capsule with 3 c.c. of water, neutralised with sodium bicarbonate, and warmed till a precipitate separates. The liquid is decanted and evaporated with dilute hydrochloric acid. The insoluble residue consists of silica, and lead or antimony may be detected by sulphuretted hydrogen, and barium by dilute sulphuric acid. After filtration, a drop of potassium ferrocyanide will precipitate any zinc, and show the presence of any trace of iron. Aluminium, calcium and magnesium may be detected in the ordinary way by ammonia, oxalic acid, and sodium phosphate. In order to preserve the article as much as possible from the attack of the hydrofluoric acid, important parts may be coated with wax, or in some cases a hanging drop of the reagent can be made to attack a sufficient surface by turning the object round. The resisting power of a glass can be easily measured by the iodeosin method (this J., 1908, 899). Boric acid glasses are used specially for physical and chemical apparatus, and in modern times the lime is often replaced by baryta, zinc oxide or alumina, which increases the resistance.—W. C. H.

Glass; The passage of vapours through ——. C. Zenghelis. Z. physik. Chem., 1910, 32, 425—430.

THE author has repeated his observations on this subject which have been criticised by Stock and Heinemann (this J., 1909, 657) and others. He still finds that silver foil enclosed in a vessel of thin glass from which the air has been partially exhausted, is attacked when the vessel is surrounded by another containing iodine crystals and closed with paraffin wax. He shows that the effect cannot be attributed to impurities in the atmosphere of the surrounding vessel, or to impurities in the paraffin. He also gives the data of five experiments, one of which showed a decided loss in weight (15·7 mgrms.) of a vessel containing 0·8 c.c. of bromine, after standing 117 days. The facts that the action on the silver is local, and that the phenomenon varies with different vessels, lead the author to assume the existence of invisible pores through which gases may pass, as a frequent occurrence in thin glass vessels. —W. H. P.

Clay; The colloid matter of —— and its measurement. H. E. Ashley. U.S. Geological Survey, Bulletin No. 388.

CLAYS are defined as mixtures of silicates of aluminium, (among which, kaolin, $Al_2O_3.2SiO_2.2H_2O$ is the most characteristic), iron, the alkalis and the alkaline-earths. Most of the grains have a colloid coating which is mainly of silicate constitution, but may consist partly of organic colloids, of iron, manganese, and aluminium hydroxides, and of hydrated silicic acid. In plastic clays, the colloid matter is in excess, and in "lean" clays, the granular matter. The colloid matters in clay may be artificially increased by adding gallotannic acid, gum, gelatin or other typical colloids. The presence of colloids in clay is supported by the fact that the plasticity is improved by the decomposing action of water (weathering), wet grinding, and pugging. The addition of an electrolyte causes fine clays to settle out from a liquid, and allows of the clear filtration of the liquid. Certain plastic bodies consist of more or less granular material coated and held together by viscous substances, and plasticity may be said to depend upon a proper ratio of the granular material to the viscous suspension medium. Many clays have the power of adsorbing considerable amounts of water, before passing into a pasty condition, and as the admixed materials in clays, *e.g.*, quartz, felspar, etc., adsorb but small quantities of water, the great adsorptive power is ascribed to the inorganic and organic colloids. Since colloids have the power of adsorbing dyes, this property has been proposed as a basis for measuring the amount of colloid matter present in a specimen. Fifty grms. of clay are suspended in 1000 grms. of a 0·3 per cent. solution of a dyestuff (malachite-green). After settling, a portion of the supernatant liquid is pipetted off, and the amount of dye left in it estimated colorimetrically. Assuming that equal quantities of colloid matter adsorb equal quantities of dyestuff it is easy to calculate out from the data acquired, the relative amounts of colloid matter in any number of clays. Such figures may be compared with any standard chosen (in these experiments, Tennessee Ball Clay, No. 3). The results of a number of observations of some physical properties of clays are given in the table. The surface-factor, A, is a number representing the total area of all the particles in a unit weight of clay, and is thus a measure of the fineness of the material. Column D gives the surface concentration of the colloids, obtained by dividing the relative colloids by the surface factor. Column E gives the values of the specific air-shrinkage, obtained by dividing the linear air-shrinkage by the relative colloids. Since ordinarily the shrinkage (B) and the surface factor (A) are both highest with a high content of colloids, the expression $\frac{B}{A}$ is approximately a constant, and plasticity is mainly due to the relative colloids. Plasticity is defined as the product of the deformability by the force resisting deformation.

Description.	Not absorbed	Jackson Purdy surface factor.	Air shrinkage.	Fire shrinkage. Seger cone 8.	Relative colloid content.	Surface concentration of colloids.	Specific air shrinkage of colloids.	Deformability.	Plasticity.
	50 g. Subst., 1000 g. water, 3 g. dye-stuff.	A.	B.		C.	D. $\left[= \frac{C}{A}\right]$	E. $\left[= \frac{B}{C}\right]$	F. $\left[= D \times E = \frac{B}{A}\right]$	G. $\left[= C \times F = \frac{C \times B}{A}\right]$
Fuller's earth, Elmer and Amend	0·00351	121	25	23	—	—	—	0·2066	—
"Lone Star," Texas, "kaolin"	0·01075	123	12·0	12·8	154	1·25	0·0780	0·0977	10·34
Potters' Supply Co., Tennessee No. 3 Ball	0·03608	184	8·5	10·5	100	1·541	0·0850	0·0462	4·62
Pfistor and Wilstl, Lischwitz, Bohemia ..	0·0680	—	8·5	10·8	97·5	—	0·0872	—	—
Excelsior Ball Clay Co., Sagger clay	0·2288	172	9·7	7·9	74·5	1·433	0·1301	0·0564	4·20
Wilhelm Priem, Zettlitz kaolin	0·938	191	7·9	6·3	32·3	1·1692	0·241	0·0413	1·335
J. Poole, B.B. English china clay	1·140	198	7·0	11·2	24·7	1·1246	0·283	0·0353	0·873
Golding, Sons and Co., Glaze felspar	1·456	—	—	melts	—	—	—	—	—
Potters' Mining Co., "Flint"	3·000	126	—	—	—	—	—	—	—
Diamond Clay Co., Fireclay (Ohio)	1·058	59	0	2·0	30·4	0·516	0	0	0

—W. C. H.

Clays and loams; The plasticity and cohesion of ——. A. Atterberg. Chem.-Zeit., 1910, **34**, 369—371; 379—380.

The author has detected six different conditions of plasticity in a clay as the water decreases in amount from that required for a thin paste to dryness. For the purposes of soil analysis the clays examined were divided into the following classes of plasticity, according to the amounts of sand (the grains of which were from 0·3 to 0·1 mm. diameter) which could be added without destroying plasticity:—

1st class. 1 part of clay to 2 parts of sand.
2nd ,, 1 ,, ,, 1 ,, ,,
3rd ,, 1 ,, ,, 0 ,, ,,
4th ,, Non-plastic clays.

Only clays with little or no humus are found in the first of these classes: clays rich in humus take up much larger quantities of water. The highly plastic clays acquire a very sticky consistence, and are difficult to work in clay machinery. Soils with strong cohesion are difficult to work, and these with a medium amount are best for agricultural purposes. There is no satisfactory method of measuring the amount of cohesion, but the following preliminary method was adopted, namely, the determination of the load, in kilos., required to split cubes 2×2×2 cm., dried at 110° C., with the edge of a steel knife. The samples, after treatment with 24 per cent. hydrochloric acid for 1 hour at 100° C., and with weak caustic soda solution for 3 minutes at 50° C., were separated by elutriation into four grades of particles, coarse sand, fine sand (0·2—0·02 mm.), dust sand (0·02—0·002 mm.) and finest material (less than 0·002 mm.), and were arranged in classes of texture according to the relative amounts of the various sized particles, thus:—

I.—More than 50 per cent. of finest material.
II.—From 50—33 ,, ,, ,,
III.— ,, 33—16 ,, ,, ,,
IV.—More than 50 ,, ,, "dust sand."
V.— ,, 50 ,, ,, fine sand.
VI.—Large amount of coarse sand.

From a number of clays and loams examined it appears that the plasticity decreases approximately as the fine material diminishes, and the cohesion decreases with decrease in plasticity. Loams and sandy soils show low cohesion values. Clays of the first class of plasticity are free from humus, and fall into the first class of texture, but clays rich in humus, of the first class of texture fall into the second and third classes of plasticity. Clays of the third class of texture, which are poor in humus fall into the third class of plasticity, but those richer in humus fall into the class of non-plastic loams, and also have low cohesion values.—W. C. H.

Richter's law. A contribution to the knowledge of the effect of fluxing materials. R. Rieke. Sprechsaal, 1910, **43**, 198—199; 214—216; 229—232.

From a review of the work of Richter, Cramer, and others it is shown that Richter's law that equivalent quantities of fluxing oxides have the same influence on the fusibility of clays of equal alumina- and silica-content cannot be regarded, as Ludwig suggested, as a special case of Raoult's law. The effects of the addition of equal molecular amounts of the oxides, CaO, SrO, BaO, MgO, BeO, FeO, MnO, K_2O, Na_2O, and Li_2O were determined upon the melting point of pure kaolin, taken as representing a compound in which the ratio of Al_2O_3 to SiO_2 is as 1 : 2, and also upon the melting points of other alumina-silica mixtures, in which the silica content was varied. It was found that the effects were not equal, and no law of uniformity could be deduced for all the oxides tried. Still, in the case of the group, CaO, SrO, BaO, when equal molecular amounts were employed, the oxide with the lowest molecular weight lowered the melting point most, and that with the highest molecular weight lowered it the least, and a similar regularity seemed to exist in the case of the alkali group. The melting point determinations of mixtures which ranged in composition from $Al_2O_3.2SiO_2.0{\cdot}25RO$ up to $Al_2O_3.2SiO_2.3{\cdot}0RO$, showed a distinct difference between the oxides, CaO, SrO, BaO, on the one hand, and the oxides, MgO, BeO, FeO, MnO, on the other. The oxides of calcium, strontium, and barium form double silicates of the type, $Al_2O_3,2SiO_2,1RO$, comparatively easily, whereas this is not the case with the other oxides used in the experiments. Compared with corresponding amounts of magnesia, increasing amounts of beryllia depress the melting point of mixtures much less; the most fusible mixtures in each case correspond approximately with the formula, $Al_2O_3,2SiO_2,2RO$. Similarly manganous oxide depresses the melting point much more than ferrous oxide; in both cases, owing to the strong reducing atmosphere of the furnace, the metals were present in the lower state of oxidation. With an alumina-silica ratio of 1 : 2, the composition of the most easily fusible mixtures, containing the oxides, CaO, SrO, BaO, MgO, FeO, and MnO, ranges between $Al_2O_3,2SiO_2,2RO$ and $Al_2O_3,2SiO_2,2{\cdot}5RO$.—W. C. H.

Porcelain tiles; Manufacture of ——. H. Eismann. Tonind.-Zeit., 1910, **34**, 537—538.

Porcelain tiles are made by dry-pressing, precisely like bricks or other tiles. The chief consideration in their manufacture is that of cost, but by using the poorest clays and broken porcelain in his raw materials, the author was able to make his mixing at a cost of 10s. a ton—a price which may be further reduced by substituting chalk and felspar-sand for felspar. The body had the composition: quartz, 48·5; felspar, 15·5; clay-substance, 36·0 per cent. An engobe was used composed of 70 parts of quartz and 30 of clay-substance. The glaze had the composition of Seger cone 4—$0{\cdot}3K_2O$, $0{\cdot}7CaO$, $0{\cdot}5Al_2O_3$, $4SiO_2$—broken porcelain again being used as a raw material. The manufacture of these tiles is said to be remunerative.—H. H. S.

Transmission of electricity through glass. Le Blanc and Kerschbaum. *See* XI.

Determination of small quantities of lead. Vernon Harcourt. *See* XXIII.

Patents.

Window glass; Manufacture of ——. Soc. Anon. des Verreries et Manufacture de Glaces d'Aniche, France. Eng. Pat. 2762, Feb. 3, 1910. Under Int. Conv., Feb. 4, 1909.

In a furnace for "spreading" window glass, working with two spreading slabs, a third carriage and operating slab are introduced, so that, as soon as the spreading of a sheet of glass on one slab is completed, this slab may be replaced by another, on which a fresh sheet of glass can be spread, whilst the previous sheet is being brought to the straightening or trimming compartment and is straightened or trimmed therein. Two workmen may thus be employed instead of one, the first being constantly engaged in spreading and the second in straightening; the output is thereby increased by 50 per cent., and the systematic and rapid circulation of the stone slabs ensures a more even temperature and, therefore, a better quality of work. Existing furnaces may be adapted without substantial alteration in construction, it being sufficient to arrange for a suitable distribution and regulation of the gas supply inlets.—F. Sodn.

Glass-annealing furnace. R. H. Miller. Fr. Pat. 407,854, Oct. 13, 1909.

The furnace is divided by means of vertical partitions into a series of chambers, through which the glass articles are carried successively in a continuous manner by the help of an endless chain conveyor. The latter passes over a series of cog-wheels, which are set near the bottom of one chamber and near the top of the next chamber throughout the whole series, the return portion of the chain passing in a space between the roof of the chambers and the top of the furnace, and between the first and last chamber walls and the outer walls of the furnace, respectively. The chain carries a series of buckets, in which the glass articles are placed, and its motion is such that each bucket moves periodically into the position vacated by the one in front of it. The hearth is situated underneath that end of the furnace, where the glass articles are introduced, and the latter are subjected first to progressively increasing, and then to progressively decreasing, temperatures. The chambers communicate by means of valves, which regulate the admission of hot gases into the various compartments, and windows are provided for the withdrawal of the annealed material.—O. R.

Quartz; Method of forming semi-liquid ——. W. Burckhardt, Biebrich on Rhine, Germany. Eng. Pat. 28,391, Dec. 6, 1909.

One or more radial, longitudinal dividing plates of carbon, carborundum, asbestos or the like, are inserted into the electric furnace in addition to the electrical heating resistance, so that the mass of semi-liquid quartz is divided into several parts. The plastic mass of semi-liquid quartz is withdrawn from the furnace, together with the electrical heating resistance and dividing plates, and when these have been removed from the mass, the separated block may be rolled out on a table or the mass may be forced into a mould of any shape and after congealing, the body can be divided by cutting or hammering.—W. C. H.

IX.—BUILDING MATERIALS.

Effect of sewage and sewage gases on Portland cement concrete. Chambers. *See* XIXb.

Patents.

Refractory bricks, furnace linings, cement and the like; Manufacture of ——. G. C., A. W., and G. E. Fludder, Colchester. Eng. Pat. 113, Jan. 2, 1909.

A solution of aluminium sulphate, in which finely ground magnesium silicate may be suspended if desired, is used as a binding material for silica, bauxite, magnesite, chrome ore, etc., in the manufacture of refractory bricks, moulded blocks, furnace linings and the like. The articles are dried and then burnt in order to sinter the aggregate and yield hard products.—W. C. H.

(1) *Abrasive material and method of making it. Composition of matter containing oxides of* (2) *aluminium and titanium, and* (3) *aluminium, silicon, and titanium, and method of making same.* L. E. Saunders, Niagara Falls, N.Y., Assignor to Norton Co., Worcester, Mass. U.S. Pats. 954,766, 954,767, and 954,768.

(1.) The abrasive material is made by melting in an electric furnace a mixture containing upwards of 60 per cent. of aluminium oxide, from 1 to 8 per cent. of titanium oxide, and from 2 to 20 per cent. of iron oxide, the oxides of iron and titanium being present in the proportion and amount required to impart a blue or blue-black colour to the mass. (2.) The composition is a homogeneous molten material consisting essentially of oxides of aluminium and titanium, and substantially free from oxides of iron and silicon, and is characterised by its hardness, toughness, and massive structure. (3.) The composition is a homogeneous molten product consisting essentially of oxides of aluminium, silicon and titanium, and substantially free from iron oxide, and is characterised by its hardness, toughness, and adamantine character. It is produced by fusing in an electric furnace a charge consisting essentially of the oxides required, and adding to the charge a reducing agent in sufficient quantity to eliminate substantially all of the iron together with a part only of the silica.
—W. C. H.

[*Fused alumina.*] *Electric furnace product, and method of making same.* G. N. Jeppson, Worcester, Mass., and L. E. Saunders, Niagara Falls, N.Y., Assignors to Norton Co., Worcester, Mass. U.S. Pat. 954,808, April 12, 1910.

Alumina, containing less than 5 per cent. of fluxing impurities, is melted in an electric furnace between graphite electrodes, and allowed to solidify to a crystalline mass, which is crushed and graded, and the grains are then bonded together with some bonding agent having sufficient strength to hold the grains together.—W. C. H.

[*Aluminous bonded article and method of making same.* G. N. Jeppson, Assignor to Norton Co., Worcester, Mass. U.S. Pat. 954,809, April 12, 1910.

Aluminous material containing reducible oxides is melted in an electric furnace under reducing conditions, and the product, after being crushed, is roasted, and mixed with a binding flux in order to form the particles into an object bound together by the re-oxidised impurities and the flux.
—W. C. H.

Stone; Manufacture of artificial ——. E. Gothan and F. Schneider. Fr. Pat. 408,058, Oct. 18, 1909.

In the manufacture of artifical stone from exothermic mixtures, more especially mixtures of magnesia and magnesium chloride, means are provided for cooling the compositions in the act of setting. This may conveniently be done by means of a system of tubes, through which cold water is flowing, the tubes being inserted, if possible, into the body of the setting mass, and afterwards withdrawn. If this is not admissible, the cooling must be external only, either by the help of water flowing through tubes or by any other suitable means.—O. R.

Refractory articles of fused alumina (artificial or natural corundum); Process for the preparation of ——. Gebr. Siemens und Co. Ger. Pat. 220,394, Sept. 26, 1907.

The fused alumina is mixed with glyceroboric acid, formed into shape, and burned. On burning, the glycerin of the glyceroboric acid is first expelled, then at a higher temperature the mass sinters, and the boric acid is volatilised completely or nearly so.—A. S.

Wood; Substances for preserving ——. A. Möllers Söhne. Ger. Pats. 219,893 and 219,912, March 11, 1909.

Dinitro-hydrocarbons and dinitrophenols, containing two nitro-groups in each benzene nucleus, are claimed as wood preservatives. The hydroxyl group of the dinitrophenol is neutralised by means of an organic base. Other preservatives may be used in conjunction with these nitro compounds, which are stated to be more efficient than the mono- or trinitro derivatives.—T. F. B.

(1) *Concrete,* (2) *manufacture of building-bricks, and* (3) *composition of matter for road or street bricks.* H. D. Phillips, Indianapolis, Ind. U.S. Pats. 954,692, 954,693, and 954,694, April 12, 1910.

The composition consists of cement, sand, arsenious acid, mica crystals, blue vitriol, and sulphur in proportions given.—W. C. H.

Portland cement; Quick-setting ——. Thorrand, Durandy et Cie. Fr. Pat. 408,060, Oct. 15, 1909.

The addition of 1 to 3 per cent. of dry ferrous sulphate to Portland cement is claimed as forming a mixture, which sets rapidly and attains great strength.—O. R.

Wood; Preserving ——. W. B. Chisolm, Charleston, S.C. U.S. Pat. 955,762, April 19, 1910.

See Eng. Pat. 5908 of 1909; this J., 1909, 984.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Report on dangerous or injurious processes in the smelting of materials containing lead and in the manufacture of red and orange lead and flaked litharge. E. L. Collis. [Cd. 5152.] Price 6d.

This report contains the following chapters:—(1) Incidence of plumbism in the smelting of metals. (2) Processes in lead smelting. (3) Processes in zinc smelting. (4) Statistics of plumbism in some Continental lead smelting works. (5) Manufacture of red and orange lead. (6) Manufacture of flaked litharge. (7) Effects of remedial measures. (8) Recommendations. Appendices give some of the French and German regulations for the zinc and lead industries.

Cast irons and carbon steels; Constitution of ——, *from the practical standpoint.* D. M. Levy. Iron and Steel Inst., May, 1910. [Advance copy.]

The author regards cast irons and carbon steels as primarily a single series of iron and iron carbide alloys, produced by the action of carbon upon molten iron and the subsequent solution, in the molten metal, of the carbide so formed. With carbon steels, the first result of the solidification is the formation of a meta-stable product in which the whole of the carbide exists in the state of solid solution, the ultimate and stable form consisting of mutually insoluble carbide and α-iron. Similarly, with cast irons, solidification first results in a meta-stable system of iron and iron carbide, which tends to change into the stable iron-graphite system. By the acceleration or retardation of this change from the meta-stable to the stable form, (such as occurs in the thermal treatment), the properties of either material may be so controlled as to render it suitable for any specific purpose. The molecular weight of iron carbide (Fe_3C) being 15 times that of carbon, the percentage of combined carbon existing in a cast iron has a greater significance when considered as carbide of iron; and this circumstance probably affords an explanation of the fact that apparently small variations in the combined-carbon content of a cast iron are accompanied by marked differences in the properties of the metal. In considering the effect of foreign elements on the condition of the carbon, silicon is regarded as tending to accelerate, and sulphur and manganese (when separate) as tending to retard, the change from the meta-stable to the stable condition; while manganese and sulphur, when present in such proportions as to form MnS, have no influence, being similar to phosphorus in this respect.—W. E. F. P.

Steel; Critical points of ——, *their method of determination and value.* G. W. Sargent. J. Franklin Inst., 1910, **169**, 253—271.

The methods in general use for determining the recalescence points in steel are enumerated and discussed in the first portion of the paper. By the auto-photographic method of Saladin-Le-Chatelier, a complete heating and cooling curve was obtained in less than two hours, the examination of which readily located, for practical purposes, the hardening and annealing temperatures necessary to make the steel possess its desired properties, and for this reason the author considers that this method is the most suitable for use by steel manufacturers, especially as some specifications require that the Ac^1 point should be determined, and that tensile test specimens should be cut from samples annealed to 10°—20° C. above this point. The paper is illustrated by several curves and microphotographs, the relation between the structure and the critical temperatures being discussed.—A. H. C.

Tool-steels; Hardening of carbon and low tungsten ——. S. N. Brayshaw. Inst. Mech. Eng., April 15, 1910. [Advance copy.]

The paper records the results obtained from six carbon tool steels, four of which contained about 0·5 per cent. of tungsten. Their analyses are given in the following table.

	W1	W2	W3	W4	A1	A2
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Carbon	1·18	1·16	1·19	1·15	1·16	1·14
Silicon	0·18	0·10	0·23	0·21	0·07	0·09
Manganese ..	0·42	0·42	0·37	0·28	0·31	0·40
Sulphur	0·023	0·023	0·012	0·012	0·018	0·018
Phosphorus ..	0·014	0·014	0·014	0·011	0·011	0·014
Tungsten	0·42	0·48	0·57	0·50	—	—

The investigation was devoted to the elucidation of problems met with in the daily practice of workshop hardening, but working on scientific lines under practical conditions. The bars were heated in the author's salt-bath furnace, containing about 130 lb. of fused melt which was as fluid as water at 680° C. (1256° F.). They were placed on a tray which by being alternately raised and lowered at regular intervals kept the bath in circulation. Two furnaces were used, the pyrometer of one being connected to a Whipple indicator; the range of temperature 750°—850° C. was represented by 17 in. on the scale. The pyrometer of the other was connected to a Callondar recorder, the same range being represented by 5½ in. on the recording sheet. The pyrometers were calibrated by a copper-tin alloy melting at 738° C., and containing 68·2 per cent. of copper and 31·8 per cent. of tin. Heating and cooling curves of the steels were taken. It was shown (1) that on heating, the point Ac 1.2.3. occurs at 738° C., and is unaltered by variations in the rate of heating. (2). That this point is the hardening point of the steel, and the hardening change does not occur at even two or three degrees below this temperature, even if the steel be heated for two hours at a time. The influence of the maximum temperature, and the rate of cooling upon recalescence was also determined. It was shown (1), that about the temperature 880° C. (1616° F.), the subsequent recalescence was lowered and rendered less susceptible to alteration by the rate of cooling. (2) That the recalescence of low tungsten steels takes place gradually at 731° C. (1348° F.), and readily at 725° C., and if the metal is heated to above 966° C. this temperature is lowered to 709° C. it being more difficult for the steel to change into the post-recalescence condition. A large number of test-bars were also prepared, and having been heated to various temperatures in one furnace were rapidly transferred to another furnace at either 731° C. or 725° C. for various times, and then quenched. Their hardness was then determined by means of the scleroscope and by the Brinell method. It was shown that there is a post-recalescence condition of low-tungsten steel reached by first heating above Ac. 1.2.3. and then immediately soaking between Ac. 1.2.3. and Ar. 3.2.1. If the steel be quenched from this condition it is softer than the same steel which has been quenched after merely soaking at this lower temperature without undergoing the previous higher heat. Very great importance is attached to this higher change-point of 880° C. (1616° F.). In conjunction with R. Hadfield a series of bending tests were carried out on steel of a similar composition, and of which the heating and cooling curves are given. A complete description of these bars is given, and the effect of heating to various temperatures on the bending tests is fully detailed, it being concluded (1) That the hardening point can be located with great accuracy, and coincides with the point Ac 1.2.3; (2) That after the temperature of the steel has been raised 20° or 30° C. above the hardening point, the hardness of the steel is lessened by further increases in temperature; (3) That there is a change point at about 880° C. (1616° F.), among the indications of which is the shortening of bars hardened in water from temperatures below this point, whereas they lengthen if this temperature be exceeded. Heating to various temperatures for various lengths of time showed (1) that prolonged soaking for 120 min. at the temperature at which the hardening change is half-produced in 30 min. does not complete the change; (2) prolonged soaking at 760° C. (1400° F.) has a slightly injurious effect, but does not affect the hardness; (3) at 810° C. (1490° F.) a great degree of hardness is produced in a short time, and 30 min. soaking impairs the hardness; (4) prolonged soaking at 880° C. seriously impairs the hardness, and a specially high degree of hardness is produced by soaking at 880° C. for a very short time, and even 7½ min. is long enough to seriously affect the hardness. The temperature of the brine also affects the hardness: bars quenched at 5° C. (41° F.) are harder than those quenched at 24° C. (75° F.), and those at 51° C. (124° F.) are decidedly soft. The effect of various annealings on the subsequent hardness is also fully dealt with, as well as the effect of subsequent soaking, after heating to the hardening temperature, both on the maximum stress and elastic limit, as well as with reference to the lengthening and shortening of the bars. Very good results are obtained as regards maximum stress and elastic limit by a very short soaking, first at 880° C. (1616° F.), and then at a temperature near the hardening point. If the first furnace be sufficiently high it is easy either by variations in the temperature of the two furnaces, or variations in the times therein, to arrive at a treatment in which the bars neither lengthen or shorten. The question of hardening cracks is also dealt with, and it is shown that those treatments which produce the highest elastic limit, accompanied by greatest hardness and finest fracture, are frequently the most risky as regards hardening cracks. The risk is lessened by heating to a sufficient time to a temperature of 900° C. (1652° F.). Low-tungsten steel is more liable to cracks than carbon steel. In experiments on tempering, it is shown that very little effect is produced by tempering at 150° C. (302° F.) for 30 min., while tempering at 250° C. (482° F.) for 15 min. of a well hardened bar softens it considerably as well as shortens it, although affecting it otherwise but little. The elastic limit was much increased by tempering up to 250° C. (482° F.). With reference to tensile tests, it was found that a variation of only 5° C. (9° F.), the extremes being above and below Ac 1.2.3, had a great influence on the extension under load, but the maximum stress did not vary very much. A very good bar was produced by quenching from a temperature fully 60° C. (100° F.) above Ac 1.2.3, a heat of five minutes producing a harder bar than one of 25 min. at a temperature of 800° C. The maximum stress alone, or the hardness alone, is not necessarily any indication of the general condition of the steel in question, or of the treatment to which it has been subjected. Tempering up to 300° C. (572° F.) greatly increased the maximum stress and elastic limit, while it reduced the extension under load, and permanent elongation for a given stress. It is particularly pointed out that there is quite a long range of 120° C. (216° F.) within which the steel may be hardened to show a good fracture, and a workman can easily keep within these limits by sight alone, but it is very improbable that most of the articles are hardened so as to reach anything like their maximum efficiency and, in fact, many are unlikely to even reach 10 per cent. of their maximum efficiency. In relation to the manufacture of razors, the author believes that it is possible to harden every razor in a gross so that each one shall be truly a duplicate of the best. This is of especial importance in the case of surgical instruments. The author also looks forward to the time when all the factors in the hardening of tool steel will be controlled with accuracy within predetermined limits, and any failure will be investigated, and the blame apportioned with as much certainty as if the mistake had been made in the machine shop, with the result that there will be an almost entire cessation of hardening cracks, and a very great economic gain from all-round increase in efficiency. The paper is illustrated by a large number of tables and curves.—A. H. C.

Case-hardening; Recent investigations on ——. S. A. Grayson. Iron and Steel Inst., May, 1910. [Advance copy.]

The various case-hardening compositions on the market belong to two classes. (1) Compositions in which the carbon is present in a form from which gaseous hydrocarbons can be produced, to which class crushed bone, and "brown scintilla" materials belong; (2) compositions in which the carbon is present chiefly in the form of fixed carbon, such as charred leather, and "hardenite." Complete analyses of these four compositions are given in the following table:

	Bone.	B. scintilla	Charred leather.	Hardenite.
	Per cent.	Per cent.	Per cent.	Per cent.
Carbon	8·0	11·0	69·0	44·0
Volatile matter and hydrocarbons ..	26·5	53·0	15·2	14·1
Nitrogen........	3·5	3·0	3·8	0·9
Ash	60·0	23·5	3·5	37·5
Sulphur	0·1	0·45	0·55	trace
Moisture	2·0	9·0	8·0	3·5
Total	100·1	99·95	100·05	100·0
Phosphoric acid..	16·0	2·0	0·10	trace
Also present	Alumina Lime Ammonia	Ammonia Lime Alumina Soda .. Silica and carbonates	Alumina Lime Iron Silica	Barium Iron(trace) .. Silica Carbonates ..

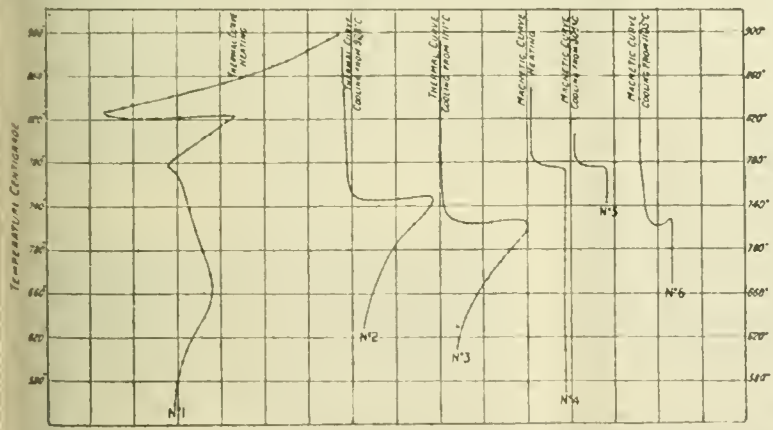
A good case-hardening steel containing 0·17 per cent. of carbon, 0·704 of manganese, 0·056 of silicon, 0·060 of sulphur, and 0·047 of phosphorus was subjected to the action of these materials for varying lengths of time, and at different temperatures, and curves are given representing the carbon per cent. in penetration to depths in inches. It is shown that not only should case-hardening compositions be classified according to the carbon content in the "case" obtained, but also according to the graduation of the carbon diffusion, which is best shown graphically. This classification is necessary because a 1·10 per cent. carbon case, although very efficient where the pressure is constant, as in a plain bearing, would be unsuitable for a position in which it had to resist repeated shocks owing to its tendency to chip off. A composition for general purpose should produce a case containing 0·9 per cent. of carbon, the eutectoid. The best possible results appear to be at a temperature of 950°—1000° C., although one of 1050° C. can be used with advantage in some cases. The diffusion of sulphur proceeds in a similar manner to that of the carbon, and is productive of a soft skin. The "brown scintilla" material, although containing a large amount of sulphur, does not act so "keenly" as does the sulphur in the charred leather material, owing probably to the fact that it contains a high percentage of volatile hydrocarbons which carry off the effective part of the sulphur. Moisture when present in amounts over 12 per cent. acts prejudicially, causing a rough surface on the work, which action appears to be intensified by the presence of sulphur. The paper is illustrated by twelve microphotographs showing the cementitic penetration.—A. H. C.

Iron and steel.] Chemical and mechanical relations of iron, manganese, and carbon. J. O. Arnold and A. A. Read. Iron and Steel Inst., May, 1910. [Advance copy.]

THE authors have examined the carbides separated from a series of annealed steels, containing about 0·9 per cent. of carbon, and varying in manganese from 0·41 to 19·59 per cent. The results obtained indicated, in most cases, a higher percentage of carbon (as determined by direct combustion) than the theoretical amount required by the iron and manganese present; but this was found to be due to the decomposition of the carbides. The amount of iron replaced by manganese in the carbides was found to increase with the manganese-content of the steel, until the latter reached 5 per cent., when it became stationary,—the carbides then containing about 23 per cent. of manganese, 70 of iron, and 7 of carbon—and did not again increase until the manganese-content of the steel reached about 15 per cent. In determining the carbon content of certain of the carbide residues by the colour-test, the results obtained were much below those indicated by direct combustion; but were found to correspond with the amount of carbide of iron present,—thus indicating that carbide of manganese affords no coloration with the nitric acid employed in the test.—W. E. F. P.

Chromium steel; The A2 point in ——. H. Moore. Iron and Steel Inst., May, 1910. [Advance copy.]

THE author has investigated the heating and cooling curves of steels containing from 0·25 to 6·4 per cent. of chromium, and the paper deals particularly with one having the following composition, carbon, 0·256; manganese, 0·160; silicon, 0·197; sulphur, 0·03; phosphorus, 0·015; chromium, 6·417 per cent. Curve No. 1 (see fig.) is the heating curve of this steel, and it shows that the point Ac1 (821°C.) is raised by the presence of chromium, from 746° C., the temperature at which it occurs in a steel containing 0·25 per cent. of chromium. This curve is peculiar in that there is a negative break at the temperature of 777° C., about 44° C. below the Ac1, and this is accompanied by what appears to be an evolution and not an absorption of heat. The cooling curves 2 and 3 are normal, and show the effect of high initial temperature in lowering the point Ar1. It is to be noted that an alteration in the chemical composition of a steel, while altering the point Ac1 has very little effect upon the Ac2 point, and in order to determine whether this point (777° C.) was the Ac2, and therefore below Ac1, the author investigated the magnetic properties of this steel. The steel was heated in a nickel wire resistance furnace, the heating coil of which served as a primary circuit. The cylinder of steel was grooved spirally, eight turns to the inch, the grooves filled with wet asbestos paper and dried, it was then wound with a nickel wire thus forming a secondary circuit, which was connected to a ballistic galvanometer. Making and breaking the heating current induced a current in the coil wound on the cylinder, which current was measured by the throw of the galvanometer. A thermo-couple was also inserted in the steel. Curve 6 shows the magnetic change point on cooling the steel from 1105° C. Since all the iron changes from the α to the β allotropic state before the Ac1 point is reached, at which the iron carbide (Fe_3C), and probably also some chromium carbide, passes into solution in the γ-iron, the author concludes that iron carbide is insoluble in β-iron. It is also suggested that the point Ac2 is not associated with an absorption of heat, but coincides with a more or less sudden change in the specific heat of the steel.—A. H. C.



Chromium steels; Some physical properties of 2 per cent. ——. A. McWilliam and E. J. Barnes. Iron and Steel Inst., May 1910. [Advance copy.]

THE series of steels examined contained from 0·20 to 0·85 per cent. of carbon, about 2 per cent. of chromium, from 0·12 to 0·24 per cent. of manganese, about 0·025 per cent. of sulphur, 0·02 per cent. of phosphorus, and less than 0·1 per cent. of silicon. In each case, the physical properties (yield-point, maximum stress, elongation, reduction of area, etc.) were determined on the material as received, and after various treatments, including normalising, annealing, quenching and tempering. The results obtained indicate that, after suitable annealing, any steel of this series may be easily machined and brought up again to the high tenacity and general hardness by the process of normalising; and also that, for a given maximum stress, the reduction of area is generally at least 10 per cent. greater with these, than with the Bessemer, or 1 per cent. manganese, steels. Heating and cooling curves of each steel were also taken, (*in vacuo*), while the microstructures, of which illustrations are given, were also investigated.—W. E. F. P.

Iron and steel and iron alloys; Determination of carbon in —— by direct combustion. T. E. Hull. Chem. Soc. Proc., 1910, 26, 91.

THE following method is recommended as being both simple and accurate:—A weighed portion of the drilled sample is placed in an asbestos boat which has been heated previously to bright redness and into which a layer of ignited silver sand has been introduced. The boat is placed in a porcelain or silica tube packed loosely with asbestos and copper oxide and the combustion is effected at a temperature of from 900° to 960° C. in a current of oxygen. The gases are dried by passing them through sulphuric acid contained in a Mohr's bulb and the carbon dioxide is absorbed in the usual way in 30 per cent. potassium hydroxide solution.
—W. P. S.

Rusting of various kinds of iron in moist air. K. Arndt. Chem.-Zeit., 1910, 34, 425—426.

THE rate at which oxidation occurs was determined by measuring the volume of oxygen absorbed after successive intervals of 24 hours, for a period of 43 days. The iron used was in the form of tubes, 20 cm. long and about 6 cm. external diameter. The surface was left in its natural state, and the cut ends were protected from rusting by paraffin. The test-piece was supported on paraffin blocks over water in a glass cylinder connected by a stop-cock with a Hempel burette, and the whole apparatus was immersed in water. Three test pieces were used in parallel experiments, the pieces being of cast iron, mild steel, and weldless tube respectively. In each case the apparatus was refilled with air after 23 days. The total volume of oxygen absorbed from the commencement was as follows :—

Time in days.	Oxygen absorbed by :		
	Cast-iron.	Mild steel.	Weldless tube.
	c.c.	c.c.	c.c.
1	13	13	5
3	24	32	8
5	30	45	30
10	45	63	109
20	59	108	198
30	73	156	293
43	95	213	389

Although cast iron rusts more rapidly at first, the oxide appears to form a protective coating which considerably reduces the subsequent rate of oxidation.—A. T. L.

Copper matte and copper-nickel matte ; Behaviour of —— in the Bessemer converter. D. H. Browne. Trans. Amer. Inst. Min. Eng., 1910, 285—305.

The object of the paper is to show that when nickel is present, in any proportion, in copper matte, the two metals behave during the matte blow as one metal, the elimination of iron and sulphur proceeding as if only copper were present. Even after the iron has been eliminated, the copper cannot be freed by slagging off the nickel, for though during the last stages of the blow the nickel commences to oxidise, it carries a large amount of copper into the slag, while at least 2 per cent. of nickel is always left in the finished copper. The author gives a series of tables showing the copper, nickel, iron, and sulphur content of samples of copper-nickel mattes taken at ten minute intervals during the Bessemer blows, and similar data of four copper matte blows and one of reverberatory practice, previously published by other investigators. In order to make the tables readily comparable, the figures for iron and sulphur were recalculated on a 100 per cent. copper basis, so that a matte containing 46·08 per cent. of copper, 24·3 of iron, and 24·7 of sulphur becomes 46·08 of copper with iron ratio 53·8 and sulphur ratio 54·7 to copper, 100. These ratios were then plotted and it was found that the curves for iron and sulphur elimination in the copper mattes of the different observers compared very closely with each other, but that those of the copper-nickel mattes were entirely erratic ; when however the iron and sulphur were calculated on a 100 per cent. copper-nickel basis instead of a 100 per cent. copper basis, all the curves for copper-nickel mattes were found to be in remarkable agreement with those for copper mattes. Two series of curves are also given showing the average curves for the iron and sulphur elimination of the four independent observers, superimposed.—F. R.

Eutectics ; Invariant systems, and uniformity in the composition of some ——. A. Gorbow. J. Russ. Phys.-Chem. Ges., 1909, 41, 1241—1300. Chem. Zentr., 1910, 1, 711—713.

The author points out that according to the thermodynamical reasoning of Gibbs, Le Chatelier, and Duhem, the different kinds of phase-equilibria of heterogeneous systems depend not upon the number of components but solely upon the degrees of freedom. It follows that all invariant systems must be subject to the same group-laws, and since the composition of invariant unitary systems can be expressed by simple chemical formulæ, the same must also be true of invariant binary and ternary systems. Other methods of reasoning lead to the same conclusion. The author has assigned stoichiometrical formulæ to about 170 different eutectics which have been mentioned in the literature, and gives in tabular form the difference between the observed and calculated composition. The results are considered to justify the conclusion that the compositions of most eutectics can be expressed by simple chemical formulæ, in accordance not only with the law of constant proportions but also with the law of multiple proportions. Further, since in eutectics of systems which have been subjected to the influence of temperature and pressure, the number of solid phases is the same as the number of independent variable components of which the system is composed, it can be shown that in many cases one of the independent variable components will be present in equal quantities in the two co-existent phases of the eutectic. If in a given system, A and B represent two independent variable components which form compounds $(A+xB)$ and $(A+yB)$, capable of melting without decomposition, then the composition of the eutectic of A and $(A+xB)$ will be $(2A+xB)$, and that of the eutectic between $(A+xB)$ and $(A+yB)$ will be $[(x+y)A+2xyB]$. It is the more basic component of the system which is distributed in equal quantities between the two phases of the eutectic, viz., the water in the case of cryohydrates and the more electro-positive metal in the case of alloys. If the basic component is not distributed equally between the two phases, then the amount in one phase will be a simple multiple of that in the other. —A. S.

Volumetric determination of manganese. Donath. *See* XXIII.

Patents.

Hydraulic classifiers for metalliferous slimes. J. M. and J. L. Holman, Camborne, Cornwall. Eng. Pat. 8060, April 3, 1909.

The apparatus consists of a tank of inverted truncated conical or pyramidal shape, having a false bottom near its lower end. Two vertical launders extend from about the middle of the false bottom to a little above the top of the tank, the overflow passing into a launder above the tank and then down through a vertical pipe into the space between the central launders and the side of the tank. In operation, the slimes are led into the top of the two vertical launders where they meet a rapid upward stream of water, resulting in a separation of the heavier particles, which fall against the stream into the space below the false bottom. The overflow is discharged into the outer space where it meets a slower stream of water resulting in a further separation, the final overflow passing over the top edge of the tank into a discharge collar-launder. Means are provided for separately discharging the coarse and fine concentrates.—F. R.

[Filtering ore slimes]. Ore solutions ; Apparatus for recovering values from ——. C. Robinson, Mount Vernon, N.Y. U.S. Pat. 954,466, April 12, 1910.

The apparatus consists essentially of two parallel perforated drums, disposed horizontally, and revolving partly submerged in separate tanks, containing respectively, ore slimes and wash water. An endless pervious belt, passing round the drums, serves as a carrier of the ore from one tank to the other. The liquids contained in the tanks are drawn by suction through the belt and into the drums, and a brush or scraper is situated between the tanks to remove the ore adhering to the belt as it comes from the washing tank.—F. R.

Solvent for precious metals. J. Penhalo and H. O. Mascall, Johannesburg. Eng. Pat. 8682, April 10, 1909.

The inventors claim the use of solutions of potassium or sodium cyanate as a solvent for precious metals, such as in the extraction of gold or silver from their ores. The strength of solution should be regulated according to the richness of the ore, and it is suggested that a solution of 0·18 per cent. strength will give good results with an ore containing 2 to 3 dwts. of gold per ton.—F. R.

Crucible furnaces. J. W. Chenhall, Totnes, Devon. Eng. Pat. 20,293, Sept. 4, 1909.

THE furnace consists of the ordinary type of coke-fired crucible furnace, but in addition to the usual means for producing a draught up through the fire-bars from the ash-pit, draught holes are provided in the walls of the furnace, in such a position that they form tiers round the furnace at a height of from that of the middle to a little above the top, of the contained crucible. Means are provided for simultaneously opening or closing the holes in one tier independently of the others. If an air-blast is required, the draught holes may be encircled by an air chamber, which is also in communication with the then enclosed ash-pit.—F. R.

Electroplating apparatus. W. R. King, Newark, N.J., Assignor to Hanson and Van Winkle Co., New Jersey. U.S. Pat. 948,056, Feb. 1, 1910.

THE apparatus (Fig. 1) comprises an electrolytic tank, 1, provided with fixed contact rods, 2, supporting the anodes, 3. Several "idler rollers," 9, secured upon the tank, 1, are provided on their outer circumference with grooves, 10. Movable contact rods, 12, support the articles, 31, to be plated, and fixed to the rods, 12, are agitators. Each of the latter comprises a hub, 14, secured to the rod by means of a screw, 15, and projecting downwards and outwards from the hub are a pair of cams, 16, connected by a rib, 17, so that by giving the rod a reciprocating motion, the cams, 16, riding in the grooves, 10, cause a simultaneous rise and fall of the rod. The rib, 17, gives a slight "jarring" movement to the work, in its lowest position, thus causing the detachment of bubbles of gas, which may have collected on the articles (see also Fig. 2). Supported on a suitable bracket, 19, and arms, 20, are bearings, 21, and mounted in these bearings is a telescopic shaft, comprising a tube, 22, provided with a longitudinal slot, 23, and a sliding shaft, 24, provided with a pin, 25, which extends into and moves in the slot, 23. Secured respectively on the free ends of the tube, 22, and the sliding shaft, 24, are crank-discs, 26, which are connected by means of studs, 27 and 29, and a connecting rod, 28, with the hubs, 14. Upon the tube, 22, is attached a fast and loose pulley, 30, which is adapted to drive the telescopic shaft and the crank discs, 26.—B. N.

Fig. 1.

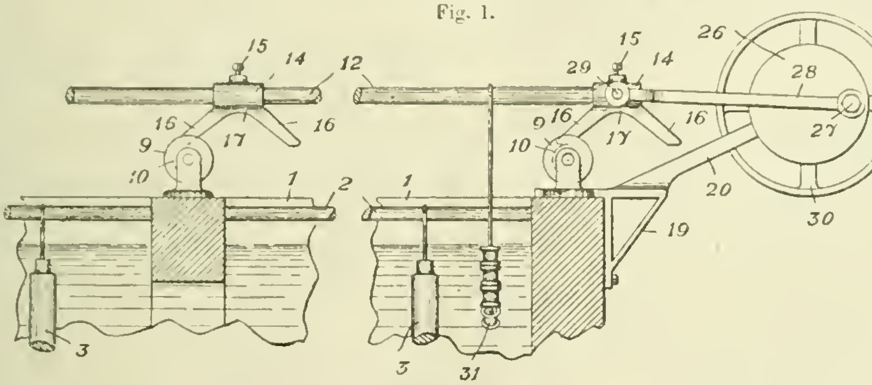
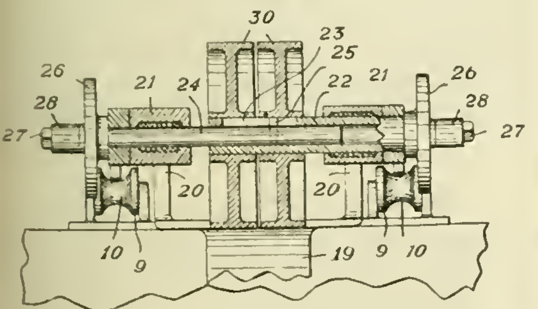


Fig. 2.



Roaster for ores. A. J. Garver, Clarkston, Wash. U.S. Pat. 954,729, April 12, 1910.

THE roaster consists of an inclined flue, horizontally divided along its length by a series of overlapping ledges, over the surface of which the ore descends. The ledges are supported upon bricks placed edgeways, and air is admitted at the junction of the ledges through apertures in the supporting bricks and in the lower side of the flue. The combustible gases for heating, pass up the space beneath the descending ore.—F. R.

Oxides and sulphides; Reduction of metallic ——, for the purpose of obtaining the corresponding metal. E. Chatillon. First Addition, dated Oct. 29, 1909, to Fr. Pat. 395,658, Jan. 3, 1908 (this J., 1909, 479).

THE industrial gases, specified in the main patent for the reduction of the molten mixtures of oxides and oxysulphides, are replaced by injections of a powdered combustible, such as charcoal, anthracite, coke, or the like. —O. R.

Sulphides; Process of treatment of mixed ——. C. A. L. W. Witter. Fr. Pat. 408,612, Nov. 3, 1909.

THE process is applicable to the mixed ores of lead and zinc, such as the complex sulphides. It is based on the fact that when a mixture of the oxides of lead and zinc, together with the necessary amount of carbon, is submitted to a temperature of at least 950° C., but not more than 1180° C., in a neutral or reducing atmosphere, the zinc alone is volatilised, the lead remaining behind. The sulphide ores, ground to the necessary degree of fineness, are roasted until a product containing not more than 0·2 to 0·5 per cent. of sulphur is obtained. This product, mixed with the necessary quantity of a reducing agent, such as carbon, and with an agglomerant, such as calcined limestone, is moulded into briquettes which are introduced continuously into a reverberatory furnace, at the end, through closed hoppers at the top. In order to obtain a reducing, or at least a perfectly neutral atmosphere at this charging point, the introduction of the heating gas and air is effected through the roof of the furnace, and the operation is conducted in such a way that the products of combustion cannot circulate across the charge. At the bottom of the furnace a layer of molten slag is constantly maintained, this becoming replaced by a bed of liquid matte as the reaction proceeds. This layer acts as a support for the freshly introduced charge and moreover serves to equalise the temperature and keep it within the specified limits; for this reason a sufficient depth is maintained, the excess being withdrawn when necessary through an orifice at the end of the furnace. The charge, falling on to the bed, is gradually reduced; the metallic zinc is volatilised and passes away through the chimney, where it meets with the products of combustion and with a supply of air; in this way it is re-oxidised, the volatile oxide being subsequently condensed and collected in cooling chambers. The gangue of the ore is absorbed by the slag, the lead passing through the permeable bed and forming a molten bath at the bottom of the furnace, whence it is drawn off periodically through a tapping hole. The carbon in the above reaction may be replaced wholly or partially by iron; in this case a molten zinciferous product is mixed with the necessary amount of scrap-iron and run into the furnace; the metallic zinc is volatilised, reoxidised and condensed as before, the necessary additional heat being applied by the bed of liquid slag.—C. A. W.

Nickel; Process for obtaining pure ——. Soc. Electro-Métallurgique Française. First Addition, dated Jan. 6, 1909, to Fr. Pat. 400,910, June 27, 1908.

According to the main patent (see this J., 1909, 1090) an alloy containing nickel, iron, carbon, and silicon, was freed from iron, carbon, and silicon by treatment in a Bessemer converter or by pulverisation in a jet of air. According to the present Addition, the process is carried out in a reverberatory furnace, a Martin furnace, or preferably, an electric furnace of a type in which the oxidation can be effected by means of air or nickel oxide without carburisation of the metal.—A. S.

Pyrophoric alloys. Treibacher Chem. Werke Ges.m.b.H. First Addition, dated Oct. 5, 1909 (under Int. Conv., Aug. 13, 1909) to Fr. Pat. 407,117, Sept. 3, 1909 (this J, 1910, 574).

Other methods of preparing pyrophoric rare earth metal masses containing oxygen, or oxygen and nitrogen, are described. For example, powdered cerium or alloys of rare earth metals with about 30 per cent. of iron, are heated in a water-bath in the air for 3—4 hours, and then compressed into rods of 1—2 grms. weight by a pressure of 5000—20,000 kilos. per sq. cm. Lanthanum containing cerium may be comminuted, heated in a water-bath in the air for 10 hours, compressed into rods of 15—20 grms. under a pressure of 1000—8000 kilos. per sq. cm., and heated to incipient redness, with partial or complete exclusion of air; or the powdered metal may be compressed first of all and then heated to redness in an airtight tube with 2 or 3 times its volume of air. An alloy of cerium and other rare earth metals may be comminuted, mixed with 3 per cent. of cerium oxide or iron oxide, compressed into rods, and the latter heated to incipient redness with partial or complete exclusion of air. An alloy of cerium with 10 per cent. of iron may be comminuted, oxidised by exposure to air for several days, mixed with 10 per cent. of magnesium powder, compressed into rods, and the latter heated to incipient redness with partial or complete exclusion of air. An alloy of rare earth metals may be comminuted, compressed into rods, and the latter heated to incipient redness in presence of a quantity of carbon dioxide insufficient to convert the metals into oxides.—A. S.

Metal; Production of a light ——. W. Rübel. Fr. Pat. 407,814, Oct. 12, 1909.

The method relates to the production of alloys of magnesium and zinc having the composition: magnesium, 90 to 96; zinc, 10 to 4 per cent. The zinc may be replaced partially by copper or wholly by an alloy of copper and aluminium, in which case the following compositions are specified: magnesium, 90; copper, 6; zinc, 4 per cent.; and magnesium, 90; copper-aluminium alloy, 10 per cent., this alloy containing 10 per cent. of aluminium. Furthermore, the magnesium itself may be replaced by calcium or by beryllium. The production of these alloys is effected by melting the magnesium in a closed iron crucible, and afterwards adding the entire quantity of zinc, copper, or copper-aluminium alloy. It is stated that the alloys can be forged and cast easily, can be turned like brass without the use of a lubricant, and that finally they are particularly resistant to the action of air or water.
—C. A. W.

Refractory metal product for the manufacture of incandescence mantle supports and protectors, and other parts of incandescence lamps. Vereinigte Deutsche Nickelwerke Akt.-Ges. vorm. Westfälisches Nickelwalzwerk Fleitmann, Witte und Co. Fr. Pat. 407,838, Oct. 13, 1909.

An alloy of nickel and chromium containing 20 per cent. of chromium is employed. The alloy has the appearance of platinum, is ductile and can be formed into wire, ribbon or sheet.—A. T. L.

Alloys of titanium and silicon. The Titanium Alloy Manufacturing Co. Fr. Pat. 407,858, Oct. 13, 1909.

Although it is known that the addition of both silicon and titanium to certain metals, principally of the iron group, is highly advantageous, it has hitherto only been found possible to introduce these elements into the charge, separately, either in an uncombined condition or as alloys with iron. It has now been found possible to produce silico-titaniums, or alloys of silicon and titanium, containing from 20 to 75 per cent. of silicon and from 5 to 70 per cent. of titanium. To this end, silver sand is mixed with rutile or pure titanium oxide in the proportion desired, and powdered carbon added in such an amount that two atomic weights of carbon are present for each molecular weight of silica or titanium oxide. The whole mixture is then reduced, preferably in an electric furnace of the arc type. Of the two electrodes of this furnace, one is constituted by the graphitic interior of the furnace itself, the other being movable vertically in a central cavity. The arc having been started by lowering the movable electrode, the charge is introduced into the central cavity so as to surround this electrode. At the close of the reaction, the fused alloy is withdrawn through the tap-hole. In certain cases, where the alloy is intended for subsequent incorporation with a metal of the iron group, it is found advantageous to add to the charge a definite proportion of scrap iron or, with a corresponding increase of the reducing carbon, a certain amount of hæmatite. In this way, ferro-silico-titaniums are obtained, and it is stated that such a product has a greater fusibility and a greater dissolving power when it is afterwards added to a metal of the iron group. Similarly, for subsequent incorporation with copper, cupro-silico-titaniums may be obtained.—C. A. W.

Aluminium; Method of obtaining ——. P. Askenasy. Fr. Pat. 407,875, Oct. 14, 1909. Under Int. Conv., Oct. 15 and Dec. 1, 1908.

Although aluminium carbide is a stable body at a high temperature, such as that of the electric furnace, yet at relatively low temperatures, not far above the melting point of the metal, it is rather rapidly dissociated into its constituent elements. It is therefore proposed to obtain aluminium by maintaining the carbide at a temperature lower than its transformation point but somewhat higher than the melting point of the metal, the process being facilitated, if necessary, by subjecting the mass to mechanical pressure.—C. A. W.

Iron; Manufacture of ductile —— *by electrolytic means.* Soc. Langbein-Pfanhauser-Werke A.-G. Fr. Pat. 407,889, Oct. 14, 1909. Under Int. Conv., Nov. 3, 1908.

Ductile iron is obtained electrolytically by the use of hot solutions of iron salts, with or without other conducting salts, and with the addition of hygroscopic substances, such as calcium chloride. Heat and pressure may be applied to the electrolyte during the deposition of the iron.
—B. N.

Steel: Method of formation of —— *by cementation of metals, such as soft steel, cast steel and iron.* E. Jouard. Fr. Pat. 408,211, Jan. 18, 1909.

The piece of iron or steel is previously coated partially or wholly with some such mixture as the following:

potassium ferrocyanide, 250; potassium bichromate, 100; ammonium chloride, 50; hide glue, 600: distilled water, 500 parts. For this purpose the glue is melted on a water-bath and mixed with the other components dissolved in water. The mixture is then boiled until it has attained sufficient fluidity to be spread with a brush over those portions of the article that are to be converted into steel. The article, coated in this way and surrounded by an inert material, is then heated in an ordinary cementation box to a temperature of 850° C., for a sufficient length of time, and is finally quenched in the ordinary manner. It is stated that, with this mixture, a cementation of 1 millimetre per hour can be obtained on pieces of soft steel, cast steel or iron.—C. A. W.

Projectiles, etc.; Method of hardening ——. P. Girod. Fr. Pat. 408,441, Jan. 23, 1909.

The steel should be such that it can be easily worked after a more or less prolonged heating to a moderate temperature followed by a simple cooling in air. In addition, the metal should be capable of acquiring a very great hardness after heating to a temperature greater than 600° to 650° C., followed by a slow cooling in air. In order to fulfil these requirements, a metal having the composition: carbon, 0·1; nickel, 2 to 6; chromium, 0·5 to 2·5 per cent. is recommended, the latter element being replaceable, wholly or partly, by silicon, manganese, tungsten, molybdenum, vanadium, titanium, tantalum, or uranium. The pieces to be worked, consisting for instance of ingots for projectiles or armour plates, are forged, rolled and pressed roughly to the dimensions required. They are then submitted to a preliminary heating to about 450° to 500° C. during an interval varying with the dimensions and weight and according to the result to be obtained. After a slow cooling in the air or in the furnace, the metal can be easily worked with the tool to the shape desired. It is now submitted to a temperature greater than 600° to 650° C. In the case of a projectile or other metallic piece, where a greater hardness is required for the point and middle part than for the portion at the rear, this heating is not effected uniformly, those portions which are to remain relatively soft being protected against too high an elevation of temperature. For this purpose a furnace may be employed containing in the partitions or in the hearth one or more holes in which the metallic pieces are suitably arranged. The metal, having been brought to the temperature desired and maintained there for a sufficient time, is finally removed from the furnace and allowed to cool in the air. In this operation a still greater hardness can be given to the point of a projectile by exposing that portion only to a current of air parallel to the axis. This irregular heating and cooling may be repeated a certain number of times until the metal has acquired the properties desired. In another method the whole piece may be raised to a temperature greater than 600° to 650° C., so that, on cooling, a uniformly hard body is obtained. For the subsequent softening of any part, that portion only is raised to a temperature lower than 600° to 650° C. and allowed to cool in the air or in a special apparatus. The softened metal may then be worked with a tool.—C. A. W.

[Iron] ores; Process of treating —— in the blast-furnace. F. A. Kjellin. Fr. Pat. 408,674, Nov. 6, 1909.

The charge in the blast-furnace, preferably at about the level where the reduction to metal takes place, is supplied with heat by means of an electric current, in addition to that furnished by the combustion of the coke. The current is supplied through electrodes of carbon, or of carbon and magnesia, or of lime. The effect is stated to be the same as that produced by working with a hot blast, the amount of fuel saved being more than corresponds with the additional heat supplied.—A. S.

Zinc carbonate ores; Process, lixiviating apparatus, and reduction furnace for the treatment of ——. G. Dantin. Fr. Pats. 408,062, 408,092, and 408,093, Oct. 16, 1909.

(1). The ore is treated with sulphurous acid at a temperature above 50° C., whereby the zinc carbonate is converted into sulphate, which is recovered by lixiviation. The zinc sulphate is reduced to metal by heating with charcoal in presence of barium carbonate, the barium sulphide also produced being subsequently re-converted into carbonate by treatment with carbonic acid. The hydrogen sulphide liberated is passed through heated tubes along with steam, and the sulphurous acid produced is used in the first stage of the process. (2). The lixiviating apparatus consists essentially of inclined pipes mounted in a chamber kept at a temperature of 70° C., and provided inside with screw conveyors. The ore pulp is fed in at the lower ends of the pipes and is carried upward slowly by means of the conveyors. At intervals along the length of the pipes, means are provided for the introduction of sulphur dioxide gas, and a current of water is passed through in a direction opposite to that of the ore pulp in order to remove the zinc sulphate formed. Any excess of sulphur dioxide is removed by aspiration from near the upper ends of the inclined pipes and is absorbed in water. (3). The furnace in which the zinc sulphate is reduced by means of carbon in presence of barium carbonate, comprises a number of inclined quartz tubes disposed in a furnace-chamber heated by means of producer gas. Each tube tapers slightly from the bottom upwards and consists of two portions connected together by a ring, which opens into a tube through which the volatile reaction products are drawn off. The mixture of zinc sulphate, barium carbonate, and carbon (wood charcoal, anthracite) is fed in at the upper ends of the quartz tubes and passes downwards, the volatile reaction-products being drawn off as mentioned and passed through a chamber maintained at such a temperature that the zinc condenses in the form of molten metal. The residue of the charge, consisting mainly of barium sulphide, is discharged from the lower ends of the quartz tubes, then falls down a vertical pipe to the lower part of an inclined pipe. It is carried up through this pipe by means of a screw and meets a current of water flowing in the opposite direction, which dissolves out the barium sulphide.—A. S.

Zinc; Method for collecting the oxides rich in zinc and enriching ores poor in —— by means of steam. J. L. Babé. Fr. Pat. 408,487, Oct. 30, 1909.

The method consists essentially in mixing the rich products extracted from poor calamines with a fresh portion of these calamines, so as to obtain an enriched ore. The fumes from the furnace, after passage through a steam generator, arrive at an aspirator and are thence passed into a mixer. This mixer consists of a rectangular chamber divided down the middle by a vertical partition. The fumes passing down one compartment and up the other are brought into contact with very fine metallic sieves, on which the oxide is deposited. These sieves are continuously washed by jets of steam, and in this way a mixture of oxides, furnace gases and steam is carried away into the condenser, the circulation being assisted by a supplementary current of air passed into the top of the mixer. The steam coming into contact with the water in the condenser, the oxides are deposited and thus serve to enrich a quantity of the crude, pulverised ore which has previously been charged into the water. Since it is necessary to provide for the circulation of the cooling agent, a second reservoir is arranged, the bottom of which is pierced with small holes so that it forms a filter. The water, overflowing from the condenser, is drawn through this filter by means of a turbine arrangement in a reservoir below, the residue on the filtering cloth being periodically removed to the condensing tank.—C. A. W.

Pyrophoric masses; Manufacture of ——. A. G. Bloxam, London. From Treibacher Chem. Werke, Treibach, Austria. Eng. Pat. 19,829, Aug. 30, 1909. Addition to Eng. Pat. 8163, April 5, 1909.

See Addition of Oct. 5, 1909, to Fr. Pat. 407,117 of 1909; preceding.—T. F. B.

Ores bearing precious metals; Treatment of ——. J. C. Clancy, New York. U.S. Pats. 955,318 and 955,319, April 19, 1910.

See Fr. Pat. 400,770 of 1909; this J., 1909, 1044.—T. F. B.

Copper-ore concentrates ; Agglomerating or briquetting —— preparatory for smelting. T. Rouse, London. U.S. Pat. 955,909, April 26, 1910.

See Eng. Pat. 4914 of 1909 ; this J., 1910, 432.—T. F. B.

Ores ; Process of treating ——. A. A. Lockwood and M. R. A. Samuel, Assignors to The Murex Synd., Ltd., London. U.S. Pat. 956,381, April 26, 1910.

See Eng. Pat. 6148 of 1908 ; this J., 1909, 839.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Glass ; The transmission of electricity through ——. M. Le Blanc and F Kerschbaum Z. physik. Chem., 1910, 32, 468—507.

The authors have electrolysed solid soda glass between mercury electrodes at temperatures in the neighbourhood of 300° C., using E.M.F.'s up to 550 volts. The initial passage of the current is entirely electrolytic, agreeing with Ohm's law, and giving a quantity of sodium at the cathode which agrees with Faraday's law. The resistance of the glass however increases, and when about four-fifths of the sodium has been removed, no further electrolysis takes place and the conductivity remains at a constant minimum much smaller than its original value. This points to the formation of a dielectric layer at the anode, the thickness of which will depend on the E.M.F. applied. By taking a sufficiently thin (0·1 mm.) plate the authors converted the glass entirely into a feebly conducting material with entirely new electrical properties. The conductivity was proportional to the square of the applied E.M.F. and the passage of the current seemed to be analogous to that in a rarefied gas. During the electrolysis of the glass at 320° C., no separation of cations is observed, but on heating the feebly conducting mass to a higher temperature (1000° C.) oxygen is evolved in quantity somewhat less than would be equivalent to the sodium previously separated. If sodium amalgam is used as anode and mercury as cathode, the insulating mass can be reconverted into the original glass by passing an electric current.—W. H. P.

Preparing concentrated sodium and potassium hydroxide solutions free from carbonates by electrolysis. Jorissen and Filippo. *See* VII.

Electrolytic separation of nickel and cobalt. Alvarez. *See* XXIII.

Patents.

Electric currents ; Production of ——. B. Schwerin. Frankfurt-on-the-Maine, Germany. Eng. Pat. 10,793, May 6, 1909. Under Int. Conv., May 7, 1908.

The process relates to a method of generating electric current by forcing liquids at a high pressure through plates or layers of electrically-active substance. The conductivity of the layer and of the liquid is regulated by means of suitable electrolytes, *e.g.* bases for electronegative bodies and acids for electropositive bodies, whereby the desired current conditions are obtained. The plates are constructed with pores as fine as possible, and the substances forming the layer are used in the most finely-divided form, the same liquid being used again and again in the process.—B. N.

Electric induction furnace. C. W. Söderberg, Ski, Norway. U.S. Pat. 954,827, April 12, 1910.

The furnace consists of an iron core, and a hearth having an intermediate portion and semi-annular ends surrounding the portions of the core that pass through the hearth. The primary coil system comprises two disc coils above the hearth, which surround those portions of the core extending through the hearth, and disc coils below the hearth, also surrounding the core. The upper coils are in close proximity to the hearth and cover only the semi-annular portions of the bath in the hearth, thus leaving the bath in the intermediate portion open ; the lower coils may be mounted in channels formed in the furnace and adapted to permit a current of air to pass around them.—F. Sodn.

Furnace ; Electric ——. E. H. Meyer and J. M. A. Stillesen, Niagara Falls, Ontario, Canada. U.S. Pat. 955,655, April 19, 1910.

A lower electrode, disposed at the bottom of the furnace, is provided with a recess adapted to contain molten product, and an inclined and movable upper electrode is supplied with means for securing uniform wear. Means are provided for maintaining an arc between the electrodes, and by means of a charging passage, the material is fed under the point of the upper electrode directly by gravity into the arc. A tapping orifice is arranged at the bottom of the furnace.—B. N.

Furnace ; Electric reduction —— with utilisation of gas. A. Helfenstein. Fr. Pat. 408,245, Oct. 25, 1909.

The furnace comprises a lower reduction compartment, surmounted by a charging chimney, and having openings for the supply of air or gas, in the top of the reduction compartment. The latter serves as a combustion chamber, the gaseous products being burnt in the space left free between the mass to be treated and the walls of the furnace.—B. N.

Furnaces ; Process of charging electric resistance ——. A. Petersson. Fr. Pat. 408,397, Oct. 28, 1909. Under Int. Conv., Jan. 7, 1909.

A portion of the charge is supplied through special apertures between electrodes of different polarity, which may be arranged either in the sides or the base of the furnace. A relatively cold layer of the charge is obtained against the wall, or on the bottom of the furnace, thus preventing the sides or bottom from becoming conductive, and avoiding short-circuits in those parts of the furnace. —B. N.

Electrolysis of aqueous solutions ; Process and apparatus for the continuous ——. Soc. Pour l'Ind. Chim. à Bâle. Fr. Pat. 408,565, Nov. 2, 1909. Under Int. Conv., Nov. 23, 1908 and March 24, 1909.

The fresh electrolyte is circulated from the upper electrode towards the lower electrode, in order to drive back the ions of the products formed, which tend to reduce the yield. The electrolyte is partially impoverished at the upper electrode, but is enriched by means of solid salt between the two electrodes, with the object of opposing as many ions as possible of the initial electrolyte to the ions migrating upwards. A support for the solid salt is arranged between the electrodes, and serves also to receive the gas formed at the lower electrode. The support consists of an inverted trough, or of a porous tissue passed in a zigzag manner over horizontal hangers. In an alternative form, the salt is supported on a horizontal tissue, arranged above the zigzag tissue for collecting the gas, thus prolonging the path over which the concentrated saline solution meets the migrating OH-ions.—B. N.

Substances of high resistance ; Method of manufacturing ——. A. Schlomann, Munich, Assignor to Vakuum-Pressgut Ges. m.b.H., Berlin. U.S. Pat. 955,360, April 19, 1910.

See Fr. Pat. 370,143 of 1906 ; this J., 1907, 204.—T. F. B.

Filaments of refractory material for electric lamps. Eng. Pat. 8781. *See* IIb.

"Forming" carburised metal filaments for electric lamps. Eng. Pat. 16,065. *See* IIb.

Improving the quality of metal-filament lamps. Fr. Pat. 408,624. *See* IIb.

Abrasive material; and composition of matter containing oxides of (1) *aluminium and titanium, and* (2), *aluminium, silicon, and titanium.* U.S. Pats. 954,766—954,768. *See* IX.

Electric furnace product (fused alumina); and [*aluminous*] *bonded article.* U.S. Pats. 954,808 and 954,809. *See* IX.

XII.—FATS; OILS; WAXES.

Linseed oil; Drying process of ——. W. Fahrion. Z. angew. Chem., 1910, **23**, 722—726.

Portions of cotton wool were saturated with the fatty acids from linseed oil, and exposed to the air for 3 or 4 days, after which they were extracted successively with cold petroleum spirit, ether, and alcohol. The extractions yielded (A) a light yellow partly crystalline mass; (B) a thick yellow syrup; and (C) a yellowish-red amorphous resin-like mass. These had iodine values of 113·1, 64·2 and 42·5 respectively. It was concluded that the residue A contained the unaltered linseed oil fatty acids, including the whole of the oleic acid, whilst B and C consisted of autoxidation products of the linolic and linolenic acids. Their elementary analyses (C, 64·2—67·4; H, 8·8—9·1; and O, 23·5—26·9) and molecular weights (B: 332·5; C: 375·0) supported the conclusion that they were mixtures of diperhydroxylinolenic acid, $C_{18}H_{30}O_6$, and perhydroxylinolic acid, $C_{18}H_{32}O_4$. The body, C, was regarded as a derivative of B, which latter had all the characteristics of Mulder's "white linoxyacid," which undergoes a molecular transformation into Mulder's "red linoxyacid." This change is probably due to the formation of an inner ester, analogous to that produced by ricinoleic acid. The linseed oil acid product, B, yielded a viscid dark red acetylation product, and when treated with nascent hydrogen yielded only an ester, but no reduction product. From further experiments in which siccatives were added to the linseed oil fatty acids, it was concluded that the chemistry of the drying process is not altered by such addition, but that the autoxidation is accelerated. Experiments with blown linseed oil showed that the free fatty acids (as well as the oil itself) were soluble in petroleum spirit, but that after saponification they were rendered partly insoluble. This was attributed to the action of the alcoholic alkali upon the peroxides first formed. In its essential details the autoxidation of linseed oil follows the same course as that of the free fatty acids, and the experimental evidence does not support Fokin's view (this J., 1907, 1149; 1909, 98, 893) that the drying of linseed oil is due to a hemi-molecular autoxycatalysis.—C. A. M.

Butter-fat; Refraction of the insoluble fatty acids of ——. G. Dumitrescu and D. M. Popescu. Ann. Falsific., 1910, **3**, 149—153.

The insoluble fatty acids obtained from 48 samples of pure butter gave refractometer readings of from 29·0 to 30·4 at 40° C., whilst in the case of 3 other samples the reading was 31·1, and the authors consider that adulteration of butter-fat is more plainly denoted by the refraction of the insoluble fatty acids than by that of the fat itself. The refraction of the fatty acids varies within narrower limits than does the refraction of the fat (39·5 to 43·7) and the addition of 10 per cent. of a foreign fat to butter fat always causes the refraction of the insoluble fatty acids of the mixture to fall outside the above-mentioned limits. The insoluble fatty acids of cocoanut oil give a refractometer reading of 15·1; those of lard, 37·4; and those of beef-fat, 37·4. (See also this J., 1907, 337).—W. P. S.

Cod-liver oil fatty acids. A. Heiduschka and E. Rheinberger. Pharm. Zentralh., 1910, **51**, 203—204. Chem. Zentr., 1910, **1**, 1538.

On mixing a solution of cod-liver oil fatty acids in chloroform with excess of Hübl's iodine solution and allowing to stand, a white crystalline product separates, which is only very slightly soluble in the usual organic solvents. It is probably a chloriodo-compound of therapic acid, of the composition, $C_{17}H_{26}O_2(ClI)_4$. When a current of chlorine is passed over it at 50° C., a brown mass is produced, from which colourless crystals of m. pt. 62° C., insoluble in water, slightly soluble in alcohol, easily soluble in chloroform, probably octochlorotherapic acid, $C_{17}H_{26}O_2Cl_8$, can be isolated.—A. S.

Cholesterol group; Investigations in the ——. *VI. Further observations on bombicesterol and the presence of cholesterol in silk worm pupæ.* A. Menozzi and A. Moreschi. Atti R. Accad. dei Lincei, Roma, 1910, [5], **19**, I., 126—129. Chem. Zentr., 1910, **1**, 1494–1495.

The unsaponifiable matter (yield, 2·5 per cent.) of crude chrysalis oil (see Lewkowitsch, this J., 1907, 24, 622) consists of hydrocarbons (see this J., 1908, 411) and cholesterol-like compounds. If the latter be removed by warm aqueous alcohol, and repeatedly crystallised from alcohol and ether, *bombicesterol*, m. pt. 148° C., is finally obtained. If the crude cholesterol be first acetylated and the acetate mixture fractionally crystallised, two acetates are obtained, viz., the acetate of ordinary cholesterol, m. pt. 113°—114° C., and the acetate of bombicesterol, m. pt. 129° C.—A. S.

Grease manufacture; Home Office Report on ——. *See* IIa.

Patents.

Soap containing gelatinous material; Preparation of ——. A. Lumière. Fr. Pat. 408,513, Jan. 25, 1909.

A colloid such as gelatin, glue, fish-glue, or other albuminous material is added to ordinary soap, either in solution during the manufacture of the soap, or in a dry powdered state to the finished soap while still in a state of fusion. The proportions recommended are 10 parts of gelatin or glue to 90 parts of finished soap. The presence of the colloid prevents precipitation of calcium salts from hard waters, and increases the detergent properties of the soap.—E. W. L.

Emulsifier, emulsifying process, and emulsion. C. K. Mills, London. From Arabol Manufacturing Co., New York City. Eng. Pat. 14,119, June 16, 1909.

See Fr. Pat. 404,959 of 1909; this J., 1910, 222.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Natural varnishes of China and Japan. Bull. Imp. Inst., 1910, **8**, 32—40.

Both the Chinese and Japanese lacquers are obtained from the juice of *Rhus vernicifera* D.C., a tree indigenous to China, whence in early times it was introduced into Japan.

Chinese lacquer.—The tree, which is abundant in Central China, grows wild and is cultivated at altitudes of 3000 to 7500 feet, the owners of the land claiming the varnish produced by it. The tree is tapped in June or early July, and the exuding greyish-white juice is collected in shells, bamboo tubes, etc., and protected from oxidation by being covered with layers of oiled paper. The tapping is repeated seven times at intervals of about seven days, and the tree is then left for 5 to 7 years to recover. In addition to that used locally, large quantities of the varnish are exported, principally to Japan. Adulteration of the varnish with tung oil is of frequent occurrence. The following figures show the quantities and value of the varnish annually exported from Hankow :—

Year	lb.	£	Year.	lb.	£
1905 ..	2,136,400	126,778	1907 ..	2,444,000	134,353
1906 ..	2,093,466	113,761	1908 ..	2,479,792	145,114

Japanese lacquer.—The lacquer tree grows abundantly all over Japan, and is cultivated largely in the districts north of Tokio. The tree is usually tapped when 10 years old, the process being renewed at intervals from June to October. Each collector taps from 600 to 800 large trees or 1000 small trees during the season, the amount of crude varnish yielded by each tree ranging from 27 to 54 grms. As a rule the tree is left for a future yield of varnish, but in some cases it is cut down, and the branches made into bundles, soaked for 10 to 20 days in water, and then tapped by spiral incisions in the bark. The varnish thus obtained is of inferior quality, and is used for ground-work and cheap articles. The raw varnish, known as kiurushi, is packed in wooden tubs, and is protected from oxidation by layers of oiled paper. Before use it is strained from particles of bark, dirt, etc., and allowed to stand in wooden tubs, when the inferior quality sinks to the bottom, leaving the thinner and finer qualities on the surface, whence they are decanted. The varnish is pressed through cotton or hemp cloths and is then ready for use as a priming or groundwork. Finer qualities are prepared by exposing the better grades of raw varnish, in shallow wooden pans, to the action of the sun or gently heating and stirring them over a fire. This causes the varnish to become dark brown in colour and of the consistency of a syrup. The product thus obtained is used for finishing, over coats of coloured lacquer. Addition of pigments is made during the stirring and exposure to the sun, the best black lacquer being obtained by the introduction of an iron salt. Cheaper black lacquers consist of an inferior grade of raw lacquer mixed with the drying oil from perilla seeds. The so-called "pear ground" lacquer, which is used with gold dust, is obtained by the addition of gamboge, whilst an inferior quality is prepared by the addition of perilla oil, plum juice (*Pyrus mume*) or the yellow extract of the fruit of *Gardenia florida*. Red lacquers contain cinnabar or red oxide of iron, and yellow contain orpiment. Brown preparations are made by mixing red and black lacquers, whilst green lacquers are obtained by adding indigo (from *Polygonum tinctorium*) to the yellow product. Various metallic powders, and also charcoal from the wood of *Camellia japonica* and *Lagerstrœmia indica*, are also frequently incorporated with the lacquers. The lacquer only hardens in a moist atmosphere and remains "tacky" when exposed to sunlight or heat. In drying there is an absorption of 57·5 per cent. of oxygen. The only method of thinning employed is by the addition of camphor. In preparing lacquer ware the prepared wood is coated with successive layers of inferior lacquer mixed with pottery dust or clay powder, and rice paste, and after each coat has hardened in a moist chamber it is rubbed down with sandstone until a smooth dull greyish-black surface is obtained, after which the article is decorated and finished with the prepared and coloured lacquers.

—C. A. M.

Drying process of linseed oil. Fahrion. *See* XII.

Patents.

Paint. O. Marchand, St. Paul l'Ermite, Canada, Assignor to A. Glackmeyer, New York, A. Archambault, J. L. Deschamp, and L. L. Archambault, St. Paul l'Ermite, Canada. U.S. Pats. 956,389 and 956,390, April 26, 1910.

(1) A mixture of zinc sulphate, caustic potash, potassium carbonate, nitric acid, a solution of rosin in "benzine," zinc dissolved in hydrochloric acid, ferric oxide, a pigment such as red ochre, linseed oil, and water. (2) A mixture of caustic potash, potassium carbonate, zinc dissolved in hydrochloric acid, zinc sulphate, aluminium, a pigment such as white lead, turpentine, and linseed oil.—A. S.

Varnish. L. H. Baekeland, Yonkers, N.Y. U.S. Pat. 954,666, April 12, 1910.

The varnish consists of a volatile organic solvent and a condensation product of a phenolic body and formaldehyde, the condensation product being characterised by its capability of changing under the influence of heat, into an insoluble and infusible body, and by the presence therein of a "base-condensing agent," in proportion not exceeding one-fifth of the equimolecular proportion of the phenolic body employed.—F. Sodn.

Colophony and [varnish ; Decolorisation of ——. P. M. R. Salles. Fr. Pat. 408,291, Oct. 25, 1909.

The process consists in the addition to the colophony or varnish of a certain quantity of a colouring matter, the colour of which is complementary to that of the colophony or varnish.—E. W. L.

Staining solution [for wood, etc.] ; Process for preparing a ——. H. Keller. Ger. Pat. 220,322, Jan. 28, 1908.

Solutions suitable for staining wood surfaces are obtained by mixing pyroxylin, an alcoholic solution of a dyestuff, and an ethereal solution of a fat or resin or both.—T. F. B.

Priming, polishing, etc., of wood surfaces. P. Horn. Ger. Pat. 220,772, Jan. 31, 1909. Addition to Ger. Pat. 202,418, Nov. 17, 1907.

In place of the neutral solutions of the decomposition products of proteins (*e.g.*, protalbin, albumose, etc.) mentioned in the chief patent (see this J., 1908, 1205), solutions containing volatile acids or alkalis may also be used, for example solutions of the protein decomposition products in alcoholic hydrochloric acid or ammonia.

—A. S.

Shellac substitute from the residues of the refining of cottonseed oil and similar products ; Process for obtaining a ——. H. Loeschigk. Ger. Pat. 220,582, Sept. 26, 1909.

The "foots" obtained in refining cottonseed oil and similar products, consisting of soaps, neutral fats, resins, and albuminous substances, are oxidised in alkaline solution (*e.g.*, by hydrogen peroxide), and then treated with acid, when the fatty matter separates from the remainder, and may be recovered by means of a solvent ; the residue is an amorphous, resinous mass, resembling shellac.

—T. F. B.

Coating or impregnating material from casein ; Process for the preparation of a —— *which is insoluble in water and non-inflammable after drying.* F. Brüggemann. Ger. Pat. 220,860, June 18, 1908.

An ammoniacal solution of casein is treated with an ammonium halogenide (chloride, bromide, iodide) and mixed with zinc oxide. The mixture gives a coating which dries in a few hours and is then insoluble in water and non-inflammable.—A. S.

Inks ; Process and apparatus for the recovery of the ingredients of oily ——. M. S. Hopkins and C. R. Barnett, Baltimore, U.S.A. Eng. Pat. 13,679, June 10, 1909.

See U.S. Pats. 932,470, 932,548, 932,549, and 932,550 of 1909 ; this J., 1909, 1049.—T. F. B.

Pigment ; Manufacture of white sulphate of lead ——. J. B. Hannay, Cove Castle, and S. B. Wilson, London. U.S. Pat. 955,396, April 19, 1910.

See Eng. Pat. 6584 of 1908 ; this J., 1909, 251.—T. F. B.

Lithopone-white and process for treating same. C. R. Steinau, Nuremberg, Germany. U.S. Pat. 955,918, April 26, 1910.

See Fr. Pat. 377,429 of 1907 ; this J., 1907, 1099.—T. F. B.

Monoazo dyestuffs and new lakes therefrom. Fr. Pat. 407,903. *See* IV.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber industry of Portuguese East Africa. Board of Trade J., May 5, 1910. [T. R.]

There has been a considerable increase in the production of rubber in Portuguese East Africa. Landolphia is the only variety exported to any extent, but both Ceara and Pará rubber trees have been planted and carefully attended to for several years past ; many thousands of these trees are now reaching the age and strength when they may be tapped. The latex of the Ceara trees is of excellent quality nearly equalling the best Pará plantation rubber. There are good prospects of this industry becoming very important in the near future.

Landolphia rubber from Sierra Leone. Bull. Imp. Inst., 910. 8, 18—21.

Eight samples of "biscuit" rubber prepared in Sierra Leone from Landolphia vines were found to be clean and well prepared. They were brown in colour, very translucent, and had a smoky odour. A typical analysis of these is given in the table, together with the results obtained with a sample in the form of red-brown strips, and with samples of small balls and strips prepared by the natives.

	"Biscuit" rubber.	Rubber in strips.	Rubber in balls. (native method).	Rubber in strips. (native method).
Moisture	1·8	1·8	5·2	2·8
Caoutchouc	85·2	85·2	75·9	83·5
Resin	11·8	11·6	9·5	9·5
Proteins	0·8	1·0	1·6	1·7
Insoluble matter	nil	nil	6·2	2·5
Ash	0·4	0·4	1·6	0·73
Commercial valuation	5s.	5s.	3s. 6d.	3s. 6d. to 3s. 9d. (Para= 4s. 7d.)
Para rubber = 5s. 10d. lb.)				

A sample of Landolphia rubber from the Karene district was in the form of small sticky, dark brown balls with the following composition :—Moisture, 2·2 ; caoutchouc, 80·6 ; resin, 6·5 ; proteins, 1·4 ; insoluble matter, 9·3 ; and ash 0·98 per cent. Commercial valuation 3s. 6d. to 3s. 9d. (Para rubber = 4s. 7d.) per lb. This contained much vegetable impurity. A sample of rubber from *L. owariensis* var. nr. *jenje*, varied in colour from brown to black and had apparently been smoked. Its physical properties were good, and it had the following chemical composition :—Moisture, 5·4 ; caoutchouc, 84·8 ; resin, 8·5 ; proteins, 1·0 ; insoluble matter, 0·3 ; and ash, 0·42 per cent. It was valued at 3s. per lb. (Para rubber = 3s. 5½d.). Another sample in the form of a black ball, derived from a species of Landolphia, was valued at the same rate as the preceding sample, though not quite equal in its composition, which was as follows :—Moisture, 8·2 ; caoutchouc, 76·2 ; resin, 7·4 ; proteins, 5·3 ; insoluble matter, 2·9 ; and ash, 1·85 per cent.—C. A. M.

Funtumia rubber from Sierra Leone. Bull. Imp. Inst., 1910, 8, 16—18.

Three samples of rubber from *Funtumia elastica* indigenous to Sierra Leone, were dark brown, clean, and had apparently been smoked. The physical properties of these were satisfactory, and they had the following chemical characteristics in the form in which they were received :—

	1. No water added to latex.	2. One part of latex boiled with 10 parts of water.	3. Latex boiled with an equal quantity of water.
	Per cent.	Per cent.	Per cent.
Moisture	3·5	9·4	7·9
Caoutchouc	83·5	81·9	84·0
Resin	5·7	5·7	5·3
Proteins	5·8	1·8	2·4
Insoluble matter	1·5	1·2	0·4
Ash	1·17	0·27	0·30

They were valued at :—(1) about 3s. ; (2) 4s. to 4s. 3d. ; and (3) 4s. per lb., the corresponding prices for fine hard Para rubber at the same time being 3s. 5½d., 4s. 7d., and 4s. 7d. per lb. respectively.—C. A. M.

Patents.

Rubber ; Process for devulcanisation of ——. L. Bancheri. Fr. Pat. 407,793, Oct. 11, 1909. Under Int. Conv., May 25, 1909.

The vapour of a terpene such as "terpinol" (obtained by dissolving terpin dihydrate in boiling water acidified with hydrochloric acid, neutralising with a dilute solution of alkali, and distilling), is caused to pass from the generating vessel into a steam-jacketed vessel, containing trays on which the waste rubber is spread out. The terpinol is absorbed by the rubber—which is heated to about the ordinary temperature of vulcanisation by means of the steam jacket—to the extent of about 15 to 25 per cent. of its weight, the excess of terpinol being condensed and run back through a siphon tube into the generating vessel. The absorbed solvent is next recovered from the rubber by maintaining the temperature of the absorbing vessel, and reducing the pressure therein by means of a pump. The solvent distils over into a condensing worm, whence it can be run off as desired and returned to the generating vessel. The last traces of solvent may be removed by drawing a current of air through the absorbing vessel.—E. W. L.

Rubber, gutta-percha, etc. ; Preparation of —— in a state of purity. V. Scholz. Fr. Pat. 407,864, Oct. 13, 1909.

The main principle embodied in the method described is that of the employment of a phenol in presence of water for the extraction of the resins from (low-grade) crude rubbers. Several advantages accrue from the use of this method :—(1) the crude material need not be dried before extraction ; (2) the temperature employed is kept conveniently low by the presence of a moderate amount of water ; (3) impurities of a protein nature, as well as putrescent substances, colouring matters, and tannins, are extracted by the water. The presence of water does not prevent the solution of the resins by the phenol employed. The quantity of water present should be at least in the proportion of one molecule to two molecules of the phenol. *Example.* 5000 kilos. of jelutong (pontianac) or euphorbia ball, etc., are heated for two hours with 5000 kilos. of o-cresol and 100 to 1000 litres of water, depending upon the amount of moisture present in the crude product. The mixture is kept well stirred during this process. The mass is then allowed to stand for 10 minutes, the cresol liquor is run off, and the extraction process is repeated with further quantities until a sufficient degree of purity of the rubber has been attained. The rubber is freed from excess of phenols by means of steam or dilute caustic soda, and the resins are recovered from the phenolic liquors by distillation *in vacuo* or in a current of steam.—E. W. L.

Ebonite capable of resisting the action of chlorine ; Manufacture of ——. M. Wildermann. First Addition, dated Nov. 6, 1909 (under Int. Conv., May 26, 1909), to Fr. Pat. 395,101, Oct. 8, 1908 (this J., 1909, 319).

It is found that other substances than graphite, when added to a rubber mixing containing the requisite amount of sulphur to satisfy the formula, $C_{10}H_{16}S_2$, confer upon it the property of resistance to the action of chlorine and alkalis. The substances which may be employed are such as are capable of resisting the action of chlorine, acids, and alkalis, *e.g.*, finely divided mica, finely divided carbon etc., and they are added in the proportion of from 5 to 15 parts per 100 parts of rubber and sulphur. The mixing must in all cases be fully vulcanised, as pointed out in the original patent.—E. W. L.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Tannins ; The dialytic properties of the vegetable ——. F. Neuner and E. Stiasny. Collegium, 1910, 129—136, 137—144, 145—148.

In this research the authors seek to throw some light on the mechanism of the tanning process, with special regard to the question whether the action is purely chemical or a combination of chemical and physical phenomena. They attempt to measure the extent and nature of the colloidal character of the vegetable tannins by dialysing their aqueous solutions. The apparatus used consists of a cylinder, having a parchment membrane stretched over one end, this being immersed in a second cylinder. The tanning infusion is poured into the inner cylinder, whilst the outer one contains water to such a height, that when the first cylinder is placed within the second, the height of the tanning infusion is just above that of the water outside. The liquors are sterilised with chloroform and kept between 15° and 20° C.; after a certain period, generally five days, the outer dialysed solution, the remaining inner solution, and the parchment are analysed for the amount of tannin and non-tannin present. The conclusions to be drawn from the figures obtained are as follows:—(1) The non-tanning matters show a much greater diffusive power than the tanning matters, bearing out the view that the non-tannins are less colloidal in character than the tannins. (2). The diffusive power differs considerably for different materials, and no connection is apparent between the chemical properties of the tanning materials *e.g.* whether they are of the pyrogallol or catechol class, and the diffusive power. An interesting fact of practical application is that those tanning materials which are the most quickly penetrating are also the most diffusible. The diffusive power of the tanning matters of the different materials increases in the following order:—mangrove, oakbark, quebracho, oakwood, mimosa, valonia, sumach, chestnut, myrobalans, and pine. Myrobalans, chestnut, and sumach are known to be quickly penetrating materials, whereas mangrove and oakbark are slowly penetrating. (3). The non-tannins of the different materials do not show very great variation of diffusive power. (4). In some cases the total amount of non-tannins after dialysis was higher than in the original infusion, whereas the amount of tannin was lower. This is explained by the catalytic power of the membrane to split up the tanning matter into non-tanning matters, and it is quite possible that something of this nature takes place in the tanning process by the action of the hide fibre. (5). Some of the infusions show a curious phenomenon after dialysis. They become very turbid, and almost refuse to pass through the membrane, and in this condition are very difficult to detannise with hide powder. This is ascribed to the separation of the more easily diffused portion. (6). The influence of concentration on the diffusive power appears to be that the more concentrated the infusion, the less the diffusive power. With some of the tannins the effect is considerable. This finds a practical application. In the early stages of the tanning process, where weak liquors are used, the penetration is rapid, whereas in the lasts tages where strong liquors are used, the effect is due more to capillary infiltration than to diffusion. (7). The older the tanning solutions are allowed to become, the slower is the rate of diffusion, but by heating again the power is restored. (8). If the tanning materials are extracted cold, the diffusive power is much lower than if extracted hot. (9). Sulphited quebracho extracts show a lower power of diffusion than non-sulphited, whilst oakwood extracts which have been decolorised by means of blood show a higher diffusive power than the decolorised. (10). Interesting figures are obtained from mixtures of tanning materials. There is no uniformity in the results; in a number of cases the diffusive power of the mixture is the arithmetical mean of the components; in some cases it is higher and in other cases lower. By mixing materials of widely different diffusive powers, the resulting power is higher than the mean. Quebracho as a component raises the diffusive power. (11). The influence of the addition of non-tanning matters on the diffusive power of the tannins is regarded as negligible. (12). The dialysing membrane itself appears to absorb appreciable quantities of tannin. —A. T. H.

Patent.

Tanning apparatus. A. G. Lauro, Genoa, Italy. Eng. Pat. 16,087, July 9, 1909.

See Fr. Pat. 405,039 of 1909; this J., 1910, 227.—T. F. B.

XVI.—SOILS; FERTILISERS.

Hydrolysable salts; Action on higher plants [rye] of some ——. A. Grégoire. Bull. Soc. Chim. Belg., 1910, 24, 200—209.

Experiments are described in which rye plants were grown in culture solutions, containing, besides the usual ingredients, calcium silicohumate, calcium carbonate, analcime, and heulandite respectively. The silicohumate had a distinctly injurious action, and the effect of calcium carbonate was slightly unfavourable; analcime, however, caused a much more vigorous growth than in the case of the control plants, and heulandite also in a less degree gave good results. The author is of opinion that readily hydrolysable salts, that is, salts containing weak acids or bases, or both, exert a special influence on plants, quite apart from any question of nutriment, and that this influence may be positive or negative, according to the compound employed. —F. Sodn.

Analysis of sulphur for agricultural purposes. (1). Bruno. (2). Collin. *See* VII.

Plasticity and cohesion of clays and loams. Atterberg. *See* VIII.

Patent.

Natural phosphates; Process for the enrichment of ——. D. Levat. Fr. Pat. 407,667, Jan. 5, 1909.

The process, which deals with the enrichment of natural phosphates containing calcium carbonate, is carried out in two stages. In the first stage, the coarsely powdered material is boiled with a solution of ammonium chloride, which converts the calcium carbonate into soluble calcium chloride, leaving the enriched phosphate as a residue, and, in the second stage, the ammonium carbonate evolved from the boiling solution is passed into the calcium chloride solution obtained in a previous operation, which causes the precipitation of calcium carbonate in a marketable form, and the regeneration of ammonium chloride. Poor phosphates are preferably subjected to a preliminary calcination, and the resulting lime is hydrated and to a large extent removed by levigation; the residue may then be treated with ammonium chloride as above.—F. Sodn.

XVII.—SUGARS; STARCHES; GUMS.

White sugar; Manufacture of —— *in Java.* H. C. Prinsen Geerligs. Bull. Assoc. Chim. Sucr. et Dist., 1910, 27, 941—945.

The production of white sugar destined for direct consumption in India has made very considerable progress within recent years in Java. The method of manufacture now in vogue is as follows: The juice coming from the mills is tempered in the cold with milk of lime at 15° Baumé to the amount of 5—6 litres for every 1000 litres of juice; it is then treated with sulphurous anhydride until the reaction is just neutral, the indication being determined by phenolphthaleïn test-paper. After passing through the juice-heaters it enters the clarifying tanks, from whence after settling it is sent to the evaporators together with the clear liquor obtained by running the "bottoms" through the filter-presses. Concentration is continued until a density of 50° Brix is reached; at this point the syrup is again allowed to clear by sedimentation, and if necessary is submitted to a second sulphiting. Boiling to grain next follows, but no return of after-product to the pan is made. When curing the resulting massecuite two sets of centrifugals are used; in the first the product is simply machined without being allowed to cool; it is then taken out, mixed with covering liquor, and machined in the second centrifugals, being this time washed after the covering liquor has been spun out. Finally the sugar is dried while in the centrifugals by a jet of dry steam, discharged, passed through sieves, and packed. The covering liquor is returned to the syrup clarifying tank to be again drawn into the pan. The centrifuged molasses is sulphited, boiled to grain, and the resulting massecuite submitted to crystallisation-in-motion, from which operation there results an exhausted molasses having an apparent purity of about 30, and a sugar which may either be sold as "molasses sugar" or else mixed with first jet massecuite in crystallisation tanks. The sugar obtained by the above-described method of manufacture is not to be compared to refined; it is not quite white, but is of sufficiently high quality to find a ready market, and is quite equal to that produced by the carbonation process. When a product of special whiteness is demanded, the contents of the pan are treated with sodium hydrosulphite, and a little ultramarine added in the centrifugals.—J. P. O.

Cane juice; Action of sulphurous acid on ——. L. Giraud. Bull. Assoc. Chim. Sucr. et Dist., 1910, **27**, 948—949.

Attention is drawn to some analytical results recently obtained by P. de Sornay when investigating the action of sulphurous anhydride on cane juices in Mauritius (see this J., 1910, 366). For the acidity (expressed in grms. of sulphur dioxide per litre) of the raw juice before sulphiting 0·88 was given as the mean of a number of determinations, whereas in the author's experience this value generally varies between 0·1 and 0·3.—J. P. O.

Organic lime salts in [beet] sugar factory products; Determination of the ——. D. Sidersky. Bull, Assoc. Chim. Sucr. et Dist., 1910, **27**, 936—938.

In abnormal working a portion of the calcium contained in the filtered second carbonatation juices and in the syrups exists as soluble neutral organic salts; so that a determination of this calcium is of value in indicating any irregularities that may have occurred during diffusion, as well as showing the degree of preservation of the roots being worked. A method for doing this is described, which has been used by the author with satisfactory results during the past campaign. The juice or syrup is first titrated with a standard solution of hydrochloric acid of convenient strength, phenolphthaleïn being used as indicator. To this neutralised liquid is then added a standard solution of sodium carbonate of equivalent strength to the hydrochloric acid until an alkaline reaction is indicated. In the absence of organic calcium salts the volume of sodium carbonate solution required will be equal to that of the hydrochloric acid added; whilst in their presence the volume of sodium carbonate solution will exceed that of the acid by an amount equivalent to the organic calcium in the sample under examination. It may sometimes happen, especially at the commencement of the campaign, that a portion of the alkalinity is due to potash; when this is so the volume of sodium carbonate solution will be proportionally less than that of the hydrochloric acid.—J. P. O.

Milk-of-lime in the sugar factory; Application of the use of phenols to the control of the ——. L. Lindet and M. Brasart. Bull. Assoc. Chim. Sucr. et Dist., 1910, **27**, 933—936.

When sweet-water from the presses has been used instead of pure water for the preparation of the milk of lime, a density reading no longer serves to indicate the volume to be used for defecating the raw juice. The lime content of the milk may, however, be readily determined in the following way: 10 c.c. are treated with 240 c.c. of a 5 per cent. solution of phenol, whereupon the lime easily dissolves and a solution amounting in volume to 250 c.c. is obtained. An aliquot portion, 25 c.c., is then titrated against N/1 hydrochloric acid solution. The number of c.c. used, when multiplied by 2·8, gives the amount of lime (CaO) contained in 100 c.c. of the milk of lime. For sampling the milk the authors recommend, in place of a pipette, a small measuring cylinder, contracted at its mouth, and having a capacity of 10 c.c.—J. P. O.

Aloïnose or the sugar of aloïn. Léger. *See* XX.

Patents.

Beetroot juice; Method of clarifying and precipitating non-saccharine matters from ——. A. Lipski. Fr. Pat. 408,024, Jan. 13, 1909.

The clarifying agent employed consists of a mixture of kaolin, calcium oxide, aluminium hydroxide, and aluminium sulphate, but the mixture may consist of the first two or the first three of these substances. The beetroot juice is heated to a temperature of from 60° to 70° C., and a quantity of the composition, corresponding with from 0·12 to 0·4 per cent. of the weight of the beetroots, is added. The mixture is then heated to 85° C., a quantity of calcium oxide is added, and the precipitate formed is removed by filtration. The amount of the composition and of the calcium oxide to be added depends on the quantity of non-saccharine organic matter in the juice and tables are given showing the requisite amounts.—W. P. S.

Beetroot pulp, etc.; Process and apparatus for the continuous extraction of ——. C. Guichard. Fr. Pat. 408,068, Jan. 14, 1909.

The apparatus consists of a series of horizontal drums mounted side by side and connected alternately at either end. The beetroot pulp is conveyed from a receptacle by means of a screw conveyor into the first drum of the series and is forced through the drum by a rotating shaft provided with screw blades; at the end of the drum where it connects with the next in the series, the shaft is fitted with specially shaped blades which force the pulp into the next drum, and so on. The water used for the extraction is admitted to the last drum and is caused to pass through the drums in the opposite direction to the pulp by means of injectors; one end of each drum is perforated and the liquid escapes into a false bottom from which it is collected and injected into the next drum. On leaving the first drum of the series the extract is passed into the receptacle containing the pulp, and drains through the perforated bottom of this receptacle into a collecting channel. The water used for the extraction may be heated.—W. P. S.

Beet slices; Process for heating —— *previous to diffusion.* H. Gieseler. Ger. Pat. 219,397, April 2, 1909.

The patent relates to the method of heating the beet slices in the diffuser, previous to the actual diffusion process, by means of steam, the temperature of which is reduced to the desired extent by creating a partial vacuum in the diffuser. The degree of vacuum is kept constant either by placing a safety device (valve, barometer tube, or the like) on the diffuser, on the pipe leading from the diffuser to the suction apparatus, or on the suction apparatus itself; or by connecting the diffuser, by means of valved pipes, with several vessels (*e.g.*, evaporators) in which definite degrees of vacuum are maintained.—A. S.

Sugar; Direct conversion of sugar syrups into crystallised ——. C. Grière, Grevenbroich, Germany. Eng. Pat. 9148, April 17, 1909. Under Int. Conv., April 25, 1908.

See Fr. Pat. 402, 305 of 1909; this J., 1909, 1216.—T. F. B.

[Dextrose and alcohol from] rice husks. Fr. Pat. 407,844. *See* XIXa.

Non-adhesive preparations from starch. Ger. Pat. 220,850. *See* XX.

XVIII.—FERMENTATION INDUSTRIES.

Barleys; Malting this season's ——. A. R. Ling. J. Inst. Brewing, 1910, **16**, 16—21.

On the whole, the quality of the 1909 barleys must be regarded as unsatisfactory, though the author considers that with rational malting, it should be possible to produce good brewing material from the majority of the barleys. From his experience of the 1909 barleys, he considers that their main characteristics may be summed up as follows. Maturation, indifferent; colour, bad; odour, bad;

moisture, high: nitrogen, normal or low: mellowness, satisfactory; size of corns, uneven; diastatic activity, high. The author recommends sweating the barley; omission of this has been found to lead to uneven germination and under-modification of the malt. Aëration of the steep should be especially useful this season; if this is not practicable, the grain should be left exposed to the air between each change of water. Whenever possible, the temperature of the steep water should be raised to 55° F. With regard to the use of lime-water in the steep, the first change of water should be so prepared that it contains about 19 grains of calcium hydroxide per gallon: the remaining change should be plain water. Different waters require different amounts of lime-water to bring them up to the strength above mentioned, but even the most highly calcareous waters, which precipitate the lime as carbonate, would not probably need more than an equal volume of lime-water. It is undesirable to add lime itself to the cistern. It has been suggested in Germany that preliminary steeping in warm water is advantageous (Moufang, this J., 1910, 506); in the author's opinion this departure requires thorough investigation before it can be recommended. The 1909 barleys appear to work very freely on the floors, and the author considers that in practice, the malts will turn out much better than might be anticipated from the appearance of the barleys. In the discussion on the paper, it was remarked that the 1909 barleys appeared to require a longer storage after sweating than usual; it was also suggested that with this year's barleys (1909), especial care should be taken to get a good strong rootlet, or that what rootlet did grow was not allowed to get "wind withered."—L. E.

Malt; Influence of saline constituents of brewing liquor on the amount of extract from ——. J. L. Baker and H. F. E. Hulton. J. Inst. Brew., 1910, **16**, 352—358.

IN 1905 the authors noticed that when malt is mashed in distilled water a higher extract is yielded than if London tap-water is used. The average loss is 0·6 lb. per quarter of malt, but as the tap-water has a gravity of 1000·29 which is equivalent to 1 lb. of extract per quarter, the absolute loss of extract is 1·6 lb. Since that time similar observations have been recorded by Pankrath, Moufang and others. The influence of solutions of gypsum, kainite, calcium chloride and salt such as might be used in brewery practice, has now been investigated and it has been found that with them the excess gravity of the mashing liquor is more than sufficient to compensate for the diminished extract yielded by the malt. As 14 of the 20 grains of solids, present per gallon in the tap-water used, consisted of calcium carbonate, solutions of this salt in carbonated distilled water were prepared and used as mashing liquor. From the results it appears that the inhibitory effect of calcium carbonate on malt extract is roughly proportional to the concentration. It is suggested that as in England the Excise levy beer duty on the specific gravity of the wort collected, an allowance ought to be made for the specific gravity of the liquor employed in mashing.
—R. L. S.

Malt infusions; The presence of anti-amylase in ——. A. J. J. Vandevelde. Bull. Soc. Chim. Belg., 1910, **24**, 198—200.

SOLUTIONS of amylase, prepared by the infusion of green malt, exhibit properties analogous to those previously observed with the proteolase of milk and certain serums (this J., 1909, 902). Preliminary heating of the solution at 55° C. causes a slight increase of diastatic activity towards starch solution.—F. SODN.

Phosphates; Action of —— *on the elimination of carbon dioxide by plants.* L. Iwanoff. Biochem. Zeits., 1910, **25**, 171—186. (Compare this J., 1910, 37.)

LIVING yeast cells are stimulated by the addition of disodium hydrogen phosphate but the positive appearance of the stimulation depends on the species and on the physiological state of the cell. In presence of toluene, phosphate invariably stimulates action: probably the toluene destroys the resistance of the cell membrane to penetration by the phosphate and this is thus able to come in contact with the cell fluid. By adding toluene it is possible to detect the presence of zymase in yeast in the same simple manner as proteoclastic enzymes are identified and the further addition of a basic phosphate causes the maximum of fermentative change. Similar experiments with wheat germs, in which the carbon dioxide produced was measured in a manometer, showed that the addition of disodium hydrogen phosphate caused a marked increase in the amount of carbon dioxide produced from glucose. The phosphate may be used in the form of solutions containing as much as 5 per cent. of the salt. Acid phosphate stimulates when present in low concentrations (0·4 per cent.) but in higher concentrations retards the change. Potassium and sodium phosphates behave alike. Stimulation is also caused by phosphate in an atmosphere of hydrogen. The powdered seeds of certain varieties of peas gave considerable quantities of carbon dioxide in presence of toluene and the addition of basic phosphate increased this amount. Experiments with other seeds gave confirmatory results.—E. F. A.

Sulphurous acid in wine; Determination of free and combined ——. P. Cazenave. Ann. Falsific., 1910, **3**, 154—158.

THE author has investigated various methods for the determination of sulphurous acid in wine and finds that the only reliable process consists in oxidising the sulphurous acid with iodine and determining the resulting sulphuric acid gravimetrically. Titration with iodine, either directly or by treating the distillate from the wine with an excess of iodine and titrating this excess, yields inaccurate results. It is recommended that the free sulphurous acid be removed by distilling the wine under reduced pressure at a temperature below 50° C.; this distillation need only be continued for 5 minutes. The sulphurous acid remaining in the residue is then determined gravimetrically after oxidation; its quantity represents the combined sulphurous acid. This amount deducted from the total sulphurous acid present (determined separately) gives the quantity of free sulphurous acid. It is not necessary to carry out the distillation in an atmosphere of carbon dioxide.—W. P. S.

PATENTS.

Malt extracts. F. Faulkner, Birmingham, and J. M. and J. H. Collet, Gloucester. Eng. Pats. 7989, Apr. 3, 1909, and 17,113, July 22, 1909.

GRAIN, and preferably skinless grain such as skinless barley or artificially decorticated grain, is malted to the withering stage. The green malt, with or without addition of water, is ground to pulp. The pulp is subjected, under pressure, to the action of a preservative and digestive agent such as sulphurous acid, at about 125° F. for 40—45 minutes; with a pulp containing 35 per cent. of water, a quantity of sulphurous acid amounting to 0·04 per cent. of the mass under treatment, may be used. The excess of acid, if any, is now neutralised, the mass is then heated to 155° F. in order to effect saccharification, and finally to the temperature necessary to effect coagulation of nitrogenous bodies. The mass is then filtered; the filtrate may be evaporated to dryness at a temperature sufficient to yield torrefaction products.—L. E.

Malting; Process of ——. J. Schneible, Chicago, Ill. U.S. Pat. 954,889, Apr. 12, 1910.

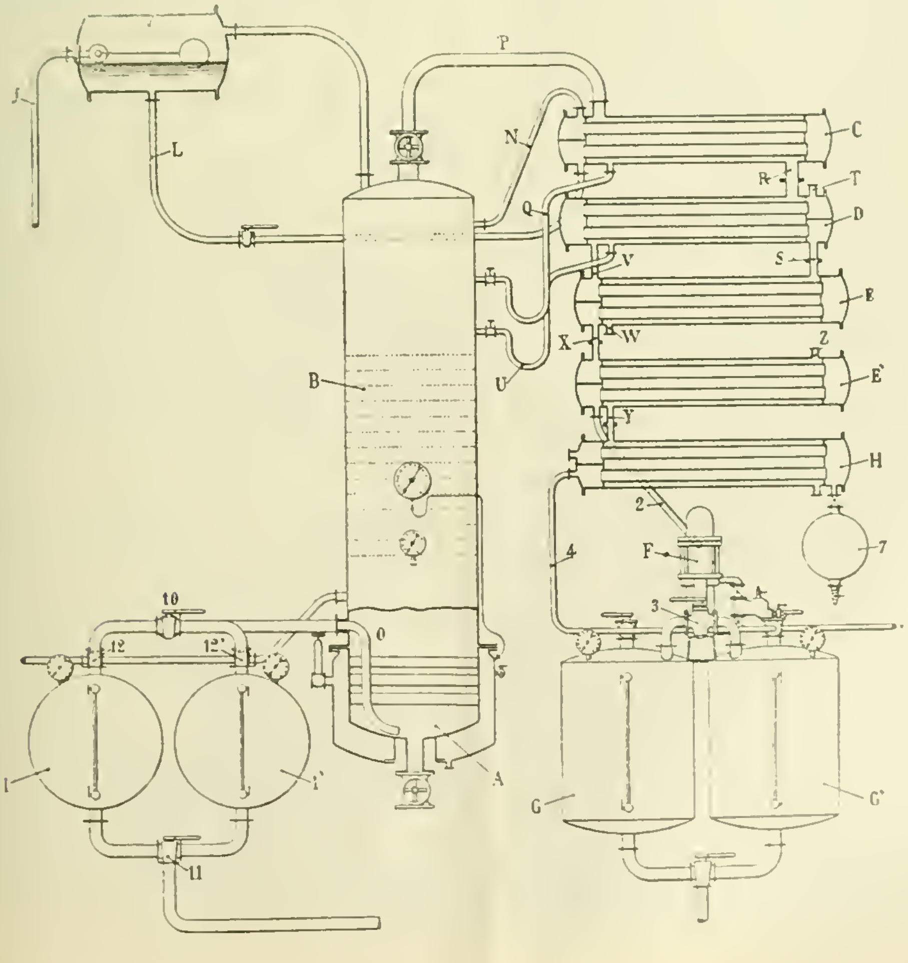
GRAINS are prepared for germination by treating them, at intervals, with water in quantity merely sufficient to moisten them without expelling their contained air, and turning the grains, at intervals, in presence of air. The treatment is effected at a substantially uniform temperature in a holder, in presence of air.—L. E.

Brewers' worts and the like; Fermentation of ——. F. M. Maynard, Birmingham. Eng. Pat. 7806, Apr. 1, 1909.

A HERMETICALLY-CLOSED or pressure fermenting vessel is combined with an air-operated wort raiser for effecting the periodical rousing and aëration of the liquid. The wort raiser comprises a standpipe situated inside or outside the fermenting vessel and adapted to take up wort and yeast in all directions from the bottom of the vessel to a sprayer by means of which the liquid is distributed over the fermentation head ; the standpipe is fitted with an enclosed air-nozzle delivering pure air axially into the pipe, and it is so constructed that it may be readily removed, cleansed and inspected ; if it is situated within the fermenting vessel, it is provided with a supporting foot to rest on the bottom of the vessel. Combined with the fermentation vessel, there are also, an adjustable skimming board, a parachute, and parachute valve mechanism in which the parachute is suspended from, or connected with, a hollow screwed rod operated by an external hand-wheel and through which a separately operated valve-rod passes ; means are provided for adjusting and operating the skimming board without opening the fermentation vessel. Outside the fermentation vessel is a saccharometer chamber or lantern with wort and air-pressure connections, so that a sample of the liquor can be periodically admitted into the lantern, tested for attenuation, and returned to the fermentation vessel. At the top of the fermentation vessel is a branched connection through which passes the spindle of the skimming board mechanism, and which provides for the removal of carbon dioxide, and for the application of air and gas pressures. Claim is also made for the application of the wort raiser above-mentioned, in an open fermenting vessel. (Reference is directed to Eng. Pats. 13.386 of 1896, 18,645 of 1897, and 16,159 of 1899 ; this J., 1896, 641 ; 1898, 784 ; 1900, 550).—L. E.

Apparatus for distillation under reduced pressure ; Continuous ——. O. Simon. Fr. Pat. 407,668, Sept. 1, 1909.

The liquid to be distilled is delivered by the pipe, J, into the closed feed-tank, K, provided with a float valve and which is maintained at the same pressure as the still, B. From K, the liquid flows by the pipe, L, through the preheater, C, and thence by the pipe, N, into the column, B. The latter is provided with the usual trays or with special spiral trays which present a large surface of liquid but do not increase the pressure in the column to any great extent. The liquid flows down B, and is fractionated by the ascending vapour from the jacketed heater, A, into which the residual spent liquid or wash flows. The spent wash is discharged alternately into one of the vessels, I, I', through the pipe, O. These vessels can be put into communication by the valves, 10, 12, 12', with the still, the atmosphere, or with a vacuum pump. The liquid collecting in I, I', is discharged through the pipe, II. The vapours given off in the still pass by the pipe, P, into the space surrounding the tubes of the heater, C, any condensed liquid flowing either to the condenser, D, through the pipe, R, or back to the column through the pipe, Q. The uncondensed vapour passes next round the tubes of the condenser, D, where it is further cooled by water which enters at S, and leaves at T, the condensed liquid passing as before either to the next condenser, E, by the pipe, V, or back to the column through the pipe, U. In E, the vapours pass through the tubes and are condensed by water which enters at W, circulates round the tubes and passes on to D, through S. The condensed liquid now flows by the pipe, X, through the tubes of the cooler, E', and is cooled by cold brine, which enters at Y, and leaves at Z. The liquid flows from E', by the pipe, 2, into the special gauge, F, and thence by the two-way tap, 3, into one or other of the vacuum receivers, G, G^1, which are used alternately. These receivers are connected by the pipe, 4, through the brine-cooled safety condenser, H, to the vacuum pump. Any liquid condensed in H, is collected in the receiver, 7.—W. H. C.



Dephlegmating columns for the distillation of alcoholic liquors. O. Perrier. Fr. Pat. 408,434, Jan. 22, 1909.

The vapour rising through the column is made to pass through capped pipes and through two series of holes in such parts of the caps as to produce a circulation of the liquid in the trays towards the overflow. The periphery of each tray is arranged in a similar manner by means of a lip extending from the walls of the column. The two series of holes are made at different heights, so that the jets of vapour issuing from them clash with each other and produce the smallest bubbles possible; the jets from the upper holes are made to take a horizontal path and those from the lower holes a vertical path, the time of travel of both in the liquid being approximately the same.—J. W. H.

Alcohol; Separating apparatus [for acetic and formic acids] for use in the manufacture of ——. Comp. Industrielle des Alcools de l'Ardèche, Paris. Eng. Pat. 18,028, Aug. 4, 1909. Under Int. Conv., Oct. 16, 1908.

See Fr. Pat. 404,360 of 1908; this J., 1910, 211.—T. F. B.

Distillation columns. Fr. Pat. 408,705. *See* I.

[Dextrose and alcohol from] rice husks. Fr. Pat. 407,844. *See* XIXa.

XIXa.—FOODS.

Meat extracts; Isolation of creatinine from ——. K. Micko. Z. Unters. Nahr. Genussm., 1910, 19, 426—434.

Although no substance other than creatinine has been discovered which yields the Jaffé reaction (compare Chapman this J. 1909, 1267), it is sometimes of importance to confirm the evidence afforded by this reaction by actually separating the creatinine from a sample of meat extract, and the following method is described for the latter purpose:—Ten grms. of the meat extract, or larger quantities in the cases of mixtures of meat and yeast extracts, are dissolved in water, basic lead acetate is added until no more precipitate forms, and the mixture is diluted with water to a volume of 1 litre. After the lapse of several hours, the liquid portion is passed through a filter, the filtrate is acidified with hydrochloric acid, evaporated, filtered, the precipitate of lead chloride is washed with a little cold water, the filtrate and washings are concentrated, and the residual solution is mixed with several times its volume of hot alcohol. The remaining quantity of lead present in the solution separates out completely on cooling. The lead-free solution is now treated with an excess of hydrochloric acid, evaporated to dryness, the residue is dissolved in 100 c.c. of water, the solution is neutralised by the addition of sodium hydroxide, and 10 c.c. of a 20 per cent. sodium bisulphite solution and 10 c.c. of a 13 per cent. copper sulphate solution are added. The mixture is boiled, allowed to cool for some time and when quite cold the precipitate is collected on a filter, and washed with cold water. The filtrate is evaporated with hydrochloric acid to expel sulphurous acid, and the copper is removed with hydrogen sulphide. The solution is next evaporated and the residue is extracted with alcohol, which is in turn evaporated and the residue again extracted with alcohol, the greater part of the alkali salts being thus eliminated. The syrupy solution of the bases thus obtained is treated with 50 c.c. of dilute sulphuric acid, an excess of 30 per cent. phosphotungstic acid is added, and the mixture is allowed to stand for two days. The precipitate is then collected on a filter, washed with very dilute phosphotungstic acid solution acidified with sulphuric acid, washed back again into a vessel with hot water, and sufficient barium hydroxide is added to render the mixture slightly, but permanently, alkaline. The mixture is filtered, the filtrate is neutralised with sulphuric acid, evaporated to a syrupy consistence, the residue being then dissolved in a little dilute sulphuric acid, and again evaporated. The syrup obtained is dissolved in a small quantity of water, hot alcohol is added and the mixture is placed aside for 24 hours, the clear solution being then decanted from the precipitate and evaporated. This residue is again treated with alcohol as before, and the alcoholic solution is evaporated. The two residues from the alcohol are also dissolved in a little water and treated with alcohol. The united alcoholic extracts are once more evaporated, the residue obtained is dissolved in 30 c.c. of water, the solution is boiled, rendered alkaline by the addition of lead hydroxide, and a considerable volume of hot alcohol is added. After the lapse of several hours, the mixture is filtered, the filtrate is evaporated, and the lead is removed as lead sulphide. After removal of the lead sulphide the solution is evaporated, and the crystalline mass obtained is treated with about 30 c.c. of 1·2 per cent. picric acid solution. Next day the creatinine picrate is collected on a filter, the filtrate is evaporated under reduced pressure and the residue is again treated with the picric acid solution, this operation being repeated until practically no more creatinine picrate is obtained. The total creatinine picrate is heated with dilute hydrochloric acid, and the picric acid liberated is extracted by means of toluene. The acid solution containing the creatinine hydrochloride is concentrated, treated with animal charcoal and evaporated until crystallisation commences. After cooling, the mass of crystals is treated with a mixture of 1 part of acetone with 2 parts of absolute alcohol, and the crystals are collected on a filter. The filtrate is evaporated, the residue is treated as before with acetone and alcohol, and the small quantity of creatinine hydrochloride thus obtained is added to the main bulk. The yield of creatinine hydrochloride obtained in the case of meat extract is about 0·45 grm., and a single crystallisation from water yields a practically pure product. Yeast extracts do not yield any creatinine hydrochloride when examined by the above-mentioned process, but mixtures of the same with meat extract give a quantity of creatinine hydrochloride proportional to the amount of meat extract present.—W. P. S.

Milk; "Protective" action of colloids in ——. J. Alexander and J. G. M. Bullowa. Chem. News, 1910, 101, 193—195.

The ratio of the albumin to the casein in milk is of considerable importance, as the casein is an irreversible, or coagulating, or unstable colloid, which is protected by lactalbumin, a reversible or stable colloid (see this J., 1909, 284). Simple chemical analysis, without taking into consideration the principle of colloidal protection, is an insufficient criterion for the actual digestibility or availability of the food. In the case of cows' milk which has been modified for infant feeding, it is necessary not only to consider the percentage of total proteins, fat, etc., present, but to see that the casein is adequately protected, this being ascertained by examination with the ultramicroscope as described (*loc. cit.*). The influence of "protection" is not, however, confined to the casein, but is probably an important factor in maintaining the emulsion of the fat.—W. P. S.

Oat-corns; Influence of different conditions of weather and cultivation on ——. A. Frei. Landw. Vers.-Stat., 1910, 72, 161—310. Chem. Zentr., 1910, 1, 1545—1546.

In the examination of oat-corns it is necessary to separate the kernels from the husks. For example in the determination of starch by Lintner's method (this J., 1907, 281; also 1908, 238) the results would otherwise be affected by the lævo-rotatory substances which are present in the husk. The rotatory power of oat-starch was found to be $[\alpha]_D = 200{\cdot}2°$ in hydrochloric acid solution and 194·7° in sulphuric acid solution. It was found that the protein content of oats is higher, and the content of starch and fat lower, the more thinly the seeds are sown, and the lower the quality of the soil. Of the corns freed from husks, the larger ones are richer in protein and starch and poorer in ash and fat, whilst in the husks the reverse is the case; in the whole corns, the amount of husk and the ash content are lower, and the content of starch, protein, and fat usually higher, the larger the size of the corns.—A. S.

Cocoa powders; Alimentary value of different commercial ——. J. M. Albahary. Ann. Falsific., 1910, 3, 159—165.

The paper deals mainly with the properties of natural cocoa and of so-called soluble cocoa. It is shown that the latter is not more soluble than is natural cocoa which has been deprived of a portion of its fat. The greater quantities of alkali, soap, and colouring matter going into solution during infusion cause the fat to be better emulsified and the insoluble constituents to remain for a longer time suspended in the liquid than in the case of natural cocoa, but the actual solution is not more concentrated. The proteins and other substances present in cocoa are neither more soluble, greater in quantity, nor better utilised in the case of soluble cocoa than in natural cocoa. The presence of soap, resulting from the neutralisation of the fatty acids of the cocoa-fat by the added alkali, is particularly objectionable when the cocoa is consumed by children and invalids. (See also this J., 1910, 369.)—W. P. S.

Vaccinium vitis Idaea, V. oxycoccos, and V. macrocarpum fruits; Constituents of ——. C. Griebel. Z. Untersuch. Nahr. Genussm., 1910, 19, 269.

The fruits of *Vaccinium vitis idaea, V. oxycoccos*, and of *V. macrocarpum* all contain benzoic acid, both free, and combined in the ester form as the glucoside vacciniin, which is at once hydrolysed by an alkali hydroxide solution. Bilberries contain from 0·054 to 0·144 per cent. of free benzoic acid; whortleberries and cranberries from 0·011 to 0·041 per cent. Finnish whortleberries contain the least. The total benzoic acid in bilberries ranges from 0·088 to 0·224 per cent. and in the other fruits, from 0·021 to 0·061 per cent. Bilberries also contain more sugar and less fruit acids and pectin. The formation both of the free benzoic acid and that combined as glucoside occurs when the fruit begins to redden, and increases as the ripening process proceeds. On crushing, or cold pressing, the berries, a portion of the free benzoic acid in the juice becomes esterified. Vacciniin, $C_6H_{11}(C_6H_5CO)O_6$ occurs to the extent of about 0·1 per cent. in the ripe fruit. Its phenylhydrazone, $C_6H_{11}(C_6H_5CO)O_5(N_2HC_6H_5)$, melts at 135°—136° C. and is nearly insoluble in water.—J. O. B.

Economic products [spices] from Mauritius. Bull. Imp. Inst., 1910, 8, 1—4.

Cinnamon bark.—The sample yielded 0·8 per cent. of oil of fair quality, which was reported by brokers to be of good quality, equal to that known as "fair Seychelles," and to be worth about 1½d. per lb. *Cinnamon leaves.*—The finely ground leaves yielded on distillation with steam 1·1 per cent. of an oil of good odour, the usual yield from cinnamon leaves being 1·5 to 2 per cent. *Nutmegs.*—These were of good quality, and were valued at 2½d. per lb. unshelled and about 3¾d. per lb. shelled. *Mace.*—This was typical of the commercial spice. It was reported to be of good quality, and worth about 1s. 8d. per lb., the somewhat low valuation being due to its small size. *Cloves.*—The sample was clean, free from stem, and of good quality, and was reported to be "good bright Zanzibar cloves" worth 5½d. per lb. On distillation it yielded 18·1 per cent. of oil, with properties corresponding with those of good oil from Zanzibar cloves.—C. A. M.

Refraction of the insoluble fatty acids of butter-fat. Dumitrescu and Popescu. *See* XII.

Patents.

Milk: Dehydrating ——. T. L. White and A. P. Elten, New York. U.S. Pat. 956,246, April 26, 1910.

The milk is dehydrated by electrical endosmosis whilst in a container provided with a dialysing diaphragm, which will allow the water to pass through, but is impervious to the other constituents of the milk.—A. S.

Rice husks; Process for utilising ——. [*Production of dextrose and alcohol.*] H. Simonin. Fr. Pat. 407,844, Jan. 8, 1909.

The rice husks are submitted to the action of a concentrated mineral acid in an autoclave at a pressure of from 3 to 4 kilos. The solution is then cooled to a temperature of 40° C. in order that resinous substances may separate out, and these are removed by filtration. The filtrate containing the dextrose resulting from the saccharification of the cellulose of the husks is neutralised by the addition of alkali carbonates, calcium carbonate, strontium carbonate, or barium carbonate, and the precipitate formed is separated by filtration. The filtrate may now be concentrated to obtain the dextrose, or it may be fermented in order to produce alcohol.—W. P. S.

Coffee; Process for the separation of caffeine from ——. H. Salle et Cie. Fr. Pat. 408,066, Jan. 14, 1909.

Raw coffee berries are first treated with steam to cause them to swell and are then submitted to the action of either gaseous ammonia or sulphur dioxide, about 1 kilo. of the latter being used for every 100 kilos. of berries. The caffeine is next extracted from the berries by means of benzene, alcohol, or chloroform, or by a mixture of these solvents. When no more caffeine is extracted, the berries are heated under reduced pressure to a temperature of 40° C. in the presence of steam, in order to remove all traces of solvent: the berries are finally dried and roasted. The caffeine may be recovered from the solution. —W. P. S.

Caffeine; Process for the extraction of —— from coffee and the like. E. Utescher. Ger. Pat. 219,405, Dec. 1, 1907.

The coffee or other material is moistened with water and exposed to the action of an electric current in order to liberate the caffeine, and is afterwards, or simultaneously, extracted with a suitable solvent, such as ethyl acetate or chloroform. It is claimed that by this method the caffeine can be almost completely removed from coffee and the like without any alteration of the aromatic constituents of the latter.—A. S.

Nutritive and flavouring substance; Method of making a ——. K. Ikeda and S. Suzuki, Tokyo. Eng. Pat. 9440, April 21, 1909.

See Fr. Pat. 402,630 of 1909; this J., 1909, 1219.—T. F. B.

Milk: Process for the fermentation of ——. J. P. Cabanné, St. Louis, U.S.A. Eng. Pat. 26,007, Nov. 10, 1909.

See U.S. Pat. 944,013 of 1909; this J., 1910, 170.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Radioactivity of Greek mineral springs. T. Komnenos A. Dambergis, and B. Aeginitis. Pharm. Post, 1910, 43, 189—190. Chem. Zentr., 1910, 1, 1634.

The authors have examined the radioactivity of the water of springs in different parts of Greece. In some places (Cyllene) the radioactivity was very low, but in other places (Loutraki, Tombasi), the activity was as high as that of any known mineral waters.—A. S.

Portland cement concrete; Effect of sewage and sewage gases on ——. S. H. Chambers. The Concrete Institute, April 21, 1910. Chem. Trade J., 1910, 46, 433—434.

Contrary to general opinion, the author finds that the gases arising from the decomposition of sewage may act injuriously upon good Portland cement concrete, when the following conditions prevail simultaneously: (1) a high degree of putrescence of the sewage, (2) a moistened surface which holds or absorbs the putrid gases, (3) the presence of a free air supply. The investigations were carried out at the Hampton Sewage works, upon an installation comprising a screening chamber, two detritus tanks, a hydrolytic tank, triple contact beds, and an air-purifying filter. The screening-chamber, channels, and tanks, which were constructed wholly of concrete, were covered in and ventilated by the hydro-mechanical system. After a few months' use the roof and walls of the hydrolysing chambers above the liquid level became coated with a white or yellowish covering of sulphur, and later they showed signs of peeling. It was found upon analysis that the soft surface layer contained 66 per cent. of calcium sulphate. Similar changes were observed in the channels and air ducts. The erosive effect was most marked at the varying level of the liquid, extensive crumbling being observed in some cases, while the concrete below the liquid level was unaffected. The action appears to be due to the oxidation of sulphuretted hydrogen in solution to sulphurous and sulphuric acids.—H. H.

Analysis of sulphur for agricultural purposes. (1). Bruno. (2) Collin. *See* VII.

Determination of small quantities of lead. Vernon Harcourt. *See* XXIII.

Patents.

Water; Chemical process for purifying ——. G. Lambert. Fr. Pat. 408,027, Jan. 13, 1909.

The water is treated with a powder consisting of a mixture of potassium permanganate and calcium hypophosphite. The water is stirred during the addition of the powder and the permanganate dissolves at once, sufficient of the powder being added to give the solution a faint pink coloration. The calcium hypophosphite dissolves much more slowly, but when in solution it reacts with the excess of permanganate, insoluble calcium phosphate and oxides of manganese being formed. The precipitate is allowed to settle and the water is filtered before use. Several forms of filter suitable for this purpose are described.—W. P. S.

Manganese from water; Process for the removal of ——. J. D. Riedel. Akt.-Ges. Ger. Pat. 220,609, Oct. 28, 1908. Addition to Ger. Pat. 211,118, Jan. 23, 1908.

According to the main patent the water was treated with insoluble higher oxides of manganese in contact with natural or artificial zeolites (see also Fr. Pat. 405,990; this J., 1910, 449). On passing a water containing manganese salts through a filtering bed composed of a zeolite impregnated with higher oxides of manganese, the manganese of the water is separated in the form of a mud. It has now been found that if this mud be not removed from the filter, it eventually forms small porous particles which do not interfere with the filtering capacity of the bed, but greatly increase its efficacy with regard to the removal of manganese from water.—A. S.

Air and other gases; Sterilisation of ——. V. Henri, A. Helbronner and M. Von Recklinghausen, Paris. Eng. Pat. 8300, April 6, 1909.

The sterilisation of air or other gases, *e.g.*, the atmosphere of living rooms, is effected by means of a metallic vapour lamp or lamps (*e.g.*, a quartz mercury vapour lamp), so arranged that a circulation of the air around and close to the lamps is obtained by means of the convection currents caused by the heat radiated from the lamps. All the air in the room will thus be gradually sterilised. A duct or shaft may be provided, adjacent to the lamps, to promote the production of convection currents; a fan also may be employed to assist the circulation.—L. E.

Plant parasites; Preparation of a composition for destroying ——. J. Hertkorn. Ger. Pat. 218,032, Dec. 31, 1907.

The composition claimed consists of chromium residues, of any origin, suspended in water, with or without addition of acids or of iron, manganese, zinc or cupric compounds, or carbohydrates.—A. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchona alkaloids and their salts; Solubility of —— *in water at 25° C.* G. L. Schaefer. Amer. J. Pharm. 1910. **82**, 175—178.

In the following list the figures indicate the amount of water, in parts by weight, required to dissolve one part of the pure, finely powdered salt, when kept at 25° C. for several days, the mixture being frequently shaken. In the case of the pure bases, saturated aqueous solutions were shaken out with chloroform or ether, and the amount of alkaloid removed was found by weighing the residue obtained by evaporating the solvent. The following are the results obtained under these conditions:—Quinine alkaloid, 3000; quinine acetate, 50; quinine anisate 2400; quinine arsenate, 650; quinine benzoate, 360 quinine dihydrobromide, 5; quinine dihydrochloride 0·7; quinine dihydrochloride with urea, 1; quinine bisulphate, 8·5; quinine chlorhydrosulphate, 1·3; quinine chromate, 3150; quinine citrate, 825; quinine basic glycerophosphate, 850; quinine hydrobromide, 43 quinine hydrochloride, 21; quinine hypoferrocyanide 2000; quinine hydroiodide, 205; quinine hypophosphite 35; quinine basic lactate, 6; quinine nitrate, 70; quinine oxalate, 1400; quinine phosphate, 800; quinine picrate 3400; quinine quinate, 3·5; quinine salicylate, 2100 quinine sulphate, 700; quinine bisulphoguaiacolate (guaiaquin), 0·5; quinine sulphocarbolate, 250; quinine urate, 550; quinine phenol-sulphate, 680; quinine tartrate, 950; quinine tannate, 2000; quinine valerate 80; cinchonidine alkaloid, 4800; ; cinchonidine bisulphate 1; cinchonidine tetrasulphate, 3; cinchonidine dihydrobromide, 7; cinchonidine hydrobromide, 60; cinchonidine hydrochloride, 21; cinchonidine dihydrochloride, 1·6 cinchonidine salicylate, 1320; cinchonidine sulphate 92; cinchonidine tannate, 1800; cinchonine alkaloid 8800; cinchonine sulphate, 1·5; cinchonine bisulphate 1·5; cinchonine hydrochloride, 22; cinchonine hydrobromide, 59; cinchonine dihydrobromide, 1·8; cinchonine salicylate (crystalline), 590; cinchonine sulphate, 85 cinchonine tannate, 1100; cinchonine tartrate, 32 quinidine alkaloid, 6900; quinidine hydrobromide, 190 quinidine hydrochloride, 86; quinidine hydroiodide 1220; quinidine salicylate, 1650; quinidine sulphate, 95 quinidine tannate, 2100; quinidine tartrate, 35; quinidine bitartrate, 310. Attention is called to the fact that some of these salts are partly dissociated by water into a more soluble and a less soluble compound. Thus one part of pure basic quinine glycerophosphate,

$$(C_{20}H_{24}N_2O_2)_2PO_4H_2.C_3H_7O_2+5H_2O,$$

requires about 850 parts of water for its complete solution at 25° C. If, however, a large excess of the salt be treated with water at 25° C., and frequently shaken for several hours, the saturated solution, when tested will then be found to contain the salt in the proportion of 1 : 200, or less. On draining the undissolved salt, and again treating it with water, its solubility will be found to have decreased markedly. The above figures were obtained with freshly prepared salts; but they cannot be taken as standards since differences in physical condition, and in the amount of water of crystallisation tend to cause discrepancies Salts of the volatile organic acids with cinchona bases become less soluble with age.—J. O. B.

Alkaloid from Pseudocinchona africana. Hydrolysis by alkalis. E. Fourneau. Comptes rend., 1910. **150** 976—978. (See this J., 1909, 812.)

The alkaloid obtained from *Pseudocinchona africana* resembles yohimbine in many of its properties. It was heated with two equivalents of sodium ethoxide dissolved in 10 times its weight of alcohol, the liquid was evaporated the soda exactly neutralised, and the gelatinous mass which separated, was taken up with alcohol. The solution deposited crystals of an acid on standing. The acid thus obtained becomes an anhydride on crystallising from methyl alcohol, when it forms glistening leaflets which melt at 300° C. on the Maquenne block. The substance dissolves in alkalis and in mineral acids, but is precipitated from its alkaline solutions by acetic acid. The anhydride has the composition, $C_{20}H_{24}N_2O_3$. The salts are derived from the hydrated form. The sodium salt crystallises in leaflets soluble in water and methyl alcohol, but insoluble in absolute alcohol.—F. Shdn.

Kakotheline ; Coloured isomeric salts of ——. H. Leuchs and F. Leuchs. Ber., 1910, **43**, 1042—1051.

When strong nitric acid acts upon brucine, a crystalline substance called kakotheline is produced, which is really bisdesmethylnitrobrucine hydrate (this J., 1909, 1163). The base has the composition, $C_{21}H_{21}O_7N_3$. It forms yellow salts with sulphuric, nitric and hydrochloric acids, which are turned into isomeric, dark-green or violet salts by the action of sulphur dioxide in solution. The sulphur dioxide appears to act catalytically. The changes which take place in brucine in the nitric acid reaction are these :—the methoxyl groups are hydrolysed, a nitro group is introduced, and one atom of oxygen is taken up.—F. Shdn.

Elaterin ; Action of silver oxide upon ——. A. Berg. Comptes rend., 1910, **150**, 981—983. (See this J., 1909, 745 and 1221.)

The author made use of elaterin crystallised from alcohol and melting at 231° C., and with $[\alpha]_D = -53{\cdot}4°$. The substance was boiled with alcohol and moist silver oxide. The liquid was filtered, treated with a little common salt, and again filtered. The filtrate was evaporated, the residue taken up with alcohol, followed by the addition of excess of sodium carbonate solution and water. A precipitate was formed, which was filtered off, and taken up with ether. On evaporation the ether left a yellow amorphous substance. This has the properties of a quinone, for the yellow colour is destroyed by nascent hydrogen. It has the composition, $C_{26}H_{36}O_7$, and has been styled *elateridoquinone*. —F. Shdn.

Aloïnose, or the sugar of aloïn. E. Léger. Comptes rend., 1910, **150**, 983—986.

Barbaloïn free from isobarbaloïn was allowed to stand for 3 years with alcohol. The liquid was then acidified with a little sulphuric acid, some water was added and the whole allowed to stand for over two years. The liquid was then found to contain a sugar which reduced Fehling's solution, gave the furfural reaction with aniline acetate and a violet coloration with hydrochloric acid and orcinol (Bertrand's reaction). The sugar has $[\alpha]_D = -57{\cdot}3°$ to $-58{\cdot}3°$ in aqueous solution. This sugar has been named aloïnose, and from its reactions appears to be a pentose.—F. Shdn.

Fruits of Pimenta acris from Mauritius. Bull. Imp. Inst., 1910, **8**, 4—5.

These dull brown pear-shaped berries yielded on distillation with steam 2·7 per cent. of a pale yellow essential oil with a pleasant odour recalling that of bay oil. Another sample yielded 3·3 per cent. of oil, with the following analytical values :—Sp. gr. at 15° C., 0·9893 ; optical rotation in 100 mm. tube, —1° 20′ ; and eugenol, 70 per cent. The oil was soluble in 0·8 part by volume of 80 per cent. alcohol. The oil would probably sell at about the same price as bay leaf oil (about 8s. per lb.). It is suggested that it would be better to distil the fruits in Europe than to attempt to prepare the oil in Mauritius, seeing that a high price, (18s. per cwt.) was offered for a trial consignment of them.—C. A. M.

Essential oils. H. Haensel. Chem. Zentr., 1910, **1**, 1612.

Elecampane oil from the root of *Inula Helenium* L., has the sp. gr. 0·9830 at 22·5° C., and is solid at the ordinary temperature. *Danewort leaf oil* obtained in a yield of 0·0763 per cent. by distilling the leaves of *Sambucus ebulus* with steam, is of a dark brown colour and has an unpleasant odour : sp. gr., 0·8998 at 15° C. ; acid value, 250·90 ; ester value, 46·0. The saponified oil has a pleasant odour resembling that of apricots and peaches, and contains an alcohol which has not been identified. Palmitic acid was detected in the oil. The air-dried roots of *Ononis spinosa* L. when distilled with steam yielded directly 0·0066 per cent. of a liquid oil, whilst, from the aqueous distillate, 0·0132 per cent. of an oil solid at the ordinary temperature was obtained. The liquid oil was of acid reaction and had the sp. gr. 0·9917 at 15° C. In a sample of distilled *limette oil*, having the sp. gr. 0·8612 at 15° C., acid value, 1·8; ester value, 12·5; ester value after acetylation, 53·42 ; the presence of limonene, *l*-terpineol, and bisabolene was detected. *Monks-pepper* (*Vitex Agnus castus*) *seeds*, on distillation with steam, yielded 0·47 per cent. of a bright, pale brown oil of strong odour : sp. gr. 0·8960 at 15° C. ; acid value, 7·41 ; ester value, 24 ; ester value after acetylation, 40. A sample of *peppermint oil* distilled in Syria had the sp. gr. 0·9130 at 15° C., acid value, 0 ; ester value, 22·25 ; ester value after acetylation, 151·5 ; its odour was good.—A. S.

Economic products from Mauritius [*Spices*]. *See* XIXa.

Patents.

Mercury emulsions ; Process for the preparation of —— *by the disintegrating action of the electric arc in liquids.* L. Egger. Ger. Pat. 218,873, April 14, 1909.

In the process described, one electrode consists of a fine jet of mercury which is directed against the other electrode. In order to render the process continuous, the liquid which forms the basis of the emulsion is continuously replenished and the emulsion continuously withdrawn from the lowest part of the containing vessel.—A. S.

Starch : Process for obtaining non-adhesive preparations from ——. G. Hertel and G. Hornung. Ger. Pats. 220,850 and 220,851, March 28, 1909.

(1) 100 grms. of starch are heated with 100 c.c. of chloroform under a reflux condenser for several hours ; the chloroform is then distilled off, and the product dried. It resembles ordinary starch in appearance, but contains up to 1·08 per cent. of combined chlorine, and forms a non-adhesive paste with water. By prolonging the action of the chloroform for two weeks, a product containing 3·25 per cent. of combined chlorine can be obtained. The products are of use in medicine. (2) The chloroform is replaced by other halogen derivatives of hydrocarbons, such as acetylene tetrachloride, tetrachloroethylene, ethylene bromide, ethyl bromide, ethyl iodide, iodoform (in alcoholic solution).—A. S.

Carboxyalkylsalicylosalicylic acids ; Manufacture of ——. A. Einhorn, Munich, Germany. Eng. Pat. 24,009, Oct. 19, 1909.

When chloro-alkyl carbonates act on salicylic acid or a salicylate, a certain amount of carboxyalkylsalicylosalicylic acid is formed, which increases with the duration of the reaction. The following methods of preparation are claimed :—(1) Action of chloro-alkyl carbonates on salicylates, alone or in presence of indifferent solvents, and in absence of concentrated alcohol : (2) action of chloro-alkyl carbonates on salicylic acid in presence of pyridine or equivalent tertiary base ; (3) action of salicylic acid or its salts on salicylic acid dialkyl dicarbonates, with or without pyridine or other tertiary base. Four examples are given of the preparation of carboxyethylsalicylosalicylic acid.

$$C_2H_5O.CO.O.C_6H_4.CO.O.C_6H_4.COOH.$$

—T. F. B.

Salicylosalicylic acid ; Process for preparing crystallised ——. C. F. Boehringer und Soehne. Ger. Pat. 220,941, Oct. 18, 1908.

Salicylosalicylic acid may be obtained in crystalline form by partial saponification of its derivatives which contain a substituent in the phenolic hydroxyl group : these may be obtained either by heating acidylsalicylic acids or by condensation of acidylsalicylic acids with salicylic acid. The saponification may be effected by aqueous solutions of acids or alkalis.—T. F. B.

Alkyl- and aryloxyacidylsalicylic acids ; Process for preparing ——. Chem. Fabr. von Heyden. Ger. Pat. 221,385, Feb. 11, 1909.

Salicylic acid or one of its salts is converted, by treatment with the halogenide or anhydride of an alkyl- or aryl-oxy fatty acid, into the corresponding derivative of hydroxyacidylsalicylic acid, HO.CO.C_6H_4.O.CO.R.OR′. A condensing agent may be used in some cases. The new compounds are said to be of value in therapeutics. —T. F. B.

Pharmaceutical compound [p-Aminobenzoic acid isobutyl ester] ; Manufacture of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,928, Aug. 3, 1909.

See Ger. Pat. 218,389 of 1909 ; this J., 1910, 452.—T. F. B.

Purin bases ; New ——. M. Engelmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 955,587, April 19, 1910.

See Ger. Pat. 213,711 of 1908 ; this J., 1909, 1167.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Polychrome screens ; Process for preparing colloidal surfaces composed of tanned and untanned elements suitable for producing ——. F. Paupel. Ger. Pat. 221,231, Dec. 17, 1907.

By alternately mounting on a suitable axis a number of circular discs of an inert substance (*e.g.*, celluloid) and a substance which directly or indirectly "tans" the colloid, and pressing them together, rollers are obtained which produce, when rolled on suitably prepared colloid surfaces, a series of tanned and untanned lines ; these films may be utilised to make polychrome screens. For example, the active discs may be made of paper impregnated with formalin, chrome alum, etc., or of a metal, but in the latter case the colloid surface must be previously treated with a suitable substance, *e.g.*, an alkali ferrocyanide. —T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Nitroglycerin ; The manufacture of, and the influence of the composition of the mixed acids on the yield of ——. C. Stützer. Z. ges. Schiess- und Sprengstoffw., 1910, 5. 165—167.

The work of Nathan and Rintoul (this J., 1908, 193) on the influence of the composition of the nitrating acid on the yield of nitroglycerin has led the author to make experiments upon similar lines. He has also compared the yields, on the manufacturing scale, with those obtained in the laboratory, when using the apparatus designed by Volpert and Schlegel in which some 50 grms. of glycerin can be dealt with. From 100 parts of glycerin the theoretical yield of nitroglycerin is 247. In one of the older German nitroglycerin factories, where a refrigerating apparatus was not in use, and the temperature of nitration was from 26°—28°C. the yield for many years was only 208 to 210. The proportion of mixed acid to glycerin was 7·79 to 1 and the composition of the mixed acid was sulphuric acid (62), nitric acid (32·5), and water (5·5). The composition of the waste acid was: sulphuric acid (71·5), nitric acid (7·75), and water (20·75). In the laboratory apparatus the yield was 205. In a more modern factory, with a refrigerating apparatus at work, the average yield during a year's work was 220, under the following conditions. The acid mixture consisted of sulphuric acid (63), nitric acid (33·5), and water (3·5). The ratio of mixed acid to glycerin was 7·45 to 1. The composition of the waste acid was sulphuric acid (75·5), nitric acid (8·5), and water (16·0). The laboratory apparatus gave a yield of 212. The following table gives the results of the laboratory yields obtained with the acid mixture stated. The figures refer to glycerin 100 parts, and the fuming sulphuric acid used contained 20 per cent. of free sulphur trioxide.

Fuming sulphuric acid.	Nitric acid.	Ratio of acid to glycerin.	Yield.
444	276	720	219·5
444	300	744	216·5
268	244	512	216·5
268	276	544	216·0
267	264	531	222·0

In the last instance where the mixed acid had a composition of sulphuric acid (53·5), nitric acid (44·5), and water (2·0), the waste acid produced had a composition of sulphuric acid (70·8), nitric acid (10.7), and water (18·5.) When the temperature of nitration did not rise above 15° C. the yield was increased to 227.—G. W. McD.

Patent.

Gunpowder ; Manufacture of smokeless ——. V. Vender, Milan, Italy. Eng. Pat. 18,279, Aug. 7, 1909. Under Int. Conv., Aug. 8, 1908.

See Fr. Pat. 405,822 of 1909 ; this J., 1910, 453.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Copper and cobalt ; Use of naphthenic acids for the detection of ——. K. W. Charitschkoff. Chem.-Zeit., 1910, **34**, 479—480.

A solution of the naphthenic acids (produced in the refining of petroleum with alkali) in benzene or petroleum spirit, gives colorations on shaking with copper and cobalt salts (see also this J., 1907, 402). By using a concentrated solution of the naphthenic acid, the copper can be so completely displaced from neutral or faintly acid solutions of copper salts, that it can no longer be detected in the solution by means of ammonia. Under similar conditions cobalt-salts give an eosine-red colour and nickel salts a faint green, which can, however, easily be distinguished from the green colour yielded by copper salts. On shaking with hydrogen peroxide the eosin-red petroleum spirit solution of cobalt naphthenate is coloured an intense greenish-brown, whereas the green nickel solution remains unaltered (see also this J., 1910, 210).—A. S.

Zinc, nickel and cobalt ; New reaction of ——, *and the electrolytic separation of nickel and cobalt.* E. P. Alvarez Rev. R. Acad. Cienc. Madrid, 1909, **8**, 163—167. Chem.-Zeit., 1910, **34**, Rep., 189.

(1). On adding potassium cyanide to a 10 per cent. solution of cobaltous chloride or cobalt sulphate in boiled water freshly saturated with sulphur dioxide, a deep red precipitate is formed, soluble in excess, forming potassium cobalto cyanide, $K_4Co(CN)_6$. This solution gives characteristic reactions with zinc, nickel and cobalt salts. With an excess of a solution of zinc sulphate in sulphurous acid, it yields an orange red precipitate of zinc cobalto cyanide, $Zn_2Co(CN)_6$, which can be dried without change but turns violet at 110°—120° C. With nickel sulphate a golden precipitate of nickel cobalto-cyanide, $Ni_2Co(CN_6)$ is formed, which becomes green on drying. Cobalt sulphate gives a red precipitate of cobalt cobalto-cyanide $Co_2Co(CN)_6$. The three cobalto-cyanides are soluble in zess of potassium cobalto-cyanide, forming the double ts, $K_2ZnCo(CN)_6$, dark red; $K_2NiCo(CN)_6$, golden; d $K_2CoCo(CN)_6$, dark red. The nickel double salt is ily soluble in strong acetic acid, but the cobalt salt ly with difficulty. These reactions may be used in amining the sulphides precipitated in ordinary qualitae analysis. (2). If 0·5 grm. of nickel cobalto-cyanide dissolved in a solution containing 5 grms. of ammonium phate, 40 c.c. of ammonia (sp. gr. 0·927) and 100 c.c. water, and the solution electrolysed in the cold with a rent of density D_{100}=3·40 ampères, at 3·7—4 volts, nickel is deposited, free from cobalt, within two hours. a solution containing 1 grm. of the nickel salt, 50 c.c. ammonia, 10 grms. of ammonium sulphate and 100 c.c. water, is electrolysed at 50°—60° C. with a current of nsity D_{100}=1—1·5 ampère, at 3·8 volts, both nickel d cobalt are deposited together.—A. T. L.

ad; A method for the approximate determination of small quantities of ——. A. G. Vernon Harcourt. Chem. Soc. Proc. 1910, 26, 82.

quick approximate test of the amount of sulphur in l gas was brought into use by the author many years o. The gas, in which the sulphur was present as drogen sulphide, was led through an alkaline solution lead, mixed with syrup, until the brown colour matched tandard. Having recently to arrange for the estimation very small quantities of lead which are breathed in as st by some of the workers in potteries, he has reversed above process, and estimated the amount of lead by mparing with a set of standards the coloration caused an excess of hydrogen sulphide. Since the liquid loured by lead sulphide fades gradually in daylight, ndards the colour of which is fast, are made by mixing sulphates of copper, cobalt, and ferric iron, and diluting mixture to match the colours given in a volume of c.c. by quantities of lead varying progressively from to 25 centimilligrams. Such dilute solutions are not loured on addition of hydrogen sulphide in presence of en a small excess of the nitric acid used for their extraction, but a brown tint, paler or deeper according to the antity of lead, appears on further addition of sodium etate. To prevent precipitation of lead sulphide there st be sugar in the liquid, and but little agitation. The terminations are made by placing the cylinder, in which e lead sulphide has been formed, on a sheet of white per between the standards—consisting of the same lume of liquid sealed up in similar cylinders—which it ost resembles, and comparing the depth of colour of the ses which form the upper surfaces of the liquids. If, r example, the lead sample be rather darker than "7," t not so dark as "10," the conclusion is that the amount lead present is more than 7, but less than 10 centiilligrams. The total volume of dilute acid used to tract lead from a weighed amount of dust or frit or aze being known, and also the volume of the part taken r testing, the percentage of lead, or lead oxide, dissolved om the sample is calculated.

In the discussion following Veley pointed out that in all atometer experiments the personal error was of a twold character, namely, first, that of one person with other, and, secondly, that of one person with himself cording to his state of health. The error from the tter was often greater than that from the former.

anganese; Volumetric determination of —— by means of potassium permanganate. E. Donath. Chem.-Zeit., 1910, 34, 437.

he author and Schöffel, having found that Volhard's ethod gave results which materially differed from the avimetric results in the case of ferromanganese, devised modification of that method (Monatsh f. Chem., 1886, 639) which essentially fulfils the conditions laid down Deiss (this J., 1910, 456). In this modification, the lution of the manganese (after removal of the iron droxide by means of zinc oxide, etc.) was treated with an excess of potassium permanganate, the liquid repeatedly boiled, and the excess of permanganate titrated with a standard solution of arsenious acid.—C. A. M.

Antimony; Volumetric determination of ——. E. Schmidt. Chem.-Zeit., 1910, 34, 453—454.

Of the various methods for the determination of antimony, the electrolytic method is the most exact. But in the absence of the necessary apparatus, there exist three volumetric methods, which the author has subjected to a comparative examination, using pure tartar emetic. These methods are all based on the oxidation of the antimony from the antimonious to the antimonic condition. (1). According to the *iodometric* method the antimony salt is titrated with iodine in presence of sodium bicarbonate:

$$2Sb_2O_3+8NaHCO_3+4I_2=2Sb_2O_5+8NaI+8CO_2+4H_2O.$$

The end point is not satisfactory, but if titration be stopped on the appearance of the first reddish tint with starch paste, as advised by Fresenius, the results are fairly accurate (maximum error less than ±0·2 per cent. for the antimony in tartar emetic). By adding an excess of 1 c.c. of *N*/100 iodine and titrating back with thiosulphate, the error may be reduced to less than 0·1 per cent., but if 2 c.c. of iodine in excess be added, the error is increased to as much as −0·4 per cent. The presence of tin is a disturbing factor in this method, but its influence may be counteracted by adding a large excess of an alkali tartrate. (2). The *potassium bromate* method is carried out in presence of dilute hydrochloric acid:

$$2KBrO_3+2HCl+3Sb_2O_3=2KCl+2HBr+3Sb_2O_5.$$

The indicator used is methyl orange, the pink colour being discharged (oxidised) when the end-point is reached. If the solution be not too dilute, the end-point is sharp and the results are practically exact. The bromate solution should be added gradually, especially towards the end. The presence of tin and of considerable quantities of copper and iron interferes with this method. (3). The *permanganate* method is based on the reaction:

$$5SbCl_3+16HCl+2KMnO_4=$$
$$5SbCl_5+2KCl+2MnCl_2+8H_2O.$$

The antimony solution is treated with hydrochloric acid, until the white precipitate first formed is dissolved, and is then titrated with standard permanganate to a permanent pink colour in the cold. The presence of tin salts is without influence on the results, which are accurate to within 0·1 per cent.: 1 c.c. of a solution containing 5·27 grms. of potassium permanganate per litre is equivalent to 1 per cent. of antimony in 1 grm. of substance. Methods 2 and 3 are especially recommended for technical purposes.—J. F. B.

Apparatus for determination of sulphur trioxide in fuming sulphuric acid. Finch. *See* VII.

Determination of sulphuric acid and of sulphur in pyrites Huybrechts. *See* VII.

Analysis of sulphur for agricultural purposes. (1). Bruno. (2). Collin. *See* VII.

Determining carbon in iron and steel and iron alloys. Hull. *See* X

Refraction of the insoluble fatty acids of butter-fat. Dumitrescu and Popescu. *See* XII

Determination of organic lime in [beet] sugar products. Sidersky. *See* XVII.

Determining free and combined sulphurous acid in wine. Cazenave. *See* XVIII.

Patents.

Colours; Apparatus for use in estimating the intensity of ——. J. W. Lovibond, Salisbury, Wilts. Eng. Pat. 23,746, Oct. 16, 1909.

In apparatus for estimating the intensity of colours, more especially that described in Eng. Pat. 12,867 of 1886 (this J., 1887, 522), an extension is fitted to either or both of the sighting-tubes, the extension being capable of angular adjustment and furnished with a reflector or reflectors, so mounted as to cause the image of the object towards which the extension is directed, to be projected through the corresponding sighting-tube; this enables objects external to the instrument (for example, the interior of a furnace) to be readily viewed, whatever their positions relatively to the observer or whatever the direction in which the latter may require to face or to point the instrument. The extension may consist of an elbow-tube, the inner limb of which is fitted to rotate in axial alignment with the sighting-tube at its objective end, and a plane reflector, so mounted at the elbow as to be adapted to receive and transmit to the eye-piece of the instrument the rays which pass from without through the outer limb of the extension; or it may consist of a pair of tubes which can be adjusted angularly with reference to one another in the same plane, the inner tube of which is fitted, as in the previous case, to rotate in axial alignment with the sighting-tube, and a plane (metal) reflector, automatically adjustable concurrently with the movement of the outer tube relatively to the inner tube and so mounted as to transmit an image through the outer tube to the eye-piece.—F. Sodn.

Gas analysis apparatus; Automatic recording ——. A. L. E. Baillet. Fr. Pat. 408,038, Oct. 15, 1909.

The apparatus is constructed entirely of metal and is adapted to record automatically the percentage of carbon dioxide in flue gases at frequent intervals. The analysis is said to be effected rapidly and the apparatus may be fixed in the boiler-house. The arrangement is such that, after absorption of carbon dioxide by potash solution, a pen records the result of each such absorption on a disc moved by clockwork.—A. T. L.

XXIV.—MISCELLANEOUS ABSTRACTS.

Ionisation of air; Effect of dust and smoke on ——. A. S. Eve. Phil. Mag., 1910, **19**, 657—673.

Experiments were made on the ionisation of air in its natural condition, using Ebert's apparatus with a constant air current, and the γ-rays from radium bromide as th constant ionising source. It was found that the number c ions decreased with the presence of smoke, dust, mist or other centres, to as much as one-half. The excess c positive over negative ions was found to be due to th negative ions rapidly combining with particles of smoke dust, or mist, and passing through the apparatus undetected. The cause of the diminution of the ionisatio current by smoke was due to the disappearance of th small ions, their place being taken by large ions whic re-combine slowly. The number of charged centres i the smoke is not affected by the intensity of the radiation The presence of charged or neutral centres of dust, smoke or mist causes a transformation from small to large ions so that the total number may be increased and the conductivity diminished. These centres also tend to increas the predominance of a charge of one kind in air, and thi must have an important influence in the variation of th potential gradient and in the production of thunderstorms.—J. H. J.

Trade Report.

Census of Production (1907). *Preliminary Tables summarising the results of the returns received under the Census c Production Act*, 1906. [Cd. 5162.] 1910. Price 7½d.

The following short statement shows for the Unite Kingdom as a whole the gross output, the cost of material used, the amount paid for work given out to other firms the "net output" as above defined, the number employed and the net output per person employed for the chemica industries covered by the present Report :—

—	Gross output. Selling value or value of work done. (1)	Materials used. Cost. (2)	Work given out. Amount paid to other firms. (3)	Net output. Excess of column (1) over columns (2) and (3). (4)	Persons employed (except out-workers). Total. (5)	Net output per person employed (excluding out-workers). (6)
	£	£	£	£		£
Bleaching, dyeing, printing, and finishing factories and workshops	17,782,000	7,172,000	241,000	10,369,000	102,611	101
Chemicals, coal-tar products, drugs, and perfumery factories and workshops	23,447,000	13,974,000	9,000	9,464,000	51,088	185
Paint, colour, and varnish factoriea	8,380,000	5,711,000	—	2,669,000	13,476	198
Soap and candle factories	11,723,000	8,925,000	—	2,798,000	17,889	156
Seed crushing factories	12,838,000	11,508,000	—	1,330,000	7,629	174
Oil factories (other than seed crushing)	6,072,000	5,060,000	—	1,012,000	5,276	192
Fertilizer, glue, sheep-dip, and disinfectant factories and workshops	5,690,000	3,756,000	—	1,934,000	12,028	161
Match and firelighter factories and workshops ..	851,000	443,000	—	408,000	4,229	96
Ink, gum, and sealing wax factories	799,000	382,000	—	417,000	1,310	318
Salt mines, brine pits, and salt factories	644,000	340,000	—	304,000	4,511	67
China and earthenware factories and workshops	7,534,000	2,854,000	84,000	4,596,000	67,870	68
Brick and fireclay factories	7,703,000	2,643,000	—	5,060,000	63,287	80

Chemical imports into Canada. Oil, Paint, and Drug Rep., May 2, 1910. [T. R.]

The imports of drugs, chemicals, and dyes into Canada during the fiscal year 1908-09 amounted to $9,133,132, imported from the following countries :—United States. $5,837,545; United Kingdom, $2,016,629; Germany. $259,064; France, $254,485; Chile, $175,551; Italy. $156,498; all other countries, $433,360. Most of the goods under this head are on the free list, the dutiable ones being proprietary medicines, the acids, alcoholic preparations, and opium. The following classes are included in the total imports :—Aniline and coal tar dyes. $306,380; brimstone and sulphur. $426,569; cream of tartar and crystals, $230,264; extracts of logwood. fustic, oak, etc., $648,142; gums, $2,318,869; opium. crude, $175,903; sodas of all kinds, $1,297,788.

Books Received.

Contribution a l'Étude des Argiles et de la Céramique. Par MM. Chantepié, Chapuy, Coupeau, Damour, Lavezard, Laville, Le Chatelier, Granger, Holborn, Hecht, Saglio, Sherzer, Vogt, Wien, Zschokke, etc. Siege de la Société d'Encouragement pour l'Ind. Nat., rue de Rennes, 44, Paris, 1906. Price Fr. 25.

Quarto vol. containing 626 pages of subject matter, numerous illustrations, and a table of contents. The following papers and treatises are given by the authors named, being Mémoires which have appeared from time to time in the Bull. de la Soc. d'Encouragement pour l'Industrie Nat.

Chantepie: The dilatation of ceramic pastes. P. Chapuy and A. Le Chatelier: Coloration of porcelain enamels. Le Chatelier: (i), Action of heat on quartz. (ii.), Studies in ceramic archeology. (iii), Action of heat on quartz. (iv), Dilation of ceramic pastes. (v), Some physical properties of ceramic pastes. Coupeau: Studies on the dilatation of ceramic pastes. E. Damour: Studies of ceramics for the manufacturers of porcelain at Limoges. A. Granger: (i), Production of a tungsten blue. (ii), Ceramics in Germany. R. Gelth: Some continuous muffles. Hecht: (i), Shrinkage of ceramic pastes. (ii), Union of pastes and ceramic surfaces. (iii), Tests of clays in the laboratory of Seger and Cramer. (iv), Extension of Seger's scale. Holborn and W. Wien: Measuring high temperatures. E. Lavezard: Contribution to the study of French clays. Laville: Geological study of the position of French clays. Saglio: Studies of enamels of high dilatation, etc. G. Vogt: (i), Composition of clays. (ii), Investigations of Chinese porcelains. (iii), Copper reds on porcelain. (iv), Seger's porcelain. (v), Observations during a study of the ceramic paste dilatations of M. Coupeau. B. Zschokke: Researches on the plasticity of clays.

Supplementary volumes presented with the Fifth Report of the Commissioners appointed to inquire and report what methods of Treating and Disposing of Sewage may properly be adopted (including any liquid from any factory or manufacturing process).

Methods of Treating and Disposing of Sewage. Appendix IV. Memoranda on Special Investigations and Experiments by Officers of the Commission, together with Reports by Dr. J. A. Voelcker and Mr. T. H. Middleton on Manurial Experiments with Sewage Sludges. [Presented to both Houses of Parliament by Command of His Majesty.] Wyman and Sons, Limited, 109, Fetter Lane, London, E.C., and 32, Abingdon Street, Westminster, S.W. Oliver and Boyd, Tweedale Court, Edinburgh. E. Ponsonby, 116, Grafton Street, Dublin. 1910. Price 7s. 6d. [See also this J. 1908, 1135.]

Quarto volume [Blue Book] containing 474 pages of subject matter, devoted to the following subjects:—I. Method of expressing or measuring "strength" of sewage as affecting purification, [G. McGowan]. II. Estimation of work done by sewage filters, and on the comparison, in this respect, of different types of filter, treating different sewage liquors, [G. McGowan and Colin C. Frye]. Experiments at Accrington on the treatment of strong and weak sewage liquors on percolating filters and contact beds, [McGowan and Frye]. Washing out of a percolating filter with water, [McGowan, Frye and Girvan]. Action of certain nitrifying, oxidising, fermentable, and disintegrating solutions on the accumulated sewage solids in contact beds, [McGowan, A. C. Houston and Frye]. Manurial value of sewage sludges, [Voelcker, and Middleton]. Sterilisation of sewage effluents, [Houston]. Sterilisation of the Lincoln water supply, [Houston and McGowan]. "Oxychloride" experiments at Guildford, [A. C. Carter]. Dorking Experimental Station, [Richards]. Comparative treatment of septic tank liquor and precipitation liquor at Rochdale by filtration through percolating filters of coarse material, [McGowan and Frye]. Experiments at Ilford on (A) Relative efficiency of deep and shallow filters; and (B) Digestion of sewage in a septic tank, [McGowan]. Quantitative experiments on sludge digestion in septic tanks at Ilford and Exeter, [McGowan, Houston, Frye and Kershaw]. Laboratory experiments on the biological purification of sewage, [Houston]. Bacteriological examination of sewage and effluents from the Bradford, Ilford, Leeds, and Manchester Sewage Works, [Houston]. Number and biological characters of *B. coli* in normal human fæces, in sewage, and in sewage effluents, [Houston]. Experiments at Oldbury by Prof. Percy Frankland and H. Silvester on the treatment of the Oldbury sewage, [Frye]. Effect of different precipitants on septic tank liquor as regards the subsequent rate of absorption of atmospheric oxygen, [McGowan and Girvan.]

Kolloidchemische Beihefte (Ergänzungshefte zur Kolloid-Zeitschrift). Monographien zur reinen und angewandten Kolloidchemie. Herausgegeben von Dr. Wo. Ostwald. Bd. 1. Hefte 6—7.

Die Brown'sche Bewegung und die wahre Existenz der Molecule. Jean Perrin. Theodor Steinkopf's Verlag, Dresden, 1910. Price M. 1.20.

8vo volume, containing 300 pages of subject matter, with seven illustrations.

The Quality of Surface Waters in the United States. Part I.—Analyses of waters east of the one hundredth meridian. By R. B. Dole. Government Printing Office, Washington, 1909. Department of the Interior. United States Geological Survey.

The volume contains 119 pages of subject matter, and an alphabetical index of subjects. The leading subjects are:—I. Methods of examination. II. Preparation of solutions. III. Departures from regular procedures. IV. Probable accuracy of estimates. V. Error of combining values. VI. Relation between total solids and percentage of error; between source and percentage of error; and between amount and percentage of error. VII. Method of expressing analytical results. VIII. Location of sampling stations. IX. Analytical results.

The results of over 5000 mineral analyses are given of water from the principal rivers of the United States east of the Rocky Mountains.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

10,903. Diver. Apparatus for drying wet materials. [U.S. Appl., May, 4, 1909.]* May 3.

10,953. Epstein. Distillation. May 3.

11,063. Greenhalgh. Distilling apparatus. May 4.

11,078. Newton (Bayer and Co.). Crushing or pulverising apparatus. May 4.

11,288. Scott, and Scott and Co., Ltd. Combined digesting and drying apparatus. May 6.

11,343 and 11,344. Ore Concentration Co. (1905), Ltd. (Elmore). Separation of constituents of mixtures by selector processes of concentration. May 7.

11,411. Orten-Böving. Compressing air or other gases. May 9.

11,461. Schneider. Apparatus for liquefying gases for demonstration purposes. [Ger. Appl., June 8, 1909]* May 9.

11,546. Martin, and Matthews and Yates, Ltd. Apparatus for treating materials with gases. May 10.

11,720. Thomson and FitzGerald. Furnaces. [U.S. Appl., May 13, 1909.]* May 11.

11,730. Bredin-Crawford. Apparatus for distilling, concentrating, and evaporating. May 11.

11,787. Burstyn. Manufacture of plate condensers. [Ger. Appl., May 12, 1909.]* May 12.

11,800. Cowper-Coles. Precipitation of smoke. May 12.

11,824. Epstein. Distillation or rectification. May 12.

Complete Specifications Accepted.

10,771 (1909). Morgan Crucible Co., and Spiers. Crucibles. May 11.

11,406 (1909). Ashton (Horsfield). *See under* X.

14,233 (1909). Calvert. Rotary apparatus for pumping or propelling liquids and gases. May 11.

19,295 (1909). Brown, Boveri, et Cie. Condensing plants. May 11.

23,038 (1909). Töpfer. *See under* XIX.

30,303 (1909). Gobbi. Apparatus for filtering liquids. May 11.

433 (1910). Wilson. Apparatus for filtering liquids. May 19.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

10,829 British Thomson-Houston Co. (General Electric Co.). Electric conductors of refractory metal.* May 2.

10,841. Tavernier and Laffargue. Manufacture of nuts or briquettes of fuel.* May 3.

10,871 and 10,873. Harrison. Manufacture of filaments for incandescent electric lamps. May 3.

11,004. Burridge. Production of artificial fuel. May 4.

11,115. Fitzpatrick (Piette et Cie.). Distribution of gas and air in regenerative coke ovens.* May 5.

11,150. Still and Sons, Ltd., and Adamson. Manufacture of incandescent gas mantles. May 5.

11,364. Falding and Cathcart. *See under* VII.

11,415. Kitsee. Metallic filaments for electric lamps.* May 9.

11,444. Clerk, Bickerton, and Bradley. Gas producers. May 9.

11,459. Williams. Manufacture of incandescent mantles.* May 9.

11,491. Bowing. Retorts for use in making water-gas. [Comprised in No. 12,583, May 27, 1909.] May 9.

11,751. Walter. Coke process. May 12.

11,801. Cowper-Coles. Manufacture of smokeless fuel briquettes. May 12.

12,013. Crossley and Rigby. Working ammonia-recovery producer gas plants in conjunction with fuel briquette plants. May 14.

Complete Specifications Accepted.

2813 (1909). Williams. Treatment of burnt residues obtained by burning the spent oxide of gas-works. May 11.

10,485 (1909). Schniewind. Charging coke ovens. May 11.

16,243 (1909). Kölnische Maschinenbau A.-G., and Wegescheidt. Gas purifiers. May 11.

20,504 (1909). Simonin. Utilisation of the waste of the purification of illuminating gas. May 11.

29,239 (1909). Gravius. Electrodes for electric arc lamps. May 19.

III.—TAR AND TAR PRODUCTS.

Applications.

10,931. Major. Manufacture of oils from coal tars, etc., and a pitch free, or relatively free, from uncombined carbon. May 3.

11,223. Myler, and Levinstein, Ltd. Production of intermediate products from carbazole. May 6.

11,440. Meister, Lucius, und Brüning. Manufacture of anthraquinone derivatives. [Ger. Appl., May 10, 1909.]* May 9.

11,472. Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthraquinone and derivatives thereof. May 9.

11,478. Flurscheim. Nitro-derivatives of aniline. May 9.

11,804. Meister, Lucius, und Brüning. Manufacture of β-anthraquinone-urea chloride. [Ger. Appl., May 12, 1909.]* May 12.

IV.—COLOURING MATTERS AND DYES.

Applications.

11,044. Bloxam (Act. Ges. f. Anilinfabr.). Manufacture of hair dyes and their application. May 4.

11,172. Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 5.

11,473. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. May 9.

11,877. Levinstein, and Levinstein, Ltd. Manufacture of azo dyestuffs. May 13.

11,946 and 11,947. Le Sueur. Manufacture of substances used in the manufacture of dyes. May 13.

11,993. Read Holliday and Sons, Ltd., Turner, and Dean. Manufacture of direct dyeing cotton dyestuffs. May 14.

Complete Specifications Accepted.

11,253 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs and process of developing them on the fibre. May 19.

11,590 (1909). Clans and Co., and Claus. Manufacture of black colouring matters containing sulphur. May 19.

21,579 (1909). Johnson (Kalle und Co.). Manufacture of reduction products of acenaphthenequinone and leuco compounds of vat dyestuffs. May 11.

23,532 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of azo colouring matters and pigment colours therefrom. May 11.

23,738 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of monoazo dyestuffs for chrome mordanted wool. May 11.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

11,077. Newton (Bayer und Co.). Apparatus for coating threads, wires, ribbons, etc. May 4.

11,374. Dickson. Manufacture of impermeable or waterproof fabrics.* May 7

11,430. Freitag. Paper for duplicating purposes.* May 9.

11,591. Eck. Protective coatings or films for fabrics. May 10.

11,729. Fabr. de Soie Artific. de Tubize. Collecting the vapours of the volatile solvents used in making artificial silk. [Fr. Appl., May 12, 1909.]* May 11.

11,895. Carré. Treatment of straw, dried grasses, etc. May 13.

Complete Specifications Accepted.

11,340 (1909). Hart. Oil admixture for use in waterproofing compositions. May 19.

29,480 (1909). Kuess. Manufacture of paper pulp from the fruit of trees of the cocoanut tribe. May 11.

4067 (1910). Bloxam (Curtius und Co.). Dyeing and sizing paper. May 11.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

10,792. Roberts and Turner. Bleaching textile fibres, etc. May 2.

10,911. Chambers and Moffatt. Bleaching and cleansing cotton and linen with cold water. May 3.

11,044. Bloxam (Act.-Ges. f. Anilinfabr.). *See under* IV.

11,055 and 11,056. Landan und Co., and Kreidl. Loading silk. [Austrian Appls., June 15, 1909.]* May 4.

11,182. Eicken. Device for dyeing pieces of fabric.* May 5.

11,249. Eck. Production of a high gloss on fabrics, etc. May 6.

11,843. Burn, Wood, and Wood. Rendering fabrics proof against water, acid, air, oil, etc. May 13.

Complete Specifications Accepted.

11,253 (1909). Newton (Bayer und Co.). *See under* IV.

18,828 (1909). Imray (Meister, Lucius, und Brüning). Production of coloured woollen effects in unions. May 11.

4067 (1910). Bloxam (Curtius und Co.). *See under* V.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Applications.

10,755. Price. Manufacture of nitrate, nitrite, sulphonitrate or -nitrito of lime, soda, or potash. [Comprised in No. 10,164, April 29, 1909.] May 2.

10,815. Collett and Eckardt. Converting calcium cyanamide into nitrate of lime. [Appl. in Norway, May 3, 1909.]* May 2.

11,033. Internat. Salt Co., Ltd., and Royston. Manufacture of salt. [Comprised in No. 10,517, May 4, 1909.] May 4.

11,112. Hargreaves. Manufacture of soda and ammoniacal salts. May 5.

11,175. Seward and others. *See under* X.

11,364. Falding and Cathcart. Recovery of valuable constituents from iron pickling liquor and gas liquor.* May 7.

11,878. Lane. Hydrogen producing apparatus. May 13.

11,906. Cassella und Co. Manufacture of andydrous sodium hydrosulphite. [Fr. Appl., May 15, 1909.]* May 13.

11,939. Moressee. Extraction of magnesia from magnetic rocks.* May 13.

12,013. Crossley and Rigby. *See under* II.

Complete Specifications Accepted.

2813 (1909). Williams. *See under* II.

10,517 (1909). International Salt Co., and Royston. Manufacture of salt. May 19.

11,128 (1909). Moritz. Apparatus for making sulphuric acid. May 19.

11,274 (1909). Johnson (Badische Anilin und Soda Fabrik). Production of nitrates. May 19.

19,920 (1909). Carulla. Manufacture of sodium sulphate, hydrogen, and iron oxide. May 19.

29,494 (1909). Chem. Fabr. Griesheim Elektron. Manufacture of anhydrous caustic potash. May 11.

30,339 (1909). Soc. pour l'Utilisation de l'Air et de ses Dérivés. Purification of barium carbonate. May 19.

408 (1910). Luckow. Electrolytic manufacture of salts of heavy metals. May 19.

779 (1910). Gathy. Treatment of dolomite. May 11.

VIII.—GLASS ; CERAMICS.

Applications.

10,930. Kent. Production of silica glass. May 3.

10,966. Dressler. Production of glazed, enamelled, or analogous surfaces on tiles, bricks, metal sheets, etc. May 3.

11,419. Meszaros. Process for silvering glass, etc. May 9.

IX.—BUILDING MATERIALS.

Applications.

10,966. Dressler. *See under* VIII.

11,926. Méndez. Manufacture of building material. May 13.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

10,782. De Spirlet. Furnaces for roasting ores. [Belg. Appl., May 5, 1909.]* May 2.

10,929. Hoover, and Mineral Separation, Ltd. Ore concentration. May 3.

11,175. Seward, von Kugelgen, and von Bidder. Electrolytic production of light metals, particularly sodium. [U.S. Appl., May 10, 1909.]* May 5.

11,287. Canning. Apparatus for electroplating metal articles. May 6.

11,343 and 11,344. Ore Concentration Co. (1905), Ltd. (Elmore). *See under* I.

11,466. Keegan, and Dunlop Pneumatic Tyre Co., Ltd. Electroplating metal surfaces. May 9.

11,714. Heathcote, and Rudge-Whitworth, Ltd. Preventing rusting and oxidation of iron and steel. May 11.

11,803. Demel. Substitute for gold leaf. May 12.

11,807. Sieurin. Recuperating metals from ores.* May 12.

11,832. Simpson. Purification and alloying of metals. May 12.

11,839. Marks (Armstrong and Co.). Cementation of iron, steel, and alloys of steel.* May 12.

11,840. Butterfield. Obtaining zinc from its compounds. May 12.

11,869. Stock. The dual system of Bessemer converters. May 13.

Complete Specifications Accepted.

7811 (1909). Maccallum. Manufacture of steel. May 11.

10,352 (1909). Göpfert. Recovering copper from waste liquors produced in pickling metals. May 11.

10,655 (1909). Cowper-Coles. Electrodeposition of iron. May 11.

11,406 (1909). Ashton (Horsfield). Apparatus in which wet crushing is employed for extracting metals from ores. May 19.

XI.—ELECTRO-CHEMISTRY.

Applications.

10,917. Frantzen. Electric furnaces. [Appl. in Norway, May 5, 1909.]* May 3.

11,175. Seward and others. *See under* X.

11,693. Billiter. Electrolysis of liquids. [Austrian Appl., July 12, 1909.]* May 11.

11,716, 11,717, and 11,718. Thomson and FitzGerald. Electric furnaces. [U.S. Appls., May 13, 1909.]* May 11.

11,837. Estelle. Depolarising agents for electric batteries. [Swedish Appl., May 13, 1909.]* May 12.

Complete Specifications Accepted.

10,791 (1909). Schauli. Electrolyte for galvanic batteries. May 11.

408 (1910). Luckow. *See under* VII.

XII.—FATS ; OILS ; WAXES.

Applications.

11,874. Wilson. Detergents. May 13.

11,953. Fattinger. Manufacture of soap.* May 13.

12,044. Braun. Process for making artificial lard. May 14.

Complete Specifications Accepted.

16,260 (1909). Johnson (Badische Anilin und Soda Fabrik). Decolorising glycerin. May 19.

27,006. (1909). Little. *See under* XIX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Complete Specifications Accepted.

23,532 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). *See under* IV.

1800 (1910). Terrisse and Coffignier. Manufacture of paints. May 11.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

10,942. Pfleumer. Manufacture of froth- and sponge-structures of rubber, guttapercha, and balata. May 3.

11,391. Milne. Treatment of waste and rejuvenated rubber. May 9.

11,576. Thame. Apparatus for treating raw rubber. May 10.

Complete Specifications Accepted.

12,424 (1909). Wildermann. Manufacture of ebonite capable of resisting the action of chlorine. May 11.

22,607 (1909). Scholz. Process for obtaining pure caoutchouc, guttapercha, etc. May 11.

23,308 (1909). Collier. Manufacture of flexible material from indiarubber, etc. May 11.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

11,345 (1909). Vulcano Tanning and Machine Co. Tanning or like treatment of hides or skins. [Ger. Appl., May 7, 1909.]* May 7.

Complete Specifications Accepted.

10,667 (1909). Spigno. Treatment of tanned hides and skins. May 19.

28,297 (1909). Utley. Clarifying and decolorising gelatine and glue liquors. May 19.

XVI.—SOILS; FERTILISERS.

Application.

11,740. Rowlands. Manufacture of artificial manure. May 12.

XVII.—SUGARS; STARCHES; GUMS.

Complete Specification Accepted.

24,589 (1909). Ewen and Tomlinson. Producing from lignocellulose fermentable sugar. May 11.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

10,818. Berry. Brewing beer and other fermented beverages. May 2.

11,047. Faulkner. Mashing of malt. May 4.

11,060. Wooldridge. Brewing. May 4.

11,545. Green. Treatment of malt for brewing purposes. May 10.

12,046. Finlay. Manufacture of beer or stout. May 14.

Complete Specifications Accepted.

24,589 (1909). Ewen and Tomlinson. *See unde* XVII.

27,360 (1909). Braasch. Production of yeast. May 11

29,114 (1909). Braasch. Production of yeast. May 11

XIX.—FOODS. WATER PURIFICATION; SANITATION.

Applications.

11,938. Neff and Brandes. Treatment of liquid [Addition to No. 12,258 of 1907.] May 13.

12,044. Braun. *See under* XII.

Complete Specifications Accepted.

10,261 (1909). Spencer. Materials for purifying ai May 11.

14,931 (1909). Tildesley, Ritchie, and Watkins. Proce for improving flour. May 11.

19,483 (1909). Hindle, Whitaker, and Knewstub Treatment of sewage sludge. May 19.

20,215 (1909) Evers. Destroying the toxic constituen of coffee beans, etc. May 11.

23,038 (1909). Töpfer. Condensing or drying milk other mixtures of liquids and solids. May 11.

27,006 (1909). Little. Manufacture of a cleansiug flu for use as a sheep dip or for disinfecting, etc. May 19.

481 (1910). Neumann. Manufacture of cocoa powde May 11.

XX.—ORGANIC PRODUCTS; MEDICINAL SU STANCES; ESSENTIAL OILS.

Complete Specifications Accepted.

25,357 (1909). Chem. Fabr. auf Actien, vorm. Schering. Manufacture of curative agents from the sple of animals. May 11.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

11,527. Saalburg. Production of multicolour phot gravures. [U.S. Appl., Nov. 16, 1908. Comprised in N 22,776 of 1909.]* May 10.

11,528. Saalburg. Production of multi-colour phot gravures.* May 10.

11,529. Saalburg. Preparation of photo-mechani printing surfaces.* May 10.

11,610. Leighton and Babcock. Photographic pap [U.S. Appl., May 10, 1909.]* May 10.

Complete Specifications Accepted.

10,611 (1909). Berthon. Three-colour photograp processes. May 11.

XXII.—EXPLOSIVES; MATCHES.

Application.

11,365. Claessen. Manufacture of smokeless powder May 7.

Complete Specifications Accepted.

11,179 (1909). Bowen. Explosives. May 11.

12,988 (1909). Burgess. Composition for neutralisi the fumes produced by blasting. May 11.

XXIII.—ANALYTICAL PROCESSES.

Applications.

11,521. Woodroffe. Apparatus for automatically anal-ing a gas or gaseous mixture volumetrically, and record the same. May 10.

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Birmingham Section.

Meeting held at Birmingham University, on Thursday, April 14th, 1910.

MR. HARRY SILVESTER IN THE CHAIR.

CORROSION OF INDUSTRIAL IRONWORK.

BY A. R. WARNES AND W. S. DAVEY.

We thought that a short paper dealing with some of the most important cases of corrosion of iron which have come under our notice, would stimulate other workers to publish their experiences and so ventilate a matter of extreme interest and importance to those connected with the chemical and engineering industries.

Considering its importance, the literature on the subject of industrial corrosion of iron appears to be very scanty:—R. Petit (Compt. rend., 1896, **123**, 1278; this J., 1897, 128) mentions that iron is acted upon by very dilute solutions of calcium chloride, sodium chloride, potassium sulphate and calcium nitrate, and that the action becomes more pronounced in the presence of carbon dioxide. Carulla, in a paper on the "Corrosion of iron by raw tar," read before the Nottingham Section of this society (this J., 1896, 325), calls attention to two bolts taken out of the valve box of a pump that raised water from a well to supply a works. These bolts which were originally 1⅛ in. thick had become badly corroded, the erosion in some parts being ⅜ in. in depth. The corrosion was supposed to be due to something communicated to the water by tar, as tar residues existed on the surface soil. Bolts in a pump used to raise tar at the same works were similarly corroded. Ammonium chloride was supposed to contribute to the corrosive action in both cases.

In several cases brought under our notice, and also in our own experience, we have not found the internal parts of tar pumps suffer from any marked corrosion, nor in one case of a water pump which raises approximately 40,000 gallons per day of water, contaminated with tar products. A portion of the end of a knocking stud taken from a tar pump after being in use for over five years showed practically no signs of corrosion.

Scheurer-Kestner (Bull. Soc. Chim. 1897, 1250—1252; this J., 1897, 141), deals with corrosion of cast and wrought iron by fused caustic soda under pressure. Laboratory experiments showed that pressure increases the rapidity of corrosion. A. Lange (Woch. f. Brau., 1899, 357; this J., 1899, 759) discusses the chemical action of liquid sulphur dioxide on the iron of cylinders of ice-making machines. Water appears to play an important part in the reaction, and the equation given by this worker is $2Fe + 3SO_2 = FeSO_3 + FeS_2O_3$. Henderson and Beilby (J. Chem. Soc., 1901, 1245—1256; this J., 1901, 1212) found that an exposure to the action of ammonia for seven days at a temperature of 800° C. rendered malleable iron so brittle that it could be broken like porcelain by a blow from a hammer.

Ed. Donath, in a paper on the "Production of ferrocyanogen from gas-liquors" (J. Gasbeleucht, 1901, 880; this J., 1902, 51) states "We can see easily that gas-liquors exercise a corrosive action on iron, but this action apparently is more energetic when the water is heated. While the pumps which are used to pump up the cold ammoniacal liquor are corroded but slightly, it is by no means uncommon to observe strong corrosive action on the iron portions of the distilling apparatus. I have even seen . . . a Feldmann distilling apparatus, which had become so completely friable that at many places it was easy to pierce the thick sides with an ordinary knife. A portion removed with a knife consisted principally of graphite and Prussian blue, and it is highly probable that this latter body was formed thanks to the presence of sulphides in the gas liquors, by the same process as in the purifying material."

In regard to the action of cold ammoniacal liquor on the iron portions of pumps we can confirm Lange's observations. In a valve taken from a pump which has constantly pumped ammoniacal liquor for over 3½ years, the greater part of the valve face still exists; hence it may be concluded that cold ammoniacal liquor is not a serious corrodent so far as iron is concerned. The corroded parts of the valve have taken on a granular appearance. We are also able to partly confirm the same worker's observation that portions of the cast iron columns of ammonia stills are corroded, in many cases becoming cellular, portions of the iron being eroded leaving cell like spaces. We cannot confirm the presence of Prussian blue in the corroded parts.

F. J. R. Carulla (J. Iron and Steel Inst., 1908, 76, 71) finds cast iron everlasting when used for ammonia stills, and instances the case of a still which had been at work for 18 years, the numerous cast iron cylinders of which showed no signs of wear. He also calls attention to the possibility of ammonium chloride attacking the iron of which tar stills are constructed, and the marked corrosion that takes place in castings of iron containing wrought iron chaplets when they are brought in contact with many chemical liquids.

When dealing with the corrosion of tar stills we shall have occasion to refer to the part which ammonium chloride plays in that action, but in this place we would like to confirm Carulla's observations in regard to wrought iron chaplets in castings. It was found that the cast iron pipes used to connect the swan-necks of tar stills to the condenser coils rapidly corroded at the point where the chaplets had been introduced, and in some cases the chaplets were eaten right out. It is most likely that the rapid corrosion which takes place at the chaplets is due to marked local electrolysis; corrosion of all metals is probably more or less due to electrochemical action. A remedy was found in this case by using pipes which were cast vertically without the use of chaplets.

In a paper on "Tests for the action of chlorides on cast iron" (this J., 1909, 508), Carulla describes the action of ferrous chloride and ammonium chloride liquors on cast iron, and a method of determining the extent of the action in each case. G. K. Davis (J. Iron and Steel Inst., 1908, 76, 81) describes the action of hot ammonium chloride solution on wrought iron. A. T. Lincoln deals with the electrolytic corrosion of brasses very fully in the Journal of the American Electrochemical Society, vol. ii., 43 (see this J., 1908, pp. 167 and 946).

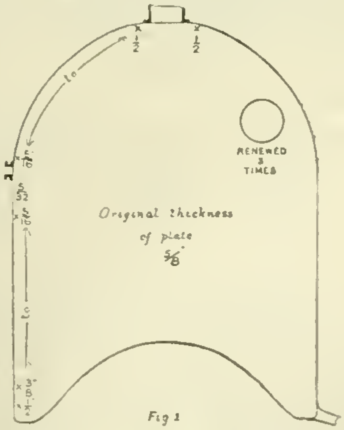

Fig 1

To the tar distiller the corrosion of his stills is a continued source of anxiety and expense, and he would welcome an alloy at a reasonable price that will resist for a longer period than wrought iron or mild steel the corrosive action of the vapours which are given off during the distillation of tar. The diagram will give some idea of the extent of the erosion in a tar still after working for five years. The plate under the manlid-stool has had to be renewed three times during this period, being eroded completely through each time. The plate under the charging block stool is another spot which gives a great deal of trouble. It will be seen from the diagram that for one foot below the stool the plate is only $\frac{5}{32}$ of an inch in thickness, being in fact the thinnest part of the whole still, neglecting of course the portion under the manlid-stool.

The mechanism of the process of corrosion of the iron of tar stills is, without doubt, a complicated one, and it is somewhat difficult to form a theory to fit in with all the conditions that may exist in the still from the commencement to the finish of the operation. We are of the opinion that the dissociation of ammonium chloride, ammonium sulphide, ammonium hydrosulphide, and ammonium cyanide, and the subsequent action of the dissociation products upon the iron, is the chief cause of the corrosion. The rate of the action is probably increased by electrochemical conditions (self-corrosion). It is quite possible also that strain contributes towards corrosion by producing a certain amount of molecular instability in portions of the iron plates, thus rendering these parts more easy of attack. The plates are eaten away at a greater speed at those points where excessive condensation takes place, for instance under the manlid-stool, and this is due, in all probability, to the continuous flow of liquid removing the final products of corrosion more rapidly at these points than they are removed elsewhere, and thus exposing a fresh surface of iron to the attack.

It is thought that the process of corrosion goes on at a greater rate during the latter portion of the distilling operation, principally during the period when steam is used to assist in the distillation. The final products into which the corroded iron is converted appear to be chiefly ferrous sulphide and ammonium ferrocyanide. Ammonium thiocyanate occurs in small quantities, and traces of ferrous chloride and Prussian blue have been found in portions of the corroded iron. It is considered that the steam introduced into the still plays no other part than that of producing ionisation of the ammonium chloride, etc., and increasing the power of action of the products of dissociation.

As far as possible it has been endeavoured to prove the theories just enunciated. To secure like conditions to those existing in a tar still during work, in glass apparatus is next to impossible.

On the undersides of manlids of stills after working, a deposit of a dirty, brown colour was noticed. Several samples of this material were collected and examined, when it was found that over 50 per cent. consisted of ammonium chloride. The composition of two samples is given in Table 1.

TABLE I.

	Ammonium chloride	Carbon	Soluble in benzene, (anthracene, naphthalene, &c.).
	per cent.	per cent.	per cent.
1.	52·31	5·63	42·06 } by diff.
2.	54·30	5·07	40·63 } by diff.

The carbon appeared to be in the graphitic state and contained a trace of iron. In the water soluble portion, which was faintly acid to litmus, a trace of ferrous iron and a large trace of sulphates were found in addition to the ammonium chloride. Ferrocyanides and thiocyanates were absent. Large quantities of ammonium chloride and ammonium sulphide were found in some of the liquors which come over during the working of the still (see Table 3). It is a well-known fact that ammonium chloride and ammonium sulphide dissociate at high temperatures into ammonia and hydrochloric acid, and ammonia and
sulphuretted hydrogen respectively, and it is quite reason
able to suppose that the hydrochloric acid and sulphurettec
hydrogen set free will attack the iron of the stills, especiall
in the presence of steam which is to a certain extent
superheated owing to the temperature of the still.

It is considered that ammonium chloride exerts a greate
action upon the iron than ammonium sulphide, and the
following experiments were carried out to prove this
Solutions of ammonium chloride and ammonium sulphid
in water were prepared at such a strength that the amoun
of hydrochloric acid combined with the ammonia in th
former salt was exactly equivalent to the amount o
sulphuretted hydrogen combined with the ammonia i
the latter. Pieces of wrought iron of known weigh
and area were totally immersed in the solutions, and th
temperature then raised to 80° C., and kept as near a
possible to that point for 4 hours. The pieces of iro
were then removed, carefully wiped, dried and reweighed
The results are shown in Table 2.

TABLE II.

Ammonium Chloride.

	Original weight of iron. Grms.	Area sq. c.m.	Loss in grms.	Loss grams. per sq. c.m.
1.	18·6805	18·78	0·0197	0·001
2.	18·6608	18·78	0·0189	0·001

Ammonium Sulphide.

	Original weight of iron grms.	Area sq. c.m.	Loss in grms.	Loss grms. per sq. c.m
1.	16·9288	17·26	0·0146	0·00084
2.	16·9142	17·26	0·0150	0·00086

The fact that traces of ferrous chloride were found in th
scrapings taken from plates in different parts of stills
also a support to the theory that ammonium chlorid
plays an active part in the corrosion.

Electrochemical action has not been proved up to th
moment, as pressure of work has prevented the makir
of experiments. Arrangements are being made, howeve
to investigate this matter. It seems quite reasonable
suppose that electrochemical action does take place.

The electrochemist believes that when a metal is broug
in contact with an electrolyte, and ammonium salts a
electrolytes, electrolysis will take place upon the surfa
and rapid corrosion will be the result.

Many experiments have been carried out by J. Thicken
of the University of Wisconsin, with the object of provi
that strained iron is more susceptible to corrosion th
unstrained iron. In all cases he found a marked differen
in the rate at which the strained portions of iron corrod
compared with the unstrained. Mild steel showed
greater corrodibility than wrought iron. He found th
in the presence of an electrolyte the strained portion
the iron became the anode and the unstrained the cathoc

We have observed that those portions of tar stills whi
are subjected to unequal strain due to expansion a
contraction corrode much more rapidly than the gene
body of the apparatus. In the cases under investigati
it is particularly noticeable at that portion of the st
next to the downtake flues. In this position there
three plates which have corroded across the corners
deep grooves. At those points in the stills where
greatest condensation takes place, the plates are ba
corroded into grooves, and the general erosion takes pl
with greater rapidity. The plates in these positions
much cleaner, being in most instances practically free fr
a scale of sulphide of iron such as is found on the grea
portion of the still plates. This, it is thought, suppo
the theory just given.

The results of an examination of the ammonia
liquors which distil over during the process of tar disti-
tion are given in Table 3. It will be noticed that

amount of ammonium chloride and also the amount of iron as ferrocyanide are greatest in the liquor which comes over during the end of the distillation. It is at this stage that steam is passing into the still and the temperature high, and it seems quite within reason to assume that the action of corrosion is at its height during this period, especially when the results given in Table 2, and the fact that steam (water) and also high temperatures increase the amount of dissociation of substances capable of dissociating are considered.

TABLE III.

	Liquor collected when still commences to work.	Liquor collected at finish of crude naphtha.	Liquor collected during the working of heavy creosote. Steam passing into the still.
Ammonium chloride	0·13 grms. per 100 c.c.	0·053 grms. per 100 c.c.	2·02 grms. per 100 c.c.
Ammonium sulphide	0·40 grms. per 100 c.c.	2·20 grms per 100 c.c.	0·54 grms. per 100 c.c.
Ammonium ferrocyanide	trace	0·04 grms. per 100 c.c.	0·056 grms. per 100 c.c.
Ammonium thiocyanate	trace	trace	large trace

The final products of corrosion are found chiefly in the shape of loose scale on the plates. Small quantities occur in the oils which distil over and in the ammoniacal water, in the former case as ferrous sulphide in the form of a fine black powder or in coagulated masses, and in the latter as ammonium ferrocyanide. An examination of the scale removed from several plates in various positions showed that ferrous sulphide was the chief final product. Ferrous chloride and Prussian blue occur in small traces. The following is the result of the analysis of scrapings taken from the top ring of plates.

		Soluble in water contained	Insoluble in water and benzol consisted of
Soluble in benzol,	16·82%	Ferrous chloride	FeS 92.28%*
Soluble in Water	0·39%	Ammonium chloride in traces	C, 7·63%
FeS and C	82·79%	Ammonium sulphate in traces	

* In some cases a small trace of Prussian blue was found along with the ferrous sulphide and carbon.

DISCUSSION.

The CHAIRMAN said that at the end of a boiler where there was rapid expansion and contraction "grooving" always occurred; but he had understood that that was due to a mechanical rather than to a chemical reason. A small crack was developed and, at last, it became a groove.

Mr. A. E. TUCKER said he had come to the definite conclusion that the corrosion of iron and steel was entirely an electrical action, involved and obscured by the chemical actions which also accompanied it. Modern research showed that alkaline materials and certain oxidising bodies prevented the inception of oxidisation, and therefore corrosion under most circumstances. He was convinced that where iron was strained by mechanical causes it always exhibited greater tendency to corrosion than unstrained iron. In strained iron the pores were opened and a rough surface was produced which was more subject to corrosion. This result was further illustrated by the well-known immunity of highly polished surfaces, such as razors, to the action of ordinary exposure to damp or foul air, which, on rough surfaces, would bring about rapid corrosion. He had seen some new carpenter's tools which had been submerged in a Cannock colliery for five or six years; when the pit was reopened the tools still appeared to be new. Again he commended the authors of the paper to recognise the electrical condition as being above all the explanation of corrosion of their tar stills; this action would be intensified by the character of the materials used in them. He had found that several acids under certain conditions produced the same result as phosphoric acid now used for anti-rust processes. This showed that the immunity from rusting in the articles operated on was not due to the formation of a phosphide or phosphate of iron, as had been suggested, but rather to an alteration in the physical condition of the surfaces.

Mr. H. L. HEATHCOTE said the electro-chemical explanation of corrosion must undoubtedly play a great part in that and other cases of corrosion. But he failed to see how in the present instance, at such high temperatures, it could be regarded as the most prominent factor in bringing about the corrosion referred to. He was inclined to look at the effect of the increase of volume due to corrosion. When the outside of the iron or crevices in the irregular surface of the iron became corroded the volume of the products, he thought, would be enormously greater than that of the original iron. The pressure exerted by these products would be enormous. The effect of this expansion was shown very well by Professor Carpenter in his work on the expansion of cast iron, when alternately heated and cooled. He was inclined to think that these stresses were, in the present case, much more important than those due to the simple expansion due to heating and cooling, if any steps were taken to coat the iron previous to using it. There was no doubt that one or other of the methods for coating iron with a phosphate coating would afford an efficient preventive of rust, especially if the coat, which was porous to a certain extent, was impregnated with oil or other ingredient which was hard to remove.

Mr. W. T. COLLIS observed that the rapid rate at which tar stills disintegrated was phenomenal and most expensive. With regard to electrical action the corrosion varied according to what was worked in the stills. Some oils were almost as destructive as tar. In reference to the plate, across which a straight groove was cut, he had usually noticed the mischief in a patch. That patch might be a foot square with one central point which would be very thin. He did not think that could be put down to electrical action.

Mr. E. A. MANN said that not only was the wear and tear of the still itself to be taken into account, but the very heavy expense entailed in the way of brickwork and fittings when replacement became necessary. He had no doubt that ammonium chloride was the greatest factor in the matter. Similar stills used for distilling light oils and creosote, which contained a large amount of sulphur compounds but were practically free from chlorides, showed nothing like the same amount of wastage. He instanced a case where a ⅝-in plate was cut completely through under the charge block of a tar still in less than three months.

Mr. A. R. WARNES, in reply, said his belief was that the grooving in this instance was due neither to electrical nor chemical action, but to mechanical causes. He believed a certain amount of electrolytic action did take place, but he and his fellow author hoped to prove that, and also deal with the matter with regard to the question of stress and strain. So far as the plates under notice were concerned, it did not look as if they were swollen. They had not tried treating iron with solutions, but steel treated with chromates had been tried in connection with the corrosion of iron, and found to be very resistant in regard to atmospheric influences, but it eventually lost that power—in one case, in about six months. They had tried nickel steel which was very hard and difficult to work. They had placed nickel steel in a still, and up to the present the results were in favour of this material. They hardly hoped, however, to use it because of the expense and the difficulty of working it.

Manchester Section.

Meeting held on Friday, December 3rd, 1909.

MR. R. H. CLAYTON IN THE CHAIR.

THE DISTILLATION OF SEWAGE SLUDGE.

BY A. H. VALENTINE, M.SC.

(This J., March 15th, 1910, p. 244.)

DISCUSSION.

Dr. J. GROSSMANN said that the paper practically described the method which he (Dr. Grossmann) had used on a large scale for two years past at the Oldham Corporation Sewage Works, where the author was engaged as chemist. The apparatus mentioned as being used for the author's laboratory experiments, was ordered several months after Dr. Grossmann's large scale experiments had been brought to a successful conclusion, a full description of which would be found in this Journal, 1898, 421; 1905, 655; 1909, 1000; and Chem. Trade J., June 5th, 1909, p. 567 (paper read before the Intern. Congress of Applied Chemistry).

Meeting held at Manchester, on Friday, March 4th, 1910.

MR. R. H. CLAYTON IN THE CHAIR.

SCHOOLS OF DYEING.

BY S. H. HIGGINS, M.SC.

Of the German schools which are devoted to teaching the practice of local industries, the one at München-Gladbach, which is the centre of the cotton industry of Rheinland, is among the newest. This school is somewhat like one of our smaller technical schools. The equipment and maintenance are provided by local manufacturers aided by a small grant from the Prussian Government. It is under Government control. The building contains a boiler and engine house, spinning, weaving, and dyeing departments, a chemical laboratory, and lecture rooms. The spinning and weaving apparatus is mostly of a small size; the dyehouse contains pots for sample dyeing besides a few jiggers and small apparatus. Much of the machinery in the school was made in Lancashire, and many of the machines used in the cotton industry of the neighbourhood were also supplied by this country. The complete course of instruction at the school extends over 2 years or 4 semesters each of 21 weeks of 44 hours. Students must be over 16 and possess a satisfactory general education. Special instruction is given in the production of cotton waistcloths, which are a speciality of the district. The school is designed to assist the local industry, and foreigners are only admitted at the discretion of the director; they are charged at the rate of £40 a year, whereas Prussian students pay £10, and those from other parts of Germany £15 a year. At the time of the author's visit there were 32 day students, 8 of whom were foreigners, and 143 evening students.

The Crefeld Fachschule is one of the oldest schools of its kind, and since its establishment has undoubtedly had much effect on the German textile industries and at the same time gained a good reputation. This school is really a combination of a trades school and a school of chemistry, because it was recognised at its inception that a knowledge of pure chemistry was essential to the study of dyeing and other branches of the textile industries. Lectures on physics, inorganic, organic, and physical chemistry, patent legislation, etc., are given. Some of the chemical laboratories are used for research connected with the textile industry, and other rooms are fitted up for the usual chemical requirements; trials are made on the small scale in an experimental dyehouse. The large scale apparatus includes hank dyeing becks, raw cotton dyeing apparatus, centrifuges, silk finishing machinery, and printing machines driven by hand and power. There is also the usual spider-web arrangement for the piece dyeing of indigo. At the Chemistry School of Mülhausen instruction is given in pure and applied chemistry, but no large scale apparatus is used. The school aims at giving special chemical instruction to those entering the dyeing industry.

Chemnitz, the centre of the cotton industry of Saxony, has a department of technological chemistry at the Staat-Lehranstalt. Here the teaching is of a theoretical kind; instruction is given in dyeing, but no large scale apparatus has been installed. At the Charlottenburg Technical High School there are a great number of special chemical courses. Karlsruhe has one of the finest of German technical high schools, where pure and applied science is taught and degrees granted. There is some dyeing in the district, and this industry is catered for at the school. Thus a research on the fading of colours under the light of the Cooper-Hewitt lamp was being carried out at the time of the author's visit, and a new dyeing laboratory was projected.

In Austria one finds that instruction in dyeing is not well provided for, so that many Austrians visit other countries for their instruction. The K.K. Oesterreichisches Gewerbe Museum, Vienna, is a higher grade technical school which is supported by Austrian manufacturers and receives a Government grant. It is mainly used for the teaching of dyeing and printing from a theoretical standpoint. There are various testing departments. The only school in Austria devoted to the teaching of practical industrial methods is the Reichenberg Staats Gewerbeschule, which has been designed on the Crefeld pattern and contains a school of dyeing. Very low fees are charged, and sometimes free tuition is given.

From the above short description of a few Continental schools it must be evident to those who are familiar with the English schools of the same kind that at least as far as equipment is concerned England does not occupy a second place. It is true that many of the German technical high schools attract large numbers of students, but this is not the case with schools of the Crefeld type. The Crefeld school itself had, in 1905, seventy students which number, however, dropped to forty-five in the following year when the fees charged to foreigners were increased. The München-Gladbach school was for some time without students. Sorau, a town in Brandenburg near the borders of Silesia and Saxony, and therefore quite near the dyeing industry of this part of Germany, built a school of the Crefeld type at a cost of a million marks, and equipped it like a university with a fine laboratory and machinery for bleaching, dyeing, printing, and finishing. At one time there were three instructors and six students, some of the students being foreigners. Further we find that in Germany the schools are not very particular as to the quality of the student they admit; they make an effort to get as many as possible. It has been said that students from the high schools pass through the schools of the Crefeld type before entering industry; but such cases are exceptional, as these men have other outlets for their training. A student from a technical high school does sometimes find his way into a trade school, and then the authorities show their delight; they do not say anything as to the educational standard of the bulk of their students. The technical high schools themselves are known to accept in their specialised technical chemical laboratories students who have had little previous chemical training. The volunteer departments of the German colour works are now much patronised in place of the schools mentioned, but it must be remembered that the training obtained in these departments, although good, cannot be a substitute for attendance at technical schools: the experience is of a different nature, and can only be supplementary to technical instruction. As regards the training and education of the workpeople engaged in the German textile and allied industries, the situation is very similar to the state of affairs in this country. The employers are inducing the people to attend technical classes, and the law is applying as much force as it can in the same direction, but yet few, other than manufacturers' sons, are taking much interest in the special technical schools described.

Turning to the United States, we find that schools of the class above described are springing up in most textile centres. The Fall River Textile School contains a small chemical laboratory and a dyehouse containing vats for hank dyeing, a machine for warp dyeing, drying cylinders for warps and other yarn dyeing apparatus. The dyehouse is designed to supply the weaving department, and contains no piece dyeing machines. The instructor thought that the schools of this class ought merely to supply their own needs, but admitted that such a procedure did not give scope for instruction in piece dyeing, printing, etc., and therefore did not encourage research in these branches of the industry. Local opinion is divided as to the value of the school. These facts serve to show that technical education has had to fight against a good deal of prejudice in America as well as in England and that the American is not so eager for technical education as some people in this country are apt to think.

Lowell, Mass., has a very capacious technical school. It was stated that the intention of the school was to train engineers to become managers. All students were expected to go through the whole course; there were a few special students, but these were not encouraged, as a general all-round training in the engineering, electrical, chemical and textile departments was aimed at. From the chemical department, which is fairly large, many chemists obtain places in the local works. The department for woollen manufacture is particularly good: some Yorkshire, but mainly Massachusetts, machines are installed. For cotton dyeing the equipment consists of two jiggers, a Klauder-Weldon dyeing machine, drying cylinders, and a few other machines. Trials were done mostly on an experimental scale; thus some mercerising trials were being performed at the time of the author's visit. Both here and at Fall River the machinery was driven electrically. As regards the staff of the school, one noticed that one dyeing instructor hailed from Manchester, the head of the weaving department from Preston, while most of the other professors and instructors were educated at one or other of the technological Institutions in America. Local opinion was also divided at Lowell as to the value of the school. The textile school at New Bedford is very similar to that at Lowell, and that at Philadelphia, the oldest of its kind in the United States, also requires little further description. The dyehouse at the latter school contains the usual small scale apparatus for dyeing, yarn dyeing becks, a hydro-extractor, a small warp dyeing machine, and a small printing machine. Prof. Walker, of the Massachusetts Institute of Technology, describes industrial chemistry as the introduction of the dollar into the chemical equation, so that in his applied chemistry department he tries to bring the student into touch with chemical industry. Thus one finds the student separating pure from crude salt, making Glauber's salt, and afterwards designing a plant for its manufacture. An attempt is made to get the student to think, and the element of cost is introduced during the instruction. The principles of bleaching and dyeing are taught and the lectures are supplemented by practical work. Special lectures on such subjects as calico printing are given from time to time by men actually engaged in the industry. Very little instruction in dyeing, however, is attempted. The Director of Applied Chemistry said that the students from his charge never went to the textile schools, although he admitted that probably this was the best way for them to become of use. Yet he thought the chemist soon got into the work of the mill. Their idea was to train engineers, and the Institute was really of the nature of a University. Their work did overlap that of Harvard University in the same city, but yet the University drew a different class of student.

At the Columbia University, New York, a good feature of the chemical course is the inspection after the lectures of a large museum, which contains many interesting things connected with the subject which has been discussed. Visits to works are paid, and memoirs have to be written giving an account of the things observed. A little hank dyeing is done, being part of a practical course connected with lectures on industrial chemistry given to 3rd and 4th year students.

The dyeing schools of other countries do not compare with those at *e.g.*, Leeds, Manchester, Bradford, and Glasgow, and even with many others of lesser importance in these islands. Just as we lead in the production, preparation, dyeing, bleaching, printing and finishing of textiles, so also is this lead maintained as far as the technical instruction applied to these industries is concerned. Also it must be said that there is little difference between the positions of England, Germany and America as regards the appreciation which manufacturers show of the training received at these institutions. But although England is foremost in this class of instruction, there are many respects in which our schools can be made more useful and in this way gain more recognition from commercial men. The technical school should be in intimate relationship with the manufacturers of the district in which it exists. At the German colour works periodical conferences are held by the technical staffs, when any progress in colour manufacture is discussed and opinions on the products of rival works are given. In this way much valuable information is recorded. The publication of an abstract of these records would be exceedingly valuable to the dyeing world, and, although the issue of such a volume is improbable, one can conceive of such a publication being compiled by the staffs and students of our technical institutes: Manchester could report on innovations in the dyeing of cotton goods, and Bradford and Leeds on the treatment of wool. In this way much valuable information could be supplied to the industry and such an action would soon meet with a response from the manufacturers. In connection with the recently formed Textile Institute there is the intention of supplying information to the trade, but surely much of this work ought to ba performed by our textile schools. It is to be hoped, however, that this Institute will be instrumental in acting as an intermediary between manufacture and the schools. Besides information concerning the properties of dyestuffs that concerning machinery might also be included in the report.

Again, our technical schools might advantageously adopt lectures on economics, *e.g.*, banking, trade unions, wages, organisation of industry and commerce, patent legislation, etc. These lectures are given in some American institutions, and it is evident that instruction in the rudiments of these subjects, besides being interesting, would be extremely useful to those entering industry. Another point in which the writer thinks our schools are lacking is that concerning the prices of materials. The question of price should be put prominently before the students and especially before those evening students who are employed in works. We know that the uses of dyestuffs are constantly being altered because of cheaper substitutes being introduced, and a consideration of the price of these substitutes along with their other advantages and disadvantages is essential. It is true that the price of an artificial dyestuff is a vague quantity varying from district to district and depending on competition and other factors, but an idea of their approximate cost would be very useful to those students already engaged in or about to enter the industry. One finds in a works that such questions as cost of power, cost of damaged goods and depreciation are factors which largely determine profits, whereas in the school one never gave such things consideration. Of course one soon becomes aware of these losses after entering the works, but a slight previous knowledge of works conditions would be extremely useful. A student entering a dyeworks direct from a university without previously passing through a technical school will probably find the position extremely awkward and discouraging. The employer is anxious that his profit should be increased and expects improvement. The chemist is in a maze, he is paralysed by unusual circumstances, and sometimes is not allowed time to recover from his embarrassment. This period of embarrassment and consequent inactivity would have been much shorter if the chemist had previously attended a technical school. Such institutions exist to place him in touch with industry. Chemists are thinkers and as industry thrives in consequence of the thoughts of those engaged in it, it is necessary that industry should attract the greatest thinkers.

Discussion.

Mr. H. J. Reynolds thought it would not be difficult to show that Germany's pre-eminence, in respect of chemical science and chemical industry, could readily be established. A few years ago a comparison was made by the Association of Technical Institutions of students studying science and technology in England as compared with Germany. In nine German technical high schools there were 13,500 students, none of whom were under 18 years of age, while in 99 English institutions, including the science sides of the Universities, and students from 15 years of age and upwards, they did not reach more than 5,000. The greater number of students in technical schools in Germany were undoubtedly men who had passed the gymnasia or the Ober-Real Schule, where they remained till they were at least 18 years of age. The technical schools in this country had comparatively few students in the day time. The preparation of the student made all the difference. Science teachers in Universities or Technical Schools could do vastly better work if the students came with proper preparation. He was pleased to find English employers were turning a more favourable eye towards the technically and scientifically trained assistant. The school, of course, did not pretend to train the student from the business point of view, but aimed at awaking his intelligence and alertness of mind. If they could imbue the student with the idea that his real business had still to be learned in the works, they had sent him out in the proper attitude of mind. It ought to be clearly brought before the student that many of the things he was able to accomplish with facility in the school laboratories were very difficult problems from a business point of view. He had more respect for the School at Crefeld than Mr. Higgins appeared to have. The Crefeld people themselves stated it had greatly developed the manufactures of their town, and that in many cases it had been the cause of goods being produced which were now in severe competition with English manufactures.

Mr. W. Thomson said the chief object of a technical training was to enable the individual to think properly. He thought the commercial point of view might very well be left until the business career was actually commenced.

Mr. H. L. Terry said that Germans were asking what was to become of German students after they were trained. Would England be better off if a larger number of students passed through the Universities? The author had stated that English students in Germany were charged a higher price for their fees for tuition than Germans. Was such the case in England, as technical institutions were largely dependent upon rates for their support?

Mr. Hübner said that there were various types of school in Austria. The so-called Höhere Staats-Gewerbe Schule was entirely different from the Crefeld or the München-Gladbach School, the entrance examination being in the Austrian schools very severe. The student devoted three years to general training, and only in the fourth year specialized in one particular branch of industry. Connected with these schools were branch schools called Werkmeister-Schulen which compared more directly with those of Crefeld and M.-Gladbach, where the training extended over two years, and where the students were trained at once in particular branches of chemistry. Austria had also Fachschulen, which might be compared with the Crefeld school. Here again, the entrance examination was of a low standard, the students entering directly on their technical training. Regarding fees for foreigners, the Manchester School of Technology made no distinction. In Germany, as far as he was aware, it only existed in the Crefeld and München-Gladbach schools. The bulk of English students in Technical High Schools and Universities in Germany, Switzerland, or Austria paid exactly the same fees as the people of the country themselves, and the fees in those countries were much lower than those charged in this country. Germany in addition to the fees paid, spent £12 or £13 upon the education of every student in her University.

Mr. J. Allen said the student, on leaving the technical school, went to a works, practically to continue his education, and, in his opinion, at least two years training in the works was necessary before he reached his greatest measure of usefulness.

Mr. R. Shepherd observed that a great deal depended upon the attitude of works managers as to what extent they appreciated the chemist.

Dr. S. B. Jatar thought they ought not to be satisfied with the fact that the technical student was an unfinished product on leaving the school. The student ought to be in a stronger position to make his way in the world.

Mr. R. E. Crowther observed that there were some students who left the technical school and who had immediately to support themselves.

Mr. Foster regarded the chemical student as being in much the same position as a skilled workman. His future was largely settled for him by commercial conditions. The management of chemical works largely resolved itself into a question of engineering. Schools of dyeing, though perfectly good on the theoretical side, did not in his opinion turn out the industrial chemists.

Mr. S. H. Higgins said that the principal reason he had prepared his paper was, because the views it contained were different from those usually accepted. He considered technical schools should aim at making students more immediately useful to works managers. Students would be all the better fitted for business experience if they had a sufficient knowledge of the current prices of materials employed in manufacture. In his experience, the problems in a works were almost exactly the same as the problems in the research laboratory.

Nottingham Section.

Meeting held at Nottingham, on Wednesday, February 23rd, 1910.

MR. S. J. PENTECOST IN THE CHAIR.

THE PREPARATION OF GLUE FROM CARTILAGE.

BY S. R. TROTMAN, M.A., F.I.C.

The products of the hydrolysis of cartilage have never been sufficiently studied, and considerable divergency and vagueness in the published descriptions still exists. In most text books one still reads that cartilage, when hydrolysed, yields chondrin which is supposed to be derived from the hydrolysis of chondrinogen, a substance bearing the same relation to chondrin as collagen or ossein does to gelatin. The so-called "typical reactions" of chondrin are that it is precipitated by acids and alum and gives a jelly less firm than that obtained from the same amount of gelatin. Its nitrogen content is given as 14·4 per cent. Mention is generally made of Mörners micro-chemical experiments upon which he founded the opinion that what is generally termed chondrin is probably a mixture of mucin and gelatin. The glue maker, however, assumes that cartilages when hydrolysed, yield chondrin, meaning thereby all that can be precipitated with alum or dilute acid.

In view of the doubt which obtains as to the nature of chondrin, I thought it would be a matter of some interest to repeat Mörners experiments on a larger scale. The results of these experiments have confirmed his results, and show conclusively that cartilage contains a mixture of mucin and collagen, and that if the mucin be completely removed, the hydrolysis of the residue yields perfectly normal glue or gelatin. In the first place, a specimen of chondrin was obtained, manufactured by a well-known firm. This was found to agree approximately in composition with the published results for chondrin and gave all its supposed reactions. It is obvious therefore that commercially there is such a substance.

The following experiments were then made with costal cartilage. A considerable quantity was cleaned and cut into thin slices (⅛ to ¼ inch thick). The fat was extracted with ether, after which the residue was dried by exposure to air. It was then placed in a bottle and shaken with lime water in a mechanical shaker. After shaking for some time the liquid was filtered and after filtration acidified. A copious white precipitate was obtained. The shaking process was repeated until no trace of turbidity was produced with acid. This precipitate was then collected and washed, and dissolved in sodium hydrate and reprecipitated. It proved to be typical mucin. Its solution had very marked foaming powers, and gave precipitates with alum and acids. It contained 12·63 per cent. of nitrogen. The precipitation by acids is not complete without heating, which causes coagulation. Prolonged boiling, either with acids or water, produces, however, semi-solution, accompanied by a high frothing power. These points are of considerable interest to glue makers. The extraction of the mucin is very slow; without the aid of shaking nearly a fortnight was required.

In the first experiments I made, I allowed the cartilage to stand in contact with the alkali. At the end of 24 hours practically nothing had been extracted, and in the absence of a precipitate with acid I concluded that no mucin was present, and proceeded; with the result that I obtained a product containing about 15 per cent. of nitrogen and having the properties of commercial chondrin. It was only when the shaking method was adopted with very thin slices that complete extraction could be obtained. The mucin-free residue was then paddled with dilute acid to remove the excess of alkali. It was next thoroughly washed and boiled with water for three hours. The solution obtained, when filtered and rapidly concentrated, set to a clear jelly, indistinguishable in appearance from that obtained from gelatin. Commercial chondrin is not only difficult to dissolve, but always gives an opaque jelly. The solution of the jelly had none of the properties generally attributed to chondrin, but on the contrary, gave typical reactions for gelatin, as is seen in the following table:—

	Commercial chondrin.	Hydrolysed mucin-free cartilage.
Dilute acid	Precipitate	No precipitate.
Alum	Precipitate	No precipitate.
Lead acetate	Precipitate	No precipitate.
Copper sulphate	Precipitate	No precipitate.
Bromine water		Precipitate.
Mercuric chloride		Precipitate.
Zinc or sodium sulphate in saturated solution		Precipitate.

The above reactions indicate that we are dealing with a solution of gelatin, or at any rate that gelatin and chondrin have identical properties. The solution was next precipitated with alcohol, and after washing, dissolved in water and re-precipitated. After the first precipitation, the nitrogen content was 16·82 per cent., but on washing, dissolving in dilute acid and re-precipitating, it rose to 17·63, which is practically identical with that of gelatin. The conclusions to be drawn from these experiments are that if mucin be first removed, normal glue or gelatin may be prepared from cartilage, and that glue never contains chondrin but merely mucin. Further, cartilages must be regarded as a source of mucin and hence as one of the causes of foaming glues.

Sections of the original cartilage, before and after alkaline extraction, were prepared and stained. They show clearly that a portion of the tissue had been removed, leaving a reticulated residue.

The yield of gelatin is very small, a large percentage of insoluble matter remaining. The cartilage used gave the following figures:

Oil	4·45
Mucin	3·13
Gelatin	5·34
Water and insoluble	87·08

The oil was of a light yellow colour with the following constants:

Iodine value	56·5
Saponification value	199·6
Melting point	25·0°C
Titer	35·5°C

The products of hydrolysis are still under investigation and will be communicated in due course.

Meeting held at Nottingham on Monday, May 23rd, 1910.

MR. S. J. PENTECOST IN THE CHAIR.

A NEW STANDARD METHOD OF COLOUR MEASUREMENT.

BY PROF. H. R. PROCTER.

Although it may be admitted that the official method of measurement and registration of the colour of tanning extracts has served a useful purpose as enabling sellers and buyers to fix a definite numerical standard in contracts, it is obvious that it fails in other respects to give much useful information as to the actual colour of the material. It is certain that no merely optical test can give complete information as to the colour which will be given to the leather, since this depends not only on the colouring matters present, but on their relative affinity for the hide and even upon the previous preparation of the latter, and it is only necessary to quote the extreme case of logwood extract, which itself is yellow, but dyes an alumed leather violet. The difficulty, however, of producing the same shade on different samples of pelt, and of guaranteeing the tanned leather against subsequent colour-change, render the actual tanning test unsuitable as a basis of contract, and still leave room for an optical method more accurate and intelligible in its results than that at present official. Attempts have been made from time to time to substitute for the Lovibond glasses some more scientific and less arbitrary scale, based on the actual spectrum, and measured by spectrophotometers, such as Hueffner's, described by Hough (Collegium, 1909, 417); but those who have gone carefully into the question will at once realize that the scientific measurement of a colour, even it it can be executed with sufficient accuracy, can only be expressed fully by the form of a curve, and not in any way suitable for commercial requirements; and that any numerical expression must be based on arbitrary assumptions as to the component colours. It therefore seems unwise to leave the simple and well-known coloured glasses of the tintometer for a more expensive, more complex, and for our purposes, probably less accurate method, although as will be shown later, the glasses have serious inherent defects; but while still retaining the colour-standards now in use, I have sought to apply them in a more accurate and an easier way, which I think also gives its information in a more comparable and clearer form.

To explain my meaning I may quote the results of a solution of a single (oakwood) extract in solution of 20, 10, 5, and 2·5 grms. per litre as measured by the tintometer and the new method (see Table I). While no intelligible relation exists between the tintometer results, those by the new method are simply proportional to the dilution of the solution, and when calculated back to terms of the original extract are identical within the limits of experimental error. The reason for the discrepancy of the tintometer results lies in the fact that the match between the glasses and the liquid, though perfect to the eye, is physically not a true one. The sum appears to be the same, but the individual constituents are different, as is at once obvious when both are dissected by the spectroscopic prism. The white unaltered light gives a band of infinite gradation of colour, from red, through orange, yellow, green and blue to violet. If a coloured glass or liquid is interposed, some portion of this band is shaded out, and the colour which we see is the combined effect of that which remains. Thus an extract absorbs violet and blue, while the red, yellow and green which remain combine to produce orange or brown, and a blue liquid like ammoniacal copper sulphate absorbs red, yellow and green, leaving blue and violet. The absorption generally occurs as a broad band gradually shaded off, and if, the unshaded portion (Fig. 1) represents the entire spectrum of white light, Fig. 6 would

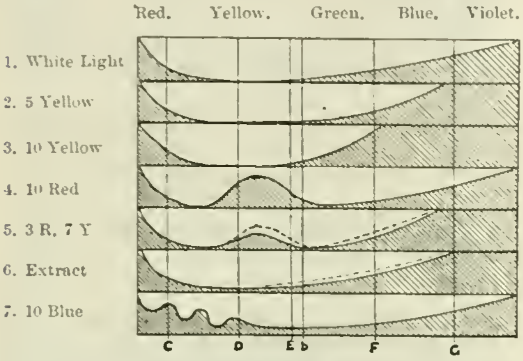

Fig. 1.—Absorption-spectra.

represent that of an extract, the shaded curve indicating the proportion of light absorbed. If the depth of colour is increased, the absorption widens; in the case of the extract, covering more blue and finally green. Thus the colour of the extract usually becomes redder as it deepens, the degree of change depending on the form of the curves.

If with these curves we compare those of the glasses, we shall find marked and curious differences. In the yellow glass (Figs. 2 and 3) the absorption somewhat resembles that of the extract, but the curve is more abrupt, so that there is little tendency for the colour to become redder as it deepens; and when the whole of the blue is absorbed further addition of yellow glasses produce little change. On the other hand the red and blue glasses (Figs. 5 and 7) are marked by curious bands of selective colour-absorption, so that by no possible combination can a curve be formed really similar to that of the extract. Fig. 5 for instance represents approximately the curve of 3R. 7Y. which matches extract Fig. 6 in the tintometer while the dotted lines in Figs. 5 and 6 give an approximate idea of the relative effect of doubling both, which clearly shows that they no longer match, both the total depth of colour and the proportion of red to yellow being varied.* This arises from the fact that doubling of a glass or of the depth of a layer of coloured liquid does not double the colour absorbed, but increases it in a proportion varying in its intensity. Thus if the first glass absorbs 50 per cent. of the total light and transmits 50, a second glass can only absorb 50 per cent of the transmitted 50 and the total absorption will be 75 per cent. or 1 1/2 times that of a single glass, while if the first glass absorbs 10 per cent. only, the second will absorb 10 per cent. of 90, or in all 1·9 times that of a single glass, and consequently a colour consisting of bands of very different intensity will not vary in the same ratio as one evenly shaded. The conditions of colour absorption being so complex that it is impossible to calculate actual colour-strength from varying tintometer measurement, I have thought it preferable rather to measure the quantity of extract or tannin required to produce a definite standard colour, than the colour produced from a standard tannin-strength as at present; since under the proposed conditions equal arithmetical variations will always represent equal quantities of colouring matter. An instrument is therefore used in which the depth of extract-solution of known strength can be varied till its colour is as dark as the colour-standard. We are, however, still met by the difficulty that no single standard colour will match all kinds of extract, since some are redder or yellower than others. I have therefore fallen back on the arbitrary standards of the tintometer, and after considerable experiment have decided on 10 Lovibond units, red or yellow, as most suitable in intensity for accurate matching. This compound unit may contain any varying proportion of red or yellow from 9Y+1R to 9R+1Y, but for all ordinary tanning extracts it approximates to 7Y+3R, and for approximate purposes, such as works control, it might be possible to adopt some average combination as a permanent standard and so greatly diminish both the cost of glasses and the trouble of making a measurement. For exact work, however, accurate match of colour is essential. By keeping the standards in pairs running from 1Y+9R to 9Y+1R a first approximation is obtained by simply changing the pairs and varying the depth of the liquid till the nearest match is obtained. A red or yellow glass (according to whether the glasses are too red or too yellow) is then exchanged for the next lower unit, so that the standard is now of 9 units in all, and the 10 is made up by adding paired decimals equal to one unit till an exact match is obtained, the additional glass being balanced as in the tintometer by the addition of a plain glass on the side of the extract. Generally speaking no glasses on the extract side are required when one pair only of coloured glasses is used, since the cylinder and liquid may be counted without sensible error as two glasses, but this will vary slightly with different instruments, and the exact compensation required must be determined by matching with plain glasses, with water in the measuring cell. The glass standard has, however, still one serious disadvantage depending mainly on the selective absorption of the red glass. For perfectly normal vision no difficulty is experienced in accurate measurement, but it is clear that an observer colour-blind to the particular tract of green absorbed by the red glass would make quite a different match to the normal observer, and even slight difference of sensitiveness to this particular tract of light would affect the depth of extract solution required to match a given amount of red glass in the standard. In the tables it may be noticed that certain observers are normally higher or lower than the average, an effect probably due to the cause just named. If so, the error would disappear if the glass standard could be made a true spectrum match of the extract, and this might perhaps be accomplished by making most of its colour depend on a brown-orange glass of suitable colour, which has a spectrum very like that of an extract, and only employing the red and yellow glasses for minor correction.

We are now in a position to state the measurement for a given extract. The colour-standard to be used is found, for example to be 7·5Y and 2·5R, or 25 per cent. red, and the depth of liquid in centimetres is 5·35. As, however, the diluted analytical solution may vary in concentration, the depth-measurement is not directly comparable for different extracts or different dilutions, and it is therefore best to calculate the theoretical concentration of extract in grms. per litre (pounds per 100 gallons) required to produce the standard colour in a depth of 1 centimetre (corresponding to the present 1 cm. cell). If the analytical solution after dilution was of 4 grms. per litre, the required figure, obtained by multiplying depth by strength, would be 21·4 grms. per litre, and again multiplying by the percentage of tannin found by analysis, (say 26·0) and dividing by 100 we should obtain 5·56 grms. as the quantity of tannin present in a solution of standard colour. Of course the greater these figures are and the higher is the tanning strength in proportion to colour, and the paler the extract.

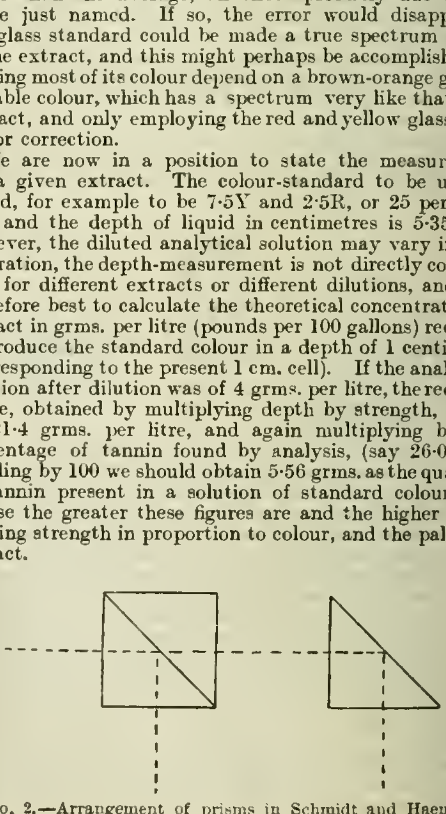

Fig. 2.—Arrangement of prisms in Schmidt and Haensch Colorimeter.

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* The curves are merely sketches and make no pretence of quantitative accuracy.

As regards instruments, the most accurate I know or the purpose is the Schmidt and Haensch colorimeter vith a Lummer-Brodhun prism (Fig. 2) in which the olour of the liquid appears as a stripe in the centre of the ield of colour from the glasses, and entirely disappears when a perfect match is obtained. Colorimeters of the Laurent and Dubosc type, in which the two colours are rought together in one field by rhombic prisms (Fig. 3) re also very good, but both are somewhat expensive £9 or £10). For those therefore who desire a cheaper nstrument, Messrs. Reynolds and Branson are endeavouring o construct a modified form of their "chrometer" in which wo separated patches of colour are seen as in the tintoneter, one through the coloured glasses and one through a ylinder in which the depth of liquid can be varied by aising or lowering a tubular reservoir. The price of this pparatus will be about 35s. with a cylinder, but without lasses, and as only about 45 glasses are required will be nuch lower than that of the complete tintometer with vhich it is at least equal in accuracy.

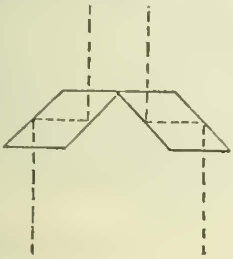

Fig. 3.—Arrangement of prisms in Dubosc Colorimeter.

In all these instruments, as in the tintometer, the use f blue glasses on one side or the other is occasionally eeded to adjust the colour of the glasses to that of an xtract. This does not necessarily suggest any impurity f the extract, but may occur in one of very light colour ven more easily than in dark one, if the colour which emains is not vivid; or on the other hand an extract f deep but vivid colour may require a shade of blue to educe it to the standard glasses. In order to avoid comlicating the measurement, it is proposed to state these mall corrections, never more than a few decimals, as an ddition to the standard (+Blue), or a subtraction from (—Blue) rather than vary the latter in red or yellow.

As regards the dilution of the liquor used for testing, has been proved that under the prescribed conditions its ffect, if any, is so small as to be negligible, and that most dvisable will differ somewhat with the character of the xtract, and the particular instrument used, as with dark olutions very small depths of liquor are needed, which annot be measured with the same proportional accuracy as hen about 5 cm. are required in the Schmidt and Haensch r 10 cm. in the chrometer. The analytical solution is lways employed as soon as it is filtered, leaving the alculation of results till the analysis is completed, and in is way possible changes of colour caused by time are voided. For the Schmidt and Haensch a suitable quantity easured with an accurate pipette may be diluted to c.c. with colourless distilled water, while for the chrometer possibly dilution to 100 c.c. will give more accurate reading, the quantity of solution taken being smaller for dark extracts and more for pale ones.

TABLE IA.

Colorimeter.

Standard tint, 2·0 Red, 8·0 Yellow = 10 units.

Concentration.	Depth of liquid.			Grm. per litre, for standard colour in 1 cm.			
	C.D.W.	H.B.	W.J.				
0 grm. per litre	·434	·424	·428 cm.	8·68	8·48	8·36	
0 ,, ,, ,,	·890	·844	·860 ,,	8·90	8·44	8·60	mean 8.68 grms.
5 ,, ,, ,,	1·818	1·710	1·796 ,,	9·04	8·55	8·98	per litre.
5 ,, ,, ,,	3·620	3·458	3·498 ,,	9·05	8·35	8·75	

In order to overcome the uncertainty or absence of daylight it has been found desirable to employ artificial light, and the inverted incandescent gas burner with Bray or Welsbach mantle, and a globe transparent at least in its lower half, has proved most satisfactory of the lights easily available. The results differ little from good daylight, and approach it the more closely the brighter the light, so that it is found best to work with the burner slightly above the matt opal reflector of the instrument, and not more than 4 to 6 ins. distant from it. The light (and heat) should be suitably shaded, not only from the eyes, but from the cylinder of liquid and it is best to work in a darkened or dimly lighted room. Before using any colorimeter it must be ascertained that when the cylinder is is filled with water and plain glasses are substituted for the standard, the brightness of the two fields is absolutely equal, and trifling differences may often be compensated by slightly moving the light towards one or other side of the instrument or larger ones, due to the construction, with plain colourless glasses. When the instrument is accurately adjusted it is best to fix its position relative to the lamp with a clamping screw. Perfect cleanliness and brightness of the cells, glasses and opal reflector is essential to accurate work.

The advantages claimed over the present method are greater ease and accuracy of execution, closer concordance of different observers, and a much more intelligible statement of results, by which both the tint and depth of colour of different extracts can be approximately compared. It is proposed that the Paris Conference of the International Association of Leather Trades Chemists should be asked to accept it as an optional method and familiarise the trade with its results by giving them for a time in addition to tintometer figures. To some extent the colour standard as apart from depth of colour is characteristic for different materials.

The following tables give some idea as to the accuracy to be expected from the method, and its results as compared with ordinary tintometer-values.

TABLE I.

Comparison of New Method and Tintometer Results on Solutions of Cerych's Oakwood Extract of Various Dilutions.

Tintometer.

Concentration.	Red.	Yellow.	Blue.
2t grms. per litre	5·3	27·0	0
10 ,, ,, ,,	2·7	10·0	0
5·0 ,, ,, ,,	1·0	3·7	0
2·5 ,, ,, ,,	could not be measured.		

The mean of 13 determinations of the same oakwood extract by five observers in various concentrations gave 8·72 grms. per litre, with a mean error of +·315 grm. or 3·6 per cent. for a single determination and of ±0·076 grm. for the final result. Each determination was the average of five independent scale-readings. As the extract contained 23·4 per cent. of tanning matter the tanning strength of a solution of standard colour would be 2·3 grms. per litre.

TABLE II.

Colour-measurement of "Mimosa D," L.D.G., 36·8 per cent. tanning matter.

Tintometer on Analytical Solution reckoned to 0·5 per cent. Tannin Strength. Red=2·5. Yellow=2·3.

Colorimeter.

Observer	Concentration standard tint.			5½ grms.per litre. Depth of liquid	Grm. per litre for standard.
	Red.	Yellow.	Blue.	in cm.	colour in 1 cm.
C.D.W.	3·6	6·4	—0·4	3·760	20·7
H.B.	3·6	6·4	—0·4	3·542	19·4
W.J.	3·6	6·4	—0·4	3·650	20·1
M.A.R.P. ..	3·8	6·2	—0·4	3·852	21·2
H.R.P.	3·7	6·3	—0·4	3·754	20·6
Mean	3·66	6·37	—0·4	3·694	
				=Extract	20·3 grm.
				Tannin	7·5 ,,

Mean error of single observer 0·75 grm.=3·6 per cent.
Mean error of final result 0·34 grm.

Meeting held at Nottingham on Wednesday, April 27th, 1910.

SIR JOHN TURNEY IN THE CHAIR.

THE BACTERIOLOGY OF THE LEATHER INDUSTRY.

BY J. T. WOOD.

σὺ ὃ σπείρεις, οὐ ζωοποιεῖται, ἐὰν μὴ ἀποθάνῃ.

Perhaps the earliest paper dealing with the part played by bacteria in the leather industry in a scientific and practical manner was that of Eitner entitled "Antiseptics in the Tannery" (der Gerber, 1889) in which he deals with it from the point of view of the prevention of injurious fermentations. In 1894 I published a general paper entitled "Fermentation in the Leather Industry" setting forth what I knew of the subject up to that time, and indicating some of the problems which were awaiting solution.

Since that date much important work has been done, especially in the bacteriology of tan liquors by Andreasch, 1897, of drenches by Wood and Willcox, and of bates by Becker and Wood, and quite recently my friend, Dr. George Abt, has published a general paper on the part played by bacteria in the putrefaction of skin and in the bates.*

Since putrefaction is the most obvious danger to the war skin it is necessary to say a few words about it. Nearly all bacteria can be cultivated on nitrogenous organic matter (the nutrient gelatine of the bacteriologist has become an article of commerce) so that there is scarcely any species of bacteria which cannot take some part in the putrefaction of skin. In an article on "Recent advances in the bacteriology of putrefaction"† I have given a short account of the researches of Tissier and Martelly on the putrefaction of meat, and it is probable that the putrefaction of skin follows much the same course. Abt (*loc. cit.*) gives the following table resuming the action of putrefactive bacteria.

Aerobic.	Mixed	Proteolytic :	*Micrococcus flavus lique faciens, Proteus vulgaris* White *staphylococcus.*
		Peptolytic :	*B. coli, B. filiformis Streptococcus pyogenes Diplococcus griseus.*
	Simple	Proteolytic :	*B. subtils, B. mesen tericus.*
		Peptolytic :	*Proteus Zenkeri.*
Anaerobic.	Mixed	Proteolytic :	*B. perfringens, B. bifer mentans sporogenes.*
		Peptolytic :	*B. bifidus, B. Lact propylbutyricus non liquefaciens (Tissier).*
	Simple	Proteolytic :	*B. putrificus, B. putidu gracilis.*
		Peptolytic :	*Diplococcus magnu anaerobius, B. faecal alkaligenes.*

The simple ferments are those which are capable fermenting nitrogenous matter only, the mixed ferment are able, not only to ferment nitrogenous bodies, proteids, but also to act upon carbohydrates, such a sugars and starches, from which they produce organi acids.

The proteolytic bacteria which begin the action ar those capable of liquefying, and afterwards decomposin the natural albumins. The peptolytic bacteria are thos which are only able to attack the soluble products of th decomposition brought about by the former, so that it clear the peptolytic organisms remain without action on sound skin, but will be able to complete the attack begu by proteolytic organisms.

In a normal putrefaction the different groups of bacter follow one another in regular order. At the beginning w find mixed aerobic organisms; first proteolytic, the peptolytic, they produce acids, principally amino-aci of the type of leucin, which are soon decomposed wit production of amines and ammonia, so that the acidity gradually neutralised. As the same time, the aerob bacteria have used up all the oxygen of the material, ar prepared the way for the mixed anaerobic bacteria. this stage the putrefaction becomes rapid, and the pr duction of ammonia is sufficient to render the ma alkaline. The simple anaerobic organisms now appe *B. putrificus, B. putidus gracilis,* and *diplococcus magn* The complete cycle may take several weeks.

The most important putrefactive organisms are probab *B. putrificus,* and *B. putidus gracilis,* which are anaerob and can only live in an alkaline medium.

It may be noted that the skins in their fresh state conta all the bacteria which develop later, and which cau putrefaction, but the putrefaction only begins when all t conditions are favourable. There is no doubt that t first stage—the solubilisation and peptonisation of t nitrogenous matter—is the most difficult, but once this h begun the fermentation soon reaches the stage at whi ammonia is evolved. We see, therefore, that to preser the skins it is necessary to prevent the presence of dissolv albuminous matter. The simplest method is that of dryi the skins, and if this is properly done, it is quite effecti in preventing bacterial decomposition, and in order prevent the attacks of higher organisms such as mit insects, and worms, the dry skins are strewn with naphth lene before being packed into bales. The other usu method of preserving skins is by means of salt. This a prevents the development of bacteria by dehydrating t fibre of the skin. There are some bacteria able to gr in the presence of salt, one species of which produces colouring matter which it is impossible to remove from t skin, and which is one of the causes of the defect known salt stains. The study of this defect, so far as I know, h not be made, and I might suggest this as an interesti and useful research. (Lantern slide.)

There are very few poisons that actually kill bacter and at the same time are without action on skin. Corros sublimate, chlorine, and bromine, will kill them, but practice the use of such substances is not possible, or ev necessary, if due attention is given to the working. T use of a solution of arsenic in caustic soda has been tri but has not been entirely successful in practice, owi

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* (Le rôle des microbes dans la putréfaction des peaux en poils et en tripe dans les confits.)—Bull. Syndicat Gén. Cuirs et Peaux, Nov. 10, 1908, 416.

† This Jour., 1906, 109.

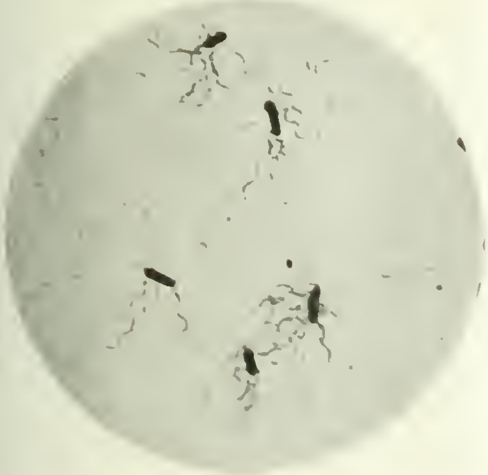

FIG. I.
Bacillus putrificus (Bienstock). Photo by Prof. Král, of Prague

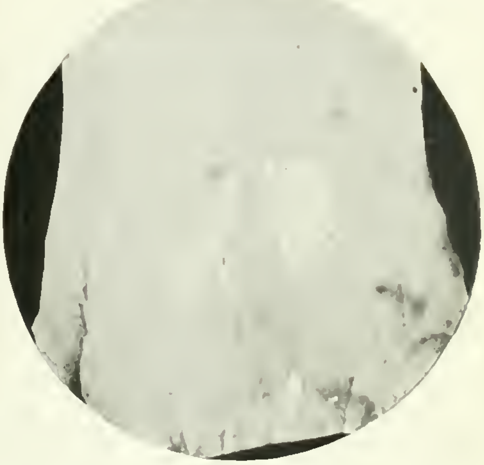

FIG. II.
Lime speck on a sheep skin.

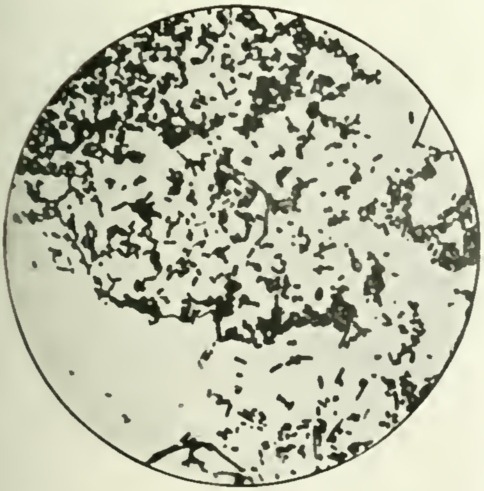

FIG. III.
Pure culture of a bacillus (*d*) from the roots of wool from a "sweating" stove

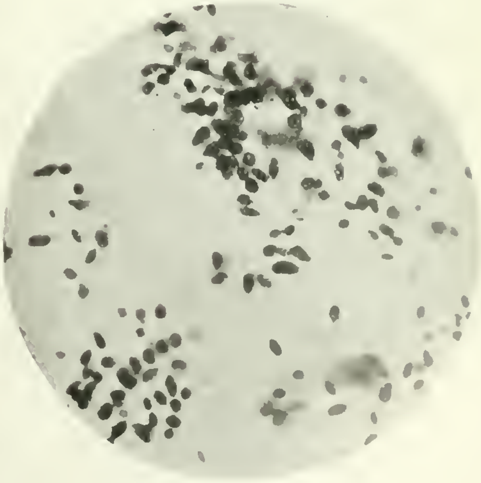

FIG. IV.
Section of sumac tanned calf skin, stained by Gram's method, and showing bacteria and mycelium-like organisms in situ. The faint band across the picture is tissue. Prepared and photo'd by Dr. Georges Abt, of the Pasteur Institute, Paris.

o the fact that the main action is due to the soda ; the arsenic has practically no detrimental action on the bacteria. Trotman found that *Bacillus subtilis* is not killed by arsenic solutions of the strength recommended. In some cases it actually continued to develop in the solution. Formaldehyde is a powerful and effective antiseptic but it has a tanning action on the skin which prohibits its use as a preservative. Since formic acid has become a cheap commercial product a good deal of attention is being paid to its use as a preservative for skins and Mr. Seymour-Jones has described its use in the pickling process.

At the present time the I.A.L.T.C. have formed a Committee under the presidency of Mr. A. Seymour-Jones, to deal with the preservation and curing of raw hides and skins with the object of reporting upon and standardising various methods in use.

The chapter on antiseptics and disinfectants in Procter's "Principles of Leather Manufacture" is very complete as a reference to this subject.

I cannot leave the bacteriology of raw skins without saying something of anthrax, which is sometimes conveyed by bacteria contained in the skins and hair. This was one of the earliest diseases which was proved to be due to a specific organism (*Bacillus anthracis*, Davaine 1863) growing in the blood of the animal infected, and capable of being cultivated on nutrient media outside the animal's body, such a culture inoculated into the blood of a healthy animal was found to produce the disease in all its virulence, and the bacteria were again found in the blood.

The anthrax bacillus is in the form of short rods very like *B. subtilis*, but as its characteristics may be found in any book on bacteriology, I shall not describe it further than to say that the chief reason it is so dangerous is its capability of forming very resistent spores, which remain capable of developing after years when again placed in favourable conditions. These spores are found in the dirt and dust of wool, horse hair, and hides of animals which have died of the disease. In this country anthrax among animals is rare, but in Russia, China, India, and many parts of the world the disease is common. and infected material is often shipped to British ports. Wet salted hides and greasy wools are free from dust, and little risk is incurred in handling them. The disease is communicated to man sometimes by breathing or swallowing the dust, but more usually by the poison lodging in some point where the skin is broken, such as a fresh scratch, or cut, or a scratched pimple, or even chapped hands.

Dr. B. A. Whitelegge, of the Home Office, from whom I have taken the above remarks, has prepared statistics of cases of anthrax caused by various industries, from which I have abstracted the following table for the five years, 1902—1906 :—

Industries.	Cases.	Deaths.
Wool sorting	15 = 5·7%	4 = 5·6%
Wool combing	87 = 33·5%	24 = 34·0%
Handling horse hair	46 = 17·5%	12 = 17·0%
Handling of hides, tanning, fellmongering	77 = 29·5%	20 = 28·2%
Other industries	36 = 13·8%	11 = 15·2%
Total ..	261 = 100%	71 = 27% of total cases.

It will be seen that the most dangerous cases are those occurring in wool combing, where there were 24 deaths in 87 cases. The next most dangerous occupations are handling of hides, tanning, and fellmongering, where there were 77 cases and 20 deaths. It would seem from these figures that the breathing in of infected dust is more fatal than inoculation from a scratch.

In connection with this disease, Dr. Turnbull, of Liverpool, tells me that the gloves which are worn by the men handling hides are liable to become a source of infection if not disinfected or sterilized regularly, as the sweat from the hands causes them to become dirty and form a nidus for various kinds of organisms.

The Committee of the I.A.L.T.C. for the preservation and disinfection of hides and skins which I have previously mentioned has also this part of the subject under consideration. and Dr. C. Ponder, of Cambridge, has been appointed by the Leather Sellers Technical College to investigate anthrax. It may be of interest to mention that the anthrax cultures now being used by Dr. Jouan at the Pasteur Institute, are descended from the original culture isolated by Pasteur himself thirty years ago.

The soaks.

The first process through which the raw skins go on reaching the tanner is the simple steeping or washing in water, known as the soaks. In the case of fresh skins coming from the markets a short immersion in cold, running water is sufficient to get rid of blood and dirt. and the skins have not time to undergo any putrefaction, In the treatment of salted skins the water quickly dissolves out the salt, and if mechanical means (paddle or drum) are used, there is little or no danger. It is in the soaking of skins previously dried, which takes several days, that the danger of putrefaction arises. At one time the deliberate use of putrid soaks was in operation, but in the modern methods, where no chemicals are used, one fresh water is given to each pack of skins. Even in this case, considerable putrefaction (by putrefaction I do not mean actual damaged grain, but include simple solution of skin substance under this head), and consequent loss of skin substance, takes place where the soaking occupies seven days or more. The bacteria of the soaks are numerous and varied, and even at a temperature of 5° C. a single loop from a comparatively fresh soak will develop so many colonies of liquefying bacteria in a gelatine plate as to quickly liquify the whole plate. A rise in temperature of a few degrees is sufficient to double the number of organisms; it is, therefore, imperative to keep the temperature of the soaks as low as possible; it should not exceed 10° C. So far as I know, the bacteria in the soaks have not been specially investigated except by Andreasch, who found the following species :—

Bacillus fluorescens liquefaciens (Flügge), *B. megaterium* (de Bary), *B. subtilis*, *B. mesentericus vulgatus*, *B. mesentericus fuscus*, *B. mycoides* (Flügge), *B. liquidus* (Frankland), *B. gasoformans* (Eisenberg), White bacillus (Maschek), *Proteus vulgaris*, *Proteus mirabilis*, *Bacillus butyricus* (Hueppe), White *streptococcus* (Maschek), Worm shaped *streptococcus* (Maschek), Grey *coccus* (Maschek). All these may be classed as putrefactive organisms, and some of them act energetically on the hide substance. The slide shows a typical plate culture on gelatine of a soak used for softening dry sheep skins, in which no chemicals have been used. The development of the colonies has had to be stopped by the application of formalin vapour before many of the species have had time to develop, otherwise the whole plate would have been liquified. From what has been said, it will be seen that the most suitable mode of preserving skins, by which the least risk will be run in subsequent operations, is the salting process, or some modification of it. We have seen that the species of bacteria developing in the soaks are mostly putrefactive, and, therefore, injurious bacteria, and I do not think that any useful purpose to the tanner would be served by a research as to the nature of the organisms developing. The line to be followed here is to work out the best method which will prevent the development of bacteria in this part of the work, that is, the soaking should be carried out, as far as possible, under antiseptic conditions.*

Depilating and Liming.

After soaking the hair or wool must be removed from the skins. This is usually done in the case of hides by immersion in lime water, or milk of lime, until the hair slips, and although lime is an antiseptic, we shall see that even in this process bacteria play an important part. I shall pass over the depilating of skins with sulphides, and sulphur compounds, which loosen the hair by dissolving the epidermal tissue, because in this case bacteria take no part.

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* The use of various substances in the soaks to prevent putrefaction has been tried. The best of these is a solution of caustic soda, one part per thousand, or of sodium sulphide 1½ to 3 parts per thousand. Forty-eight hours in either of these solutions is sufficient to soften most dried skins, while putrefaction is almost entirely prevented, and the soaking may be conducted without danger at temperatures up to 18° C. (*Vide* Procter, Principles of Leather Manufacture, p. 114.)

Both hides and sheep skins are frequently unhaired by the process known as sweating, in which the wet skins are hung in a moist chamber (the sweating stove) at a temperature of 15° to 20° C., partial putrefaction commences; ammonia is evolved, and in four to five days the hair or wool may be easily removed. Procter finds that the vapour of ammonia alone is sufficient to loosen the hair, but in sweating, the prime cause is the solution of the epidermal tissues surrounding the hair roots by bacteria, or rather, by digestive enzymes produced by bacteria.

Villon was the first to describe the organism which attacks the albuminous matter of the hair roots; he calls it *Bacterium pilline*, and describes it as an aerobic organism which decomposes pilline, transforming it into leucin, tyrosin, butyric and margaric acids, and sets free ammonia, which dissolves the coriin, and thus sets free the hair. From the description given it is very doubtful whether Villon's Bacterium was a pure culture, although he considered it to be so.

Villon's experiments have been criticised by Schmitz-Dumont (15) who describes the specific depilating organism as a streptococcus, which by decomposing the rete malpighi loosens the hair. Schmitz-Dumont's experiments are little more convincing than Villon's as to the sweating being caused by a specific organism, the difficulty being to sterilize the skins without injury. I have examined the bacteria from the roots of wool in a sweating stove used for depilating sheep skins, and have isolated several organisms, among which are the bacteria described in a former paper [*] as *bacillus* D. & E. (Fig. 3). I also found *B. fluorescens liquefaciens*, [†] but I have not made an attempt to ascertain whether one of these alone, or all of them, are responsible for the unhairing process. I found a similar organism to *bacillus* D. in old limes; all of these produce ammonia from organic nitrogenous matter, and are capable of living in a strongly alkaline medium, even of higher alkalinity than a saturated lime water. Probably one of these organisms is the same as the bacteria of Villon and Schmitz-Dumont, but in my opinion it will be found that the action is produced by a simultaneous growth of several different species of bacteria.

Procter states that an old lime becomes charged with ammonia and other products of the action of lime upon skin, such as tyrosin, leucin, and some caproic acid, but so far as I am aware the mode of production of these bodies is still unknown, and it seems doubtful whether ammonia is produced in the cold in a sterile lime. In the case of the sweated unlimed skin, we know that the ammonia and alkaline bodies are produced by the action of bacteria, on dissolved skin substance, and it is highly probable that the same kind of action goes on in the limes, and that it is produced by the same bacteria. The fresh lime dissolves the interfibrillar substance of the skin, [‡] bacteria obtain access from the air, then decompose the skin substance with the production of the bodies named. That this is so is supported by the statement that in Payne and Pullman's liming process, in which the skins are first treated with caustic soda, and afterwards placed in a solution of calcium chloride, they cannot be unhaired unless they have been previously acted upon by putrefactive bacteria, that is, the skin can be limed with the hair on, and this fact has been made use of in the preparation of fur skins.[§] This would seem to be an additional proof that the loosening of the hair in the limes is brought about by the same means as the unhairing in the sweating stove, though, in the latter case, real putrefactive bacteria are liable to attack the skin, whereas in the limes the skin is preserved from the action of these putrefactive organisms.

Payne, however, states that hydrosulphide of lime i produced by the action of caustic lime on the sulphur i the hair and that this has an unhairing action. In thi case a sterile lime should unhair. I believe it will do s if time be given for the chemical action to take place That this is a slow process is the probable explanation of th failure to unhair which has been observed in Payne an Pullman's process.

There is no doubt that the growth of bacteria in the lime is one of the principal factors in the "mellowing" as w call it. Griffith (J. Amer. Leather Chem. Assoc., 191 5, 109—129) states that the mellowness of the used lim liquor may be artificially produced by the addition c ammonium sulphate to the limes.

There is a form of damage, which principally affects shee skins, known as "lime speck" (Fig. 2), and which is due to colony of bacteria forming on the grain side of the ski just below the hyaline layer. When lime is applied to th skins by the fellmonger, in order to remove the wool, portion of it becomes fixed in the colony in the form carbonate, and partly as a combination with the fatt acids from the wool roots. Possibly there is also some con bination of lime with the skin substance, which has bee liquified by the bacteria.

True lime speck, so far as I know, is never caused aft the wool is removed, by sulphide or by lime only, althoug it is stated that it sometimes occurs in sweated skin It may be classed as a putrefactive damage, and can b avoided by keeping the skin in a sterile condition unt it is ready for painting. A further investigation of th defect is necessary, and would be very useful.

I have already suggested (this Jour., Nov. 30th, 190 1274) that the role of bacteria in the liming process shou be worked out in our research laboratories in the same w as the bacteria in tan liquors, bates and drenches ha been investigated by Andreasch, Becker, and myse From what has been said it will be evident that the speci to be isolated in this case are much less numerous th in most other parts of the tanning process, and the wo should demand a proportionately less time.

Bating and Puering.

The next process which the skins go through befo passing into the tan liquors is to remove the lime, and gi the desired character to the leather. Sole leather mu be firm and dense, it is, therefore, usually sufficient f the surface lime to be removed by washing or handli in soft water, the natural acidity of the tan liquors dissolv the remainder of the lime.

Light leathers, which must be supple when tanne require not only to be freed from lime before going in tan, but also require a portion of the interfibrillar substan to be dissolved out, and the fibres brought into such a co dition that the resultant leather will stretch witho springing back. The removal of the lime, and perhaps al some of the interfibrillar substance may be effected by mea of acids used in a careful way, but as my object is to discu the bacteriological problems of the bate, I shall pass ov the purely chemical methods, and proceed directly to t fermentative processes which have been in use for t purpose since very early times. The skins are first wash to remove as much lime as possible, after which, hides f dressing or harness leather, are passed through a bat consisting of an infusion of pigeon or hen manure. Ski for light leathers, such as goat and sheep, are treated wi an infusion of dog manure in water at a temperature 30° to 40° C. This somewhat disgusting process und normal conditions produces excellent results, and t great difficulty in finding an efficient substitute has be to combine in one bath the peculiar effects of the du bate. Since the cause of the action in the two bates very similar, I shall refer more particularly to the d dung bate, which is usually known as a puer. Ski in the bate lose their plumpness and firmness, and becon soft and slippery, or "fall," as we term it. The bati liquor has some osmotic effect, which causes the swolle fibre to give up its water. This falling also mechanicall squeezes out a further quantity of lime, and at the san time a considerable chemical action takes place, so that t skin which originally contained 5 % of lime will, on comi om the puer, contain only 0·7 to 1% of lime, calculated n the dry weight of skin. What is it in the dung which roduces this extraordinary result? So far as our present nowledge goes, the causes are very complicated: there is 1) the chemical action of various salts of organic acids hich are contained in the dung. This is chiefly confined o the solution of lime, the reaction being similar to that aking place in a solution of ammonium chloride,

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[*] This Jour., 1899, p. 990.

[†] B. fluorescens is not invaribly present, but there is some organism which produces a dark grey colouring matter, and which eventually overgrows the depilating organisms.

[‡] See the amount of skin substance dissolved in fellmongers' collecting limes. Wood and Trotman, this Journ., 1909, p. 1304. Where a lime was found containing 3·37 grms. skin per 100 c.c.

[§] As a matter of fact, Payne and Pullman's process of liming sterilizes the skin, so that the depilating bacteria cannot grow.

$$2NH_4Cl+Ca(OH)_2=CaCl_2+2NH_3+2H_2O.$$

2) The osmotic effect we have mentioned above: the terpretation of it is not yet quite clear, and I shall not herefore attempt to explain it.

3) The action of bacteria and of enzymes produced by hese organisms undoubtedly plays the greatest part in the "bringing down" of the skins, because, not only do they roduce the acids, ammonia and amines which bring about he chemical reactions, but they also produce digestive rments or enzymes, which have a solvent action on the bres of the skin.

With the object of ascertaining the effect of the various pecies of bacteria contained in the dung upon skins, a arge number of various species have been isolated, and the ffect of pure cultures in different media has been tried.[*] number of the results have been published in this ournal. Professor H. Becker, who has done a great deal f this part of the work, is of opinion that the principal rganisms concerned in the bating exist in the dogs' ntestines, and belong to the group of coli bacteria. These re very widely distributed bacteria, and are found in the arge intestines of mammals, and, as a consequence, in lmost all soils, and in the mud of rivers and lakes.

Lortet found it along with other organisms in the mud f the Lake of Geneva at a spot where the water was hemically very pure. Dr. A. C. Houston, the bacteriogist of the Metropolitan Water Board, enumerates sixteen arieties of this organism, 80 per cent. of which produced cid and gas in lactose peptone cultures, indol in peptone ater cultures, and when grown in milk produced acid and lot. The bacterium slide resembles that of typhoid fever, nd has frequently been mistaken for it. It is, however, much more resistant to destructive influences. As ou see, it is a short bacillus, possessing flagellae by hich it moves more or less rapidly.

Professor Becker's Bacterium No. 12, which he has amed *Bacillus erodiens*, is undoubtedly a variety of *B. coli*, ut has a more rapid motion, and does not coagulate milk, lthough it renders is somewhat thick. Cultivated in roth it gives off much gas, consisting of 12 per cent. carbon ioxide, 85 per cent. hydrogen, 3 per cent. oxygen. If glucose e added the quantity of carbon dioxide rises to 40 per cent. nd acid is produced. The most rapid growth is at 37° C. nd at this temperature a broth culture has a distinct educing action on skin. According to the medium in which t is grown, it produces acid or alkali, and thus comes nder the heading of mixed bacteria. In sugar[†] solutions cid is produced, and in proteid solutions ammonia compounds, indol and evil smelling gases are given off. Thus y varying the medium the effect produced may also be aried. I shall refer to this a little later.

I found in studying the bacteria of dog dung that the pecies existing in the *fresh* dung, which developed in rdinary plate cultures, appeared to belong to four or five pecies only, mostly bacilli. At the end of two or three eeks, the original species had given place to others, mostly cocci, in a very similar way to the change which akes place in putrefaction. It will be seen, therefore, hat no single species produces the complex chemical nd physiological changes which take place, or the bodies necessary for the bating of skin as some observers have supposed, but the various species succeed one another as the medium changes its reaction and composition until finally the organic portion is resolved into the simplest bodies such as carbon dioxide, ammonia and hydrogen. There is thus a moment when the dung is at its best so far as the bating action is concerned, and this moment is due to the vital activity of bacteria, and consequently varies according to the temperature, and some other influences (electrical condition of the atmosphere, etc.). One may say it is at its best at about fifteen days in summer, and one month or more in winter. Puer which has been dried is not so powerful in its action as that which is immediately made into a paste with water. It appears to lose its "nature," partly owing to irreversible dehydration processes, and partly because some of the bacteria are killed. I have here plate cultures on agar from fresh puer, and from a puer wheel in use. These show the number of bacteria in the puer wheel to be much greater than in the fresh puer. Many of the species of bacteria resemble one another very closely, and to show every species would weary you to no useful purpose. I shall, therefore, only throw on the screen the principal species existing in puer.

It will be noted that many of these organisms are identical with those which carry on putrefaction. The quantity of ammonia and volatile bases produced is very small, but non-volatile bases are produced in considerable quantity; the problem of the constitution of these, and of their mode of action on skin is one awaiting solution.

Another group of organisms which have some influence in the bating process are the class called by Beyerink *Granulobacter*. They produce butyric acid, and this acid combining with the ammonia compounds of the dung forms salts which undoubtedly exert an effect on the lime in the skins, though its action on the fibre is not so great as the compounds of lactic and propionic acids.

I have pointed out previously the importance of the nutrient medium, or substratum, in which the bacteria grow, on the species surviving. In it one can see on a small scale the Darwinian process of natural selection. There is a great struggle for existence between the various species, and the circumstances determining the survival of this or that organism are extremely complicated, and we are yet very much in the dark as to the action of the various chemical compounds contained in the puer, so that it is unsafe to neglect even those which are present in only small amounts. Very minute quantities of certain bodies, almost too small for detection by chemical means, are sufficient to cause large differences in the growth of certain organisms. For instance, Raulin found that the addition of a trace of zinc to his nutrient liquids increased the crop of the mould *Aspergillus niger* more than four times the weight of a crop grown in the same liquid free from zinc.

If we inoculate a nutrient material with a pure culture of bacteria, and the medium is not exactly adjusted to the needs of the particular organism, it will not thrive, and will speedily be overgrown by some other species obtaining access from the air. This fact very much discounts the use of pure cultures of bacteria which have been proposed for bating, although in the case of Erodin, where the medium has been adjusted to suit the organism, considerable success has been attained. The whole of the enzymes and chemical compounds essential for a perfect bate, are not present in the dung when it leaves the animal's body, but these compounds are produced by the continued action of these and other bacteria which obtain access from the air. The production of the enzymes depends, too upon the composition of the nutrient medium, since this exerts a selective influence on the species of bacteria obtaining access to it. Just as in the spontaneous souring of milk numerous bacteria have free access to it, yet the lactic ferment is generally so pure that it may be and is used as a pure culture on a large scale in the manufacture of lactic acid.

Seeing that the action of the dung varies in a great measure, according to the food on which the animals have been fed, and in the main a carnivorous diet is more effective than a vegetable diet, it was thought that the dung of an animal fed entirely on a meat diet would have a greater effect. I, therefore, procured some lion's dung, and puered skin with it, but it was found to have less action than the ordinary dog puer employed. The same result was obtained after keeping it for several weeks, and allowing the bacterial flora to develop.

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[*] The subject is not so far removed from direct human interest s one might suppose. For many years Metschnikoff, in Paris, has een studying the bacterial flora of the human intestines. His heory is that old age is cause by the poisonous products of these ntestinal bacteria, and he proposes to counteract the effects of hese poisonous organisms by introducing into the system large uantities of lactic acid bacteria, either in the form of tabloids, r in the form of sour milk cultures.

[†] Dr. A. C. Houston has been kind enough to make an examinaion of *B. erodiens*, and to ascertain its action on various sugars. t produces fluorescence in neutral red broth cultures, acid and gas n lactose cultures, indol, and acid and clot in milk cultures. It erments dulcite with production of acid, but *not* cane sugar, donite, inulin, inosite, salicin, or raffinose.

The chemical composition of the lion's dung was as follows :—

Water	59·2 per cent.
Ash	21·1 ,,
Lime (CaO)	10·3 ,,
Phosphates (P_2O_5)	10·67 ,,
Organic matter	19·7 ,,

A bacteriological examination showed the presence of *B. coli* and a liquefying *diplococcus* not identified. A curious feature was a branching mould with extremely fine mycelium, in parts developing into yeast-like cells, and which invaded the whole plate.

The recent researches of Tissier and Metchnikoff have shown that the flora of the intestines, both of men and animals, consist very largely of anaerobic bacteria. These have been overlooked in previous researches, owing to imperfect means of studying this class of organisms. Indeed, in one work on the microbes of the alimentary canal of the dog no mention was made of them, whereas they are all very active.

The following anaerobic bacteria have been isolated :—*B. bifidus*, *B. perfringens*, *B. bifermentans*, *B. funduliformis* (Veillon), *B. capillosus*, *B. sporogenes*, *B. ventriosus*, *B. Rodella III*, *Staphylococcus parvulus*, *Diplococcus orbiculus*, *Coccobacillus preacutus*, *Coccobacillus oviformis*. Most of these organisms, and the new methods by which they have been isolated, are fully described in a new work entitled "Les Anaèrobies" by M. Jungano and A. Distaso, of the Pasteur Institute, Paris.

Various bates have been patented based on the above-mentioned researches, and in a recent patent it has been proposed to use an extract of the pancreas in conjunction with an ammonium salt.[*] Undoubtedly this will have a certain bating action, as I showed as far back as 1894, but I do not think from the evidence we have at present that the action of living bacteria can be dispensed with. Enzymes are of a colloidal nature, and consequently will not penetrate a semi-permeable membrane like skin, but the bacteria entering by means of the vessels and ducts into the interior of the skin produce their products in situ, and the action is thus greatly intensified.

Professor Procter, in his recent paper, to which I have referred above, says (page 331) "There is, however, no reason that all the necessary effects both of puering and bating should not ultimately be attained by purely chemical treatment without the risk and uncertainty which must always attach to bacterial and ferment action."

While I agree with him in this, still it is well to remember that in the case of one of the very oldest of the fermentation industries, that of the production of alcohol, a comparatively simple body, the natural process has not yet been replaced by a chemical one, and I believe this applies also to the manufacture of vinegar.

Chemical methods of bating may be used for leathers like chrome and alum leather, but even here natural processes like drenching, in which acids are produced gradually during the working of the skins, give more beautiful results. With vegetable tanning materials the advantage is still on the side of the natural processes when these are conducted in a proper manner.

List of Bacteria which have been found in dung (mostly dog dung).

1. *Micrococcus* *ureae* (Cohn), (Pasteur).
2. ,, *fulvus* (Cohn) (Crookshank, p. 221, Macé, and Zopf.).
3. ,, *prodigiosus.*
4. ,, *ureae liquefaciens.*
5. *Bacterium sulphureum.*
6. ,, *coli commune.*
7. ,, *coli anindolicum.*
8. ,, *coli anaerogenes.*
9. ,, *furfuris a.*
10. ,, *furfuris β.*
11. *Bacillus fluorescens putridus.*
12. ,, ,, *liquefaciens.*
13. ,, *subtilis.*
14. ,, *saprogenes* (Herfeld, this J., May, 1895) three varietie
15. ,, *butyricus* (Hueppe).
16. ,, *putrificus-coli.*
17. ,, *pyocyaneus.*
18. ,, *janthinus.*
19. ,, *coprogenes foetidus.*
20. ,, *pyogenes foetidus* (a variety of *B. coli*).
21. ,, *zenkeri.*
22. ,, *magnus.*
23. ,, *spinosus.*
24. ,, *liquefaciens* (Eisenberg).
25. ,, *amylobacter* (Van Tieghem).
26. ,, *acidi paralactici.*
27. ,, I. } Isolated from horse manure by Severi
28. ,, II. } Centr. Bl. f. Bakt. (2), I., 97.
29. ,, III. }
30. ,, from horse dung (anaerobic) Severin, Central E für Bakt. (2) III., 708.
31. ,, from horse dung (anaerobic), No. 3.
32. ,, *oedematis maligni* (Vibrion Septique, Pasteur).
33. ,, *mesentericus vulgatus.*
34. ,, *lactis aerogenes.*
35. ,, *cavicido* (Brieger).
36. ,, *albuminis* (Bienstock).
37. ,, *Bienstockii.*
38. ,, *tenuis.*
39. ,, *enteritidis sporogenes* (Klein).
40. ,, *lactis acidi* (Ankerschmid, 1905).
41. ,, *megatherium* ,,
42. ,, *cadaveris sporogenes* (Klein) said to be identical wi No. 16.
43. ,, *thermophilus* (Houston).
44. ,, *a.* from puer. Wood, p. 8. J.S.C.I. 1898, p. 1012
45. ,, *b.* ,, ,, ,, ,,
47. ,, *mycoides.*
48—61. 14 species isolated from dog and pigeon dung by Pr H. Becker. Zeit. f. Öffentlich. Chemie. Heft xxiii. Jahrga X. p. 447.
62. *Sarcina fimentaria* (Lehmann and Neumann).
63. *Streptococcus* from Sewage. Houston, 7 p. 104, 114.
64. ,, *brevis.*
65. ,, *longus.*
66. ,, *-pyogenes.*
67. ,, *liquifaciens coli.* (Gamgee. Phys. Chem. 2).
68. *Streptothrix* from stable manure. Severin, 6.
69. *Spirillum serpens* (Kutscher).
70. ,, *tenue* ,,
71. ,, *undula* ,,
72. ,, *volutans* ,,
73. ,, from pig dung. Smith, Centr. Bl. f. Bakt., **16**, (1). 124.
74—76. *Vibrio*, three species isolated by Kutscher.
77. *Clostridum butyricum* (Prazmowski) said to be identical wi No. 25.
78. *Streptococcus faecalis.* Sidney Martin, 37 and 38. Ann. R Loc. Gov. Board, 1907—9.

Drenching.

After bating, the skins go through a simpler fermentati
process known as drenching. An infusion of bran
generally used at a temperature of 35° C. 5 to 10 grs.
litre, or half to one lb. per 10 gallons. The skins fr
the bate, after washing in water, are placed in this liqu
It ferments vigorously for 18—24 hours. A considera
quantity of gas is evolved, and weak organic acids a
produced, which are absorbed by the skins, and sw
them slightly. In a drench taken in actual work, b
without skins, the acids produced per litre were :—

Lactic acid	0·7907
Acetic acid	0·2402
Formic acid	0·0306
Butyric acid	0·0134
Total acids..	1·0749

The composition of the gases was—:

Carbon dioxide	25·2%
Hydrogen	46·7%
Nitrogen	26·0%
Oxygen	2·1%

A small quantity of trimethylamine was also fou
The nature of this fermentation was very thoroug
investigated by the author and Dr. W. H. Willcox fr
1892 to 1897, and was found to be due to the spec
action of bacteria, which we have called *Bacillus furfu*
There are two varieties of this organism, *a* and *β*, which
very similar in form, and differ only in the shape of
colonies when grown in glucose gelatine, and also t
when grown together, they produce more acid than w
growing separately. They are sensitive to acids, wh
inhibit their growth, and when the acidity reaches *N*/

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[*] "Oropon," an artificial bate, manufactured by Röhm & Haas of Darmstadt.

eir growth ceases, and being non-sporing organisms, ey soon die. They are present in the puer used for ting the skins, and consequently there is no difficulty starting a fermentation.

The mode of action of the drench on skins may be mmed up as follows :—

1. The solution of the last traces of lime which has not en removed by the bate, by the organic acids produced the fermentation, and the subsequent swelling action these on the skin fibres. The acids also dissolve a small nount of skin substance.

2. Simultaneously with (1) the distention and floating the skins by gases produced by the fermentation, so abling them better to take up the acids.

3. The mechanical absorption of dirt by the particles of an or flour in the drench.

I do not know of any further investigation of the drenchg process since the above research was made, but in actice, meal is now frequently used instead of bran, d consequently a smaller quantity may be employed. he mechanical effect of meal in removing dirt is not so eat as with bran, but where the adherence of the bran the skin is objectionable, no doubt the use of meal is be preferred.

With regard to the production of acids by bacteria, ordan[*] points out that there is no fundamental difference etween the formation of acid, and alkali by bacteria, nce ammonia is just as much a true decomposition roduct of nitrogenous bodies, as are the amino acids hich are produced by the digestion of gelatine, and in ctic acid and sugar fermentation. Both processes go on multaneously, and the reaction of any culture medium, which bacteria are growing, depends not only on the apability of these organisms of attacking certain substances r even on their chemical constitution, but also on the xact moment of growth when reaction is ascertained.

Bacteria of Tan Liquors.

We owe most of our knowledge of the fermentation rocesses going on in tan liquors to Professor F. Andreasch, f Vienna (born April 29th, 1867), who published the result f his work in "Der Gerber" in 1895-6. I had the rivilege of knowing Andreasch personally, and can estify to the thoroughness with which his work was done. lis death, June 14th, 1899, at Pörtschach in Carinthia vas a great loss to the tanning world.

Andreasch found that neither yeasts nor bacteria ferment he tannin itself, but that they attack the non-tannins f the liquors with production of alcohol and acids. Some noulds, such as *Penicillium glaucum*, decompose the annin, especially in those materials which contain only small amount of non-tannin in comparison with their annin, such as quebracho and knoppern.

It would be impossible in a short lecture to give details f Andreasch's work,[†] but the more important results f his researches may be briefly summarised thus :—

1. Putrefactive bacteria from the hides, bates, etc., ccommodate themselves to the acid reaction of tan iquors; they dissolve certain nitrogenous constituents f the hide, and thereby furnish the chief nutriment for he more specific acid-producing bacteria. In liquors which are in use, the production of acid is proportional o the hide substance present, provided sufficient quantity f carbohydrates are present.

2. Acetic acid, which in fresh tan liquors is the chief cid, is always formed by two separate processes :—(1) the production of alcohol by yeasts from the glucoses of the non-tannins, and (2) the fermentation of the alcohol by acetic bacteria. In tan liquors it is never formed directly from carbohydrates.

3. Lactic acid is produced by several species of bacteria both from the sugars and other carbohydrates of tan liquors, and from the sugars alone by a yeast. A good supply of nitrogenous nutriment is necessary for its production, the greater part of which is furnished by the hides.

4. Butyric acid occurs in traces only in sound tan liquors.

A practical application of the results, is the preparation of sour liquors from materials poor in fermentable matter, by addition of glucose and alcoholic yeasts. A proper lactic fermentation is best induced by the sowing of the lactic yeast in the liquors.

I have given a list of the organisms isolated by Andreasch, which may be of use to workers on this subject.

Recently Von Schroeder (Zur Kenntnis des Gerbprozesses. Koll. Chem. Beihefte, Dresden, 1909, p. 21) found that, when a tannin solution was kept in contact with hide powder for 20 days gallic acid was formed, but that when the hide powder and the tannin solution were sterilized, no gallic acid was produced. He ascribes the formation of the gallic acid to the action of bacteria, but he makes no attempt to demonstrate their presence, although, in order to have the effect described by him, the microscopic demonstration of the bacteria should have been easy. It may be possible that there exists a specific organism capable of converting gallotannic acid into gallic acid.

List of organisms taking part in the fermentation of tan liquors. Andreasch.

A. *Yeasts.*
   1. *Saccharomyces pastorianus.* Hansen.
   2. *S. ellipsoideus.* Hansen.
   3. *S. apiculatus.* Reess.
   4. *S. ellipsoideus* I. Hansen
   5. *S. acidi lactici.* Grotenfeld.
   6. A rose coloured *torula.*
   7. An orange-yellow *torula.*
   8. *Mycoderma.*

B. *Acetic acid ferments.*
   9. *Bacterium aceti.* Hansen.
   10. *B. Pasteurianum.* Hansen.

C. *Lactic acid ferments.*
   11. *Bacillus acidi lactici.* Hueppe
   12. *Bacterium acidi lactici.* Grotenfeld
   13. *Bacterium lactis acidi.* Marpmann.
   14. *Bacillus* XIX. Adametz.
   15. *Bacillus a.* Freudenreich.
   16. Lactic acid *tyrothrix.* Duclaux.
   17. Lactic acid *bacterium* I. Andreasch
   18. Lactic acid *bacterium* II. Andreasch
   19. Lactic acid *Bacillus a.* Andreasch.
   20. Lactic acid *Bacillus β.* Andreasch.
   21. Lactic acid *micrococcus a.* Andreasch
   22. *Bacterium acidi lactici.* Pasteur.
   23. *Bacillus lactis viscosus.* Adametz
   24. Gas forming liquefying lactic acid bacillus. Andreasch
   25, 26, 27. Lactic acid yeasts of tan liquors *a*, *β* and γ Andreasch.

D. *Butyric acid ferments.*
   28. *Clostridium butyricum.* Prazmowski.

E. *Other organisms causing viscous or ropy fermentation.*
   29. *Bacillus viscosus.* Frankland.
   30. *B. mesentericus fuscus.* Hueppe.

Note.—*B. viscosus* is identical with *B. fluorescens liquefaciens* Numerous other bacteria were found in the liquors but did not take part in the fermentation.

F. *Moulds.*
   31. *Penicillium glaucum.*

Leather.

It is not possible to say much about the bacteriology of leather, and I do not know of anyone who has worked at it. Many of the bacteria of the bates and tan liquors remain in the empty spaces of the leather from which the glands have been removed by scudding, etc., and Dr. G. Abt has been able, by suitable staining methods, to demonstrate these *in situ*. Figure 4, which has been prepared by Dr. G. Abt, of the Pasteur Institute, shows a section of calf skin tanned with shumac, and stained by Gram's method. The empty spaces of the skin contain a mycoderma and a few long bacilli. Owing to the great magnification necessary to show the organisms, it is impossible to distinguish the tissue, although this is easily seen under the microscope. The illustration is interesting as being one of the first preparations of leather showing the presence of micro organisms *in situ*. They are in all probability merely the dead organisms, and it is uncertain whether any are capable of further growth. I have not heard of any case of anthrax being conveyed by leather tanned from an infected hide, notwithstanding the very resistant nature of the spores of this organism.

Mycoderma vini and *M. cerevisiae* have also been found in the interstices of the leather. Everyone knows that moulds grow very readily on damp leather, as may be seen in the case of a pair of boots left in a damp cupboard, and sometimes this is the case with leather in the drying rooms under certain conditions. The commonest variety met with is the green mould *Penicillium glaucum*, but there are cases in which *Aspergillus niger*, a black mould has developed in spots during the drying of the leather, thus causing considerable damage.

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[*] Koch's Jahresbericht über Gährungsorganismen. 1906. p. 102.

[†] See abstract, this Jour., 1896, 910; 1897, 340, etc.

I have also met with a case in which American shoulders stored by a Railway Co. had become damaged owing to a discolouration. caused by a mould. Other leather in the same store was not affected. It was found that the difference in behaviour was due to the presence of glucose and Epsom salts in the American leather, which. being hygroscopic. gave the moulds a very favourable nutrient medium. In some cases moulds grow upon coloured leather. and in so doing discharge the colour, causing light coloured spots. Quite recently Trotman (this Journal, 1909. 1238) has found a mould causing a pink colouration on skivers. He also found a variety of pink torula, which produced a brownish pink growth on the same goods.

An investigation of the variods species of moulds growing upon leather would be very interesting.

It is impossible to give more than a general outline of a subject like this in one paper, and I must make this my apology for a very inadequate treatment of it.

In conclusion I should like to urge upon the Directors of the Leather Industries Department of the Leeds University, and of the new Technical College of the Leathersellers' Company, the necessity of taking up the bacteriology of leather manufacture in a manner worthy of the subject. It is impossible for this work to be taken up as part of a course by the present teachers. It requires continuous work in attending to the cultures, etc., and, therefore requires a special room set apart for the work and a bacteriologist to give it attention. The work for such a man might well be combined with the microscopic study of skin and leather, the preparation and staining of sections of which demand a special technique, but which in my opinion is of equal importance with chemistry in helping us to understand what goes on in the process of making skins into leather.

I wish to acknowledge my indebtedness to Professor H. Becker, of Frankfort, for the loan of some of the slides, to Mr. A. Mee, of Nottingham, for the preparation of slides and diagrams, and to Dr. Gordon Parker for the loan of cultures.

DISCUSSION.

Dr. J. GORDON PARKER said that all chemists and members of the leather trade owed a deep debt of gratitude to Mr. Wood as the only Englishman who had given practical attention to bacteriology as applied to leather manufacture. No one had found a material which could be used as a perfect susbtitute for excrement, in the production of leather, until Mr. Wood and his colleague, Professor Becker, discovered "Erodin." Certain hides coming from China and elsewhere were frequently infected with anthrax. The Home Office, very properly, imposed certain restrictions upon the tanner in dealing with these hides, but foreign tanners were less restricted and were able to make free use of these hides. The Leathersellers' Company had recently voted a large sum of money for investigation in bacteriology in their Technical College, and had appointed Dr. Constant Ponder to investigate the disinfection and curing of skins and to study those microbes which play such a great part, not only in the preservation of skins and hides but also in the preliminary processes, prior to the manufacture of the leather. Animals, slaughtered in China, Africa and in some parts of America, were killed by natives who did not realise the importance of taking immediate steps to prevent putrefaction and cared little about the temperature at which the skins were dried. Although the skins came to this country dry and hard, putrefaction had in many cases already commenced and was resumed when they were put into soak. It used to be no uncommon occurrence to lose 25 per cent. in this way. "Erodin," if properly used, was certainly a magnificent thing for certain classes of skins, but it would readily become contaminated in a leather factory, unless cleanliness were studied and the puer house kept clean. He had seen "Erodin" applied with very good results in several continental tanneries, but in each instance he was particularly struck with the cleanliness of the puer house. The men from other departments were not allowed to enter, the skins were tipped into the puer vats from outside, and every precaution was taken to avoid contamination by putrefactive bacteria. The average English tanner did not realise the importance of the wet work in the lime yard and bate house prior to the manufacture of leather, for the character of the product was determined before the goods ever went into the tan yard proper. Up to now only the fringe of the subject had been touched upon, and there was much to learn.

Dr. E. STIASNY agreed with the lecturer's view that alkaline arsenic solutions did not kill the bacteria of a lime liquor. Eitner and Meyer had also shown that arsenic did not sterilise a lime. He did not regard the hair loosening action of ammonia in old limes as a serious factor, since ammonia lost its power of unhairing in presence of lime or calcium salts. Had Mr. Wood tested the action of potassium xanthogenate, which is said to kill the putrefactive bacteria in the "sweats" without inhibiting the action of the hair loosening organisms ?

Dr. PONDER, touching upon the question of the anthrax baccilli, commented on the process of disinfection of skins used in leather manufacture. In the case of a sick animal which discharged a substance containing anthrax organisms, spores were formed by the action of the air, and it was these spores which they had to consider The bacteria could be killed by strong disinfectants, but then those strong disinfectants had a tendency to destroy the skins. It was necessary that they should allow the spores to develop into vegetative bacterial form. This was a point that needed further investigation.

Mr. E. M. PAYNE said he had devoted a good deal o attention to the question raised by Mr. Wood. H realised that the problem of unhairing the hides was one o the most difficult they had to deal with. The soda lime process was a practical method. A two per cent solution of caustic soda would kill the anthrax germ

The CHAIRMAN (Sir John Turney) said it was very gratifying to know that Mr. Wood had been recognised a an authority on a subject which had such an importan bearing upon the success of the leather trade. He had been in the trade some fifty years and recognised from the first that the one essential was cleanliness. He defie anyone to succeed in the business who did not observe strictly the laws of cleanliness.

Mr. J. T. WOOD in reply said he hoped that the work begun by Dr. Ponder on anthrax would eventually be o great benefit to the trade, and was glad to learn that th Leathersellers Company were prepared to support bacteriological research in a practical way in their new college. In reply to Dr. Stiasny, he had mentioned Schmitz-Dumont' work in the paper, but he had not personally prove whether potassium xanthogenate had the effect described he doubted if it was a practical method ; at any rate h had never heard of it being used on a large scale. Mr Payne's remark that the sodium hydrate solution used i his liming process killed anthrax spores was very interesting. No doubt it depended on the time the spores wer in contact with the alkaline solution. He was indebted t Sir John Turney for permission to publish some of th work done in the Trent Bridge laboratory.

Yorkshire Section.

Meeting held at Station Hotel, York, on Monday, April 25t
1910.

PROF. W. M. GARDNER IN THE CHAIR.

THE DEVELOPMENT OF SULPHURIC ACID FRO SULPHIDE DYESTUFFS AND FROM FREE SULPHUR.

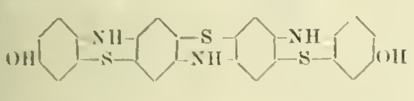
BY WALTER M. GARDNER AND HERBERT H. HODGSO

(A contribution from the Department of Chemistry a Dyeing, Bradford Technical College.)

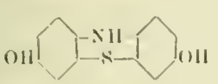
The experiments described in this paper were original undertaken with the object of investigating the cause causes of the rotting action sometimes observed in cotton fabrics which have been dyed with sulphide blacks.

A brief résumé of the work of previous investigators will serve to show the present position of the whole subject.

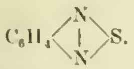
The composition of sulphide blacks.—The discovery in 1873 by Croissant and Bretonnière of sulphido colouring matters possessing the remarkable property of dyeing unmordanted cotton, and the subsequent manufacture of Cachou de Laval by the Société Anonyme des Matiéres Colorantes de St. Denis are now matters of chemical history. In 1893 Vidal published his first patent for the production of Vidal Black, a body formed by fusing *p* aminophenol with sulphur and sodium sulphide. When the same compounds are fused at a much lower temperature than that used for Vidal Black, Bernthsen's dioxythiodiphenylamine is produced, and Vidal therefore assumed that the constitution of his black might be somewhat as follows :—



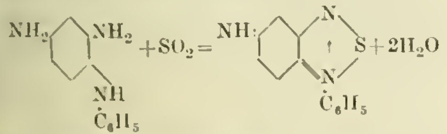
i.e, a kind of condensed polymer of the dioxythiodiphenylamine of Bernsthen.



Since Vidal's patent, many others have been taken out, and almost every likely combination of substances has been subjected to the sulphur melt. Owing to tho insolubility of the sulphide blacks in all solvents excepting sodium sulphide and similar bodies, their resolution into definite identifiable compounds has not been successfully carried out. The task of elucidating the constitution of the sulphide blacks by analyses thus seems to present insurmountable difficulties, and they appear indeed to be highly complex mixtures, and not homogeneous substances. A few synthetical attempts at a solution of the problem have, however, to be recorded. C. Ris, (J. Soc. Dyers and Col., 1901, 217) set out to determine whether the black sulphide colours contain as chromophor a piazthiol,



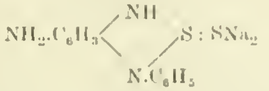
radicle, and he showed that when diaminodiphenylamine is treated with aqueous sulphurous acid in sealed tubes at 180° to 190° C, a black substance is obtained which is insoluble in most solvents, and which exhibits the characteristic properties of a sulphide dye, viz., solubility in alkaline sulphides and affinity for unmordanted cotton. The black thus produced is deepened by oxidising agents. According to Ris, the action takes place as follows :—



By reduction (*c.g.*, with zinc and hydrochloric acid), large quantities of sulphuretted hydrogen are evolved, and the original diaminodiphenylamine regenerated. The body therefore possesses an induline-like structure, one phenylene radicle being replaced by sulphur. Its sulphonic acid is formed in an analogous manner, is readily soluble in caustic soda, and becomes an intense black in the presence of sodium sulphide. The product obtained from diaminooxydiphenylamine possesses similar properties.

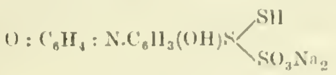
This method of producing sulphide dyes was found to be generally applicable. Thus, either *p*-aminophenol or *p*-phenylenediamine, when heated in sealed tubes with aqueous sulphurous acid to 180° C., yielded characteristic sulphide colours, which dyed unmordanted cotton black blue.

Ris assumed that the solutions of sulphide dyestuffs in sodium sulphide contain soluble polysulphide addition products, *e.g.*,



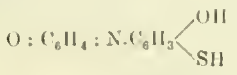
$$NH_2.C_6H_3\begin{matrix}\diagup NH \\ \diagdown N.C_6H_5\end{matrix}\diagup S:SNa_2$$

In the "Revue Générale des Mat. Colorantes," Jacek suggests the following formula as representing the composition of a black,



$$O:C_6H_4:N.C_6H_3(OH)S\begin{matrix}\diagup SH \\ \diagdown SO_3Na_2\end{matrix}$$

which corresponds to a thionol ouserved by Bernthsen, possessing the composition



$$O:C_6H_4:N.C_6H_3\begin{matrix}\diagup OH \\ \diagdown SH\end{matrix}$$

In view of the interest attached to a knowledge of the constitution of these products, we are at present engaged in a synthetical attempt to prepare certain sulphide blacks, and hope to publish the results of these experiments shortly.

Tendering of the cotton fibre by sulphide blacks.—The sulphide blacks are extremely fast dyes and have, on this account, assumed great importance, but, it is, unfortunately a fact that cotton dyed with them sometimes becomes tender or rotten, this being especially liable to occur in goods exported to hot countries. The weakening of the fibre does not usually take place immediately, but may occur within a week, a month, a year, or not at all. Union (wool and cotton) material, containing sulphide black warps, is particularly susceptible to this defect; more especially when the wool weft has been stoved with sulphur or "cross-dyed" with acid dyestuffs.

Chapuis (J. Soc. Dyers and Col., 1900, 84 and 124) attributes the tendering to drying and calendering at too high a temperature (in this case the alteration is immediate), or to the presence of sulphur, (either free or partially oxidised) deposited on the fibre during the dyeing or in the after-fixing process.

Chapuis points out that a certain amount of sodium thiosulphate is always formed from the sulphide used in the preparation of tho dyestuff or in the dye-bath—

$$2Na_2S+5H_2O=Na_2S_2O_3+2Na_1OH+4H_2.$$

He states that all the colouring matters of this class contain thiosulphate of soda and it is well known that this substance, when treated with a mineral acid, yields a deposit of sulphur. This is, therefore, a sure source of free sulphur. Further, if the reactions necessary for the formation of the colouring matters are incomplete, irregularly conducted, or effected with excess of sulphur, some of the latter will remain as such in a finely divided state in the colouring matter. This is another possible source of sulphur, and during the process of dyeing, the fibre may assimilate very variable quantities of this sulphur, which it will be impossible to eliminate subsequently. The more or less rapid oxidation of the free sulphur to sulphuric acid then results in the tendering of the fibre.

A. E. Sunderland (J. Soc. Dyers and Col., 1901, 3; this J., 1901, 243) suggests that the tendering may be due to :—(1.) Acid left in during after-development. (2.) Decomposition of the polysulphides absorbed by the cotton at the same time as the colour. (3.) Decomposition of the colour itself.

In opposition to the previous authors, F. Bayer & Co. (Leipziger Monatscrift für Textil Ind., June, 1901; also J. Soc. Dyers and Col., 1901, 204), state that :—(1.) Sulphide colours when dyed without after-treatment render the fibre 12 to 15 per cent. stronger. (2.) If the after-treatment with metallic salts is carefully done, the finished goods will show the same strength after dyeing as before. (3.) The theory of the oxidation of the sulphur on the fibre to sulphuric acid has no basis. (4.) The operations of ironing, pressing, steaming, finishing, etc., where high temperature, with or without perssure, is applied, when carried out with insufficient care, and under favourable conditions, may tender the cotton.

A very interesting class of sulphur colours was patented by Green and Meyenberg (Eng. Pat. 4792 of 1900 ; this J., 1901, 118). They claimed to have eliminated the cause of tendering. They set out to discover a less empirical and more rational method of formation than the process of fusion with sodium sulphide and sulphur ; and by oxidising certain organic compounds under suitable conditions in the presence of sodium thiosulphate in aqueous solution, they succeeded in obtaining black and brown colouring matters and also in isolating well characterised intermediate products (dithiosulphonic acids), which clearly indicated the nature of the reaction.

With regard to tendering, Green and Meyenberg state that the conclusions of Chapuis are well supported by their own investigations, viz., that the destructive effect is due to the deposition of finely-divided sulphur upon the cotton fibre, which subsequently becomes oxidised to sulphurous or sulphuric acid.

L. J. Matos (this Journal, vol. xxi., (1902), p. 224), treated fine cotton yarns with solutions of the following reagents respectively, in the proportions in which they occur in the dyebath : St. Denis black, sodium chloride, sodium sulphate, sodium sulphide, caustic soda, and sodium carbonate. Only the sodium sulphide caused the yarn to become weaker, and this to a very small extent. He also found that the usual fixing agents had practically no effect and concludes that tendering is caused by allowing traces of acid to remain in the fibre after fixing.

Appleyard and Deakin (J. Soc. Dyers and Colourists, 1902, p. 128) have studied the action of certain inorganic sulphur compounds on cotton. Their experiments show that when cotton is saturated with the solution and dried, commercial sodium sulphide tenders the fibre to a greater extent than the pure salt. In a perfectly dry atmosphere no tendering whatever takes places, and the amount of tendering of the yarn was increased with the amount of moisture in the atmosphere. The effect of precipitating on the fibre copper sulphide, ferrous sulphide and sulphur respectively was studied. Tendering takes place in all cases in a damp atmosphere, the presence of sulphur having the greatest effect. Sodium sulphate on the other hand has no action.

Pilling (J. Soc. Dyers and Colourists, 1906, p. 54), after an exhaustive series of experiments, came to the conclusion that tendering is due in all cases to the generation of sulphuric acid, which either originates from the destruction of the colour molecule itself, or from the oxidation of sulphurous acid from outside sources, in which case certain metallic compounds, and even perhaps the colouring matter itself may act as a catalytic agent.

G. E. Holden (J. Soc. Dyers and Col., 1910, 76 ; this J., 1910, 558) also states that free sulphuric acid is the cause of the tendering of the fibre, and that the acid does not originate from sodium sulphide or polysulphides, but arises from the oxidation of the colour molecule.

L. E. Vlies (J. Soc. Dyers and Col., 1910, 79 ; this J., 1910, 558), considers that it has been conclusively proved that the formation of sulphuric acid is the cause of the rotting of the fibre, but that the origin of the acid is still a matter of doubt.

Methods of preventing the tendering of the fibre.—Green and Meyenberg (J. Soc. Dyers and Colourists, 1901, p. 89), propose to eliminate the cause of tendering by the use of dyestuffs from which free sulphur is entirely absent, and by conducting the dyeing process in the absence of sodium sulphide. The dyes are dissolved by boiling in a concentrated solution of sodium sulphite with which they form soluble compounds (probably salts of thiosulphonic acids). These compounds are then reduced with glucose and caustic soda, and the material dyed in the solution, the colour being developed and fixed by means of metallic salts.

Various methods have also been proposed with the object of neutralising the acid as formed. Cassella and Co. (J. Soc. Dyers and Colourists, 1901, p. 240) state that if acetate of sodium, potassium, ammonium, or magnesium is added to the developing bath, the strength of the cotton fibre remains unimpaired. Pilling (J. Soc. Dyers and Col., 1906, 61 ; this J., 1906, 216) and Pearson (J. Soc. Dyers and Col., 1906, p. 65) propose to impregnate the dyed goods with a carbonate or an acetate. Recently the Chemische Fabrik Griesheim Elektron (Eng. Pat. 11,729 of 1909 ; this J., 1910, 209) state that sodium acetate effects only a partial protection and have patented a process in which lactic or tartaric acids are used in the presence of a certain amount of their alkaline salts. Holden and Maguire form an insoluble calcium tannate on the fibre, and this being available for reacting at once with any sulphuric acid formed, is said to impart immunity against tendering.

From the foregoing summary of previous work, it will be seen that considerable divergence of opinion exists with regard to the cause or causes of the defect of tendering of cotton dyed with sulphide blacks, and that the recorded experimental results also show marked discrepancies.

The experiments now to be described were, therefore, carried out with a view to a final settlement of some of the questions involved.

The presence of free sulphur in sulphide dyestuffs.—The presence of free sulphur in many sulphide dyestuffs had already been demonstrated by Chapuis, Pilling, and others, using carbon bisulphide as solvent. We found, however, in the course of our experiments, that the use of this solvent led to discordant results, since it is slowly dissociated at its boiling point with deposition of sulphur. When dealing with small amounts of free sulphur, this introduces errors of considerable magnitude, and is a probable cause of the varying results previously recorded. Ether was eventually selected as being the most satisfactory solvent, the following typical results showing the effect of various sulphur solvents.

I.—Extraction of sulphur from cotton cloth dyed with sulphide black.

	Duration of extraction.	Weight of		% of sulphur on weight of of cloth.
		Cloth taken.	Sulphur extracted.	
Carbon bisulphide ..	7 hours.	2 grms	0·0282 grms	1·41
Carbon tetrachloride.	7 ,,	2 ,,	0·0132 ,,	0·66
Ether	7 ,,	2 ,,	0·0116 ,,	0·58
Chloroform	7 ,,	2 ,,	0·009 ,,	0·45
Petroleum ether ...	7 ,,	2 ,,	0·007 ,,	0·35
Benzene	7 ,,	2 ,,	0·0052 ,,	0·26

The amount of extractable sulphur in the actual commercial dyestuffs, is, as was to be expected in view of the above results, very considerable, though varying widely in different dyestuffs. In carrying out the experiments on this point, six of the chief commercial sulphide blacks were selected, and amounts of sulphur varying from 1·00 per cent. to as much as 12·63 per cent. were obtained. For obvious reasons the dyes are here distinguished by letters rather than by their commercial names.

II.—Extraction of sulphur from commercial sulphide blacks by ether.

Dyestuffs.	Sulphur extracted per cent.
" Black A "	2·92
" Black B "	4·21
" Black C "	3·59
" Black D "	1·00
" Black E "	12·63
" Black F "	1·15

With the view of exhaustively extracting one of the dyestuffs, 5 grms. of " Black A " were treated with ether for a total period of 287 hours, the amount of sulphur extracted being estimated at intervals. The total sulphur yield was 5·2 per cent., of which about two-thirds was extracted during the first period of seven hours. The dyeing properties of the black were entirely unaffected by the extraction of the sulphur.

III.—*Complete extraction of " Black A " by ether.*

Time of Extraction.	Sulphur Extracted.		
	Additional.	Total.	Percentage.
7 hours		0·1854	3·708
14 ,,	0·0178	0·2032	4·064
21 ,,	0·0130	0·2162	4·324
28 ,,	0·0100	0·2262	4·524
35 ,,	0·0100	0·2362	4·724
42 ,,	0·0050	0·2412	4·824
49 ,,	0·0042	0·2454	4·908
56 ,,	0·0041	0·2495	4·990
63 ,,	0·0014	0·2509	5·018
70 ,,	0·0016	0·2525	5·050
77 ,,	0·0016	0·2541	5·082
84 ,,	0·0002	0·2543	5·086
91 ,,	0·0004	0·2547	5·094
140 ,,	0·0056	0·2603	5·206
189 ,,	slight trace		
236 ,,	slight trace		
287 ,,	slight trace		

A similar cumulative extraction of cotton cloth dyed commercially with " Black B " for a total period of 35 days gave a total sulphur yield of 1·554 per cent., the largest amount being again dissolved out during the first period of seven hours.

We have thus shown that the commercial sulphide dyes contain relatively large amounts of sulphur extractable by ether, and that cotton material dyed with them may also contain as much as 1·5 per cent.

It cannot be assumed that treatment with dry ether at its boiling point will decompose the colour molecule, and it is therefore clear that the sulphur extracted in the above described experiments existed in the free state in the commercial dyestuffs and on the cotton cloth.

The development of sulphuric acid.

(*A*) *From free sulphur.*—The chemical activity of free sulphur has frequently been a matter of remark. When heated with metals or metallic oxides, sulphides are frequently formed. Senderens found (Bull. Soc. Chim., (3), 6800—807) that boiling solutions of the oxides of alkalis or alkaline earths act on sulphur with formation of sulphides and thiosulphates, and also (Compt. rend., 104, 58—60) that aqueous ammonia in the cold slowly forms a polysulphide and thiosulphate. Silver oxide also reacts with sulphur in presence of moisture, forming as final products silver sulphide and sulphuric acid. Cupric oxide reacts in a similar manner.

Vortman and Padberg (Ber., 22, 2642—2644) found that when aqueous solutions of many proto salts are boiled with flowers of sulphur, about half the metal is precipitated as sulphide, the remainder being oxidised to the per salt.

Our experiments strongly emphasize the chemical activity of free sulphur, and show that notable amounts of sulphuric acid are formed by the direct atmospheric oxidation of sulphur in presence of moisture. Senderens (*loc. cit.*) states that water and sulphur do not react at 100° C. ; but this is only correct if air is excluded.

In our experiments on this point, finely divided sulphur in various forms was placed in water either without addition or with the addition of traces of those metallic salts (copper sulphate, ferrous sulphate, potassium bichromate, potassium chlorate) which are employed in the fixation of sulphide dyestuffs on cotton. The amount of sulphuric acid formed was estimated by titration with *N*/10 caustic soda solution, and is expressed as *N*/10 sulphuric acid. The vessels containing the sulphur were kept in a water oven for the times stated, and careful control experiments were made in all cases in order to ensure the absence of error due to the possible absorption of acid from the atmosphere in the laboratory.

IV.—*Atmospheric oxidation of sulphur with or without addition of traces of certain metallic salts.*

	1 grm. flowers of sulphur.	1 grm. flowers of sulphur with addition of traces of—			
		Copper sulphate.	Ferrous sulphate.	Potassium bithromate.	Potassium chlorate.
Time of heating	102 hrs.	102 hrs.	102 hrs.	102 hrs.	102 hrs.
N/10 sulphuric acid formed..........	1·875 c.c.	9·226 c.c.	4·438 c.c.	5·039 c.c.	6·258 c.c.
Per cent. of sulphur converted	0·300	1·476	0·710	0·806	1·001

Direct oxidation of sulphur to sulphuric acid is thus proved, and the amount of acid formed is considerably increased by the catalytic action of certain metallic salts.

Similar sets of experiments to the above were carried out with various forms of finely divided sulphur, and, as might be expected, the more finely divided the sulphur, the larger the proportion of sulphuric acid formed.

The details are as follows :

V.—*Oxidation of various forms of finely divided sulphur.*

(1 grm. sulphur in each case.)

			Amount of N/10 sulphuric acid formed				
Form of sulphur used.	Temp.	Time.	Sulphur alone.	Sulphur + copper sulphate.	Sulphur + ferrous sulphate.	Sulphur + bichromate.	Sulphur + chlorate.
(a) Pptd. from sod. thiosulphate by sulphuric acid.	Water bath.	78 hrs.	2·691 c.c.	7·143 c.c.	4·429 c.c.	2·489 c.c.	6·969 c.c.
(b) As (a) but washed and dried.	,,	116 ,,	6·318	12·311	8·676	6·209	10·039
(c) Coml. " pptd. sulphur."	,,	120 ,,	4·824	11·202	12·946	6·528	11·938
(d) * ,, ,,	,,	72 ,,	7·692	27·792	18·108	12·722	20·540
(e) † ,, ,,	Cold.	182 ,,	4·180	5·040	4·720	4·512	4·720
(f) Pptd. by water from acetone-alcohol solution.	Water bath.	25 ,,	1·528	9·880	6·156	1·564	7·036

* In this series (d) an amount of catalytic agent equal in weight to the sulphur was added.

† In this series (e) equal volumes of hydrogen peroxide were added in each case.

The above results, while not always quantitatively concordant, indicate that copper salts have a greater effect in bringing about the formation of sulphuric acid than chromates or salts of iron, and this experimental result is very interesting in view of the prevalent idea that exists amongst practical dyers that tendering of the fibre is more liable to occur when copper salts have been used in the after-treatment.

The laborious and extended nature of the above summarised experiments on the oxidation of sulphur is indicated by the fact that they involved not less than 510 distinct estimations of sulphuric acid.

(*B*) *The development of sulphuric acid from sulphide dyestuffs.*

VI.—*Detection of acid in cotton cloth.*—In an initial experiment a piece of the cotton cloth dyed with "Black A" (as used in Exp. I.) was kept in the water oven in a moist condition for three hours, when a distinct acid reaction was obtained. After repeatedly boiling with water to remove every trace of acid the same piece of cloth again developed an acid reaction under similar conditions.

VII. *Amount of acid developed in the cloth.*—Experiments were then made in which the same cloth was allowed to remain for varying periods of time in a warm moist atmosphere, the amount of acid formed being determined at daily intervals. The experiments were continued for a total period of 40 days, the cloth being heated in the water oven for six hours daily, and remaining cold for 18 hours daily. Under these conditions 1 grm. of the cloth dyed with "Black A" heated for a total period of 240 hours during 40 days developed acid equal to 2·975 c.c. $N/10$ sulphuric acid. This gives an acid development equal to 1·457 per cent. sulphuric acid calculated on the weight of the cotton cloth; an amount amply sufficient to tender the cloth. Acid development was still taking place at an apparently undiminished rate, when the experiments were broken off.

VIII.—*Acid developed after extraction of the free sulphur from the cloth.*—The cotton cloth dyed with "Black A" and extracted with sulphur solvents (see Exp. I.), was then treated as in the last series of experiments. Using the ether extracted cloth, under these conditions acid-development did not commence until seven days had elapsed and proceeded much more slowly than in the case of the cloth from which the free sulphur had not been removed. One grm. of extracted cloth heated for a total of 137 hours during 27 days gave an acid development equal to 0·54 c.c. $N/10$ sulphuric acid, or 0·265 per cent. sulphuric acid on the weight of the cloth.

In the case of the cloth extracted with carbon tetrachloride the amount of acid development was practically identical with the above, reaching 0·25 c.c. $N/10$ sulphuric acid in 72 hours (with ether, 0·26 c.c. in 72 hours).

Complete extraction of the free sulphur from a sulphide dyestuff by means of ether appears to take place in about 140 hours (see Exp. III.). In order to ensure complete extraction of the dyed cloth, 5 grms. was continuously extracted with ether for 250 hours. On subsequently treating for acid-development 0·35 c.c. $N/10$ sulphuric acid was formed (= 0·343 per cent.).

It is considered highly probable, therefore, that this acid was produced by a slow decomposition of the colour molecule. It is not to be assumed that the amounts of acid found in the above experiments represents the total amount of sulphur oxidised. Loss of acid will probably occur through hydrolysis of the cellulose, the amount found by titration thus representing the balance.

IX.—*Rapid oxidation of the free sulphur.*—Previous experiments (Exp. IV. and V.) show that treatment of the material with oxidising agents after dyeing, increases acid-development, and it was thought that by inducing rapid oxidation in the presence of a large amount of water, the tendency to rotting of the fibre might be eliminated. No success was, however, obtained on these lines, acid development being unaffected and still taking place over a long interval of time. One grm. of cotton cloth dyed with "Black A" were treated as follows:—

(*a*) Boiled in water for 2 hours.

(*b*) Boiled with water containing 1 grm. of potassium chlorate for 2 hours, then with water for 2 hours.

(*c*) Boiled with 1 grm. of potassium bichromate (with acetic acid) for 2 hours, then with water for 2 hours.

Each piece was then treated as before for acid-development for a period extending over 210 hours heating, and the amount of acid found was (*a*) 2·000 c.c. (*b*) 1·982 c.c. (*c*) 2·162 c.c. $N/10$ sulphuric acid.

The replacement of sodium sulphide in the dye-bath by sodium sulphite or sodium hydrogen sulphite also had no apparent effect on subsequent acid-development.

Effect of after-treatment of dyed cotton on acid-development.—It has already been shown (Exp. V.) that the oxidation of sulphur is assisted by the presence of the various metallic salts used in the fixation of sulphide blacks. One grm. of cotton dyed with "Black A" and fixed in different ways was now subjected to acid-development, and the results corresponded to those obtained in the case of sulphur.

X.

		Acid-Development $N/10$ sulphuric acid.			
		Dyed and fixed with			
Time of heating	Cotton dyed only	Copper sulphate	Ferrous sulphate	Potassium bichromate	Potassium chlorate.
78 hrs.	3·307 c.c.	12·79 c.c.	10·030 c.c.	5·606 c.c.	8·565 c.c.

XI.—A sulphide dyestuff similarly treated gave acid-development as follows ($N/10$ sulphuric acid).

Dyestuff used.	Dyestuff alone.	Dyestuff + copper sulphate.	Dyestuff + ferrous sulphate.	Dyestuff + potassium bichromate.	Dyestuff + potassium chlorate.
Coml. "Black A"	12·481 c.c.	15·280 c.c.	18·573 c.c.	9·344 c.c.	12·749 c.c.
Coml. "Black A" after extraction with ether	10·741 c.c.	14·194 c.c.	13·197 c.c.	3·449 c.c.	9·296 c.c.

We have thus shown that development of sulphuric aci occurs whenever commercial sulphide blacks, or materia dyed with one of them is subjected to continued heat in th presence of moisture. Acid-development is not prevente by previously treating the dyestuff or the dyed materia with sulphur solvents, and the amount of acid formed in fixed period of time is increased by the presence of metalli fixing agents, more especially by copper salts.

Notes on antimony sulphide.—It was a matter of som interest to ascertain whether metallic sulphides woul behave in a similar manner to the sulphide dyestuffs a regards acid development. Our experiments on this poin have been confined to antimony sulphide and are, therefor not exhaustive. Commercially "pure" antimony sulphid was extracted with ether for 24 hours, and 5 grms. o antimony sulphide gave no less than 1·799 grms. of sulphu (35·59 per cent.). Further extraction with the solven failed to remove any additional amount of sulphur.

Both commercial and extracted antimony sulphid were then subjected to the acid-development condition without and with the presence of the metallic salts previou ly employed, and in all cases oxidation took place; th amount of acid developed being considerably greater in th unextracted sample.

DISCUSSION.

Mr. W. Gathorne Young asked whether it had been determined that tendering of the fabric did not occur if it were dyed with a sulphide dyestuff from which the free sulphur had been removed by a solvent beforehand.

Prof. H. R. Procter stated that in the manufacture of leather by the two-bath chrome process considerable quantities of sulphur were deposited, but no tendering took place, and the leather retained all its properties. The finished product was, however, treated with an emulsion of oil in soap solution, and this possibly prevented the formation of free sulphuric acid. Would the presence of soap have a detrimental effect on yarn if a little were left in the finished product?

Mr. T. Fairley mentioned that modern paper was frequently very imperfect, and often compared unfavourably in permanence with the writing of older documents. The chlorinating agents used to bleach the fibres might, if not perfectly removed or neutralised, also bleach the ink; while one agent, often used as "antichlore" to neutralise the bleaching agents, might, if it is used in excess, gradually deposit finely divided sulphur in the paper. After a time the fine sulphur was oxidised to sulphuric acid, damaging both paper and writing.

Mr. J. T. Craven asked if washing with water, then a good soaping and another wash with water, had been tried for removing the acid from fabrics.

Mr. R. E. Wainwright asked if any tendering took place in piece goods, or if it only occurred in yarns.

Prof. W. M. Gardner in reply, said oxidation of the free sulphur probably took place before decomposition of the sulphur-containing colour molecule and therefore if the free sulphur was extracted tendering was retarded. The conditions tending to bring about the formation of sulphuric acid on material dyed with sulphide dyes were moisture and heat. Goods sent to America or India often became rotten after storing, whereas portions of the same goods stored in this country might not be so affected. No tendering occurred in goods if alkali was left in them, but mere washing was not sufficient to prevent tendering. The presence of calcium soap or calcium tannate on the goods would have a protective action. Many cases of tendering in piece goods were known.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Electric motors and appliances; The erection of protected —— in situations where there is danger of fire or explosion. Trzeciok. Chem. Ind., 1910, 33, 274—277.

In commenting on the safety regulations with regard to the erection of electrical appliances, issued by the Society of German Technologists, the author states that whilst the subject is of extreme importance in the chemical industry no experimental work has been done and it is only by deduction from experiments carried out in connection with the coal mining industry that any information is available. The very limited success which was obtained in preventing the explosion of gas from mines, when the sparking parts of the apparatus were immersed in oil, or when the motors, etc., were surrounded by wire-gauze, or more solid covers fitted with tortuous cooling outlets for the explosion gases, has led to the conclusion that really safe fittings have yet to be found and that security can only be obtained if all dynamos, motors, switches, resistances, etc., are placed absolutely outside of the danger zone.—J. A.

Patents.

Concentrating liquids; Apparatus for ——. Soc. d'Exploitation de Procédés Evaporatoires (Système Pracho and Bouillon), Paris. Eng. Pat. 9276, April 19, 1909. Under Int. Conv., June, 23 1908.

The invention consists essentially in the use of nests of heating tubes slightly inclined to the horizontal and heated externally by steam, with a view to producing a high velocity in the circulating liquid, with a consequent high coefficient of heat transmission. The length of the heating tubes should be at least 75 times their diameter and the static level of the liquid should be maintained at about the middle of the tubes. The heating tubes are connected with an upper reservoir divided into compartments for the separation of the vapour, and a lower reservoir for the liquid, the two reservoirs communicating with one another by return tubes of large diameter. A trap is provided at the bottom of the lower reservoir for the removal of any deposited solids.—J. W. H.

Evaporation; Method of —— and apparatus therefor. N. H. Hiller, Carbondale, Pa. U.S. Pat. 955,965, April 26, 1910.

A portion of the liquid is evaporated under high pressure by an external heating agent and another portion under a lower pressure by the heat of condensation of part of the vapour from the high-pressure boiler. The heat of condensation of the vapour from the low-pressure evaporator is utilised to heat the feed liquid. The condensed liquids are reboiled in another boiler and the waste heat used for the preliminary heating of the feed liquid.—W. H. C.

Clay, slimes, minerals, and the like; Process and apparatus for treating earthy material for the separation of ——, and washing and mixing apparatus for the same. W. A. Mercer, London. Eng. Pats. 9671 and 9672, April 23, 1909.

(1). The earthy material, mixed with water, is fed into an inclined screw conveyor, which carries the heavy matter in an upward direction, delivering it into a shoot at the top of the conveyor-casing, above the level of the water in the apparatus. The water is always moving in a downward direction and carries the fine materials in suspension into a settling appliance. The latter consists of a U-shaped trough, divided into a series of settling chambers, each pair with a connecting passage across their lowermost ends, so that the current of water passes downwards on one side and upwards on the other side to the final outlet, means being provided for discharging the product from each settling chamber separately. (2). The apparatus comprises a rotary cylinder fitted with a series of radial wings, or ribs, attached inside the periphery of the cylinder, and running longitudinally from end to end. The delivery end of the cylinder is of truncated conical form, the outlet being situated at the apex. The conical end is provided with open conduit channels, connected with alternate ribs of the last series, which conduct the material raised by them to the outlet. Means are provided for inclining the axis of the rotating cylinder to a desired degree.—O. R.

Drying brewers' draff and other material ; Apparatus for ——. R. Motion, Glasgow. Eng. Pat. 10,027, April 28, 1909.

The apparatus consists of a belt conveyor on which the material is spread evenly and carried through press rolls, and a pair of hollow rolls heated by hot air or steam, on the surface of which, in turn, the material is carried by means of an endless perforated or permeable band (preferably fine wire cloth). A jockey pulley maintains the band at a suitable tension to press the material against the hot surfaces, and, in addition, small rolls are provided on the first of the heated rolls to increase this action. A worm conveyor finally discharges the material into a vertical shoot, where it may be subjected to the action of the hot air discharged from the rolls.—J. W. H.

Desiccating apparatus. J. H. Campbell, New York, and C. H. Campbell, Philadelphia, Pa., Assignors to National Nutrient Co., Jersey City, N.J. U.S. Pat. 956,038, April 26, 1910.

The claim is for a vessel in which the liquid is concentrated by being heated and having air blown through it. Further concentration is then effected by blowing a current of air over a thin film of the liquid spread over shelves or projections in a chamber. The cake formed is scraped off the shelves, broken up and finally dried.—W. H. C.

Drying machine. J. P. Marshall, Assignor to F. H. Ludington, St. Louis, Mo. U.S. Pat. 956,122, April 26, 1910.

The material to be dried is spread by a rotating radial distributing arm upon the surface of a fixed horizontal disc, heated from below. A radial scraper is caused to move over the surface of the disc in front of the distributing arm. The dried material removed by the scraper is conducted to a receiving hopper which is caused to travel round the edge of the disc in proximity to the outer end of the arm carrying the scraper.—W. H. C.

Briquetting and pressing of material. Allgem. Briketierungs-Ges. m. b. H., Berlin. Eng. Pat. 16,500, July 15, 1909. Under Int. Conv., Aug. 26, 1908.

During the period in which the pressing is taking place, successive pressures of increasing amount are applied for decreasing periods of time, with a view to the elimination of the air contained in the original material. The valves controlling the admission of pressure water from different sources of varying pressure are actuated by cam gearing during the compression period, the different pressure stages being regulated as required.—J. W. H.

Cylinders and the like ; Means for passing steam or other fluids into and from rotating ——. J. Nuttall, Bury. Eng. Pat. 19,285, Aug. 21, 1909. Addition to Eng. Pat. 7111, March 24, 1909.

A hollow stem at each end of the cylinder is provided with a hollow head which, as the cylinder rotates, turns in the fixed bearing parts to which the pipes carrying the steam and condensed water are attached.—J. W. H.

Filter presses or the like for wet substances. P. M. Justice, London. From International Continuous Filter Press Co., Providence, R.I., U.S.A. Eng. Pat. 23,981, Oct. 19, 1909.

The invention is an improvement on that described in Eng. Pat. 8924 of 1907 (this J., 1907, 1156). The garbage or other material to be filtered or rendered is carried through the machine by means of a conveyor-worm. Immediately upon entry the material comes into contact on all sides with filter plates through which much of the water contained in the material passes. At a further position in the casing the material passes over other similar filter plates. "Fin-plates" are provided in the casing to prevent the rotation of the material and assist in its movement along the casing. Finally the material is discharged through a disc valve controlled by a cylinder fed by compressed air. Knives are fixed upon this disc valve for cutting any material which might cause choking. Traps and reservoirs, controlled by compressed air, are connected to each filter plate, so that at definite intervals some of the liquor may be forced back, through the filter plates, with the object of keeping them clear ; the movement of the valves controlling this action is entirely automatic and takes place at predetermined intervals under simple control.—J. W. H.

Moulding or filtering apparatus for the manufacture of slabs or blocks of heat-insulating material. W. D. A. Bost, Paisley. Eng. Pat. 27,406, Nov. 25, 1909.

The apparatus consists of a simple vacuum filter in which the usual vessel is divided into two parts at the perforated plate, the joint between the two being made by means of a hydraulic seal containing mercury. Air or steam may be blown into the lower part of the filter while the upper part is being filled, after which, suction may be applied as usual.—J. W. H.

Filters and means for cleansing the same. J. S. Roak, New York. Eng. Pat. 29,863, Dec. 21, 1909.

The filter is intended for treating large volumes of water and is arranged so that the filtering medium may be mechanically cleaned when foul. The filtering material rests on a bed of cement on which is placed a grid of pipes provided with orifices through which the filtered water passes and leaves the apparatus. A gauge-glass is fixed outside the casing carrying the filter bed to indicate the level of the liquid. When the filter bed becomes foul, its upper layers are stirred up by moving jets of water and the foul liquid produced washed out of the apparatus. The nozzles through which the jets of water issue are carried on hollow arms rotated by a water motor.—J. W. H.

Filtering process. G. Moore, Joplin, Mo. U.S. Pat. 955,836, April 19, 1910.

A solid cake is built up on the filtering medium by causing the liquid portion of the pulp to be filtered to pass through the medium by maintaining a difference of pressure between the opposite sides of the filter and continuously agitating the pulp. When formed the cake is washed free from soluble matter by passing a liquid through it while the difference of pressure is maintained.—W. H. C.

Clarifying and filtering liquids and fluid substances, Centrifugal machine for ——. T. B. Marshall, Poughkeepsie, N.Y., Assignor to the De Laval Separator Co. New Jersey. U.S. Pats. 955,889 and 955,890, April 26 1910.

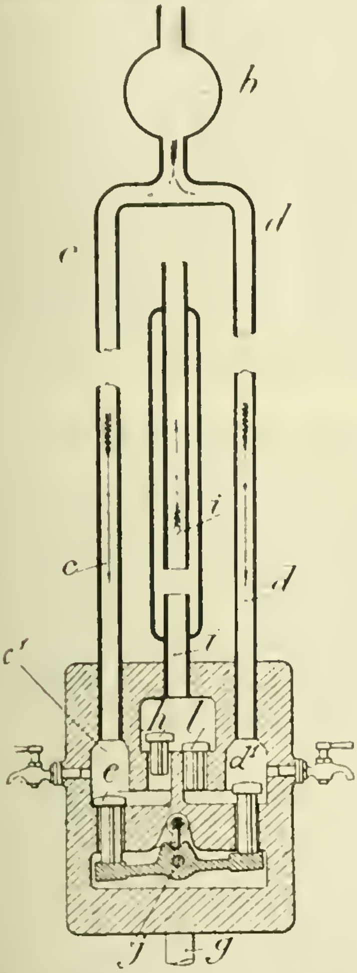
The centrifugal separator consists of two superpose bowls rotated together. The liquid is fed into the centra portion of the lower bowl, which has a solid outer wal and is not provided with filtering material. From th periphery of the lower bowl the liquid passes up a passag into the upper bowl which has either a perforated oute wall or layers of filtering material.—W. H. C.

Filter. G. Knock, Cleveland, Ohio. U.S. Pat. 956,366 April 26, 1910.

A hollow base having several perforated "filte members" upon its upper surface is provided with common outlet pipe connected to a vacuum pump, an a corresponding number of hoods are adjustably supporte by a frame above the base plate.—W. H. C.

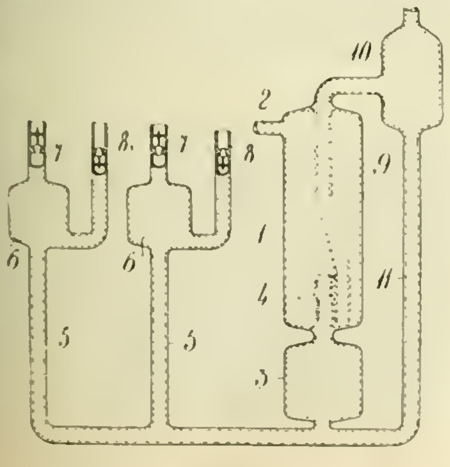
Raising liquids ; Apparatus for ——. J. B. Courtet Romans, France. Eng. Pat. 27,479, Nov. 25, 1909 Under Int. Conv., Dec. 1, 1908.

The apparatus is a duplex hydraulic ram and consist of two chambers, c_1, d_1, communicating with the wate supply through pipes, c, d, and a filter, b, and provide with suitable valves connected with the delivery pipe, i, and waste water pipe, g. The delivery valves, h and l, are automatic in action and the waste water valves are controlled by being supported on a balanced beam, j, so that they are alternately opened and closed, producing the well known hydraulic ram action.—J. W. H.



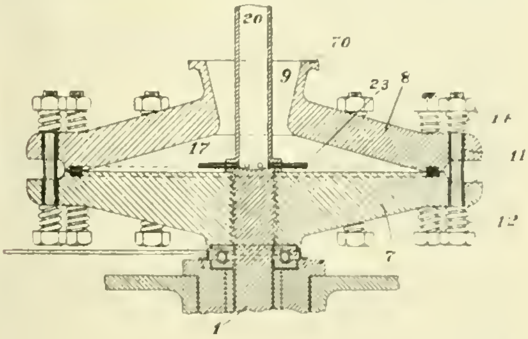
Pump driven by means of compressed or rarefied gas. O. Rodke, Stocksund, Sweden. U.S. Pat. 947,533, Jan. 25, 1910.

The claim is for a pump having liquid pistons and valves worked by compressed or rarefied gas. The reservoir, 3, is charged with liquid up to the top of the pipe, 4, some of the liquid overflowing into the vessel, 1, and sealing the lower end of the pipe, 9. On admitting compressed gas through 2, into the chamber, 1, the liquid in 3, is driven up the pipes, 5, into the chambers, 6, and also up the pipe, 11. At the same time the liquid in the chamber, 1, is forced up the pipe, 9, until the pressure is sufficient to force it out of the upper end of the pipe into the enlargement, 10, of the pipe, 11. The chamber, 1, is then in communication with the air through 10, and the pressure falls, with the result that the liquid in 6, 5, and 11, sinks again into 3, and overflows again at 4, sealing the pipe, 9, once more. These operations are repeated so long as compressed gas is supplied, and the liquid driven up into the chambers, 6, acts as a liquid piston. When it sinks, gas enters through the inlet valves, 8, and when it rises, the gas is expelled through the outlet valves, 7.—W. H. C.



Separator; Centrifugal ——. W. R. Macklind, Mineral Point, Mo. U.S. Pat. 949,488, Feb. 15, 1910.

The separator chamber is formed of two plates, one, 7, having a flat upper surface and the other, 8, having a concave lower surface. They are held together by bolts, 11, provided with springs, 12, 14, which keep the edges of the plates in contact. The two plates are rotated by the shaft, 1, to which the lower one is attached. The material to be separated is fed into the central pipe, 20, and is discharged through the radial pipes, 23, into the chamber, 17. The solids are driven by the centrifugal force to the periphery of the chamber where they take a wedge-shaped form and gradually force the plates apart against the action of the springs, so that the outer solid portion is extruded between the edges of the plates. The liquid portion collects in the central part of the chamber, 17, and passes up the funnel-shaped opening, 9, and over the lip, 70.—W. H. C.



Distilling-column. E. Bolton, Milwaukee, Wis. U.S. Pat. 955,127, April 19, 1910.

The upper part of the column above a set of heat-absorbing and radiating frames is provided with a set of superposed continuous coils through which a cooling fluid is circulated, and which acts as a constant-temperature still-head. Alternate coils are connected at the outside with the fluid supply main, and at the centre with a common exhaust main. The intermediate coils are connected at the centre with the supply and at the outside with the exhaust mains.—W. H. C.

Refrigeration; Method of ——. W. Cooper, Assignor to General Refrigerating Co., Pittsburg, Pa. U.S. Pat. 955,582, April 19, 1910.

The claim is for the method of refrigeration which consists in intermittently and alternately distilling and absorbing a refrigerating agent. The vapours are condensed and then expanded or evaporated in the refrigerating chamber. The expansion chamber is kept full of liquid during both the distillation and absorption periods. The rate of absorption is controlled by regulating the temperature of the absorbing liquid.—W. H. C.

Dissociating and removing vapour from aqueous liquids. W. T. Hoofnagle, Ridgewood, N.J. U.S. Pat. 956,097, April 26, 1910.

The liquid to be decomposed is submitted in a rarefied state in a vacuum chamber to the action of a diffused or non-disruptive electrical field. The products of decomposition are removed as fast as they are generated. —W. H. C.

Reversing-furnace; Regenerative ——. L. L. Knox, Ben Avon, Pa., Assignor to Keystone Furnace Construction Co., Pittsburg, Pa. U.S. Pat. 956,367, April 26, 1910.

The claim is for the provision of a wall or arch of refractory material separating the gas and air ports. A hollow, water-cooled box is embedded in the arch and is provided with projections which partially support the refractory material.—W. H. C.

Cooling or drying apparatus. W. G. Schröder, Lübeck, Germany. Eng. Pat. 23,552, Oct. 14, 1909. Under Int. Conv., Oct. 15, 1908.

See Fr. Pat. 408,032; this J., 1910, 614.—J. W. H.

Cooling apparatus for fluid or semi-fluid substances. E. Schou, London. U.S. Pat. 957,629, May 10, 1910.

See Eng. Pat. 1160 of 1909; this J., 1909, 1048.—T. F. B.

Filtering or straining water or other liquids or fluids; Apparatus for ——. E. Gobbi, Asnieres, France. Eng. Pat. 30,303, December 28, 1909. Under Int. Conv., April 19, 1909.

See Addition of April 19, 1909, to Fr. Pat. 359,128 of 1905; this J., 1909, 1220.—T. F. B.

Filter-press. Maschinenfabrik F. Weigel Nachf. A.-G. Fr. Pat. 409,377, Nov. 18, 1909.

See Eng. Pat. 21,660 of 1909; this J., 1910, 545.—T. F. B.

Vacuum-pan. G. S. Baker, London. U.S. Pat. 956,508, May 3, 1910.

See Fr. Pat. 392,948 of 1908; this J., 1909, 103.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coke ovens; Utilisation of by-product gases from ——. H. M. Payne. Eng. and Min. J., 1910, **89**, 927—928.

At Gelsenkirchen, Germany, where a very complete coke-oven by-product plant is in operation, the company daily supply, in addition to the ordinary by-products, over 21 million cb. ft. of illuminating gas to the district at about 11½d. per 1000 cb. ft., and realise on this item a profit of about £75 per day. The tar, which amounts to about 7½ lb. per ton of coal, is used in various forms, as a binding material for briquetting coal slack, as a coating for prepared roofing, and when mixed with furnace slag, for road-making. The products of its distillation also yield carbolic acid, anthracene, toluene, creosote, naphthalene, and benzol. The benzol is chiefly used in Germany in combination with denatured alcohol as a fuel for haulage motors, the waste gases from the combustion of benzol alone being objectionable and dangerous. The motors weigh from 2 to 5 tons, develop 8 to 18 h.p. and cost from £350 to £425. It is said that the cost of running is 1¼–2d. per ton mile compared with 6d. under the same conditions with horses. The best by-product benzol (65 per cent. benzol refined to 90 per cent.) sells at about 8½d. per gall. and costs about 4d. per gall. to produce. A ton of coal yields about 3 to 3½ gallons of 65 per cent. benzol and about 25 lb. of high grade "sal ammoniac."—F. R.

Town gas-supply from coke-oven installations. Förster. J. Gasbeleucht., 1910, **53**, 385—389.

In coke-oven plant working with recovery of by-products, the gas obtained is of the same calorific value as ordinary illuminating gas during the first 10 hours after charging. In the Rhineland-Westphalia district, the coke-oven installations, after meeting their own requirements, could supply more than enough rich gas for the whole of the towns in the Rhine province. The problem of long distance transmission of gas under high-pressure has been solved in England and in America, and some of the details of this method of transmission and distribution are discussed. Körting called attention to the large number of consumers in great cities, for example it is estimated that in England there are 20—30 gas meters per 100 inhabitants. This points to the need of an absolutely reliable supply of gas. Further, unless placed in competition with local gas supplies, the price of coke-oven gas would be raised. In his opinion, it was cheaper to bring coal to Berlin for gas-making, because the gas-works are producers of coke, tar and ammonia for a local market.—A. T. L.

Coal gas; Progress in the manufacture and use of ——. H. Bunte. Chem.-Zeit., 1910, **34**, 531—532.

The annual consumption of coal gas in Germany has doubled during the last 10 years and is now about 2 milliards of cb. m. In Berlin the consumption has increased from 183 million cb. m. in 1898 to 400 million cb. m. per annum, or an increase from 70 to 120 cb. m. per head. Extensive installations of mechanical transport appliances together with the new ovens of Bueb and Körting and of Ries are stated to have reduced the labour required in gas making to one-quarter. In view of the development of aerial navigation, attention is drawn to the importance of decarburising processes for the production of balloon gas and of methods for producing cheap technical hydrogen from coal-gas or water-gas. —A. Sbld.

Water-gas production in vertical furnaces; Economic aspects of ——. Debruck. J. Gasbeleucht., 1910, **53**, 409—415.

The paper deals with the disputed question as to whether it is more economical, when vertical furnaces are employed in the manufacture of coal-gas, to generate the water-gas for admixture in the retorts, or to produce it separately. The author institutes a comparison on the basis of averages of the results obtained in the gas-works of Mariendorf, Zürich, Cologne and Düsseldorf. After taking all factors into account, he calculates the following cost prices per 1000 cb. m. of mixed gas: production in 7 vertical furnaces with 10-hour charges and separate water-gas generators, M. 26.69 (26s. 2d.); production in 8½ vertical furnaces with 12-hour charges, steam being admitted for 2 hours, M. 24.07 (23s. 7·2d.). There is thus a gain of M. 2.62 (2s. 6.8d.) per 1000 cb. m. in favour of the latter process. It is pointed out that several important factors in the calculation, notably the relation which the total capacity of the plant bears to the usual output, and the charges for interest and depreciation will vary considerably in different cases.—R. V. S.

Petrol-air gas. W. Key. J. Gas Lighting, 1910, **110**, 496—498.

The author deals chiefly with the production of petrol-air gas (for illuminating purposes) in a rotary generator of his own design. In this apparatus, which is a multi-chambered, turbine arrangement, the air and petrol are completely fractionated in small volumes by violent agitation in numerous small chambers. Each portion of air thus instantly takes up the whole of the petrol vapour allocated to it, and as the whole combined products pass into a central chamber before issuing to the holder, a gas of uniform quality results. The supply of petrol is controlled by means of a pointer moving over a graduated dial, the process being practically automatic after this initial adjustment for any desired quality of gas. —W. E. F. P.

Naphtha ; Natural —— from the province of Santa Clara, Cuba. C. Richardson and K. G. Mackenzie. Amer. J. Science, 1910, **29**, 439—446.

The authors have examined a sample of "white" naphtha found at a depth of 1560 feet in Santa Clara, Cuba. It occurs in black quartz and green serpentine in association with water and an emulsion of oil, water and rhyolitic clay. It consists of a mixture of paraffins and naphthenes, and is practically free from unsaturated hydrocarbons. The sample was pale yellow in colour, and on standing for a long time yielded a light brown sediment. It had a sp. gr. of 0·732 at 15·6° C., gave N_D 25° = —1·4092, and yielded the following fractions on distillation: Below 75° C., 3·5; 75° to 100° C., 18·9; 100° to 125° C., 51·3; 125° to 150° C., 18·4; 150° to 160° C., 1·2; and residue, 2·1 per cent. by weight. In the authors' opinion its formation was due to the upward filtration of a heavy petroleum oil through a clay stratum, and partial liberation of the naphtha in the upper part of the stratum by saline waters, whilst the remainder of the oil in the clay formed an emulsion with water.—C. A. M.

Petroleum or its products ; Determination of the origin of a ——. N. Chercheffsky. Comptes rend., 1910, **150**, 1338—1341.

The sample is fractionated into one-twentieth parts by vol.), and the following determinations are made with the distillates (below 300° C.):—(1). Sp. gr. at 15° C. (2). Boiling point, *i.e.*, the mean of the temperatures between which the fraction distils. The curve representing the density as a function of the boiling point is characteristic and is called the "curve of origin." (3). Refractive index: this is proportional to the density, hence the curve representing the refraction as a function of the boiling point is also characteristic. (4). Solubility index. The solubility is determined by the method of Riche and Halphen (this J., 1895, 191, 313), but using a definite volume (25 c.c.) and calculating the result to 100 c.c. (5). Critical temperature of solution: equal volumes of the product and of 96·5 per cent. ethyl alcohol are heated in a sealed tube until the mixture just becomes clear, and the temperature is noted at which the liquid becomes turbid on cooling. (6). Temperature of turbidity: equal volumes of the product and of acetic anhydride are heated in an open tube until the mixture just becomes clear, and the temperature is noted at which the liquid becomes turbid on cooling. (7). Iodine value: this affords an indication of the content of unsaturated hydrocarbons. By the aid of tables, of which a complete set is to be published, the origin of a given sample can, it is stated, be readily ascertained by means of the data mentioned. Some results obtained (mean values of a large number of samples) are given in the following table :—

Origin.	I. Distinctive characters as functions of densities.						II. Densities and indices of refraction at 15° C. as functions of boiling points.		
			Indices of :		Temperatures :				
	Density at 15° C.	Boiling point °C.	refraction at 15° C.	solubility.	critical, of solution, °C.	of turbidity, °C.	Boiling point, °C.	Density at 15° C.	Refractive index at 15° C.
American	0·780	191	1·4345	93	50	78·5	150	0·754	1·4203
„	0·800	227	1·4453	117	68·5	91	200	0·785	1·4372
„	0·820	266	1·4564	154	87	104·5	250	0·811	1·4515
Russian	0·780	158·5	1·4309	75	36	66	150	0·775	1·4282
„	0·800	182	1·4419	85	47·5	72	200	0·812	1·4488
„	0·820	219·5	1·4533	92	60	79·5	250	0·8425	1·4670
Roumanian	0·780	153	1·4334	73	clear at ordinary temperature.	53	150	0·7785	1·4324
„	0·800	179	1·4458	79·5	30	57	200	0·814	1·4538
„	0·820	207·5	1·4572	90·5	42	63·5	250	0·861	1·4799
Galician	0·780	166	1·4356	74	31	60	150	0·7665	1·4278
„	0·800	202	1·4466	94	53	75·5	200	0·799	1·4460
„	0·820	242	1·4586	125·5	72·5	89·5	250	0·824	1·4610
Shale	0·780	167·5	1·4373	74	31	54·5	150	0·766	1·4302
„	0·800	198	1·4469	92·5	42·5	63	200	0·801	1·4474
„	0·820	227·5	1·4568	109	54	71	250	0·835	1·4883

The iodine value of refined American petroleum containing products of dissociation (cracking) varies from 20 to 25; that of shale products ranges from 75 to 100 for light spirit and from 65 to 75 for lamp oils; and that of normal petroleum products ranges from 0 to 7. In the case of lubricating oils the following results have been obtained :—

	Russian spindle oil.	American. cylinder oil.
Density at 15° C.	0·894	0·891
Refractive index at 15° C.	1·4888	1·4950
Critical temperature of solution	150° C.	194° C.
Degree of inflammability (Luchain)	198° C.	255° C.
Solidification	liquid at —15° C.	solid at 0° C.

Paraffin wax may be distinguished from ceresin by somewhat similar methods, as indicated in the following table :—

	Paraffin 3 R B (petroleum).	Paraffin 4 R (shale).	Ceresin (ozokerite).
Solidifying point (capillary tube)	52·7°	47·6°	66·9°
Refractive index at 100° C.	1·4185	1·4161	1·426
Critical temperature of solution	148°	141°	172·5°
Solubility in carbon bisulphide at 15° C. (for 100 c.c. of saturated solution)	19·07	34·65	1·97
Iodine value	0·3	0·1	0·5

—A. S.

Flash-point apparatus ; Comparative tests with English and German ——. H. F. Wiebe and P. Hebe. Petroleum, 1910, **5**, 885—889.

Four English instruments (Abel's) were measured and tested in comparison with three German (Pensky's) instruments. The deviations from the standard measurements prescribed by the English Act of 1907 and the German Act of 1882, all expressed in mm., were as follows (see table, p. 682) :—

	a. Distance from upper edge to filling mark.	b. Distance of lowest point of wick tube from under side of cover when lamp is at lowest point.	c. Distance of middle of thermometer bulb from under side of cover.
English instruments—	mm.	mm.	mm.
Permissible deviation	+2·54	+2·54	+2·54
Observed deviation	−1·4 to +0·8	+1·3 to +5·6	−2·7 to −0·3
German instruments—			
Permissible deviation	+1	±1	±1
Observed deviation	+0·5	−0·35 to +0·7	−0·1 to +0·9

In the case of the English instruments, *b* represents the length of the wick tube, and c the distance from the end of the mercury bulb. Comparative tests applied with these apparatus showed that the English instruments gave, on the average, results about 2·10° C. lower than the German instruments. Even after applying corrections for variations in the dimensions of the apparatus, the results obtained with the English instruments were still 0·93° C. lower than those given by the German instruments, and this figure must be regarded as the difference due to the type of apparatus.—C. A. M.

Petroleum ; Pyrogenic decomposition of —— in presence of catalysers. I. Ostromisslenski and J. Burshanadse. J. Russ. Phys.-Chem. Ges., 1910, **42**, 195—207. Chem. Zentr., 1910, **1**, 1711—1712.

I. *Mechanism of the formation of benzene in the pyrogenic decomposition of petroleum.* If in the formation of benzene from petroleum at high temperatures, acetylene is first produced and then polymerises to benzene, the yield of benzene should be higher when the petroleum is heated in presence of a catalyser, since it is known that the polymerisation of acetylene can be accelerated catalytically. On passing petroleum vapour through a combustion tube containing a spiral of iron wire gauze and heated to 700° C., the products contained 10·9 per cent. of benzene, as compared with 7·75 per cent. when no iron gauze was used. On using nickel instead of iron, no benzene was obtained, but considerable quantities of free hydrogen.

II. *Decomposition of hydrocarbons into carbon and hydrogen by a contact process.* A gas of very low density, suitable for filling balloons, for lighting, heating, etc., can be obtained by the catalytic decomposition of petroleum or of other hydrocarbons, *e.g.*, benzene. Nickel, nickel oxide, and oxides of manganese, at 600°—750° C., are the most effective catalysers; practically no liquid products, acetylene, ethylene, or carbon dioxide are formed; a residue of coke is left. The process may be divided into two stages: in the first, coke and gaseous products are formed; and in the second, the latter are decomposed catalytically into carbon and hydrogen. The gas obtained contains 75—80 per cent. of hydrogen.—A. S.

Asphaltum ; Methods for the examination of ——. A. Sommer. J. Ind. Eng. Chem., 1910, **2**, 181—187.

THE following methods were devised mainly for the examination of asphaltic materials intended for country roads:—*Specific gravity :* A sample of the melted asphaltum is allowed to cool in a vessel constructed in two parts. As soon as a normal temperature is reached, the lower part of the vessel, which holds exactly 10 c.c., is removed, and the sp. gr. determined either by direct weighing or by suspending the lower cup from a special hydrometer in water at 15·5° C. *Asphaltum :* Two grms. of the asphaltum are shaken with 75 c.c. of a petroleum spirit of 86° Bé., distilling between 100° and 240° F. until disintegrated, the flask allowed to stand overnight, the supernatant liquid then decanted, and the precipitate transferred to a filter and washed with petroleum spirit. The portions of precipitate still adhering to the flask and the contents of the filter are now dissolved in benzene, the solution evaporated in a weighed basin, and the residue dried in the water oven until constant in weight. Any substances insoluble in carbon bisulphide must be deducted from the weight of "asphaltenes" thus obtained. In the case of fluxes and harder bitumen the ether-alcohol method, which precipitates the softer constituents of the asphaltum in addition to the "asphaltenes," is useful:—Two grms. of the sample are mechanically shaken for about 20 minutes in a stoppered cylinder with 40 c.c. of a mixture of alcohol and ether (4 : 3), and then allowed to stand overnight, after which the precipitate is separated, washed with alcohol-ether and dissolved in benzene as described above. *Evaporation method :* This is the method most frequently used in U.S.A. for soft bituminous products. A definite quantity of the material is evaporated at a fixed temperature in a dish of certain dimensions, and the loss, and consistency of the residue determined, usually by finding the depth in tenths of 1 mm., to which a needle weighted with 100 grms. will penetrate the material at 25° C. The standard is generally taken as 10 mm. of "100 penetration," and the amount of residue of that consistency is described as the "asphaltic contents." The author points out tha the percentages thus obtained are frequently not the rea values, since they may be due in part to substances produced by the long-continued action of heat upon asphaltogenous substances under conditions that will no occur when the materials are in actual use. Such product may be distinguished from mixtures of hard asphaltum bases with thinning agents by determining the consistency of the distillates obtained with an ordinary Engler apparatus. If, during the distillation there is a sudden rise o temperature the presence of a light thinning agent i indicated, whereas a residuum oil will distil more regularly As a rule it is sufficient to distil off about 20 per cent of the sample. A table is given showing the percentag of asphaltum obtained by various methods, and th differences of the distillates, in the case of four differen asphaltic compositions. Figures are also given to illustrat the wide variations obtained in evaporating the asphaltum under different conditions, and it is pointed out that i specifying the asphaltic contents of a material it is necessar to state the conditions, *viz* :—(1) Quantity of asphaltum evaporated. (2) Size of vessel. (3) Temperature an length of time. (4) Whether the evaporation takes plac (*a*) in a closed oven; (*b*) in the open air; and (*c*) with o without stirring. *Paraffin wax :* The methods o Zaloziecki (this J., 1888, 349) and of Holde (this J., 1897 362, 471; 1898, 803) give results that differ greatl from each other, and it is therefore necessary in all specifications fixing a limit to the amount of paraffin scale that th m. pt. of the separated wax should also be given. Th so-called "cold test" found in certain specifications i here shown like other consistency tests, to give no tru valuation by itself, of asphaltic substances. *Tar :* Th author's method consists in distilling the sample an extracting the distillate with dimethyl sulphate. Fou c.c. of the distillate from the destructive distillation of th asphaltum (to coke) are shaken for one minute in a 10 c. graduated cylinder with 6 c.c. of dimethyl sulphat When solution is not complete, separation of the insolubl portion takes place in a few minutes, and the percentag may be calculated from the reading. The following resul were thus obtained:—E grade petroleum asphaltum insoluble; Bermudez asphaltum, insoluble; Cuba asphaltum, insoluble; gilsonite, insoluble; coal tar, 100 p cent. soluble; 20 per cent. of tar with 80 per cent. of aspha tum, 15 per cent. soluble; 50 per cent. of tar with 50 p cent. of asphaltum, 35 per cent. soluble; and 80 per cent of tar with 20 per cent. of asphaltum, 60 per cent. solubl *Water* may be determined by a modification of Graefe method:—50 c.c. of asphaltum are mixed with 50 c.c. of volatile petroleum distillate (*e.g.*, the commercial turpen tine oil substitute *texene*, which distils between 270° an 450° F.), and the mixture distilled, until the liquid adde has passed over. The amount of water may then be rea in a graduated receiver. *Sulphur :* About 0·2 grm. of th asphaltum is spread on a fragment of pure cotton woo which is then placed in a platinum cone suspende from a copper wire in an atmosphere of oxygen. The cotton is then ignited by means of an electric current, and after combustion of the asphaltum is complete, a solution of sodium peroxide is introduced into the flask, and the sulphur determined in the usual way.—C. A. M.

PATENTS.

Briquettes, blocks or slabs [of coal, coke, etc.]; Manufacture of ——. J. B. Ballantine and J. McWilliams, Kew, and W. E. Windsor-Richards, London. Eng. Pat. 1645, Jan. 22, 1909.

THE material to be briquetted is mixed with the agglutinant and heated to a high temperature out of contact with the air. It is then exposed to the air for a short time and pressed to the form required.—J. W. H.

Coal-dust, coal-slack, and the like; Method of semi-coking ——. C. W. Beehler, St. Louis, Mo. U.S. Pat. 955,310, April 19, 1910.

THE dust and slack are heated in a chamber or retort which is continuously rotated so that the semi-coked material is formed into balls. The balls formed in a series of retorts are taken by a conveyor to a closed vessel in which they are subjected to the action of steam jets. The gas generated in this vessel, together with that liberated during the coking process, is used for heating the retorts.
—A. T. L.

Coke ovens or the like; Burners of ——. F. W. C. Schniewind, New York. Eng. Pat. 10,482, May 3, 1909.

THE heating flues in a coke oven are provided with a horizontal burner channel extending the length of the flue. Horizontal burner tubes carrying nozzles can be freely inserted or removed from these channels. At the end of the burner nozzles firebrick fittings are placed which fill up the spaces between the burners and regulate the supply of air to the gas burning at each nozzle.
—J. W. H.

Coking ovens, retorts or the like. F. W. C. Schniewind, New York. Eng. Pat. 10,486, May 3, 1909.

THE openings in the retorts or coking chambers of coke ovens are sealed by means of a deep rib upon the cover or door and a deep channel on the oven. The cover is lined with a block of refractory material which bears upon the coking charge and moves with it, compressing it and preventing the formation of spaces in which volatile products might accumulate.—J. W. H.

Coke-oven. W. J. Kearns, Fairchance, Pa. U.S. Pat. 956,974, May 3, 1910.

THE oven has a tunnel head provided with a feed opening, and the walls of the tunnel head are formed with an air passage which partially surrounds the opening. A "conductor" communicates with the combustion chamber at the feed opening and leads to the main flue, which is preferably situated at a lower level; the bottom wall of the conductor is provided with intersecting longitudinal and transverse air passages, which communicate with the air passage surrounding the feed opening and also with the atmosphere, but are separated from and independent of the interior of the combustion chamber and conductor, so as to permit the circulation of cold air within the passages without its coming in contact with the products of combustion. The upper wall of the conductor may consist of removable slabs, one of which may close the feed opening and another constitute a valve for controlling the passage of the products of combustion to the main flue.—F. SODN.

Gas retorts; Process of charging upright ——. E. G. B. Körting, Berlin. U.S. Pat. 955,970, April 26, 1910.

THE fine and coarse portions of the coal are separated by a screen and are fed separately in two parallel, vertical, columns into each retort.—W. H. C.

Semi-water gas; Process for the production of ——. J. E. Gower, London. Eng. Pat. 7400, Oct. 27, 1909.

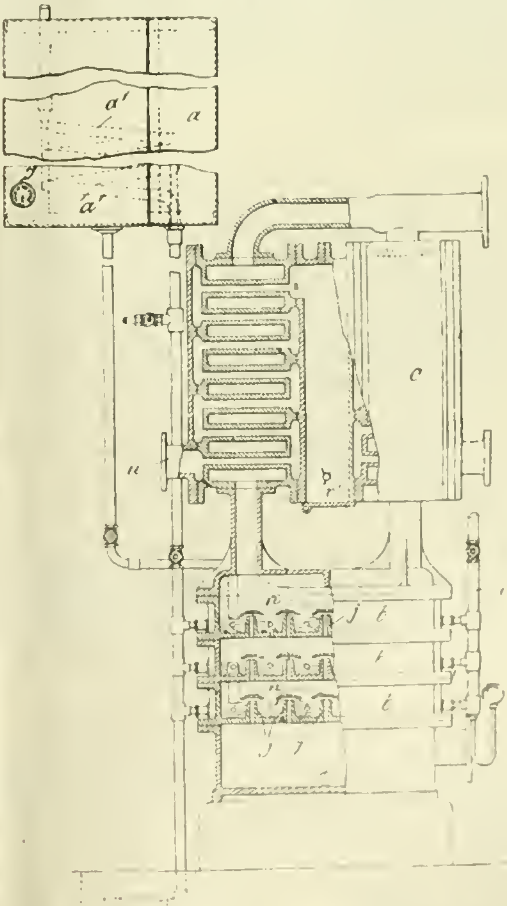
POWDERED fuel is introduced in regulated quantities into the upper part of the generating chamber and as it falls it meets with and falls through a regulated stream of heated air introduced through jets placed immediately below the fuel inlets. It is at once partially burned and converted into carbon monoxide, and the incandescent unconsumed particles of carbon as they continue to fall meet with jets of steam introduced at a lower level, whereby the remaining carbon is converted into water-gas. The lower part of the chamber is luted with a water-seal and is provided with a screw conveyor to remove the ash.—W. H. C.

Gas producer plants for either suction or pressure, preferably for use on shipboard. A. W. Withers, London. Eng. Pat. 9468, April 21, 1909.

A SELF-CONTAINED producer gas plant, particularly for use on shipboard, is designed so that the generator, vaporiser, scrubber, and washer form a single unit. The scrubber is made of annular form wholly surrounding the generator, the water tank is placed above it, and the vaporiser is formed of a series of drip plates situated in an annular space between the generator and the scrubber. Before passing into the scrubber the gas is caused to bubble through a water seal maintained at constant head by means of a float device.—H. H.

Carburetting of gas. C. B. Tully, Hythe, Kent. Eng. Pat. 13,549, June 9, 1909.

THE apparatus is particularly applicable to the carburetting of methane hydrogen gas with hydrocarbons evolved from tar. The tar is supplied from a dehydrating tank, a, and passes in a circuitous course through a number of



trays, *b*, having projecting slits, *j*, through which the gas to be carburetted is passed. Deflectors, *n*, direct the gas over the surface of the tar. The tar is heated by steam supplied from the pipe, *u*, the exhaust steam passing to the coil, *a'*, in the dehydrating tank, *a*. The gas is fixed in the chambers, *c*, by passing it through a sinuous passage heated by gas burners, *r'*.—H. H.

Gas-generators. T. de Fontaine, Hanover, Germany. Eng. Pat. 24,611, Oct. 26, 1909.

In gas producers of the type having conical hearths and rotary clinker-pans, a blast-nozzle having a number of helical projections is mounted upon the clinker-pan, and serves to distribute the air evenly by means of air jets opening from the rear faces of the projections, and also, in conjunction with fixed helical ribs on the conical hearth, to break up the clinker and force it towards the clinker-pan. A fixed vane on the outer surface of the conical hearth serves to discharge the clinker from the rotating pan, the outer wall of which is parallel to that of the hearth and is provided with helical ribs.—H. H.

Gas-producer. G. C. Stone, New York, and R. H. Dodd, Palmerton, Pa. U.S. Pats. 955,614, and 955,615, April 19, 1910.

(1). A feeding device for ensuring a uniform distribution of fuel over the top of the fuel column comprises a number of fuel-feed tubes having their upper or charging ends arranged in a ring and their lower ends distributed uniformly over the top of the fuel-column. The fuel is delivered centrally on to a conical surface which directs it outwards to the ring of charging orifices. The device may also be used for varying the distribution if desired. (2). In a similar device to that described above, the fuel is delivered on to the conical spreader from a rotating hopper, and the spreader is provided with ribs or guides, so that the fuel is delivered to each of the charging orifices in turn.—A. T. L.

Gas; Method and apparatus for producing ——, and gas producer. E. E. Slick, Pittsburg, Pa. U.S. Pats. 957,006 and 957,007, May 3, 1910.

(1). In a gas producer one layer of the charge is moved transversely while gas is being produced. Pushers or a movable horizontal section of the producer are actuated mechanically to give this effect. (2). The lower portion of the shell of a gas producer is arranged to swing or move relative to the rest of the producer, while working. The joint between the two parts of the producer is made by means of a water seal.—J. W. H.

Gas-purifying material; Process for the revivification of spent —— in the purifier. W. Oppermann. Ger. Pat. 220,953, Dec. 30, 1908.

The iron oxide is placed in the purifier in the known manner on a number of superposed wooden grids or trays. When the oxide is saturated with sulphur, the gas supply is cut off, the lowest tray is removed and emptied, and then replaced. The contents of the other trays are now broken up and discharged into the next lower ones, and the top tray is charged with fresh oxide. The material is now in a suitable condition to be revivified by passing a current of air through the purifier.—A. S.

Purifying apparatus for gas producers. L. Heinen. Ger. Pat. 221,856, Feb. 12, 1909.

The apparatus consists of a series of pipes connected together alternately at either end, and in which metal brushes are arranged in spiral form. The gas, in passing through the pipes, is cleaned by the frictional and sifting action of the metal brushes.—A. S.

Internal combustion engines; Fuel for ——. Rütgerswerke-Akt.-Ges. Ger. Pat. 221,469, Oct. 18, 1906.

Hydrocarbons which alone are only suitable for use in engines with high compression, are rendered suitable for engines in which compression can only be effected up to 5 atmospheres, by mixing them with 1 per cent. of a substance such as ether, carbon bisulphide, or low-boiling hydrocarbons, having a vapour pressure of at least 2000 mm. at 100° C. For example with this admixture, satisfactory results can be obtained with a tar oil having a flashing point of 51° C. (Pensky), and of which 90 per cent. distils between 160° and 260° C.—A. S.

Extinguishing burning "benzin," etc.; Process of ——. M. Breslauer, Charlottenburg, Germany, Assignor to Minimax Consolidated Ltd., London. U.S. Pat 955,316, April 19, 1910.

The process consists in the use of a liquid containing oxy-haloid compounds of sulphur, the liquid being squirted or sprayed on to the seat of the fire by means of compressed gases.—A. T. L.

Desulphurising petroleum distillates; Process of —— H. V. Walker, Brooklyn, N.Y., Assignor to The Maa and Waldstein Co., Newark, N.J. U.S. Pat. 955,372 April 19, 1910.

Petroleum distillates, gas naphtha, and similar hydrocarbon liquids are desulphurised by passing them in th form of vapour over anhydrous copper chloride, an through an alkaline lead solution.—A. T. L.

Coke; Treatment of —— for use as fuel in open furnace B. Ely and A. Rollason. Fr. Pat. 408,910, Oct. 2 1909. Under Int. Conv., Dec. 3, 1908.

See Eng. Pat. 26,121 of 1908; this J., 1909, 876.—T. F.

Methane; Process of manufacturing —— or mixtures methane and hydrogen. P. Sabatier, Toulouse, Franc U.S. Pat. 956,734, May 3, 1910.

See Eng. Pat. 27,045 of 1908; this J., 1909, 876.—T. F.

Gas from peat; Apparatus for making ——. Peat G and Coal Co. Fr. Pat. 409,263, Oct. 28, 1909.

See U.S. Pat. 938,691 of 1909; this J., 1909, 1240.—T. F. B

Retort furnaces for the manufacture of gas and for simil purposes. T. M. Thom and H. Pryor. Fr. Pat. 409,42 Nov. 11, 1909. Under Int. Conv., Nov. 12, 1908.

See Eng. Pat. 24,332 of 1908; this J., 1909, 1125.—T. F.

Carban monoxide; Process for removing —— from gas and simultaneously replacing it by hydrogen. Chen Fabr. Griesheim-Elektron. Fr. Pat. 409,506, Nov. 2 1909. Under Int. Conv., Jan. 28, 1909.

See Eng. Pat. 2523 of 1909; this J., 1909, 1116.—T. F.

Gas producers. R. V. Farnham. Fr. Pat. 409,80 Nov. 30, 1909.

See Eng. Pats. 26,199 of 1908 and 11,675 of 1909; this J 1910, 203.—T. F. B.

Obtaining sulphurous acid from acid sludge [from petrole refining]. U.S. Pat. 956,184. *See* VII.

Concentrating and purifying sludge-acid [from petroleu refining]. U.S. Pat. 956,276. *See* VII.

Erratum.—This J., April 30, 1910, page 480, col. title of fourth abstract. The number of the first pate should be 951,272.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Distillation, carbonisation and the like of coal and other carbonaceous materials. C. W. Tozer, London. Eng. Pat. 20,158, Sept. 3, 1909.

Iron retorts capable of being charged through one end and discharged through the other, are fitted with internal longitudinal ribs to strengthen them and conduct heat to the interior of the retort. Longitudinal cores may also be provided through which the heating gases are conducted.—H. H.

Electrical conductor for illuminating purposes. I. Ladoff, Schenectady, N.Y., Assignor to P. C. Peck, New York, and A. M. Ladoff, Schenectady, N.Y. U.S. Pat. 955,273, April 19, 1910.

An arc light electrode composed of silicon and a more conductive metal such as iron.—A. T. L.

Plastic mass [for filaments] from compound of tungsten, etc.; Method of making a ——. H. Kreusler, Wilmersdorf, Assignor to Siemens und Halske, A.-G., Berlin. U.S. Pat. 956,979, May 3, 1910.

See Fr. Pat. 378,743 of 1907; this J., 1907, 1192.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Perchloric acid as a reagent in organic chemistry. Hofmann and others. *See* XXIII.

Patent.

Anthracene compounds; Production of new ——. Badische Anilin und Soda Fabrik. Third Addition, dated Nov. 18, 1909, to Fr. Pat. 357,239, Aug. 25, 1905. Under Int. Conv., Feb. 12, 1909.

See Ger. Pat. 218,162 of 1909; this J., 1910, 482.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Thioindigo; The oxidation products of ——. N. Danaila. Bull. Soc. Chim., 1910, 7. 359—361.

The author has investigated the red oxidation products obtained by the action of 97 per cent. nitric acid on thioindigo. By suspending the material in glacial acetic acid, the quantity of nitric acid required may be reduced, and the oxidation proceeds more rapidly. Three products, all of a red colour, were isolated, representing the addition of one, two and three atoms of oxygen respectively to the thioindigo molecule. They are all soluble in hot nitrobenzene and only sparingly soluble in other solvents. They are reduced to colourless products by hydrosulphite or by zinc and acetic acid; their properties are analogous to those of thioindigo. They are crystalline bodies: $C_{16}H_8S_2O_3$, m. pt. 325° C.; $C_{16}H_8S_2O_4$, m. pt. 245° C.; $C_{16}H_8S_2O_5$, m. pt. 237° C., all undergoing decomposition at the melting points.—J. F. B.

Alkanet root, and the distribution of the colouring matter therein. E. Eriksson. Ber. deuts. Pharm. Ges. 1910, **20**, 202—208.

The paper is mainly taken up with descriptions of microscopic sections of alkanet root (*Alcanna tinctoria* Tausch, or *Anchusa tinctoria*). Diagrams of the sections are given, showing the distribution of the red colouring matter. About 5 per cent. of commercial alkannin can be extracted from the root. When freed from fat and resin, alkannin consists of two red pigments, one being coloured green, the other blue, by the action of alkalis. According to Tschirch red crystals have been observed in spaces in the cortex of old specimens of alkanet root.—F. Shdn.

Comparative examination of different pigment colours in regard to their applicability in painting, and especially as artists' colours. Täuber. *See* XIII.

Patents.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,461, May 3, 1909.

The diazo compounds of *m*- or *p*-aminobenzoic acids or of aminoanisic acid or of other phenolic ethers of 1 : 2 : 4-hydroxyaminobenzoic acid are combined in alkaline solution with acidyl-1-amino-8-naphtholsulphonic acids. The new dyestuffs, when dyed on chrome mordants on cotton, or when printed with chrome mordants give very clear pure red shades which are very fast to chlorine and are intended as a substitute for Alizarin Red. An example illustrates the production of the dyestuff from diazotised *m*-aminobenzoic acid and 1-acetylamino-8-naphthol-3 : 6-disulphonic acid.—J. C. C.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,462, May 3, 1909.

Dyestuffs similar to those claimed in Eng. Pat. 1397 of 1909 (this J., 1909, 1309) are obtained by combining the diazo derivatives of unsulphonated nitroamines of the benzene series, other than free nitroaminophenols, with derivatives of 2-amino-8-naphthol-6-sulphonic acids alkylated or arylated in the amino-group. The dyestuff prepared from diazotised *o*-nitroaniline and 2-phenylamino-8-naphthol-6-sulphonic acid dyes wool red-violet shades fast to milling and light, and that obtained from *p*-nitroaniline and 2-*p*-anisidylamino-8-naphthol-6-sulphonic acid dyes wool blue-black.—J. C. C.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,356, May 13, 1909.

Diazo derivatives of nitroamines of the benzene series which contain no sulphonic acid group (other than free o-aminophenols), such as the nitroanilines or their derivatives, are combined in neutral or alkaline solution with 2-alkyl-, aryl-, or alkylaryl-amino-8-naphthol-6-sulphonic acids or with derivatives thereof substituted in the 1-position, such as the 1 : 2-naphthothiazol-8-oxy-6-sulphonic acids, 1 : 2-naphthiminazol-8-oxy-6-sulphonic acids, etc. The dyestuff obtained from diazotised *o*-nitroaniline and 2-anisidylamino-8-naphthol-6-sulphonic acid dyes wool in brown shades which are fast to milling and light, and that prepared from the same diazo-compound and 2-ethylamino-8 naphthol-6-sulphonic acid dyes wool olive-brown. —J. C. C.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,086, Aug. 19, 1909. Addition to Eng. Pat. 1397 of 1909.

Dyestuffs similar to those described in the chief patent (this J., 1909. 1309) are obtained by combining in acid solution the diazotised aryl ethers of 5-nitro-2-aminophenolsulphonic acids with 2-arylamino-8-naphthol-6-sulphonic acids. The dyestuff prepared from 5-nitro-2-aminodiphenylether-4^1-sulphonic acid (obtained by nitrating an acyl derivative of 2-aminodiphenylether-4^1-sulphonic acid and eliminating the acid radical) and 2-*o*-anisidylamino-8-naphthol-6-sulphonic acid dyes wool a dark blue shade fast to milling and light. By combining the diazo-compound of 5-nitro-2-aminodiphenylethersulphonic acid (prepared by nitrating *p*-toluenesulphaminodiphenyl ether, saponifying and sulphonating the nitro-compound thus obtained with concentrated sulphuric acid) with 2-phenylamino-8-naphthol-6-sulphonic acid, a dyestuff is obtained which dyes wool blue-black.—J. C. C.

Azo dyestuffs and their intermediate products ; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated Nov. 22, 1909, to Fr. Pat. 402,546, April 30, 1909. Under Int. Conv., Feb. 27, 1909.

DYESTUFFS possessing the same properties as those described in the chief patent and the first addition (this J., 1909, 1191 ; 1910, 81) are obtained by employing sulphonic acids of aminodiphenyl ethers instead of the latter only. Example : the sulphonic acid of *o*-aminodiphenyl ether is diazotised and combined with 1 : 8-aminonaphthol-4-sulphonic acid (as a freshly precipitated, aqueous suspension). The intermediate product is rendered alkaline and diazotised *p*-chloro-*o*-aminophenyl ether added. The new dyestuff dyes wool from an acid bath in fast blue black shades.—J. C. C.

Azo dyestuffs and their intermediate products ; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 408,225, Oct. 23, 1909. Under Int. Conv., Dec. 3, 1908, and Sept. 4, 1909.

CLAIM is made for dyestuffs prepared, for example, by combining diazotised *o*-aminophenyl ether with 1-phenyl-3-methyl-5-pyrazolonesulphonic acid in alkaline solution, or by combining diazotised *p*-chloro-*o*-aminophenylethersulphonic acid with *o*-tolyl-3-methyl-5-pyrazolone. The dyestuffs produce fast yellow to orange shades on wool in an acid bath.—J. C. C.

Anthracene vat dyestuffs and their intermediate products ; Production of ——. Farbenfabr vorm. F. Bayer und Co. Fr. Pat. 409,407, Nov. 19, 1909. Under Int. Conv., April 16, 1909.

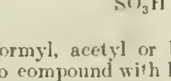
VAT dyestuffs giving fast orange to violet shades are obtained by condensing aminobenzoylaminoanthraquinones with halogenated anthraquinones, or halogenated benzoylaminoanthraquinones with aminoanthraquinones, or aminobenzoylaminoanthraquinones with halogenated benzoylaminoanthraquinones. Example : A mixture of 30 kilos. of 1-monobenzoylamino-4-aminoanthraquinone, 20 kilos. of 2-chloroanthraquinone, 1 kilo. of cupric chloride, 30 kilos. of anhydrous sodium acetate, and 300 kilos. of nitrobenzene is boiled. The dyestuff is precipitated by adding benzene, and is collected, washed with benzene, and dried. Tables are given showing the properties of this and other similar dyestuffs.—J. C. C.

Vat [anthracene] dyestuffs ; Process for preparing —— containing nitrogen. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 220,580, March 6, 1909.

THE product obtained by the action of dehydrating agents on 2.2^1-dimethyl-1.1^1-dianthraquinonyl, is nitrated, and the nitro-group reduced to an amino-group. The resulting products dye unmordanted cotton fast violet shades from the vat.—T. F. B.

Monoazo dyestuffs for chrome mordanted wool ; Manufacture of ——. A. G. Bloxam, London. From Akt.-Ges. f. Anilinfabr., Berlin, Germany. Eng. Pat. 23,738, Oct. 16, 1909.

BY diazotising a derivative of the diaminophenolsulphonic acid of the constitution,



in which R = a formyl, acetyl or benzoyl group, and combining the diazo compound with 1-phenyl-3-methyl-5-pyrazolone in alkaline solution, dyestuffs are obtained which dye wool from an acid bath in combination with a chrome mordant in deep red shades which are fast to light. An example illustrates the use of the acetyl derivative of the above acid. —J. C. C.

Azo dyestuff ; Red —— and process of making same. W. Herzberg and M. Ronus, Assignors to Akt.-Ges. f. Anilinfabr., Berlin, Germany. U.S. Pat. 954,960, April 12, 1910.

CLAIM is made for the dyestuff obtained by combining diazotised 1-amino-2-methyl-4-nitrobenzene with β-naphthol. It is a brilliant red powder and is especially adapted for the manufacture of lakes.—J. C. C.

Trisazo dyestuffs dyeing cotton direct ; Production of ——. Akt.-Ges. f. Anilinfabr. Fr. Pat. 409,376, Nov. 18, 1909.

TRISAZO dyestuffs are prepared, for example, as follows :— 4-nitro-1-naphthylamine-6 (or -7)sulphonic acid is diazotised and combined in acid solution with *m*-amino-*p*-cresol methyl ether. The resulting aminoazo compound is filtered off, diazotised, and combined with 1-naphthol-4-sulphonic acid in alkaline solution. The temperature of the mass is now raised to 60°—70° C. and the nitro-group is reduced by the addition of a solution of sodium sulphide. When the process is finished, the product is salted out, collected and dissolved in water : it is then diazotised and combined with 1-naphthol-4-sulphonic acid. The dyestuff produced dyes cotton in clear blue shades which are remarkably fast to light.—J. C. C.

Dichlorodibromoindigo, and process of making same. P. Julius, V. Villiger, and P. Nawiasky, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. U.S. Pat. 957,683, May 10, 1910.

A SYMMETRICAL dichlorodibromoindigo, in which the halogen atoms are in the positions, 4 : 4′ : 5 : 5′, is prepared by hydrolysing and oxidising an ester of the corresponding chlorobromoindoxylcarboxylic acid. It is a greenish blue powder which dyes cotton in very green shades of blue.—J. C. C.

Anthracene series ; Production of a blue dyestuff of the ——. Badische Anilin und Soda Fabrik. Fr. Pat. 409,381, Nov. 18, 1909. Under Int. Conv., Dec. 12, 1908 ; Feb. 17, and Aug. 27, 1909.

THE sulphonic acid of Indanthrene Blue, described in the first addition of July 10, 1901, to Fr. Pat. 309,503 (this J., 1902, 111 is probably a disulphonic acid. A new acid, probably a monosulphonic acid, is obtained by sulphonating Indanthrene Blue with moderate sulphonating agents such as sulphuric acid monohydrate or concentrated sulphuric acid in the presence of boric acid. Similarly the hydroxylated Indanthrenes furnish corresponding sulphonic acids. If the sulphonic acid group is eliminated, a new dyestuff is obtained which dyes cotton in greener shades than does Indanthrene Blue itself : it can also be prepared directly from Indanthrene Blue by heating the latter with 92—95 per cent. sulphuric acid in the presence of boric acid at temperatures below the temperature of sulphonation. —J. C. C.

Indigo ; Halogen derivatives of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 409,618, Nov. 25, 1909. Under Int. Conv., Aug. 5, 1909.

THE 4 : 4′-dihalogenated Indigos are the only ones that can be smoothly converted into tri- and tetra-halogen derivatives by the action of halogens at the ordinary temperature or even below this : those substituted in the other positions can only be halogenated at a high temperature and, in the case of chlorine, this is attended with some destruction of the molecule. Example I.—A suspension of 33·1 kilos. of 4 : 4′-dichloroindigo in 200 kilos. of nitrobenzene is treated with 14 kilos. of chlorine, the whole being stirred and cooled with ice. The product is collected, washed with alcohol and dried. Example II.—A mixture of 15·6 kilos. of 4 : 4′-dichloroindigo and 400 kilos. of 93 per cent. sulphuric acid is cooled in ice and when solution has taken place, 12 kilos. of bromine are added. The mixture is stirred for 2 hours while being cooled and then left for some time at the ordinary temperature. The new dyestuffs give bright greenish blue shades which do not alter in artificial light.—J. C. C.

Vat dyestuffs; Production of ——. Farwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Nov. 15, 1909, to Fr. Pat. 390,484, July 29, 1907. Under Int. Conv., Dec., 24, 1908.

Instead of the diaminothioindigos mentioned in the chief patent (this J., 1908, 1148) the products obtained by condensing 6- (or 5-)amino-3-oxy-1-thionaphthene (or *m*- or *p*-amino-oxythionaphthene) with isatin or its substitution products or analogues, or with the anilides of isatin containing the anilido-group in the α-position, may be halogenated in a similar manner: the acetyl derivatives of these condensation products may also be used.—J. C. C.

Acenaphthene-quinone; Manufacture of reduction products of —— and of leuco compounds of vat dyeing colouring matters. G. W. Johnson, London. From Kalle und Co., Biebrich on Rhine, Germany. Eng. Pat. 21,579, Sept. 21, 1909.

See Fr. Pat. 407,225 of 1909; this J., 1910, 482.—T. F. B.

Azo colouring matters and pigment colours derived therefrom; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 23,532, Oct. 14, 1909.

See Fr. Pat. 407,903 of 1909; this J., 1910, 621.—T. F. B.

Vat [anthracene] dyes. J. Deinet, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 957,039, 957,040, 957,041, 957,042, and 957,146, May 3, 1910.

See Fr. Pat. 400,653 of 1909; this J., 1909, 1029.—T. F. B.

Vat [anthracene] dye. P. Thomaschewski, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 957,125, May 3, 1910.

See Fr. Pat. 400,653 of 1909; this J., 1909, 1029.—T. F. B.

[Anthracene] dyestuffs; Production of blue ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 409,911, Dec. 3, 1909. Under Int. Conv., Dec. 7, 1908.

See Ger. Pat. 216,773 of 1908; this J., 1910, 207.—T. F. B.

Azo colouring matters; Process for producing new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 407,692, Oct. 7, 1909. Under Int. Conv., Oct. 31, 1908.

See U.S. Pats. 953,033, 953,034, and 953,035 of 1910; this J., 1910, 554.—T. F. B.

Pentabromo-indigo; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Feb. 8, 1909, to Fr. Pat. 392,638, June 29, 1908.

See Eng. Pat. 3019 of 1909; this J., 1910, 342.—T. F. B.

Hexabromo-indigo; Process of making greenish-blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 409,038, Feb. 5, 1909.

See Eng. Pat. 2609 of 1909; this J., 1909, 1245.—T. F. B.

Anthracene derivatives [anthrathiazoles]; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 408,967, Nov. 11, 1909. Under Int. Conv., Nov. 17 and Dec. 1, 1908.

See Ger. Pats. 216,308 and 217,688 of 1908; this J., 1910, 14, and 342.—T. F. B.

Indigo sulphides; Process for preparing halogenated ——. L. Cassella und Co. Fr. Pat. 409,037, Feb. 5, 1909.

See U.S. Pat. 920,156 of 1909; this J., 1909, 595.—T. F. B.

Gallocyanine derivatives; Production of new ——. Manufacture des Mat. Col., ancien. L. Durand, Huguenin, et Cie. Fr. Pat. 409,302, Nov. 6, 1909. Under Int. Conv., Oct. 18, 1909.

See Eng. Pat. 25,752 of 1909; this J., 1910, 413.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Proteins; Products of partial hydrolysis of ——. Preparation of d-alanyl-glycine [from silk waste]. E. Abderhalden. Z. physiol. Chem., 1910, 65, 417—419. (See also this J., 1910, 146, 415.)

In the manufacture of silk-peptone, the formation of as much as 8 per cent. of *d*-alanyl-glycine, in a nearly pure condition, has been observed. In order to prepare this dipeptide, 100 grms. of silk-waste are treated with 300 grms. of 70 per cent. sulphuric acid at a temperature of 0° C. with constant stirring. Solution is complete after about 2 hours, and the liquid is allowed to remain for 4 days at a temperature of 26° C. It is then diluted to 10 litres with ice and water, and the sulphuric acid is removed by means of the calculated quantity of pure barium hydroxide. The solution is filtered and concentrated to a small bulk under reduced pressure at a temperature of 40° C. The pale yellow residue is boiled with methyl alcohol, and the insoluble matter, after standing for some hours, is removed by filtration. The filtrate is again evaporated to dryness and the residue is dissolved in a minimum quantity of water at 60° C. The solution is tested with absolute alcohol in order to ascertain how much may be added without producing a distinct precipitate. This quantity of alcohol is then added to the main solution, and crystallisation is induced by rubbing the side of the vessel with a glass rod and sowing a few crystals of *d*-alanyl-glycine. In satisfactory cases the dipeptide crystallises after 24 hours. The crystals are drained, washed with alcohol and ether, and dissolved in hot water. The pure dipeptide melts at about 235° C. (corr.) and shows $[\alpha]_D = +48 \cdot 45°$.—J. F. B.

Proteins [from silks]; Study of the products of partial hydrolysis of ——. E. Abderhalden and A. Suwa. Z. physiol. Chem., 1910, 66, 13—18.

Abderhalden (this J., 1910, 414, etc.) has studied the products of the total hydrolysis of several varieties of silk in order to ascertain whether all yield the same mono-amino-acids in approximately the same proportions. It has been shown that in all cases the same amino-acids are indeed obtained, but, as regards the proportions of the ultimate products, the various silks arrange themselves in definite groups. Some varieties, *e.g.* Italian raw silk, yield large proportions of glycocoll, alanine and tyrosine, whilst from silks of the type of wild silks and tussah silks, the yield of glycocoll is considerably lower. The investigation has now been extended in order to ascertain whether those proteins which yield the same products in similar proportions on total hydrolysis, also yield similar products on partial hydrolysis. For this purpose the silks were dissolved in fuming hydrochloric acid and digested at the ordinary temperature for several days. From degummed Canton silk there were isolated glycyl-*d*-alanine anhydride and glycyl-*l*-tyrosine anhydride. From New-Chwang silk and Indian tussah, *d*-alanine anhydride and glycyl-*d*-alanine anhydride were isolated. It was noted that silks of the tussah type always yielded large quantities of *d*-alanine anhydride, whereas this body was never obtained from silks of the Italian and Canton type. Unfortunately the mixed anhydrides afford no information as to the structure of the dipeptides from which they are derived, and this question can only be solved by the direct isolation of the dipeptides themselves. The authors find, however, that mixed anhydrides do not appear to be formed by a secondary combination of the esters of two amino-acids when mixtures of these are allowed to crystallise slowly.
—J. F. B.

"Glanzstoff" artificial silk. E. Berl. Chem.-Zeit., 1910, 34, 532—533.

The author has investigated the formation and properties of cuprammonium-cellulose. Only ammoniacal solutions of copper hydroxide or of basic copper salts dissolve cellulose; ammoniacal solutions of crystalloid copper-tetramine sulphate, $Cu(NH_3)_4SO_4$, do not dissolve it.

The viscosity of cuprammonium-cellulose depends on the previous preparation of the cellulose, the quantity dissolved, and the age of the solution. The solution greedily absorbs oxygen, oxycellulose of little value for spinning, being formed. On dialysing cuprammonium-cellulose in ammonia, a jelly is obtained, which on drying *in vacuo* over sulphuric acid, gives a blue powder, soluble in ammonia, and containing 69·5 per cent. of cellulose and 30·5 per cent. of copper hydroxide. A greenish blue powder soluble in ammonia and containing 62 per cent. of cellulose is obtained by precipitating cuprammonium-cellulose with formaldehyde. Alcohol precipitates a mixture of cellulose and black copper oxide, which is no longer soluble in ammonia. The formation of cuprammonium-cellulose is stated to be a colloidal phenomenon, the colloidal portion of the cuprammonium hydroxide joining the cellulose to form an adsorption product soluble in ammonia; this explains the various reactions and the want of stoichiometric ratios between the copper and cellulose on solution and precipitation.—A. SBLD.

Sulphite wood pulp industry; Roasting pyrites and purification of the gases in the ——. A. Frohberg. Wochenbl. Papierfab., 1910, **41**, 1602—1606.

IN the roasting of pyrites the main object is the preparation of a gas containing 14 per cent. of sulphur dioxide and not more than 1 per cent. of excess oxygen; the purification of the gases from dust, etc. is a separate problem. The decomposition of pyrites into ferrous sulphide and sulphur begins at a comparatively low temperature (about 248° C.), but is only complete at a very much higher temperature. Sulphur vapour is resolved into simple molecules at a temperature of 900° C., and at the same temperature sulphur trioxide is completely dissociated into the dioxide and oxygen. A furnace-temperature of at least 900°—1000° C. is therefore the most favourable for the preparation of rich gases, since the combustion of the sulphur vapour is then rapid and complete, and the resulting gases contain no sulphur trioxide. The roasting of pyrites takes place in two stages: in the first, sulphur is distilled and burnt; in the second, the ferrous sulphide is converted into ferric oxide. In the intermittent type of furnace it is impossible to obtain gases rich in sulphur dioxide during the latter stage; hence the mechanical furnace, in which both stages proceed simultaneously, is essential. Every means must be adopted to obtain as high a temperature of combustion as possible, *e.g.*, drying the pyrites, lagging the furnace, preliminary heating of the pyrites to 250° C., heating and drying the air, and a large surface of combustion. The chamber in which the sulphur is volatilised should be as large as possible. The principle of the rotary furnace presents many attractions, and it should be possible to devise some means whereby this furnace may be used without causing an excessive amount of dust. For the purification of the gases from dust and sublimed impurities, the wet process is most suitable. The best system is the centrifugal system, adopted in Theisen's apparatus as applied to blast-furnace gases. The gas should first be cooled to 90°—100° C. by means of water-sprays. It is then introduced into a conical drum with spiral channels on its walls, through which a stream of water flows in the opposite direction. The gas is agitated by means of an internal cylinder with fanning blades. The suspended particles are thrown outwards against the channelled walls and are there retained by the water. The gas emerges at a temperature of 50—60° C., and the water passes through a filter and back into the apparatus.—J. F. B.

Cotton cellulose; Hydrolytic fission of ——. C. G. Schwalbe and W. Schulz. Ber., 1910, **43**, 913—917.

THE authors propose to make a systematic and comparative re-investigation of the processes and products of the hydrolytic fission of celluloses of various origins. They have begun with the action of sulphuric acid on cotton cellulose, and have studied the group of colloidal modified celluloses produced by the action of the relatively concentrated acid:—"vegetable parchment," Flechsig's "amyloid," Guignet's "soluble cellulose," Ekström's "acid cellulose." These forms of modified cellulos differ among themselves in the details of the main reaction of the type, *e.g.*, stability on heating, solubility in 10 pe cent. sodium hydroxide, staining with iodine in presenc or absence of sulphuric acid, cupric-reducing value, an tendency to further hydrolysis on boiling with dilut sulphuric acid. Guignet's "soluble cellulose" differ from the other members of the group in its remarkabl resistance to further hydrolysis by the dilute acid; i appears readily to undergo reversion, and its "coppe value" is actually reduced by boiling with dilute acid In repeating Flechsig's work on the total hydrolysis c cellulose by the prolonged action (21 hours) of 69 per cent sulphuric acid on cotton, the authors neutralised th solution with sodium hydroxide and boiled it directl with Fehling's solution. The "copper values" so dete mined were relatively low, and very much higher valu were obtained from the same solutions by neutralisin with barium carbonate. By prolonging the time of actio of the sulphuric acid, it was possible to recover 20 per cent of dextrose, either by crystallisation or as osazone. I one case, following Ekström's prescription, and subs quently heating in the autoclave, 44 per cent. of dextros was recovered. It is strange that the highest yield sugar was obtained from a solution possessing a relativel low cupric-reducing value, although when barium ca bonate was used for neutralisation this was considerabl increased. It is suggested that in these reactions two kin of result may happen:—(1) The cupric-reducing pow is high, but the sugar cannot be isolated, owing eith to the anti-crystallising tendency of the by-produc (dextrins) or to the fact that but little sugar is prese and hydrolysis is incomplete; or (2), the cupric-reducir power is low and the yield of sugar is high. In the fir case, the deficiency of sugar is permanent and cann be remedied by continuing the hydrolysis; in the secon case the sugar appears to form a loose compound with th by-products, in which its cupric-reducing power is partial suppressed. The authors have verified this synthetical by preparing mixtures of dextrose and Guignet's "solub cellulose," the cupric-reducing powers of these mixtur being abnormally decreased.—J. F. B.

Cellulose; The saccharification of ——. H. Ost ar L. Wilkening. Chem.-Zeit., 1910, **34**, 461—462.

THE authors have re-investigated the question of the tot hydrolysis of cotton cellulose by sulphuric acid, and th experiments lead them to conclude that Flechsig's clai (Z. physiol. Chem., 1882, **7**, 913), that 98 per cent. of t cellulose may be converted into dextrose, is justifi Starting on the lines laid down by Simonsen (this 1898, 365,481, 1164), they recognised that quantitati yields could not be expected by methods depending hydrolysis by dilute acid at high temperatures in t autoclave. Thus, from a 5 per cent. solution of dextr only 30 per cent. could be recovered after heating f 1½ hours at 145° C. with 2 per cent. sulphuric acid, t major portion of the sugar being destroyed, either reverse condensation (isomaltose) or by conversion in acids. 4·718 grms. of dry cotton cellulose were heat six times in succession with 1 per cent. sulphuric acid 150° C. for 2 hours. The united extracts showed a dextr value (cupric-reduction) equivalent to 44·3 per cent. the cellulose. The dark-coloured residue (2·18 grm when dissolved in stronger acid and hydrolysed, yield a further 42·7 per cent. of apparent dextrose, calculat on the cellulose. The authors have succeeded in effecti a practically complete saccharification of cellulose following Flechsig's procedure. Out of the many var tions of conditions cited in the paper, the following m be selected as an illustration of one yielding the b results:—5 grms. of cellulose were dissolved in 50 c.c. 72 per cent. sulphuric acid, and after 3 hours at the or nary temperature, the solution was diluted until it contair 3 per cent. of sulphuric acid and 0·25 per cent. of cellul products. The clear liquid thus obtained was digest in the autoclave for 2 hours at 110° C. The cupr reducing power of the solution was determined with previous neutralisation, and showed a dextrose value 100·4 per cent. on the cellulose. There were also pres organic acids, yielding soluble barium salts, equivalent to 1·3 per cent. (as sulphuric acid) of the cellulose. The specific rotatory power of the dissolved organic solids, estimated by gravity, was $[\alpha]_D = +44 \cdot 8°$, and 1 grm. of these solids yielded 1·15 grms. of dextrosazone. In several cases fermentation experiments were carried out with the solutions neutralised by chalk, and yields of alcohol were recorded equivalent to 80—83 per cent. of the apparent dextrose values.—J. F. B.

Cellulose; Determination of the degree of bleaching of ——. C. G. Schwalbe. Z. angew. Chem., 1910, **23**, 924—928.

The author criticises Vieweg's proposal (Papier-Zeit., 1909, **34**, 149) to measure the degree of damage suffered by cellulose in bleaching, by determining the proportion of sodium hydroxide neutralised on boiling for 15 minutes in 1 per cent. solution. It is shown that the decomposition of oxycellulose, hydrocellulose and cellulose itself by boiling alkali does not reach a final point; also mercerised cotton shows a smaller consumption of alkali than the original cellulose. Hence the author prefers the cupric-reduction method standardised by himself (this J., 1907, 548). In order to obtain useful results by this method a large number of precautions have to be taken and some special appliances are necessary. If the stirrer revolve too rapidly and part of the cellulose be exposed above the Fehling's solution during boiling, the "copper value" may be increased abnormally and the fibre become black. Further, the use of rubber stoppers and connections in conjunction with Fehling's solution increases the precipitation of copper, and a special reflux condenser, through which pass a stirrer-shaft and dropping-funnel, is described, which is fitted into the neck of the boiling-flask. The author now uses 300 c.c. of water and 100 c.c. of Fehling's solution per 3 grms. of cellulose, and boils for 15 minutes. The precipitated copper is not completely extracted by dilute nitric acid, and it is necessary to dissolve the last traces from the cellulose mass by digestion with ammonia. The precipitation of cupric hydroxide by "adsorption" is comparatively high in the case of hydrated or modified celluloses, and the "copper values" have to be corrected by a determination of this "hydrate copper value," by immersing a fresh portion of the cellulose in cold Fehling's solution for 45 minutes. Modified celluloses are particularly liable to undergo further oxidation whilst in contact with the Fehling's solution, and exposure during boiling and filtering should be avoided. These celluloses present considerable difficulty in filtration, which may be avoided by mixing them with previously treated kieselguhr. In precipitating the copper by electrolysis, complications may arise from the presence of organic matters derived from the cellulose; the solutions should therefore be evaporated to dryness and the residue ignited before the electrolytic determination. The latter is described in detail.—J. F. B.

Chloro-derivatives of ethane and ethylene. [*Solvents for cellulose acetate, fats, resins, etc.*] Clément and Rivière. *See* XX.

Paper trade of Japan. Board of Trade J., May 26, 1910 [T.R.]

The average yearly increase in the demand for foreign paper in Japan is about 15 per cent. During 1909, in spite of the general depression, the importation of practically all kinds of paper showed a marked increase. Sulphite paper, which is a substitute for common Japanese paper (Hanshi), was in such demand that the Japanese mills started making a quality similar to that which was being imported, and the local product has proved so satisfactory that two-thirds of the demand is now being manufactured in Japan. Owing to the competition of Continental news paper, the local mills, about half of whose entire production is of this grade of paper, have had to reduce their price from 5s. per ream to 4s. 9d. per ream. One of the large native paper mills will shortly put into operation four new machines, which will turn out, roughly, 4,000,000 lb. per month, and it is anticipated that this will seriously affect the importation of Continental news paper. The stringency of the money market during 1908 was probably responsible for the falling off of imports, rather than the replacement of foreign paper by the local product. The following are the figures of the total imports of paper in 1907, 1908, and 1909:—1907, £850,245; 1908, £637,953; 1909, £871,411. Stocks carried forward to 1910 are comparatively small, and should have no detrimental effect on new business.

Patents.

Fibre; Process for making a resilient ——. S. A. Flower, New York. U.S. Pat. 957,152, May 3, 1910.

The patent covers the manufacture of a resilient material, by treating vegetable fibre, *e.g.*, coir fibre, with caustic soda, neutralising in acetic acid, placing in an aniline bath, and drying the resulting product.—A. T. H.

Fibres from cuprammonium cellulose solutions; Process for preparing lustrous ——. Hanauer Kunstseidefabrik. Ger. Pat. 221,041, Sept. 6, 1908.

Cuprammonium cellulose solutions are forced through fine orifices into coagulating baths consisting of cold or warm, saturated solutions of bisulphites, *e.g.*, sodium bisulphite. The coagulating bath may be reinforced, during the process, by passing sulphur dioxide through it. The fibres are then washed with dilute acids to remove the traces of copper, then washed with water, and finally treated with sodium carbonate solution at a temperature about 70° C. The ammonia is readily recovered from the coagulating bath after the process, whilst the copper, which is chiefly present as its tetramine sulphite, can be easily removed from the fibres by washing.—T. F. B.

Water-purifying apparatus for paper and like factories. F. Schneider, Schwarzenberg, Saxony. Eng. Pat. 25,587, Nov. 5, 1909.

The plant, which is for the separation of fibres, etc., from the waste water, is of the column type. The waste water enters at the top of a central pipe, the lower end of which is widened, forming a cone which rests upon a strainer divided into sections by radial partitions. Passing through the strainer the water flows upwards, and overflows at the top of the tower into a filtering device provided with interchangeable sieves, where it is freed from any suspended matter which may have passed through the strainer.—F. M.

Pulp fibres from pigments, size, filling and other impurities; Process and apparatus for separating ——. B. W. Petsche, Yonkers, N.Y. U.S. Pats. 955,898 and 955,990, April 26, 1910.

The pulp fibres are separated from pigments, size and other impurities by passing the pulped material over a screen, whilst subjecting it to the action of streams of water. For the recovery of fibres from waste printed papers, the pulped material is agitated with an alkaline solution; and the pulp is driven over a coarse screen by streams of water acting thereon; the material passing through the coarse screen is floated on to a fine screen and is there subjected to the action of streams of water directed in such a manner as to move it over the screen. The apparatus consists of a series of screens adjustable at any angle over a series of troughs, and a series of water pipes arranged across the screens at intervals, with spraying nozzles adjustable at any angle.—J. F. B.

Spinning viscous liquids; Machine for ——. E. Elsässer. Barmen-Rittershausen, Germany. U.S. Pat. 957,460. May 10, 1910.

See Eng. Pat. 8711 of 1908; this J., 1908, 977.—T. F. B.

Fibres from solutions; Apparatus for obtaining ——. W. A. E. Crombie and F. Schubert. Fr. Pat. 409,387, Nov. 19, 1909.

See Eng. Pat. 24,922 of 1908; this J., 1910, 17.—T. F. B.

Plastic product and its manufacture. S. Morimura. Fr. Pat. 409,661. Nov. 27, 1909.

SEE Eng. Pat. 27,266 of 1909 ; this J., 1910, 557.—T. F. B.

Printed paper ; Process for removing printing ink from ——, in order to permit its re-use for making paper. Henkel und Co. Fr. Pat. 409,697, Nov. 10, 1909. Under Int. Conv., Dec. 14, 1908.

SEE Ger. Pat. 215,312 of 1908 ; this J., 1910, 18.—T. F. B.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Jute and lignocellulose textiles ; Industrial bleaching of ——. F. J. G. Beltzer. Bull. Soc. Chim., 1910, 7, 294—300, 361—367.

THE author gives a short summary of the chemical properties of the jute fibre. From the point of view of textile bleaching, the principal factor is the lignin complex, which combines with chlorine, forming products soluble in water. The formation and removal of these chlorinated products destroys the cohesion of the ultimate fibres and the textile is weakened. The guiding principle in the application of hypochlorites is therefore to avoid chlorination and to confine the action entirely to one of oxidation. For this purpose it is of the highest importance to avoid acidification of the hypochlorite solutions and to ensure a neutral or even a slightly basic reaction. The bleaching of jute by the action of nascent oxygen alone may also be effected by the use of peroxides, perborates, etc. in alkaline, neutral, or acid solutions. A satisfactory bleach liquor consists of a solution containing 5 grms. of sodium peroxide and 1 grm. of sodium sulphoricinoleate or "tetrapol" soap per litre. The latter ingredient ensures penetration and equalisation of the bleaching liquor. The cloth is run backwards and forwards between squeeze rolls in this bath at a temperature of 30°—40° C. for 2 hours. It is rinsed and steeped in a stock solution containing 1 litre of sodium bisulphite liquor and 50 grms. of oxalic acid per 10 litres for 8—10 hours at a temperature of 70°—80° C. In order to obtain better results the cloth may be subjected to two peroxide treatments, with an intermediate sour, the second peroxide bath being reserved for the first treatment of the next batch. A finishing steep in a solution of 5—10 grms. per litre of "blankit" at 20°—25° C. for 12 hours improves the colour. The cost of this process works out at 13 frcs. per 100 kilos. of cloth. The cost may be reduced by substituting a hypochlorite for the first peroxide bath. The cloth is run in a neutral or basic solution of any hypochlorite, with a little "tetrapol," at a temperature of 30°—40° C. It is then passed over, without washing, into a solution of 3 grms. per litre of sodium peroxide at the same temperature, being finished with acid bisulphite as before. A certain advantage is obtained by working with solutions prepared by electrolysis : (*a*) electrolytic hypochlorite, (*b*) electrolytic perborate, finishing, if cost permits, with (*c*) electrolytic hydrosulphite. If desired, the bisulphite treatment may be replaced by a fumigation with sulphur dioxide in the usual manner. For cheaper, but inferior results, the peroxide treatment may be dispensed with and the cycle of operations then consists of hypochlorite bleach, ammoniacal "antichlor" and ordinary "sulphuring."
—J. F. B.

Aniline Black process ; Notes on the copper ——. N. Evans. J. Soc. Dyers and Col., 1910, 26, 117—119.

As a result of a series of experiments the author concludes that (*a*), the use of a basic padding liquor or of one having part of its hydrochloric acid replaced by acetic or tartaric acid results in the formation of a poorer black ; (*b*), the quantity of sodium chlorate which gives the best result is one-half the weight of the aniline ; (*c*), the addition of ammonium chloride to the padding liquor does not improve the shade obtained ; (*d*), the "ageing" of the cloth after drying by exposing it to a warm moist atmosphere is unnecessary ; (*e*), to obtain a black of maximum fastness the chroming process must be a slow one. In any case the fastness of the black obtained is improved by treating the chromed cloth before washing with a hot solution of aniline hydrochloride of $\frac{1}{4}$—$\frac{1}{2}$ per cent. concentration.—P. F. C.

Hydrosulphite-formaldehyde and the progress made in its application to calico printing. L. Baumann and G. Thesmar. Bull. Soc. Ind. Mulhouse, 1910. **80**, 59—78.

THE hydrosulphites were discovered in 1869 by Schützenberger, who obtained them by the action of zinc on bisulphites. Bernthsen later showed that their formula was $Me_2S_2O_4$ (Me signifies a monovalent metal). The first industrial process for the preparation of an almost pure hydrosulphite of good stability was that of Bazlen, who precipitated the hydrosulphites from their concentrated solutions with common salt and washed the precipitate repeatedly with alcohol or acetone. La Société Emile Zundel of Moscow in 1902 discovered that hydrosulphites combine with formaldehyde to form stable compounds of definite composition and sodium hydrosulphite-formaldehyde was first put on the market in the following year by the Farbwerke Hoechst under the name of Hydrosulphite N.F. In 1904, Baumann, Thesmar and Frossard showed that commercial sodium hydrosulphite-formaldehyde is a mixture in almost equal proportions of two substances, one of which, sodium sulphoxylate-formaldehyde, is the active reducing agent, whilst the other, sodium bisulphite-formaldehyde has no discharging power. The formation of these two substances is expressed in the following equation—$(Na_2S_2O_4,2H_2O)+2CH_2O+2H_2O = (CH_2O,NaHSO_2,2H_2O)+(CH_2O,NaHSO_3,H_2O)$. In 1905 the Badische Anilin- und Soda-Fabrik, and in the following year the Farbwerke Hoechst and L. Cassella und Co., put products on the market containing 90—95 per cent. of sodium sulphoxylate-formaldehyde under the names of Rongalite C, Hydrosulphite N.F. conc. and Hyraldite C extra, respectively. *Application for fixing dyestuffs in direct printing.* The dyestuffs which enter principally into consideration here are those forming leuco-compounds which are soluble in alkalis and have, in this condition a marked affinity for the fibre. Indigo is the chief example of the class in question. In the process of the Farbwerke Hoechst (this J. 1904, 544), the use of large quantities of caustic alkali is recommended for dissolving the leuco-compound, whilst the Badische Anilin- und Soda-Fabrik (this J. 1907, 1007) recommends milder alkalis such as zinc white or sodium sulphite. The authors find by experience that caustic alkali is best when deep shades are required, whilst a mild alkali such as sodium carbonate is more suitable for producing light and medium shades. Other dyestuffs which can be fixed on the fibre by the sodium carbonate method are the brominated indigos, Thioindigo Red and Scarlet, the Ciba Red, Blues and Violets, and dyestuffs of the Indanthrene class. The addition of glycerin to the printing colour is usually advantageous. A process, patented by Kalle und Co. (see Ger. Pat. 210,682 ; this J., 1909, 833), enables these dyestuffs to be reserved by the sodium salt of ortho- or para-nitrotoluenesulphonic acid. *Application for the production of discharge effects.* The dyestuffs used for the production of discharge effects with hydrosulphite-formaldehyde can be conveniently divided into two classes—(*a*) those which are completely destroyed by reduction, leaving only residues which are easily removed by washing, and (*b*) dyestuffs which are reduced by hydrosulphite-formaldehyde to leuco-compounds. To the first class belong most azo-colours, whether formed on the fibre (as in the case of Paranitraniline Red), or fixed by direct dyeing. For the production of multi-coloured discharge effects with the aid of basic dyestuffs, it has been necessary to prepare a printing colour containing a basic dyestuff and tannin without using acid. This can be effected by adding either phenol or aniline and alcohol. Recently however basic dyestuffs have been largely replaced by sulphide dyestuffs for this purpose. *a*-Naphthylamine Claret is very difficult to discharge, being scarcely affected by the ordinary process. The authors found however that the presence of iron salts materially assisted the reduction (Bull. Soc. Ind. Mulhouse, 1905; this J., 1906, 176 and 371). Shortly afterwards Wilhelm (Bull. Soc. Ind. Mulhouse 1906; this J., 1906, 690) discovered that many organic substances, including nitroalizarin had the same effect, whilst the Badische Anilin- und Soda-Fabrik recommended Induline Scarlet and the Farbwerke Hoechst, Patent Blue V. Sunder and Slatonstoffski found the addition of anthraquinone very beneficial (this J., 1907, 196). In the second class of dyestuffs indigo takes first place. In order to obtain clear whites it is necessary to remove all traces of the reduced dyestuff from the fibre. This can be effected with dyestuffs of the indigo series without great difficulty, for at high temperatures their leuco-compounds lose their affinity for vegetable fibres, so that after steaming the goods it is quite sufficient to wash them in boiling water, with or without the addition of a little alkali, in order to remove the leuco-compounds formed on the fibre. To prevent the oxidation of the leuco-compound and thus ensure clear whites, the Farbwerke Hoechst recommend the addition of anthraquinone to the discharge paste, this substance being very readily oxidised to oxanthranol. By adding dyestuffs of the indanthrene or algole series to the printing colour, coloured discharges are obtained.—P. F. C.

Colour systems; Action of light on ——. K. Gebhard. Z. angew. Chem., 1910, 23, 820—827. (Compare this J., 1909, 304, 1084; 1910, 84.)

The author has been able to confirm his hypothesis that the fading of colours under the influence of light is primarily due to the production of "dyestuff peroxides." The methods suitable for the detection of organic peroxides are mentioned, and their suitability for the purpose in question discussed, as also the conditions which are conducive to the production of such peroxides. Experiments show that exposure to those light rays which are complementary to the colour of the dyestuff tends to induce the greatest amount of peroxide formation. Platinum vessels appear to have a markedly favourable influence upon the amount of peroxide produced, and the stability of these compounds is evident from the fact that they may be obtained in the solid condition by careful evaporation of the solutions containing them. The peroxide of Malachite Green, obtained by warming a solution of the dyestuff with hydrogen peroxide, is black and opaque, and when exposed to violet light is rapidly decolorised. It may be obtained in the solid state by "salting out" with sodium sulphate. Experiments with dyed shades show that peroxides are more easily detected in the presence of cotton than when they are in contact with wool; further that they are produced by exposing the shades in either a moist or a dry atmosphere, but that in the presence of moisture they more readily decompose, liberating active oxygen. An interesting hypothesis is that with respect to the influence which reduction of the dyestuff peroxide by the fibre has upon the fixation of the colour, and the author hints at the possibility of means for producing faster dyeings by a method based upon his observations. The probability of the formation of hydrogen peroxide (either directly or secondarily) is discussed, as also the effects of its presence under various conditions. The question of the effect of moisture is examined in detail, and the author states his belief that primarily, dissociated oxygen molecules associate themselves with the ions of water, with the intermediate formation of hydrogen trioxide, and secondarily that there is a formation of peroxide-hydrates or peroxides. He describes the means successfully employed in proving that it is the perhydroxyl ions which are mainly responsible for the destruction of dyestuffs, when these are exposed to light.—F. M.

Patents.

Bleaching, dyeing, or otherwise treating textile materials; Apparatus for ——. J. Cox, Colne. Eng. Pat. 27,432, Nov. 25, 1909.

The invention relates to a mechanically-controlled "knock-off" motion, for the purpose of stopping the driving mechanism which works the pump in an apparatus for dyeing, bleaching, etc., and thus determining the precise period the materials are under treatment. The "knock-off" rod, which controls the "belt-shipper," is actuated by means of a spring, which is brought into action when the main driving shaft has made the requisite number of revolutions.—B. N.

Bordeaux dyeings; Process for producing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 221,481, Jan. 23, 1909.

Bordeaux-red dyeings are obtained by combining diazotised Primuline, on the fibre, with arylamides of 2.3-hydroxynaphthoic acid. For example, fibres dyed with 2 per cent. of Primuline are diazotised and treated with a solution of 2.3-hydroxynaphthoic acid anilide, containing 2 grms. of the anilide and 2 grms. of 40° B. sodium carbonate solution per litre. Pure "bluish-bordeaux" shades are thus produced, very fast to light and acid.—T. F. B.

Dyeing with sulphide dyestuffs; Process for ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 221,887, Jan. 18, 1907. Addition to Ger. Pat. 199,167, Jan. 17, 1907.

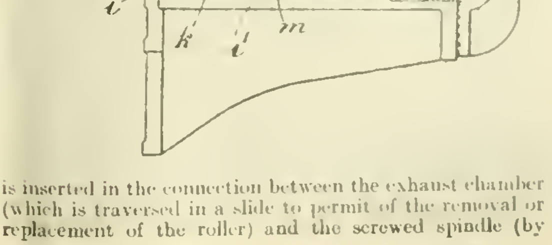
The process for dyeing wool by means of sulphide dye-baths containing bisulphites, described in the principal patent (see Eng. Pat. 8631 of 1907; this J., 1908, 559), can be equally well applied to the dyeing of vegetable fibres and silk.—T. F. B.

Steaming and cooling textile fabrics; Machines for ——. J. B. Whiteley, Lockwood, Yorks. Eng. Pat. 15,140. June 29, 1909.

In machines for blowing dry steam and subsequently drawing cool air through cloth wound on a perforated roller, the collar of the roller is extended at the steam-admission end so as to form a drainage chamber for condensed water. This chamber has a blank end which is provided with perforations through which the steam freed from condensed water passes into the roller. The drainage chamber has internal ribs which direct the condensation water into recesses connected to valves, which are automatically opened in turn by a cam arrangement as the roller rotates, and are so made that when disengaged from the cam, the steam or air pressure automatically closes them.—P. F. C.

Steaming and cooling and like machines used in finishing textile fabrics; Rollers of ——. J. B. Whiteley, Lockwood, Yorks. Eng. Pat. 15,141, June 29, 1909.

In order to allow for the free expansion and contraction of the rollers without interfering with the tightness of the joints between the roller ends and their collars, a spring is inserted in the connection between the exhaust chamber (which is traversed in a slide to permit of the removal or replacement of the roller) and the screwed spindle (by



means of which the traversing is effected). On the casing, *h*, of the exhaust chamber, *c*, lugs, *i*, *i'*, are provided through which a plain extension, *j*, of the screwed spindle, *d*, passes freely. A spring, *k*, is confined between the lug, *i*, and a fast collar, *m*, on the spindle. A bracket, *n*, is secured to the lug, *i'*, outside the collar, *m*. When the roller, *b*, expands, the lugs *i*, *i'*, approach the bevel pinion, *e*, the lug, *i*, compressing the spring, *k*, and the bracket, *n*, moving with the lug, *i'*, towards the pinion, *e*. The contraction following the introduction of cold air causes the lugs to return to their normal positions.
—P. F. C.

Finishing process. R. T. Todd, Lawrence, and R. B. Batty, Methuen, Mass. U.S. Pat. 956,550, May 3, 1910.

THE process is for the treatment of woollen and worsted fabrics preparatory to dyeing. The pieces are passed through boiling water and then subjected to the simultaneous action of live steam and rotary pressure. These operations are repeated several times, after which the cloth is passed through cold water and folded down.—F. M.

Sizing compositions ; Compound for use in preparing ——. A. Vermeisteh, Lawrence, Mass., and N. Verhulst, Pawtucket, R.I. U.S. Pat. 956,551, May 3, 1910.

IN the preparation of a warp size, to 250 gallons of water are added 1½ oz. of copper sulphate, 5 oz. of sodium borate, 9¾ oz. of hydrous silicate of magnesium and 9¾ oz. of flour.—F. M.

Dyeing of wood. A. Jahn and M. Grünhut, Vienna. Eng. Pat. 10,170, April 29, 1909.

SEE Fr. Pat. 402,527 of 1909 ; this J., 1909, 1200.—T. F. B.

Vegetable fibres ; Process for the impregnation of ——, more especially in the cold. P. Hoffmann and E. Decoster, Lille, France. Eng. Pat. 11,024, May 10, 1909.

SEE Fr. Pat. 402,041 of 1909 ; this J., 1909, 1247.—T. F. B.

Dyeing machine. J. T. Psarski, Cleveland, Ohio. U.S. Pat. 955,993, April 26, 1910.

SEE Fr. Pat. 408,307 of 1909 ; this J., 1910, 623.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Sulphur ; Determination of —— in pyrites and marcasite. E. T. Allen and J. Johnston. J. Ind. Eng. Chem., 1910, 2, 196—203.

THE error due to partial oxidation of the sulphides of iron in minerals containing them, when ground for analysis may be reduced to 0·05 per cent. by gently crushing them to a size to pass through a sieve of 20 meshes to the inch. In the case of non-homogeneous material which requires to be finely pulverised, the error may be determined by washing a weighed portion of the powder with boiled water in an atmosphere of carbon dioxide and determining the iron in the washings. To avoid possible loss of sulphur it is preferable to use the method of Carius rather than those of Lunge or Fresenius. The iron is separated by two precipitations with sodium carbonate, thus avoiding the use of ammonium salts, which cause greater losses of sulphur. In precipitating the barium sulphate the free acid ought to be reduced to a small measured quantity (2 c.c. of 2 per cent. hydrochloric acid in 350 c.c. of liquid), and the reagent should be added at a measured rate from a burette. In all cases corrections should be applied to the barium sulphate precipitate :—(1) for solubility, depending on the amount of free acid and the volume of the solution ; (2) for the occlusion of sodium sulphate by the precipitate, depending chiefly upon the quantity of alkali chloride originally present ; (3), for a certain amount of "free" sulphuric acid in the precipitate, which is lost on ignition. This need not exceed 0·03 per cent. of the total sulphur. The corrections may be determined by the precipitation of pure sodium sulphate. The sum of the errors in the analysis should not exceed 0·2 per cent. of the total sulphur. For sulphur in pyrites the method of Hintz and Weber was found to be the best of those previously published, the sulphur being first oxidised by Lunge's method and then precipitated as barium sulphate ; but even the best of the results obtained by that method varied from the true amount of sulphur by 0·5 to 0·7 per cent. Incidentally it is pointed out that the precipitation of iron with ammonia involves considerable errors, especially when the ammonia solution has been kept in glass bottles and the precipitation is made in glass beakers. The same error would also be found in the precipitation of alumina or other oxides.
—C. A. M.

Sulphur in soluble sulphates ; Exact determination of ——. E. T. Allen and J. Johnston. J. Amer. Chem. Soc., 1910, 32, 588—617.

THE most important sources of error in the determination of sulphur in soluble sulphates, under the conditions usually obtaining in practice, have been investigated by the authors and are found to be the solubility of the barium sulphate precipitate and the occlusion by it of sodium or other sulphate and "free" sulphuric acid which is lost on ignition. In making a determination, it is recommended that nitrates, chlorides, and ammonium salts be, as far as possible, avoided and that the following conditions be observed:—The solution, measuring 350 c.c., is acidulated with 2 c.c. of 2 per cent. hydrochloric acid and heated to boiling ; precipitation is effected slowly (about 4 minutes for 2 grms. of precipitate), with constant stirring, and the precipitate is allowed to stand for 18 hours, when it is filtered off and washed until 25 c.c. of the washings show a barely perceptible opalescence with silver nitrate ; the filter is subsequently burnt very slowly, and heating of the precipitate is continued until a constant weight is obtained. To obtain results which are accurate to 0·1—0·2 per cent. of the total sulphur, corrections, which are preferably determined by experiment for the case in hand, are applied for the errors mentioned above. A very good uncorrected determination may be made by precipitating rapidly, but in this case there is a partial compensation of variable errors, and the method is not so reliable as that of slow precipitation with subsequent correction.—F. SODN.

Alkali bromides ; The electrolysis of —— and the delay in the separation of halogens at the anode. F. Foerster and J. Yamasaki. Z. Elektrochem., 1910, 16, 321—355.

CAREFUL investigation of the electrolysis of sodium bromide, the electrolyte being thoroughly stirred, leads to a confirmation of the results of Kretzschmar (Z. Elektrochem., 1904, 10, 789), namely, that the primary process at the anode is the discharge of bromine ions, with a certain amount (according to conditions) of discharge of hydroxylions. The bromine gives with the alkali (coming from the cathode or previously added) sodium hypobromite, and this is converted in one of two ways into bromate. In neutral solution the conversion is effected by a simple chemical reaction with free hypobromous acid which is produced in the neighbourhood of the anode : $2HBrO + NaBrO = NaBrO_3 + 2HBr$. In alkaline solution the hypobromous acid is not produced and the oxidation is caused electrochemically by direct oxidation at the anode : $NaBrO + 2O = NaBrO_3$. This theory is in complete agreement with the authors' extensive series of experiments in which the effect of varying temperature, current density, bromide and alkali concentrations, was studied both with bright and platinised platinum anodes. The discharge of bromine ions at a platinised anode only takes place at the theoretical anode potential when the platinum is entirely free from oxygen. Otherwise the discharge is delayed and requires a higher potential than would be expected. The plentiful discharge of hydroxyl ions in alkaline solution with its attendant evolution of oxygen leads to particularly high values for the anode potential even with a bright platinum electrode. This retarding action is probably due to platinum-oxygen compounds, which, in some way not yet understood, prevent the transformation of the nascent halogens into free halogen molecules. W. H. P.

Phosphomonoper acid [oxyorthophosphoric acid] and perphosphoric acid. J. Schmidlin and P. Massini. Ber., 1910, **43**, 1162—1171.

Phosphoric acid and its salts yield no perphosphoric acid by electrolysis, nor does orthophosphoric acid react with hydrogen peroxide. By the reaction of phosphoric anhydride with 30 per cent. hydrogen peroxide, however, with the precautions described in the paper, a substance is obtained which, when diluted with ice-cold water, shews similar properties to Caro's acid, and indeed, acts more strongly as an oxidiser, for it oxidises manganous salts in the cold to permanganic acid. Analysis shows the formula of the substance to be H_3PO_5, and the author regards it as oxyorthophosphoric acid (phosphomonoperacid), $O:P(OH)_2.O.O.H$. Its formation is expressed by the equation, $P_2O_5+2H_2O_2+H_2O=2H_3PO_5$. Its concentrated solutions gradually decompose (and when rendered alkaline do so much more rapidly), but in dilute solution it can be kept for very long periods, and forms a delicate reagent for manganese. The same substance can be obtained from pyrophosphoric or metaphosphoric acid, though not so conveniently as from the anhydride. When pyrophosphoric acid is used, and is kept in great excess relatively to the hydrogen peroxide, there is always formed, besides oxyorthophosphoric acid, a small quantity of perphosphoric acid, $H_4P_2O_8$. This has not been isolated, but is recognisable by its action in causing the formation of aniline black from aniline, and the slow separation of iodine from hydriodic acid. The difference in reaction between oxyorthophosphoric acid and perphosphoric acid is exactly analogous to that between Caro's acid and persulphuric acid. Both Caro's acid and persulphuric acid are formed when ozone is left in contact with sulphuric anhydride, but phosphoric anhydride does not react with ozone. The oxidation of manganese salts by oxyorthophosphoric acid suggested the existence of a corresponding nitrogen acid in Crum's reagent (lead peroxide and nitric acid); but attempts to prepare such an acid from nitric anhydride and hydrogen peroxide failed. Raschig's pernitric acid does not oxidise manganous salts: the authors suggest that it is perhaps pernitrous acid, $O:N.O.OH$, isomeric with nitric acid.—J. T. D.

Bleaching powder and similar substances; Action of carbon dioxide and of air upon ——. R. L. Taylor. J. Soc. Dyers and Col., 1910, **26**, 115—116.

The action of carbon dioxide on bleaching powder is similar to the action of mineral acids, in that the product of the reaction contains chlorine but no hypochlorous acid. The usual explanation of the reaction is that hydrochloric and hypochlorous acids are simultaneously produced by the action of the acid upon the bleaching powder and that they immediately interact with the liberation of chlorine. If the action of carbon dioxide on bleaching powder is to be similarly explained, it is implied that the action of hydrochloric acid on carbonates is a reversible one and that chlorides are therefore partly decomposed by carbon dioxide. Air free from carbon dioxide acts very slowly on a solution of bleaching powder and the product is practically all hypochlorous acid arising from the hydrolysis of calcium hypochlorite. If, however, ordinary air containing the usual quantity of carbon dioxide be passed through a solution of bleaching powder, a mixture of hypochlorous acid and chlorine is carried over. At first the amount of chlorine is about equal in volume to the hypochlorous acid, but when the whole of the calcium hydroxide contained in the solution has been converted into carbonate by the carbon dioxide of the air, the chlorine forms ninety per cent. of the volume of evolved gas.—P. F. C.

Aluminium compounds; Progress in the technology of ——. F. Russ. Z. angew. Chem., 1910, **23**, 943—944.

The production of aluminium sulphate in Germany has increased very largely in recent years, being 50,000 tons in 1902, as against 3100 tons in 1890. Austria consumes annually 12,000 tons of the sulphate, mostly of home production. The crystalline aluminium hydroxide is employed for the manufacture of the oxide, and if free from iron, for that of the sulphate; the colloidal hydroxide is used for the manufacture of the acetate and the bisulphite. Cryolite is used in the manufactore of "milk-glass," also as a flux in the production of the metal. The compound, $Na_2SiF_6.NaAlO_2$, is used in calico-printing. Attempts are being made to establish the manufacture of barium aluminate. Aluminium nitride, prepared from the carbide in the electric furnace, may be used for the manufacture of ammonia from atmospheric nitrogen. The only raw materials now generally available are clays and bauxite. According to the alkaline process, bauxite is used with sodium carbonate or with sodium sulphate and carbon and lixiviated; in the latter case no iron goes into solution; the solution is heated under pressure to separate sodium aluminium silicate, and the aluminium hydroxide is precipitated by carbon dioxide, the sodium carbonate being recovered. The product contains 2—3 per cent. of silica, which is too much for the preparation of the metal. According to Bayer's process the calcined bauxite is decomposed by heating under pressure with a solution of sodium hydroxide of 44°—47° B. The aluminium hydroxide is then separated in a crystalline form, free from silica, by diluting to 24° B., sowing crystals and stirring; the mother liquors are concentrated *in vacuo* for further use. The acid process is employed for the manufacture of aluminium sulphate and of the colloidal hydroxide for conversion into the acetate or bisulphite.
—J. F. B.

Thermic reactions in vacuo. F. E. Weston and H. R. Ellis. Faraday Soc. Trans., May 31, 1910. (Advance proofs.)

For the purpose of studying *in vacuo* reactions similar to the "thermite" reaction, the authors make use of a wide-mouthed bottle of 3 litres capacity, fitted with a rubber stopper carrying three glass tubes. Two of the tubes carry stout copper wires embedded in Faraday cement. The third tube is connected with a mercury pump and manometer. The bottom of the bottle is covered with a mixture of ignited sand and quicklime. A Hessian crucible, embedded in the sand, is used to hold the mixture, on top of which is placed 0·1 grm. of fuse contained in tissue paper. On inserting the cork a loop of very thin iron wire, connected with the two copper leads, lies embeded in the fuse, which is fired by passing a current. The fuse consists of a mixture of aluminium (4 parts) and sodium peroxide (3 parts). Working in the above manner the authors have found that a mixture of magnesium powder and silica produces when ignited *in vacuo*, magnesium, unreduced silica, two or more silicides of magnesium, silicon, magnesium oxide, and probably silicon monoxide.
—G. W. McD.

Tartaric acid; Determination of —— in crude natural products. C. Beys. Comptes rend., 1910, **150**, 1250—1251.

The following method is stated to give more reliable results than that of Goldenberg and Géromont: 1—2 grms. of the substance is heated on the water-bath for 30 minutes with an equal weight of sulphuric acid "diluted to $\frac{1}{20}$"; after cooling, 5 vols. of alcohol and then 10 vols. of ether are added. The cloudy mixture quickly clears; it is filtered, and the precipitate washed with "the same volume" of ether and alcohol (2 : 1). The filtrate which contains the tartaric acid is neutralised with alcoholic potash, using phenolphthalein as the indicator; an excess of the potash (5—10 c.c.) is then added to saponify any ethereal tartrates, and the mixture warmed to 38° C. After cooling, the liquid (A) is easily decanted from the precipitate (B) which adheres to the vessel. The small quantity of tartaric acid in the liquid A is precipitated by excess of glacial acetic acid and washed well with 96 per cent. alcohol. The precipitate B is dissolved by boiling with 12—15 c.c. of water, 5 c.c. of glacial acetic acid are added, and after agitating for 5 minutes, the precipitation of potassium bitartrate is completed by adding alcohol until the mixture contains 65 per cent. of alcohol. The mixture is well agitated and filtered after 1 hour; the precipitate is washed with 65 per cent. alcohol, and then with 96 per cent. alcohol, and finally dissolved, together with the precipitate from solution A, in boiling wafer. This acid solution is then titrated as recommended in Goldenberg and Géromont's method (this J., 1908, 245). (See also this J., 1907, 841).—A. Shld.

Tartaric acid mother liquors; Supersaturation of ——. P. Carles. Bull. Soc. Chim., 1910, **7**, 326—327.

In the production of tartaric acid from calcium tartrate by the addition of sulphuric acid, the mother liquors become dark in colour and supersaturated. This is due to the presence of salts of iron, which are very soluble and prevent the precipitation of the acid. The liquors should be largely diluted in the open air, and treated with enough potassium ferrocyanide to precipitate the iron. After the Prussian blue has settled, the clear liquor can be evaporated, when crystals readily separate, or the acid can be converted into potassium bitartrate.—F. Shdn.

Sulphurous acid in aqueous solution; Electrolytic oxidation of ——. A. Fischer and G. Delmarcel. Bull. Soc. Chim. Belg., 1910, **24**, 236—237.

The authors describe some preliminary experiments on the electrolytic oxidation of sulphurous acid in aqueous solution (from 1 to 5 per cent. of sulphur dioxide), using a platinum wire gauze cylinder (140—150 sq. cm. surface) as anode, and as cathode, first a nickel cylinder split longitudinally and afterwards a helix of platinum wire (10 sq. cm. surface). The solution of sulphurous acid was contained, along with the anode, in a porous cell, which was surrounded by the cathode, the latter dipping in a solution of sulphuric acid and sodium sulphite. It was found, using currents of 1 ampère, and in a few cases, of 2 ampères, that the rate of oxidation and the current-yield are greater with low concentrations of sulphurous acid. After a definite period, when the evolution of oxygen at the anode becomes visible, there is a sudden fall of current strength. The oxidation is not increased by addition of copper acetate or other catalytic agents to the electrolyte, but the platinum electrodes themselves act as catalysers. During electrolysis about 25 per cent. of the sulphurous acid traverses the walls of the porous cell by dialysis, and is reduced at the cathode to sulphur and hydrogen sulphide. It is suggested that this portion of the sulphurous acid and the hydrogen liberated at the cathode might be utilised for the reduction of titanic salts to the commercially valuable titanous compounds.—A. S.

Cerium in cerite and monazite; Volumetric determination of ——. F. J. Metzger and M. Heidelberger. J. Amer. Chem. Soc., 1910, **32**, 642—644.

The method of determining cerium by oxidation with sodium bismuthate and subsequent reduction (this J., 1909, 626) may be applied to the rapid and accurate analysis of cerite and monazite sands. Cerite (0·5 grm.) is decomposed by fusion with potassium bisulphate, and the melt is dissolved in about 350 c.c. of cold water, acidulated with not more than 5 c.c. of strong sulphuric acid, after which the solution is left in contact with the residue overnight or until all basic salts are dissolved. Monazites (0·6 grm.) are decomposed in the usual manner by heating with strong sulphuric acid for at least 6 hours, and the solution is poured into about 350 c.c. of ice-cold water and allowed to stand, as above, until all basic salts have dissolved. In either case, the solution obtained is filtered and heated to boiling, and the rare earths are precipitated by adding a large excess (100 c.c. or more) of a saturated solution of oxalic acid. After standing overnight, the precipitated oxalates are filtered off and washed with a 1 per cent. solution of oxalic acid, and they are then washed off the filter with hot water and converted into hydroxides by boiling with sodium hydroxide. The precipitate is filtered off, washed well with hot water, and dissolved off the filter by means of dilute sulphuric acid; the solution is diluted to 100 c.c., after adding enough sulphuric acid to bring the total amount to 20 grms. of concentrated acid, and then 2 grms. of ammonium sulphate are added and the determination is completed by oxidation with sodium bismuthate (1 grm.) as already indicated (*loc. cit.*).—F. Sodn.

Hydriodic acid and bromic acid, in the presence of a large amount of hydrochloric acid; Reaction between ——. [*Determination of iodides.*] D. L. Randall. J. Amer. Chem. Soc., 1910, **32**, 644—646.

Potassium bromate may be substituted for the more expensive iodate in determining iodides by Andrews' method (J. Amer. Chem. Soc., 1903, **25**, 756), but the bromate is the more powerful oxidiser, the reaction proceeding in accordance with the equation, $3KI+KBrO_3+6HCl=4KCl+3H_2O+2ICl+IBr$. In carrying out the titration, 5 c.c. of chloroform are added to the solution, which is mixed with twice its volume of hydrochloric acid, and the standard bromate solution is added until, after violent shaking, the chloroform is found to have lost its pink colour.—F. Sodn.

Mercuric chloride; Preparation of —— *from mercuric sulphate and common salt in the wet way.* E. Rupp and W. Klee. Apoth.-Zeit., 1910, **25**, 219. Chem. Zentr., 1910, **1**, 1690.

The interaction of mercuric sulphate and common salt in aqueous solution affords a simple method of preparing mercuric chloride. The mixture of the two salts with a small quantity of water is warmed to 33°—34° C., drained quickly with the aid of the pump, and the residual mercuric chloride re-crystallised from hot water. Or, 100 parts of mercuric sulphate are mixed with 40 parts of common salt, both in a finely-powdered condition; the mass is stirred with 20 parts of 5 per cent. hydrochloric acid to form a paste, which is frequently stirred during 24 hours, and then triturated and extracted with 95 per cent. alcohol, the mercuric chloride being purified as before by re-crystallisation from boiling water. A yield of 90 per cent. is stated to be obtained. The same method can also be used for the preparation of mercuric chloride from the nitrate.

In the gravimetric determination of mercury, if a few grams of common salt be added to the nitric acid solution of the mercury, and the latter neutralised with dilute alkali, then the precipitate of sulphide obtained subsequently will be in a form allowing of rapid filtration, owing to the flocculating effect of the common salt.—A. S.

Chemical action of high pressures; compression of nitrous oxide and of a mixture of nitrogen and hydrogen; decomposition of carbon monoxide by pressure. E. Briner and A. Wroczynski. Comptes rend., 1910, **150**, 1324—1327.

(See this J., 1909, 705; 1910, 85.) Unlike nitric oxide, nitrous oxide remained quite unaffected when strongly compressed, no decomposition taking place even at 420° C. under a pressure of 600 atmospheres. With a mixture of nitrogen and hydrogen, no reaction was observed at a pressure of 900 atmospheres at the ordinary temperature. Carbon monoxide was not decomposed at a pressure of 800 atmospheres at the ordinary temperature, even in presence of platinised asbestos. At 320° C., however, decomposition took place at 400 atmospheres; after 11 hours at 600 atmospheres, the gas contained 5·5 per cent. of carbon dioxide, and a slight dark grey deposit was observed in the containing tube.—A. S.

Carbon monoxide; Action of ozone on ——. P. Clausmann. Comptes rend., 1910, **150**, 1332—1333.

Carefully cleaned glass tubes were filled with a mixture of ozonised oxygen (200 mgrms. of ozone per litre) and carbon monoxide, the gases being prepared separately and well purified. The tubes were then sealed and exposed to light. Under these conditions, with gases dried by means of phosphorus pentoxide and mixed in equal volumes, 2·83 parts of carbon dioxide were formed per 100 parts of total oxygen in 8 days; under similar conditions, but in the dark, only 0·88 part of carbon dioxide was formed. With undried gases, exposed to the light, 3·67 parts of carbon dioxide were formed in one day.—A. S.

Phosphorus-sulphur compounds. VII. So-called phosphorus pentasulphide. A. Stock. Ber., 1910, **43**, 1223—1228. (See this J., 1910, 210, 350.)

Pure phosphorus pentasulphide was prepared by a modification of Kekulé's method. An intimate mixture of 100 parts of purified red phosphorus and 260 parts of sulphur was heated, in portions of 30–40 grms., until reaction set in, and then further heated until distillation began. After cooling, the product was coarsely powdered, and placed in tubes of Jena glass, from which the air was then exhausted. The tubes were next sealed, packed in sand in iron tubes provided with screw-caps, and heated for one hour to about 700° C. After cooling, the glass tubes were broken, and the contents powdered and repeatedly extracted with boiling carbon bisulphide. Molecular weight determinations indicate that the sulphide is really tetraphosphorus decasulphide, P_4S_{10}. A comparison of the characters of the three sulphides, P_4S_3, P_4S_7, and P_4S_{10}, is given in the following table:—

	P_4S_3	P_4S_7	P_4S_{10}
Colour of solid substance	yellow	white	yellow
Colour of molten substance at 300° C.	brownish-yellow	pale yellow	reddish-brown
Sp. gr. at 17° C.	2·03	2·19	2·09
Melting points (corr.)	171°—171·5°—172·5° C.	305°—308°—310° C.	286°—288°—290° C.
Boiling point at 760 mm.	407°—408° C.	523° C.	513°—515° C.
Solubility in carbon bisulphide at 17° C.	1 : 1	1 : 3500	1 : 450
,, ,, ,, 0° C.	1 : 3·7	1 : 20,000	1 : 550
,, ,, ,, −20° C.	1 : 9	—	1 : 1200
,, benzene at 17° C.	1 : 40	—	—
By cold water	scarcely attacked	tolerably easily decomposed	slowly decomposed
On keeping	scarcely decomposed	stable	appreciably decomposed

—A. S.

Units of radioactive emanation; German and French ——. A. Jaboin and G. Beaudoin. J. Pharm. Chim., 1910, **1**, 497—499.

Comparative experiments show that the French unit of emanation, the *mgrm.-minute*, is equivalent to about 7 *volts*, or German units; this suggests the importance of establishing an international unit.—F. Sodn.

Determining carbon in iron, graphite, and tungsten. Dennstedt and Klünder. *See* X.

Test for hydrocyanic acid. Moir. *See* XXIII.

Patents.

Gas [sulphur dioxide]; Apparatus for making —— by burning solid matter in a current of air or other gas. J. Westgate, Liverpool. Eng. Pat. 17,348, July 26, 1909.

The apparatus consists of a combustion chamber which is made in two parts, the upper part being water-jacketed, and a device by means of which the solid material is automatically delivered to the furnace, the rate of feed being regulated by adjusting the throw of a pawl arm which drives a feed worm through a ratchet wheel. The worm discharges the material into the combustion chamber close to the end at which the air enters, and an exhauster is placed in the exit flue to draw the gas through the chamber. The combustion is started by the insertion of a red-hot bar through an aperture in the wall of the chamber, which is normally closed. The apparatus is intended primarily for the production of sulphur dioxide to be used in bleaching bran, etc.—F. Sodn.

Sulphurous acid from acid sludge [from petroleum refining]; Process of obtaining ——. G. Schildhaus and C. Condrea, Campina, Roumania. U.S. Pat. 956,184, April 26, 1910.

Acid tar or sludge is heated to 200°—300° C., and, at the same time a current of air, heated to about the same temperature, is introduced into the retort; the liquid hydrocarbons contained in the distillation products are condensed, and the remaining gases, containing sulphurous acid, are washed, first with heavy hydrocarbon oil and finally with sulphuric acid; the coke is continuously removed from the retort.—F. Sodn.

Sludge-acid [from petroleum refining]; Process of concentration and purifying ——. L. Blacher and S. Sztencel, Campina, Roumania. U.S. Pat. 956,276, April 26, 1910.

Practically pure sulphuric acid is obtained from "sludge-acid" by running the waste acid into a suitable boiler, containing concentrated sulphuric acid heated to the boiling point, blowing a current of air through the acid, and condensing the escaping vapours.—F. Sodn.

Electrolytic production of salt solutions [gold chloride]; Processes and apparatus for the ——. T. Girtin, London. Eng. Pat. 20,192, Sept. 3, 1909.

The invention aims at an increased efficiency in the electrolytic solution of metals, by causing the cathode liquid to circulate automatically through a cooling worm, thus preventing a rise of temperature in the electrolyte and the deposition of hydrogen on the cathode. To this end, the tank which holds the electrolyte (*e.g.*, hydrochloric acid) is made to contain a number of porous pots or cylinders with sealed tops; through each of these are inserted a cathode and two pipes, one of which conducts the cooled electrolyte to the cell from a storage vessel, whilst the other, by which the gas generated during electrolysis escapes, is so arranged that bubbles of the liquid are continuously carried up with the gas and pass through the cooling worm to the storage vessel. The anode plates (*e.g.*, of gold) are placed between the porous pots.—F. Sodn.

Manganates, permanganates, halogens, and hydroxides; Process of producing ——. F. J. Machalske, Assignor to R. F. Pierce, Chicago, Ill. U.S. Pat. 956,120, April 26, 1910.

A manganous compound or manganese dioxide, mixed with a halide of the desired base (*e.g.* an alkali chloride), is heated in the presence of oxygen or an oxidising agent, at a temperature high enough to bring about the production of a manganate and liberation of the halogen.
—F. Sodn.

Alkali chlorides [sodium chloride]; Process of purifying ——. C. H. Dasher, Oakland, Cal. U.S. Pat. 956,303, April 26, 1910.

Sodium chloride is fused at about 780° C., and silica and a suitable alkali salt, such as sodium carbonate, are added in sufficient quantity to react with the impurities present and form silicates that are insoluble in the fused mass and infusible at the temperature specified; the fusion is continued until the silica changes to a pasty mass, which gradually settles through the fused chloride as the evolution of gas diminishes, and the purified salt is then separated from the precipitated impurities.—F. Sodn.

Lime; Process of hydrating ——. W. H. Kemler, Ashland, Ky. U.S. Pat. 956,977, May 3, 1910.

Calcined lime is slaked with water in a suitable vessel, and the mass is agitated with an excess of water by pumping it from the top of the vessel back into the bottom again, so as to throw it upwards. After this treatment, any uncalcined material is separated by means of a screen, and the "lime pulp" is allowed to settle and is finally applied to a revolving heated cylinder, from which it is scraped when dry.—F. SODN.

Chemical reactions in gases or gaseous mixtures; Process for preventing the reversion of —— by rapid cooling of the gaseous reaction-products. A. Scherbius and H. Wach. Ger. Pat. 221,129, Nov. 17, 1908.

THE gaseous reaction-products and the cooling agent, in the form of gas or vapour, are forced at a high velocity through two or more concentric expanding nozzles. The reaction-product and the cooling agent may be under different pressures, in which case they mix by diffusion on expanding. If a vapour which condenses at the ordinary temperature be used as cooling agent, the condensed liquid can subsequently be easily separated from the reaction-product.—A. S.

Tantalic, niobic, and titanic acids; Process for the separation of —— from one another and from other substances. L. Weiss and M. Landecker. Ger. Pat. 221,429, April 25, 1909.

THE substance is fused with alkali bisulphate, the product lixiviated with water, and the solution treated with sulphurous acid and boiled, whereupon the tantalic, niobic, and titanic acids are quantitatively precipitated, together with the greater portion of any tin that may have been present. The tin is removed from the precipitate by means of ammonium sulphide solution, the residue is ignited and fused with a slight excess of alkali carbonate, preferably sodium carbonate, a small quantity of an oxidising agent, such as sodium nitrate, being added near the end of the operation, and the mass then heated gently till the nitrate is completely decomposed. The product is boiled with water and filtered, the insoluble matter containing nearly the whole of the titanium. After removal of any small quantities of titanium still present in the solution, the latter is treated with carbon dioxide or a bicarbonate, whereby the tantalum is precipitated quantitatively. The niobium may be finally precipitated by ammonia.—A. S.

Acid mixtures adapted for use for nitration; Denitration of ——, and recovery of the constituents. V. Vender, Milan, Italy. Eng. Pat. 18,280, Aug. 7, 1909. Under Int. Conv., Aug. 8, 1908.

SEE Fr. Pat. 405,819 of 1909; this J., 1910, 423.—T. F. B.

Gases; Separation of —— from their mixtures. R. J. Lévy, A. Helbronner, and Soc. l'Air Liquide, Paris. U.S. Pat. 957,170, May 3, 1910.

SEE Fr. Pat. 376,854 of 1906; this J., 1907, 1047.—T. F. B.

Potash salts; Process of recovering ——. A. Alberti, Rome U.S. Pat. 957,295, May 10, 1910.

SEE Fr. Pat. 402,925 of 1909; this J., 1909, 1313.—T. F. B.

Sulphur-burner. P. H. Grimm, Assignor to The Sulphur Dioxide Co., Glen Cove, N.Y. U.S. Pat. 957,418, May 10, 1910.

SEE Eng. Pat. 10,774 of 1909; this J., 1910, 352.—T. F. B.

Sodium sulphite and ammonium chloride; Process of making ——. R. Friedrich, Glösa, Germany, and F. Hirsch, Vienna. U.S. Pat. 957,761, May 10, 1910.

SEE Eng. Pat. 11,123 of 1909; this J., 1909, 1034.—T. F. B.

Titanium-nitrogen compounds; Production of ——. Process of making ammonia. C. Bosch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 957,842 and 957,843, May 10, 1910.

SEE Fr. Pat. 387,002 of 1908; this J., 1908, 809.—T. F. B.

Peroxides, etc.; Process for rendering —— stable. L. Sarason. Fr. Pat. 409,108, Nov. 4, 1909. Under Int. Conv., Nov. 5, 1908.

SEE Eng. Pat. 23,678 of 1908; this J., 1910, 152.—T. F. B.

Copper sulphate and other metallic sulphates; Manufacture of ——. H. E. Dolphin. Fr. Pat. 409,280, Oct. 30, 1909.

SEE Eng. Pat. 8555 of 1909; this J., 1910, 488.—T. F. B.

Alkali carbonates; Process for making ——. J. D. Riedel Akt.-Ges. Fr. Pat. 409,513, Nov. 23, 1909.

SEE Eng. Pat. 27,126 of 1909; this J., 1910, 565.—T. F. B.

Oxides of nitrogen; Process for preparing —— by explosive combustion. F. Häusser. Fr. Pat. 409,758, Nov. 29, 1909.

SEE Ger. Pat. 216,518 of 1907; this J., 1910, 25.—T. F. B.

Magnesite; Process for preparing —— in the form of paste or impalpable powder, and of calcined magnesite therefrom. J. Leese. Fr. Pat. 409,809, Nov. 30, 1909. Under Int. Conv., Jan. 11, 1909.

SEE Eng. Pat. 612 of 1909; this J., 1909, 835.—T. F. B.

VIII.—GLASS; CERAMICS.

PATENTS.

Kaolin; Process for preparing ——. The Exploration Co., Ltd. Fr. Pat. 409,372, Nov. 18, 1909. Under Int. Conv., Jan. 30, 1909.

SEE Eng. Pats. 2294 and 2295 of 1909; this J., 1909, 1130.—T. F. B.

Separating clay, slimes, minerals, and the like. Eng. Pats. 9671 and 9672. *See* I.

IX.—BUILDING MATERIALS.

Examination of asphaltum. Sommer. *See* IIA.

PATENTS.

Plaster composition. C. Ellis, Larchmont, N.Y., Assignor to Ellis-Foster Co., New Jersey. U.S. Pat. 955,953, April 26, 1910.

CLAIM is made for a cement, consisting of "lime sulphate borax waste" which has been calcined to remove water of hydration, and for a plaster composition comprising the calcined waste, fibrous or other filling material, and "extending" materials, such as sand and hydrated lime. —F. SODN.

Stones, artificial; Process for the production of ——, from ashes of brown coal. H. Schimmelpfeng. Ger. Pat. 221,871, June 5, 1908.

ARTIFICIAL stones of low specific gravity are obtained by moistening ashes from brown coals or lignites, pressing into blocks, and drying.—A. S.

Lime and cement kilns. N. Perpignani and E. Candlot, Paris. Eng. Pat. 13,068, June 3, 1909.

IN a vertical, shaft kiln, the chimney is composed of two superposed pipes, the lower pipe being movable and connected with the upper, fixed pipe, by means of a water seal.—O. R.

Slag cement from moist slag and quicklime; Process for the manufacture of ——. A Müller. Ger. Pat. 221,329, Dec. 21, 1908.

The moist granulated slag is mixed with quicklime which has previously been partly slaked, to the extent that, on mixing with the slag, the moisture of the latter is just sufficient to complete the slaking.—A. S.

Magnesia cement; Process for the manufacture of ——. "Ortoclor" Impresa Litosilo Sbertoli. Ger. Pat. 221,461, April 10, 1908.

Hydrated magnesium oxychloride, $MgO, MgCl_2, 11H_2O$, is prepared by any of the known methods, and is then ignited so as to yield the compound, $MgO, MgCl_2, H_2O$. The latter is mixed with magnesia, and ground, giving, it is stated, a product which can be kept and transported without undergoing alteration, and which, on mixing with water yields a good cement-mortar. Mixtures of the following composition, $MgO, MgCl_2, H_2O+7MgO$ ("Litosilo") and $MgO, MgCl_2, H_2O+3MgO$ ("Ortoclor") are said to be especially suitable.—A. S.

Building-blocks; Manufacture of ——. C. Körtling and C. Jacatsch, Cassel, Germany. U.S. Pat. 957,351, May 10, 1910.

See Eng. Pat. 6958 of 1909; this J., 1910, 90.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron and steel in the Transvaal. F. W. Harbord. Times Eng. Suppl., May 25, 1910, 15.

In a report recently issued by the Transvaal Mines Department, the author deals with the possibility of the remunerative manufacture of iron and steel in the Transvaal. There are large deposits of magnetic quartzites near Pretoria, which could be mined at a moderate cost, and similar deposits at Airlie, which could be mined at a low cost. The deposits have not yet been extensively proved as to quantity and average quality, but outcrop samples have shown 46 per cent. of iron and 24 per cent. of silica. Smaller quantities of richer non-silicious ores occur in other localities. The chief difficulties standing in the way of the manufacture of pig-iron are satisfactory supplies of good limestone and metallurgical coke at a reasonable cost. If the South African railways would agree to take 30,000—35,000 tons of rails and sleepers per annum, then an iron and steel works, including one large and one smaller rolling mill, and with a capacity of 1000 tons of steel per week, might be established on a sound basis, but it would be impossible to produce steel at a price low enough for export, or to compete effectively against imported products in the neighbourhood of the seaports, unless under an ample protective tariff. The author also considers that there is no possibility, at present, of the remunerative production of pig iron in the electric furnace in the Transvaal. An electric steel plant designed for the treatment of the large accumulations of scrap at the railway yards at Pretoria and elsewhere, would, however, in his opinion be successful both technically and financially, and he suggests that the best method would be for the Government to concede to private individuals the exclusive right to purchase the accumulated railway scrap and the future annual production for a fixed number of years at a reasonable price.—A. S.

Iron ores; Agglomeration of ——. F. Witte. Stahl u. Eisen, 1910, **30**, 755—760.

At the Fernie Works in Giessen a very friable brown iron ore is utilised containing in the raw state 25 per cent. of moisture, 16·78 of iron, and 15·41 of manganese, the latter mainly in the form of pyrolusite. The moisture caused considerable trouble, and the presence of clay suggested making the ore into bricks. This attempt however failed, as not only were the bricks expensive to make, but they consisted of only slightly baked ore and a considerable amount of dry dust, although the metal content was raised to 50 per cent. The ore is now agglomerated in a long iron rotating oven, lined with firebrick, and inclined at an angle of 6°, which terminates in a frame the lower part of which opens into another rotating cylinder into which the agglomerated ore falls. The frame also serves for the introduction of a coal dust flame playing centrally along the rotating oven. A wood fire is lighted at the bottom of the oven, and then a blast of air is injected, carrying with it very fine coal dust, which being made from Westphalian gas coal, immediately ignites, producing an intense flame. The ore is dried in the upper part of the oven, and in the lower part, where it reaches a temperature of 1100° C., it becomes agglomerated into hard pieces, the size of nuts, intermingled with light pieces of burnt clay encasing particles of agglomerated ore. Analysis shows a content of 26·31 per cent. of iron, 22·30 of manganese, 10·31 of alumina, 15·94 of silica, and 0·31 of combined water, the mine ore being enriched from 32·2 to 48·6 per cent. in metal content. No reduction to metal takes place, but a considerable reduction of the manganese peroxide to the monoxide. Very full economic and working details are given.—A. H. C.

γ-Iron; Solvent power of —— *for iron carbide in iron-carbon alloys containing manganese.* H. Lütke. Metallurgie, 1910, **7**, 268—273.

Conflicting views are held as to the position in the equilibrium-diagram of iron-carbon alloys, of the point E, representing the carbon-concentration of the saturated solid solution at the eutectic temperature (1130° C.). In order to test the influence of manganese on the position of this point, E, the author examined both thermally and micrographically two series of alloys containing about 5 per cent. and 10 per cent. respectively of manganese, and from 1·5 to 4 per cent. of carbon. By the thermal method it was found that with both series of alloys, the eutectic makes its appearance between the limits 2 and 2·3 per cent. of carbon. The micrographic examination of the alloys indicated that the point, E, was in the neighbourhood of 1·8 per cent. of carbon, which does not differ much from the value 1·7 given by Gutowsky (Metallurgie, 1909, **6**, 731; also this J., 1910, 91) for iron-carbon alloys free from manganese. Some tests with alloys containing higher percentages of manganese showed that with 2·4 per cent. of carbon, the carbon-concentration of the solid solution is not appreciably increased until more than about 49 per cent. of manganese is present.—A. S.

Iron containing temper carbon; Action of hydrogen and nitrogen on —— *at different temperatures.* F. Wüst and E. Sudhoff. Metallurgie, 1910, **7**, 261—264.

Starting with a white iron containing 2·79 per cent. of carbon, 0·32 of silicon, and a little manganese, the separation of temper carbon was effected by heating the metal *in vacuo* for periods of from 5 to 10 hours at temperatures ranging from 950° to 1000° C. In general the content of carbon was reduced by from 0·03 to 0·15 per cent., whilst on the average, 55 per cent. of the total carbon separated as temper carbon. Pieces of the metal were then heated at different temperatures (880°—1080° C.) in currents of hydrogen and of nitrogen. The hydrogen was first purified by means of lead acetate, silver nitrate, heated platinised asbestos, soda-lime, white phosphorus, alkaline pyrogallol solution, concentrated sulphuric acid, and phosphorus pentoxide; and the nitrogen by means of soda-lime, phosphorus, alkaline pyrogallol solution, concentrated sulphuric acid, a heated copper gauze spiral, and phosphorus pentoxide. In neither case was there any loss of carbon by volatilisation, the total carbon remaining practically unaltered, but in hydrogen, the proportion of temper carbon was reduced by from 0·6 to 0·8 per cent. The results, which were confirmed by metallographic examination of the metal, are in agreement with those of Wüst and Geiger (this J., 1905, 1112), but are opposed to those of Charpy (this J., 1908, 23).—A. S.

Magnets; Permanent steel ——. W. Brown. Scient. Proc. Roy. Dublin Soc., 1910, **12**, 312—320.

EXPERIMENTS are described to find the best shape and dimensions of magnets, the same kind of steel being used throughout, and in the same physical condition. Sixteen samples were used, two of which were practically pure iron, the others contained various proportions of carbon, manganese, silicon, nickel, tungsten and chromium. The specific magnetization of each is tabulated at the date of preparation, and after one month and six months, and the percentage loss in the full period. From an examination of this table the author concludes that the retentivity of the magnets is improved by the presence of a small quantity of nickel, but diminished by larger percentages: though the original magnetic moment does not seem to be greatly affected thereby. In tungsten steels, an increase of 0·5 per cent. of carbon and 12 per cent. of tungsten caused an increase of 65 per cent. in the magnetic moment, and increased the retentivity nearly three times. In chrome steels a low percentage of chromium seems to have a better effect than a higher; though when nickel is present it appears to mask the effect of chromium if the amount of the latter is small. Abt has published some results on the comparison of the magnetic moments of magnets having the same dimensions, and magnetized in the same field, but of different compositions, that is, crucible, diamond and tungsten steels. The magnetic moments were 33·7, 35·9 and 62·15; and at the end of four months the percentage losses were 1·1, 25·9 and 26·5 respectively. The last value is very high for tungsten steel; the chemical composition of the steels, however, is not given in the paper. In the present investigation, the best results were obtained from tungsten and chrome steels. In every case the magnetic moment is increased after a month's rest, due no doubt to the material coming back to its state of molecular equilibrium after magnetisation; then there is a gradual decrease in the moment until the magnet becomes permanent.—R. C. P.

Magnets; Chrome steel permanent ——. W. Brown. Scient. Proc. Roy. Dublin Soc., 1910, **12**, 349—353.

ASSUMING, as stated by Mme. Curie that small quantities of silicon have little or no effect on the magnetic properties of steel, the magnetic moment per grm. is found to increase smoothly with increase of chromium to a maximum at 2·5 per cent. of chromium, whence it falls until 3·5 per cent. of chromium is reached; further additions leaving the magnetic moment unaffected. The maximum points are, however, liable to disturbance through varying quantities of carbon, silicon, manganese, tungsten and copper: and these substances affect also the retentiveness of the magnets. The magnetic moment per grm. also varies with the form of the sample tested, as shown by the results of various observers.—R. C. P.

Carbon; Determination of ——, in iron, graphite, and tungsten by combustion. M. Dennstedt and T. Klünder. Chem.-Zeit., 1910, **34**, 485—486.

THE authors burn the metal in a stream of oxygen in a quartz tube heated by Teclu burners, in the manner of Dennstedt's "simplified" combustion method. The quartz tube, 45 cm. long, is supported by two iron uprights 25 cm. apart. The filings or borings are contained in a porcelain boat 14 cm. long, behind which in the tube is a platinum "star," or a roll of platinum foil, 6—7 cm. long. The oxygen having been started, the platinum is heated to redness by a flat-flame Teclu burner, then the iron is heated by the second burner (without flat-flame slit) till superficially oxidised. The end of the boat next the platinum is now strongly heated till the metal begins to burn, and the combustion is regulated by the oxygen stream and the burner so as just not to be fierce enough to melt the metal or oxide. When the combustion has thus been carried back to the other end of the boat, the slit is put on the burner and the sheet-iron cover over the tube, and the boat is heated as strongly as possible for 15 minutes, then allowed to cool in the oxygen stream, and the absorption apparatus weighed. Frequently, th whole of the carbon is thus burnt; but sometimes wit irons, and practically always with steels, it is necessary t take out the boat, powder the oxide, replace it, and hea a second, it may be a third or fourth time, till the absorp tion apparatus ceases to gain in weight. Even whe three or four heatings are needed, the operation is quickl finished and it needs but little attention. Results ar accurate. Graphite can be burnt in the same way, bu must be very finely powdered and needs strong heatin Metallic tungsten can be treated in the same way; but it carbon is burnt out at such a low temperature that Jen glass tubes may be used.—J. T. D.

Copper; Rapid method for the electrolytic determination ——— in ores. R. C. Benner. J. Ind. Eng. Chem 1910, 2, 195—196.

FROM 0·5 to 1·0 grm. of the ore (free from interferin elements) is dissolved in nitric acid or *aqua regia*, and lead is present, the solution is evaporated with su phuric acid until white fumes appear, after which th excess of sulphuric acid is neutralised with ammoni and 3 c.c. of strong nitric acid are added. In the absenc of lead the solution is concentrated to 3 c.c. In eithe case the liquid is diluted to 75 c.c. and the copper deposite upon a cylindrical platinum electrode about one inch i diameter, and half an inch in length, made from wire gauze 52 meshes to the inch. The current used is 8 to 10 ampère and 3 to 4 volts. Should the deposit be dark in colou it is redissolved in nitric acid and again deposited in th same way. The results thus obtained are practicall identical with those given by the ordinary method. I the case of slags or other material of low grade, yielding large amount of gelatinous silica, accurate results may b obtained by disintegrating the material with nitric aci followed by hydrofluoric and sulphuric acids. Th liquid is evaporated until white fumes appear, and th determination is then made as in the case of ores. Arseni when present in sufficient quantity to be deposited wit the copper, may be removed by dissolving the depos and reprecipitating the copper under the same condition as before.—C. A. M.

Copper; [Electrolytic] determination of —— in blist and refining copper. W. F. Ferguson. J. Ind. Eng Chem., 1910, 2, 187—195.

THE most suitable conditions for obtaining accurat results are described in detail. If the current used f the electrolysis is too low in density, or if the electroly has too oxidising an action, the results may be too hig owing to oxidation of the deposited copper; whilst, o the other hand, extreme conditions in the other directio may lead to the deposition of impurities. In order t reduce to a low limit the error caused by the use of sample made up of particles of dissimilar size and con position, 80 grms. are used by the author for the dete mination, and after dissolving, precipitating silver, an making up to 2000 c.c., four aliquot portions are take by means of a dividing pipette, and are kept at the sam temperature as the rest of the solution by means of current of water passing through the jacket of the pipett To prevent oxidation of the deposited copper by the electr lyte, a current of as high a density as possible whilst st yielding a smooth deposit is employed, and errors in weigh ing are minimised by depositing 2 grms. of copper upon small electrode. The electrolysis is carried out in a vess with a concave bottom so as to promote active circulatio of the electrolyte.—C. A. M.

Zinc; Metallographic examination of metallic ——, an of the alloys of zinc with low percentages of the meta commonly occurring in commercial zinc. P. T. Arneman Metallurgie, 1910, 7, 201—211.

PURE zinc, and binary alloys of zinc with each of the oth metals in question were examined both thermally (meltin point curves being taken on quantities of 100 grms. co tained in a crucible surrounded with a non-conductin jacket so as to prolong the time of cooling as far as possib and micrographically. The surfaces used for micrographi examination were both sections and also surfaces of olidification. The latter were made by casting small discs in a circular hole cut through a wooden plate, which was laid on the flat bottom of an inverted cylindrical carbon crucible. The crucible was first heated by a Bunsen burner to about the melting-point of the alloy, the mould then laid on it, the alloy as little above its melting-point as possible poured in, and a cover put over, to stand cooling. The solidified surface showed none of the markings of the crucible, but well-formed crystals of the constituents of the alloy. Both untouched, and also etched, these surfaces in many cases are much clearer for ocular observation than polished sections, though hey cannot be so well reproduced photographically. In the thermal portion of the work the author has incorporated in his diagrams the results of former observers as well as his own. A long series of diagrams and of photomicrographs illustrates the paper. The following ummarises the results :—

Zinc.—Two samples of pure zinc, one from Merck, the other prepared by the author, were examined thermally, partly n order to calibrate the pyrometer. Both were found to olidify at 419° C., and to show a perfectly uniform curve n cooling. No indication of allotropic change at 360° C., as suggested by Le Chatelier from measurements of electric resistance, was observed in either sample. Both surfaces and sections of zinc show a polygonal structure under he microscrope. Slight etching increases the sharpness of the dividing lines of the polygons.

Zinc-iron.—From 22 to 11 per cent. of iron, two contituents separate, $FeZn_3$ and $FeZn_7$, the proportion f the latter of course increasing as the percentage of iron iminishes. From 11 to 7·3 per cent. of iron one constiuent only separates, consisting of mixed crystals of $FeZn_7$ and zinc; below 7·3 per cent. of iron, these mixed rystals separate along with increasing proportions of metallic zinc. The micrographic appearances of surfaces and sections containing from 3·3 to 0·1 per cent. of iron bear out the last statement. Mixed crystals are shown n diminishing quantity, and are clearly visible, according o the author, if even 0·06 per cent. of iron is present. Hence this quantity of iron can be detected by the microcope. The mixed crystals are both harder and more esistant to acids than zinc. With increase of iron the alloys become harder and more brittle; those containing —9 per cent. of iron are extraordinarily brittle and riable.

Zinc-lead.—The whole range of these alloys was xamined. The metals are only partially miscible, mixures containing from 0·5 to 97 per cent. of lead separating nto two layers of liquid. The melting-point falls as lead is introduced, to 418° C. at 0·5 per cent., and then remains onstant to 96·6 per cent.; it now rapidly falls to 317° C. t 98·8 per cent. (the eutectic) and then rises to 327° C. t 100 per cent. The cooling observations indicate that in alloys containing from 0 to 98·8 per cent. of lead, ine and eutectic, and in those containing more, lead and utectic, should be observed. All these alloys are soft nough to be cut with a knife. The micrographic appearnces of alloys containing 10 and 1 per cent. of lead show clearly the distinction between the eutectic and the zinc, o that 1 per cent. of lead can be easily recognised.

Zinc-cadmium.—This diagram is perfectly simple. inc and cadmium form no mixed crystals. The melting-oint falls from 419° C. to 264° C. at 84 per cent. of cadmium (eutectic), then rises steadily to cadmium at 320° C. There are to be expected then, in surfaces or sections, nly eutectic with zinc or cadmium as the case may be; nd this expectation is borne out, from 84 to 1 per cent. f cadmium. Below 1 per cent. some change in structure akes place, possibly from formation of mixed crystals, hough this is not clearly made out.

Zinc-arsenic.—Below 2 per cent. of arsenic no break in he cooling curve could be seen, and richer alloys were ot examined. Friedrich and Leroux state that above 19° C. arsenic-zinc compounds separate from these alloys, leaving pure zinc, which solidifies at 419° C. The ne-arsenic alloys are hard and brittle and show strong endency to segregation. The alloys, etched with ammonium cupric chloride, so as to deposit copper on the zinc, show bright patches (presumably the compounds above mentioned) which can be detected even if 0·1 per cent. of arsenic be present.

Zinc-antimony.—The melting-point falls with introduction of antimony to 412° C. at 2·5 per cent., then rises to a maximum at 40 per cent., corresponding to the compound, Zn_3Sb_2. On cooling a change in the eutectic occurs, marked by a halt in the cooling at 350° C. The constituents of the alloys should therefore be zinc and β-eutectic up to 2·5 per cent. of antimony, and β-eutectic and Zn_3Sb_2 beyond this. The alloys are all hard and brittle. The photomicrographs show very clearly the fine crystals of the compound in the richer alloys, and also show strikingly the difference between the small quantity of this compound in the alloys just above 2·5 per cent. of antimony, and the small quantity of polygonal zinc in those just below.

Zinc-tin.—This curve resembles that of zinc-cadmium alloys; eutectic, 94 per cent. of tin, solidifying at 199° C. The eutectic is clearly visible in the photographs, down to 0·1 per cent. of tin.

Zinc-bismuth.—This is similar to the zinc-lead curve; from 1 to 97 per cent. of bismuth there is immiscibility in the fluid state. The light eutectic is quite easily seen in the photographs with as little as 0·1 per cent. of bismuth.

Zinc-copper.—The melting-point rises gradually to 425° C. at 2·5 per cent. of copper, then very much more rapidly. Below 2·5 per cent., there should be but one constituent in the alloy, the mixed crystals η; above that, the two kinds of mixed crystals η and ϵ. The photographs of the richer alloys show this, but the poor alloys are not homogeneous.

Commercial zinc.—Photographs are given of two kinds of commercial zinc, A containing 0·01 per cent. of iron and 3 per cent. of lead, B containing 0·065 and 1·7 per cent. respectively. In B, both impurities are easily recognisable: in A only the lead. A bibliography is given at the end of the paper.—J. T. D.

Tin ores; Assay of ——. J. Gray. J. Chem., Met. and Min. Soc. S. Africa, 1910, **10**, 312—315.

The object of the paper is to draw attention to the necessity of having a standard method for assaying tin ores in S. Africa. The author briefly reviews eleven different methods and he considers, as the result of comparative tests, that fusion with sodium peroxide and subsequent titration with standard iodine solution is the most satisfactory. A series of assays, by this method, was made of a tin ore to which varying amounts of impurities were added, and the author states that the addition of aresnic, antimony, molybdenum or tungsten, up to at least 30 per cent., bismuth up to 20 per cent., and titanium up to 15 per cent., had practically no effect on the accuracy of the assay. A bibliography on the solution of cassiterite is appended.—F. R.

Bearing metals and stamped alloys. W. Guertler. Metallurgie, 1910, **7**, 264—268.

Bearing metals consist of a soft plastic matrix, usually composed mainly of tin or lead, in which harder crystals, containing copper, tin, etc., are embedded. The author has endeavoured to prepare cheaper products containing essentially lead as matrix and iron or iron alloys as the harder constituent. It is impossible to prepare such products by the usual fusion methods, as lead and iron are practically immiscible in the molten state. Successful results were however obtained by heating an intimate mixture of the powdered metals to 250°—300° C., and then stamping in moulds. The mixtures of powdered metals were prepared either by precipitating dilute lead solutions with excess of iron powder, or by grinding together iron powder and "lead-tree" crystals. Pig-iron and spiegeleisen are especially suitable for the preparation of these stamped alloys, as they are cheap and can be easily pulverised in cement mills. Also, pure cementite may be used in place of iron, or chromium, tungsten, nickel, etc., may be added to the latter. The products are stated to have good mechanical properties. The author discusses the points of resemblance and difference between his stamped alloys, and the products prepared by Friedrich (this J., 1910, 358) by kneading, whilst one or more of the constituents were in a pasty condition. He considers that both his products and those of Friedrich, so far as they are composed of metals, are to be regarded as true alloys.—A. S.

[*Ore concentration.*] *Oil flotation process at Broken Hill.* T. J. Hoover. Eng. and Min. J., 1910, **89**, 913—917.

A DETAILED description is given of the ore concentration plant at Broken Hill which is daily treating 750 tons of old lead-zinc tailings assaying about 19·5 per cent. of zinc, 6 per cent. of lead, and 7·5 oz. of silver per ton. The ore consists of blende, galena, pyrites, pyrrhotite, rhodonite, calcite, and a soft complex carbonate containing manganese, iron, calcium, zinc and magnesium, together with much quartz, the silica amounting to 42 per cent. of the total. The original tailings, over 90 per cent. of which pass a screen having apertures of 0·0625 in., are ground to pass a 0·024 in. screen, and the pulp, containing over 25 per cent. of solids, is heated by steam to 115° F. and violently agitated in a series of mixers, first with acid and then with oil, using one lb. of oil per ton of ore. As the pulp emerges from the mixers, a thick seething froth, consisting of lead and zinc sulphides supported by bubbles of air, floats to the surface and is separated in a series of spitzkasten. The froth is then repeatedly submerged until the concentrate ceases to float, after which it is drained in bins having filter bottoms until dry enough to shovel into trucks. 400,000 tons were treated in the first two years, with a recovery of 85 per cent. of the total zinc, 70 of lead, and 75 of silver, the concentrate assaying 47 per cent. of zinc, 10 per cent. of lead, and 14 oz. of silver per ton. Plans of the plant and details of constructional and working costs are given, together with the results of a sizing test on the ore at different stages of the process.—F. R.

Sulphur in metallic molybdenum and tungsten and in their iron alloys; Determination of ——. W. Trautmann. Z. anal. Chem., 1910, **49**, 360—361.

IN the determination of carbon in molybdenum and tungsten and their iron alloys, by combustion, the sulphur also is oxidised to sulphur dioxide and trioxide, the former being absorbed along with the carbon dioxide in the caustic potash solution, whilst the latter displaces an equivalent quantity of hydrochloric acid from the calcium chloride in the drying tube, which hydrochloric acid is subsequently absorbed by the caustic potash. By combustion in pure oxygen, the sulphur may be determined rapidly and exactly, the sulphur oxides being absorbed in caustic potash, and the solution subsequently oxidised with bromine, and the sulphur determined as barium sulphate in the usual manner.—A. S.

Metals [lead]; Action of distilled water on ——. M. Traube-Mengarini and A. Scala. Z. Chem. Ind. Kolloide, 1910, **6**, 240—250. (See this J., 1909, 857, 1171.)

THE authors have investigated the action of water upon lead at the ordinary temperature. The contradictory results obtained by previous workers are to be ascribed to the fact that lead in every form is retained by paper and by other filtering media, so that decantation must be resorted to. In the absence of oxygen, distilled water acts on lead appreciably in the course of some 40 hours; the progress of the reaction can even be observed under the microscope. The liquid contains lead in colloidal form. Contact with air results in the immediate precipitation of a white crystalline lead oxyhydroxide, which is quite insoluble in water. When lead is boiled with water in air, the liquid remains transparent till cool; the oxyhydroxide then separates. When lead is allowed to stand in water at the ordinary temperature, the colloidal lead is oxidised to oxyhydroxide as fast as it is formed. Even after one minute the opalescence due to the formation of this product may be seen. Under the microscope in air, a fragment of lead resting in water is seen to be surrounded by a narrow clear space (the "dead space" of Liebreich), which is, however, filled by the colloidal solution (as proved by the ultramicroscope). Outside the clear space innumerable, minute, needle-shaped crystals in motion (resemblin bacteria) of the oxyhydroxide are observed. Potassiun nitrate in 0·25 per cent. solution (and still more in 1 pe cent. solution) diminishes the formation of oxyhydroxide Sodium sulphate (0·01 per cent.) inhibits the action stil more strongly, as also does sodium chloride (0·05 per cent.)

The concentration of lead in the colloidal solution seems to tend towards a maximum indicating the formatio of a saturated colloidal solution. This is the case whethe air is excluded or not. When a piece of lead having 3·0 sq cm. surface was placed in 100 c.c. of distilled wate for 144 hours *in vacuo*, 0·0199 grm. of lead was found in th liquid. In air in the same time the liquid acquired 0·099 grm. of lead.—R. V. S.

Metallic deposits; New method of production of —— U. Schoop. Comptes rend., 1910, **150**, 1044—1046.

OBJECTS can be covered with a deposit of any fusib metal or alloy by projecting the fluid metal through suitable jet by means of some indifferent gas under pressure A coating of from 0·02 mm. to several mm. thickness ca be thus produced upon almost any material. The tempera ture of the stream of metallic particles just outside th jet is between 10° and 60° C. The pressure used is hig being 20—25 kilos. per sq. cm. Tin, lead, copper, and alu minium and its alloys can be deposited by this proces which is also adaptable for the purpose of making *clich* —F. SHDN.

Determination of titanium. Gemmell. *See* XX 11.

Chinese antimony. Chem. and Drugg., May 21, 191 [T.R.]

A BRITISH Consular report upon the trade of Changsa f 1908 [Cd. 4419] states that a Chinese company was forme last year, called the Hua Ch'ang Antimony Co., which w granted a smelting monopoly for twenty-five years. T result of the more scientific handling of the ore by t company was that regulus antimony appears as an expo for the first time, 4800 cwt. being shipped. The princip purchasers of antimony during 1909 were Japanese an German firms. The total exports during the last thr years have been as follows: *Crude.*—1907, 61,843 cwt. 1908, 17,060 cwt.; 1909, 22,013 cwt. *Ore.*—1907, 71 cwt.; 1908, 9243 cwt.; 1909, 7452 cwt.

Zinc mine in Eastern Siberia. Board of Trade J May 26, 1910. [T.R.]

A ZINC mine at Tiutcho, 37 versts (24½ miles) from the b of that name, at about the forty-fifth parallel, start regular work in 1909. Over 9,000 tons of calamine ha already been shipped to Antwerp, and a further 80,0 tons have been extracted and are awaiting shipmen The ore contains from 47 to 51 per cent. of zinc, a very litt silver, and in some parts 5 per cent. of copper. It has far been quarried, but tunnelling is now being start The mine lies inland near the Tiutcho River, and connected with the bay by a light railway of 60 cm. gaug there being an aërial ropeway to the minehead. Steame load from lighters in the roadstead. There are quantities timber in the vicinity; it will be possible, therefore, complete cargoes with consignments of timber, and a sa mill has already been erected for that purpose.

PATENTS.

Gold; Extraction of ——. F. A. Ford, London. En Pat. 7101. March 24, 1909.

THE patent is concerned with the elimination of sulph and arsenic from pyritic and other gold ores, includi those containing antimony and tellurium, in order render them amenable to treatment by amalgamati cyaniding or other known methods of extraction. T crushed ore is mixed with about 7 per cent. of powder carbon and 2 per cent. each of kainite and a sulphide, su as sodium sulphide, and the mixture roasted at a l heat with the usual precautions till "sweet," the (i quired being from about ½ to 1 hour. The proportions the added mixture may be varied according to the mposition of the ore.—F. R.

anide-barrel. B. O. Webb, Los Angeles, Cal. U.S. Pat. 956,655, May 3, 1910.

he barrel is mounted so that it can revolve on a horizontal is, and is provided with knobs on the inner surface of lateral walls and with a longitudinal horizontal partition viding it into upper and lower compartments. The e is fed into the upper compartment, which is also provided with means for introducing fluids. The solution oduced is withdrawn from the lower compartment. he barrel is provided with a pressure-gauge, a safety-lve, and with connections for the introduction of wash-g-liquor, these connections comprising a nipple pro-ecting into the interior of the barrel and a conical deflector ounted on the end of the nipple.—A. S.

rucible furnaces and crucibles used in same. J. Newton and C. Billington, Longport, Staffs. Eng. Pat. 8903, April 15, 1909.

he claim is for the use of a crucible having a plugged utlet pipe at the side near the bottom for withdrawing e molten contents. The crucible is heated in a furnace aving an opening which corresponds to the outlet pipe the crucible. Reference is directed to Eng. Pats. 82 of 1872, 16,776A of 1889 and 21,481 of 1901 (this J., 890, 950; 1902, 617).—W. H. C.

urnaces for treating metals and metalliferous ores. E. T. Fennell and J. Sackett, Woolwich. Eng. Pat. 11,863, May 19, 1909.

he furnace consists of a horizontal cylindrical furnace-ody capable of partial rotation about its long axis and nnected to suitable regenerators, provision being made r alternately firing the furnace from each end, the waste ases passing to each of the regenerators alternately. he openings at the ends, through which the furnace is red, are cut in an upward direction, so that the flames mpinge on the roof of the furnace, thus heating the charge y radiation, and avoiding the oxidation caused by the last striking directly on to the charge.—F. R.

urnaces; Heating and annealing —— and the like. W. Kirkham, Sheffield. Eng. Pat. 12,710, May 29, 1909.

he furnaces, which are of any desired shape, are characterised by having a gas-producer incorporated in the urnace structure and by having two tiers of horizontal ues arranged immediately below the bed of the furnace. he waste gases pass from the furnace chamber, down a ertical flue, to the lower series of flues, and after traversing he space beneath the furnace bed escape to the stack, hile air enters by means of the upper series of flues and ecomes highly heated in its passage to and fro between he furnace bed and the lower flues, finally passing up and hrough perforated bricks into the upper portion of the as-producer chamber.—F. R.

e-heating furnaces; Regenerative gas ——. F. K. Siemens, London. Eng. Pat. 23,534, Oct. 14, 1909.

he invention relates to reheating furnaces for ingots, in hich the temperature increases gradually from the harging end or pre-heating hearth to the finishing end f the bed. The finishing hearth is heated by means of a orse-shoe flame as described in Eng. Pat. 25,057 of 1902 this J., 1903, 1197), by which an excess of heat may be btained. Some of this excess can be utilised in heating he pre-heating hearth either by diverting a portion of the lame, or by carrying some of the gas from he single set of producers to this hearth, the air being rawn through passages in the regenerators or through the egenerators themselves.—J. W. H.

Furnace; Electric —— [for smelting zinc]. H. W. Hixon, Philadelphia, Pa. U.S. Pat. 957,058, May 3, 1910.

The furnace, for smelting zinc, comprises a casing, with a non-conducting refractory lining, and is provided with upper and lower electrodes, the latter constituting the interior bottom of the furnace. A central tube of refractory material projects through the bottom of the casing, and extends upwards into the furnace. The tube is closed at its upper extremity, and is provided with passages which incline upwards, and which establish communication between the interiors of the furnace and tube for the passage of zinc vapour through the tube to a condenser attached to its lower end. The walls of the portion of the tube near the lower electrode are made solid, in order to prevent the entrance of slag or other foreign material. An exit pipe is arranged in the top part of the furnace above the upper electrode, for withdrawing certain diluting gases. A hopper, consisting of two compartments, each provided with a conical closure, is arranged to project material into the furnace, each closure being operated independently of the other and being provided with locking and unlocking means, for preventing the escape of gases or vapours from the furnace or the entrance of air during the charging operation.—B. N.

Tin-containing materials; Process for the extraction of values from ——. D. M. Levy, Birmingham. Eng. Pat. 9397, Apr. 21, 1909.

The material, which may consist, for example, of tin smelting products and residues or complex tin ores, is smelted in a blast, or reverberatory furnace, certain quantities of arsenic, sulphur and iron being added so as to produce a suitable matte-speiss product. This product is separated from the slag or metallic portion and removed to a converter provided with suitable condensing apparatus, where it is subjected to a current of air, steam or any suitable gaseous mixture. In this way the tin oxide is volatilised and condensed together with the arsenic oxide, and the two may subsequently be separated by a process of sublimation, the former being left as a residue from which the metallic tin may be obtained by any known method. The residue in the converter obtained as above contains any cobalt, nickel, copper, gold or silver originally present in the charge.—C. A. W.

Solder for aluminium or aluminium alloy. C. J. Bailey, Manchester. Eng. Pat. 9651, April 23, 1909.

The solder is prepared by first melting 3 parts by weight of aluminium and immediately adding 16 parts by weight of zinc, and after thorough mixing, adding one part by weight of antimony. The molten mass is then well stirred and, if required, a little sal ammoniac is added to clarify the alloy. Any scum or dross is skimmed off and the solder cast into bars or strips. In use the solder is melted by means of an ordinary blowpipe, with or without a flux.—F. R.

Zinc; Extraction of ——. C. S. Brand, Troon, Ayrshire. Eng. Pat. 9955, April 27, 1909.

In order to separate the vapours of lead from those of zinc and so obtain a pure metal in the distillation of zinc residues, it has been proposed to arrange a filter-bed of refractory material at the retort end of the condensing pipe. In the reduction of zinc ores and concentrates however, it is necessary to employ a higher temperature, so that the filter in this position would soon become choked. For this purpose therefore, the filter is placed entirely within the retort, towards the front, so that it is always subjected to a sufficient temperature to prevent condensation of the zinc vapours. The filter itself comprises a container of elliptical cross-section, which is fitted more or less tightly into the front part of the retort before the insertion of the condenser. This container is provided with end walls, of which the front wall contains one large aperture, and that at the rear, two smaller ones. In this way, and by placing the container somewhat askew in the retort, a well is formed at the bottom, in which the intercepted metals are accumulated. The front aperture serves as an exit for the zinc vapours and for the insertion of the filtering material, generally lumps of some refractory substance such as broken clay retorts. The apertures at the rear form an entrance for the volatilised zinc and heavier vapours and also serve for the removal of the intercepted lead, in a molten condition, at the close of the reaction.—C. A. W.

Iron or steel ; Process for the production of —— direct from iron ore. W. A. Hargreaves, Woodville, S. Australia. Eng. Pat. 18,349, Aug. 9, 1909.

THE ore, preferably composed mainly of iron sesquioxide, is ground and screened to the necessary degree of fineness, the material passing through an 18-mesh sieve and retained by a 90-mesh sieve being employed. With an ore of greater fineness, the subsequent reaction might be too violent, but, should an extra heat be required, a certain proportion of the finer product may be mixed with the coarser ore. The ground ore, after thorough drying, is mixed with a sufficient quantity of powdered aluminium of about the same degree of fineness, and, in certain cases, as in casting or welding operations, with a certain amount of metallic iron or steel. As an example, the proportions : ore, 62 ; aluminium, 20 and iron turnings, 18 per cent. may be taken. The mixture having been placed in a crucible, the reaction is started in the ordinary manner by means of a fuse of powdered aluminum and barium peroxide. In order to obtain a steel of a given class, ferromanganese, spiegeleisen or iron containing the necessary amount of carbon may be added before or during the operation. (Reference is directed to Eng. Pats. 27,625 of 1896, 22,294 of 1902, 28,757 of 1904, and 788 and 28,361 of 1906 ; this J., 1903, 1051 ; 1907, 154).
—C. A. W.

Iron ores ; Process for cleaning ——. E. F. Goltra, St. Louis, Mo. U.S. Pat. 957,157, May 3, 1910.

IRON ores mixed with a moist clayey gangue are heated so as to expel moisture and volatile matter and to render the gangue easily separable from the ore, and are then subjected to a "tumbling" action, whereby the gangue is shaken loose and pulverised, so that it can be subsequently readily removed by means of a strong gaseous blast.—A. S.

Ore or other comminuted solid matter ; Means for separating pulverised —— from liquid. A. J. Arbuckle and A. Osborne, Johannesburg. Eng. Pat. 24,402, Oct. 23, 1909.

THE apparatus is more particularly intended for separating the solid constituents of slimes from the water or solvent solution. The separating vessel may take the form of an inverted cone supported on three uprights, or it may be cylindrical, but in the latter case it is preferably constructed with a conical bottom. The interior of the conical vessel is divided into floors by means of segmental plates supported on radial bars. These bars, of L-section, are riveted at the outer ends to the inside of the tank, the inner ends on any floor being clamped together so that they form a complete ring and mutually support one another. For the additional support of the segmental plates, horizontal cross-pieces are laid between any two of the radial bars, and on these cross-pieces the metal plates, or suitably shaped wooden pieces, are fixed. In each floor radial slots or passages are provided, a slot being contrived between any two segments by slightly separating the adjacent radial supports. These slots in the several tiers are arranged one above another from the top to the bottom of the vessel, so that an unobstructed passage for the settling solids is obtained ; the widths of the passages, moreover, increase from floor to floor, the widest ones being found at the bottom. Radial scraper bars are provided on each floor, these scrapers being rotated by means of a shaft which passes up the centre of the apparatus and which is driven by a horizontal shaft and bevel wheels at the bottom. The shaft itself is surrounded by a vertical feed-pipe constructed in telescopic sections and provided with holes at the different levels for the passage of the scraper-bars, the pipe in this way being carried round with the shaft. In the working of th apparatus, the pulp is delivered at the top of the fee pipe and, passing down below the level of the botto floor, is deflected by an interior cone on to the sides of th apparatus. As the liquid ascends, the solids are deposite on the several floors, whence they are removed by th scrapers and carried down through the slots. The materi accumulating at the bottom is forced through outlets b means of spirally disposed arms rotating on the vertic shaft. Meanwhile the clear liquid rises in the apparat and is finally carried away by means of an overflow at th top. When larger, cylindrical, vessels are employe an increased number of slots, not always radially arrange is provided. The scraper bars moreover are fixed o several vertical shafts disposed so that the paths adjacent scrapers overlap.—C. A. W.

[De-watering ore pulp.] Tanks or vessels for separatin comminuted solid matter, such as pulverised ore, fro liquids. A. J. Arbuckle, Johannesburg. Eng. Pa 24,403, Oct. 23, 1909.

THE apparatus consists essentially of a series of inverte truncated conical vessels, arranged concentrically withi an outer containing vessel, and having their upper en in the same plane. The cones are maintained, by suitab means, at equal distances from one another, thus formin a series of conical annular spaces, in conjunction with clear central passage or duct formed by the truncate ends. The ore pulp is fed into the central passage an flows upwards between the cones, upon the surface which the solid matter becomes deposited, the cle liquid overflowing into a collar-launder fixed to the ri of the containing vessel. If desired a series of opposite disposed, or upright, cones may be also arranged conce trically between the outermost inverted cone and the sid of the containing tank. The central vertical passa may be either cylindrical or tapering upwards accordi to whether the lower open ends of the cones are equa or graduated in size. The settling surfaces of the cone which may be provided with slots or passages to assi in breaking up the ascending current of ore pulp, a formed at an angle of about 60° to the horizontal, so th the accumulated solids ultimately fall by gravity to th bottom of the containing vessel, from which they a subsequently removed.—F. R.

Metals in solution ; Process of separating ——. W. S. Gat and H. H. Dow, Midland, Mich., Assignors to T Ontario Nickel Co., Ltd., Worthington, Canada. U.S Pat. 956,763, May 3, 1910.

A PORTION of a solution containing iron, copper, an nickel is treated with a reagent capable of producing less soluble precipitate with iron than with copper a nickel. The iron precipitate (*e.g.*, ferric hydroxide) removed and agitated with another portion of the origin solution until it is practically free from the copper an nickel compounds (*e.g.*, hydroxides and basic carbonate present. After again removing the precipitate, the solution is added to another portion of the original solution, which the reagent is being added as described abov The copper-nickel solution, after removal of the iron, treated with a reagent capable of producing a less solub precipitate with copper than with nickel, and the precipita is purified in a similar manner.—A. S.

Metallic slimes ; Process for treating ——. J. Dunston Dollar Bay, Mich. U.S. Pat. 956,800, May 3, 1910

COPPER slimes are agitated with an emulsion of kerosen an aqueous solution of sodium nitrate, and sulphuric aci and the portion which floats is collected.—A. S.

Metalliferous substances ; Process for the desulphurisati and agglomeration of finely-divided ——. Metallurgisc Ges. A.-G. Ger. Pat. 218,372, Dec. 5, 1907. Additi to Ger. Pat. 204,082, July 30, 1907.

ACCORDING to the main patent, the material, *e.g.*, copp sulphide ore, was carried on a grating through an ignitio zone, a current of air being also passed through the mas he present patent refers to a rational and economic ethod of carrying out the process. The ore is charged nto perforated receptacles carried on an endless band. he receptacles may be mounted so that they can be lted, or they may be fixed firmly to the supports, nd the whole mounted so as to rotate around horizontal axis The device used for igniting the charge placed between the ore-supply end and the wind-box urnishing the air blast. A hopper is provided from which protecting layer of limestone is spread over the charge, nd there is also a device for breaking the lumps of sintered re. A. S.

opper from waste liquors produced in pickling metals ; Process and apparatus for recovering ——. A. Göpfert, Woeklum bei Balve, Germany. Eng. Pat. 10,352, May 1, 1909.

ee Fr. Pat. 402,338 of 1909 ; this J., 1909, 1205.—T. F. B.

opper matte and ores ; Process of treating impure ——. H. Maschmeyer, Assignor to Usine de Desargentation Soc. Anon., Hoboken, Belgium. U.S. Pat. 957,231, May 10. 1910.

ee Eng. Pat. 19,585 of 1908 ; this J., 1909, 527.—T. F. B.

opper ores and other ores ; Treatment of ——. Ore Concentration (1905), Ltd. Fr. Pat. 409.291, Nov. 4, 1909.

ee Eng. Pat. 16,667 of 1908 ; this J., 1910, 30.—T. F. B.

ron ; Process for the production of ductile electrolytic ——. Langbein-Pfanhauser-Werke, A.-G., Leipzig-Sellerhausen, Germany. Eng. Pat. 24,841, Oct. 28, 1909. Under Int. Conv., Nov. 3, 1908.

ee Fr. Pat. 407.889 of 1909 ; this J., 1910, 636.—T. F. B.

Steel ; Process of making hardened ——. H. de Nolly, Assignor to Comp. des Forges et Aciéries de la Marine et d'Homecourt, St. Chamond, France. U.S. Pat. 957,706, May 10, 1910.

See Eng. Pat. 25,742 of 1907 ; this J., 1908, 944.—T. F. B.

Iron ; Process for making ——. International Metal Products Co. Fr. Pat. 409,531, Nov. 23, 1909.

See U.S. Pats. 940,784 and 940,785 of 1909 ; this J., 1910, 219.—T. F. B.

Ores and carboniferous earths ; Process of treating ——. A. A. Lockwood, London. U.S. Pat. 956.773, May 3, 1910.

See Eng. Pats. 26,264 of 1908 and 8287 of 1909 ; this J., 1910, 95.—T. F. B.

Ores or other solid material ; Means for separating pulverulent —— from liquids. A. J. Arbuckle and A. Osborne. Fr. Pat. 408,960, Nov. 11, 1909.

See Eng. Pat. 24,402 of 1909 ; preceding.—T. F. B.

Separating pulverised solids, such as powdered ore, from liquids ; Vats, reservoirs, or other receptacles suitable for ——. A. J. Arbuckle. Fr. Pat. 408,966, Nov. 11, 1909.

See Eng. Pat. 24,403 of 1909 ; preceding.—T. F. B.

Tin ; Apparatus for reducing ——. R. W. Scott, London. U.S. Pat. 957,111, May 3, 1910.

See Eng. Pat. 12,642 of 1908 ; this J., 1909, 714.—T. F. B.

Furnaces ; Regenerative, reheating ——. F. K. Siemens. Fr. Pat. 409,650, Nov. 26, 1909.

See Eng. Pat. 23,534 of 1909 ; preceding.—T. F. B.

Separating clay, slimes, minerals, and the like. Eng. Pats. 9671 and 9672. *See* I.

XI.—ELECTRO-CHEMISTRY.

Accumulator plates ; A rapid method of preparing lead —— by means of phosphoric acid and phosphates. F. Fischer. Z. Elektrochem., 1910, **16**, 355—357.

The large unprepared lead plates are all first oxidised to form a coating of lead monoxide by making them anodes in the electrolysis of a 10 per cent. solution of sodium phosphate at 80° C. between cathodes of the same area. The E.M.F. is allowed to rise during the process from 2·2 to not more than 2·6 volts. After 24—36 hours the plates are covered with a firm coating of lead monoxide. This is then reduced to spongy lead by electrolysis of so-called accumulator acid (sp. gr. 1·18) at room temperature with 1 amp. per sq. dcm. until hydrogen is evolved. The plates are then washed for 12 hours and on half of them the coating is oxidised to lead peroxide, by making them anodes in a similar electrolysis of a more dilute acid (sp. gr. 1·09). An uninterrupted current of 1 amp. per sq. dcm. must be passed until oxygen is freely evolved. The reduction requires about as long as the formation of the original coating, the oxidation about twice as long, the whole process taking 4—5 days.—W. H. P.

Electrolysis of alkali bromides, and the delay in the separation of halogens at the anode. Foerster and Yamasaki. *See* VII.

Electrolytic oxidation of sulphurous acid in aqueous solution. Fischer and Delmarcel. *See* VII.

Mercury cathode in rapid electro-analysis. Kimley. *See* XXIII.

Patents.

Electrolytic cells. J. R. Williams, H. W. and B. Bradley, Sheffield. Eng. Pat. 9796, April 24, 1909.

The electrolytic cell comprises anodes formed in pairs, provided with connecting pieces which lie across perforated partitions extending along the cell. Each cathode is disposed between a pair of anode surfaces, the cathodes being provided with lugs by means of which they are suspended from an electrically-connected member. The cathodes are also provided with edge-shields to prevent feathering at these points.—B. N.

Electrodes ; Carbon —— for galvanic elements. S. Benkö, Budapest, Hungary. Eng. Pat. 12,677, May 28, 1909.

The electrolyte or depolarising gas, or a mixture of these, is pressed through the pores of the carbon electrode, the latter being surrounded by a frame, or the like, consisting of metal, or a mixture of metal and carbon, so that the fluid or gas or mixture of these, flowing under the action of pressure or suction, can only force its way through the part of the electrode which is surrounded by the frame. Several methods are described for securing the edges of the carbon to the metal frame. Thus, the part to be attached to the metal may be subjected to the action of the vapour of a metal, or saturated with a salt of the impregnating metal, and the latter separated in a galvanic bath. In an alternative method, carbon powder is galvanically coated with metal, or mixed with metal powder, the part forming the frame being constructed of this mixture, or carbon powder may be sprinkled into molten metal with continuous stirring during cooling, so as to obtain a mixture of carbon and metal in the form of a sand-like powder.—B. N.

Secondary-battery plates ; Process for the preparation of ——. F. A. R. Wright, Cleveland, Ohio. U.S. Pat. 956,919, May 3, 1910.

Two series of lead plates are immersed in a suitable electrolyte, each series being connected in parallel, and an electric current is passed through the plates and electrolyte in one direction. The electrolyte contains sulphuric acid, and an oxidising substance in such amount that the cathode plates are unaffected during the passage of the current, which is continued until the desired quantity of lead peroxide is formed on the anodes. The current is then reversed, until the lead peroxide previously formed is reduced to spongy lead, and until the required amount of lead peroxide is produced upon the plates formerly unaffected.—B. N.

Furnace ; Combined electric arc or resistance and induction ——. J. H. Reid, Newark, N.J. U.S. Pat. 956,544, May 3, 1910.

The furnace is provided with electrodes, and means for passing a current through them from an external source. A suspended annular induction heating coil is adapted to be lowered into the charge between the electrodes, means being provided for circulating a cooling medium around the interior of the coil, and a heating current is thus induced independently of that passing through the electrodes.—B. N.

Electrolysis of aqueous solutions ; Processes and apparatus for continuous ——. O. Imray, London. From Soc. of Chem. Industry in Basle, Basle. Eng. Pat. 25,118, Nov. 1, 1909.

See Fr. Pat. 408,565 of 1909 ; this J., 1910, 638.—T. F. B.

Insulating compound ; Refractory waterproof ——. W. H. Wright and J. Hoffman, Schenectady, Assignors to General Electric Co., New York. U.S. Pat. 956,870, May 3, 1910.

See Eng. Pat. 25,853 of 1903 ; this J., 1904, 1034.—T. F. B.

Electrical conductor for illuminating purposes. U.S. Pat. 955,273. *See* IIb.

Electrolytic production of salt solutions. Eng. Pat. 20,192. *See* VII.

Purifying oily or greasy water or condensed steam by electricity. Eng. Pat. 26,477. *See* XIXb.

XII.—FATS ; OILS ; WAXES.

Linseed oil and lacquer oil ; Flock formation in ——. J. Hertkorn. Chem.-Zeit., 1910, 34, 462—463.

The flocculation of linseed oils in the boiling process is not always due to the presence of carbohydrates or proteins from the seed, but is often caused by adulteration with a fatty acid glyceride, which polymerises at a temperature of 240°—260° C., yielding insoluble gelatinous products. When the polymerisation sets in, linseed oil is enclosed in the solidifying jelly, but on further heating and stirring, the jelly suddenly breaks, and spongy, slimy flakes separate. These flakes rapidly harden in the presence of air in the blowing process and frequently ignite spontaneously, causing explosions and fires in the boiler. Chief among the adulterating oils in question, are Chinese wood oil and candlenut oil. Genuine, pure, but "thin," linseed oils show no apparent gelatinisation, but skins and flakes, which lead to explosions, may be formed. The phenomenon in this case differs from that observed with an adulterated oil, in that the oil becomes brown or black and pitchy and yields a useless product. Normal linseed oils containing even a few tenths of a per cent. of wood oil gelatinise on heating to 240° C., but remain pale in colour, and the odour of the wood oil is pronounced. Certain treated, quick-drying train oils behave in linseed oil in the same manner as wood oil ; these also are recognised by their odour on heating. Only the "thin" qualities of linseed oil are liable to this adulteration, since the adulterating oils are far more viscous than norma linseed oil. The phenomena of gelatinisation are no necessarily caused by deliberate adulteration ; they ar produced, for instance, if a barrel or vessel, having contained wood oil, is subsequently used for linseed oil. I practice the danger of spontaneous ignition in blowing i avoided by heating the oil for a long time at 150°—260° C. allowing the polymerised flakes to settle, and decantin off the clear oil before blowing. The polymerised residue are worked up separately for oil-lacquers, for which the are said to be eminently suitable.—J. F. B.

Chinese wood oil ; Constants of ——. A. Kreikenbaum J. Ind. Eng. Chem., 1920, 2, 205—208.

It is customary to group both Chinese and Japanese woo oils under the name of "tung oil," but according to th author the two products are quite distinct and thei analytical values ought to be separately recorded. Th following results were obtained with average samples o commercial shipments of Chinese wood oil during tw years and they indicate the uniformity of this product In each case the samples were kept before analysis in tightl closed vessels in a dark cool place, some of the analyse being made a year later and others immediately afte receipt of the consignment. The values given by l samples were as follows :—Sp. gr. at 15·5° C., 0·9416 t 0·9454 (usual figure, 0·941) ; acid value, 1·7 to 7·1 saponification value, 189·8 to 191·8 ; and iodine valu (Hübl), 169 to 172·6. Age had practically no effect upo the iodine value. In most cases the absorption of iodin from Hübl's solution was complete in 4 hours. (Th Hanus method was not applicable to Chinese wood oi the results yielded by it ranging from 188·9 to 210·8.) —C. A. M.

Cocoanut oil ; By-products obtained in the purification o ——. *Composition of the essential oil from cocoanut oi* A. Haller and A. Lassieur. Comptes rend., 1910, 15(1013—1019.

Crude cocoanut oil owes its peculiar odour to the presenc of a small amount of an essential oil. The princip constituents of this oil are methylheptyl and methylnony ketones. A small amount of an aldehyde is also present The oil therefore resembles oil of rue (*Ruta graveolens* Under the action of hydrogen at 250°—300° C. in th presence of nickel, methylnonyl ketone yields a hydro carbon, C_9H_{20}, and a pinacoline, $C_{22}H_{44}O$. The hydro carbon boils at 150°—155° C. at 760 mm. The pinacolin melts at 27° C., and gives an oxime boiling at 233°—237° C at 15 mm., and a semicarbazone, m. pt. 225°—227° C. —F. Shdn.

Cholesterol group ; Investigations in the ——. *VII. Th phytosterol from walnut oil.* A Menozzi and A. Moresch Atti R. Accad. dei Lincei, Roma, 1910 [5], 19, I., 187—192. Chem. Zentr., 1910, 1, 1777—1778.

100 kilos. of walnuts yielded 38·4 kilos. of kernels, fro which, by extraction with ether, 23·2 kilos. of oil wer obtained. 1000 grms. of the oil yielded 2·6 grms. of un saponifiable matter, from which by repeated crystallisation a phytosterol was isolated containing 1 mol. of water o crystallisation, and having the m. pt. 138° C., and rotator power $[\alpha]_D^{14} = -33{\cdot}76°$. After drying, the compoun contained 83·77 per cent. of carbon and 11·88 per cent. o hydrogen. The molecular weight of the hydrate, a determined cryoscopically in naphthalene, was found t be 391. Crystallographically, the phytosterol agrees wit that obtained by Mügge from cottonseed oil (Z. Unter Nahr. Genussm., 1, 45). The acetate forms prismati needles melting at 121° C., with $[\alpha]_D^{17} = -40{\cdot}48°$, and containing 81·19 per cent. of carbon and 11·43 per cent. o hydrogen. The formate, benzoate, salicylate, dibromo acetate, and the dihydro-derivative and its acetate are als described.—A. S.

Monoglycerides ; Synthesis of symmetrical ——. A. Grün. Ber., 1910, **43**, 1288—1291.

Hitherto only unsymmetrical α-monoglycerides, $CH_2OR.CH(OH).CH_2OH$, have been synthesised, but the author has now prepared symmetrical β-monoglycerides, $CH_2OH.CH(OR).CH_2OH$, by the esterification of *α.α′* dichlorhydrin, and the removal of the chlorine from the chloro-derivative by the action of silver nitrite (see Ber., 1907, **40**, 1795; 1909, **42**, 3748). The preparation of β-monolaurin and β-monopalmitin by this method is described. β-Monolaurin crystallises in small white needles having a silky lustre. The crystals sinter at 58° C. and melt to a clear liquid at 61° C.; after they have been kept for some time, the melting point falls to 57·5° C. α-Monolaurin melts at 59° C. according to Krafft; at 52° C. according to Grün and von Skopnik. Only the β-compound forms a phenylurethane (m. pt. 74° C.) on treatment with phenylisocyanate. β-Monopalmitin forms white leaflets, which melt at 74° C. when freshly prepared and at 69·5° C. after several months. α-Monopalmitin melts at 72° C. according to Krafft; at 65° C. according to Guth. —A. S.

Beeswax ; Abnormal composition of ——. G. Buchner. Z. öffentl. Chem., 1910, **16**, 128—130.

Two samples of East African beeswax, examined by the author gave the following results:—Acid value, 19·98 and 20·99; saponification value, 81·07 and 87·87; ratio: 3·03 and 3·1; and m. pt. (one sample), 65·5° C. Glycerides were present in traces. It was concluded that these were pure waxes in which, whilst the acid value was normal, there were variations from the normal figures in the amounts of the saponifiable and unsaponifiable portions. The amount of alcohols in the second wax determined by Buisine's method was 46·42—46·89 per cent., whilst the hydrocarbons amounted to 17·08—17·12 per cent. These waxes had many points of resemblance with the Indian Ghedda wax (this J., 1905, 154).—C. A. M.

Candelilla wax ; Examination of ——. R. F. Hare and A. P. Bjerregaard. J. Ind. Eng. Chem., 1910, 2, 203—205.

This wax occurs as a deposit upon the leaves of a plant growing wild in dry situations in North Mexico and South Texas. The plant (probably *Euphorbia antisyphilitica*) is termed *Candelilla* by the Mexicans. The wax separated from the leaves by treatment with hot water was a dark brown substance, which when freed from fragments of bark and other impurities by solution, first in chloroform and then in hot absolute alcohol and 90 per cent. benzol, became pale greyish-yellow in colour. The yield was about 2·5 per cent. of the partially dried plants. The wax was harder and more brittle than beeswax, but not so hard or brittle as carnauba wax. It was readily soluble in all the usual solvents when hot, and the solutions, on cooling, yielded gelatinous pomade-like masses. The sample examined contained 0·64 per cent. of ash consisting of practically pure calcium carbonate. The following analytical values were obtained:—Sp. gr. at 15°/15° C., 0·9825; m. pt. 67°—68° C.; solidifying point, 64·5° C.; acid value, 12·4 (on ash-free substance, 17·4); saponification value, 64·9 (on ash-free substance, 84·1); iodine value, 36·8 (on ash-free substance, 33·6); unsaponifiable matter, 91·17 (on ash-free substance, 84·2) per cent.; fatty acids, 6·57 per cent.; and refractive index, 1·4555 at 71·5° C. The wax acids were dark brown in colour, softer than the original wax, and free from ash. The unsaponifiable matter became soft at about 75° C., but did not flow even at 125° C. It gave the Liebermann-Storch reaction. The dried and filtered commercial wax was found to contain 80·30 per cent. of carbon and 12·69 per cent. of hydrogen, and had thus a similar composition to the sugar-cane wax examined by Dumas (C = 81 per cent.; H = 14·16 per cent.). It is probable that candelilla wax is a mixture of an alcohol, an ester and some free fatty acid. Attempts to acetylate the unsaponifiable matter, however, by the Benedikt-Lewkowitsch method gave negative results. —C. A. M.

Influence of solvents on drying of linseed oil. Powney. *See* XIII.

Detecting palm-kernel and coconnut oils in butter and lard, and of lard in butter. Ewers. *See* XIXa.

Detecting coconnut oil in butter and lard. Fendler. *See* XIXa.

Chloro-derivatives of ethane and ethylene. [Solvents for cellulose acetate, fats, resins, etc.] Clément and Rivière. *See* XX.

Patents.

Glycerin ; Method and apparatus for use therewith for the extraction of crude —— *from the salt produced during the concentration of soap or other lye.* Lever Brothers, Ltd., Port Sunlight, and A. C. Edwards, Brussels. Eng. Pat. 14,750, June 23, 1909.

The soap lye, etc., is concentrated in an evaporator containing two or more chambers, and the mother liquor from the first of these is made to pass through the precipitated salt which has been discharged from the second chamber and thence into the second chamber. As it is already practically saturated with salt it will not dissolve any more, but will extract the glycerin which is adherent to the salt discharged from the second chamber. The same process may be repeated with the succeeding chambers when present, whilst the crude glycerin from the last evaporating chamber may be made to pass through the salt which has been discharged from that chamber, so that simultaneously it leaves behind any salt it carries and washes any adherent glycerin from the discharged salt.—C. A. M.

Shaving cream which does not attack the skin ; Process of making a ——. J. Lütje. Fr. Pat. 409,521, Nov. 22, 1909. Under Int. Conv., Nov. 24, 1908.

See Ger. Pat. 216,250 of 1908; this J., 1909, 1314.—T. F. B.

Extraction of glue, gelatin and fats from bones and skins. Eng. Pat. 10,616. *See* XV.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Pigment-colours ; Comparative examination of different —— *in regard to their applicability in painting, and especially as artists' colours.* E. Täuber. Farbenzeit., 1910, 1330 and 1382. Chem.-Zeit., 1910, **34**, Rep., 244.

The author has compared the fastness of a large number of pigments in the form of water colours and oil colours. Of yellow colours, Naples Yellow, Cadmium Yellow, and ochre are unobjectionable; Zinc Yellow is tolerably good; and Indian Yellow and its substitute, Naphthol Yellow, may be classed as of medium quality. Naphthol Yellow can only be used as oil colour. Chrome Yellow, on the other hand, is useful only as water colour, becoming brown under the influence of light when used as oil colour. Indanthrene Yellow lakes may be recommended as good substitutes for Indian Yellow. Of the reds, the iron oxide pigments, burnt ochre, English Red, *Caput mortuum*, and burnt sienna, are quite permanent, but are deficient in tone. Cadmium Red, which is equally fast to light, has a more vivid and purer tone. Of the older red pigments, however, only madder and alizarin lakes and cinnabar have quite satisfactory tones, and these are not sufficiently fast to light, the madder and alizarin lakes gradually fading, and the cinnabar becoming darker. Fortunately, in many cases, these pigments can be efficiently replaced by newer tar products, *viz.*, lakes from Permanent Red 2G extra, Indanthrene Bordeaux, and Pigment Scarlet 3B. As water-colour Thioindigo Red is much to be recommended, but is useless as an oil colour. Red lead is satisfactory as oil colour when used alone or for a final coating, but is unsatisfactory in admixture with other colours, and under blues. Cobalt Violet is a very fast colour, as also are the lakes of Acid Alizarin Blue and Indanthrene S, which are bluer in shade. These lakes, both as water colours and oil colours, are remarkably fast to light, being quite unaffected after exposure for 18 months. Of blue pigments, Cobalt Blue is the best of the older colours. Ultramarine Blue is equally fast to light, but is not satisfactory in other respects. Prussian Blue is less fast to light, though still good in this respect. Indigo is much less fast to light and is useless as an oil colour. In an exposure of 18 months, Indanthrene Blue G proved as fast as Cobalt Blue, but it has a redder and poorer tone. The two chromium oxide greens, Cobalt Green, and Green Earth are good green colours, whilst mixtures of Indanthrene Yellow and Indanthrene Blue yield colours which may be used in place of the less permanent Cœrulein lakes. Asphaltum and Gussow Brown are very poor in regard to fastness to light.—A. S.

Linseed oil ; Influence of solvents on the drying of ——. W. E. F. Powney. Analyst, 1910, **35**, 192—198.

With the object of determining the relative utility of turpentine and turpentine substitutes, the author has conducted several series of drying tests upon raw and boiled linseed oil, both alone and mixed in equal volumes. The solvents used were (*a*) genuine American turpentine distilled between 160° and 170° C. ; (*b*) a turpentine substitute composed entirely of petroleum hydrocarbons ; and (*c*) a turpentine substitute containing approximately 17 per cent. of (*a*) and 83 per cent. of (*b*), by volume. Equal volumes (weighed quantities) of oil and solvent were mixed in shallow dishes and weighed at intervals during their exposure to the atmosphere. Blank experiments made with non-drying oil of similar specific gravity to the linseed oil, indicated the approximate amount of each solvent retained by the oil at any given time ; on deducting this from the gross increase in weight, the nett figures represent the actual increase in weight (*i.e.*, the amount of oxidation) of the oil in every case. The author considers that the results indicate that :—(1) Except in the case of raw oil, none of the solvents accelerates the drying to any marked degree ; turpentine is, on the whole, the most suitable. (2) Suitable turpentine substitutes (such as the mixture of petroleum hydrocarbons and turpentine used in the experiments) may possess such relatively high efficiency as to warrant their employment for many purposes in place of pure turpentine.—W. E. F. P.

Turpentine ; Hydrogenation of ——. G. Vavon. Comptes rend., 1910, **150**, 1127—1130. (See this J., 1910, 44.)

Samples of French, German and American oils of turpentine were distilled, and the portions distilling between 155° and 165° C. were reduced by hydrogen in the presence of platinum black. Each sample gave the same hydrocarbon, $C_{10}H_{18}$, boiling at 166° C., solidifying at —45° C., and with the sp. gr. 0·861 at 15°/15° C. The optical rotation for the yellow mercury ray ($\lambda = 578$) varied between ±23·8°. By comparing the optical rotations of the oil before and after reduction, the author was able to deduce the amounts of *a*- and *β*-pinene present. The French oil contained 63 per cent. of *a*-pinene, the remainder being *β*-pinene. The German oil contained 73 per cent. of *a*-pinene and 27 per cent. of *β*-pinene. The American oil contained 72 per cent. of *a*-pinene and 28 per cent. of *β*-pinene. *β*-Pinene was separated by fractionation, and boiled at 164° C., having $[\alpha]_j = -22{\cdot}7^\circ$. When reduced by hydrogen, the product had $[\alpha]_j = -23{\cdot}5^\circ$.—F. Shdn.

Loango copal. A. Tschirch and M. Willner. Arch. Pharm., 1910, **247**, 265—276.

The resin, Loango copal belongs to the class of copaiba copals. It is almost entirely soluble in a mixture of ether and alcohol, and in pyridine or quinoline. The direct acid value varies between 106·4 and 114·8 ; the hot saponification value lies between 126·0 and 134·4, and the cold saponification value (after 24 hours) is between 142·8 and 154·0. The portion of the resin soluble in ether and alcohol was extracted with various alkalis and the following acids were isolated. Ammonium carbonate gave *a*-loangocopalic acid, $C_{20}H_{36}O_2$, which is monobasic, and forms a lead salt insoluble in alcohol. The same alkali also extracted *β*-loangocopalic acid, $C_{15}H_{30}O_2$, which is also monobasic, but forms a soluble lead salt. Sodium carbonate extracted loangocopalolic acid, $C_{18}H_{34}O_2$, *a*-loangocopal resin, which is soluble in ether, and an oil boiling at about 160° C. By means of sodium hydroxide there were isolated : loangocopalinic acid, $C_{24}H_{44}O_2$, and *β*-loangocopal resin, insoluble in ether and hot alcohol. The resin contains 3 per cent. of ash.—F. Shdn.

Sierra Leone copal. A. Tschirch and M. Willner. Arch. Pharm., 1910, **248**, 285—293.

The copal obtained from Sierra Leone is soluble to the extent of 97·7 per cent. in acetone, and is completely soluble in quinoline. The direct acid value is 108·6—114·4. The saponification value (hot method) is 145·9—150·1, and the saponification value (cold method) 142·8—146·7. The portion of the copal soluble in ether contained leonecopalic acid, $C_{25}H_{48}O_3$, soluble in ammonium carbonate solution, leonecopalolic acid, $C_{21}H_{38}O_2$, soluble in sodium carbonate solution, *a*-leonecopal resin, and an essential oil. The portion of the resin soluble in a mixture of ether and alcohol contained leonecopalinic acid, $C_{14}H_{24}O_2$ and *β*-leonecopal resin, $C_{14}H_{26}O_2$, which is insoluble in ether. The ash amounts to 2—3 per cent.—F. Shdn.

Gamboge. F. O. Taylor. J. Ind. Eng. Chem., 1910, 2, 208—210.

Out of fifteen samples of commercial gamboge examined by the author, only six were undoubtedly genuine, the others being heavily adulterated with starch, with sand, and in one case with lead chromate. The author finds that the alcohol solubility test of the U.S. Pharmacopœia is a valuable means of detecting adulteration and requires no modification, but he suggests that the standard for ash should be " not to exceed one per cent." The acid value might also be included among the tests, whilst a starch test should be given and worded so as to exclude any gamboge which gives more than a faint green coloration when boiled in the powdered form with water, cooled and treated with iodine.—C. A. M.

Flock formation in linseed oil and lacquer oil. Hertkorn. *See* XII.

Chloro-derivatives of ethane and ethylene. [*Solvents for cellulose acetate, fats, resins, etc.*]. Clément and Rivière. *See* XX.

Patents.

Pigment with basis of calcium cyanamide and process of making same. R. Fulloni, Rome. U.S. Pat. 957,153, May 3, 1910.

Claim is made for a paint composed of calcium cyanamide, a metallic sulphate, and a vehicle.—A. S.

Painted surfaces ; Process for cleaning ——. P. Stave and H. Meyer. Ger. Pat. 221,039, Oct. 11, 1908.

Surfaces which have been coated with oil-paints are cleaned by treating them first with a mixture of 70—75 parts of a 3 per cent. solution of acetic acid and 25—30 parts of a 3 per cent. solution of boric acid, and then with water.—A. S.

Abietic acid from crude rosin ; Process for preparing pure ——. P. Levy. Ger. Pat. 221,889, June 12, 1908.

Rosin (100 kilos.) is dissolved in alcohol, and an alcoholic solution of sodium ethylate (containing 7·6 kilos. of sodium) is added ; the sodium salt of abietic acid is thus precipitated in a pure, crystalline condition. It is converted into abietic acid by dissolving in water and decomposing with the calculated quantity of mineral acid.—T. F. B.

Paints ; Manufacture of ——. H. Terrisse, Veriner, Switzerland, and C. Coffignier, Presles, France. Eng. Pat. 1800, Jan. 24, 1910. Under Int. Conv., Jan. 30, 1909.

See Fr. Pat. 398,956 of 1909 ; this J., 1909, 1050.—T. F. B.

Minium ; Manufacture of ——. W. Eckford, and Walkers, Parker, and Co., Ltd. Fr. Pat. 409,880, Dec. 2, 1909. Under Int. Conv., Dec. 4, 1908.

See Eng. Pat. 26,258 of 1908 ; this J., 1910, 166.—T. F. B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

[Rubber] Latex ; Enzymes in ——. V. Cayla. India Rubber J., 1910, **39**, 563—564.

Almost all the rubber latices (chiefly latices of *Ficus elastica, Castilloa elastica, Funtumia elastica*), examined by the author (Compt. rend. Soc. de Biol., 1903, **36**, 3, 110) in the fresh state contain either an oxydase, a peroxydase, or a catalase and there is reason to believe that these are concerned not only in the coloration of the rubber, but also in the phenomenon of spontaneous coagulation. It has also been found that a rennet-like enzyme exists in the latex of *Ficus elastica* (this J., 1909, 483). Attempts to obtain evidence of the existence in *F. elastica* latex of an enzyme capable of digesting albumin have so far been unsuccessful, that is to say it has not been found possible to digest either milk casein or egg albumin with the latex, by one week's incubation at 35° C.—E. W. L.

Caoutchouc ; Constitution and synthesis of ——. S. S. Pickles. Chem. Soc. Proc., 1910, **26**, 111.

In statements made recently by Klages and by Harries (this J., 1910, 502), certain doubts have been expressed regarding the possibility of the polymerisation of isoprene into caoutchouc by the methods indicated by Tilden. These methods were of two characters, (1) the action of certain reagents (for example, an aqueous solution of hydrogen chloride) on isoprene, and (2) the slow spontaneous polymerisation of isoprene itself. The latter method has been repeated by the author, and a white, rubber-like compound was produced, which gave derivatives like those obtained from natural caoutchouc, namely, the tetrabromide $((C_{10}H_{16}Br_4)x$, and the nitrosite. The constitution of caoutchouc was discussed, objection being taken to the dimethylcyclooctadiene formula. Other formulæ were proposed for caoutchouc, and the ozonide which, the author considered, afford a better explanation of the properties and behaviour of these substances. Kondakoff had shown that methylisoprene ($\beta\gamma$-dimethyl-$\Delta^{\alpha\gamma}$-butadiene) underwent polymerisation to a rubber-like compound in a few months' time. The author had himself tried the experiment with dimethylisoprene ($\beta\epsilon$-dimethyl-$\Delta^{\beta\epsilon}$-pentadiene), but this did not appear to polymerise readily. The displacement of the hydrogen atoms attached to the terminal carbon atoms of isoprene by methyl groups apparently prevented or restrained polymerisation. The polymeride of isoprene, as at first precipitated, was more or less sticky. This was probably due, not to resin, but to the presence of hydrocarbons other than rubber. Natural rubber was similarly sticky and weak, when first precipitated from solution in terpenes. Although Harries had obtained a rubber-like compound from the polymerisation of octadienes, he had not shown that it formed additive compounds of the type $C_{10}H_{16}Br_4$. Ethyl acrylate readily polymerised to rubber-like compounds, but in the process the double bond disappeared.

Rubber cultivation in Bolivia. Board of Trade J., May 19, 1910. [T.R.]

After Brazil, Bolivia is the most important country in South America for the production of rubber, a circumstance which is not generally known, owing to the absence of ports and the consequent inclusion of Bolivian rubber in the statistics of Chili, Peru, Argentina, and Brazil. The immense territory touched by the rivers Abuná, Acre, and Madre de Dios on the one hand, and by the rivers Itenez and Mamoré on the other, is covered with magnificent forests of *Hevea*. The official figures for rubber production in Bolivia are given as 1,929,608 kilogs., valued at £424,514, in 1906 ; 1,830,513 kilogs., valued at £353,655, in 1907 ; and 1,818,187 kilogs., valued at £216,082, in 1908. Rubber cultivation in Bolivia is seriously hampered by the imperfect method of levying the export tax, which varies very considerably in different parts of the country, and appears to be left to the discretion of the individual Customs authorities.

Patents.

Rubber compounds. J. Smith, Chicago, U.S.A. Eng. Pat. 1207, Jan. 17, 1910.

It is claimed that the addition of a finely-powdered, friable bitumen, such as grahamite, to a rubber mixing, renders such mixing better able to resist the action of the atmosphere, sunlight, acids, alkalis and oils. The bitumen is preferably powdered so as to pass a 200-mesh sieve. An example of a mixing for a soft rubber prepared with the addition of this ingredient, is as follows :—Rubber, 15 lb. ; reclaimed rubber, 15 lb. ; sulphur, 1½ lb. ; and grahamite, 17½ lb., vulcanised, in the form of 1 in. thick pieces, in moulds, at a steam pressure of 60 lb. for 35 minutes. To produce a hard rubber two pounds of litharge may be added to the above mixing, the amount of sulphur increased and the vulcanisation carried out as follows :—The steam pressure begins at 60 lb., and is gradually increased, during 30 minutes, to 75 lb., at which it is maintained for 2 hours. The product is cooled for one hour before being taken from the mould.—E. W. L.

Rubber or similar material ; Machine for reducing —— *to an impalpable powder.* C. E. Gardner, Gloucester Eng. Pat. 17,327, July 26, 1909.

A box containing the rubber waste to be ground is kept in contact with a rapidly revolving abrading wheel, by means of a weighted cord passing over a pulley, the box sliding on a horizontal bed. The box is constructed in such a way that the rubber contained in it can be kept cool by causing a current of air to circulate through it. The box can be withdrawn from contact with the wheel by means of a hand-wheel operating a pinion, gearing with a toothed segment, provided with an arm to which the cord fitted with the counterweight is also connected. The abrading wheel is constructed in the form of a shell, the periphery of which is formed with transverse grooves to receive bars or blocks of the abrading agent, with intermediate clearances between the bars, communicating with spaces or compartments formed by arms connecting the shell to the hub, while openings are formed on the ends of the shell to enable a current of air to pass through the wheel and so keep it cool. The abrading bars (of corundum, etc.) are arranged either in the form of double helices or diagonally, so that a practically continuous abrasive surface is presented. A receptacle is provided beneath the wheel to collect the dust formed, and a grid is inserted to filter off any rubber which may have become heated in spite of the ventilation provided, and so remain imperfectly ground. In addition to its primary motion of revolution, a sideways movement, at right angles to this, is imparted to the abrading wheel by means of a worm mounted on a feather on the wheel shaft, and gearing with a worm wheel provided with a pin working in a slot at one end of a bell-crank lever, the latter being pivoted at the other end, and provided also with a pin working between two collars on the shaft.—E. W. L.

Ebonite capable of resisting the action of chlorine ; Process for the manufacture of ——. M. Wildermann, Ealing. Eng. Pat. 12,424, May 26, 1909. Addition to Eng. Pat. 18,269, Aug. 31, 1908.

See Addition of Nov. 6, 1909, to Fr. Pat. 395,101 of 1908 ; this J., 1910, 641.—T. F. B.

Caoutchouc, guttapercha, and the like; Process for obtaining pure ——. V. Scholz, Hamburg, Germany. Eng. Pat. 22,607, Oct. 4, 1909.

SEE Fr. Pat. 407,864 of 1909; this J., 1910, 641.—T. F. B.

Rubber; Manufacture of spongy ——, *for making tyres for vehicles, automobiles, and cycles.* E. Poizot. First Addition, dated Feb. 12, 1909, to Fr. Pat. 401,303, July 17, 1908.

SEE Eng. Pat. 16,663 of 1909; this J., 1910, 364.—T. F. B.

Rubber, guttapercha, balata, and similar substances; Apparatus for removing foreign matter from ——. The British Murac Synd., Ltd., and M. M. Dessau. Fr. Pat. 408,983, Nov. 12, 1909. Under Int. Conv., Nov. 13, 1908.

SEE Eng. Pat. 24,438 of 1908; this J., 1910, 225.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Fermentation in the tanyard. L. A. Groth. J. Amer. Leather Chem. Assoc., 1910, **5**, 269—272.

THE author indicates in a general way the actions of bacteria and enzymes on hides and tan liquors, finally concluding that the product of the action of bacteria upon hide-substance cannot be made into leather. Fermenting hides convert tannin principally into gallic acid, which is in turn destroyed; tannin may, however, ferment spontaneously under the influence of micro-organisms, producing gallic, butyric, and ellagic acids, and this cannot be permanently prevented by the use of antiseptics or heat. Electricity is stated to be the only efficient agent, for besides preserving the tan liquor, it protects the leather produced in the liquor from future deterioration.—A. T. H.

Dyeing leather. F. A. Atteaux. J. Ind. Eng. Chem., 1910, **2**, 218—219.

THE author describes many of the methods in general use for dyeing all classes of leather goods, dealing with the special treatment of chrome stock, at some length, and refers also to the application of mordants such as tannins, tartar emetic, and potassium-titanium oxalate, and the dyestuffs in ordinary use, viz., basic, acid, alizarin, direct and sulphide colours. One special method for dyeing with acid colours is as follows:—Drum the leather in a 2 per cent. neutral solution of the dyestuff for 20 minutes at 120° F., wash, and treat with a cold bath of 2½ per cent. of sodium nitrite and 5 per cent. of hydrochloric acid for 15 minutes; again wash and develop for a further period of 15 minutes in a cold, 1 per cent. solution of phenylenediamine or *m*-tolylenediamine. This bath must be cold or the resulting colours are dull and rusty.—A. T. H.

Leather; The drying of ——. L. Jablonski. Z. angew. Chem., 1910, **23**, 890—891.

THE water-content of various kinds of leather shows considerable variations. The average percentages of water in bark-tanned sole-leather, tawed leather, and chamois are 18, 25 and 22 respectively. Von Schroeder has shown that the percentage of water in a sample of leather may vary as much as 4 per cent. in the course of a year. Special precautions must be taken in drying-out leather, since the capillaries of the material contain, not water, but tannin solution, the solid part of which, when deposited on the grain causes the leather to become stained and brittle. This is avoided by "oiling-off" on the grain side, which causes a slower evaporation and separation of the tannin on the flesh side. In arranging drying rooms it is important that the arrangement should be such as to allow the air to circulate through the whole space.—D. J. L.

Tanning materials; Vegetable ——. J. H. Yocum. J. Ind. Eng. Chem., 1910, **2**, 216—217.

THE author reviews the commercial position of the tanning materials used in the United States, after which he deals with them from a chemical and a practical point of view, giving the characteristics and general use of each material, remarking also upon the effect of organic and inorganic non-tannins on the resulting leather.—A. T. H.

Tannins. III. Ellagitannic acid. M. Nierenstein. Ber., 1910, **43**, 1267—1270.

THE author considers ellagitannic acid to be the diglucoside of luteotannic acid, which is the intermediate product in the oxidation of digallic acid (tannin) to ellagic acid. The ellagitannic acid was obtained from myrobalans, and purified as far as possible by dialysis. The product was treated with a solution of potassium hydroxide and ethyl chloroformate. The liquid was acidified with hydrochloric acid, and the precipitate obtained was warmed with pyridine. The ellagitannic acid obtained in this way could be crystallised from acetic acid and pyridine in slightly yellow needles, and melted between 329° and 336° C. It has the composition $(C_6H_{10}O_5)_2.3H_2O$, and $[\alpha]_D=+18{\cdot}02°$ in water at 17° C. It loses its water of hydration at 110° C., and when boiled with dilute sulphuric acid is converted into ellagic acid. Under the action of emulsin, luteotannic acid is produced.—F. SHDN.

PATENTS.

Leather; Treatment of chrome-tanned —— [*with lactic acid*]. R. W. Griffith, New York. Eng. Pat., 24,508, Oct. 25, 1909. (See also this J., 1910, 579.)

THE lactic acid bath employed consists of a solution of commercial lactic acid in the proportion of 3 per cent. of the wet weight of the leather after shaving or draining, the commercial lactic acid being standardised at 22 per cent. of lactic acid. In claiming the use of lactic acid, the inventor includes its employment as free acid, added as such or subsequently set free in the bath, or as lactic acid in combination with a base or bases which when disengaged are substantially soluble in the bath.—E. W. L

Glue, gelatine and fats; Apparatus and process for the extraction of —— *from bones and skins.* L. Dörner, Manchester. Eng. Pat. 10,616, May 5, 1909.

THE apparatus, which is a combined digester, filter, and evaporator, consists of a vertical, closed vessel having a manhole in the top and one in the bottom, for insertion and withdrawal of material. In the bottom of the vessel is a grid containing a granulated cork filter, through which the liquid passes to a steam-heated evaporator. The apparatus is provided with steam and water supply, all necessary gauges, and ejectors for producing a vacuum. The process is carried out by filling the digester and washing the material with a weak solution of sulphuric acid, which is circulated by an injector; this solution is drawn off, and volatile products are removed and passed into water by treating with steam at low pressure, generated from the evaporator. The material is now steamed at one atmosphere pressure, and the condensed water, containing the extracted fat and glue, filters into the evaporator; the top layer of fat is removed at intervals, through a stopcock, and when sufficiently concentrated, the glue is also drawn off through another cock. Further extractions are made under increased pressure, after which, the residual matter is washed, and dried by drawing air through the digester. The extracted glue is collected, bleached and further concentrated in vacuum as usual. It is claimed that the process is quicker and cheaper than the orthodox method, and that it eliminates all bad odours.
—A. T. H.

XVI.—SOILS; FERTILISERS.

Mica in arable land; Part played by ——. Bieler-Chatelan. Comptes rend., 1910, **150**, 1132—1135.

Finely powdered mica (muscovite) gives to 1000 parts of water 0·48 part of potassium, whilst orthoclase only yields 0·2 part. The solution of the potassium in muscovite is increased by the presence in the water of ammonium sulphate, lime, citric acid, or acid calcium phosphate. The latter substance will produce a solution containing 2·24 parts per 1000 of potassium, whilst cold concentrated hydrochloric acid produces a solution of 2·90 parts per 1000. The alluvial soils of the Rhone valley and Valais (Switzerland) contain 15 to 20 per cent. of white mica and the total potassium content is 30 parts per 1000. These soils yield very little potassium (less than 0·2 part per 1000) to distilled or carbonated water. Yet, with the exception of rapidly growing plants such as asparagus, the effect of adding manures containing potassium is very small. The author finds an explanation in an experiment in which grass was found to absorb potassium from powdered mica which had been previously extracted with hydrochloric acid.—F. Shdn.

Barium by plants; Absorption of ——. H. Colin and J. de Rufz. Comptes rend., 1910, **150**, 1074—1076.

It was found that peas, which had been allowed to germinate in distilled water and had then been transferred to a dilute solution (0·125 in 1000) of barium nitrate or chloride, continued to grow and the barium was absorbed. After fifteen days growing, barium was found in the roots by warming sections to 66° C. with strong sulphuric acid and examining them under the microscope. A dry root weighing 0·930 grm. gave 0·146 grm. of ash, which yielded 0·015 grm. of barium sulphate. 2·640 grms. of the dried stem gave 0·173 grm. of ash, which contained only a trace of barium.—F. Shdn.

Patents.

Manure and fertilisers; Manufacture of ——. M. Ginster, West Bromwich, Staffs. Eng. Pat. 23,238. Oct. 12, 1909.

The manure or fertiliser is manufactured by treating blood with sulphuric acid for a certain time, and drying the product in a steam chamber. The patent also covers the treatment of fish, bones, excreta, horn, hoofs, wool dust and scutch, in the same manner, either separately or in admixture.—A. T. H.

Superphosphate; Process of emptying —— out of decomposition-chambers. K. J. Beskow, Helsingborg, and M. Ekedahl, Limhamn, Sweden. U.S. Pat. 956,792. May 3, 1910.

See Fr. Pat. 399,907 of 1909; this J., 1909, 996.—T. F. B.

Treating raw potatoes to obtain a durable product for agricultural and industrial purposes. Eng. Pat. 17,937. *See* XIXa.

XVII.—SUGARS; STARCHES; GUMS.

Formaldehyde; Occurrence of —— in sugar house products. P. A. Yoder and W. G. Taggart. Intern. Sugar J., 1910, 12, 239—245.

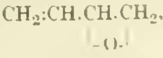
The question whether formaldehyde if used as a preservative of raw juice, all escapes during the process of concentration or whether it persists in the final products has been investigated by the authors. For estimating the formaldehyde they devised the following modification of the milk test:—The solution under examination is acidified with phosphoric acid, then distilled from a saturated brine bath in a current of superheated steam. To 5 c.c. of distillate contained in a test-tube are added 5 c.c. of a freshly-prepared 1 per cent. peptone solution and 10 c.c. of concentrated hydrochloric acid containing 1 part of ferric chloride in 5000. Similarly a set of standards for comparison are prepared; these may include suitable strengths from 1 : 50,000 to 1 : 2,000,000, and a blank. The test-tubes, contained in a stand, are immersed in a water-bath previously heated to such a temperature that the cold tubes reduce it to 82·5° C. After 5 minutes at this temperature and occasional shaking, the stand is plunged into a bath of cold water. When cool the colour intensities of each sample and its nearest standard are matched by varying the depths of the columns in Nessler tubes in the usual way. If the concentration of formaldehyde in the sample is greater than 1 : 100,000, the solution should be diluted ten- or a hundred-fold before mixing and heating, in order to bring the concentration within the range 1 : 100,000 and 1 : 1,000,000. A study of this method showed that it is not applicable to solutions weaker than 1 : 1,000,000; that blanks give a slight coloration; and that with solutions stronger than 1 : 100,000, and reagents of the proportions prescribed above, the increase in the intensity of colour is not correspondingly great. It was also observed that the presence of sulphites strongly interfered with the development of colour. Contrary to the conclusions of Shrewsbury and Knapp (this J., 1909, 156) the present authors found no advantage in substituting nitric acid as the oxidising agent. In some preliminary experiments results were obtained which appear to corroborate the contention of Trillat (this J., 1906, 191) and A. A. Ramsay (this J., 1908, 1218) that formaldehyde is formed in the caramelisation of sugar, and not furfural as asserted by La Wall (this J., 1909, 1264). The authors used in their experiments a small experimental mill, and made runs with the addition of formaldehyde to the raw juice to the amount of 25 parts per million, and also without the addition of any reagent. Their results indicate that formaldehyde is present in all the products, even when none had been added. There is, however, evidence of an excess of formaldehyde in the products from juice to which the addition had been made, amounting in the case of first sugar to 1·6 per cent. and in the molasses to 6 per cent. of the total quantity added to the raw juice.—J. P. O.

Sugar; Solubility of refined ——. T. Koydl. Z. Zuckerind. Böhm., 1910, 34, 445—450.

The author has made comparative determinations of the rate at which various kinds of refined sugar dissolve in water. The apparatus used comprised four cylindrical vessels (4·5 by 4·5 cm.), the bottoms of which consisted of very fine silk gauze. The vessels were attached to a vertical stirring apparatus driven by a small electric motor. A cube of the sugar, or a portion of about 5 grms., was placed in each of the vessels. By means of the stirrer, the sugar was alternately immersed in, and withdrawn from, 500 c.c. of water kept at a temperature of 20° C. The stirrer was driven at a rate of 60 revolutions per minute. Each vessel contained a sample of the same sugar, and the average time required for solution was determined. It was found that, under these conditions, the time required for solution of refined sugars of normal quality ranges from 0·7 to 5·0 minutes.—L. E.

Erythritol: New synthesis of natural and of racemic ——. H. Pariselle. Comptes rend., 1910, **150**, 1343—1346.

Oxy-1.2-butene-3.4,



$CH_2{:}CH.\underset{-O-}{CH.CH_2}$, prepared by heating epibromhydrin (Comptes rend., 1909, **149**, 295) with potassium carbonate, was treated with water acidulated with a few drops of sulphuric acid, heated under a reflux condenser, and the product distilled *in vacuo*, whereby butenediol or erythrol, $CH_2(OH).CH(OH).CH{:}CH_2$, b. pt., 91°—93° C. at 12 mm., was obtained. This on oxidation with a 1 per cent. solution of barium permanganate below 0° C. yields a mixture of natural and racemic erythritol. The reaction product is filtered, the barium precipitated with sulphuric acid, and the filtered solution concentrated to a syrup *in vacuo*. The syrup is treated with a crystal of natural erythritol and allowed to stand *in vacuo* for 15 days, whereupon natural erythritol crystallises out. The crystals are drained on a porous plate and purified by recrystallisation from boiling alcohol. The porous plate is pulverised, extracted with boiling water, the solution concentrated to a syrup *in vacuo*, and treated with hydrochloric acid and benzaldehyde, whereupon crystals of the dibenzoic-acetal of racemic erythritol separate.—A. S.

Viscosaccharase, an enzyme producing gum from sucrose. M. W. Beijerinck. Koninkl. Akad. van Wetensch., Amsterdam, Wisk. en Natk. Afd., 1910, **18**, 591—595. Chem. Zentr., 1910, **1**, 1738.

MANY bacilli when cultivated on neutral or faintly alkaline agar plates, in presence of sucrose or raffinose, produce a peculiar colloid reaction, an emulsion being formed surrounding the colonies of bacilli. The phenomenon is caused by an enzyme, named *viscosaccharase* by the author. The enzyme can be separated along with other enzymes, such as diastase, trypsin, pectosinase, by filtering a culture of *Bac. mesentericus vulgatus*, and adding alcohol to the filtrate. Besides the mucilaginous emulsion mentioned, which does not diffuse from the agar into water, viscosaccharase also produces from sucrose, a substance, soluble in water, which reduces Fehling's solution.—A. S.

Gums. E. Meininger. Arch. Pharm., 1910, **248**, 171—201.

AN examination has been made of several gums, of which the botanical origin had been definitely ascertained. The gum from *Acacia pycnantha* Benth. contained 13·55 per cent. of moisture, 0·92 per cent. of ash, in which calcium and magnesium were present, and 0·64 per cent. of matter insoluble in water. A solution of the gum in two parts of water is miscible in all proportions with lead acetate solution. The rotatory power of the gum when dissolved in water, was $[\alpha]_D = -19{\cdot}39°$. The arabic acid which was separated, was found to contain 1·31 per cent. of nitrogen. From the results of hydrolysing the gum, a large quantity of galactan was inferred to be present, with smaller quantities of pentosan and methylpentosan. The gum from *Acacia horrida* Willd. contained 15·34 per cent. of moisture, 2·59 per cent. of ash, in which calcium and magnesium were found, and 0·98 per cent. of matter insoluble in water. The rotatory power of the gum in aqueous solution, was $[\alpha]_D = +53{\cdot}94°$. A 15 per cent. solution of the gum in water is acid to litmus, and gives a flocculent precipitate with lead acetate. The arabic acid isolated from the gum was found to contain 0·71 per cent. of nitrogen. Hydrolysis indicated the presence of galactan, pentosan, and a little methylpentosan. The gum obtained from *Acacia arabica* Willd. contained 14·39 per cent. of moisture, and 2·41 per cent. of ash. Part of the gum is soluble in water, the remainder forming a jelly. It contains pentosan with a smaller proportion of galactan. The amount of moisture in the gum from *Melia Azadirachta* L. was 15·41 per cent., and the ash was 2·99 per cent. It dissolves in water leaving 0·27 per cent. of insoluble residue. The rotatory power of the gum in aqueous solution is $[\alpha]_D = -57{\cdot}16°$. The gum contains galactan and pentosan. It yields arabinose on hydrolysis, besides other sugars. Determinations of the nitrogen in several other gums are given, also a table showing the amounts of various sugars obtained from different specimens.
—F. SHDN.

Saccharification of cellulose. Ost and Wilkening. *See* V.

PATENTS.

Starch or other pasty materials ; Apparatus for moulding and dehydrating —— by means of compressed air. C. Drumm. Ger. Pat. 217,335, Oct. 27, 1908.

THE wet starch is introduced into wagons divided into compartments by vertical partitions, and the wagons are then run into a pressure-chamber, into which compressed air is introduced. The water is forced through the perforated floors of the compartments into a common collecting trough, the ends of which communicate with movable outlet pipes passing through the ends of the pressure-chamber.—A. S.

Fermentable sugar ; Process for producing —— from lignocellulose. M. F. Ewen and G. H. Tomlinson, Chicago, U.S.A. Eng. Pat. 24,589, Oct. 26, 1909.

SEE U.S. Pat. 938,308 of 1909 ; this J., 1910, 38.—T. F. B.

Sugar ; Apparatus for the treatment or preparation of ——. E. Shaw, London. U.S. Pat. 957,113, May 3, 1910.

SEE Eng. Pat. 4112 of 1904 ; this J., 1905, 245.—T. F. B.

Saccharometers. Eng. Pat. 22,992. *See* XXIII.

XVIII.—FERMENTATION INDUSTRIES.

Malt for specially pale coloured worts ; Manufacture of ——. M. Bermann. Woch. für Brau., 1910, **27**, 226—227.

IN recent years a demand has arisen for exceptionally pale beers, especially for the French market. The choice of the barley and the preparation of the malt for such beers require the most careful attention. The barley must be of such a nature (poor in protein and of mellow constitution) that a well modified malt can be obtained with the shortest possible growth of acrospire. The colour of the husks is of subordinate importance, since it is largely eliminated in the steep, but dark, rain-damaged barleys show an exceptional tendency to acrospire development ; bluish-white barleys are steely, so that only yellowish-white to pale straw-yellow barleys come into consideration. Broken husks tend to over-steeping and coloration on the kiln. In steeping, the absorption of water must be so regulated that subsequent sprinkling, which increases acrospire development, may be avoided, but the absorption should not be allowed to proceed too far. An absorption of 40—46 per cent. of the original weight of the grain is about correct. On the floors, the couches should be treated cool and slowly, as thin as possible without causing premature drying, and turned carefully with the shovel. When the minimum permissible degree of modification with minimum growth of acrospire has been reached, the couches should be well aerated in order that they may dry quickly. The green malt should go to the kilns as dry as possible, and should leave the upper floor of the kiln quite hand-dry. A three-floor kiln is advantageous on account of the good preliminary drying which it affords ; failing this, an artificial draught is indispensable. The temperature must be increased very slowly, especially at first, and the floors should be loaded thinly. Still, contact of a large proportion of the malt with the hot floors is to be avoided, and leads to the development of colour ; for this reason, also, the turning should not be excessive. The malt (or barley) should be graded to eliminate narrow corns, which tend to be darker in colour owing to longer growth and excessive moisture on the kiln. All the above remarks apply also to the preparation of a Pilsen malt of normal colour which is required to be high-cured.
—J. F. B.

Malt extract ; Amount of —— yielded by the husks. A. Winkelmann. Z. ges. Brauw., 1910, **33**, 218—219, 233—236.

THE constituents of the husks, soluble in water, varied, according to the method of extraction employed, from 8 to 11 per cent. of their solids or from 0·6 to 1·3 per cent. of the malt solids. High mashing temperatures and the presence of calcium carbonate or sulphate in the liquor increase the extract. Under similar treatment husks from different malts yield varying amounts of extract. The extract from husks is, compared with the extract from whole malt, very rich in nitrogen and ash. Malt husks contain comparatively much colouring matter, which is slightly soluble in cold water but readily soluble on boiling; the presence of calcium carbonate in the mashing liquor increases and calcium sulphate decreases the colour of the extract obtained.—R. L. S.

Hordein and bynin ; Proteins of barley and of malt soluble in alcohol. W. Kraft. Z. ges. Brauw., 1910, 33, 193—195, 205—207.

Osborne has shown that barley contains approximately 4 per cent. of a protein (hordein) soluble in 75 per cent. alcohol (this J., 1908, 172). From malt he was able to separate 1·25 per cent. of a similar protein which he named bynin. The author has investigated these proteins and from their behaviour towards alkaline and peptic hydrolysis, their optical activities and their solubilities, concludes that they are identical. The fact that different proportions of glutaminic acid were yielded on hydrolysis is regarded as no proof of their constitutions being different. During germination the hordein present in a barley decreased from 2·42 per cent. to 1·82 at 2 days old, 1·58 at 4 days, 1·36 at 3 days and 1·17 at 7 days.—R. L. S.

Yeast juice ; Alcoholic ferment of ——. V. Function of phosphates in alcoholic fermentation. A. Harden and W. J. Young. Proc. Roy. Soc., 1910, **82**B, 321—330. (Compare this J., 1906, 490, 1111 ; 1907, 62 ; 1908, 824 ; 1909, 1157.)

When dextrose or lævulose is added to yeast juice in presence of excess of phosphate, a period of accelerated fermentation occurs during which the added sugar undergoes the reaction,

$$2C_6H_{12}O_6+2PO_4HR_2=$$
$$2CO_2+2C_2H_6O+2H_2O+C_6H_{10}O_4(PO_4R_2)_2,$$

and it is shown experimentally that one molecule of carbon dioxide is evolved for each molecule of sugar added. The total fermentation becomes very small when the available phosphate of a mixture of ferment, co-ferment and sugar is greatly reduced. Correspondingly the addition of a small amount of phosphate to this mixture produces a relatively large increase in the total fermentation. Hexosephosphate, when digested with yeast juice, is hydrolysed by an enzyme, hexosephosphatase, to free phosphate and a fermentable sugar similar to that formed when hexosephosphate is hydrolysed by acids. Finally hexosephosphates when treated with yeast juice are converted into carbon dioxide, alcohol and free phosphate. It is suggested that in alcoholic fermentation two molecules of the hexose or of the enolic form common to dextrose, lævulose and mannose are each decomposed primarily into two groups, of which two go to form carbon dioxide and alcohol and the other two are synthesised to a new chain of six carbon atoms which forms the carbohydrate residue of the hexose-phosphate. The phosphoric acid groups may possibly be introduced before the rupture of the original molecules or may even be the determining factor of this rupture.—E. F. A.

Alcoholic fermentation ; Influence of the sugar content on the inhibitive action of certain acids on ——. M. and Mme. M. Rosenblatt. Comptes rend., 1910, **150**, 1363—1366.

In a previous communication (see this J., 1909, 952), the concentrations at which certain acids completely prevented the alcoholic fermentation of sucrose in 1·25 per cent. solution were given. Experiments have now been made with sucrose solutions of different concentrations and with acids at the limiting concentrations previously determined and also at lower concentrations. Briefly the results show that by increasing the proportion of sugar, the inhibitive action of the acids is counteracted, the effect being more marked the higher the concentration of the sugar and the nearer the concentration of the acid approaches that at which alcoholic fermentation is completely arrested. For instance with a 10 per cent. solution of sugar it is necessary to use twice as much sulphuric acid and four times as much acetic acid to prevent fermentation as is required for a 1 per cent. solution of sugar.—A. S.

Invertase ; Influence of acids and alkalis on the activity of ——. C. S. Hudson and H. S. Paine. U.S. Dept. Agric., Bureau of Chemistry. Circular No. 55, 1910.

Acids and alkalis affect specially purified invertase in two ways. In low concentrations, they influence its activity, but only in higher concentrations do they permanently destroy it. The velocity of destruction by acid at 30° C. is scarcely appreciable with a concentration of 0·01-*N*. but increases rapidly with the acidity until the latter reaches 0·05-*N*, when the destruction is almost instantaneous. The velocity of destruction follows the formula for unimolecular reactions. The lower limit of concentration of alkali necessary to destroy the enzyme is a little less than 0·01-*N*, the destruction being almost instantaneous for the concentration 0·045-*N*. The activity of invertase in acid solutions insufficiently concentrated to destroy the enzyme was measured for hydrochloric hydrobromic, nitric, phosphoric, sulphuric, boric, oxalic, tartaric, citric and acetic acids, the results being shown in a curve-diagram. The activity of invertase depends almost entirely on the concentration of hydrogen ions in the acid solution, the various acids showing typical differences corresponding with their degrees of dissociation. The activity of invertase is zero in alkaline solutions, rises to a maximum in very faintly acid solutions and decreases as the degree of acidity is increased.—T. H. P.

Acids ; Determination of volatile —— in the products of fermentation of certain microbes, by Duclaux's method. G. Seliber. Comptes rend., 1910, **150**, 1267—1270.

Experiments were made with *B. butyricus*, *B. perfringens*, and *B. putrificus* on the following culture medium : Whey, 1 litre ; glucose, 15 grms. ; peptone Chapoteaut, 10 grms. gelatin, 3 grms. In some cases calcium carbonate was added. After maintaining the cultures at 37° C. for 3—7 days, the acids were determined according to Duclaux's method, the distilled acids being neutralised with lime water (with litmus as the indicator). *B. butyricus* produced butyric and acetic acids. *B. perfringens* yielded acetic and formic acids ; with some cultures of this bacillus acetic acid is formed in greater quantity and also some propionic acid. In the case of *B. putrificus*, the odour indicated higher fatty acids, which, however, could not be distinguished ; the proportions of acid in different fractions of the distillate are however characteristic. *B. perfringens* did not give butyric acid with a sugar medium, but this acid is always produced in media containing casein. It is found that the nature and quantity of the volatile acids formed serve in some cases to distinguish the micro-organism, but the culture must be made in suitable media. Some species such as *B. butyricus* require the presence of calcium carbonate ; with others such as *B. perfringens*, the medium must be free from certain proteins such as casein. The use of Duclaux's method in biochemical investigations is strongly advocated.
—A. Seld.

Enzyme action. XIII. Enzymes of the emulsin type. H. E. Armstrong and E. Horton. Proc. Roy. Soc., 1910, **82**B, 349—367. (Compare this J., 1908, 823.)

Dunstan and his co-workers have considered that the glucoside extracted from *Phaseolus lunatus* seeds is an *a*-glucoside. Evidence is now brought forward to show that both glucoside and the correlated enzyme belong to the *β*-series. The glucoside is invariably hydrolysed by almond-emulsin, though to a very minor extent ; the enzyme extracted from *Phaseolus lunatus* seeds acts but slightly on amygdalin. Both enzymes are without action on *a*-methylglucoside and maltose; yeast extract is without action on the *Phaseolus* glucoside, the slight action sometimes observed being attributed to the presence of traces of emulsin. The dextrose residue in phaseolunatin is shown to be of the β-type. Both emulsin and phaseolunatase readily hydrolyse Fischer's glucoside (mandelonitrileglucoside). It is suggested that a distinct enzyme is operative in separating the nitrilic radical from phaseolunatin, and that this, rather than a simple β-glucase, is the main constituent of the active product from *Phaseolus* beans. Several specific enzymes exist which may all be spoken of as β-glucases; these have a common factor, sympathetic with the dextrose member of the glucoside, whereas the secondary member is different in the several enzymes. The molecule of dextrose attached to Fischer's glucoside in amygdalin is so placed as to render association with the β-glucase almost impossible until the amygdalase (secondary member) has prepared the way by removing the terminal dextrose group.—E. F. A.

Determination of tartaric acid in crude natural products. Beys. *See* VII.

Patents

Fermented mash and the like; Method of freeing —— from noxious odours and flavours. A. P. Stitzel, Louisville, Ky. U.S. Pat. 956,650, May 3, 1910.

The fermented mash, pomace, or cider, is pumped through a medium such as sand, in order to remove solid particles, and is then passed through an odour- and flavour-absorbing medium such as charcoal. The liquid may then be distilled in any approved way.—L. E.

Hops; Preparation of extract of ——. G. G. Smith. Fr. Pat. 409,889, Dec. 2, 1909.

See Eng. Pat. 24,300 of 1909; this J., 1910, 104.—T. F. B.

Drying brewers' draff. Eng. Pat. 10,027. *See* I.

XIXa—FOODS.

Milk; The catalase of —— as an indicator of disease. C. Revis. J. Roy. Inst. Publ. Health, April, 1910, 1—7.

It having been stated by Lam (Int. Congr. Appl. Chem., Rome, 1906) that diseased milk could be differentiated from good milk by a rough determination of its catalytic activity, the author has investigated the matter with the results which are given below. As it is essential that the source of the catalase should be known, the main part of the work consisted in determining the catalytic activity of milks and at the same time counting the number of leucocytes present. Milks from both diseased and healthy cows were examined, the catalytic activity being measured by treating a definite volume of the milk with hydrogen peroxide and determining the quantity still present after a definite interval of time. The number of leucocytes present, if of any value at all in detecting mastitis, seems to afford a better indication of this disease than does the catalytic activity of the milk, even when this latter value has been determined on fresh milk where the growth of bacteria has not influenced the activity. It appears that the so-called leucocytes are at least only partially responsible for the catalase of milk, but that to some of these bodies a certain catalytic power must be attributed. The catalase is probably of triple origin—namely, from leucocytes, from the udder itself, and from bacteria—and hence a determination of the catalytic power is of little value for hygienic control purposes, and is only likely to lead to unwarrantable conclusions.

—W. P. S.

Sucrose and calcium sucrate in milk and cream; Detection of ——. S. Rothenfusser. Z. Untersuch. Nahr. Genussm., 1910, **19**, 465—475.

The method proposed is a modification of the one described previously by the author (this J., 1909, 956), the reagents and solutions required being as follows:—(1). Diphenylamine reagent. (2). Lead acetate solution (see this J., 1910, 584). (3). Ammonia of sp. gr. 0·944; a weaker solution of ammonia, sp. gr. 0·967, is also used, but only in the case of creams containing more than 20 per cent. of fat. For the detection of sucrose in milk, 30 c.c. of the sample are heated to a temperature of 85°—95° C., and an equal volume of a mixture of 2 vols. of lead acetate solution with one vol. of ammonia is added, the whole being then shaken for 30 seconds. After filtration, 3 c.c. of the filtrate are mixed with 3 c.c. of the diphenylamine reagent and heated for 10 minutes in a boiling water-bath. If as little as 0·02 per cent. of sucrose be present in the milk, a bright blue coloration will be obtained. A portion of the filtrate should be also tested with Fehling's solution to ascertain whether all the lactose has been removed by the ammoniacal lead acetate; sucrose may safely be stated to be present when the filtrate does not reduce Fehling's solution but gives a coloration with the diphenylamine reagent. Cream may be tested in the same way, but as mentioned above, the more dilute ammonia must be used when the fat content exceeds 20 per cent. In the case of milk powders, 6 grms. of the sample are dissolved in 50 c.c. of hot water and 30 c.c. of the solution are employed for the test. Calcium sucrate may be detected in cream in a similar manner, the test depending on the detection of the sucrose. As very small quantities of sucrose are present in cream which has been thickened by the addition of calcium sucrate, it is recommended that, after the addition of the ammoniacal lead acetate, the mixture be heated for a short time to 60°—65° C., before filtration.—W. P. S.

Palm kernel oil and cocoanut oil; Detection of —— in butter and lard, and detection of lard in butter. E. Ewers. Z. öffentl. Chem., 1910, **16**, 131—141; 147—152.

An addition of 10 per cent. of palm fats to butter may be detected with certainty by a method based upon the fact that fatty acids from the soluble barium salts, or better the soluble magnesium salts of the former may (unlike the corresponding fatty acids from butter) be completely extracted with petroleum spirit. Five grms. of the fat are saponified with 20 c.c. of alcoholic potassium hydroxide solution, and the resulting soap solution titrated with standard sulphuric acid to obtain the saponification value. The alcohol is evaporated, the soap dissolved in 180 c.c. of hot water, and, after cooling to 20° C., is treated with 50 c.c. of $N/2$ magnesium sulphate sulution, made up to 250 c.c., and filtered with the aid of a pump. 200 c.c. of the filtrate are shaken in a separating funnel with 10 c.c. of $N/2$ sulphuric acid and 50 c.c. of petroleum spirit, the extraction being repeated, first with 50 c.c. and then with 20 c.c. of the solvent. The petroleum spirit extracts are washed with water, and the aqueous layer and washings (310 c.c. in all) are united, mixed with 1 c.c. of dilute (1 : 3) sulphuric acid, and a little pumice stone, and distilled, so that the distillation takes an hour. The distillate is then titrated with $N/10$ potassium hydroxide solution and the number of c.c. required gives the "distillation magnesium value" (D.M.V.), *i.e.*, the number required to neutralise the residual fatty acids of the soluble magnesium salts from 4 grms. of the fat, after the extraction with petroleum spirit. The fatty acids from the petroleum spirit solution are also separated, and neutralised with $N/10$ potassium hydroxide solution, the number of c.c. consumed giving the "petroleum apirit magnesium value" (P.M.V.). The sum of the two values gives the "total magnesium value" (T.M.V.). The following table gives typical results obtained by this method:—

Fat.	Saponification value.	Reichert-Meissl value.	T.M.V.	D.M.V.	P.M.V.	Difference D.M.V.—P.M.V.
Butter, 10 samples	225·2—232·5	27·7—30·4	25·5—30·4	17·8—20·8	7·7—10·1	10·1—11·9
Palm fats, 4 samples	256·6—258·6	6·4— 6·7	26·7—27·2	1·3— 1·4	25·3—25·9	23·9—24·6
Lard, 8 samples	193·7—196·0	0·0— 0·4	0·0— 0·3	0·0— 0·3	0·0— 0·1	0·0— 0·2
Butters with 10% palm fats, 18 samples......................	227·4—233·0	—	25·9—30·1	16·2—18·7	9·7—11·4	6·4— 8·3
Butter +5·5 % coconnut oil and 11·1% lard...................	225·7	—	25·8	16·8	9·0	7·8
Butter with 15% lard, 6 samples	219·8—226·6	—	22·9—26·0	16·2—17·7	6·6— 8·3	9·4 —9·7
Lard with 5% palm fats, 3 samples	197·4—197·6	—	—	0·2— 0·2	1·3— 1·4	—
Lard with 10% palm fats, 5 samples	200·5—201·6	—	—	0·2— 0·4	2·5— 2·6	—

The determination of the mean molecular weight of the fatty acids separated from the insoluble barium salts does not, in the author's experience, enable 15 per cent. of lard to be detected with certainty in butter, and the same remark applies to the method of Juckenack and to the use of the critical temperature of solution. The latter method will also not detect 15 per cent. of palm fats in butter or lard, and is only of use as a preliminary test.—C. A. M.

Cocoanut oil; Detection of —— in butter and lard. Fendler. Z. öffentl. Chem., 1910, **16**, 152—166.

The following method is based upon the ready solubility of lauric and myristic acids in 60 per cent. alcohol. The residue in the distillation flask from the determination of the Reichert-Meissl value is cooled to about 40° C., and transferred to a graduated 100 c.c. cylinder, in which it is shaken with 50 c.c. of petroleum spirit for some minutes. After separation, 25 c.c. of the petroleum spirit layer are withdrawn, the solvent evaporated completely, and the residue treated with 50 c.c. of alcohol of sp. gr. 0·9123 at 15° C. The flask is shaken for 5 minutes, and then left for an hour in water at 15° C., after which a little of the liquid is filtered, and 10 c.c. of the filtrate titrated with N/10 alkali solution. Ten samples of pure butter gave values of 40·5 to 48·0 c.c.; pure cocoanut oil (4 samples), 193·0 to 205 c.c.; palm-kernel oil, 188·0 c.c.; butters (4), with 10 per cent. of cocoanut oil, 63·0 to 66 c.c.; with 20 per cent. of cocoanut oil, 88·0 c.c.; with 40 per cent., 114·0 c.c.; and with 50 per cent., 142·0 c.c. Should, therefore this "solubility value" exceed 60 there can be no doubt as to the adulteration of a given sample of butter. In testing lard for cocoanut oil, the Reichert-Meissl value and the solubility value of the non-volatile acids by the above-described methods should be determined. Should the former exceed 1·0 and the latter be considerably over 20·0, adulteration is proved. Adulteration of lard with palm-kernel oil may be detected in the same way.

—C. A. M.

Banana meal. J. von Sury. Chem.-Zeit., 1910, **34**, 463.

The use of banana meal as a foodstuff has extended largely in recent times. It is prepared from the unripe fruits by drying and grinding. The chemical composition of the meal is very different from that of the ripe fruit. Whilst the latter contains 70 per cent. of sugars and only 1—2 per cent. of starch, the meal from the green fruit contains nearly 80 per cent. of starch and only 3—4 per cent. of sugars. In Switzerland a special banana "cocoa" is manufactured, of high nutritive value and fine aroma. The following numbers represent the mean of 4 analyses of banana meals from Jamaica :—Water, 12·77; ash, 2·45; nitrogen, 0·75, equal to protein, 4·69; non-nitrogenous substances, 78·32; crude fibre, 1·28; fat, 0·49 per cent.—J. F. B.

Cornacea stolonifera; Fruit of ——. J. Duncan. Chem. News, 1910, **101**, 217—218.

The fruit of *Cornacea stolonifera*, the wild red osier dogwood tree, which grows on the banks of the Wood River, New York, is in the form of berries with an odour recalling that of currants. A sample of the dried fruit yielded 3 per cent. of ash, 0·054 per cent. of nitrogen, 38·5 per cent. of reducing sugar (maltose), and 11·5 per cent. of a dextrin-like body soluble in hot alcohol. Extraction with ether of the residue, after removal of the sugar, yielded 3·5 grms. of oil (from 200 grms. of the original fruit) with the following characteristics :—Sp. gr., 0·9658; saponification value, 349; and Reichert value, 1·4. The oil had an odour resembling that of castor oil. No citric, tartaric or oxalic acid was found in the fruit.—C. A. M.

Patents.

Potatoes; Process for treating raw —— in such manner as to obtain a durable product for agricultural and industrial purposes. Patent-Press-Kartoffel-Industrie H. Gumpel, Dahmsdorf-Müncheberg, Germany. Eng. Pat. 17,937, Aug. 3, 1909. Under Int. Conv., May 7, 1909.

The potatoes, in the form of small pieces or of pulp, are deprived of the greater part of the juice in one or more stages The first stage is best effected by vacuum or diffusion of air, or by air-pressure, whilst the operation is completed by mechanically exerted pressure. The mass is subsequently dried, shaped, and pressed. The albuminous substances are obtained, by cold or hot means, from the juice, and the residual water may, on account of the fertilising substances contained in it, be used in the treatment of the soil for agricultural purposes. (Reference is directed to Eng. Pats. 778 of 1871; 1117 of 1883; 24,035 of 1906; and 8699 of 1908; see this J., 1909, 256.)—L. E.

Condensing or drying milk and other mixtures of liquids and solids; Method of —— and apparatus therefor. M. Töpfer, Rittergut Grosszschocher, Germany. Eng. Pat. 23,038, Oct. 8, 1909.

See Fr. Pat. 407,389 of 1909; this J., 1910, 587.—T. F. B.

Drying or condensing apparatus [for milk, etc.]. M. Töpfer, Rittergut, Germany. U.S. Pat. 953,807, April 5, 1910.

See Fr. Pat. 407,389 of 1909; this J., 1910, 587.—T. F. B.

Milk; Process for the fermentation of ——. J. P. Cabanné. Fr. Pat. 408,990, Nov. 12, 1909.

See U.S. Pat. 944,013 of 1909; this J., 1910, 170.—T. F. B.

XIXB—WATER PURIFICATION; SANITATION.

Water; Sterilisation of —— by ultra violet rays. G. Vallet. Comptes rend., 1910, **150**, 1076—1077.

Water, which contained 1000 *Bacilli coli communis* per litre, and of which one-fiftieth of a drop would fertilise bouillon, was subjected to the action of ultra-violet rays. The mercury vapour lamp, used was 6 cm. long, had a double jacket of quartz, and required an E.M.F. of 110 volts. The energy consumed was 4 hectowatt-hours. 10 cubic metres of water could be sterilised in an hour under the following conditions. The water must be filtered so as to be as clear as possible. Each portion of the water must come into contact with the lamp and must be within reach of the active light for at least one minute. The out-going water must be collected from the layer immediately surrounding the lamp.—F. Sodn.

Nitrates in water; Composition of the yellow compound formed in the phenolsulphonic acid method for the determination of ——. E. M. Chamot and D. S. Pratt. J. Amer. Chem. Soc., 1910, **32**, 630—637.

Phenolsulphonic acid, prepared by heating a mixture of phenol (15 grms.) and strong sulphuric acid (128 c.c.), consists chiefly of 1·2·4-phenoldisulphonic acid with a large excess of sulphuric acid. The yellow colour obtained by treating a water residue, containing nitrate, with this reagent, in the usual way, is not due to salts of picric acid, as hitherto supposed, but to the formation of tripotassium nitrophenoldisulphonate, $C_6H_2OK(SO_3K)_2.NO_2.1\frac{1}{2}H_2O$, a salt which crystallises in orange-yellow prisms. Traces of picric acid appear on heating or with residues containing more than 50 parts per million of nitrogen as nitrate.
—F. Sodn.

Metals [lead]; Action of distilled water on ——. Traube-Mengarini and Scala. *See* X.

Patents.

Oily or greasy water or condensed steam; Mode of and means for purifying —— *by electricity.* E. Perrett, Wallington, Surrey, and R. B. Perrett, London. Eng. Pat. 26,477, of 1908; date of application, June 7, 1909.

Ordinary water or lime-water is subjected to electrolysis and is then mixed with the oily water to be purified, the oily precipitate formed being afterwards removed by filtration. Or, a portion of the oily water may be subjected to electrolysis, then mixed with a further quantity of oily water, and the whole filtered. The apparatus employed consists of an electrolytic tank in which the electrodes are so arranged that the liquid passing through the same is caused to take a zig-zag course; the lime-water enters at one end of this tank and the oily water enters at a point nearer the outlet end, this outlet being provided with an adjustable aperture. The proportions of lime-water and oily water may be regulated automatically by means of a tank divided into a number of compartments; the lime-water is delivered into one compartment and its discharge is regulated by means of a valve operated by a ball-float in one of the other compartments containing oily water. The latter is also separated automatically into two portions, one of which is conducted to the electrolytic tank whilst the other is delivered directly to the filter.—W. P. S.

Sewage; System for the purification of ——. C. Potts, Morristown, N.J. U.S. Pat. 955,683. April 19, 1910.

The system consists of two separate filter-beds each of which is provided with a chamber connected with the bed and fitted with a discharge pipe and valve; these valves are operated by floats in such a manner that while one bed is filling, the other is being emptied. The filter-beds are connected with a series of secondary filters by means of a distributing apparatus placed between the discharge outlets of the primary filters and the secondary filters; this distributing device consists of a number of compartments each connected with one of the discharge outlets and provided with a pipe leading to one of the secondary beds.—W. P. S.

Sewage disposal; Apparatus for ——. B. J. Ashley, Chicago. U.S. Pat. 956,665, May 3, 1910.

The sewage is conducted into a tank from which it overflows into an inclined perforated pipe buried below the surface of the ground. This pipe is embedded in filtering material and a second perforated pipe is placed below the first. Each pipe is provided with a vertical tube reaching above the surface of the ground and means are provided for causing a current of air to pass from the lower perforated pipe through the filtering material and thence through the upper perforated pipe.—W. P. S.

Garbage; Destruction of —— *and recovery of by-products.* W. M. Cross, Kansas City, Mo. U.S. Pat. 956,569, May 3, 1910.

The garbage is subjected to destructive distillation and the liquid portion of the distillate is neutralised with sulphuric acid. This solution is then evaporated under reduced pressure to a syrupy consistence, the heat required being obtained from the hot gases and vapours resulting from the distillation. Condensation of the vapours and gases also takes place.—W. P. S.

Water; Apparatus for removing iron from —— *continuously.* Deseniss und Jacobi Akt.-Ges. Fr. Pat. 409,110, Nov. 6, 1909. Under Int. Conv., April 7, 1909.

See Eng. Pat. 12,246 of 1909; this J., 1910, 107.—T. F. B.

Waters; Use of electric mercury-vapour lamps for sterilising ——. T. Nogier. Fr. Pat. 409,447, Feb. 17, 1909.

See Eng. Pat. 30,512 of 1909; this J., 1910, 588.—T. F. B.

Water; Apparatus for sterilising —— *by ozonisation.* Ozonair, Ltd. Fr. Pat. 409,570, Nov. 24, 1909. Under Int. Conv., Dec. 15, 1908.

See Eng. Pat. 27,226 of 1908; this J., 1910, 171.—T. F. B.

Purifying liquids by means of an electric current: Process and apparatus for ——. H. B. Hartman. Fr. Pat. 409,901, Dec. 3, 1909.

See U.S. Pats. 951,311 and 951,313 of 1910; this J., 1910, 514.—T. F. B.

Filter-presses or the like for wet substances [garbage, etc.]. Eng. Pat. 23,981. *See* I.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloid precipitants; Aromatic nitro-compounds, especially nitro-phenols, as ——. L. Rosenthaler and P. Görner. Z. anal. Chem., 1910, **49**, 340—358.

Experiments are described on the use of various aromatic nitro-compounds as precipitants for alkaloids. The nitro-compounds used were: *o*-, *m*-, and *p*-nitrophenol, 2·4-dinitrophenol, 2·4·6-trinitrophenol, 2·5·6-trinitroresorcinol, 3-nitro- and 3·5-dinitrocresol ($CH_3 : OH = 1 : 4$), 2·4·6-trinitro-*m*-cresol, 2·4·6-trinitrothymol, 2·4-dinitro-*a*-naphthol, trinitro-*a*-naphthol (m. p. 117° C.), tetranitrophenolphthalein (sodium salt), hexanitrodiphenylamine (ammonium salt), dinitro-*a*-naphtholsulphonic acid (potassium salt), and dinitroanthrachrysonedisulphonic acid (sodium salt); whilst the bases were adrenaline, aconitine, alypine, antipyrine, arecoline, atropine, berberine, brucine, quinidine, quinine, cinchonine, dionine, emetine, eucaine, eumydrine, euporphine, heroine, hordenine, hydrastine, hydrastinine, cocaine, codeine, caffeine, colchicine, coniine, morphine, nicotine, novocaine, pelletierine, physostigmine, pilocarpine, stovaine, strychnine, and veratrine. The results obtained are collected in tabular form in which the limits of dilution within which a precipitate is produced in one minute, or in a few cases (in which a crystalline precipitate is formed slowly) in one hour, are also given. None of the nitro-compounds tried appears to be a better general precipitant for alkaloids than picric acid, or picrolonic acid (see Matthes and Rammstedt, this J., 1907, 1252). In a few cases, however, the precipitates show characteristic forms under the microscope, and two plates are given showing hese forms in the case of the precipitates produced with caine and trinitroresorcinol, strychnine and dinitro- esol, cinchonine and trinitrophloroglucinol, arecoline nd trinitrophloroglucinol, hordenine and trinitrothymol, niine and dinitroanthrachrysonedisulphonic acid, and ydrastinine and trinitrophenol, trinitrocresol, trinitro- ymol, trinitroresorcinol, trinitrophloroglucinol, and initroanthrachrysonedisulphonic acid respectively.—A. S.

parteine in broom-plant ; Variation in the content of —— according to the season. J. Chevalier. Comptes rend., 1910, 150, 1068—1069. (See this J., 1910, 295.)

HE broom plants grown in Seine-et-Oise (France) were thered month by month, and the amount of sparteine lphate was determined, which could be obtained from e kilo. of the entire dry plant. The amounts corre- onding to each month were :—January, 4·02 grms. ; ebruary, 4·15 ; March, 6·80 ; April, 3·25 ; May, 4·32 ; ne, 3·27 ; July, 3·00 ; August, 2·33 ; September, 3·58 ; etober, 4·07 ; November, 4·75 ; December, 4·07.—F. Shdn.

erberine. Berberrubine. G. Frerichs. Arch. Pharm., 1910, 248, 276—284.

HEN berberine hydrochloride is heated with urea to 0° C., a red base, berberrubine, $C_{19}H_{15}NO_4$, is oduced by the loss of CH_2 and one molecule of water m 1 mol. of the berberine. It is undoubtedly e phenolbetaine of a quaternary hydroxy-base. It ystallises from water in dark-red leaflets, and melts at out 285° C. The crystals contain three molecules of ater of crystallisation. The hydrochloride and sulphate e readily prepared by adding the respective acids to the ueous solution of the base. The base reacts with acetic hydride and ammonium sulphide. Hydroberberrubine, $_{19}H_{17}NO_4$, is formed when berberrubine is heated with nc and dilute acetic and sulphuric acids. It is almost soluble in water and crystallises from dilute alcohol nearly colourless leaflets melting at 167°—168° C. hen a solution of one of the salts is treated with sodium droxide, a precipitate is at first produced, which is luble in excess. When berberrubine is heated with cess of methyl iodide, berberine hydriodide is produced. —F. Shdn.

orycavine. G. O. Gaebel. Arch. Pharm., 1910, 248, 207—250.

EVERAL pure salts of corycavine were made ; the hydro- loride melts at 219° C., the hydriodide at 236° C., and e platinum chloride double salt at 214° C. A large umber of experiments were made with a view to eluci- ting the constitution of the base. The composition is presented by the formula, $C_{23}H_{21}NO_6$, the formula, $_{22}H_{23}NO_6$, not being regarded as correct. There are no ydroxyl or methoxyl groupings present. The base ntains one methyleneoxy grouping, and one methyl oup is attached to the nitrogen. Corycavine methiodide elts at 219°—220° C. When treated with sodium droxide, corycavimethine, $C_{24}H_{25}NO_6$, m. pt. 153°— 4° C., is produced. The latter substance is decomposed by e action of sodium hydroxide into trimethylamine and a mpound free from nitrogen. Crystalline products were tained by the action of zinc dust and hydrochloric acid on corycavine, and also when corycavimethine was idised with permanganate.—F. Shdn.

antharidin in different species of cantharides. W. C. Colledge. Pharm. J., 1910, 84, 674.

HE results obtained in the examination of six different ecies of cantharides found in South Africa, whilst showing w variable is the amount of cantharidin in the beetles, dicate that South Africa may prove to be a satisfactory llecting-ground for the drug. The cantharidin was timated by a modification of the method described by lf and Greenish (this J., 1907, 341) and the yields were follow : *Mylabris oculata*, Thunb., 0·615 ; *M. holocericea*, ley, 1·3 ; *Decatoma lunata*, Pallas, 1·0 ; *Eletica wahlbergia*, Fabr., 0·32 ; *Cantharis velata*, 2·73 ; *Lytta coelestina*, 1·89 per cent. Specimens of the Chinese blister fly yielded 1·2 per cent. of cantharidin by the same process.—A. S.

Parsley oil ; Constituents of ——. J. Chevalier. Bull. Sciences Pharmacol., 1910, 17, 128—131. Chem Zentr., 1910, 1, 1799.

According to the author, mixtures containing isomyristicin and "apiol-butter" have recently been sold as crystalline apiol. Experiments have shown that except for slight differences of intensity, the pharmacodynamic action of apiols and myristicins from various sources is the same. Myristicin is less active and less toxic than the apiols. On the other hand, isoapiol and isomyristicin are less toxic than the isomeric allyl-compounds. The liquid apiol of water-fennel oil is less toxic than crystalline apiol. Crystalline apiol possesses no advantages over well-rectified parsley oil, freed from "parsley butter." The "parsley butter" consists almost exclusively of apiin.—A. S.

Samphire ; Essential oil of ——. M. Delépine. Comptes rend., 1910, 150, 1061—1063. (See this J., 1909, 906.)

The essential oil of samphire (*Crithmum maritimum* L. Omb.) was resolved into four fractions, boiling respectively at, I., 44°—46° C. at 14 mm. ; II., 62°—64° C. at 13 mm. ; III., 94°—96° C. at 15 mm. ; and IV., 157°—158° C. at 13 mm. The last fraction consisted of apiol (*loc. cit.*). The first fraction contained *d*-pinene. The second fraction, which was the largest, contained dipentene and *p*-cymene. The principal constituent of the third fraction, which boiled at 210°—214° C. at the ordinary pressure, was the methyl ether of thymol.—F. Shdn.

Cajuput oil. R. C. Cowley. Chem. and Drug., 1910, 76, 62.

There are at least seven different varieties of *Melaleuca leucadendron* in Queensland, the tree being a very common one in the coastal districts. The kind growing in the Brisbane district, is *M. leucadendron*, var. *lancifolia* ; it is known locally as the "Ti-tree." A sample of oil from this tree, distilled in Brisbane, was quite colourless and had the following characters :—Sp. gr., 0·922 ; optical rotation (100 mm.), −3° ; refractive index, $n_D = 1{\cdot}4623$; cineol, 45 per cent.—A. S.

Oil of Cinnamamum Tamala. Schimmel's Report, April, 1910, 122—123.

Besides other low-grade *Cinnamomum*-species, it is especially *Cinnomomum Tamala* (Nees et Eberm.), a tree of medium size, growing plentifully in Southern Asia, which yields "Mutterzimt," *Cassia Lignea*, or Wood cassia, termed by the retail trade simply *Cassia*. The leaves of the tree are still used medicinally in the East Indies ; in former years they were also met with in commerce (the narrow *Folia Malabathri*) but they are now obsolete. The leaves contain an essential oil, of which a sample, which had been distilled by Mr. I. H. Burkill, of Calcutta, has been examined. The oil was of a lemon-yellow colour, and had a clove-like, at the same time slightly peppery, odour. It possessed the following characters :—Sp. gr. at 15° C., 1·0257 ; $\alpha_D = +16° 37'$ (100 mm.) ; $n_{D20°} = 1{\cdot}52596$; phenol-content, 78 per cent. ; soluble in 1·2 volumes and over of 70 per cent. alcohol. The phenols consisted of eugenol (m.p. of the benzoyl compound 69° C.). When freed from phenols, the oil had the high optical rotation, $\alpha_D = +66° 40'$, and yielded a solid nitrite which, when recrystallised from ethyl acetate melted at 113° to 114° C. It contained therefore *d-α*-phellandrene. In respect of its high eugenol content it is closely allied to the ordinary oil from Ceylon cinnamon leaves.

Guayava oil. Schimmel's Report, April, 1910, 123.

The guajava tree (*Psidium Guayava* Raddi, *Myrtaceæ*, is a native of tropical America and bears fleshy berries which are eaten both in the raw state and as a preserve. The leaves, when chewed, are said to be a remedy in toothache. An oil of guajava leaves from Santiago de

Cuba, which had been obtained from the raw material to the extent of 0·2 per cent., has been examined. It was of a lemon-yellow colour and had a faint aromatic odour; sp. gr. at 15° C., 0·9157; $\alpha_D = -10° 5'$ (100 mm.); $n_{D_{20}°} = 1·49638$; acid value, 2·0; ester value, 6·4; soluble in about 10 volumes of 90 per cent. alcohol.

Oil of Mentha silvestris. Schimmel's Report, April 1910, 123—124.

AN oil of *Mentha silvestris* L., (from the Imperial Institute, London), prepared in Cyprus, was found to possess the following properties:—Sp. gr. at 15° C., 0·9701; $\alpha_D = +31°30'$ (100 mm.); $n_{D_{20}°} = 1·49544$; acid value, 2·4; ester value, 20·9; ester value after acetylation, 171·4; soluble in 3 vols. of 70 per cent. alcohol; (the diluted solution showed slight opalescence;) faintly mint-like odour; yellow colour. It is obvious that the saponification value of 171·4 after acetylation of the oil cannot in this case be indicative of the menthol content, which, judging by this factor, should have been 54·8 per cent.; for, as a matter of fact, the sample contained but little menthol. The mint-like odour was chiefly due to the presence of pulegone, of which the oil contained 40 per cent. (isolated with sodium sulphite). In addition to this a phenol (probably carvacrol) could be detected, from which it is to be supposed that this, also, would become esterified and would help to swell the acetylation value. Owing to the simultaneous occurrence in it of menthol, pulegone and a phenol, the oil cannot be used either as peppermint oil or as European pennyroyal or origanum oil. It is differentiated from oil of peppermint by its much higher specific gravity and by its pronounced dextrorotatory power.

Camphor monopoly in Japan. Z. angew. Chem., 1910, 23, 736—737.

THE management of the Japanese camphor monopoly attempted to control the market by increasing the price of camphor from M. 2·61 in 1903 to M. 4 in 1906 and 1907. At the same time they stimulated the production of camphor by giving a higher price to the planter and by planting new trees, so that by March 1909, 28 millions of young trees had been planted. After the introduction of German artificial camphor, however, and the revival of the Chinese production, it was recognised that the Japanese monopolists were no longer able to dictate terms. Hence large reductions in the price were made, and since Sept. 1908, Japanese camphor has been sold in London and New York at 135 to 140 shillings for 50·8 kilos. At the same time, to reduce the loss, part of the camphor oil was sold to the refineries and the separated camphor taken back, whereas previously the refiners had received the residues (red and white oils and tar) as payment for the refining. The following table shows the results obtained in the refineries in the five years ending 1908.

	1904	1905	1906	1907	1908
	tons.	tons.	tons.	tons.	tons.
Camphor oil	426	384	503	560	594
Separated camphor....	217	198	251	280	286
Red oil	83	76	99	109	117
White oil	66	61	79	88	106
Tar	8	7	10	11	8
Total	374	342	439	488	517
Loss	52	42	64	72	77

The loss of camphor by volatilisation during transport and storage amounts to about 1·5 per cent., and considerably greater losses are incurred during the subsequent treatment of the camphor, either by storage for 9 months or so, to let the oil exude, or by distillation to obtain a product containing 97 per cent. of pure camphor. The financial conditions of the industry in old Japan are given in the following table:—

Year.	Quantity of camphor sold.	Price received.	Cost of Production, etc.	Profit or Loss.
	tons.	£	£	£
1903 ...	209	28,520	30,953	— 2,433
1904 ...	510	74,071	61,381	+ 12,690
1905 ...	482	76,895	60,572	+ 16,323
1906 ...	599	119,709	78,797	+ 40,912
1907 ...	458	91,955	88,066	+ 3,889
1908 ...	293	45,016	111,079	— 66,063

In Formosa the cheaper cost of production renders t conditions much more favourable. Only a small quanti of camphor is used in Japan itself, although the opening the celluloid factory now in course of construction an intended to produce over 2 million lb. per annum, w probably increase the consumption. The total quantiti and values of camphor exported (principally to U.S. France, England, Germany and India) from Japan a Formosa are given in the Customs returns as follows:—

Year.	Quantity.	Value.	Year.	Quantity	Value.
	tons.	£		tons.	£
1900	2,814	454,547	1905...	2,626	471,15
1901	2,922	478,814	1906...	2,804	597,26
1902	4,058	637,903	1907 ..	3,087	779,89
1903	3,900	617,727	1908 ..	2,018	384,93
1904	3,216	547,487			

—C. A. M.

Ngai camphor. Schimmel's Report, April, 1910, 148—1

NGAI camphor is the name given to the solid parts of t essential oil of *Blumea balsamifera* D C. roughly separat from the liquid oil. The constitution of Ngai camph varies very considerably, for whereas a sample examin in 1895 consisted almost entirely of *l*-borneol, anoth sample received recently from Mr. R. S. Pearson, Debra Dun, British India, contained about 75 per cent. *l*-camphor and only 25 per cent. of oil. The crude produ showed a spec. rot. $[\alpha]_D = -46·26°$ in a 54·18 per ce xylene solution, its m. p. being 175°. After acetylati the same xylene solution showed a saponification val of 46·4, corresponding to 13·2 per cent. of borneol. Fr this the borneol content of the Ngai camphor itself cou be calculated at 24·4 per cent. The separation of t two constituents was effected in the usual manner converting the borneol into its phthalic acid ester a driving off the camphor by steam. After repeated cryst lisation the two bodies were identified as *l*-borneol a *l*-camphor. From the slight rotations of the isolat pure bodies it is to be inferred that the admixed yell oil must be strongly lævorotatory, but it was impossi to polarise the latter, the available quantity being t small.

Linalool. J. Dupont and L. Labaune. Schimm Report, April 1910, 172.

WHEN hydrogen chloride gas is passed through linal which has been diluted with its own weight of dry tolue and heated to 100° C., water is split off, and the hyd chloric ester of linalool, linalyl chloride, $C_{10}H_{17}Cl$, obtained to the extent of 80 per cent. Geraniol, wh treated in the same manner, likewise yields linalyl chlori although not so abundantly (about 60 per cent.). T compound possesses the following constants: b. p., to 96° C. (6 mm.); sp. gr. at 20° C., 0·9361; $[\alpha]_{D20°} =$ 1·50°; $n_{D20°} = 1·4813$; mol. refr. found 52·5, calc 52·28. In order to regenerate the alcohol, the auth added silver nitrate to the alcoholic solution of the chlori when an almost inactive linalool was regenerat By this method, therefore, starting from geraniol, th arrived at linalool, a conversion which had already b pointed out by Tiemann and Semmler (Ber., 1898, 832; also this J., 1898, 598), and which may also ccomplished by heating with water in an autoclave his J., 1898, 599). The use of hydrochloric acid by the ld process gives less favourable results, for apparently monochloride is formed which is contaminated with ichloride.

inene hydrochloride; Liquid ——. P. Barbier and V. Grignard. Bull. Soc. Chim., 1910, 7, 342—350.

HE so-called liquid pinene hydrochloride contains besides ornyl chloride, about 5 per cent. of fenchyl chloride, wo other chlorides whose constitution has not been etermined. The liquid pinene hydrochloride was ixed with ethyl bromide and allowed to run on magnesium turnings. Oxygen was passed through e product, which was then fractionated. A fraction oiling between 170° and 220° C. was obtained, which as a mixture of alcohols. The mixture was treated ith magnesium and the hydrocarbons distilled off. y fractionation a solid alcohol was separated, which roved to be borneol. A liquid portion was obtained om which the phenylurethanes of borneol and fenchyl lcohol were separated. When the latter alcohol was xidised with nitric acid, fenchone was produced. It ielded two oximes. One was identified as *l*-fenchonexime, m. pt. 160°—161° C. The other oxime melted at 61°—162° C., but crystallographic measurements gave gures differing from those hitherto obtained for oximes of enchone.—F. Shdn.

Terpinene question"; Notes on the ——. O. Wallach. Nachr. K. Ges. Wiss. Göttingen, 1909, 391—399. Chem. Zentr., 1910, 1, 1716—1717.

HE author disagrees with the statements which have een expressed that the nature of terpinene is still obscure. o-called "terpinene" must be regarded as a mixture of $^{1.3}$- and $\Delta^{1.4}$-dihydro-*p*-cymene ($\Delta^{1.3}$- and $\Delta^{1.4}$-*p*-enthadiene), and probably other isomerides. $\Delta^{1.3}$-Dihydrocymene, named by the author, *a*-terpinene, and y Semmler, carvenene, is characterised by yielding *a*-dihydroxy-*a*.*a*′-methylisopropyladipic acid on oxidaon, and is probably the hydrocarbon which forms the rpinene-nitrosite, for the yield of the latter is greater, e larger the quantity of *a*.*a*′-dihydroxy-*a*.*a*′-methylopropyladipic acid produced on oxidation of the rpinene. $\Delta^{1.4}$-Dihydrocymene, or γ-terpinene (Semmr's isocarvenene) is characterised by yielding an rythritol melting at 237° C. on oxidation with permananate; this is quite distinct from the erythritol ielded by terpinolene, since by losing one molecule of ater it can be converted into a mixture of carvacrol nd thymol. *β*-Terpinene ($\Delta^{1.4(7)}$-menthadiene), which orresponds to *β*-pinene and *β*-phellandrene, and is lso capable of yielding terpinene dihydrohalogenides, as not hitherto been detected in so-called "terpinene." ut has been prepared synthetically (see this J., 1908, 997). he author holds that, in future, the name terpinene hould only be used, with the requisite prefix, for a definite drocarbon. (See also this J., 1909, 959; and Semmler, his J., 1909, 106, 258, 441, 1273.)—A. S.

-Cyclogeranic acid; Derivatives of ——. L. Bouveault. Bull. Soc. Chim., 1910, 7, 350—354.

THYL iodide was condensed with methylheptenone n the presence of zinc, and the ethyl ester of hydroxyydrogeranic acid was produced. This was directly onverted into ethyl cyclogeranate, which boils at 101°—02° C. at 10 mm., and is very difficult to hydrolyse. he ester was heated to 110°—120° C. with alcoholic otassium hydroxide, and the free acid purified by disillation in a vacuum. It distilled at 130°—140° C. at 0 mm., and when pure melted at 106° C., the melting point f *a*-cyclogeranic acid. This acid can be converted into he ethyl ester again by the action of sodium ethoxide nd ethyl bromide, and on hydrolysis the ester yields he same acid. By treating the acid with phosphorus entachloride and ammonia, the amide of *a*-cyclogeranic cid was obtained, which melted at 120°—121° C. The mide of *β*-cyclogeranic acid melts at 202° C.—F. Shdn.

a-Cyclogeraniol. L. Bouveault. Bull. Soc. Chim., 1910, 7, 354—357.

When the ethyl ester of *a*-cyclogeranic acid is reduced with sodium and alcohol, *a*-cyclogeraniol is produced. This has the composition, $C_{10}H_{18}O$, and boils at 213°—217° C. The acetate boils at 115° C. at 20 mm. The phenylurethane forms fine white needles, melting at 75° C. The pyruvate, $C_{13}H_{20}O_3$, which has the properties of a lactone, distils at 180° C. at 10 mm., and melts at 114° C. *a*-Cyclogeraniol can be produced by reducing the amide of *a*-cyclogeranic acid in amyl alcohol with sodium. Geranyl acetate can be converted into *a*-cyclogeranyl acetate by the same method which is used to convert geranic acid into cyclogeranic acid, that is by the action of cold, 70 per cent. sulphuric acid.—F. Shdn.

Di- and trimethylamine; Platinichlorides and periodides of ——, *and an examination of their use in separating the bases.* J. Bertheaume. Comptes rend., 1910, **150**, 1063—1065.

The platinichlorides of di- and trimethylamine were prepared and their solubilities in alcohol of various strengths at 0° C. were determined. The figures show that these bases cannot be satisfactorily separated by means of the platinichlorides. In Weiss' method the solution of the hydrochlorides is precipitated with iodine in potassium iodide and the precipitate treated with a cold solution of soda lye, which converts the dimethylamine periodide into a yellow iodide and dissolves the trimethylamine periodide. Dimethylamine periodide, $NH(CH_3)_2.HI.I_3$, melts when dry at 83°—85° C. The prism angle of the crystals is 130°. It cannot be precipitated at 0° C. when the dilution is more than 1 in 1000. The solubility is decreased in the presence of sodium chloride, potassium chloride or magnesium sulphate, but increased in the presence of ammonium chloride. Trimethylamine periodide crystallises in hexagonal plates, the prism angle of which is 127°. The substance melts at 65° C. Recognisable crystals can be obtained with a solution containing one part of the hydrochloride in 50,000 parts of water. In the presence of the above mentioned metallic and ammonium salts, precipitation will take place when the dilution is twice as great. Large quantities of these bases cannot be very well separated by this method, as the yellow iodide of dimethylamine rapidly decomposes. —F. Shdn.

Methylamines and ammonia; New method of determining the three —— *in mixtures.* J. Bertheaume. Comptes rend., 1910, **150**, 1251—1253.

1—2 grms. of the hydrochlorides, dried at 110° C., are dissolved in a small quantity of water acidified with hydrochloric acid, and the solution is well mixed with at least 20 grms. of quartz sand. The mixture is dried perfectly *in vacuo* over sulphuric acid and then extracted with warm pure chloroform. The chloroform solution is evaporated to dryness, the residue is weighed and dissolved in 2000 times its weight of water. A known quantity of this solution (200—300 c.c. at most) is cooled to 0° C., and per 100 c.c. taken, at least 30 c.c. of a solution of iodine in potassium iodide (127 grms. of iodine and 150 grms. of potassium iodide in 1000 c.c. of water), also cooled to 0° C., are added. The mixture is kept for 1 hour at 0° C., the crystals of trimethylamine periodide are filtered off in a funnel well plugged with glass wool, dried, and washed with a cold mixture of the above iodine reagent and water (1 : 3). The crystals are then dissolved in normal sodium sulphite solution, the solution distilled with excess of sodium carbonate in a Schlœsing apparatus, and the trimethylamine determined volumetrically in the distillate. The dimethylamine is similarly determined in the mother liquors from the trimethylamine periodide crystals. The residue insoluble in chloroform is dried to free it from chloroform and extracted with hot water; in this solution, the monomethylamine and ammonia are separated by Francois's method with yellow oxide of mercury (this J., 1907, 432, 721).—A. Sbld.

Ethane and ethylene [solvents for cellulose acetate, fats, resins, etc.]; Chloro-derivatives of ——. L. Clément and C. Rivière. Caoutchouc et Gutta-percha, 1910, 7, 4021—4022.

The chloro-derivatives of ethane and ethylene are destined to take a very important place as industrial solvents, since they are non-inflammable and non-explosive. Their solvent power is extremely high and they present a range of boiling points from 55° to 159° C. The derivatives which are at present of commercial importance are the following:—*sym.-Tetrachloroethane*, b. pt. 147° C., sp. gr. 1·6, is slightly anæsthetic and not very volatile. It dissolves sulphur in all proportions on heating; it is very slightly soluble in water; it attacks iron and copper in presence of moisture and is decomposed to an appreciable extent by strong alkalis. This body is applicable for extractions at high temperatures, particularly for the extraction of sulphur. It is a solvent of resins and fatty oils and is capable of considerable application in the lacquer, varnish and paint industry. It dissolves cellulose acetate. *Pentachloroethane*, b. pt. 159° C.; sp. gr. 1·7, is applicable for the same purposes as the preceding; it is a particularly good solvent for cellulose acetate. *sym.-Dichloroethylene*, b. pt. 55° C.; sp. gr. 1·25, is very slightly soluble in water and does not attack metals in presence of moisture. It is available as a non-inflammable substitute for ether, particularly for the extraction of perfumes and essential oils. *Trichloroethylene*, b. pt. 88° C.; sp. gr. 1·47, is non-anæsthetic, very slightly soluble in water, is not decomposed by alkalis and does not attack metals in presence of moisture. It is a satisfactory substitute for benzene or carbon tetrachloride for the extraction of oils and fats, to which it imparts no odour. *Tetrachloroethylene*, b. pt. 121° C.; sp. gr. 1·62, is suitable as a solvent for fats and for domestic purposes. Tetrachloroethane is stated to be the cheapest of the solvents hitherto proposed for cellulose acetate, its cost being about 1 frc. per kilo. Not all the cellulose acetates possess the same degree of solubility, and those processes which yield products soluble in tetrachloroethane are destined to come to the front. The manufacture of cinematograph films from cellulose acetate is an established industry, and this ester is likely to be used for lacquers, varnishes and proofing fabrics. Plastic masses are obtained by the action of ethyl acetate and camphor on Bayer's "cellite," a form of cellulose acetate.
—J. F. B.

Essential oil of cacao butter. Haller and Lassieur. *See* XII.

Gamboge. Taylor. *See* XIII.

Thorium nitrate. Chem. and Drugg. May 28, 1910. [T.R.]

The fall in thorium prices is attributed to over-production rather than to competition and an absence of understanding between manufacturers. The import of monazite sand into the United States is rendered difficult by the high import duty charged, so that American manufacturers of thorium nitrate have to obtain their supplies from local sources, though, owing to cheaper European manufacturing processes, much of the thorium nitrate employed by the incandescent-mantle industry is imported from Europe, despite the high duties. Apart from America, thorium nitrate is manufactured only in Europe, the monazite sand being supplied from Brazil. The yearly consumption of monazite sand for the manufacture of thorium nitrate is said to range between 2,000 tons and 2,500 tons. According to Brazilian Government estimates, 15,000 tons of monazite sand have been supplied to the Hamburg market during the past five years on the basis of a treaty between the Government and a European "combine" to which the Hamburg firm of de Freytas belongs. A Brazilian-American firm is known to have imported into Hamburg from private monazite-sand deposits in Brazil another 5,000 tons, while other firms have imported about 2,000 tons. This gives a supply of monazite sand of about 22,000 tons in a period of five years, compared with a consumption of 10,000 tons. Now that the treaty between the Brazilian Government and the combine of thorium nitrate manufacturers is on the eve of expiry, the Brazilian Government is said to have already received tenders from twenty-five firms.

A radium safe. Times, May 31, 1910. [T.R.]

A safe, the first of its kind constructed, has been made by Messrs. Chubb and Sons for the British Radium Corporation. It has been specially constructed from the design of the technical advisers to the corporation for the storage and protection of radium, and though only about 3 ft. in height it weighs a ton and a half. The safe has been constructed with an interior shell of three-inch lead and an outer casement of a similar thickness of steel. A circular lathe-turned door is provided, which has a "dead" fit, and has an ingenious contrivance for immediately remedying any wear and tear caused by opening and shutting the door. To prevent loss of emanations when the door is opened, two valves have been fixed into the door, through which tubes of mercury will be passed for the collection and storage of the emanations.

Patents.

Bacilli culture and preservation. E. M. Marshall and W. A. Smith, London. Eng. Pat. 11,933, May 20, 1909.

A solid preparation, containing lactic acid or other bacilli in active condition and not less than 10 per cent. of water, is obtained by incorporating such bacilli with a carbohydrate nutrient medium and the required amount of water, with or without the addition of other substances. Or lactic acid bacilli may be cultivated in sugar solution until the required bacterial richness is attained, and then incorporated with the other ingredients. Under these conditions the bacilli in the solid preparations become capable of development when the associated carbohydrate is dissolved. These solid preparations may be made in the form of tablets, mixed with almond, sugar, etc., and covered with a protective wrapping.—C. A. M.

Lactic acid bacterial preparations and the productio thereof. W. R. Dodd, Allen and Hanburys, Ltd., an J. B. Smith, London. Eng. Pat. 17,649, July 29, 1909

Two equal portions of milk are thoroughly sterilised an cooled to a temperature of about 105° F.; one portion i then inoculated with a pure culture of *Bacillus Bulgaricu* and the other portion with a pure culture of *Streptococcu lactis.* The quantities of milk thus inoculated are separately incubated at 105° F. for about 24 hours, at the en of which time the curds formed are separated from th whey, pressed, and mixed together, a little salt bein added to the mixture, if desired. The mixed curds ma be packed in jars ready for use, or still further pressed a in the manufacture of cheese; if required, the cheese thu obtained may be set aside to mature, or the curds may b mixed with cheddar or other cheese.—W. P. S.

Lactic fermentation; Process for the manufacture in the for of grains of pure or mixed cultures of bacteria or microbe producing ——. C. Löloff, Breslau, Germany. Eng Pat. 21,173, Sep. 16, 1909.

A suitable nutrient fluid is inoculated with aërobic lacti acid bacilli which form a mycelium-like scum; or wit mixtures of such bacilli with anaërobic lactic acid bacilli or with mixtures of anaërobic lactic acid bacilli with neutra aërobic bacteria which form a similar scum that is no injurious to health; or with mixtures of all these micro organisms. From time to time the scum is separated divided, and dried, the resulting product having th appearance and properties of Caucasian kephir grain whilst being much cheaper.—C. A. M.

Curative agents [enzyme preparations] ; Manufacture of ——. Chem. Fabrik auf Actien (vorm. E. Schering), Berlin. Eng. Pat. 24,505, Oct. 25, 1909. Under Int. Conv., Oct. 26, 1908.

ENZYMIC solutions, which, when injected into animals, produce regular intestinal peristalsis, are obtained by xpressing the stomach or intestine (or mucous membrane hereof) removed from an animal which is killed whilst in he act of digesting. The resulting fluid is (preferably) reed from albumin and rendered aseptic by filtration. Or he stomach, etc., from the digesting animal may be riturated and extracted with a saline solution or with ydrochloric acid, and the extract neutralised and treated s before. These preparations, when evaporated to dryness, eave a brown hygroscopic powder, which is readily oluble in water, dilute alkali solutions and hydrochloric nd nitric acids, but is insoluble in alcohol. The aqueous olution may be boiled without losing its biological properties. Intramuscular injection of 5 to 15 c.c. of a oncentrated solution promotes peristalsis.—C. A. M.

urative agents from the spleen of animals ; Manufacture of ——. Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 27,357, Nov. 24, 1909. Under Int. Conv., Nov. 28, 1908. Addition to Eng. Pat. 24,505 of 1909, dated Oct. 26, 1908.

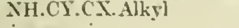
THE ferment producing normal intestinal peristalsis, described in the principal patent (preceding) may also be obtained from the spleen of animals killed whilst digesting. The triturated organ is expressed or extracted by solutions f salts or dilute acids, and the extracts boiled to remove lbumin and rendered aseptic by filtration.—T. F. B.

Bacteria cultures ; Process for the preparation of specially active ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 221,266, Nov. 8, 1908.

THE bacteria, for example, tubercle bacilli, are cultivated uccessively in media to which gradually increasing quantities of arsenious acid are added. In this way, tarting with a medium containing 1 part of arsenious cid in 200,000, bacilli can be obtained which will develop igorously in a medium containing 1 part of arsenic in 5,000. The substance of these bacilli contain a small uantity of arsenic. Moreover, the arsenious acid in the medium is converted into organic compounds. Both the atter and the substance of the bacteria are of value therapeutically. The organic arsenic compound contained in he nutrient medium used for the cultivation of tubercle acilli is stated to exhibit the specific action of tuberculin. —A. S.

Acetyl derivatives of alkylated iminopyrimidines ; Process for preparing ——. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 409,223. Sept. 21. 1909. Under Int. Conv., Sept. 22 and Oct. 1, 1908, and Jan. 23, 1909.

BY treating alkylated iminopyrimidines with acetylating gents, acetyl derivatives of the general constitution,



$$\begin{array}{l} \mathrm{NH.CY.CX.Alkyl} \\ \dot{\mathrm{C}}\mathrm{Y.NH.}\dot{\mathrm{C}}\mathrm{Y} \end{array}$$

re obtained, where X represents hydrogen or alkyl, and oxygen, :NH, or :N.CO.CH_3, providing that one Y is lways :N.CO.CH_3. Thus, 5-diethyl-2-acetimino-4.6-oxypyrimidine, obtained by acetylating 5-diethyl-2-mino-4.6-dioxypyrimidine, melts at 176° C. ; 5-dipropyl--acetimino-4.6-dioxypyrimidine melts at 184°—186° C. ; -diethyl-2.4-diacetimino-6-oxypyrimidine melts at 136°—38° C. ; and 5-ethyl-2-acetimino-4.6-dioxypyrimidine melts at about 202° C.—T. F. B.

Alkylbarbituric acids ; Conversion of acetyl derivatives of alkylated iminopyrimidines into ——. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 409,224, Sept. 21, 1909. Under Int. Conv., Sept. 22, 1908, and April 10, 1909.

WHEN the acetyl derivatives of alkylated iminopyrimidines (see Fr. Pat. 409,223, preceding) are treated with water or with aqueous solutions of acids, they are converted into the corresponding alkylbarbituric acids. Thus, diethylbarbituric acid is obtained by boiling 1 part of 5-diethyl-2-acetimino-4.6-dioxypyrimidine with 12 parts of water.—T. F. B.

Ketone-alcohols and methylene-ketones ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 409,403, Nov. 19, 1909. Under Int. Conv., Jan. 7, 1909.

ACETONE and its homologuea may be condensed with formaldehyde, by aid of mild alkaline condensing agents, to form ketone-alcohols ; on dehydration these are converted into the corresponding methylene-ketones. Suitable dehydrating agents are zinc chloride, sulphuric acid, alkali bisulphates, etc., whilst alkali or magnesium carbonates, disodium hydrogen phosphate, and borax serve as alkaline condensing agents. Ketobutanol, $CH_3.CO.CH_2.CH_2.OH$, obtained from acetone and formaldehyde, has a b. pt. of 109°—110° C. (30 mm.), whilst methylketobutanol, obtained from ethylmethylketone, has a b. pt. of 90°—95° C. (15 mm.). Their dehydration products, methylene-acetone and methylene-methylethylketone, boil at 80° and 96° C. respectively.—T. F. B.

o-Dihydroxyphenylalkamines ; Process for preparing optically inactive ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 220,355, April 3, 1909.

THE synthetically prepared *o*-dihydroxyphenylalkamines (suprarenin, etc.) are optically active. They can, however, be converted into the inactive compounds by the prolonged action of mineral acids, or by warming with the same ; *e.g.*, 1·5 grms. of *l*-*o*-dihydroxyphenylethanolmethylamine are heated with 13·5 c.c. of *N*/1 hydrochloric acid solution and 15 c.c. of water for two to three houra at 80° to 90° C., after which the solution is inactive.—T. F. B.

Iodo-acidyl-salicylic acids ; Process for preporing ——. Chem. Fabr. von Heyden. Ger. Pat. 221,384, Jan. 7, 1909. Addition to Ger. Pat. 212,422, May 26, 1907 (see this J., 1909, 1005).

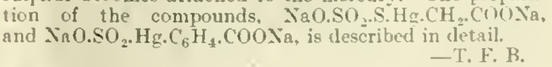
WHEN salicylic acid or its salts are treated with halogenides or anhydrides of iodo-fatty acids, iodo-acidylsalicylic acids are formed. Iodo-acetylsalicylic acid (m. pt. 138° C.) and α-iodo-isovalerylsalicylic acid (m. pt. 102° C.) are obtained by the action of iodo-acetyl chloride and α-iodo isovaleryl chloride, respectively, on sodium salicylate in benzene solution. The products are applicable to pharmacy.—T. F. B.

Oxymercuri-carboxylic acids ; Process for producing preparations soluble in water from the anhydrides of ——. W. Schoeller and W. Schrauth. Ger. Pat. 221,483, Feb. 25, 1909.

ANHYDRIDES of oxymercuri-carboxylic acids, of the general formula, $\overline{\mathrm{Hg.R.CO.O}}$, where R is an aliphatic or aromatic hydrocarbon residue, are dissolved in aqueous solutions of alkali salts at least one alkali-metal atom of which is united to a sulphur atom ; such salts are, alkali sulphites, thiosulphates, hydrosulphites, and alkali salts of sulphur derivatives of alcohols, phenols, and thiosulphonic acids. The resulting solutions are evaporated, preferably *in vacuo*, and the products dried ; they are readily soluble in water. By this process, the anhydride ring is broken, and the alkali metal atom unites with the carboxylic group, whilst the sulphur becomes attached to the mercury. The preparation of the compounds, $NaO.SO_2.S.Hg.CH_2.COONa$, and $NaO.SO_2.Hg.C_6H_4.COONa$, is described in detail. —T. F. B.

β-Methyladipic acid ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 221,849, Dec. 10, 1908.

β-METHYLADIPIC acid may be prepared by oxidation of *p*-methylcyclohexanol or *p*-methylcyclohexanone,



$$CH_3.CH{<}\begin{array}{c}CH_2.CH_2\\CH_2.CH_2\end{array}{>}CH.OH \text{ or } CH_3.CH{<}\begin{array}{c}CH_2.CH_2\\CH_2.CH_2\end{array}{>}CO.$$

Suitable oxidising agents are nitric acid, permanganate bichromate, etc. For example, four parts of p-methylcyclohexanol are slowly added to 20 parts of concentrated nitric acid; by cooling the solution, the greater part of the β-methyladipic acid crystallises out.—T. F. B.

Fatty acids or their esters; Process for preparing saturated compounds from —— volatile with difficulty or non-volatile, by hydrogenation in presence of nickel. E. Erdmann. Ger. Pat. 221,890, June 20, 1909. Addition to Ger. Pat. 211,669, Jan. 19, 1907 (see this J., 1909, 944).

The saturated products obtained according to the principal patent are advantageously separated four the reduced mixture by distillation under diminished pressure. For example, stearic acid may be distilled at 200° C., if the pressure be reduced, and hydrogen be present. The apparatus in which the reduction is carried out is provided with a condenser and connected with a vacuum pump, which is worked during the reduction; the saturated product may then be removed as soon as it is formed. —T. F. B.

Acetylsalicylic acid; Alkaline salts of ——. G. Richter, Budapest, Hungary. Eng. Pat. 29,439, Dec. 16, 1909.

See Ger. Pat. 218,467 of 1908; this J., 1910, 452.—T. F. B.

Ester from chaulmoogra oil. L. Taub, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 957,633, May 10, 1910.

See Eng. Pat. 1984 of 1909; this J., 1909, 1273.—T. F. B.

β-Methyladipic acid; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 409,083, Nov. 15, 1908. Under Int. Conv., Dec. 9, 1908.

See Ger. Pat. 221,849 of 1908; preceding.—T. F. B.

β-Methyltetramethylenediamine; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 409,404, Nov. 19, 1909. Under Int. Conv., Dec. 9, 1908.

See Ger. Pat. 216,808 of 1908; this J., 1910, 234.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Three-colour photographic processes. R. Berthon, Assieu, France. Eng. Pat. 10,611, May 4, 1909.

Photographic plates or films are prepared, having on one side a panchromatic emulsion, and on the other side a series of very small transparent spheroidal grains or cylindrical bands, close together; these may be formed by embossing a gelatin or celluloid film. Plates made in this manner are exposed with the emulsion farthest from the lens, behind an objective in which is fixed a screen composed of the three fundamental colours. The resulting negative is reversed, and may then be projected through the objective and screen, giving a coloured projection. The grained or embossed screen acts as a series of lenses in front of the emulsion, causing the separation by refraction of the images of the screen projected in microscopic condition at points close together on the sensitive film; the result is similar to that obtained by a grained or lined screen, except that in the present process more light passes to the emulsion.—T. F. B.

Drying of perforated cinematograph films; Apparatus for the continuous ——. R. W. James, London. From Comp. Gén. de Phonographes, Cinematographes, et Appareils de Précision, Paris. Eng. Pat. 21,099, Sept. 15, 1909.

An endless band, of sufficient length to permit the drying of the films, and running edgewise, carries at equal intervals a number of suspenders, provided with guide bars and pins to catch the perforations of the film. The wet band of film is fed at a uniform speed over a fixed roller, and hooks on one of the suspenders; a loop is then formed, the length depending on the speed of the travelling belt and of the film, until the second suspender is reached, when it is again caught. After passing over the last suspender the film is run off on to a suitable winding roller, rotating at the same speed as the feeding roller. Rollers fixed at suitable points near the feed roller and the winding roller, effect the hooking and unhooking of the film.—T. F. B.

Screen consisting of four sets of selective elements, for the photography of colours, and its manufacture. L. Dufay, and Soc. Anon. des Plaques et Produits Dufay pour la Photographie des Couleurs. First Addition, dated Feb. 5, 1909, to Fr. Pat. 408,552, Jan. 26, 1909.

Screens similar to those described in the principal patent (this J., 1910, 593) may be obtained by preparing two screens, each consisting of two series of selective elements, and fastening these together with a thin intermediate layer of inactive material. This modification is of value when the solutions used for preparing the first two sets of elements react with those used for making the other sets. —T. F. B.

Polychrome screens; Process for obtaining ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 409,044, Feb. 6, 1909, and First Addition thereto, dated Feb. 27, 1909.

One of the difficulties experienced in preparing polychrome screens by staining is that the colours are liable to diffuse into one another in the gelatin. This is avoided by utilising dyestuffs which precipitate one another, or by adding to one of the solutions a substance which will precipitate the other dyestuff already printed. One third of the surface of a gelatin film may, for example, be stained with a solution of eosin scarlet, a second portion with a solution containing metanil yellow, cyanine, and ferric chloride, and the remaining portion with a solution of a basic violet dye, *e.g.*, methyl violet: in this instance the ferric chloride forms a precipitate with the eosin, which prevents the green from diffusing, whilst the basic violet precipitates the acid dyes at the junction of the colours. The surfaces may be printed with a reserve of fatty ink and stained by immersion, or they may be printed directly with the dyes —T. F. B.

Photographs in colours; Sensitised plate or film for th production of ——. R. Beyer. Fr. Pat. 409,323, Nov 12, 1909.

The plate consists of a support of glass, paper, etc., o which are applied successively a layer of gelatin, a gelati screen constituting the light filter and formed of smal coloured areas, and a panchromatic silver bromide emul sion; this last is separated from the filter by a thin laye of varnish, rubber, or other substance impermeable t water. The plate is exposed in the usual way with it emulsion farthest from the lens; it is then develope reversed, and dried as usual, and separated from its su port. The layer constituting the light filter is now sens tised by bichromate and exposed behind the positive t light, when it is developed as in the pigment process an applied to paper.—T. F. B.

Three-colour screens for the photography of colours; Proce of making ——. R. Krayn. Fr. Pat. 409,397, Nov. 1 1909. Under Int. Conv., Nov. 20, 1908.

This process is based on the fact that gelatin, staine with a suitable dyestuff, and treated with a substan (such as ferric chloride) which acts as mordant for th dyestuff and which also "tans" the gelatin, cannot su sequently be stained. The gelatin film is printed over third of its surface with a fatty ink, and is then stained a mordanted, and the ink removed. One half of the uncoloured portion of the surface is now printed with fatty ink, stained with the second colour, and mordanted, and the ink again removed. The portion of the surface still remaining colourless is finally stained with the third colour.—T. F. B.

[Photographic] film drying machines. F. B. Thompson, Chicago, U.S.A. Eng. Pat. 24,555, Oct. 26, 1909.

See Fr. Pat. 408,554 of 1909 ; this J., 1910, 593.—T. F. B.

Sensitised surface or film for photographic purposes. W. H. Caldwell, Mallaig. U.S. Pat. 956,567, May 3, 1910.

See Eng. Pat. 1689 of 1908 ; this J., 1909, 259.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

White phosphorus in match-making ; Use of —— in the United States. Oil, Paint, and Drug Rep., May 16, 1910. [T. R.]

The investigation of fifteen American match factories during the year 1909 has proved that, in spite of modern methods and precautions, phosphorus poisoning in the most serious form occurs in the United States. Numerous cases of phosphorus poisoning were discovered by special agents of the Bureau of Labor who visited the factories, and it was learned that many other cases had occurred. There is no doubt that in some instances the employers have been in ignorance of the serious dangers of match-factory employment. In several factories visited, not a single notice was posted warning the employees of the peculiar dangers to which they were exposed. The United States is practically the only commercial country of any importance which has not taken any steps to prevent the unrestricted use of white phosphorus in the manufacture of matches. While several States have enacted laws prohibiting the employment of children under sixteen years of age in certain operations in match factories, no State has yet made any adequate provision for the protection of the health of workers over sixteen years of age in the match industry.

Patents.

Explosives. F. E. W. Bowen, London. Eng. Pat. 11,179, May 11, 1909.

The explosive consists of ammonium perchlorate (40 parts), sodium nitrate (30), trinitrotoluene (10), paraffin wax (10), and powdered aluminium (10 parts). Another composition given is ammonium perchlorate (43 parts), sodium nitrate (32), trinitrotoluene (15), and powdered aluminium (10 parts).—G. W. McD.

Noxious fumes produced by blasting ; A composition for neutralising the ——. W. Burgess, Camborne, Cornwall. Eng. Pat. 12,988, June 2, 1909.

The composition consists of potassium nitrate (24 parts), bleaching powder (3), cupric oxide (2), and flour or carbon (1 part). The ingredients are mechanically mixed and then moistened with a solution of bleaching powder. The material is either made into grains or compressed into blocks for insertion into the bore-hole in front of the primer and detonator or between the cartridges.—G. W. McD.

Explosives. C. Wester, Helsingborg, Sweden. Eng. Pat. 18,622, Aug. 12, 1909.

The explosive consists of ammonium perchlorate (35), sodium nitrate (45), dinitrobenzene (10), and sawdust (10 parts). Two per cent. of the sawdust may be replaced by an equal amount of vaseline.—G. W. McD.

Explosives giving rise, on detonation, to chlorine, hydrochloric acid, or similar products. E. Carbonelli. Fr. Pat. 409,684, Oct. 12, 1909.

Explosives containing ammonium perchlorate produce, on detonation, deleterious products such as chlorine or hydrochloric acid, unless salts such as sodium and potassium nitrates are present as ingredients. For the purpose of combining with the chlorine at the moment of explosion, it is proposed to employ manganese or its compounds as an ingredient of ammonium perchlorate explosives. The compounds of manganese mentioned as suitable are the oxides, silicide, and boride of manganese, and also manganates and permanganates and preferably ammonium permanganate.—G. W. McD.

Explosive. C. P. H. Claessen, Berlin, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 957,307, May 10, 1910.

See Eng. Pat. 2509 of 1908 ; this J., 1908, 770.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Iron and copper ; Precipitation [determination] of —— with nitrosophenylhydroxylamine ["cupferron"]. H. Biltz and O. Hödtke. Z. anorg. Chem., 1910, 66, 426—431.

Baudisch's method (this J., 1910, 115) has been found to give good results in separating iron gravimetrically from varying proportions of aluminium, chromium, and nickel ; the precipitate is washed first with 2 *N* hydrochloric acid and then with water, before removing the excess of "cupferron" with ammonia. The determination of copper is best carried out in acetic acid solution, and the metal may be determined thus in the presence of zinc ; separation from cadmium is effected in hydrochloric acid solution ; the precipitate is washed first with weak acid. The method cannot be applied to the determination of iron or copper in the presence of silver, mercury, lead, or tin.—F. Sodn.

Titanium ; Determination of ——. A. Gemmell. Analyst, 1910, 35, 198—202.

The method described is a modification of that devised by Newton (this J., 1908, 248). An alloy containing 90 per cent. of zinc and 10 per cent. of aluminium, is employed, the reduction of the titanium sulphate solution being conducted at a temperature of about 50° C. in a flask fitted with a rubber stopper and Bunsen valve. The reduced solution is cooled and filtered, under diminished pressure, into a flask containing ferric sulphate and dilute sulphuric acid (the air having been previously expelled from the flask by the addition of a little sodium carbonate to the acid liquid), and titrated with standard permanganate. The time required for the reduction of quantities up to 0·05 grm. of titanium dioxide is from 5 to 8 minutes ; but with larger amounts, a much longer time is necessary, and it is then also advisable to allow a stream of carbon dioxide to play over the funnel during the filtration of the reduced solution. Owing to incomplete reduction, and oxidation during filtration, inaccurate results are obtained when the amount of titanium dioxide present exceeds 0·15 grm. With ferruginous minerals, etc., containing titanium, the total iron and titanium oxides are estimated together in one portion, and the ferric oxide alone in another portion. In the former determination, the time required for reduction is usually from 30 to 45 minutes ; in the latter estimation, the end-point of the reduction (which only occupies from 3 to 6 minutes) is found by means of thiocyanate solution, and no special precautions are taken to prevent oxidation since, by conducting the filtration in the ordinary manner, any reduced titanium is re-oxidised, while the iron (being less sensitive to oxidation) remains in the ferrous state.
W. E. F. P.

Arsenic ; Quantitative volatilisation of —— from solutions, after reduction of arsenic chloride to arsenious chloride by hydrazine salts. P. Jannasch and T. Seidel. Ber., 1910, **43**, 1218—1223.

Jannasch and Heimann have shown previously (Verhandl. Naturhistor.-medizin. Ver. zu Heidelberg, N.F. **9**, 84 ; Chem. Zentr. 1908, **1**, 410) that arsenic can be volatilised quantitatively in a current of hydrochloric acid gas, from solutions containing hydrazine sulphate. In order to obtain accurate results, however, it is necessary to continue the distillation for 2—3 hours, and in some cases, even, to distil a second time. It has now been found that if potassium bromide or hydrobromic acid be added to the solution, the arsenic can be completely separated by distilling for, at the most, 1 hour, and the use of the current of hydrochloric acid gas can be dispensed with. The substance under examination is rinsed into a round distillation flask by a small quantity of water and hydrochloric acid, and 80—100 c.c. of hydrochloric acid of sp. gr. 1·19, 1 grm. of potassium bromide, or concentrated hydrobromic acid, and 3 grms. of hydrazine chloride or sulphate are added. The flask is then fitted with a ground glass connection, leading through a condenser, to a receiving flask containing about 200 c.c. of water. The contents of the distillation flask are then distilled for about 1 hour, until the volume is reduced to 25—30 c.c. In the distillate the arsenic can be determined gravimetrically as sulphide or as magnesium pyroarsenate, or volumetrically by Györy's method (Z. anal. Chem., 1893, **32**, 415) of titration with potassium bromate. The residue in the distillation flask can be used for the determination of other metals which may have been present with the arsenic. Results are given showing that the method gives accurate results in the separation of arsenic from antimony, tin, and other metals.—A. S.

Arsenic, antimony and tin ; Determination of —— by means of potassium ferricyanide in alkaline solution. H. E. Palmer. Amer. J. Science, 1910, **29**, 399—403.

The reactions involved in the determination of arsenic, antimony, and tin by this method are as follows :—

$$As_2O_3 + 4K_3Fe(CN)_6 + 4KOH = As_2O_5 + 4K_4Fe(CN)_6 + 2H_2O\ ;$$

$$Sb_2O_3 + 4K_3Fe(CN)_6 + 4KOH = Sb_2O_5 + 4K_4Fe(CN)_6 + 2H_2O\ ;$$

$$SnO + 2K_3Fe(CN)_6 + 2KOH = SnO_2 + 2K_4Fe(CN)_6 + H_2O.$$

In each case the resulting ferrocyanide is then oxidised by means of permanagnate solution—

$$10K_4Fe(CN)_6 + 2KMnO_4 + 8H_2SO_4 = 10K_3Fe(CN)_6 + 6K_2SO_4 + 2MnSO_4 + 8H_2O.$$

Arsenic :—The solution containing the arsenic in the arsenious condition is treated with an excess of purified potassium ferricyanide at least 5 times greater than is required to oxidise the arsenic, and with about 25 c.c. of 20 per cent. potassium hydroxide solution, the volume of the liquid being kept below 100 c.c. After standing for some minutes the liquid is treated with about 10 grms. of ammonium sulphate and about 100 c.c. of magnesia mixture, the ammonium magnesium arsenate filtered off, and the filtrate and washings strongly acidified with dilute sulphuric acid, and titrated with potassium permanganate solution. A correction (averaging about 0·1 c.c.) must be applied for the amount of permanganate required to give a pink coloration to the ferricyanide solution alone. *Antimony* is determined in the same way, except that it is unnecessary to remove the antimony before the titration. *Tin* :—In determining the metal the solution should be made with cold concentrated hydrochloric acid, and an atmosphere of hydrogen kept above the liquid to prevent oxidation of the stannous salt. The latter is then oxidised with at least five times the theoretical amount of potassium ferricyanide solution, which has previously been mixed with sufficient potassium hydroxide solution to dissolve the precipitated stannic acid. About 10 grms. of ammonium sulphate are next added, and the liquid heated to 50° to 60° C. so as to precipitate the tin completely. After filtration, the precipitate is washed with a 10 per cent. solution of ammonium sulphate, and the filtrate and washings are strongly acidified with sulphuric acid and titrated with permanganate solution. The tabulated results show that the errors in the determination of the three metals fall within the limits of −0·0006 and +0·0009 grm.—C. A. M.

Permanganate ; Titration of —— with arsenious acid in neutral or weak alkaline solution. E. Deiss. Stahl u. Eisen, 1910, **30**, 760—765.

(See this J., 1910, 456). A blank experiment using a permanganate solution (1 c.c.=0·005935 grm.) with 2·0 grms. of zinc oxide, 10 c.c. of zinc sulphate solution, and 600 c.c. of boiling water, showed a constant error of 0·08 c.c. of permanganate solution, which amount was subtracted in all the experiments detailed in the paper. Freshly sublimed arsenious acid with half its weight of sodium hydroxide was dissolved in water giving a solution of which 1 c.c. contained 0·00577 grm. of arsenious acid. It was found that in the titration there was always an excess of arsenious acid used above that required theoretically, and even in a less alkaline or even alkali-free solution this excess was never nil. The author excludes the possibility of impurity in the arsenite solution, and discusses the probable presence of colloidal manganese peroxide in the permanganate solution, which would react on titration in an acid solution, but not in an alkaline medium. It is pointed out that this would result in a diminution of the arsenious acid required and is therefore precluded. The only other variant is the method of application which consisted in taking a measured quantity of the permanganate into a flask, adding 600 c.c. of boiling water, and not quite enough arsenite solution to complete the reaction. 2 grms. of zinc oxide were ground up with 10 c.c. of zinc sulphate solution and then added. After shaking and allowing to settle, the arsenite was added with repeated shaking until the solution became colourless ; more permanganate was then added, and the operation repeated, thus obtaining the value of the arsenite solution in terms of permanganate. It is shown that if the analysis be carried out in exactly the same way as the titration, the results are trustworthy, and can be used for small quantities of permanganate, although the figures do not conform exactly to those required theoretically.—A. H. C.

Gas analysis ; Use of phosphorus solutions in ——. M. Centnerszwer. Chem.-Zeit., 1910, **34**, 494—495.

In order to avoid the disadvantages attending the use of solid phosphorus for the absorption of oxygen, the author recommends the use of a 1 to 1·5 per cent. solution of phosphorus in castor oil, or other non-volatile oil. The solution is prepared by heating 3 grms. of dry phosphorus with 230 c.c. of castor oil to 200° C. on an oil bath with continued shaking. The solution is used in the ordinary Hempel pipette. For gases rich in oxygen, the solution must be warmed during the absorption. For this purpose, the absorption pipette is fitted with a nickel wire which is immersed in the liquid and is heated by the passage of an electric current. The wire has copper leads and may be connected to a 16 candle-lamp fitting or to a secondary battery of 2 to 4 cells.—A. T. L.

Electroanalysis ; The mercury cathode in rapid ——. W. S. Kimley. J. Amer. Chem. Soc., 1910, **32**, 637—641.

For the electrolytic determination of metals with the mercury cathode, the author recommends a cell consisting of a flask of about 125 c.c. capacity, the round bottom of which is covered with mercury (about 40 grms.), in communication with which is a platinum wire sealed through the glass ; the cell is washed, dried, and weighed, before and after electrolysis. In carrying out a determination, when the deposition is complete, the solution is siphoned off, as far as possible, without breaking the circuit ; the flask is then filled with distilled water and this is removed in like manner, the process being repeated until the current sinks almost to zero, after which the flask is detached from the stirrer and the liquid removed by means of a glass tube drawn out to a point and connected with a filter-pump. After a thorough washing with water, the amalgam is washed three times with alcohol and once with ether, and is then dried in a steam-oven, the flask being removed at intervals of a minute and the vapour blown out. A convenient cell for small volumes is made by placing the mercury in an ordinary weighing bottle with straight sides, holding about 60 c.c., and making connection by means of a platinum wire sealed in a glass tube which reaches to the bottom of the vessel. The use of a mercury cathode is specially applicable to the determination of zinc and of copper in strongly acid solutions.—F. Sodn.

Hydrocyanic acid ; New sensitive test for ——. J. Moir. Chem. Soc. Proc., 1910, **26**, 115.

The author having found the guaiacum test unsatisfactory, and the phenolphthalin-copper test (this J., 1905, 562) sometimes inapplicable, has succeeded in finding a reagent which will detect hydrocyanic acid in a dilution approaching one part in five millions of water. The test depends on the oxidation of a leuco-compound by nascent cyanogen resulting from the action of cupric copper on cyanides, but the author finds that none of the common leuco-compounds can be used. The reagent is made by adding small quantities of copper acetate and acetic acid to a warm solution of hydrocœrulignone (tetramethoxy-diphenol) in a large quantity of water, digesting the mixture at 50° for a few hours, and filtering. The solution to be tested is rendered faintly acid with acetic acid (using sodium acetate also if a "strong" acid is present), and then treated with about one-quarter of its volume of the reagent. In solutions stronger than 1 in 100,000, an immediate crystalline precipitate of cœrulignone (red with purple lustre) is obtained ; with weaker solutions, a brick-red coloration. Oxidising substances must, of course, be absent, but most of them can be avoided by applying the test on paper exposed to the vapour evolved by the liquid to be tested, as in the guaiacum test. A similar reaction is given by other tetra-substituted diphenols and by benzidine and its derivatives. Benzidine gives an indigo shade ; dianisidine, bluish-green, and tolidine, a green shade.

Although not so sensitive as hydrocœrulignone, these reagents are more trustworthy and keep much better. The colours produced are all derivatives of so-called diphenoquinhydrone.

Perchloric acid as a reagent in organic chemistry. K. A. Hofmann, A. Metzler, and K. Höbold. Ber., 1910, **43**, 1080—1086.

Perchloric acid (70 per cent., obtained by evaporating the commercial acid) far surpasses other acids in its power of forming well-crystallised salts with organic substances which exhibit very feeble basicity, and thus of obtaining such substances in a state of purity. To the solution of the substance in ether, benzene, tetrachloroethane, or carbon tetrachloride, perchloric acid is added, and the pure perchlorates crystallise out. Or the substance may be added direct to the perchloric acid, and the separated crystals drained on earthenware, or the solution evaporated *in vacuo*. Fine crystals are obtained by the evaporation of solutions in glacial acetic acid. The acid does not act as an oxidising agent even at 100° C. : there is no danger in handling the 70 per cent. solution : and the organic perchlorates are never explosive below 130° C. (save where the basic compound is itself explosive). The hydrolysis of the perchlorates is effected with great ease, by water in the case of weakly basic substances, by lime or potassium carbonate in the case of stronger bases. A number of perchlorates are described, amongst them those of triphenylamine and tritolylamine, showing that these substances do exhibit basic character. Both of these salts are colourless ; isatin also gives a colourless perchlorate, and azobenzene a yellow one.—J. T. D.

Quinones ; Quantitative determination of ——. R. Willstätter and R. Majima. Ber., 1910, **43**, 1171—1175.

The method worked out by the authors is in principle that of Valeur, addition to the quinone of hydriodic acid (iodide and hydrochloric or sulphuric acid) ; but differs in many of the working details. The quinone is titrated in ethereal solution. The reaction of hydriodic acid upon quinone is not complete, but reversible, hence to complete it there must be a considerable excess of hydriodic acid present. When the quinone solution is pure, the titration of the iodine is best done direct, to disappearance of the colour ; but if there be coloured impurities present, excess of thiosulphate must be used, and the excess titrated by iodine, using starch as indicator. There are objections to the use of sodium bicarbonate, and the authors find that the excess of thiosulphate can be safely added in the acid solution, if it be sufficiently dilute. The ether must be carefully purified, and even then there is danger of the action of air on the ethereal solution of hydriodic acid setting free iodine, so that the excess of hydriodic acid must be as small as is compatible with completing the reaction. In the case of some quinones (xylo-, thymoquinone, etc.) the reaction is very slow, and a considerable excess of hydriodic acid must be used ; under these circumstances it is necessary to work in an atmosphere of carbon dioxide—and in any case the liability to error from atmospheric oxidation of the hydriodic acid is lessened if this be done. To carry out the analysis, the quinone in 0·2—0·4 per cent. ethereal solution is treated in a separating funnel with 2 c.c. of potassium iodide solution and 1 c.c. of sulphuric acid (each 30 per cent.) and shaken for two minutes, till the aqueous layer remains clear. Now 50—60 c.c. of water are added but not shaken, and then $N/10$ thiosulphate in 10 c.c. portions, shaking after each, till the colour of the ethereal layer is reduced to bright red-brown, after which 2 c.c. additions of thiosulphate are made. Thus, when the ether is colourless, not so much as 2 c.c. excess of thiosulphate can be present. If coloured impurities be present, careful watching of the effect of the additions will generally enable the operator to be certain that there is excess of thiosulphate present (if necessary, a few drops of the aqueous layer can be run off and tested with iodine) before that excess becomes considerable. Then the aqueous layer is run off, and the thiosulphate titrated with iodine and starch.—J. T. D.

Determining the origin of a petroleum or its products. Chercheffsky. *See* IIa.

Comparative tests with English and German flash-point apparatus. Wiebe and Hebe. *See* IIa.

Examination of asphaltum. Sommer. *See* IIa.

Determining degree of bleaching of cellulose. Schwalbe. *See* V.

Determining sulphur in pyrites and marcasite. Allen and Johnston. *See* VII.

Determination of sulphur in soluble sulphates. Allen and Johnston. *See* VII.

Reaction between hydriodic acid and bromic acid in presence of a large amount of hydrochloric acid. [*Determination of iodides*]. Randall. *See* VII.

Determination of tartaric acid in crude natural products. Beys. *See* VII.

Volumetric determination of cerium in cerite and monazite. Metzger and Heidelberger. *See* VII.

Determining carbon in iron, graphite, and tungsten. Dennstedt and Klünder. *See* X.

Rapid electrolytic determination of copper. Benner. *See* X.

Determining copper in blister and refining copper. Ferguson. *See* X.

Assay of tin ores. Gray. *See* X.

Determining sulphur in molybdenum and tungsten and their iron alloys. Trautmann. *See* X.

Detecting sucrose and calcium sucrate in milk and cream. Rothenfusser. *See* XIXA.

Detecting palm-kernel and cocoanut oils in butter and lard, and of lard in butter. Ewers. *See* XIXA.

Detecting cocoanut oil in butter and lard. Fendler. *See* XIXA.

Composition of yellow compound formed in the phenolsulphonic acid method for the determination of nitrates in water. Chamot and Pratt. *See* XIXB.

Platinichlorides and periodides of di- and trimethylamine, and their use in separating the bases. Bertheaume. *See* XX.

Determining the three methylamines and ammonia in mixtures. Bertheaume. *See* XX.

PATENTS.

Air pyrometers and apparatus for measuring the specific gravity of gases. M. Arndt, Aix-la-Chapelle, Germany. Eng. Pat. 10,102, April 28, 1909. Under Int. Conv., April 28, 1908.

To compensate for changes of atmospheric pressure the air pyrometer is combined with an auxiliary air chamber in which a volume of air at the initial pressure is confined. As the measuring bell dips into the sealing liquid, the said volume of air is compressed, and reacting upon the sealing liquid relatively to the pressure, eventually brings into action a terminal liquid pressure column. The two air chambers are connected by means of a rod or other device with a water receptacle provided with a supply pipe and an intermittently acting siphon, and this receptacle when full acts as a weight.—C. A. M.

Specific gravity of liquids ; Apparatus for estimating the ——. G. D. Macdougald, Dundee. Eng. Pat. 11,099, May 11, 1909.

The apparatus consists of a series of tubes containing standard solutions of known specific gravity, and a suitable pipette for introducing small quantities of the substance to be examined below the surface of the standard solutions. The pipette used has thin walls and, preferably, a tapering bore and a bent end.—G. W. McD.

Saccharometers. R. Fürstenau, Charlottenburg, Germany. Eng. Pat. 22,992, Oct. 8, 1909.

In the type of saccharometer claimed, the pressure of the carbon dioxide liberated in the fermentation of the sugar is measured by means of an elastic diaphragm connected with an indicating device. This diaphragm may be put in communication with the atmosphere both externally and internally by means of a controllable opening, thus allowing the pointer of the scale to be brought again into the zero position. The influence of variations of temperature is obviated by constructing the compartments of the apparatus of suitable dimensions.—C. A. M.

Air or other gases ; Means for testing —— *for particular kinds of gases.* M. Arndt, Aachen, Germany. Eng. Pat. 462, Jan. 7, 1910. Under Int. Conv., Jan. 7, 1909.

The thread or band of material to be used as the testing agent is impregnated by being drawn through a receptacle containing a solution of the reagent. This receptacle may communicate by a narrow side passage with the storage reservoir of the reagent, the passage being sufficiently narrow to prevent to a large extent the liquid rising into the reservoir. It may be constructed in the form of a U-tube, which is continuously fed from the reservoir, the flow of liquid being controlled by a constant level flask. The movement of the thread or band through the receptacle may be effected electrically, or by the application of running water, *e.g.* by means of a vessel which is alternately filled and emptied.—C. A. M.

XXIV.—MISCELLANEOUS ABSTRACTS.

Distilled water ; Oxidising action of commercial ——. L. Tixier. Bull. Sci. Pharm., 1910, 17. Pharm. J., 1910, 84, 645.

Ordinary distilled water, although answering all the requirements of the French Pharmacopœia, is found to show distinct properties of an indirect oxydase. It gives a blue reaction with fresh tincture of guaiacum and acetic acid solution of benzidine in presence of hydrogen peroxide, and reacts with Meyer's phenolphthalein reagent. It loses this property when redistilled from a glass retort. It is, therefore, supposed that its oxidising reactions are due to extremely minute traces of copper derived from the distilling plant, although the amount of the metal present is not sufficient to give reactions by ordinary tests. Mineral waters, well, river, and tap-water do not give these reactions.

Silent electric discharge upon chloroform, and carbon tetrachloride in the presence of hydrogen, and upon methyl chloride ; Action of the ——. A. Besson and L. Fournier. Comptes rend., 1910, **150**, 1118—1121.

A current of hydrogen was passed through chloroform heated to about 70°—75° C., and the vapours exposed to the action of the silent electric discharge. An oily reddish coloured liquid collected, which was repeatedly fractionated. The following substances were isolated, carbon tetrachloride ; a liquid, C_2Cl_4, boiling at 120° C. ; a liquid, C_2HCl_5, boiling at 160° C. ; a solid, C_2Cl_6, distilling at 185° C. ; a liquid, C_3Cl_6, boiling at 210° C. ; a thick liquid, C_3HCl_7, distilling at 120° C. at 15 mm., and at 245° C. at the ordinary pressure ; a very viscous liquid, C_4Cl_8, boiling at 155° C. at 15 mm., and at 275° C. at the ordinary pressure. The chief product was the solid, C_2Cl_6. Carbon tetrachloride and hydrogen gave almost the same products. Methyl chloride gave ethylene chloride and its higher homologues increasing by CHCl, and a liquid, $C_4H_5Cl_3$, distilling at 135° C. at 15 mm.—F. Shdn.

Acetaldehyde ; Action of the silent discharge on the vapour of —— *in the presence of hydrogen.* A. Besson and L. Fournier. Comptes rend., 1910, **150**, 1238—1241.

Acetaldehyde vapour was submitted to the action of the silent discharge, whilst a very slow current of dry pure hydrogen was passed through the tubes. The product obtained was a complicated mixture, consisting chiefly of water, acetic acid and homologues, acetone and several ketonic bodies. The reaction varied with the experimental conditions. A potential of 12,000—15,000 volts was used.—A. Sbld.

Gases ; Chemical effects of the ultra violet rays on —— *: polymerisation.* D. Berthelot and H. Gaudechon. Comptes rend., 1910, **150**, 1169—1172.

An investigation of the effect of the ultra-violet rays from a quartz mercury-vapour lamp, on acetylene, ethylene, cyanogen, and oxygen shows that in every case there is a diminution in volume owing to polymerisation, no other chemical change being observed. Acetylene is converted into a yellow solid (more readily under reduced pressure or when mixed with an inert gas such as hydrogen or nitrogen) ; ethylene gives a liquid polymer with the odour of rancid fat ; cyanogen is converted into paracyanogen ; and oxygen, to a small extent, into ozone.

F. Sodn.

Gases; Chemical effects of ultra-violet rays on——. Oxidising actions. Oxidation of cyanogen and ammonia; synthesis of formic acid. D. Berthelot and H. Gaudechon. Comptes rend., 1910, **150**, 1327—1329.

Under the influence of ultra-violet rays, cyanogen is oxidised practically completely to carbon dioxide and nitrogen. A mixture of ammonia and oxygen yields nitrogen and water, but free hydrogen is not oxidised appreciably by oxygen at the ordinary temperature under similar conditions. By the action of ultra-violet rays on mixtures of acetylene and ethylene respectively with oxygen, some formic acid is produced.—A. S.

Books Received.

Theorie der Gewinnung und Trennung der Aetherischen Oele durch Destillation. (Grundzüge einer allgemeinen Destillationslehre). von C. Von Rechenberg. Mit zahlreichen Abbildungen und Tabellen. Bearbeitet im Auftrage der Firma Schimmel und Co. in Miltitz be Leipzig. L. Staackmann, Leipzig. 1910. Price, M. 12.50; half-calf, M. 15.

8vo volume containing 732 pages of subject matter, with 108 illustrations, including numerous curve-diagrams, and an alphabetical index. The text is divided as follows:—I. Practice of distillation. II. Dalton's law of diffusion. III. Distillation of mixtures of immiscible liquids. IV. Distillation under increased or diminished pressure. V. Distillation by superheated steam. VI. Chemical-physical processos in the distillation of plants. VII. Small and portable distillation plants. VIII. Molecular association and dissociation; their influence on evaporation. IX. Boiling temperatures and vapour pressures of individual substances. X. Solutions. XI. Distillation of mixtures of liquids of limited mutual solubility. XII. Distillation of homogeneous mixtures with a minimum boiling temperature. XIII. Distillation of homogeneous mixtures having no constant boiling point. XIV. Distillation of labile addition-compounds. Homogeneous mixtures with a maximum boiling temperature.

Dust Preventives and Road Binders. By Prevost Hubbard, Asst. Chemist, Office of Public Roads, U.S. Dept. of Agriculture; Secretary of Committee on Road Materials, Amer. Soc. for Testing Materials. J. Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1910. Price, 3 dols. or 12s. 6d. (net).

8vo volume containing 404 pages of subject matter, with 51 illustrations, and an alphabetical index. The following are the chapter headings:—I. Dust prevention and road preservation. II. Classification of dust preventives and road binders. III. and IV. Inorganic dust preventives and road binders. V. Organic non-bituminous dust preventives and road binders. VI. Hydrocarbons. VII. Bitumens employed as dust preventives and road binders. VIII. Petroleum and petroleum products. IX. Semi-solid and solid native bitumens. X. Application of petroleum and asphaltic materials. XI. Tars and tar products. XII. Application of tar and construction of bituminous macadam. XIII. Examination of bituminous road materials and interpretation of results. XIV. Methods of testing bituminous road materials proposed or adopted by American Societies. XV. Selection of dust preventives and road binders. Appendix.

Poisoning by Arseniuretted Hydrogen or Hydrogen Arsenide. Its properties, sources, relations to scientific and industrial operations, symptoms, post-mortem appearances, treatment and prevention; with a record of 120 cases by different observers. By John Glaister, Doctor of Medicine of University of Glasgow, etc., etc. E. and S. Livingstone, Edinburgh. 1908. Price, 5s. net.

Small 8vo volume comprising chapters on the subjects mentioned in the title and also one on analytical methods for the detection of arsenic in animal tissues, and a bibliography of recorded cases of poisoning by arseniuretted hydrogen.

International Language and Science. By L. Couturat, formerly Professor at University of Caen, O. Jespersen, Professor at University of Copenhagen, R. Lorenz, Professor at Federal Polytechnicum of Zürich, W. Ostwald, Professor emeritus of University of Leipzig, and L. Pfaundler, Professor at University of Graz. Translated by F. G. Donnan, Professor at University of Liverpool. Constable and Co., Ltd., 10, Orange Street, Leicester Square, London, W.C. 1910. Price, 2s. net.

Small 8vo volume containing 74 pages of subject matter divided among the following chapters:—I. (L. Pfaundler). Need for a common scientific language. II. (R. Lorenz). The *Délégation pour l'adoption d'une langue auxiliare internationale.* III. (O. Jespersen). Linguistic principles necessary for the construction of an international auxiliary language, with an appendix on the criticism of Esperanto. IV. (L. Couturat). Application of logic to the problem of an international language. V. (R. Lorenz). Relationship of the international language to science. VI. (W. Ostwald). The question of nomenclature. VII. (L. Pfaundler). Conclusion: reading, writing, and speaking. There is also an appendix containing:—(1) *Linguo Internaciona di la Delegitaro*; grammar, word-formation, list of grammatical words. (2) Specimen pages from the International-English dictionary. (3) An experiment in double translation. (4) *Uniono di l'amiki di la linguo internaciona*; extracts from the provisional statutes, and membership form.

Bulletin of the Imperial Institute. Vol. VIII. No. 1. Price, 1s.

This issue of the Bulletin contains the results of investigations in connection with economic products from Mauritius, rubbers from Sierra Leone, and Tartar gum from the Sudan; also notes on the preparation of beeswax, on the natural varnishes of China and Japan, on the cultivation and utilisation of the soy bean (Part II.), on new rubber-yielding plants in Mexico, &c.

*New Books.

Beckurts, Dr. H.: Die Methoden der Massanalyse Unter Mitwirkg. v. Dr. O. Lüning. Zugleich völlig umgearb. 8. Aufl. v. Fr. Mohr's Lehrbuch der chemischanalyt. Titriermethode. 1. Abtlg. (VII, 482 S. m. 87 Abbildgn.) gr. 8. Braunschweig, F. Vieweg & Sohn. 1910. M. 14.

Berg- u. hüttenmännische Abhandlungen. Kattowitz, Gebr. Bohm.

46. Heft. *Simmersbach*, F.: Die geologischen Unterlagen des Radiums. (10 S. m. 1 Abbildg.) 1909. 80 Pf.

47. Heft *Oberschuir.*: Die Bleierzlagerstätten v. Goppenstein im Lötschental (Finsteraarhornmassiv). (18 S. m. Abbildgn. u. 2 Taf.) 1909. 1.40.

49. Heft. Die Kohlenvorräte der Vereinigten Staaten nach den neuesten Ermittelungen. (17 S. m. 1 Karte.) 1909. M. [illegible]

51. Heft. *Simmersbach*, Bruno: Frankreichs Bergbau u. Hüttenwesen im J. 1908. (24 S.) 1909. M. 1.

52. Heft. *Schmidt*, Dr. A.: Ueber Kupfer u. das Entstehen der Kupfererze. (18 S.) 1910. M. 1.

54. Heft. *Diancourt :* Norddeutschlands Kalisalze. m(20 S. m. I Abbildg.) 1910. M. 1.

Chesnau, M. G.: Theoretical Principles of the Methods of Analytical Chemistry. 1910. 8vo. London. Macmillan. Net 7s. 6d.

Elektrizität, die, im Dienste der *Zuckerindustrie.* (Bericht der Elektrizitäts-Aktien-Gesellschaft vorm. Kolben u. Co. in Prag-Vysočan.) [Aus: "Ztschr. f. Zuckerindustr. in Böhmen."] (33 S. m. Abbildgn.) Lex. 8°. Prag, (F. Rivnáč). 1909. M. 1.

Euler, Prof. H.: Allgemeine Chemie der Enzyme. (VIII, 241 S. m. 4 Fig.) Lex. 8°. Wiesbaden, J. F. Bergmann. 1910. M. 7.00.

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*Dissertations.

[Prices vary, ranging from two to three shillings.]

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Brehme, P.: Zur Kenntnis des Mononatriumacetylens. Heidelberg. 1909. 34 S. m. 3 Fig. 8°.

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Eisenlohr, F.: Ueber die Produkte aus Milchzucker und Calciumhydroxyd. Freiburg. 1909. 43 S. 8°.

Ellmer, A.: Ueber die Fettsäuren des Lebertrans. Freiburg. 1909. 37 S. 8°.

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Haken, W.: Beitrag zur Kenntnis der thermoelektrischen Eigenschaften der Metalllegierungen. Berlin. 1910. 64 S. m. 4 Fig. u. 8 Taf. 8°.

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Koref, F.: Ueber das Gleichgewicht bei der Schwefelkohlenstoffbildung. Berlin. 1910. 30 S. m. 4 Fig. 8°.

Kraze, K.: Vorkommen und Nachweis von Jod in einigen natürlichen Salzmineralien. Halle. 1909. 37 S. m. 1 Fig. 8°.

Krohn, D.: Ueber die Inhaltsstoffe der Rhizoma Imperatoriae. Erlangen. 1909. 64 S. 8°.

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Voigt, M.: Beiträge zur Oxydation des Phosphors im basischen Konverter. Dresden. 1910. 81 S. m. 10 Fig 8°.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works and dissertations in the preceding lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT: MACHINERY.

Applications.

12,233. Davidson. Compounds for extinguishing fires.* May 18.

12,307. Epstein. Distillation or rectification. May 19.

12,424. Hewitt. Separation of the constituents of gaseous mixtures. May 21.

12,542. Bühring and Wagner. Apparatus for separating liquids from gases or vapours.* May 23.

12,543. Repin. Refrigerating machine utilising the absorption of sulphurous acid by camphor.* May 23.

12,633. Hesse. Solvents. May 24.

12,736. Guillaume. Heating the rectifying column of distilling and rectifying apparatus. [Fr. Appl., May 26, 1909.]* May 25.

12,748. Larsen and Storm. Separating a single gas from a mixture of gases. [Addition to No. 8211 of 1910. Appl. in Norway, Sept. 10, 1909.]* May 25.

12,831. Leune. Machine for the centrifugal treatment of liquids. [Fr. Appl., Oct. 2, 1909.]* May 26.

12,863. Epstein. *See under* XVIII.

Complete Specifications Accepted.

10,630 (1909). Halliday. Furnaces. June 1.

12,906 (1909). Lee. Furnaces. May 25.

18,194 (1909). Newton (Bayer und Co.). Steam traps. May 25.

30,069 (1909). Haddan (Aktiebolaget Separator). Centrifugal separators with filtering apparatus. June 1.

1227 (1910). Altonaer Margarinwerke Mohr und Co. Mechanism for grinding or mixing emulsions, &c. May 25.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

12,210. Greaves. Refractory materials for use in coke ovens and gas retorts. May 18.

12,296. Scott. Gas purifiers.* May 19.

12,327. Alexanderson. Extraction of oil from bituminous shale and other bituminous materials. May 19.

12,349. Von Groeling and Smith-Rewse. Apparatus for treating paraffin wax. May 19.

12,425. Gebr. Siemens und Co. Protective coating for bodies consisting of carbon. [Ger. Appl., May 24, 1909.]* May 21.

12,440. Rockwell. Processes and apparatus for carbonising.* May 21.

12,613. Trainer. Manufacture of block fuel, briquettes, &c.* May 24.

12,776. Tatlock. *See under* III.

12,894. Dempster and Sons, Ltd., and Broadhead. Gas purifiers. May 27.

12,923. Jones. Coke ovens. May 27.

Complete Specifications Accepted.

11,254 (1909). Trachsler and Ernst. Manufacture of producer gas. May 25.

11,265 (1909). Gobbe. Production of gas and coke. May 25.

13,026. (1909). Climie. Gas producers. May 25.

15,193 (1909). Soc. Franç. d'Incandescence par le Gaz. Preparation of filaments for incandescent electric lamps. May 25.

15,496 (1909). Jahoda. Manufacture of metallic filaments for electric incandescent lamps. June 1.

18,808 (1909). Weber. Manufacture of metallic filaments for incandescence electric lighting. May 25.

23,760 (1909). Oligny, and Peat Gas and Coal Co. Production of gas from peat and other substances. May 25.

III.—TAR AND TAR PRODUCTS.

Applications.

12,129. Meister, Lucius, und Brüning. Manufacture of β-anthraquinonyl ureas. [Ger. Appl., May 19, 1909.]* May 17.

12,776. Tatlock. Removal of rosolic acid and other like colouring matters from tar, blast furnace, gas producer, and other oils. May 26.

IV.—COLOURING MATTERS AND DYES.

Applications.

12,130. Meister, Lucius, und Bruning. Manufacture of violet to blue dyestuffs of the triphenylmethane series. [Ger. Appl., May 25, 1909.]* May 17.

12,139. Newton (Bayer und Co.). *See under* VI.

12,141. Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 17.

12,142. Newton (Bayer und Co.). Manufacture of vat dyestuffs. May 17.

12,321. Meister, Lucius, und Brüning. Brominating dyestuffs of the thioindigo series. [Ger. Appl., May 19, 1909.]* May 19.

12,423. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a yellow azo dyestuff. May 21.

12,426. Meister, Lucius, und Brüning. Manufacture of a red monoazo dyestuff and colour lakes therefrom. [Ger. Appl., May 25, 1909.]* May 21.

12,433. Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 21.

12,558. Holliday and Sons, and others. Manufacture of direct dyeing cotton dyestuffs. May 24.

12,715. Kubicek. *See under* XXIII.

12,828. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of dyestuffs of the anthraquinone series. May 26.

12,921. Ransford (Cassella und Co.). Manufacture of dyestuffs. May 27.

Complete Specifications Accepted.

13,903 (1909). Imrie (Anilinfarben und Extract- Fabr. vorm. J. R. Geigy). Manufacture of *p*-amino-*m*-oxyazo colouring matters. May 25.

13,904 (1909). Anilinfarben und Extract- Fabr. vorm. J. R. Geigy. Manufacture of *o*-oxydisazo colouring matters. May 25.

15,848 (1909). Newton (Bayer und Co.). Manufacture of dyes of the anthracene series. June 1.

V.—FIBRES; TEXTILES: CELLULOSE; PAPER.

Applications.

12,726. Lilienfeld. Manufacture of a substitute for silk or horsehair from vegetable fibrous material. May 25.

12,976. Klaber. Apparatus for effecting the rapid drying of sheets of paper, &c. May 28.

Complete Specification Accepted.

11,354 (1909). Newton (Bayer und Co.). Manufacture of lustrous threads, wires, and bands. May 25.

VI.—BLEACHING; DYEING; PRINTING; FINISHING

Applications.

12,139. Newton (Bayer und Co.). Production of azo dyes on the fibre. May 15.

12,140. Newton (Bayer und Co.). Process of dyeing. May 17.

12,527. Ransford (Soc. de la Manufacture d'Indiennes E. Zundel). Finishing of fabrics. May 23.

12,551 and 12,552. Copley. Method and apparatus for mercerising cotton or vegetable fibres in the loose state, or in the roving or sliver, or in the form of loosely twisted yarn. May 24.

12,998. Newton (Bayer und Co.). Production of discharge effects. May 28.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

12,137. Newton (Channing). Manufacture of sulphuric acid from smelter gases.* May 17.

12,229. Kaiser. Oxidising nitrogen by means of electric discharges. [Ger. Appl., May 19, 1909.]* May 18.

12,510. Valentin. Preparation and dissolving of the silicates of sodium and potassium. [Appl. in Spain, May 24, 1909.]* May 23.

12,855. Harold and Cottee (Mislin). *See under* XVII.

Complete Specifications Accepted.

12,908 (1909). Svedberg. Production of colloidal sols or gels. June 1.

13,697 (1909). Greenwood. Manufacture of tubes, crucibles, &c., of magnesia. June 1.

18,816 (1909). Boult (Kritzer). Lime hydrating apparatus. May 25.

21,884 (1909). Gill. Manufacture of ferric oxide. May 25.

475 (1910). Chem. Werke vorm. Dr. H. Byk. Treatment of borates containing active oxygen. June 1.

8093 (1910). Ges. f. Chem. Industrie in Basel. Manufacture of oxalates. May 25.

VIII.—GLASS; CERAMICS.

Complete Specifications Accepted.

13,515 (1909). Cotton. *See under* IX.

2548 (1910). Marks (Player). Production of sheet glass. May 25.

IX.—BUILDING MATERIALS.

Applications.

12,177. Siegmann. Composition for building, manufacturing, &c.* May 17.

12,525. Ernst and Trachsler. Furnace for burnin cement, &c. (Swiss Appl., May 26, 1909.]* May 23.

12,845. Heuschkel. Manufacture of artificial marble May 26.

Complete Specifications Accepted.

13,515 (1909). Cotton. Producing heat for and furnace for firing brick and pottery kilns. May 25.

16,588 (1909). Smith and Edwards. Testing cement and like materials. May 25.

17,002 (1909). Boucherie. Process for impregnatin wood. June 1.

3016 (1910). Lessing. Manufacture of cement fro blast furnace slag. May 25.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

12,138. Newton (Channing). Smelting pyritic ores May 17.

12,214. Hiorth. Electric induction smelting furnac [Appl. in Norway. May 22, 1909.]* May 18.

12,343. Eveland. Carburisation of iron and ste May 19.

12,492. Matthews, Strange, and Pim. Manufacture ingots or masses of steel or steel alloy. May 23.

12,493. Huntington. Agglomerating iron or other o or metalliferious substances. May 23.

12,497. Cowper-Coles. Electrodeposition of zinc. May

12,498. Cowper-Coles. Removal of scale and ox from iron and steel. May 23.

12,570. Campbell and Campbell. Solder for aluminiu May 24.

13,009. Murex Magnetic Co., Ltd., and Lockwood. Separation of ores and the like. May 28.

13,012. Thompson (Mix und Genest). Galvanising aluminium and its alloys.* May 28.

Complete Specifications Accepted.

4531 (1909). Martin. Separation of complex ores. June 1.

9300 (1909). Martin. Separating complex ores or their concentrates. June 1.

11,843 (1909). Cowper-Coles. Compound anode and cathode bars for use in electrodeposition of metals. May 25.

12,337 (1909). Reid. Separating and refining metals. June 1.

21,419 (1909). Hodgkinson. Carburising iron, iron alloys, and mild steel. June 1.

XI.—ELECTRO-CHEMISTRY.

Applications.

12,229. Kaiser. *See under* VII.

12,430. Aktiebolaget Elektrometall. Regulating the electrodes in reverberatory electric furnaces. [Appl. in Sweden, May 21, 1909.]* May 21.

12,601. Serpek. Electrical resistance furnaces.* May 24.

12,625. Salom. Manufacture of negative plates for storage batteries.* May 24.

Complete Specifications Accepted.

26,266 (1909). Harden. Electric furnaces. May 25.

26,845 (1909). Helfenstein. Electric furnaces. May 25.

XII.—FATS; OILS; WAXES.

Applications.

12,193. Sanderson. Sand soap. May 18.

12,727. Stewart and Chard. Crushing or disintegrating seeds or beans to facilitate extraction of oil. May 25.

12,808. Sherman. Extraction of a saponaceous matter. May 26.

12,855. Harold and Cottee (Mislin). *See under* XVII.

13,008. Patent Borax Co., Ltd., and Bradford. Soap.* May 28.

Complete Specifications Accepted.

12,331 (1909). Schauermann. Candles. May 25.

1227 (1910). Altonaer Margarinwerke Mohr und Co. *See under* I.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

12,426. Meister, Lucius, und Brüning. *See under* IV.

12,715. Kubicek. *See under* XXIII.

Complete Specifications Accepted.

11,755 (1909). Bellet. Manufacture of ultramarines. May 25.

12,480 and 26,729 (1909). Eckford. Purification and treatment of red or orange lead or lead paste and making paint therefrom. June 1.

21,206 (1909). Christian. Anti-corrosive, anti-fouling compound. June 1.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Application.

13,027. Johnson. Indiarubber substitutes. May 28.

Complete Specifications Accepted.

11,905 (1909). Henning and Wetter. Flexible elastic and plastic compositions. June 1.

13,570 (1909). Kautschukges. Schön und Co. Treatment of caoutchouc and the like. May 25.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

12,314. Piggott. Preparation for treating leather. May 19.

12,855. Harold and Cottee (Mislin). *See under* XVII.

Complete Specification Accepted.

22,903 (1909). Dickson. Leather. May 25.

XVI.—SOILS; FERTILIZERS.

Application.

12,844. Heuschkel. Manufacture of artificial manure. May 26.

XVII.—SUGARS; STARCHES; GUMS.

Application.

12,855. Harold and Cottee (Mislin). Production of milk sugar, casein, fat, albumen, and phosphates. May 26.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

12,237. Skworzoff. Manufacture of malt extract.* May 18.

12,581. Schneible. Brewing.* May 24.

12,863. Epstein. Distillation and rectification and utilising the residue thereof. May 26.

12,915. Shears and others. Manufacture of beer and other alcoholic liquids. May 27.

12,917. Whitaker. Manufacture of porter and stout. May 27.

12,993. Hotblack, and Kidd and Hotblack, Ltd. Production of clear beer similar to non-deposit beer.* May 28.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

12,157. Zimmer. Disinfectants and emulsions having disinfecting properties.* May 17.

12,432. Wallis, and Wallis, Ltd. Treatment of germ of wheat and obtaining a preparation for incorporation with flour and meal. May 21.

12,645. Brown. Purification of sewage or other impure liquids. May 23.

12,947 and 12,948. Henri, Helbronner, and von Recklinghausen. Apparatus for treating liquids with ultraviolet rays. May 27.

12,949. Henri, Helbronner, and von Recklinghausen. Sterilisation of water liquids. May 27.

Complete Specifications Accepted.

11,329 and 24,897 (1909). Hayes. Furnaces for destroying refuse. May 25.

12,667 (1909). Fieldhouse, and Oxychlorides (1907), Ltd. Purification of sewage or trade waste by the underdrainage system. June 1.

18,429 (1909). Welcome. Deodorising or drying nightsoil and the like. June 1.

20,737 (1909). Lacombe. Apparatus for purifying water. May 25.

20,819 (1909). Maconochie and Vasey. Nutritive food. June 1.

22,468 (1909). Smith. Wheatmeal. June 1.

1744 (1910). Witte. Producing lecithin in milk, cream, etc., in the process of butter making. May 25.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Application.

12,344. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of albumose silver compounds. [Addition to No. 4564 of 1909.] May 19.

Complete Specification Accepted.

25,678 (1909). Sefton-Jones (Quade). Manufacture of sodium glycerophosphate and a preparation containing it. June 1.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

12,252. Sury. Colour photography on paper from one plate.* May 18.

12,266. Dawson, Finlay, and Thames Colour Plate, Ltd. Colour photography. May 18.

XXII.—EXPLOSIVES, MATCHES.

Application.

12,951. Chamant. Chlorated and perchlorated gelati explosives for mines, quarries, &c.* May 27.

XXIII.—ANALYTICAL PROCESSES.

Application.

12,715. Kubicek. Method and means for analysing th composition of colours. [Austrian Appl., May 25, 1909.] May 25.

Journal of the Society of Chemical Industry.

No. 12, Vol. XXIX. JUNE 30, 1910. No. 12, Vol. XXIX.

Presentation of an Address to His Majesty the King.

On Wednesday, June 22nd, a Deputation of the Society, consisting of the Right Hon. Sir Henry E. Roscoe, F.R.S., First President, Prof. R. Meldola, F.R.S., Vice-President, Mr. Thomas Tyrer, Hon. Treasurer, Mr. E. Grant Hooper, Vice-President, Mr. Walter F. Reid, Vice-President, and Mr. Charles G. Cresswell, Secretary, waited upon His Majesty The King at St. James' Palace for the purpose of presenting a loyal address (*see* this J., May 31, 1910, p. 603).

Sir Henry Roscoe, in introducing the Deputation, said :—

"I have the honour to introduce to Your Majesty a Deputation from the Society of Chemical Industry and to present to Your Majesty a loyal address.

"The Society has for its object the union of Science and Practice. It numbers more than 4,000 members and has sections not only in the chief cities of this Kingdom, but in Your Majesty's possessions beyond the seas and in the United States of America, and exerts a powerful influence on the progress of Industrial Chemistry throughout the world."

His Majesty in reply, said :—

"I thank you on behalf of the Queen and myself for the loyal and dutiful address which you have laid before me to-day.

"It is a consolation to me in this time of sorrow to feel that my grief is shared by my subjects in all parts of the great Empire over which I have been called to reign, and to know that the character and aims of my beloved father were appreciated by those whose prosperity and welfare were ever in his thoughts.

"You may be assured that it will be my constant endeavour to justify the confidence which you repose in me, to follow with the help of Almighty God, in my father's footsteps, to uphold the honour of our country, and to labour, so far as in me lies, for the prosperity and progress of my people."

Sir Henry Roscoe then kissed hands, and presented Prof. R. Meldola and Mr. E. Grant Hooper.

The Deputation then retired.

Birmingham Section.

Meeting held at Birmingham University on Thursday, April 14th, 1910.

DR. T. SLATER PRICE IN THE CHAIR.

NOTES ON THE TESTING OF COAL TAR CREOSOTE.

BY J. C. MANN.

Considering the importance of coal tar creosote and the creosoting industry generally one is surprised to find so little information in technical or scientific journals bearing upon this subject.* The pages of our own Journal contain very little information on this particular product. Its importance to the tar distiller may be gauged from the fact that, next to pitch, it is by far the largest of his crude products. I estimate that the annual production in Great Britain from gas works tars alone is about twenty-five million gallons. To this may be added the amount distilled from coke oven tars which probably reaches another ten million gallons. I do not anticipate that the above figures will be increased in the near future, but probably reduced owing to the amount of tar and tar preparations likely to be absorbed for road making.

Recent tests in the United States of the merits of different wood preservatives and methods of application (instituted I believe by the Bureau of Forestry) have placed coal tar creosote in the first rank. The result of this has been to give a welcome demand for the article, the oil being shipped in bulk to the States, the individual cargoes reaching, in some instances, to nearly one-and-a-half million gallons (about 7,500 tons). A considerable quantity is also exported in barrels to Northern Europe, Russia, South America, South Africa and New Zealand. At one time Germany did import, but with the general adoption of coke oven recovery plants the Germans now not only supply their own requirements, but even export. However, it is interesting to know that "English" coal tar creosote holds its own. Our own railway companies consume a large quantity for treatment of sleepers, etc., and to this must be added that used for treating telegraph and telephone poles, for fuel oil, disinfectants and a variety of other purposes.

Although the price of the article is only reckoned in pence per gallon and the market fluctuations by sixteenths of a penny per gallon, buyers and users are very insistent, and rightly so, upon the quality conforming to certain defined specifications. Table I. represents an abstract of six specifications taken at random. Where the maximum amount of water is not fixed, up to 3 per cent. is generally accepted. It will be noticed that these specifications, though varying in text really bear upon the following points:—(1) Water; (2) Phenols; (3) Naphthalene; (4) Heavy coal tar oils. As will be seen, these points are governed by clauses defining:—(1) The maximum percentage of water allowed; (2) The minimum percentage of phenolic bodies to be present; (3) The temperature at which the oil shall remain liquid (or fail to deposit naphthalene) or the maximum amount of napthalene to be present at a given temperature, generally 15·5° C.; (4) The specific gravity and the maximum amount of distillate to be given at some stated temperature.

To decide these points the chemist resorts to the following operations:—

(1) *Water.* Distillation of a measured quantity (usually 100 c.c.) in a retort until no more water is given off. The distillate is collected in a small graduated cylinder to which has previously been introduced a few c.c. of coal tar naphtha, the latter keeps in solution any naphthalene that may have come over and enables a clear reading to be obtained.

(2) *Phenolic bodies.*—The total distillate obtained up to 315° C. is washed, by heating and agitating with three successive quantities (30, 20 and 20 c.c. respectively) of sodium hydroxide solution of sp. gr. 1·200. The total solution of the phenols thus obtained is washed with and separated from a small quantity of ether to remove any traces of neutral oils that may be present, then gently warmed on water bath to drive off remaining traces of ether, cooled and rendered slightly acid with dilute sulphuric acid, 1 : 3. The acidified solution is transferred to a graduated cylinder and after allowing time for settling the percentage of phenolic bodies is read off. Should the percentage of anhydrous phenols be required, the phenols obtained as above are separated from the sodium sulphate solution, run into a small tared retort, the water distilled off and the anhydrous residue weighed in the retort.

(3) *Naphthalene percentage or liquidity (or depositing) point.*—This point is not always easy to settle. In casea where the specification states "That the oil shall give no deposit" at some given temperature (see table I.), the usual method is to cool the previously liquified oil to the temperature specified and maintain it at that temperature for two hours. Should no signs of crystallisation appear, it is assumed that the oil passes the specification requirement, but I have often come across samples which have given a negative result on first examination or perhaps at several subsequent examinations and a positive result later or *vice versa*. It is highly conceivable that many factors may interfere with the crystallisation of a body like naphthalene from such a complex mixture as coal tar creosote.

Where the specification stipulates the maximum o minimum percentage of naphthalene to be present at 15·5° C the recognised method to ascertain this percentage i perhaps more definite, but the results obtained, even b the same worker, are by no means concordant; furthermore, the operation is both tedious and unpleasant. I is as follows:—A quantity of the sample conveniently on hundred grammes is cooled to and kept at a temperatur of 10° to 15·5° C. for twelve hours to effect crystallisatio The mass is then stirred for the space of two hours an kept at constant temperature at 15·5° C. during that tim It is then turned out on to a linen filter cloth, allowe to drain for a few minutes, roughly squeezed by the han and lastly pressed in a hydraulic or screw press betwee folds of absorbent paper (but still in the filter clot until it ceases to lose weight. The pressed mass is finall removed from the filter cloth and weighed.

The difficulties in the way of conducting such an oper tion, especially during the summer months, will be readil understood. Probably due to the manner in whic crystallisation takes place, the filtering is sometimes very tedious operation. It is obviously essential th until all oil has been expressed from the filtered ma that the temperature of 15·5° C. should be maintaine Further, I have found that the temperature at which th oil is kept during the twelve hours, ranging as it may fro 10° to 15·5° C. seriously affects the results obtaine This will be seen on reference to Table II.

Altogether, this method is highly unsatisfactory; a mo rational, and certainly a more expeditious, will therefo be suggested by me.

(4) *Heavy coal tar oils.*—The specific gravity is taken any of the recognised methods, a standardised hydromet being the instrument usually adopted.

With regard to distillation, in some specifications t method and conditions are precisely stated; the si of retort or flask, position of bulb of thermometer, ra of distillation, etc., all being expressly laid down, but others there is an irritating vagueness, much to be dep cated, when it is taken into consideration that a sam of creosote will give a variation of 5 per cent. and ov in the distillate obtained at 315° C., according as is distilled in a flask with the bulb of thermometer in l with the side tube or distilled in a retort with the bu of thermometer wholly immersed in the liquid. Yet both these methods are adopted by buyers' chemists. It would simplify matters considerably if the details of distillation were at all times given concisely. I have known differences to arise which might have been accompanied by most serious consequences from a financial point of view to one or other of the parties to the transaction had it not been ascertained that the respective chemists were working on entirely different lines.

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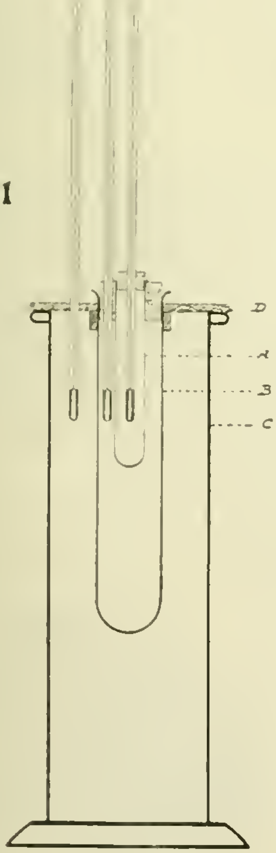
* Since writing these notes an interesting reprint of a MSS., presented by W. F. Sherfersee, Bureau of Forestry, Manila, Philippines, to the U.S. Forest Service, has appeared in the pages of the *Chemical Trades Journal.*

For some years past I have worked on and used a method for the approximate determination of the amount of naphthalene present at 15·5° C., which appears to give very satisfactory results. The method is based upon the determination of the rise in temperature due to the latent heat of crystallisation of bodies contained in the distillate. At first I thought it possible to make the determination on a small part of the distillate obtained in clause 4, that is to say the distillate yielded at 315° C. using an aliquot part of the remainder for the determination of phenols, and thereby save a distillation, but although the method worked fairly well when dealing with light creosotes (which practically distilled all over below 315° C.) it was not applicable to creosotes containing a large percentage of heavy oils, the results being much higher than the actual. For the purpose of this determination it was found necessary to carry the distillation further.

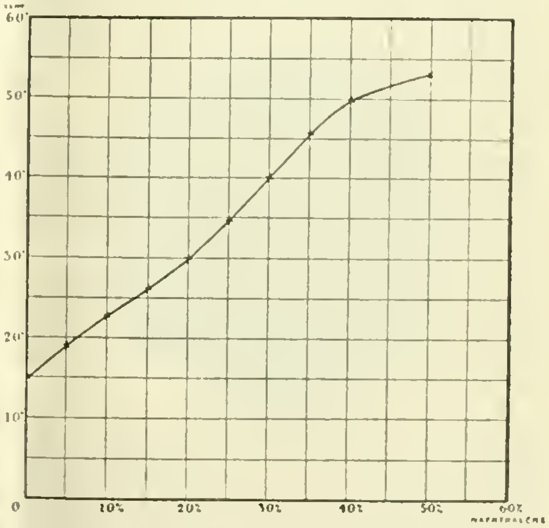
FIG. 1



The apparatus used for determining the "latent heat point" is shown in figure 1. It consists of an inner tube, A (10 cms. by 1·5 cms.) provided with a cork through which passes a thermometer, preferably calibrated in 0·2° C. the zero mark being about 5 cms. from the bulb. Tube A is fitted concentrically into tube B (18·5 cms. by 3·5 cms.) by means of perforated cork, this cork also carries a thermometer: the space between A and B acts as an air jacket. Tube B is fitted into vessel C which may be of any convenient size, the latter acting as a water jacket. B is carried by passing through a disc of wood, D, a strong elastic band is slipped over B after passing through D to prevent D rising when immersed in water contained in C. Disc D requires to be clamped to rim of C and also carries a thermometer. C is provided with a stirrer.

The test is made as follows:—A portion of the sample, about 50 c.c., is distilled from a small retort practically to dryness, or until incipient decomposition of residue is observed, the collected distillate is warmed until wholly fluid and then well mixed. The small tube A is removed from the apparatus and filled about two-thirds with the distillate, and gradually cooled being gently stirred meanwhile with thermometer, until the formation of crystals causes the contents of tube to become opaque, the temperature being noted. The temperature of the water jacket, C, and air bath, B, is then regulated so as to be two or three degrees lower than the opacity point just noted. The contents of A are remelted and again cooled gradually to opacity, any moisture is rapidly removed from outside of A and the tube passed through perforated cock into B, the thermometer in A being adjusted so as to be quite central and about 2 cms. from bottom of tube. The temperature will be noticed to slowly rise, afterwards remain constant for from onehalf to one minute, finally falling—the maximum temperature obtained is taken as the latent heat point.

FIG. 2



The curve, figure 2, was obtained in the first instance by adding weighed quantities of naphthalene to various samples of the creosote naphthalene-free at 15·5° C. The ordinates giving the "latent heat point" in degrees centigrade, and the abscissæ the percentage of naphthalene. Since then I have examined many samples and checked the naphthalene figure, to be obtained from the curve by taking the latent heat point against the method given in clause 3, using very great precautions which would make the process practically impossible as a technical method, and have obtained very concordant results.

Tables II. and III. will give some idea of the variation in results obtained by the present recognised method, and of the accuracy of the suggested method. The same creosote was used in all the tests referred to in these two tables.

The results that I have obtained, and the time saved by using it, especially when dealing with salty creosotes, warrant, I think, the publication of this method. If other workers obtain satisfactory results with it coal tar creosote might be valued, so far as naphthalene is concerned, on its "latent heat point" in the same way as crude carbolic acid is valued on its "crystallising point."

TABLE II. (*recognised method.*)

	1	2	3	4
Minimum temperature obtained during 12 hours crystallisation	10° C.	12° C.	14° C.	15° C.
Pressed naphthatene obtained	21%	17%	16·5%	15%

TABLE III. (*suggested method.*)

	Centigrade.			
	1	2	3	4
Opacity point	20·2	21·0	21·4	20·6
Temperature—water jacket	19·0	19·0	19·0	19·0
,, air bath	19·0	19·0	19·0	19·0
"Latent heat point"	26·5	26·5	26·2	26·3

DISCUSSION.

The CHAIRMAN said the apparatus used to determine the "latent heat point" was apparently an adapt tion of Beckmann's freezing point apparatus. He was not quite certain whether the term "latent heat point" was a suitable one and he wondered whether the author could find a better name.

Dr. R. S. MORRELL wished to know if the amount of naphthalene crystallising out depended on the nature and amount of the phenolic bodies present. He would be glad to hear if Mr. Mann had been able to indicate the cause of the darkening of creosote in the air and to suggest a remedy.

Mr. COLLIS said with regard to the latent point of creosote, that the amount of naphthalene crystallising out would probably vary with the different oils, and again, with the different temperatures. It seemed to him that, if creosotes were obtained from a number of sources, the results would not be concordant.

Mr. WARNES confirmed from his own experience the results as stated by Mr. Mann. Some years ago he had worked with him, and they were exceedingly concordant. The results obtained with different creosotes containing the same percentage of naphthalene were almost identical. If the temperature of 60° F. were used in the air bath and water bath instead of using the opacity temperature, a slight difference was found in those samples which contained a large percentage of naphthalene, and a large difference in those which contained a small percentage of naphthalene. He thought that so long as the worker took adequate precautions, used the same amount of creosote in the tube, and adhered to the method of keeping the air and water baths at a previously arranged standard temperature, the results would be commercially correct. When one considered the length of time that the other and more general process took, the trouble of scraping from the linen the creosote salts, (and, unless extraordinary precautions were taken the method became inaccurate) he thought the new method would find favour because, with little trouble, one could obtain accuracy to within a few per cent. If one used the pressure method, adopting elaborate precautions, filtering through a jacketed funnel, keeping the water at 15° C., and using small quantities, so that one could press rapidly, results were obtained quite comparative with the amount of naphthalene added, and with this test. He hoped coal tar distillers would adopt the method described rather than that of cooling and pressure.

Mr. F. H. ALCOCK asked to what the efficacy of creosote as a preservative was due. Apparently from the specifications read there was not much phenol or naphthalene required. He suggested that shaking up the material with alkali would take out the phenolic bodies. Naphthalene was not soluble in water, but would be soluble in ether. Phenols would be soluble in alkaline bodies, but naphthalene would not. It occurred to him that some such system of analysis would serve for an examination of creosote. With regard to the troublesome system of removing the refrigerated bodies by pressure, the process of scraping the linen to remove the precipitates might be obviated by using some solvent, such as ether, benzene, chloroform, and the like.

Mr. P. L. WHITEHOUSE urged that a simple and easy method for the determination of naphthalene was much to be desired. He would like to know what standard Mr. Mann adopted. He evidently took creosote free from naphthalene at 15° C. and standardised by adding naphthalene to that creosote. If the results were based upon that the total naphthalene would not be given, because creosote at 15° C. was not free from naphthalene. Creosote as a rule had no distinct scientific characters assigned to it. Often there was no test required or only simple ones. It was only in cases where definite tests were required that this method would be useful. Creosote was used for such a variety of purposes, that every buyer had to make his own specification, based on the qualities most useful to him. He would like to know a simpl method by which to get out the phenols. Some simpl method was desired for determining the "acid" o "total phenol" value of the creosote. It was tim some definite tests were made for such things as creosot and tar, and it would be beneficial if definite rules coul be laid down for carrying out the work.

Mr. MANN in reply said he would gladly welcom any suggestion for a better term than "latent heat point,' but the difficulty was to get a name sufficiently explanatory In reply to Dr. Morrell he said that he knew of no mean by which the darkening could be prevented. As t whether the results obtained were influenced by th amount of phenolic bodies, he would emphasise that th naphthalene point did not represent the total naphthalen present in the oil, but the amount not in solution. A to the relation between phenolic bodies and naphthalen in solution, one could roughly estimate that an oil contai ing say, 30 per cent. of phenols would throw out abo 30 per cent. of naphthalene when these phenols we removed, in other words each per cent. of tar acids in th oil enabled it to carry an equal quantity of naphthale and remain a clear solution.

The methods of testing quoted in the early part of th paper were taken from standard specifications. He h used the new method with creosotes obtained from Ma chester, Yorkshire and Birmingham districts respectivel and the results were fairly concordant. As he h mentioned before, it was the naphthalene not in soluti that was determined approximately, and it was th naphthalene that was controlled by the specificatio Most of the creosote shipped to the United States was us by the railway corporations for the preservation of sleepe The preservative qualities of the various constituents we ably discussed in a paper read at the Institute of Ci Engineers some years ago by S. B. Boulton, than wh there was no better authority on the subject. Naphthale apart from any preservative property it possessed, act beneficially in filling the pores of the timber, althou it was probable that the heavy liquid bodies had t greater preservative effect.

The tar acids were removed by washing out with alkaline solution. His experience was not similar to th of Mr. Whitehouse, who seemed to think that creos was bought on easy conditions in a free and easy wa he found that when contracts were given hard and f rules were imposed as to quality and the buyer insis that the creosote must be delivered in accordance with specification.

TABLE I.

Various buyers specifications for Coal Tar Creosote.

	Specific gravity.	Phenolic bodies.	Water.	Naphthalene.	To become liquid at	To yield on distillation.
a	1025—1045 at 35° C.	5% minimum	not stated	30% at 15·5° C. maximum	35° C.	4% max. at 170° C 12% .. between 170—210° C. 50/60% between 210—270° C. 25/30% above 270° C.
b	1035—1065 at 15·5° C.	6% minimum	not stated	to give no deposit at 4·5°C.	—	not stated
c	1050—1060 at 15·5° C.	6% minimum	3% maximum	to give no deposit at 24° C.	38° C.	between 22·5% and 27·5% residue at 321° C.
d	not below 1010 at 38° C.	8% maximum	not stated	25% at 15·5° C. maximum	38° C.	40% min. between 205/235° C. minimum 20% Residue 270° C.
e	1050 at 15·5° C.	10% minimum	not stated	to give no deposit at 15·5° C.	—	to distil mostly above 210° C.
f	not below 1015 at 50° C.	6% minimum	not stated	25% at 15·5° C. maximum	40° C.	not stated.

ERRATUM.

In the discussion on "The Corrosion of Industrial Ironwork" (this J., June 15, 1910, p. 659), Mr. John C. Mann was one of the speakers, not Mr. E. A. Mann, as printed.

London Section.

Meeting held at Burlington House on Monday, May 2nd, 1910.

MR. W. F. REID IN THE CHAIR.

THE CRYSTALLINE PRODUCTS OF THE HYDRATION OF PORTLAND CEMENT.

BY E. J. READ, B.A., F.I.C.

It has been known for some time that certain crystalline products are formed during the hydration of Portland cement, and various researches have been published bearing on the subject, amongst which I may mention those of Le Chatelier and Candlot. It has been maintained by some that the setting of cement is entirely due to the formation of such crystals, while others favour a colloidal theory, more especially for the hardening process which follows, but is continuous with the setting. It is not my object to discuss these various theories, but to describe a few results of my own in the hope that they may be of use to others who are interested in the subject.

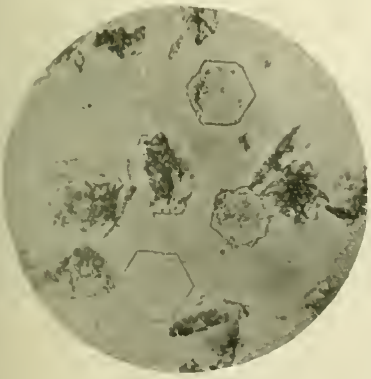


FIG. 1. × 400.

When Portland cement is gauged with water, lime goes into solution and a layer or skin of calcium carbonate is formed on the moist surface which protects the interior mass more or less completely from the action of the air. Such a pat of cement, however, is not convenient for the study of the crystalline products of hydration, because of the close proximity of the grains of cement, which does not allow sufficient room for the formation of large crystals, and also from the difficulty which appears to exist in cutting satisfactory sections in which one can assume that there has been no action of the cementing and mounting media.

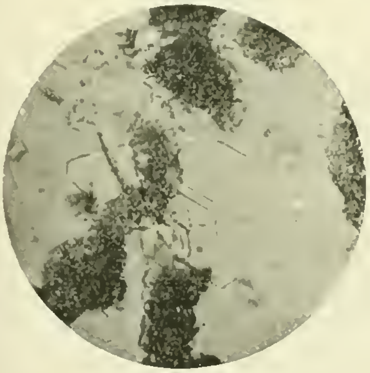


FIG. 2. × 400.

My method is to prepare a microscope slide of the ground cement using water or lime water as a medium, and ringing the preparation with paraffin wax or some inert cement. In this way the process of hydration can be kept under observation for any desired period of time. It is out of contact with the air, a condition which obtains in the ordinary setting of cement. The proportion of water can be reduced to that which is used in laying a wet concrete, so that such a microscopic preparation should give some idea of what actually takes place during the early stages of hydration of Portland cement.

As the result of the examination of many samples of cement, there appear to be two distinct varieties of crystals which accompany the set. One of these is tetracalcic aluminate, the other calcium sulpho-aluminate. Cements can be obtained showing either one or the other, and in some samples both crystalline forms are in evidence. In addition to these, large irregular crystals of calcium hydrate are formed at a later period.

As stated by Le Chatelier, of the forms of hydrated calcium aluminate which exist, those only need be considered, in connection with the set of cement, which are permanent in presence of excess of lime water. The only one thus permanent is the tetracalcic aluminate, to which Le Chatelier gives the formula $Al_2O_3.4CaO,12H_2O$. It was obtained by him in the form of spherical aggregates of long needles or in compact spherolites.

In my own method of preparing this salt I prefer to use sodium aluminate, prepared in the wet way, by dissolving aluminium in caustic soda solution, as in this way one can prepare an aluminate free from carbonate. On precipitating a dilute solution of this with a clear, hot solution of calcium hydroxide in excess, one obtains on cooling crystals which vary in form, according to the proportion of aluminate, from those obtained by Le Chatelier to regular hexagonal plates, such as are formed during the set of rotary cement.

Fig. 1 shows the precipitated aluminate of lime, Fig. 2 the hydration product of rotary cement. These crystals twin readily through the centre of two opposite sides of the hexagon forming complex star-shaped aggregates. They are insoluble in concentrated solutions of cane sugar while the lime crystals, which also appear in cement are soluble. So far as optical properties are concerned the natural and precipitated hexagonal plates appear to be identical.

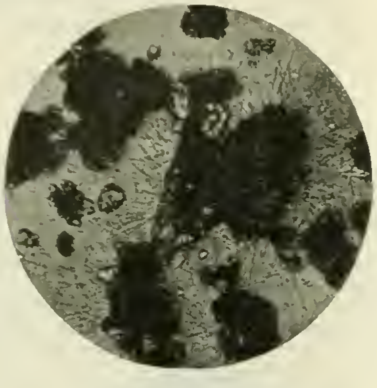


Fig. 3. × 400.

Of the sulpho-aluminate set there are two varieties; one the set which is induced by added gypsum and the other that which occurs in cements made in the old bottle-shaped kilns in which it is produced, in part at least, by the presence of the alkali sulphates and aluminates which these cements often contain. Fig. 3 shows the crystals from a rotary cement which has been slowed by gypsum. Fig. 4 shows a sulpho-aluminate formed by the action of alkali sulphate. In this case the needle-shaped crystals are much finer and more felted together. Fig. 5 is a precipitated sulpho-aluminate of lime of the composition given by Candlot, $Al_2O_3.3CaO.3CaSO_4.30H_2O$.

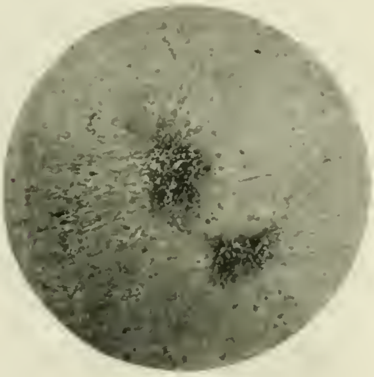


Fig. 4. × 400.

Fig. 6 shows one of the large lime crystals which form later in such microscopic preparations as I have described. They are optically identical with the crystals from a gauged cement which has been kept under water when every precaution has been taken to exclude carbon dioxide. These crystals are easily detached and obtained in a sufficiently pure state to be identified as calcium hydroxide.

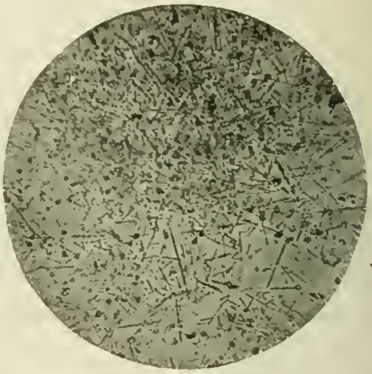


Fig. 5. × 400.

The microscopic preparations when kept for many months gradually become opaque and dry up by absorption of water. If the slide be then cleared with paraffin oil the colloidal structure described by Michaëlis becomes evident; the lime crystals are not easily recognised, but the hexagonal aluminate remains in evidence.

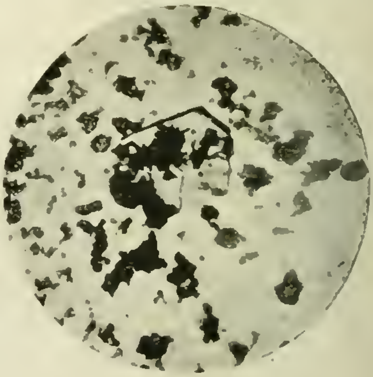


Fig. 6. × 250.

Discussion.

Mr. B. Blount asked how the crystals were obtained; was the cement in its powdered state enclosed in a little cell? A matter which presented to him very great difficulty was to cut a section from a piece of set cement and from that to decide what particular compounds were there. That task had baffled his own efforts and those of other petrographical people; in fact, he believed, it had never been done in a fully satisfactory manner.

The Chairman said it was by grappling with the question in a scientific manner, as Mr. Read had done, that real light was thrown on the actual processes which went on in hardened hydraulic cement. There was certainly great difficulty, as Mr. Blount had said, in cutting sections; but the chief objection had been that people would use water and emery to grind the sections, which was of no use; because the water dissolved a great deal more than was abraded by the grinding. Using ordinary distilled petroleum, he found no difficulty in making sections.

Mr. Read said the cement was put on a slide, and was crystallised in that way with wax round it.

Meeting held at Burlington House, on Monday, June 6th, 1910.

DR. J. LEWKOWITSCH IN THE CHAIR.

THE FIRST SYNTHESIS OF ETHYL ALCOHOL.

BY R. MELDOLA, F.R.S.

In the course of an inquiry into the history of organic synthesis preparatory to the publication of my book on this subject in 1904* I came to the conclusion that with respect to the first synthesis of a vital product our countryman, Henry Hennell, was in precisely the same position, so far as concerned the artificial production of alcohol, as was Wöhler with respect to the synthesis of urea, which was accomplished in the same year, 1828. This conclusion was stated in my address to section B of the British Association at Ipswich in 1895,† and was repeated in the introductory chapter to the book above referred to. The conclusion at which I had arrived after a quite impartial and independent examination of the original papers by Faraday and Hennell was by no means new; it was simply an independent confirmation of views proclaimed at a much earlier period by such authorities as Chevreul, Wurtz, Fehling, Roscoe and Schorlemmer, Henry Watts, &c. The reopening of the question of Hennell's claim called forth in 1899 a counterclaim by the late illustrious French chemist, Berthelot,‡ from which has arisen a polemical discussion, the latest contribution to which is by M. E. Jungfleisch, the distinguished Professor in the Collége de France, who, in a remarkably lucid paper, argues the case for M. Berthelot both with great skill and with scientific moderation.§

Disputes about priority with respect to scientific discovery are, as a rule, unsatisfactory. I should not have ventured into the arena of polemics on the present occasion were it not that the eminence of M. Jungfleisch and the ability with which he attacks my conclusions, are such as to render his own deliberate verdict worthy of the most serious and respectful consideration. With every desire to give full weight to M. Berthelot's reclamation and to abandon my own position if found untenable, I have been induced by the publication of M. Jungfleisch's article to look once again and more critically into the evidence. As the result of this second inquiry into the claim of Hennell has been to confirm the conclusion formerly arrived at, it seems desirable that the chemical world should now be put in possession of the evidence upon which that claim was based. In submitting this evidence it is perhaps hardly necessary to point out that even if the case in favour of Hennell is considered as proved, the fame of the illustrious French founder of organic chemical synthesis suffers not the slightest diminution. The name of Berthelot will always be revered by the chemists of this country as by those of his own; it is but a small crumb from the rich table of his scientific labours that we claim on behalf of a comparatively obscure English worker, of whom, but for his untimely death, we should probably have heard more as a scientific chemist.

In order to limit the present discussion to those points which are actually at issue it will be necessary to recapitulate briefly the claim as advanced by myself on behalf of Hennell:—

(1) Faraday in 1825 had been investigating the illuminating gas produced by the destructive distillation of oil—the so-called "oil-gas." In the liquid condensed from this gas he had discovered benzene among other hydrocarbons, and among the "vaporous" constituents, olefiant gas. He observed that the latter was absorbed by sulphuric acid:—"Even olefiant gas itself is dissolved by it in small proportions." "In determining the 'vapours' present in oil and coal gas it is an object to possess means by which their presence and quantity may be ascertained; and this I find may be done with considerable exactness by the use of sulphuric acid, oil, &c., in consequence of their solvent power over them." "Sulphuric acid is in this respect a very excellent agent. It acts upon all these substances instantly, evolving no sulphurous acid, &c." "When olefiant gas is present, additional care is required in analytical experiments in consequence of the gradual combination of the olefiant gas with the sulphuric acid. I found that one volume of sulphuric acid in abundance of olefiant gas absorbed about 7 volumes in 24 hours in the dull light of a room; sunshine seemed to increase the action a little, &c." "I find also that sulphuric acid will condense and combine with olefiant gas, no carbon being separated, or sulphurous or carbonic acid being formed, and this absorption has in the course of 18 days amounted to 84·7 volumes of olefiant gas to one volume of sulphuric acid. The acid produced combines with bases, &c., forming peculiar salts, which I have not yet had time, but which it is my intention to examine." From a paper "On New Compounds of Carbon and Hydrogen and on certain other Products obtained during the Decomposition of Oil by Heat," Philosoph. Trans. Roy. Soc., 1825, p. 340 *et seq.* (Read June 16th, 1825.)

(2) The following year Hennell, through Brande, communicated a paper to the Royal Society, in the course of which he says:—"I have also ascertained that hydrocarbon (referring to olefiant gas) with an additional proportion of sulphuric acid, affords a compound which is capable of uniting with salifiable bases and of forming a distinct series of products." Referring to Faraday he continues:—"He gave me some sulphuric acid which had been exposed to olefiant gas during some of his experiments on the products of the decomposition of oil by heat. It had absorbed about 80 times its volume of the gas, acquired a deep brown colour and a smell resembling oil of wine. It was saturated by carbonate of potash, carefully evaporated to dryness, and the dry mass digested in alcohol. A small quantity of a salt was obtained from the alcoholic solution having the crystalline form and general character of the salts I have been describing.

"Thus it would appear that hydrocarbon constituted of single proportionals, or 6 carbon and 1 hydrogen by weight, has the power of combining with sulphuric acid; and that whether it be evolved and then combined, as in the case of olefiant gas, or its elements separated from other compounds, as from alcohol, it forms precisely the same combination, sulphovinic acid." It may be added that the original object of Hennell's work was the investigation of the so-called "oil of wine," and that the paper was entitled "On the Mutual Action of Sulphuric Acid and Alcohol, with Observations on the Composition and Properties of the Resulting Compound." Philosoph. Trans. Roy. Soc., 1826, p 240. (Read March, 9th, 1826.)

(3) Two years later Hennell sent a second instalment of his work to the Royal Society, in the course of which paper he states:—

> "When alcohol and sulphuric acid in equal weights are put together without the application of any heat beyond that generated during the mixture, the most abundant and important product is sulphovinic acid, above one half of the sulphuric acid being converted into that peculiar acid by union with hydrocarbon."

He adds further that "the sulphuric acid loses half its saturating power by the union, and all the salts formed by the new acid are soluble." He finds that ether is produced by the distillation of sulphovinic acid and he proves conclusively that sulphovinic acid on distillation with dilute sulphuric acid is resolved *quantitatively* into its components, sulphuric acid and alcohol. The paper is entitled "On the Mutual Action of Sulphuric Acid and Alcohol, and on the Nature of the Process by which Ether is formed. Philosoph. Trans. Roy. Soc. 1828, p. 365 *et seq.* (Read June 19th, 1828.)

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* "*The Chemical Synthesis of Vital Products.*" Edward Arnold, 1904

† *Rep. Brit. Assoc.* Ipswich, 1895, p. 649.

‡ *Comp. rend.*, 1899, Vol. 128, p. 862. Prominent among the latter supporters of Hennell's claim is P. Fritsche: see *Journ. f. pr. Chem.*, Vol. 65, p. 597.

§ *Revue Scientifique.* Jan. 29th, 1910, pp. 129—140.

The above summary of the main conclusions must make it clear :—

(1) That Faraday was aware that ethylene was among the products of the destructive distillation of oil and coal.

(2) That Faraday was familiar with the use of sulphuric acid as an absorbent for ethylene and other hydrocarbons.

(3) That Hennell identified the acid produced by the combination of ethylene and sulphuric acid as sulphovinic acid.

(4) That Hennell discovered that sulphovinic acid was decomposed by heating with dilute sulphuric with the production of alcohol.

The chain of evidence seemed sufficiently complete to warrant the deduction that this was the first synthesis of ethyl alcohol and therefore of a vital product. It is urged by way of objection to this claim that neither Faraday nor Hennell nor their contemporaries made any specific reference to their having produced alcohol by a chemical process. So far as Hennell is concerned this criticism is, I venture to think, disposed of by a passage which makes it clear that he fully realised, as far as existing knowledge admitted, the results of his own experiments :—

"*We may . . . form either alcohol or ether, using olefiant gas as the hydrocarbon base : for I have shown in my last paper* (1826) *that olefiant gas by combining with sulphuric acid forms sulphovinic acid, and the acid so produced forms either ether or alcohol, according to circumstances which are under perfect command.*" (Philosoph. Trans. Roy. Soc. 1828, p. 371. Italics are mine.)

Nothing could be clearer than this statement. If the discovery failed to rouse the same interest in the scientific world as the contemporaneous synthesis of urea from ammonium cyanate by Wöhler, this is explicable by the circumstance that alcohol was not in 1828 regarded as an organic compound in the old sense of being the product of a living organism.[*] Whether Hennell's synthesis was "complete" is in reality a matter of definition. All that was claimed by me in 1895 was that it was as complete as Wöhler's synthesis of urea, for the latter set out from a cyanogen compound which was prepared from nitrogenous "organic" matter. To this point, however, it may be necessary to return when the arguments against Hennell's claim[†] are being considered.

The historical record of the work done in connection with the synthesis of alcohol is so fully, and, on the whole, so accurately set forth by Prof. Jungfleisch that those who are interested in the question under discussion cannot do better than read his paper. On one point only may it be necessary to question the rendering of a particular paragraph in Hennell's original (1828) paper because important conclusions respecting Hennell's position are drawn from an expression which the author makes use of. In acknowledging Faraday's assistance he says, as will be seen from the full text quoted above :—"He gave me some sulphuric acid," &c. This is translated by Prof. Jungfleisch: "Il me donna un peu d'acide sulfurique, &c." A point against Hennell is made out of this statement, because it is concluded therefrom that he was working with such a small quantity of material that any conclusions arrived at by him were thereby rendered doubtful. But this, as will be seen from Hennell's statements, is a gratuitous deduction. There is no evidence that he had in hand only a small quantity of Faraday's acid : the passage indicates simply that out of the whole of the acid given to him he obtained a small quantity of the potassium salt after neutralisation by potassium carbonate and the extraction of the whole of the dried residue by alcohol. His identification of this salt as potassium sulphovinate seems conclusive, so far as covered by the terms "crystalline form and general characters." It may even be concluded that he was so far satisfied with his diagnosis that he did not take the trouble to exhaust the residue of dried potassium salts by alcoholic extraction ; he had dissolved out enough for his purpose, and, as any modern chemist would do under similar circumstances, when he wanted more of the material he adopted the more direct method of preparing the compound directly from alcohol and sulphuric acid.

Passing now to the specific criticisms of the work of Faraday and Hennell, the first and perhaps the most important point urged by Prof. Jungfleisch is that the ethylene used by Faraday in saturating the sulphuric acid to the extent of about 80 volumes could not have been pure, because pure ethylene is not absorbed to anything approaching this extent at ordinary temperatures and pressures. In other words the presence of sulphovinic acid in Faraday's sulphuric acid is attributed primarily to the presence of ether and alcohol vapours in the olefiant gas used. Faraday, it is true, does not give any particulars respecting the state of purity of his gas in his 1825 paper ; neither does he specify the precise conditions under which the absorption by sulphuric acid was effected. There is certainly no warrant for the belief that the particular specimen of acid given to Hennell was saturated by the olefiant gas from oil gas. I quite agree with Prof. Jungfleisch that there is no justification for this statement. But Hennell himself has never made such an assertion ; all that he says in his paper is that the acid given to him "had been exposed to olefiant gas *during some* of his (Faraday's) experiments, &c. (italics are mine). The ethylene may have been, and no doubt was made by Faraday by the ordinary method after he had satisfied himself of the presence of this gas in oil gas. The assertion that "les mémoires de Hennell . . . prêtent parfois à la confusion ; par exemple, le gaz oléfiant, soumis par Faraday au traitement sulfurique, y semble indiqué comme provenant des produits de la décomposition de l'huile par le chaleur, &c.," is certainly an unwarrantable interpretation of Hennell's statement. Prof. Jungfleisch's translation of this passage in Hennell's paper is quite correct, so that this criticism appears to be all the more unjustifiable.

The contention that *the whole* of the sulphovinic acid contained in the sulphuric acid worked up by Hennell could not have been due to the ethylene absorbed must certainly be conceded, in the light of existing knowledge. Prof. Jungfleisch has done well to insist upon this point. The later discovery that *pure* ethylene is absorbed only to the extent of 1·4 volumes by 1 volume of sulphuric acid was made by Liebig in 1834[*] and has since become common knowledge. But in making this concession I venture to think that the validity of Hennell's claim is in no way affected ; his position may be said to have undergone quantitative but not qualitative modification as the result of later research. The deduction from Liebig's work and from the later experiments of Goriainoff and Butleroff (1870) is drawn by Prof. Jungfleisch in terms which will appear to impartial critics of the present controversy as extreme :—

"De telles observations ne laissent pas entrevoir la possibilité que l'acide sulfovinique trouvé par Hennell dans le produit qu'il tenait de Faraday ait eu l'éthylène pour origine ; cet acide sulfovinique, comme l'a montré Liebig, avait eu l'alcool et l'éther comme générateurs."

He thus even disallows the 1·4 volumes which Liebig allowed ! And again—in claiming for Berthelot the discovery that purified ethylene and sulphuric acid combine to form sulphovinic acid he states :—

"Faraday a cru, il est vrai, l'avoir effectuée en 1825, mais, dès 1834, Liebig a montré que l'experience de Faraday était fautive, l'éthylène n'étant pas absorbé par l'acide dans les conditions adoptées ; l'acide sulfovinique, sommairement caractérisé par Hennell en 1826 dans le produit de Faraday, avait été formé aux dépens des vapeurs d'alcool et d'éther contenues dans l'éthylène employé. Faraday n'a, d'ailleurs, jamais tiré de cette expérience une conclusion relative à la synthèse de l'alcool."

This last statement is perfectly true, but it has never been asserted that Faraday did make such a claim. All that he said was that, after having absorbed the ethylene, the sulphuric acid contained an acid capable of forming "peculiar salts," which he proposed investigating later. Had he done so he might have been the discoverer of the synthesis of alcohol from ethylene. As it was he handed over this work to Hennell, and the correct conclusion, that this was a synthesis of alcohol, although not expressed in modern phraseology, is quite clearly drawn by Hennell in the paragraph previously quoted. It cannot be conceded that :—

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[*] See the Address to Sect. B. *Brit. Assoc. Rep.* Ipswich, 1895. Also "*Chemical Synthesis of Vital Products,*" introductory chap. p. 1.

[†] In speaking of Hennell's "claim" it must be understood that he himself never put forward any claim beyond the statement of the results of his experiments. Prof. Jungfleisch is perfectly correct on this point. It is we who claim that the first synthesis of alcohol must be credited to Hennell.

[*] Annalen, Vol. IX., pp. 1 *et seq.*

"De cette synthèse, d'ailleurs, Hennell, pas plus que Faraday, n'a jamais parlé." (See, *per contra*, Philosoph. Trans. Roy. Soc. 1828, p. 371.)

The position to which the discussion has brought us up to this stage may be summarised by the statement that while it is admitted by both parties in the controversy that Hennell effected the second step (the decomposition of sulphovinic acid into alcohol) he had not realised the irst step because the sulphovinic acid used by him had, according to Liebig's experiments, originated from alcohol and ether vapours, and not from ethylene. How far this s true will appear from the argument already submitted—hat *some* of the sulphovinic acid, if only a small proportion, esulted from the ethylene absorbed. Is not that sufficient o establish the principle that alcohol can be and was ynthesised from olefiant gas? Is not the opposite position—that none of Faraday's sulphovinic acid originated rom ethylene—an unwarranted straining of the evidence gainst Hennell? It is not the question of the establishment of a practical, working method that is at issue, since Berthelot's method, although an enormous advance over Hennell's, still cannot claim to have brought the synthesis o more than an academic stage. The observations of Faraday, followed by the experiments of Hennell, seem o me to have established the principle quite satisfactorily nd to justify the claim which has been made with respect o Hennell's position.

It may perhaps be pertinent in the next place to consider omewhat more fully the nature of the evidence adduced by Prof. Jungfleisch in support of the contention that Faraday's 80 volumes of absorbed "gas" consisted hiefly of ether and alcohol vapours. Neither Faraday in 825 nor Leibig in 1834 made any definite statement with espect to the strength of the sulphuric acid. Faraday ays nothing about the state of purity of his olefiant gas, but Liebig is very precise in his description of the means employed to purify his gas by caustic potash and sulphuric cid. Faraday gives no description of his apparatus, but f the acid given by him to Hennell in 1826 was the same s that which he refers to in his paper of 1825—and the vidence points to this being the case—then the gas and cid in Faraday's experiment may have been in contact or more than a year. Liebig's gas, after purification, was passed into graduated tubes over mercury, and the ulphuric acid then introduced. The absorption to the xtent recorded was complete in two days, and on further bsorption was observed after three weeks. It does not ppear to me that the arrest of the experiment after three weeks warrants the complete obliteration of Faraday's esult. At least it may be pleaded that this is again straining of the evidence by the Counsel for the Opposition against Hennell. Liebig, it is true, infers rom his results that sulphuric acid has no specific ffinity for ethylene—in other words, that there is no hemical combination, but simply a physical solution. do not think this view is generally admitted; certainly ll the works of reference which I have consulted are unanimous in attributing the absorption to the formation of ulphovinic acid.*

It now becomes necessary, in order that there may be no misunderstanding as to the real point at issue, to consider in turn the evidence upon which Berthelot's claim is ased. What steps were taken by the illustrious French hemist which in the opinion of his supporters are considered ufficient to override all the earlier work of Faraday and Hennell? These steps, apart from side issues, are really only two :—(1) The synthesis of ethylene from its elements *viâ* acetylene; (2) The more complete conversion of ethylene into sulphovinic acid. Dealing with the second step first, it may be asked what improvement or modification was introduced by Berthelot, and was that modification so fundamental as to warrant the conclusion that success only was achieved thereby? A reference to the original publications will make it clear that the whole point of difference which, it is virtually declared, converted Faraday's failure into a success by Berthelot is that the latter discovered that agitation was essential in order to insure complete absorption of the ethylene by the acid. This method was made known by Berthelot in 1854. Unquestionably it was an improvement; it is described moreover with a scientific precision in every way worthy of the reputation of its distinguished discoverer. The only doubtful point that arises is whether Faraday, whose skill as an experimenter none will challenge, was completely ignorant of this fact—whether, indeed, he had not shaken up his acid from time to time, and so contributed somewhat more than Liebig supposed to the amount of genuine "synthetical" sulphovinic acid in the acid which he gave to Hennell. However, as nothing specifically is said on this point in his paper of 1825, "judgment will be given by default" by those who are anxious to minimise Hennell's claim.* Returning to Berthelot's process, the following description is quoted from his well-known work, "Chimie Organique fondée sur la Synthèse," vol. i., 1860, chap. iii., p. 104 :—†

A globe of 31—32 litres capacity was filled with purified ethylene, and into this 900 grammes of pure (boiled) sulphuric acid were introduced by instalments together with "some kilogrammes" of mercury. After continuous and violent agitation :—"Le gaz oléfiant s'est absorbé graduellement. Après 5300 secousses, l'absorption devenant trop lente, on arrêta l'opération. Elle avait duré quatre jours. 30 litres de gaz oléfiant se trouvaient absorbés; l'acide avait pris une odeur et une teinte analogues à celles d'un mélange d'acide sulfurique et d'alcool; il se troublait de même très légèrement par l'eau." The volume of gas absorbed was determined by measuring the volume of air admitted on opening the globe. The residual olefiant gas although diluted with air, "conservait la propriété d'être absorbable, soit par le brome, soit par l'acide sulfurique concentré avec le concours de l'agitation." From the acid thus saturated he obtained (by Hennell's method) a quantity of alcohol corresponding to 45 grammes of absolute alcohol, and to three-quarters of the ethylene absorbed. He characterises the alcohol and the ethylene obtained from it with all scientific accuracy. He adds in a footnote that 100 grammes sulphuric acid absorb 6·7 grammes of ethylene, corresponding to 120 volumes.

All chemists must pay homage to the memory of the man who carried out that piece of work. It surpassed the experiment of Faraday in scale (so far as we know), in the purity of the ethylene, and in the completeness of the conversion of the latter into sulphovinic acid. Combined with his proof of the convertibility of acetylene into ethylene by reduction, it will stand for all time as a classical achievement in chemical synthesis. But still it must not be forgotten that at the time of that work the science of organic chemistry had developed by some 29 years since Faraday's investigation of oil-gas. And after allowing for such development, both in theory and in practical methods—and Berthelot was himself among the most active in promoting such development—there yet remains in the mind of the impartial critic the conviction that Faraday had realised in principle that chemical combination which Berthelot afterwards brought about with much greater completeness—that the great French chemist had gone beyond his English predecessor in degree only, and not in principle. In considering this achievement, it is impossible to avoid being struck by the circumstance that Berthelot came very near, without actually realising the main condition which makes possible the production of sulphovinic acid from ethylene as a practical and even a technical process, viz., the heating of the sulphuric acid. There is not a hint in any of Berthelot's descriptions of his experiments which, so far as I have been able to ascertain, indicates that he regarded the temperature of the acid as important in determining the absorption of ethylene. This, if my reading of his work is correct, is all the more remarkable because it was he who first distinctly called attention to the necessity for applying heat to insure complete combination between ethylene and hydrogen chloride or iodide.*

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* *Beilstein*, 3rd. ed., Vol. 1., p. 112, credits Faraday & Hennell ith this discovery.

* I attribute no weight to the argument that Faraday made no public rejoinder to Liebig's criticism of his work. It is well known that he was most averse to enter into scientific controversy. It is possible that correspondence passed between him and Liebig with reference to this work, but if so we have, unfortunately, no record of it.

† The original paper from which the above description is reprinted, appeared under the title "*Sur la reproduction de l'alcool par le bicarbure d'hydrogene*," in 1855 in the *Comptes rendus* Vol. XL., p. 102.

The discovery that the heating of the sulphuric acid promotes the absorption of ethylene and the consequent formation of ethylsulphuric acid was made, as Prof. Jungfleisch points out, by Goriainoff and Butleroff in their paper of 1873 ("Ueber die Polyölene und die Umwandlung von Aethylen in Aethylalkohol").† It is hardly fair, however, to attribute to these chemists the absolute and unqualified condemnation of Faraday's result. All that is claimed is that the absorption is facilitated in their particular form of apparatus by raising the temperature; they introduced a new principle which raised the academic results of Faraday and Berthelot to the rank of a potential practical process, and they even suggested that the success of Berthelot's synthesis may have been due not simply to intimate mixture of the gas and acid brought about by the mechanical agitation, but to the rise of temperature caused by the agitation. May it not also be suggested that Faraday's impure ethylene containing alcohol and ether vapours, when brought into contact with sulphuric acid, was absorbed with a sufficient elevation of temperature to increase the percentage of "synthetical" sulphovinic acid?

Coming now to the first step, the synthesis of ethylene from acetylene, there is of course no difference of opinion between the contending parties. The palm must be awarded to Berthelot, and the chemical world in general has long acknowledged its indebtedness to the illustrious French chemist for the discovery of this elegant and fundamental point of departure in organic chemical synthesis. The question raised by me in 1895, however, centred entirely round the synthesis of *vital* products; ethyl alcohol being regarded as such a product in opposition to the views concerning its origin held in the time of Faraday and Hennell. Of course neither Faraday nor Hennell could have realised the significance of their discoveries from this point of view in 1828, and all arguments directed against this work on account of their silence on this point appear to me quite futile.‡ Berthelot in 1855 had of course fully realised his achievement, for he says in his paper of that year already referred to:—"C'est la première fois que l'alcool est obtenu sans l'intermédiaire d'une fermentation" (*loc. cit.* p. 104). Also in his "Leçons sur les Methodes Générales de Synthèse" (1864):—

"Voila donc la synthèse du premier composé qui puisse s'appeler naturel."

From this it would almost appear that he did not consider Wöhler's synthesis of urea as the synthesis of a natural product or else that it was not "complete" or "total" from his point of view. The whole question of what is understood by "complete synthesis" is thereby raised, and this, as I have previously said, is entirely a matter of definition. It is certainly due to the work and teaching of Berthelot that the term organic synthesis has become associated in modern chemistry with the idea of totality or completeness in the sense of setting out from a compound, such as a hydrocarbon, capable of being formed directly from its elements. From this point of view then, Hennell's synthesis was not "total," because Faraday's sulphovinic acid had, as I contend, been formed at least partially from ethylene obtained from alcohol. But in this sense neither was Berthelot's first synthesis complete, because in the experiment above described it is clear from the admission that the ethylene used by him was purified so as to free it from ether vapour that his gas was also prepared from alcohol. It was not until he had repeated this experiment with ethylene from acetylene that the synthesis became total. A reference to this repetition with synthetical ethylene is made in his work "De la Synthèse en Chimie Organique" published in 1860 (p. 183), already quoted, but no description of the experiment is given. It would have been no easy task at that time to prepare 31—32 litres of ethylene from acetylene. Possibly the repetition was a small scale experiment. At any rate I have not been able to find any published details of this work, although I do not profess to have exhausted the literature, because the point appears to me quite immaterial. It is significant that in this same work he describes the separation of ethylene from illuminating (? coal) gas through the formation of the iodide and the decomposition of the crude product by potash. From 300—400 litres of the gas he obtained by this method ½-litre of olefiant gas.

If it be conceded in accordance with the evidence submitted that some unknown proportion of Faraday's sulphovinic acid was synthetical, then the difference between Hennell and Berthelot resolves itself simply into the use by the former of ethylene derived from alcohol after Faraday had shown that the destructive distillation of oil gave rise to this gas among other products, whereas Berthelot showed that ethylene *could be* obtained from carbon and hydrogen, *viâ* acetylene, and that such ethylene *could be* converted into alcohol, although for practical experimental purposes he also used the gas obtained from alcohol. To maintain that the ethylene obtained by the destructive igneous decomposition of oil renders the synthesis of any compound therefrom "incomplete," because oil is an organic (*i.e.*, vital) product to start with, seems to me to be both an unnecessary and an unscientific limitation of the term organic synthesis. At any rate, Wöhler's synthesis of urea was, as has already been pointed out, in precisely the same position with respect to its generators. It is open for any extreme advocate of the narrower interpretation of synthesis to claim this discovery also for Berthelot, since chemical science is again indebted to the late illustrious French chemist for the proof that cyanogen compounds can be directly synthesised from carbon, hydrogen, and nitrogen. From the biochemical point of view, however, any process which, like destructive distillation, yields products devoid of life supplies materials which, for synthetical purposes, may be regarded as legitimately "inorganic," as though they had been formed by the electric arc or the electric furnace. Hennell's synthesis of alcohol still appears to me to be as "complete" as the state of chemical science in his time admitted. With Wöhler he must, I think, be credited with having been the first to prepare a vital product by purely chemical methods, although, unlike Wöhler, he was unable to realise that he had achieved a biochemical triumph. This decision I should like to repeat in conclusion, is arrived at "without prejudice," and with the most profound and undiminished admiration for the beautifully perfected methods of th late M. Berthelot.

Yorkshire Section.

Meeting held at Station Hotel, York, on Monday, April 25th 1910.

PROF. W. M. GARDNER IN THE CHAIR.

A COMPARISON OF DIFFERENT TYPES OF CALORIMETERS FOR SOLID FUELS.

BY L. L. LLOYD PH.D., AND G. W. PARR.

The experiments here recorded were carried out in orde to compare the relative value of different types o calorimeters for the determination of the calorific power o solid fuels.

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[*] See, for example, his "De la Synthèse en Chimie Organique," Soc. Chim. de Paris, 1860; Leçons de Chimie, etc., p. 184. There is some discrepancy between this and the published statements in Beilstein & Watts, both of whom state that HI and HBr combine with ethylene at 100°, but that HCl does not.

[†] Annalen, Vol. CLXIX., p. 146.

[‡] It is scarcely necessary to point out that the recognition of alcohol as a vital product is mainly due to the immortal work of Berthelot's great compatriot, Pasteur.

The following calorimeters were used—Bryan Donkin, Roland Wild, Darling, and the Lewis Thompson.

The Bryan Donkin Bomb Calorimeter.—The experiments vere all carried out, using water in the calorimeter at the emperature of the room, and the combustion was effected n each case under a pressure of 20 atmos. Ignition of the uel was made by means of fine platinum wire, and contact nade for about three seconds, so that the heat developed y the current may be neglected. No correction has been nade for the nitric acid formed during combustion.

The apparatus gives consistent results with finely powdered coals, but coke requires the passage of the urrent for some ten to fifteen seconds in order to start ombustion, and consequently untrustworthy results are obtained. The coke is, however, completely combusted when mixed with a long flaming coal.

The Roland Wild Calorimeter is a simple modification of Parr's calorimeter, the fuel being burnt with sodium peroxide and ignition effected by means of a piece of nickel wire half an inch long, which is heated to redness and dropped through a valve into the combustion chamber, he valve being then closed as quickly as possible. The nickel wire being very small, no correction need be applied. As in Parr's calorimeter, the correction for the heat of ombination of the combustion products of the fuel and odium peroxide is assumed to be equal for all kinds of uel; this amounts to 27 per cent. of the total heat produced, and therefore 0·73 grm. of fuel is taken instead of one grm.

With long flaming coals a flash is produced in the form of a flame projected through the valve, but with nonbituminous coals the combustion takes place quietly. Coke, unless very finely powdered, is with difficulty gnited; this, however, may be overcome by mixing the coke with a known quantity of dry tartaric acid for which a correction must be made.

The sulphur and phosphorus in the fuels are completely oxidised, and may be estimated in the melt by the usual methods.

The Darling Calorimeter.—The fuel was combusted as completely as possible, the time required for combustion was about 10 minutes, from 3 to 4 litres of oxygen being used, no corrections being made for unburnt fuel.

The Lewis Thompson Calorimeter.—No corrections were made for unburnt fuel.

A summary of the results is given in Table I., and the results compared, in percentages, with the Bryan-Donkin as standard in Table II.

Lewis Thompson Calorimeter.—This apparatus gives fairly comparative results for bituminous coals. The best results appear to be obtained by diluting the fuel as largely as possible with the chlorate mixture; a practical limit is, however, reached, at which point the combustion starts with difficulty, and probably owing to the presence of fused chloride, the charge soon goes out. For non-flaming coals, the results are untrustworthy, the amount of unburnt coal in many cases being very high.

Darling Calorimeter.—This calorimeter is only of value for bituminous coals, the complete combustion of non-flaming coals being very difficult.

Roland Wild Calorimeter.—The results for bituminous coals are in all cases higher in value than those obtained with the Bryan Donkin; this may possibly be due to the combustion of the hydrogen in the fuels. With anthracite and coke, practically similar results are obtained with the two forms of calorimeter mentioned above.

Brame and Cowan (this J., 1903, 1230) have obtained, with the Lewis Thompson calorimeter, results which are lower by 1·8 to 6·2 per cent. than those obtained with the Mahler bomb calorimeter, and Gray and Robertson (this J., 1904, 704) quote results which are similarly 0·9 to 13 per cent. lower.

The combustion of pure substances by means of the Bryan-Donkin and the Roland Wild calorimeters is being carried out.

Table I.

Coal.		Bryan Donkin.	Roland Wild.	Darling	Lewis Thompson.
A. Long flaming ...	M.	7539(7)	7624(8)	7453(6)	7276(6)
	H.	7556	7664	7562	7522
	L.	7492	7499	7325	6844
B. Long flaming ...	M.	6318(6)	6567(6)	6287(6)	6324(6)
	H.	6370	6583	6384	3176
	L.	6243	6527	6107	6232
C. Anthracite.	M.	7321(6)	7316(6)	6530(7)	*
	H.	7360	7389	6980	
	L.	7301	7278	6120	
Dı. Coke in very fine powder.	M.	*	7122(6)	*	*
	H.		7166		
	L.		6933		
Dii. Coke results from mixture.	M.	7045(6)	7092(6)	6638(6)	*
	H.	7106	7114	6844	
	L.	6972	7056	6048	
E. Salicylic acid ...	M.	4732(6)	4976(6)		
	H.	4884	4999		
	L.	4635	4935		

Table II.

A.	....	+1·13	— 1·14	—3·49
B.	....	+3·92	— 0·49	—0·1
C.	....	—0·068	—10·81	
Dii..	....	+0·67	— 5·78	
E.	....	+5·1		

A & B. Bituminous Coals.
C. Anthracite.
Dı. Finely powdered coke.
Dii. The results were calculated for coke, but the experiments carried out with coke and a bituminous coal of known value.
E. Salicylic acid was used as a standard.
* Results in these cases were so variable as to be unreliable.

Discussion.

Mr. S. H. **Davies** asked if any other substance besides salicylic acid had been used for the experiments, and if so had a separate calculation been made for every different kind of substance used.

Mr. T. **Fairley** asked what time was taken for the maximum rise of temperature. A correction should be introduced for the heat of decomposition of such substances as sodium peroxide and potassium chlorate where these were used in the combustion. This might be done by burning something of definite compositon like pure carbon.

Mr. W. **Gathorne Young** asked if the author had any experience of the Cook modification of the Mahler bomb. It was generally recognised as the most reliable instrument, and was used at the National Physical Laboratory. He welcomed the appearance of a reliable instrument at a low price, which would make it more popular than the existing instruments for precise fuel calorimetry. The Bryan Donkin calorimeter gave maximum and minimum results nearer to the average than the Roland Wild calorimeter according to the experiments in Tables 4 and 5, but these differences were not important. Had any experiments been made with liquid fuels? He suggested pure ceresin as a standard substance. Could barium peroxide be substituted in the case of liquid fuels, since it was more stable.

Mr B. G. **McClellan** referred to the incompleteness of the combustion of naphthalene which had been noted by several investigators when this substance is used for the determination of the water equivalent of bomb calorimeters, and said that phthalic anhydride and sugar were used with excellent results. His experience with the Cook modification of the Mahler bomb had shown that it gave very satisfactory results with solid fuels, but he found that considerable damage to the glaze lining resulted when this instrument was employed for liquid fuels such as petrol.

Mr. J. **Evans** asked if the higher values for the Roland Wiid figures were due to the use of sodium peroxide.

Prof. A. Smithells said that in fuel calorimetry, results often averaged out correctly, although in many instruments corrections for variation and composition were ignored. The Lewis Thompson calorimeter, for instance, gave wonderfully accurate results for such a crude method.

Dr. L. L. Lloyd, in reply, said he had tried tartaric and other acids in addition to salicylic acid, and was now trying other substances containing higher percentages of hydrogen. Naphthalene on combustion did not burn completely. The time taken for the rise in temperature to the maximum was two minutes. He had not come across any account of the Roland Wild calorimeter before these results were published, and thought they were all within the limit of experimental error. The calorimeter could not be used for liquid fuel, since it was impossible to mix such substances with sodium peroxide if traces of sulphur were present. An allowance was made for heat of decomposition of sodium peroxide by taking only 0·73 grm. of the fuel. Unless perfectly dry sodium peroxide was used the results were not reliable. Barium peroxide decomposed on heating, and was therefore not suitable.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Boiler-incrustations; Influence of ——, on the economy and safety of heating installations. E. Reutlinger. Z. des Ver. deutscher Ingenieure, 1910; through Stahl u. Eisen. 1910, 30, 929—930.

The effect of incrustations in retarding the transmission of heat has been greatly overestimated; on the other hand they may cause dangerous overheating of the plates. Calculation shows that an incrustation 5·5 mm. (¼ inch) thick may cause losses of heat amounting to 20—30 per cent. according to the temperature of the firing gases. Oil or fat is much more objectionable in this respect; a coating of tar 0·3 mm. thick caused a loss of 30—45 per cent. If the transference of heat is effected entirely by contact and not by radiation, the losses caused by incrustations may not, where hot gases form the heating medium, be more than one-third of the above amounts; but they are much greater where the heating is done by hot water or saturated steam—in cases as much as 70—80 per cent. In such cases (steam-heated evaporators, brewing coppers, etc.) incrustations should be most carefully avoided. Where the temperatures of the heating medium and of the material heated do not remain constant, the author comes to the following conclusions:—1. *Heating medium constant, heated fluid variable.*—(Steam-heated hot-water apparatus, surface condensers, etc.) For apparatus not too heavily worked and of moderately large size, the loss may amount to 15—30 per cent.; for smaller heating surface, or rapid circulation, as much as 50 per cent. 2. *Heating medium variable, heated fluid constant.*—(Boilers, and all arrangements in which steam experiences changes of pressure and temperature at different parts of the heating surface). The loss may amount to about 7 per cent. if contact-heating alone be considered; 5 per cent., if the heating be both by contact and radiation. The loss increases somewhat with the demands made upon the boiler; but even in a locomotive boiler in full work, an incrustation of 2—3 mm. thick will not cause a loss of more than 5—9 per cent. 3. *Both heating medium and heated fluid variable.*—(Feed heaters, economisers, spray condensers). For installations heated by saturated steam, losses of 20—35 per cent.; for those heated by gases or superheated steam, losses of 5—15 per cent. For very narrow tubes, or for heat-transference between moving liquids, the loss may amount to 50 per cent.—J. T. D.

Patents.

Crucibles. The Morgan Crucible Co., Ltd., and C. W. Speirs, London. Eng. Pat. 10,771, May 6, 1909.

A limit is placed on the size of crucibles of the ordinary type by considerations of strength and rate of heating. The crucible claimed is provided with a central flue of such shape that the transverse section of the trough of the annular crucible so formed is similar to that of an ordinary crucible.—J. W. H.

Pumping or propelling liquids and gases; Rotary apparatus for ——. J. G. Calvert, Gothenburg, Sweden. Eng. Pat. 14,233, June 17, 1909. Addition to Eng. Pat. 214, Jan. 4, 1909.

The screw pump or propelling apparatus claimed is a modification of that described in the main patent (this J., 1910, 141), by which the axial flow of the fluid through the pump is facilitated. At the outlet and inlet ends, the conical casing and the core which carries the helical vanes are made cylindrical. In the case of the pump with a stationary receiving chamber, vanes are secured to the stationary conical core with a view to destroying the circumferential motion of the fluid.—J. W. H.

Filtering liquids; Apparatus for ——. J. Wilson, London. Eng. Pat. 433, Jan. 7, 1910.

The apparatus comprises a filtering tank, having troughs of U- or V-section formed in the bottom, and containing a bed of filtering material such as sand and shingle. Perforated outlet pipes for the filtered liquid are arranged in each of the troughs. In order to permit of a thorough cleansing of the filtering medium at intervals, a separate set of perforated pipes is arranged in the troughs, these pipes being connected to a water supply. The filter-bed in cleansed by first blowing air through the outlet pipes, and then permitting an upward flow of clean water from the second set of perforated pipes.—A. T. L.

Filtering apparatus. D. J. Kelly Assignor to Kelly Filter Press Co., Salt Lake City, Utah. U.S. Pat. 957,467, May 10, 1910.

Means are provided for exhausting the air from a filter tank during the time it is being filled and for supplying compressed air during the process of filtration, when the "hydraulic pressure" due to the liquid being filtered has fallen below a definite predetermined value. The supply of compressed air is automatically regulated by the pressure existing in the tank.—W. H. C.

Vacuum-filter. M. E. Hiltner, Deadwood, S. D. U.S. Pat. 957,558, May 10, 1910.

The filtering medium is arranged upon an endless belt which passes over a pair of pulleys. The filtering surface is alternately put into connection with a vacuum- or a pressure-chamber. During the time the filter is connected with the pressure-chamber the surface is sprinkled by a suitable device.—W. H. C.

Filtration of liquids. H. C. Hinton. Fr. Pat. 408,963, Feb. 4, 1909.

Sand or other suitable filtering medium is mixed with water and pumped through a filter-press so that layers of sand are formed between the plates. After draining away the water, the liquid to be filtered is introduced into alternate plates, passes through the sand bed and away by the next plate. If a more perfect filtration is required, the liquid is made to pass successively through two or more layers of sand. This is effected by altering the adjustment of the discharge taps.—W. H. C.

Distilling apparatus. G. Laczay, New York. U.S. Pat. 957,613, May 10, 1910.

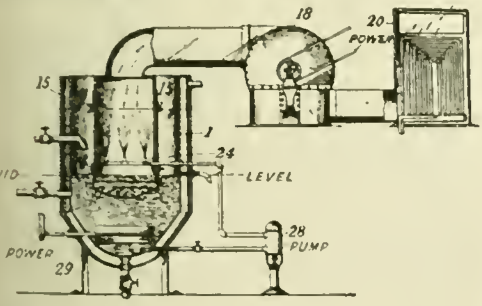
A water-jacketed still or boiler supported on trunnions so that it can be tilted, has a diaphragm supported just below the flat cover and has a spiral passage formed between the diaphragm and the cover by a spiral partition. Water is conducted from the condenser tank by a small pipe to the centre of the spiral passage.—W. H. C.

Distillation, fractionation, and rectification; Horizontal column for ——. O. Perrier. Fr. Pat. 409,041, Feb. 6, 1909.

Two horizontal shafts each carrying a series of discs dipping into the condensed liquid, rotate at a high speed in opposite directions in a horizontal oval drum through which the vapours from the still pass. A series of partitions divides the drum into chambers, so that the vapours pass through the chambers in turn and are subjected to the spray produced by the rotating discs.—J. W. H.

Condensing or desiccating fluid substances. A. G. Kalb, Chicago, Ill., Assignor to Natural Dry Products Co., Augusta, Me. U.S. Pats. 957,685, 957,686, 957,849, and 957,850, May 10, 1910.

(1) and (2). The liquid to be condensed is heated in the steam-jacketed vessel, 1, agitated by the stirrer, 29, withdrawn by the pump, 28, and returned through the jets, 24, in the form of spray into the inner vessel, 15. The latter has a perforated bottom and is partially immersed in the liquid in the vessel, 1. Air, heated in the stove, 20, is forced by the fan, 18, into the vessel, 15, and after passing through the spray passes through the perforations and through the liquid in the vessel, 1. (3) and (4). The method and apparatus are substantially similar to those just described, but a collecting chamber is provided in which any solid particles carried away by the current of air are arrested.—W. H. C

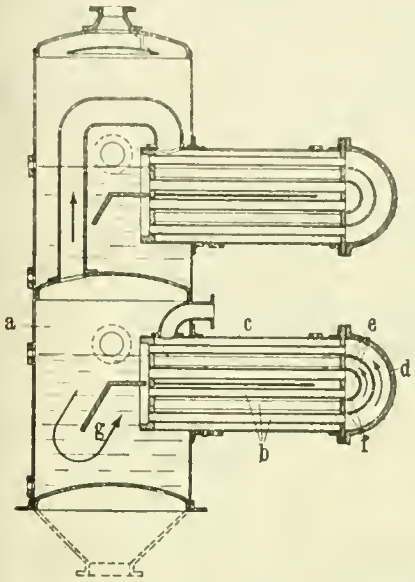


Regenerative furnace. F. Meyer, Englewood, N.J., Assignor to Metallurgical Co. of America, New York. U.S. Pat. 958,150, May 17, 1910.

A furnace for heating retorts, muffles, crucibles, etc., comprises a horizontal combustion chamber divided into two compartments by a dividing wall having fuel inlets. The two compartments communicate at one end, and are connected at the opposite end by a downtake, to regenerators which serve alternately for heating the air and for the passage of the products of combustion when the currents are reversed.—A. T. L.

Evaporating apparatus with lateral heater. Maschinenbau-Akt.-Ges. Golzern-Grimma. Fr. Pat. 408,888, Oct. 11, 1909.

The tubular heater, c, projects laterally from the body of the vacuum vessel, *a*, and is provided with perfectly straight tubes, *b*. The liquid circulates as shown by the arrows beneath the baffle-plate, *g*, through the tubes, *b*, and the bends, *e*, and returns through the upper tubes. The cover, *d*, with the connecting bends, *f*, is easily removable to allow the straight pipes, *b*, to be cleaned out. —W. H. C.



Centrifugal machine or hydro-extractor; High speed ——. H. Copaux. Fr. Pat. 408,996, Nov. 13, 1909.

The bowl or drum of the machine is enclosed and rotated within a closed chamber from which the air can be exhausted. The object of this is to avoid the retardation due to the friction of the air against the drum, in order to attain a high speed.—W. H. C.

Extracts; Process for the manufacture of dry —— in a porous form rendering them easy to dissolve or reduce to powder. J. F. P. Kestner. Fr. Pat. 409,053, Feb. 6, 1909.

The liquid extract is concentrated under a pressure equal to or greater than that of the atmosphere and at a temperature somewhat exceeding 100° C., until if cooled it becomes solid. The concentrated liquid is then run while hot into a vacuous chamber to obtain a dried, porous, and easily powdered solid.—J. W. H.

Melting solid materials or refining liquid substances; Process for ——. O. Thiel. Fr. Pat. 409,573, Nov. 24, 1909. Under Int. Conv., Sept. 18, 1909.

A bath of molten cast iron is used for melting solid materials (e.g., crude phosphates, etc.) or for refining liquid substances (slags). When the desired result is obtained, the materials are removed through an opening above the bath and a new charge added at once.—J. W. H.

Rate of flow of steam and other gases and vapours; Method of and apparatus for determining ——. C. C. Thomas, Madison, Wis., U.S.A. Eng. Pat. 30,405, Dec. 29, 1909. Under Int. Conv., Dec. 30, 1908.

See U.S. Pat. 946,886 of 1910; this J., 1910, 260.—T. F. B.

Rate of flow of gases, vapours, and other fluids; Process and apparatus for determining the ——. C. C. Thomas. Fr. Pat. 410,788, Dec. 28, 1909. Under Int. Conv., Dec. 30, 1908.

See U.S. Pat. 946,886 of 1910; this J., 1910, 260.—T. F. B.

Concentrating liquids; Apparatus for ——. P. Kestner, Lille, France. Assignor to Kestner Evaporator Co., Philadelphia. Reissue No. 13,117, dated May 24, 1910, of U.S. Pat. 882,322, March 17, 1908.

See Eng. Pat. 18,576 of 1907; this J., 1908, 13.—T. F. B.

Evaporating and concentrating liquids; Apparatus for ——. E. Shaw. Fr. Pat. 410,791. Dec. 29, 1909.

See Eng. Pat. 20,765 of 1908; this J., 1910, 200.—T. F. B.

Separating liquids from solids; Process of ——. H. G. Nichols, near Ymir, British Columbia. U.S. Pat. 958,272, May 17, 1910.

See Fr Pat. 389,706 of 1908; this J., 1908, 1008.—T. F. B.

Errata.—This J., 1910; 678, col. 2, l. 24 from top (title) for "Roak" *read* "Roake." This J., 1910; 679, col. 1, l. 5 from bottom (title) *for* "Rodke" *read* "Rodhe."

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Action of air on ——. P. Mahler. Comptes rend., 1910, **150**, 1521—1523.

On passing a current of dried and purified air over finely powdered dried coal (different samples of French coals) at temperatures up to 105° C., water, carbon dioxide and carbon monoxide were produced, the quantities increasing in general with the temperature, but varying according to the state of division of the coal and the velocity of the air current. 150 grms. of a coal from Courrières, for instance, yielded in 30 hours the following quantities of carbon dioxide and monoxide respectively at the temperatures mentioned:—25°—30° C., 1·00 c.c., 2·88 c.c.; 45° C., 1·55, 3·73; 65° C., 4·25, 5·59; 85° C., 12·00, 4·97; 105° C., 30·00, 6·67 c.c. When the coal was not first dried, the production of carbon monoxide was much smaller, viz., 1·13 c.c. in 30 hours at 35° C. Experiments were also made under similar conditions at higher temperatures, and it was found that above 125° C. there was a considerable increase in the amounts of water, carbon dioxide, and carbon monoxide produced, whilst indications were also obtained of the formation of hydrocarbons. Above 150° C., the condensed water was distinctly acid and had an acetic odour. In all cases ulmic (humic) acid was produced from the coal in addition to the other oxidation products.—A. S.

Tan bark as a boiler fuel. D. M. Myers. School of Mines Quarterly, 1910, **31**, 116—144.

The author gives in detail the results of numerous practical trials of spent tan for steam-raising purposes. The material, in both pressed and unpressed condition, was used alone and in admixture with wood and coal. The boilers were of the horizontal tubular kind, the construction of the furnaces, method of stoking, etc., being variously modified during the progress of the investigation. The spent tan as obtained in the fire-room contained about 65 per cent. of moisture, its weight averaging 2·13 times that of the air-dry bark ground at the mill. The available heat value of the air-dry bark being about 5676 B.T.U. per lb., that of the spent tan averaged 2665 B.T.U. per lb., and the degree of leaching was found not to influence the heat value of the spent material, except in so far as it affected the actual weight. The percentage composition of a representative sample of spent hemlock tan was found to be 51·8 of carbon, 6·04 of hydrogen, 40·74 of oxygen, and 1·42 of mineral ash. As the result of tests made with wet spent hemlock tan in a typical installation at a tannery, the combined efficiency of boiler and furnace was found to be 58·2 per cent., based on the available heat value, and 43·9 per cent. calculated on the total heat value, of the fuel; while, when an automatic stoker furnace designed by the author was employed, the efficiency figures obtained were respectively 71·1 and 54·4 per cent. The increase in available heat obtained by pressing the spent tan before burning was found to be about 1⅛ per cent. for each per cent. of moisture expelled; but the amount of moisture retained rarely falls below 58 per cent., and since pressed tan burns more rapidly than the unpressed material, a corresponding reduction in grate area is necessary in order that pressing may be advantageous in practice. In a series of comparative tests it was found that the addition of about 1 part by weight of coal to 6 parts of pressed tan increased the combined thermal efficiency of furnace and boiler from 59·4 to 63·4 per cent., the percentage rated capacity of the boiler being increased from 92 to 135·5. When wood was mixed with the tan for firing, the best results were obtained by grinding the wood to the size known as "hog-feed," the presence of logs or slabs of wood being found disastrous both to the furnaces and to combustion. The author finds that ample combustion space is necessary for the satisfactory burning of tan, and for this reason regards low-arched furnaces as unsuitable for the purpose. He also finds that tan cannot be burned economically in an ordinary coal setting without a refractory arch separating the fire from the cooling surface of the boiler shell or tubes, this being the case both for hand firing and automatic stoking, even when the tan is enriched with coal in such proportion that the heating values of the two fuels are equal. Under normal conditions, the boiler horse-power per square foot of grate was found to be about 2·08 for oak tan and 1·5 for hemlock tan, these values being very largely influenced by the comparative excellence of the firing. The author concludes that, basing comparison on flue gas analyses, the combustion of tan is more complete than that of coal under equally favourable conditions. The high moisture content of the tan, however, produces a comparatively low furnace temperature, and acts against an equally high combined efficiency of furnace and boiler.—W. E. F. P.

Carbon and hydrogen; Direct union of ——. *Synthesis of methane. Part II.* W. A. Bone and H. F. Coward. Chem. Soc. Proc., 1910, **30**, 146.

In continuation of their previous experiments (this J., 1908, 1143), the authors are now able to report a not less than 95 per cent. yield of methane from less than 0·03 grm. of highly purified sugar charcoal (containing not more than 0·06 per cent. of ash and less than 0·1 per cent. of hydrogen) by maintaining it in a steady current of pure dry hydrogen at 1150°C for from seventeen to twenty-five hours continuously, thus completing the proof of the direct synthesis of methane from its elements at this temperature.

Petroleum spirit; First Report of the Departmental Committee on ——. [Cd. 5175.]

The first report of the Departmental Committee on Petroleum Spirit, which was appointed in December, 1908, has been issued as a Parliamentary Paper. The Committee consists of Sir H. H. Cunynghame (chairman), Sir B. Redwood, Major A. McNeill Cooper-Key, Mr. J. Ollis, and Mr. A. Boyle, and the terms of reference were "to inquire into the sufficiency of the existing regulations relating to the storage, use, and conveyance of petroleum spirit, and to report what further precautions, if any are in their opinion desirable as tending to diminish the dangers attendant thereon." The expression "petroleum spirit" in the report means "any petroleum to which the Petroleum Acts, 1871 to 1881, apply, *i.e.*, petroleum having a flashpoint of less than 73° F. when tested in the manner prescribed by the Petroleum Acts." At the date of the passing of the Petroleum Act of 1871, the trade in petroleum spirit was small compared to its present dimensions. Motor spirit is now obtainable in most villages. In addition to this the use of petroleum spirit has greatly increased. Omissions, which at the time of the passing of the Act were negligable, have now assumed importance. Since the year 1905 the amount of petroleum spirit imported into the United Kingdom has trebled.

The most important of the defects and omissions is the omission of any provision for Government control, or the need for a central authority. The whole administration of the Petroleum Acts is in the hands of the local authorities, which, except in Scotland, are for the most part, small bodies. Provision for direct Government control should be made in such a way that it may be possible (1) for general rules to be made by the central authority prescribing such general principles as are universally applicable for guarding against dangers arising from the storage, use, and conveyance of petroleum spirit, and (2) for officers to be appointed to supervise the working of the Acts by inspection or otherwise. But this should not diminish the responsibility of local authorities for carrying out the provisions of the Acts. Their existing powers of imposing conditions in the licences granted by them should be preserved, and general rules should not be made without previous notice to local authorities, and, if necessary, a departmental inquiry at which the local authorities and the various interests concerned should be represented. In view of the great growth in the amount of petroleum spirit stored and used, the number of local authorities should be reduced by the substitution of county councils for district councils in England and for justices in petty sessions in Ireland. There should be a definite obligation placed upon the local authority to appoint officers whose duty it shall be to enforce the provisions of the Acts, and the powers of local authority officers are insufficient. But these officers should not be given greater powers than those conferred upon an officer of the local authority under the Explosives Act. The ease with which petroleum spirit can be obtained has caused a great increase in its use for domestic dry-cleaning. To forbid totally the use of the spirit in private houses would be too drastic, but much might be done for the coming generation by simple instruction in the properties of petroleum spirit and the dangers inherent in its use for domestic purposes. The use of petroleum spirit hair-washes in hairdressing establishments should be prohibited, and it should be made illegal for any hairdresser to use petroleum spirit on the hair of the living subject. No great change is necessary in the present regulations applicable to the keeping of petroleum spirit for use in motor vehicles, but the regulations should be made under the Petroleum Acts and not under the Locomotives on Highways Act, and regulation No. 7 should be amended to allow of two spare tins being carried on a motor-car without notification to the local authority, and a regulation should be added making it compulsory to keep a supply of dry sand or some other suitable substitute in every storehouse or garage. Larger vessels than those at present allowed should not be kept under the regulations. The fitting of a gauze-protected vent pipe or other safety device of some approved description should be compulsory in motor boats licensed to ply for hire, and section 7 of the Petroleum Act, 1871, should be altered to prevent the keeping of petroleum spirit in any glass or earthenware vessel of a greater capacity than half a pint. Large quantities of petroleum spirit are manufactured by distillation. In these cases, a storage license is required by the terms of which such conditions as will secure safety can be imposed. It is therefore unnecessary to recommend further restrictions, since the manufacture is sufficiently regulated under the existing law.

Calibration and method of using the combustion calorimeter. Roth. *See* XXIII.

Patents.

Drying apparatus for peat and the like. C. A. Matheson, Assignor to G. B. Farmer, Perth, Ontario, Canada. U.S. Pat. 957,232, May 10, 1910.

The peat is caused to pass over the stepped bottom of a removable pan arranged within a suspended casing to which a reciprocating motion can be imparted. The pan is heated by suitable means and a layer of heat-insulating material is interposed between the pan and the casing.
—W. H. C.

Briquettes; Manufacture of —— from porous and hygroscopic fuels such as peat. T. Franke. Fr. Pat. 409,589, Nov. 25, 1909. Under Int. Conv., April 26, 1909.

The peat is freed from incombustible matter and while still wet is mixed with a readily combustible binding agent and formed into briquettes. In this way, after the moisture has evaporated, the briquettes retain the porous character of the peat, and burn more efficiently owing to the presence of oxygen and moisture in the pores.
—A. T. L.

Coke-ovens; Charging ——. F. W. C. Schniewind, New York. Eng. Pat. 10,485, May 3, 1909.

A charging-hopper mounted on a trolley is carried on rails above a battery of ovens, so that it can be brought over the charging door of any oven. The hopper is of the same length as the ovens, and discharges the coal uniformly over the length of each oven by means of a rotating drum with projecting arms or ribs arranged beneath the mouth of the hopper. The trolley also carries mechanism for raising and lowering the covers of the charging apertures, and for ramming down the charge, and in order that this mechanism may be directly above the charging apertures, the hopper is arranged to one side and a plate or apron is provided beneath the drum to guide the coal into the charging aperture.—A. T. L.

Coke-ovens; Means for charging ——. J. H. Darby and W. Colquhoun, Sheffield. Eng. Pat. 11,035, May 10, 1909.

To prevent the formation of "black-ends," *i.e.* uncoked coal, against the lining of the doors, the retort is charged in such a way as to leave a free space at the charging end. For this purpose, in charging, a false plate is placed between the charge and the push-plate. The push-plate is withdrawn and the charging door closed upon the false-plate while the charging "peel" is withdrawn, and the door is then again opened for the removal of the false-plate.
—A. T. L.

Coke and the like: Apparatus for conveying, cooling, and discharging incandescent ——. Berlin-Anhaltische Maschinenbau-Act.-Ges., Berlin. Eng. Pat. 18,908, Aug. 17, 1909. Under Int. Conv., June 30, 1909.

The apparatus is of the type in which a truck into which the coke is discharged from the retorts is driven by an endless cable to the point where it is emptied, and back again to the retorts. The installation is arranged so that a workman in the retort-house can control the whole operation of discharging the retorts, quenching the coke, and emptying the trucks. In one form, the truck runs to and fro along the same track. The endless cable is driven in either direction by a pulley with open or crossed-belt drive. The belt-shifter has three positions, for forward and backward drive and for stopping respectively, and is controlled from the retort-house by an endless cord. On leaving the retort-house, the truck is automatically stopped beneath a quenching spray, at the bottom of an up-gradient, while the driving arm on the endless cable leaves the truck and passes down and along a loop formed by guide-pulleys beneath the track. An arm on the truck controls the water-valve as the truck passes. The driving arm on the cable, having passed the loop, takes the truck up an incline to the discharging platform, where it strikes a fixed stop which automatically opens the hinged sides of the truck. At the same time, an arm on the truck strikes an arm connected with the belt-shifter and reverses the direction of motion of the cable. The empty truck is thus taken back to the retorts, where it is stopped by the attendant pulling his controlling cord. In another form, an endless track is used, and the truck runs always in the same direction, so that any number of trucks may be used on the one track. In this case, the controlling cord is connected to the switch of an electromotor for driving the cable.—A. T. L.

Coke; Process for quenching ——. E. Schulte, New York. Assignor to The United Coke and Gas Co. U.S. Pat. 958,184, May 17, 1910.

The incandescent coke is charged into an air-tight chamber provided with inlet and outlet pipes for the passage of inert gases through the coke. The gases resulting from the combustion of a slight amount of the coke in the air enclosed in the apparatus are circulated by a fan through the column of coke and then through a cooling apparatus. This may be of the multitubular type, the gases passing over the exterior of water-cooled tubes.—A. T. L.

Coke; Process of quenching ——. H. Koppers, Essen-on-the-Ruhr, Germany. U.S. Pat. 958,651, May 17, 1910.

The coke is immersed in hot water for a sufficient time to cool the outer part of each lump, and is then exposed to the atmosphere. In this way a non-brittle coke of uniform quality is obtained.—A. T. L.

Coke-ovens. The Carbon Coke Co. Fr. Pat. 409,553, Nov. 24, 1909.

The oven comprises a tall vertical cylindrical chamber, into which coal is fed at the top, provided with a hinged bottom plate operated by a vertical link, the lower end of which is drawn back by a nut working on a screwed rod, for discharging. A series of vertical heating flues is formed by hollow segmental blocks built around the wall of the coking chamber, and an outer series of hollow segmental blocks forms the air-heating flues. Alternatively the heating flues may be horizontal, a separate burner being provided for each, and the coking chamber may be divided by a vertical partition into two chambers semi-circular in plan.—A. T. L.

Blast-furnace gases, etc.; Method and furnace for burning ——. H. E. Parson, Assignor to Parson Manufacturing Co., New York. U.S. Pats. 958,428 and 958,429, May 17, 1910.

The method is for the simultaneous combustion of solid fuel and blast-furnace gas. As applied to the heating of a steam-boiler, the boiler furnace contains a solid fuel fire, fed with an air-blast, and the gas is forced into the furnace by a separate blast. The boiler pressure is used to control automatically the blast for the solid fuel or both of the blasts.—A. T. L.

Deodorising exhaust gases especially those of internal combustion engines. L. Bregha and H. Kaiser, Vienna, Austria. Eng. Pat. 14,403, June 19, 1909.

The exhaust gases are passed through a chamber containing a mixture of calcium oxide and chloride before being allowed to pass into the air.—W. H. C.

Gas; Manufacture of —— *from peat.* Peat Gas and Coal Co. Fr. Pat. 409,263, Oct. 28, 1909.

The wet peat is treated in a disintegrator so as to destroy its porosity and at the same time it is sprinkled with petroleum or other hydrocarbon. The pasty mass is then heated in a retort until converted into coke. Air is admitted to the retort during the coking, and the heated air mixed with gas from the retort is carburetted by passing through tar obtained from the peat. The gas is then cooled and the by-products condensed.—A. T. L.

Gas-purifiers. Kölnische Maschinenbau Act.-Ges. and C. Wegescheidt, Köln, Germany. Eng. Pat. 16,243, July 12, 1909.

The purifier is built with double walls at each end and from both ends conduits are formed for the gas which extend the whole length of the purifier. These conduits are formed of louvred laths arranged in the shape of a roof, so as to support the oxide or other purifying material and leave a space below, through which the gas may flow and pass into or from the oxide through the openings between the louvres. The gas enters the space between the double walls at one end of the purifier, passes through openings into the louvred conduits which are connected to this end of the purifier and thence through the layer of oxide to the adjacent conduits connected to the other end of the purifier. From these exit conduits the gas enters the space between the double walls at the farther end and thence it passes to the delivery main. The flow of gas is controlled by valves provided with indicating gauges. When the purifiers are to be emptied, the laths of the louvres are turned vertically so as to allow the material to be easily discharged.—W. H. C.

Purifying, cooling, and drying producer and other gases; Apparatus for ——. J. Fritz. Ger. Pat. 218,734, May 6, 1909.

Hollow cylinders or cones are superposed in a casing and are provided on their surface with baffle-plates arranged to form a continuous zig-zag passage for the gas. The compartments formed by the baffle-plates are connected with the supply of water used for purifying the gas, in such a manner that the gas passes alternately through dry compartments and compartments supplied with water. Each compartment is provided with a separate outlet for condensed tar, etc.—A. S.

Gas; Apparatus for drying or purifying ——. A. Elsenhans. Ger. Pat. 221,966, Dec. 1, 1907.

The apparatus is of the type in which gas is freed from liquid by introducing it into a bell or drum rotating rapidly on a vertical axis, the liquid being projected against the wall of the drum by the centrifugal force. According to the present patent, the drum is rotated in an outer casing containing liquid, and the lower end of the drum dips into o just touches the liquid. The particles of liquid separated from the gas by the centrifugal force run down the wall of the drum and mix with the liquid in the outer casing, and so are prevented from being again entrained by the gas. The drum may be provided with openings fo the escape of the purified gas. Instead of the drum itself dipping into the liquid, its lower end may be surrounded by an annular partition dipping into the liquid, the purified gas escaping through the space between th drum and the partition. Several drums may be arranged one above the other on a common shaft, the liquid ma overflow from one casing to that next below, or may b supplied to and withdrawn from each casing independently. The invention can be applied to the centrifuga gas-purifier described in Ger. Pat. 180,863 (see Fr. Pat 360,341 of 1905; this J., 1906, 466), the outer annula partition of the purifier being extended downwards so a to dip into an annular gutter containing liquid.—A. S

Spent oxide of gas works; Treatment of burnt residue obtained by the burning of the ——. P. E. Williams Leytonstone. Eng. Pat. 2813, Feb. 5, 1909.

To produce a material, suitable for use in purifying coa gas from sulphuretted hydrogen, from the residue whic remains after the spent oxide has been roasted or burned fo the manufacture of sulphuric acid, it is necessary to extrac the iron sulphates which are contained in the residue, a these compounds interfere with the absorption of th sulphuretted hydrogen. The burnt residue is leached wit warm water to extract the iron and calcium sulphates an the residue is washed and dried. The solution of iro sulphates containing some calcium sulphate is treate with an alkali to precipitate the iron as hydrated oxide. The hydrated oxide obtained as above is, after drying to a sufficient degree, mixed in suitable proportions with the washed residue and with sawdust or other suitable absorbent material and is then ready for use in purifying gas. It may, if desired, be first rendered slightly alkaline with a solution of an alkali. An alternative method is claimed in which the burnt oxide is treated directly with an alkaline solution.—W. H. C.

"Waste" of the purification of illuminating gas; Utilisation of the ——. H. Simonin, Pierrefitte, France. Eng. Pat. 20,504, Sept. 7, 1909.

The spent oxide is first extracted with a weak (2 per cent.) caustic ammonia solution by which it is claimed that all the nitrogen existing as ammonia or as cyanogen compounds is rendered soluble. After washing the oxide free from ammonia, it is dried at a temperature just below 200° C., whereby all the water, naphthalene and tarry matters are driven off or decomposed but no sulphur is distilled. Finally the dry residue is distilled in absence of air to recover pure sulphur or it is burned in a current of air to produce colourless sulphurous or sulphuric acid. The solution containing ammonia and cyanogen compounds is distilled with lime to recover the ammonia and the residual liquid is distilled with caustic soda and steam to convert the cyanogen compounds into ammonia. —W. H. C.

Petroleum residues and tar; Process for separating solid hydrocarbons from ——. J. Tanne and G. Oberländer. Fr. Pat. 409,516, Nov. 23, 1909.

The petroleum residue or tar is dissolved in at least one-half its weight of benzene containing 5 to 10 per cent. of glacial acetic acid, with gentle heating. The solution is allowed to cool gradually, and after 12 hours is placed in a refrigerating chamber. After 48 hours the separation of paraffin, ozokerite, etc., is complete, and the liquid is removed in a press.—A. T. L.

Organic aluminium compounds [from montan wax]; Process for preparing ——. E. Schliemann's Export-Ceresin-Fabrik. Ger. Pat. 221,888, May 6, 1908.

Aluminium salts of montanic acid are obtained by treating crude or refined montan wax with aluminium compounds, preferably in presence of saponifying agents (alkalis). For example, 6·3 kilos. of metallic aluminium are digested with 84 kilos. of 33 per cent. caustic soda solution and 1000 litres of water until it is converted into hydroxide; 382 kilos. of melted, refined montan wax (containing about 70 per cent. of acid) is added to the solution, whereupon the insoluble aluminium tri-montanate, m.pt. 93°—95° C., is precipitated. By using more aluminium, the mono- or di-montanate may be produced. On account of their stability the products are well suited for use as impregnating materials.—T. F. B.

Fuel briquettes; Process of forming an agglomerant for the manufacture of ——. C. E. Hite. Fr. Pat. 410,016, Nov. 30, 1909.

See U.S. Pat. 941,454 of 1909; this J., 1910, 11.—T. F. B.

Coke oven. W. Mueller, Dusseldorf, Germany. U.S. Pat. 958,154, May 17, 1910.

See Fr. Pat. 404,671 of 1909; this J., 1910, 203.—T. F. B.

Coke ovens. W. W. Peck. Fr. Pat. 409,976, Nov. 3, 1909.

See Eng. Pat. 24,469 of 1908; this J., 1910, 11.—T. F. B.

Fuel; Production of ——. T. Parker, London. U.S. Pat. 958,761, May 24, 1910.

See Eng. Pat. 17,347 of 1906; this J., 1907, 1271.—T. F. B.

Producer gas; Manufacture of ——. H. Trachsler and F. Ernst, Zürich, Switzerland. Eng. Pat. 11,254, May 12, 1909.

See Ger. Pat. 211,575 of 1908; this J., 1909, 830. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 23,415b of 1899, and 14,077 and 16,986 of 1902.—T. F. B.

Gas and coke; Processes of and apparatus for producing ——. E. Gobbe, Jumet, Belgium. Eng. Pat. 11,265, May 12, 1909. Under Int. Conv., May 16, 1908.

See Fr. Pat. 402,767 of 1909; this J., 1909, 1187.—T. F. B.

Gas from peat and other substances; Processes for producing ——. J. D. Oligny, Ville Emard, and Peat Gas and Coal Co., Montreal, Canada. Eng. Pat. 23,760, Oct. 16, 1909.

See Fr. Pat. 409,263 of 1909; preceding.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Chestnut-wood; Behaviour of —— *on destructive distillation, and the products obtained.* G. Borghesani. Chem.-Zeit., 1910, 34, 609—610.

In the author's experiments, tests were made with wood from the trunk, branches and roots respectively of the chestnut tree. In the air-dry condition, the wood from the trunk contained 33·17 per cent. of moisture (drying at 150° C.) and 5·45 per cent. of bark; that from the branches contained 17·37 of moisture and 20 of bark; and that from the roots contained 31·14 per cent. of moisture and 20·1 per cent. of bark. The distillation tests were made in cast iron retorts, the temperature being raised gradually to 500° C. Two series of tests were made at different rates of distillation, *viz.*, 0·05 kilo. per hour and 1 kilo. per hour. After the test, the charcoal was withdrawn immediately and weighed, and then again weighed after standing in the air for 15 mins. The condensed products were also weighed, and the weight of gas was taken as the difference between the weight of the original wood and the combined weight of charcoal and condensed products, the loss on distillation being taken as 1 per cent. In the crude wood acid, after separation of the tar, the acetic acid was estimated by direct titration with $N/2$ ammonia, using sensitive litmus paper as indicator. Then, after fractional distillation, the methyl alcohol was estimated as methyl iodide (Krell, Ber., 1873, 6, 1310) or directly (Grodzky and Krämer, Ber., 1874, 7, 1492), and the acetone as iodoform (Krämer, Ber., 1880, 13, 1000). The results obtained (see following table) show that chestnut-wood stands between beech-wood and oak-wood in regard to its behaviour on destructive distillation.

Wood from.	Distillation.	Charcoal.		Total distillate.	Tar.	Wood acid.		Anhydrous acetic acid (calc.).	Methyl alcohol.	Acetone.	Wood gas.
		In the retort.	In the air.			Quantity.	Acidity as acetic acid.				
		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Trunk	slow	27·31	30·09	59·46	3·96	55·50	4·87	2·70	0·68	0·07	13·20
	rapid	22·76	25·74	54·05	3·30	50·75	4·10	2·25	0·56	0·06	23·19
Branches	slow	21·00	22·84	60·00	4·32	55·68	8·38	4·65	1·16	0·12	19·00
	rapid	17·50	19·54	54·54	3·60	50·84	7·00	3·90	0·97	0·11	27·96
Roots	slow	23·75	26·25	58·75	4·06	54·69	5·85	3·30	0·83	0·08	17·50
	rapid	20 00	22·74	53·41	3·38	50·03	4·90	2·75	0·69	0·07	26·59

—A. S.

Resins; Production of aldehydic —— by carbonising wood in closed vessels. R. P. Duchemin. Bull. Assoc. Chim. Sucr. et Dist., 1910, 27, 1101—1106 (Cp. Fr. Pat. 402,907 of 1908; this J., 1909, 1320).

Between the retorts and the condensers is interposed a series of saturating vessels in which the pyroligneous vapours, previously freed from tar, are treated with an alkali carbonate. The liquors which collect in these vessels are dark at first, but turn yellow on becoming acid, and then deposit a black, plastic amorphous magma which contains small quantities of water and of acetates. On heating, this resinous product melts at about 60° C., loses its water, and, if heating be stopped at about 200° C., it cools to a black, hard mass exhibiting a conchoidal fracture. If a mixture of formaldehyde and the heavy phenolic oils which separate on distilling crude pyroligneous acid, is heated in presence of hydrochloric acid, resinous substances of the same physical aspect as the product from the saturating vessels, are obtained, though part of the oils appears to remain unchanged, and the product requires to be thoroughly washed before it becomes firm and plastic. If the saturators are connected to only one retort, a very small proportion of resins is obtained, owing to the fact that the bulk of the aldehydic products is liberated before the phenolic products; if the saturators are connected to three or four retorts in which the distillations are started at intervals of 12 or 24 hours, the interaction of the aldehydic and phenolic products is very complete. These resinous substances are soluble in alkalis, and are reprecipitated by acids. They are readily soluble in methyl alcohol, benzene, methyl acetate, and acetone, though their solubility in these solvents decreases in proportion to the temperature to which they have been heated. Resinous substances are also obtained by distilling crude methyl alcohol in presence of alkali, but these differ from the product obtained in the saturating vessels, in that they are insoluble in alkalis; these resins, which are partially carried over in distillation, cause methyl alcohol to turn yellow in course of time. The removal of the resins in the saturating vessels facilitates the preparation of white sodium acetate and the purification of the methyl alcohol. In conclusion, the author suggests that the tars obtained by carbonising wood in closed vessels are merely solutions of resins in phenols.—L. E.

Patents.

Metallic filaments for incandescence lamps; Manufacture of ——. Cie. Franç. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 409,608, Nov. 25, 1909.

A small quantity of an alkali, such as sodium, potassium or ammonium hydroxide or carbonate, is added to the organic substances used to form the binding agent. For example, the binding agent may consist of 160 grms. of sugar, 160 grms. of gum tragacanth, 5 litres of water, and 5 c.c. of 28 per cent. ammonia.—A. T. L.

Carbon filaments [for electric lamps and other resistances]; Manufacture of ——. H. Draeger and Sprecher und Schuh A.-G. Fr. Pat. 409,906, Dec. 3, 1909. Under Int. Conv., Nov. 30, 1909.

Filaments having carbon as a base and containing a metal such as mercury or bismuth absorbed in the pores, and also containing a non-metallic element, such as silicon, are prepared by either of the following methods. In one method, a porous carbon filament, obtained from powdered carbon and a binding agent, is heated *in vacuo* in the presence of mercury and silicon carbide in an electric furnace. The silicon forms a layer of carbide on the surface of the filament which has absorbed mercury vapour. In a second method, a carbon filament coated with silicon carbide is prepared as described above, the core of carbon is burned out and the hollow filament is filled with mercury. —A. T. L.

Filaments suitable for incandescent electric lamps; Preparation of ——. Soc. Franç. d'Incandescence par le Gaz, Paris. Eng. Pat. 15,193, June 29, 1909. Under Int. Conv., July 18, 1908.

See Fr. Pat. 401,307 of 1908; this J., 1909, 1080.—T. F. B.

Electric incandescent lamps; Method of regenerating carbon-filament ——. E. A. Krüger, Seehausen, Germany, Assignor to A. Bloch, Paris. U.S. Pat. 958,652, May 17, 1910.

See Eng. Pat. 8283 of 1909; this J., 1909, 1027.—T. F. B.

Organometallic compounds; Process for preparing —— especially for making filaments for incandescence lamps. Cie. Franç. pour l'Exploitation des Proc. Thomson-Houston. Fr. Pat. 410,562, Nov. 30, 1909.

See Eng. Pat. 8781 of 1909; this J., 1910, 618.—T. F. B.

Incandescence mantles. J. O. Zdanowich. Fr. Pat. 410,949, Nov. 22, 1909. Under Int. Conv., Dec. 21, 1908.

See Eng. Pat. 27,755 of 1908; this J., 1910, 145.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Coal tar; "Water soluble" ——. Raschig. *See* IX.

Patents.

Tar, tar oils, etc.; Apparatus for the fractional distillation of ——. A. Reichmann. Ger. Pat. 221,898, Feb. 19, 1907.

Several horizontal stills are fixed, parallel to one another, in a furnace setting, each still having its own furnace. A flue from the furnace passes lengthwise through each still, and a portion of the still is also directly heated. A portion of the gases from each furnace (except the last) passes to the flue of the next, so that the stills become progressively hotter as the liquid flows through the series. Each still is connected with the adjacent stills by valved tubes, one at either end, for the entry and exit of the liquid, and each is provided with a suitable neck leading to a condenser. The apparatus is designed so that the stills may be used either continuously or intermittently. —T. F. B.

2-Amino-5-naphthol-7-sulphonic acid; Process for preparing carbaminic acid alkyl or aralkyl esters of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 221,967, July 11, 1909.

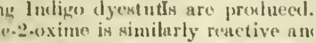
Derivatives of 2-amino-5-naphthol-7-sulphonic acid, of the composition, $C_{10}H_5(OH)(SO_3H)$, NH.COOR, R being an alkyl or aralkyl residue, are readily obtained by the action of the necessary chlorocarbonic acid ester on the aminonaphtholsulphonic acid in presence of substances which combine with mineral acids. The products, unlike the corresponding aryl esters, are very stable, and may be used in the preparation of dyestuffs. Two methods are described in the specification for the preparation of the carbaminic acid ethyl ester of the J-acid.—T. F. B.

Separating solid hydrocarbons from petroleum residues and tar. Fr. Pat. 409,516. *See* IIa.

IV.—COLOURING MATTERS AND DYES.

Isatin-anils. II., III. R. Pummerer. Ber., 1910, 43, 1370—1376; R. Pummerer and M. Göttler, *ibid.*, 1376—1386.

The methylene group of 3-oxy-1-thionaphthene reacts with aromatic nitroso-compounds more smoothly than in the case of indoxyl (this J., 1910, 14) and the 2-anils of thionaphthenequinone, which hitherto have been prepared through 2-bromothionaphthenequinone, are formed. The anil group is loosely combined and with mineral acids thionaphthenequinone is readily obtained. With indoxyl, 3-oxy-1-thionaphthene, oxindole, or acenaphthenone, the corresponding Indigo dyestuffs are produced. Thionaphthenequinone-2-oxime is similarly reactive and yields with indoxyl, 2-indole-2-thionaphtheneindigo as well as Indigo. Thionaphthenequinone-*p*-dimethylamino-2-anil,

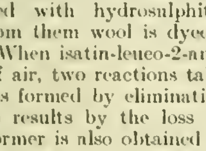


$$C_6H_4<\overset{S}{\underset{CO}{}}>C:N.C_6H_4.N(CH_3)_2,$$

prepared from 3-oxy-1-thionaphthene and nitrosodimethylaniline, (a little Thioindigo is also formed) crystallises in greenish red dichroic prisms melting, when free from benzene, at 176° C. When boiled in acetic acid solution with 3-oxy-1-thionaphthene, it gives Thioindigo, and under the same conditions with indoxyl and oxindole, it yields 2-thionaphthene-2 (or 3)-indolindigo, and with acenaphthenone (in an indifferent solvent), 2-thionaphtheneacenaphtheneindigo. Both series of isatinanils give vats when treated with hydrosulphite and sodium hydroxide, and from them wool is dyed in shades fairly fast to washing. When isatin-leuco-2-anil is treated with acids in absence of air, two reactions take place namely, Indigo Red 2-anil is formed by elimination of aniline and water, and Indigo results by the loss of two molecules of aniline. The former is also obtained by heating a vat containing isatin-leuco-2-aniland excess of hydrosulphite or by condensing alkaline solutions of indoxyl and isatin-leuco-2-anil or, more conveniently, by condensing isatin-2-anil in alkaline solution with indoxyl. Indigo Red 2-anil is a violet vat dyestuff, but its leuco-compound shows no affinity for cotton.—J. C. C.

Kermes; The dyestuff of ——. O. Dimroth. Ber., 1910, **43**, 1387—1401.

The author has investigated the colouring matter of kermes, which he calls "kermesic acid," and compared it with carminic acid. The two acids belong to the same colour-group but the former is the less complicated. Its formula is $C_{18}H_{12}O_{9}$, and it contains four hydroxy-groups which can be acetylated. It yields, on degradation, the same products as does carminic acid; thus oxidation with nitric acid gives nitrococcussic acid, and on oxidation of the trimethyl derivative, the monomethyl ester of methylcochenillic acid and a ketonic acid of the formula, $C_{13}H_{12}O_8$, are obtained. The formula,



for kermesic acid may provisionally be accepted.

Kermesic acid gives a spectrum closely resembling that of carminic acid. It dyes wool from an acid bath in orange red shades, but the bath is not exhausted; on a tin mordant the colour is scarlet red and on an alumina mordant Bordeaux tints are obtained.—J. C. C.

Patents.

Azo dyestuffs; Manufacture of ——, *and process of developing them on the fibre.* P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,253, May 12, 1909.

The diazo-compounds of monoacyl-phenylene- or tolylenediamines are combined with one molecule of 2:2-dinaphthylamine-5:5-dihydroxy-7:7-disulphonic acid.

$$SO_3H.C_{10}H_5(OH)\cdot NH\cdot C_{10}H_5(OH)\cdot SO_3H,$$

the acyl group is eliminated and the resulting aminoazo-compound is diazotised and combined with one molecule of a naphtholsulphonic acid or 2:5:7-aminonaphtholsulphonic acid or with a derivative of this acid substituted in the amino-group. The order of combination of the two components may be reversed. On dyeing or printing these dyes on cotton and combining them with diazotised nitroanilines, shades varying from red to violet to blue are obtained which are very fast to washing. The shades can be discharged to a pure white by means of hydrosulphite. Example, 150 parts of *p*-aminoacetanilide are diazotised and the diazo-compound is added to a solution of 224 parts of 1-naphthol-3-sulphonic acid in a solution of 180 parts of sodium carbonate in 2000 parts of water. After an hour the mixture is heated to 95° C. for an hour with concentrated sodium hydroxide, the amino-compound diazotised and the diazo-solution added to a solution of 505 parts of the disodium salt of 2:2-dinaphthylamine-5:5-dihydroxy-7:7-disulphonic acid in 5000 parts of water containing an excess of sodium carbonate. The dyestuff is separated in the usual way. When dyed on cotton and treated with diazotised *p*-nitroaniline, a deep blue is obtained.—J. C. C.

Black colouring matter [dyestuff] containing sulphur; Manufacture of ——. Claus and Co., Ltd., Manchester, and W. Claus, Alderley Edge, Cheshire. Eng. Pat. 11,590, May 17, 1909.

1:2:4-Dinitrophenol (prepared from 48 parts of dinitrochlorobenzene by boiling it with 150 parts of water and 62 parts of sodium hydroxide) is boiled for about 12 hours with 124 parts of sodium hydrosulphide solution (30 per cent. NaSH) and 26 parts of sulphur. The resulting dyestuff gives a black with a greenish shade on cotton.
—J. C. C.

Urea of the anthraquinone series and process of making same. A. Schmidt and G. Kränzlein, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 958,325, May 17, 1910.

β-Anthraquinonyl-ureas are obtained by heating β-anthraquinonyl-urethanes or β-anthraquinonyl-urea chlorides with mono- or diaminoanthraquinones. They dye cotton and wool yellow to brown and reddish brown shades. β-β-Dianthraquinonyl-urea, $CO(NH.C_{14}H_7O_2)_2$, for example, is formed by heating β-anthraquinonyl-urethane with β-aminoanthraquinone.—T. F. B.

p-Amino-m-oxyazo colouring matters; Manufacture of ——. H. Imrie, London. From Anilinfarben- und Extract-Fabriken vorm. J. R. Geigy, Basle, Switzerland. Eng. Pat. 13,903, June 14, 1909.

See Fr. Pat. 404,535 of 1909; this J., 1910, 268.—T. F. B.

o-Oxydisazo dyestuffs; Manufacture of ——. Anilinfarben- und Extract-Fabriken vorm. J. R. Geigy, Basle, Switzerland. Eng. Pat. 13,904, June 14, 1909. Under Int. Conv., March 29, 1909.

See Fr. Pat. 404,536 of 1909; this J., 1910, 268.—T. F. B.

Vat dyes; Blue ——. W. Bauer, Vohwinkel, and A. Herre, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 958,464 and 958,465, May 17, 1910.

See Eng. Pat. 7819 of 1909; this J., 1910, 81.—T. F. B.

[Azo] dye. F. Runkel and M. Herzberg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 958,830, May 24, 1910.

See Fr. Pat. 402,546 of 1909; this J., 1909, 1191.—T. F. B.

[Azo] dyestuffs; Black ——, *and process for producing them.* Farbenfabr vorm. F. Bayer und Co. First Addition, dated Dec. 17, 1909, to Fr. Pat. 405,928, Aug. 11, 1909. Under Int. Conv., April 26, 1909.

See Eng. Pat. 10,462 of 1909; this J., 1910, 685.—T. F. B.

Azo dyestuffs; Process of making ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 410,641, Dec. 20, 1909. Under Int. Conv., Jan. 7, 1909.

See U.S. Pat. 935,031 of 1909; this J., 1909, 1120.—T. F. B.

Azo dyestuffs; Process of making ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 410,717, Dec. 27, 1909. Under Int. Conv., April 22, 1909.

SEE Eng. Pat. 10,461 of 1909; this J., 1910, 685.—T. F. B.

Azo dyestuff; Process of making an ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 410,718, Dec. 27, 1909. Under Int. Conv., March 4 and 19, 1909.

SEE Eng. Pat. 9908 of 1909; this J., 1910, 146.—T. F. B.

Sulphur [sulphide] dye and process of making same. R. Haugwitz, Friedrichshafen, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 958,640, May 17, 1910.

SEE Fr. Pat. 394,832 of 1908; this J., 1909, 305.—T. F. B.

Monoazo dyestuff; Manufacture of a red —— and lakes derived therefrom. Act.-Ges. f. Anilinfabr. Fr. Pat. 410,480, Dec. 21, 1909.

SEE U.S. Pat. 954,960 of 1910; this J., 1910, 686.—T. F. B.

Monoazo dye and process of making same; Black ——. F. Scholl, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 958,774, May 24, 1910.

SEE Eng. Pat. 15,089 of 1909; this J., 1910, 412.—T. F. B.

Sulphurised [thioindigo] dyestuffs; Process of making leuco derivatives of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 410,732, March 20, 1909.

SEE Eng. Pat. 5558 of 1909; this J., 1910, 81.—T. F. B.

Dyestuffs [ureas] of the anthraquinone series; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 410,842, Oct. 27, 1909. Under Int. Conv., Feb. 1, 1909.

SEE U.S. Pat. 958,325 of 1910; preceding.—T. F. B.

Nitro-o-oxyazo colours and process of making same. K. Elbel, Assignor to Kalle und Co., Biebrich, Germany. U.S. Pat. 958,912, May 24, 1910.

SEE Eng. Pat. 22,200 of 1909; this J., 1910, 15.—T. F. B.

Azo dye; Orange ——. K. Schnitzspahn, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 959,078, May 24, 1910.

SEE Ger. Pat. 217,277 of 1908; this J., 1910, 268.—T. F. B.

Disazo dye and process of making; Orange ——. M. Böniger, Assignor to Chemical Works, formerly Sandoz, Basle, Switzerland. U.S. Pat. 959,109, May 24, 1910.

SEE Eng. Pats. 20,649 and 20,650 of 1909; this J., 1910, 15.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cotton cellulose; Action of sodium hydroxide and water under pressure on ——. C. G. Schwalbe. Chem.-Zeit., 1910, **34**, 551.

ONLY celluloses which contain oxycellulose show the property described by Tauss for cellulose, viz. production of hydrocellulose on heating under a pressure of 20 atmospheres. Pure, normal cellulose ("maco" cotton) suffers but a very slight hydrolysis. At temperatures above 100° C. dehydration appears to take place; the "hydration value" decreases with increase of temperature. The proportion of products soluble in water increases only very slowly with increase of temperature up to 150° C., but it increases very rapidly above this temperature. On heating with sodium hydroxide under pressure, the cupric-reducing power of the cellulose, which appears under the action of sodium hydroxide at temperatures below 100° C., disappears, when the concentration of the lye is 1—2 per cent.; with lyes of higher concentration (3—5 per cent.) the cupric-reducing power does not disappear until a temperature of 135° C. is reached. The degree of hydrolysis, as expressed by the cupric-reducing power, is at a maximum with a 4 per cent. lye; lyes of 3 per cent. and of 5 per cent. both have a weaker action. The solubility of cotton cellulose in sodium hydroxide at the ordinary temperature decreases as the concentration of the alkali is increased; this is also the case at 100° C. At a temperature of 150° C. the solubility in lyes of 1—5 per cent. concentration ranges from 5 to 7 per cent. Above 150° C. the solubility of cellulose increases with extreme rapidity. The temperature of 150° C. may be regarded as the decomposition temperature of cotton cellulose. Relatively, the solubility of cotton cellulose is lowest in 5 per cent. sodium hydroxide and highest in 4 per cent. sodium hydroxide. As in the case of water, sodium hydroxide also appears to produce dehydration at temperatures above 100° C., since the "hydrolysis value" decreases with increase of temperature. "Maco" (Egyptian) cotton appears to possess a higher degree of hydration than American cotton.—J. F. B.

Lignin [lignocellulose]; Formation of acetic and formic acids in the hydrolysis of substances containing ——. W. E. Cross. Ber., 1910, **43**, 1526—1528.

BY the hydrolysis of jute, straw, beechwood, fir-wood, etc., with 1 per cent. sulphuric acid in an autoclave at 110° C., small quantities (1·2—2·8 per cent.) of formic and acetic acids were produced. From fir-wood approximately 4 parts of acetic to 1 of formic acid were produced. Under similar conditions cotton, filter-paper, wood-cellulose, pectin (from gooseberries), and wood-gum (pentosan) did not yield formic and acetic acids, or only traces, and the author hence considers that the presence of formyl and acetyl groups in the lignocellulose molecule may be regarded as established.—A. S.

PATENTS.

Artificial threads; Manufacture of ——. P. Friedrich. Fr. Pat. 409,789, Nov. 30, 1909. Under Int. Conv., Dec. 3, 1908.

BY using cuprammonium cellulose solutions of great tenacity, as, for example, those containing, in addition to cellulose, such substances as carbohydrates or alcohols, as described in Fr. Pat. 400,321 (Eng. Pat. 4104 of 1909), and addition thereto (this J., 1909, 934, 1121) and Fr. Pat. 404,372 (see Eng. Pat. 11,700 of 1909; this J., 1909, 1246), filaments squirted in the usual manner may be drawn out into very fine threads and hardened in a single coagulating bath, preferably of the kind described in Ger. Pat. 206,883 (this J., 1909, 362). The cellulose solution should contain a smaller quantity of ammonia than of cellulose, and it should have such a tenacity that it can be drawn into filaments 50 cm. long in the air; the concentration of the coagulating bath should be so adjusted that the filament can be drawn out without breaking during the first 10 cm. of its passage through the bath. —A. S.

Radiferous fibres and method of their manufacture. H. Farjas and A. Jaboin. 1st Addition, dated Feb. 16, 1909, to Fr. Pat. 406,299, Dec. 4, 1908.

IN the original patent (this J., 1909, 1194) a method was described of causing a radium salt to adhere to the surface of fibres. According to the present addition the fibres are cleaned and then immersed in a solution of radium-barium chromate in chromic acid. A solution of sodium acetate is now added, drop by drop, so that the radium-barium chromate is only slowly precipitated, in which case it is deposited on the fibres, to which it adheres. It may afterwards be transformed into the sulphate by soaking the fibres in a solution of sulphuric acid of suitable strength, such, for example as 1 part in 10 or in 100.—E. F.

Acid treatment [carbonising] of pieces of cloth and felt; Apparatus for ——. R. Jahr. Fr. Pat. 409,293, Nov. 5, 1909.

The fabric to be carbonised is led slowly through two vats containing a suitable acid liquor, the size of the vats and the speed of the machine being so regulated that the material is immersed for about twenty minutes. It is then passed between a pair of squeezing rollers and over a suction apparatus to remove the excess of liquor, and is afterwards led through the carbonising chamber. In order to ensure that the fabric is evenly impregnated, a to-and-fro-motion is imparted to it by passing it between two rollers which are provided with a reversing gear.—P. F. C.

Fibres; Method of protecting ——, *whether loose or in the piece, from the action of acids, calcium superphosphate, etc.* C. de Guide and F. Briart. Fr. Pat. 409,648, Nov. 26, 1909.

The fabrics or fibres are immersed in a soap solution, a potassium soap being used by preference, and are then dried.—E. F.

Paper pulp from the fruit of trees of the cocoanut tribe [coir]; Manufacture of ——. V. J. Kuess, Tunis. Eng. Pat. 29,480, Dec. 16, 1909. Under Int. Conv., Apr. 8, 1909.

Cocoanut fibres (coir refuse) are prepared by a mechanical tearing or grinding treatment. The material is then treated with three times its weight of a solution of the following composition: water, 1000 litres; potassium carbonate, 20 kilos.; sodium carbonate, 10 kilos.; caustic soda (70—72 per cent.), 5 kilos.; "solidified petrol" 30 kilos., and sodium chloride (optional), 30 kilos. The materials are digested for 5 hours in an autoclave at a temperature of about 150° C.; the liquid is then strained off and the fibre is reduced to pulp. The same liquid may be used ten times in succession if the losses are made good by the addition of fresh liquor. The "solidified petrol" is prepared by melting 10 kilos. of soap with 10 kilos. of rosin and dissolving the heated mixture in 80 kilos. of petroleum of sp. gr. 0·813; a solution of 9 kilos. of caustic potash in 12 kilos. of water is then stirred in, and finally a hot solution of 3 kilos. of boric acid in 12 litres of water is added.—J. F. B.

Fibres from vegetable tissues; Extracting ——. M. R. Kennedy, Dansville, N.Y., Assignor to The National Straw Pulp Co., New York. U.S. Pat. 951,317, Mar. 8, 1910.

Straw is first subjected to a preliminary digestion at a temperature below boiling point with the spent liquor from the last stage of the process. It is then well washed with hot water, sprayed with more spent liquor, and the necessary quantity of fresh chemicals is added. The whole mass is then thoroughly mixed and transferred to a cooker, (which is arranged below the digester), and subjected to a high temperature under a steam pressure of 50—100 lb. to the square inch.—P. F. C.

Paper; Treatment of flax and hemp and their wastes and other vegetable fibres for manufacture of ——. L. Dumons. Fr. Pat. 409,014, Nov. 13, 1909.

The fibrous material, *e.g.* flax or hemp waste, is boiled with an alkali in the usual way and is then subjected to the action of a very dilute solution of a hypochlorite to which an acid has been added to liberate the chlorine. The washed product is again boiled with alkali and again treated with dilute bleaching powder solution.—J. F. B.

Paper pulp; Manufacture of ——. G. L. H. Devimeux. Fr. Pat. 409,034, Feb. 5, 1909.

Plants and vegetable fibrous matters are macerated with lime and alcohol, in the proportions of 200 kilos. of lime and 25 litres of alcohol per ton of the material. Maceration is effected in closed vessels, hot or cold according to the nature of the material, and lasts for about six days. The product is then stacked in heaps, which are allowed to become warm. Lastly the fibres are separated by milling and are further treated in the usual manner.—J. F. B.

Paper pulp; Process for removing colouring matters, inks, printer's ink, etc., from waste paper, and conversion of the latter and of rags, jute, etc., into ——. L. Herz. Ger. Pat. 220,424, Feb. 12, 1909.

The material is treated in the cold with caustic soda lye and ammonia solution, and then washed and bleached in the usual manner.—A. S.

Paper; Dyeing and sizing of ——. A. G. Bloxam, London. From F. Curtius und Co., Duisburg, Germany. Eng. Pat. 4067, Feb. 18, 1910.

For the more economical sizing of paper pulp, magnesium sulphate is used in conjunction with aluminium sulphate for precipitating the rosin size. Since, however, the precipitate obtained with magnesium sulphate has not the same property of fixing dyestuffs as that obtained with aluminium sulphate, the use of a small amount of sodium bisulphate is claimed in conjunction with the other two salts. A suitable mixture of precipitating salts is composed of 50 parts of aluminium sulphate, 40 parts of magnesium sulphate and 10 parts of sodium bisulphate. —J. F. B.

Paper, cardboard, textiles, threads, cork, wood, tobacco, colours, glues, etc.; Process for rendering elastic ——. Chem. Fab. Reisholz. Fr. Pat. 409,897, Dec. 3, 1909.

As a softening agent or deliquescent, in place of glycerin or liquid glucose, for the purpose of rendering materials elastic, lævulose, either pure or in the form of invert sugar, is claimed. In order to prevent the crystallisation of the lævulose, it may be mixed with 3—10 per cent. of salts, *e.g.* sodium, calcium or magnesium chloride, magnesium sulphate, or ammonium acetate, or of glycerin or liquid glucose.—J. F. B.

Nitrocellulose; Arrangement for feeding paper into the nitrating vessels in the manufacture of ——. Selwig and Lange. Fr. Pat. 409,220, Sept. 17, 1909. Under Int. Conv., June 1, 1909.

The apparatus consists of a vertical stem suspended from a travelling carriage, which can be adjusted over any of the nitrating vessels. At the lower end of the stem is situated a reel of paper, the paper from which passes over a guide-roll and between a pair of drawing rolls also carried by the stem. The drawing rolls are operated by means of a belt driven by an electric motor mounted at the upper end of the vertical stem. An oscillatory motion may be imparted to the stem if desired.—J. F. B.

Acetylated cellulose derivatives; Production of new —— *by direct transformation of natural cellulose.* V. J. A. Pauthonier. Fr. Pat. 409,465, Nov. 20, 1909.

Cellulose, in the form of cotton, paper, etc., is treated with a mixture of acetic anhydride and a conjugated aliphatic sulphonic acid, new acetyl-sulphoaliphatic acid esters of cellulose being thus formed. The products are white, soft to the touch, and when compressed have a spongy appearance; they are soluble in glacial acetic acid, chloroform, and acetone and are said to be suitable for the production of photographic films and for other purposes, and for the replacement of nitrocellulose in the production of celluloid. According to the proportions of the ingredients employed, substances of varying degrees of plasticity and solubility are obtained. As an example of the method of manufacture, 162 grms. of dry cotton are treated with 460 grms. of acetic anhydride, 600 to 700 grms. of glacial acetic acid, and from 5 to 50 or more grms. of sodium sulphoricinate, together with sufficient free sulphuric acid to liberate the sulphoricinic acid. The glacial acetic acid acts as a diluent only. The operation is best conducted by first adding the glacial acetic and sulphuric acids together with a little of the acetic anhydride, and then gradually adding the remaining constituents, with thorough mixing, after the reaction has started, in order to avoid heating. The mass is kneaded for some time and allowed to stand for 12 to 18 hours. The reaction is completed when a sample, after washing and drying, is soluble in acetone. The mixture is then filtered, and the substance precipitated by adding water, treated with sodium carbonate, washed, and dried.—E. F.

Plastic materials analogous to celluloid; Manufacture of —. P. Breteau and H. Leroux. Fr. Pat. 409,557, Feb. 19, 1909.

COMPOSITIONS adapted for use instead of celluloid are obtained by replacing the natural or synthetic camphor used in the manufacture of ordinary celluloid by an equal amount of any of the following substances:—aromatic aldehydes, such as pure or commercial benzaldehyde, and homologous alkylated or arylated derivatives, hydroaromatic ketones, such as hexahydrobenzylketone, tetrahydrobenzylketone and their alkylated homologues, hydronaphthylketones, the complex mixture obtained by oxidation of the product resulting from the catalytic hydrogenation of crude phenols, or mixtures of the above substances. Similar products are also obtained by replacing the nitrocellulose used in the production of ordinary celluloid by organic or inorganic acid esters of nitrocellulose, hydrocellulose or oxycellulose, or by a mixture of these various esters, with or without nitrocellulose.—E. F.

Peat, peat-moss and similar materials; Manufacture of plastic objects from ——. T. Franke. Fr. Pat. 409,590, Nov. 25, 1909.

PEAT, peat-moss, sawdust or other similar materials are dried in the air, disintegrated, sifted and placed in water until "just saturated." An agglutinant is now added; if the materials are moistened to the right extent this agglutinant does not penetrate the particles but merely holds them together during subsequent drying. In this way shoe-soles and similar articles are produced, and may be strengthened by incorporating layers of gauze in the mass.—E. F.

Threads, wires, and bands; Manufacture of lustrous ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 11,354, May 13, 1909.

SEE Fr. Pat. 408,370 of 1909; this J., 1910, 624.—T. F. B.

Paper and similar materials; Process of making —— *pliable.* F. Evers, Dusseldorf, Germany. U.S. Pat. 957,196, May 10, 1910.

SEE Fr. Pat. 409,897 of 1909; preceding.—T. F. B.

Cocoanut fibre; Process for converting —— *into paper pulp.* V. J. Kuess. Fr. Pat. 409,614, Nov. 25, 1909. Under Int. Conv., April 8, 1909.

SEE Eng. Pat. 29,480 of 1909; preceding.—T. F. B.

Fabrics with disinfecting and sterilising properties. Ger. Pat. 222,292. *See* XIXB.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Discharging indigo by means of oxygen compounds of nitrogen. F. Binder. Rev. Gen. Mat. Col., 1910, 14, 169.

THE author has examined large quantities of goods prepared by means of the process of Freiberger (see Eng. Pat. 13,896 of 1908; this J., 1909, 472), in which discharges are produced on indigo-dyed material by printing with a mixture of a nitrate and nitrite, and then passing through an acid bath. He states that the shade of the indigo is not affected, the whites are pure, even on deep grounds, and no oxycellulose is formed. The process is cheaper than any of the other known methods of discharging.—A. S.

Dyed cotton goods; Action of light on finished ——. P. G. Jones. J. Soc. Dyers and Col., 1910, **26**, 147—150.

THE author noticed that upon exposure to light, a dyed pattern which had been finished with oil behaved differently from one which had received no finish. Exposures were then made of patterns which had been treated with different kinds of finishing oils, such as sulphonated oil, soluble oil (saponified castor oil), soluble oil made neutral by addition of free fatty acid, and "monopol soap," and the results compared with those of untreated patterns. On the whole the results as regards homogeneity were disappointing, but they indicate that the colours may be roughly divided into groups. Thus one group, about 50 per cent. of the total number of dyestuffs tested, contains those of which the fastness to light is diminished by a treatment with oil, and includes representatives of practically all classes of dyestuffs. Group II includes those dyestuffs (some 30 per cent. of the number tested) which are unaffected by an oil finish. All classes but that of the sulphide dyestuffs are represented in this group. Group III (13 per cent.), contains those colours which are less affected by a sulphonated, than by a soluble oil. About 8 per cent. of the shades were less affected by a soluble than by a sulphonated oil and 9 per cent. (with one exception direct cotton dyestuffs) were rendered faster by an oil treatment. Dextrin has a markedly beneficial effect upon the fastness of the shade, especially when used alone, but also when used in conjunction with an alkaline finishing oil.—F. M.

Fastness to light of colours in printed tapestry carpets. D. Paterson. J. Soc. Dyers and Col., 1910, **26**, 152.

IT has been stated that shades produced upon tapestry yarns by printing and steaming, are not so fast to light as those obtained with the same dyestuffs but dyed in the bath. The fastness is however an inherent property of the dyestuff and is independent of the method employed in fixing it upon the fibre, and as a result of comparative trials the author is able to assert that there is no difference in the properties of the colours, dyed upon yarns by the two different methods.—F. M.

PATENTS.

Keir. J. A. Butler, Winthrop, Mass. and L. Flick, Saylesville, R.I. U.S. Pat. 958,591, May 17, 1910.

THE keir comprises a vertical cylindrical casing and a receptacle which can float therein. The fabric is treated in this receptacle, and is withdrawn from it through an opening in the bottom. The receptacle has an inclined wall which guides the fabric towards the opening.—A. T. L.

Coloured woollen effects in unions; Process for producing ——. O. Imray, London. From Meister, Lucius, und Brüning, Hoechst-on-Maine, Germany. Eng. Pat. 18,828, Aug. 16, 1909.

UNION goods are prepared from undyed wool, cotton, and wool previously dyed and rendered incapable of absorbing further dyestuffs by means of tanning substances and metallic salts by the method described in Eng. Pat. 19,668 of 1900 (this J., 1901, 1110). After being finished in the grey, these goods are dyed in the piece in a bath containing direct dyeing dyestuffs and, if necessary, dyestuffs which dye wool only. It is found that the ground of the fabric, consisting of wool and cotton, can thus be dyed evenly in light shades, black, dark blue, Russian green, brown, claret-red, scarlet or other shades, whilst the previously treated interwoven fibres retain their original colour unchanged. These may have been treated, for instance, with tannin and tartar emetic. Better effects are obtained if a metallic salt, especially zinc sulphate, is used in addition to the sodium sulphate ordinarily added to the dye-bath

The previously treated woollen yarn may have been dyed, for example, with one of the following dyestuffs:—Milling Yellow O, Milling Scarlet 4RO, Fast Acid Violet A2R, Fast Acid Blue R conc., Patent Blue A, Alizarin Direct Green G, or Dianil Brown MH, to which are added 10 per cent. of tannin. 4 per cent. of formic acid and 20 per cent. of sodium sulphate crystals, the threads being rendered incapable of absorbing further dyestuff by adding 3 per cent. of tin salt to the dyebath. After weaving, the fabric is finished in the grey, using neutral soap by preference in the milling, and dyed in the piece for instance by one of the following recipes (calculated for 100 kilos. of goods):—*Buff.* 50 grms. of Dianil Fast Brown B, 20 grms. of Oxydianil Yellow O, 5 grms. of Dianil Black ES, 10 grms. of Orange 2, and 5 grms. of Acid Alizarin Grey G. *Light Blue.* 200 grms. of Dianil Blue H6G, 50 grms. of Patent Blue A and 5 grms. of Acid Violet 5 BF. *Fawn colour.* 300 grms. of Dianil Fast Brown B, 150 grms. of Dianil Orange, 10 grms. of Dianil Black ES, 90 grms. of Orange 2 and 60 grms. of Acid Alizarin Grey G. *Russian Green.* 3 kilos. of Dianil Green BBN., 1½ kilos. of Dianil Yellow 2R, ½ kilo. of Dianil Black ES. *Dark Blue.* 4 kilos. of Dianil Blue H2G, 2 kilos. of Dianil Black ES, 250 grms. of Dianil Black CR and 150 grms. of Amino Black 3B. *Red.* 2 kilos. of Dianil Red 4B and 1 kilo. of Dianil Bordeaux B. *Black.* 4 kilos. of Patent Dianil Black EF. conc. and 1 kilo. of Amino Black 3B. The dyeing is carried out in about 2 hours at a temperature near the boiling point in a bath to which 20—30 kilos. of Glauber's salt and 2 kilos. of zinc sulphate are added. —E. F.

Dyeing machine. J. Richardson and J. F. Neef, Philadelphia, Pa. U.S. Pat. 957,801, May 10, 1910.

The material to be dyed is packed in receptacles which have perforated bottoms and removable perforated covers, and can be vertically mounted on the perforated horizontal partition of a dyeing tank. The lower compartment of the tank is provided with vertical walls which extend radially from a central inlet opening arranged in the floor of the tank. Means are provided for circulating the dye liquor through the apparatus.—P. F. C.

Chemically treating textiles mounted on bobbins; Machine for ——. T. Robatel, J. Buffaud et Cie. First Addition, dated Nov. 6, 1909, to Fr. Pat. 403,118, May 18, 1909 (this J., 1909, 1312).

A number of prisms of triangular cross-section are mounted apex outwards around the periphery of a disc so as to form a sort of cylindrical case, each or each alternate prism having its free end turned outwards so as to form a projecting spur. In order to keep the prisms in position they are bound together by a series of hoops of such diameter as will just permit a sheath made of a number of parallel strips to slip over the case with the apex of each prism fitting into and projecting beyond the space between the strips. The material to be dyed is wound round the combined case and sheath and the sheath is afterwards withdrawn, the spurs at the ends of the prisms serving to prevent the wound material from slipping off the case.—P. F. C.

Two-colour effects on union fabrics; Process for producing ——. L. Cassella und Co., Ges. m. b. H. Fr. Pat. 409,052, Feb. 8, 1909.

By adding to the dye-liquor a substance which is lighter than and not miscible with water, and is liquid at the dyeing temperature, a fabric containing cotton and wool can be dyed without staining the wool. Light hydrocarbons and their substitution products are suitable for this purpose. Example:—A dye-liquor is prepared containing 3—4 per cent. of a substantive dyestuff and the necessary quantity of sodium sulphate, the temperature being maintained at 20°—30° C. Sufficient benzene is then poured into the jigger to form a thick layer on the surface of the dyeing solution. The material to be dyed is slowly passed through the dye-liquor and then dyed in the ordinary way.—F. F. C.

Moistening or similarly treating fabrics, fibrous materials and other similar substances; Machine for ——. W. Briggs. Fr. Pat. 409,122, Nov. 16, 1909.

A jet of compressed air or some other "pulverising agent" is discharged against a liquid or semi-liquid and converts it into a fine spray which is then projected against the material to be treated. The apparatus for producing the spray comprises two hollow cylinders arranged parallel to one another, one being connected with a reservoir containing the liquid to be sprayed and the other with a supply of compressed air. These two cylinders are placed in communication at intervals along their length, by cross-pipes provided at each end with stop-cocks, and each of the pipes is provided with a chamber of special design, wherein the liquid and the compressed air are brought into contact so as to produce a very fine spray which is discharged through nozzles on to the travelling textile material. —P. F. C.

Dyeing and printing; Process of ——. Farbenfabrik vorm. F. Bayer und Co. Fr. Pat. 409,748, Nov. 27, 1909. Under Int. Conv., Nov. 30 and Dec. 7, 1908.

Hydroxyanthraquinones containing ketonic groups which are partly or completely reduced can be used to dye fast shades. Example:—A dye-bath is prepared with 2—5 kilos. of acetic acid and 10 kilos. of a 20 per cent. paste of the leuco-compound of erythroxyanthraquinone. 100 kilos. of chromed wool are entered into the bath, which is heated to boiling and kept boiling for 1—1½ hours. A deep brown is thus obtained.—P. F. C.

Waterproofing compositions; A new or improved oil admixture for use in ——. A. M. Hart, London. Eng. Pat. 11,340, May 13, 1909.

The oil which it is proposed to call "Lucrate" is prepared by boiling 1 cwt. of melted animal fat with 1½ oz. of sodium hydroxide ("T W 13") the mixture being finally heated to 200°—250° F., when the clear oil is drawn off and mixed (a) with 1½ to 20 per cent. of vegetable oil, (b) with 2½ to 20 per cent. of paraffin or 1½ to 20 per cent. of petrol, or (c) with a vegetable oil obtained from the waste of cotton seed, hemp seed, etc.—J. C. C.

Mercerised cotton goods; Process for imparting a silky feeling to —— after dyeing with sulphide dyestuffs. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 410,937, Oct. 19, 1909.

See Eng. Pat. 11,729 of 1909; this J., 1910, 209.—T. F. B.

Azo dyestuffs and process of developing them on the fibre. Eng. Pat. 11,253. *See* IV.

Production of aldehyde derivatives. Addition to Fr. Pat. 350,607. *See* VII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

[*Sulphuric acid manufacture.*] *Power consumption in raising acids.* T. Meyer. Z. angew. Chem., 1910, 23, 972—973.

According to the author the efficiency attained in raising acid by means of compressed air and montejus is very low, only 3½ per cent. of the total energy supplied (in kilogram-metres) being utilised. Better results would be obtained if the compressed air were returned to the suction pipe of the compressor, instead of being allowed to escape, but this is impracticable because it always contains some acid mist. It is estimated that 71 per cent. of the total power consumption in sulphuric acid manufacture is required for raising acid, and the cost of power for this purpose alone is 3 per cent. of the total manufacturing cost (see also this J., 1909, 1032). Economy in this direction is thus urgently needed, and the author recommends the use of centrifugal pumps, with their modern improvements, *e.g.*, multistage turbine pumps connected to an electro-motor. A pump constructed of hard lead is stated to have given an efficiency of 19·4 per cent. Quincke was unable to accept the author's figures as correct. He considers that acid raising with compressed air is cheaper than the use of a centrifugal pump, but the first cost of the apparatus is higher.—A. S.

Sulphuric acid ; Smeltery smoke as a source of ——. W. H. Freeland and C. W. Renwick. Eng. and Min. J., 1910, **89**, 1116—1120.

At Ducktown, Tenn., in conjunction with a copper smelter, a lead chamber sulphuric acid plant has been erected having a capacity of 160 tons of 60° B. acid per day, the latter being entirely derived from the waste gases from the pyritic smelting. The gases, which average 3½ per cent. of sulphur dioxide, pass through a dust chamber and then into a long horizontal flue with a parallel return running the whole length of the building, and having means for short circuiting the current at different points. The variation in the temperature of the entering gases is equalised by causing them to pass through a greater or less length of flue. After cooling and passing through a second dust chamber, the gases enter two Glover towers where 40 per cent. of the sulphur dioxide is oxidised to sulphuric anhydride. The gases are then forced by means of lead fans into two sets of eight acid chambers, which have a total volume of 1,050,000 cb. ft., special means being provided to neutralise the effects of the contained carbon dioxide. The acid produced is said to be clear and of good quality. The sulphur content of the ore smelted varies from 14—19 per cent. and the low-grade matte averages 25 per cent.—F. R.

Sulphuric acid and sulphates ; General method for the volumetric determination of ——. F. Repiton. Monit. Scient., 1910, **24**, 382—384.

The method consists in adding an excess of standard barium chloride to the sulphate solution and then precipitating the excess of this reagent with an excess of potassium bichromate, in the presence of ammonia, and titrating the filtrate with stannous chloride. A known volume of *N*/4 barium chloride is added to the boiling sulphate solution, containing hydrochloric acid, and, after boiling for 5 minutes, a quantity of standard bichromate solution, exactly equivalent to the barium chloride first introduced, is added, in the presence of a large excess of ammonia (containing calcium chloride). The mixture is stirred and heated, then cooled to the original temperature in a closed vessel, and made up to 150 c.c.; finally, it is filtered and the excess of bichromate is determined in 50 c.c. of the filtrate by means of standard stannous chloride solution, in the presence of a large excess of hydrochloric acid, using mercuric chloride as indicator. The stannous chloride solution is standardised in terms of the bichromate before a determination, and the volume of the former required to produce a cloudiness with the indicator is also ascertained, a constant volume of indicator and of total liquid being adhered to throughout, and the titration being performed in an atmosphere of carbon dioxide. The method is of general application and may be employed with coloured salts.—F. Sodn.

Potassium chlorate ; Action of —— on concentrated sulphuric acid. (Preliminary note). S. Smith. Chem. Soc. Proc., 1910, **26**, 124—125.

The author has observed that at 338° C. the action of potassium chlorate on concentrated sulphuric acid is entirely unattended by explosive violence, the addition of the powdered salt to the boiling acid merely resulting in a brisk effervescence, with the production of chlorine, oxygen, and perchloric acid. The volume of oxygen evolved corresponds with about 90 per cent. of the total oxygen contained in the potassium chlorate, whilst the amount of perchloric acid formed appears to be very small. This reaction was studied at various temperatures, and it was found that from 338° to 200° C. no crackling or detonation is produced. At 170° C., however, the addition of potassium chlorate to sulphuric acid results in a number of small detonations, which increase in violence as the sulphuric acid is cooled and reach a maximum between 130° and 120° C., when a sharp explosion results. Below 120° C., the violence of the action diminishes, until, at 60° C., chlorine peroxide is quietly evolved without crackling or detonation.

Nitric oxide formation ; The relation of —— to the electrical and thermal properties of short continuous-current arcs with cooled anodes. W. Holwech. Z. Elektrochem., 1910, **16**, 369—390.

The author has extended the work of Haber and Koenig (this J., 1908, 27, 1070, and 1909, 28) and of Morden (this J., 1909, 520), using a short continuous current arc with a hot cathode and a cooled anode. With an improved apparatus Morden's concentrations of over 9 per cent. of nitric oxide (from air) were reproduced, but his maximum yield seems to have been a little too high, a more correct value being about 80 grms. of nitric acid per kilowatt-hour. By careful regulation of the position of a finely pointed iridium probe, it was possible to investigate the electrical conditions in the arc. If the anode is kept thoroughly cooled so that there is no vaporisation, the fall of potential is quite regular up to about 0·01 mm. from the electrodes. The stronger this field is made the better will be the yields and the concentrations obtained, provided that rise of temperature and corresponding thermal effects are avoided. The sharp falls of potential in the immediate neighbourhood of the electrodes can have little effect on the yield especially if, as in the author's apparatus, they are prevented by external influences from causing any rise in temperature. In no case could the author observe any softening of the iridium foil used to investigate the fall of potential, and it is therefore probable that the effects produced are mainly electrical, while those of the commercial processes are mainly thermal. In the commercial arcs there is generally a fall of less than 10 volts per cm. and a yield of 60 to 75 grms. of nitric acid per kilowatt-hour. With a short arc the fall is 100-200 volts per cm. and while the yields are quite as good it is possible to obtain much better concentrations of nitric oxide under similar conditions.
—W. H. P.

Ultra-violet rays ; Oxidising action of —— on gases. Oxidation of oxides of nitrogen and of sulphur. D. Berthelot and H. Gaudechon. Comptes rend., 1910, **150**, 1517—1520.

Exposure to ultra-violet rays from a quartz mercury vapour lamp produced no appreciable effect on air or on mixtures of nitrogen and oxygen. Nitrous oxide, alone or mixed with oxygen, and nitric oxide, were decomposed, with formation of free nitrogen and nitrous and nitric acids. Sulphur dioxide, alone or mixed with oxygen, yielded free sulphur and sulphuric acid.—A. S.

Sodium chloride gel. P. von Weimarn. J. Russ. Phys.-Chem. Ges., 1910, **42**, 235—236. Chem. Zentr., 1910, **1**, 1910—1911.

On passing a strong current of dry hydrogen chloride through a saturated solution of sodium ethylate in amyl alcohol, the liquid sets to a translucent jelly.—A. S.

Iron bisulphide ; Formation of —— in solutions. W. Feld. Z. angew. Chem., 1910, **23**, 969—971.

Some irregularities in the working of a large installation for freeing coke-oven gas from hydrogen sulphide (and ammonia) by the author's process, using ferrous sulphide (see Eng. Pat. 3061 of 1909 ; this J., 1910, 352), led to the discovery that when ferrous sulphide and sulphur are heated together in neutral or faintly acid liquids, iron bisulphide is always formed. It is produced for example when excess of alkali polysulphide is added to an iron solution and the mixture boiled. The formation of iron bisulphide in this way is hindered by excess of alkali or of bases such as magnesium hydroxide and ferrous hydroxide. If ammonium polysulphide be used instead of alkali polysulphide, the formation of iron bisulphide takes place only after the excess of ammonia has been expelled. In the author's gas-purification process, the solution used for removing the hydrogen sulphide contains ferrous thiosulphate, or thiosulphate and polythionates. Experiments showed that on treating such solutions with hydrogen sulphide, iron bisulphide is formed both in the cold and on warming when no polythionate is present, but only on boiling when both thiosulphate and polythionate are present. The formation of iron bisulphide in this way may prove of service in analytical chemistry. Solutions of nickel, cobalt and iron, and also zinc, give no precipitate with thiosulphate, but in presence of the latter, hydrogen sulphide produces a precipitate of the sulphide of the metal and sulphur. Manganous salts do not give this reaction, nor do manganese salts yield a sulphide insoluble in hydrochloric acid when boiled with alkali polysulphide solution.—A. S.

Hydroxides of silicon, aluminium, and iron; Adsorptive power of ——. P. Rohland. Z. anorg. Chem., 1910, **67**, 110—112.

The hydroxides of silicon, aluminium, and iron, formed as colloids by the action of water and hydrochloric acid on talcs, exhibit adsorptive powers similar to those shown by them in the case of clays (this J., 1909, 1250; 1910, 89), though in a less degree. But although colloids and complex dyestuffs are adsorbed, no adsorption of the ions of weak acids and crystalloids and simple coloured substances, such as potassium bichromate, has been observed.—F. Sodn.

Nitrides and oxides extracted from aluminium which has been heated in air. J. O. Serpek. Comptes rend., 1910, **150**, 1520—1521.

That alumina and aluminium nitride are formed when aluminium is heated in air has been known for a long time (see Matignon, this J., 1900, 667). The author, after numerous experiments, is unable to confirm the statement of Kohn-Abrest (this J., 1910, 570) that a nitride different from AlN is formed.—A. S.

Nickel carbonyl and carbon bisulphide; Interaction of ——. J. Dewar and H. O. Jones. Chem. Soc. Proc., 1910, **30**, 137—138.

Nickel carbonyl and carbon bisulphide vapours interact readily at the ordinary temperature to form carbon monoxide and a bronze-coloured deposit containing nickel, sulphur, and carbon; the liquids, on the other hand, interact only to a very slight extent. An examination of the volume changes when the two vapours are allowed to react in a specially devised apparatus shows that the reaction is probably represented by the equation (II) rather than (I):

$$2Ni(CO)_4 + CS_2 = 2NiS + 8CO + C \quad . \; . \; . \; (II)$$
$$Ni(CO)_4 + CS_2 = NiS + 4CO + CS \quad . \; . \; . \; (I).$$

The reaction, however, is incomplete, proceeds more extensively at low pressures than at higher pressures, and is completely inhibited by the presence of carbon monoxide of a sufficient concentration. Thus, for example, there is no change in a mixture containing nickel carbonyl vapour under 37·5 mm., carbon bisulphide vapour under 32·5 mm., and carbon monoxide under 68·5 mm. pressure. In order to account for the influence of carbon monoxide on the reaction, and for the fact that the reaction, although not reversible, is incomplete, it is suggested that the actual reaction takes place, not between molecules of nickel carbonyl and carbon bisulphide, but between free nickel produced by the dissociation of nickel carbonyl and carbon bisulphide. The initial concentration of free nickel in the vapour of nickel carbonyl would be small, and would be much reduced by the presence of carbon monoxide, to which the dissociation of nickel carbonyl is very sensitive. Consequently, the presence of carbon monoxide would tend to inhibit the reaction until it would finally come to standstill. The behaviour of nickel carbonyl vapour at low pressures indicated that dissociation takes place in contact with the glass surface, and the interaction with carbon bisulphide appeared to take place similarly.

Nitrate trade of Chile. Oil, Paint, and Drug Rep., May 30, 1910. [T.R.]

The U.S. Consul at Valparaiso, reports as follows:—"The Chilean shipments of nitrate to the United States during 1909 were valued at $18,769,236, against $14,765,250 in 1908, and $16,899,723, in 1907. The basic value of the importations of Chilean nitrate of soda into the United States last year, according to customs statistics, was about $31 per long ton, against $36·50 in 1908 and $40 in 1907." The U.S. Consul at Iquique reports as follows:—"The present price of nitrate is $1·59 per quintal (101·61 lb.) for the 95 per cent. product, and $1·65 for the 96 per cent. product, with 1 per cent. salt, for immediate delivery free alongside ship. Of the 154 oficinas or nitrate manufactories in Chile, 55 are not being worked, 36 being closed before July 1, 1909, some for sometime previously on account of having worked out their nitrate grounds, or the cost of production from various causes having been too high. The oficinas in which the cost of production is low are reported as being worked to their limit, taking advantage of the cessation of restrictions regarding production at the discontinuance of the nitrate combination. Although strong efforts in its favour are being made by those whose cost of production is high, there does not appear to be any prospect of a new combination. The amount of nitrate produced in the different Pampas is given by the Association Salitrera de Propaganda, in quintals, as follows, during the eight months ending February 28, 1909 and 1910:—

Place of production.	1909.	1910.
Tarapaca	13,033,790	16,756,891
Tocopilla	2,104,400	4,167,020
Antofagasta	5,407,899	6,843,385
Aguas Blancas	2,568,805	2,595,640
Taltal	3,838,832	4,349,547
Total........................	26,953,726	34,712,483

Potassium cyanide; U.S. Customs decision. Oil, Paint, and Drug Rep., May 30, 1910. [T.R.]

The merchandise in question described on the invoice as "cyanide of potassium" was assessed with duty at 25 per cent. *ad val.* under par. 3 of the Tariff Act of 1909 as a "chemical mixture." It was claimed by the importers to be dutiable under par. 64 of Act at the rate of 12½ per cent. *ad val.* as "cyanide of potassium." The question raised here was involved in the Board's decision, G. A. 4777 (T. D. 22521), wherein the article was held to be cyanide of potassium according to trade usage and understanding; counsel for the government contending that only the pure cyanide of potassium used in medicine would fall within the provision, as by virtue of the Pure Food Act, the impure article was not permitted to be labelled or sold as such. In view of the fact that the article had been uniformly and generally bought and sold as cyanide of potassium for many years and that Congress had made no changes in the provision, the Board sustained the protest.

Potash salts; German law relative to the sale of ——. Oil, Paint, and Drug Rep., June 6, 1910. [T.R.]

On May 25th last, a law was promulgated and immediately came into force, regulating the production and sale of potash salts in Germany up to Dec. 31st, 1925. Broadly speaking, the law makes all potash mines within the German Empire members of a pool, which is controlled by the executive officers appointed by the government, none of whom may have any interest, direct or indirect, in the potash business. The governing powers are the Federal Council, an Allotment Commission, and a Commission on Appeals. The first is charged with the framing of the necessary regulations for enforcement of the act and for the adjustment of such difficulties as may from time to time arise. The Allotment Commission has the task of assigning to each mine its proportion of output, based upon the productive capacity of the mine and plant, and the Commission on Appeals has been designed to decide upon such protests as may be made against rulings of the Allotment Commission. This Allotment Commission, however, has only to do with the individual allotments of the mines, the total output of all being fixed by the Federal Council, the chairman of which is designated to act when appeals upon questions affecting the gross outturns of the pool arise. A mine owner is allowed to exceed his proportion in any one year by 10 per cent., but the excess will be deducted from his share of the next year's business. In the same way, if he produces 10 per cent. less than his annual allowance, he is allowed to make it up the following year, but all over and above the 10 per cent. margin either way is subject to heavy penalties. The maximum prices for domestic distribution are fixed, and it is ordered that the export prices must not exceed these. Rebates are allowed under certain conditions, and for quantities and freight differentials are arranged so as to equalize the costs to the buyers as far as possible. One mine owner may divide his allotment with another, which might often happen in cases where certain specified grades were needed to complete contracts. But in the event of a transfer of allotment, the mine owner making it must reimburse any workmen or employees to the full amount of their wages for a period of twenty-six weeks, should they be thrown out of employment as the result of such transfer. If the average wages paid to workmen employed in a potash works are reduced below the figure paid for the same class of work during 1907 and 1909, the allotment figures for the said works shall be deducted in proportion; and if the regular working hours of any class of labour are increased beyond those prevalent in 1909, a reduction of allotment will also follow as a penalty.

Patents.

Salt; Manufacture of ——. International Salt Co., Ltd., London, and E. R. Royston, Liverpool. Eng. Pat. 10,517, May 4, 1909.

For the production of salt of relatively large grain from evaporated salt of relatively small grain, the moist salt, as it comes from the evaporator, is dried by contact with heated gases and then passed to the melting furnace, after which it is cooled and finally crushed to the required size. Claim is also made for the rapid cooling of the melted salt after it has been tapped. The moist salt may be dried in an inclined cylinder through which the waste heating gases from the melting furnace are made to pass, and this cylinder may be rotated and provided with agitating devices or it may be stationary and traversed by a conveyor. The dry salt falls directly from the cylinder on to a conveyor which feeds the melting furnace, and automatic means may be provided for regulating the feed. Cooling the molten salt, after agitation with oxygen, if desired, may be effected by delivering it on to a shallow trough which is jacketed and cooled by a circulating liquid, the solidified salt being continuously pushed forward by mechanical scrapers, or it may flow from the furnace into hinged buckets attached to an endless conveyor, the cooling being expedited by passage through a tunnel supplied with cool air. (Reference is directed to Eng. Pats. 9884 of 1892, 24,191 of 1893, 14,644 of 1899, and 8117 of 1903; this J., 1892, 768; 1894, 395; 1900, 662; 1904, 740.)—F. Sodn.

Salt; Processes of refining —— and recovering its impurities as by-products. C. Glaser and G. J. Muller, Baltimore, Md. U.S. Pats. 957,416 and 957,417, May 10, 1910.

(1). To a solution of the impure salt is added such a quantity of hydrochloric acid as is sufficient to dissolve any impurity not wholly soluble in water, but insufficient to precipitate any of the sodium chloride, and then suitable reagents, such as barium chloride, and sodium carbonate, are added to the solution, so as to react with the impurities and render them separable from the sodium chloride, and, at the same time, increase the mass of salt by adding to the solution an element of sodium chloride. (2). Impure salt is leached by an acidulated saturated solution of pure salt, to dissolve the impurities, and is then washed with a saturated solution of pure salt. The acidulated leaching solution may then be treated with barium chloride, to precipitate the contained sulphate, and subsequently neutralised.—F. Sodn.

Sodium sulphate, hydrogen, and iron oxide; Manufacture of ——. F. J. R. Carulla, Derby. Eng. Pat. 19,920, Aug. 31, 1909.

Instead of using water alone for the absorption of hydrochloric acid in the Le Blanc process, some or all of the receivers or towers are packed with scrap iron or mild steel, ferrous chloride being thus formed and hydrogen evolved. The chloride is then converted, by precipitation, into iron oxide (*e.g.*, as in Eng. Pat. 27,302 of 1908; this J., 1909, 1126), and, since very dilute solutions are preferable for this purpose, the absorption of the last traces of hydrochloric acid is rendered very easy by this process, the ferrous liquor plant being conveniently placed at the end of the system, and hydrochloric acid of high strength being produced, if desired, in intermediate parts of the plant.—F. Sodn.

Salts of heavy metals [lead chromate, Prussian blue, and white lead] which are insoluble or hardly soluble in the electrolyte; Electrolytic manufacture of ——. C. Luckow, Cologne, Germany. Eng. Pat. 408, Jan. 7, 1910.

The process consists in electrolysing a solution containing a few per cent. of a mixture of a "dissolving salt" and, in much smaller proportion, a "precipitating salt," using anodes of the heavy metal or an alloy of heavy metals and cathodes of the same heavy metal or alloy, with active fillings of the corresponding oxides in a "fungous" state. The cathodes serve as depolarising means, and on or more of them are formed as boxes, so as to constitut "filtering cathodes." Solutions of alkali or ammoniu salts are generally used as the electrolyte, the "precipitatin salt" being replenished as its acid becomes used up in th process; the cations alone enter the filtering cathode and the alkali hydroxide is removed therefrom by siphon or the like. The cathodes may be enclosed, i necessary, with wooden frames and filtering cloths. Th current density is preferably about 25—75 amps. per sq. m of anode surface, and the tension, 1—3 volts per cell For the production of lead chromate (chrome yellow by this process, anodes of soft lead and cathodes of sof or hard lead, with active fillings of lead oxide, are employe and the electrolyte is a solution containing about 1½ pe cent. of a mixture of alkali chlorate and bichromat the bichromate and water being replenished as consume For Prussian blue or Paris blue, the anodes are of iron an the cathodes of iron, with active fillings of iron oxid the electrolyte being a solution of about 1 per cent. of mixture of alkali chloride and ferrocyanide; more of th latter and water are added as they become used up. F white lead, the electrodes are similar to those used f lead chromate, and the electrolyte is a solution containin 1—2 per cent. of mixed alkali chlorate and carbonat carbonate and water being constantly added as require —F. Sodn.

Sodium aluminate, aluminium fluoride, and other aluminiu compounds; Processes of making ——, *and process of treating ores [to prepare sodium].* P. A. Emanu Aiken, S.C. U.S. Pats. 957,754 to 957,756, and 957,84 May 10, 1910.

(1). Clays or other ores containing alumina, silica, and ir are heated in closed retorts with an excess of sodium bisu phate, so as to produce a double sulphate of sodium a aluminium (containing three molecules of the former to o the latter), a ferric alum, and free silica; the double lphate is then separated from the silica and heated in retort lined with carbon, and the resulting product is ated with lime, after which the sodium aluminate is solved out and a current of hydrofluoric acid gas passed to the solution. (2). Normal sodium sulphate is heated to red heat with an excess of coke, in a retort lined with rbon, until completely reduced to sodium sulphide; en lime and more carbon are added, and the mixture heated to about 600° C., and finally to about 850° C., hen sodium distils over. (3). Sodium is made by heating mixture of sodium aluminate and sodium carbonate, or her sodium compound, with carbon, in a closed vessel.). Clay is treated substantially as in (1), for the production of sodium aluminate.—F. Sodn.

lehyde derivatives; Production of —— and their application as discharging agents. Badische Anilin und Soda Fabrik. Fourth Addition, dated Nov. 4, 1909, to Fr Pat. 350,007, Jan. 7, 1905. Under Int. Conv., Dec. 23, 1908.

HE reduction of formaldehyde and sulphurous acid by ne dust (this J., 1905, 1300) is effected in the presence of umonia or other nitrogenous base; ammoniacal and her derivatives of formaldehyde-sulphoxylic acid are thus rmed. The reagents may be mixed in any order; for ample:—(1). 384 kilos. of sulphurous acid are introduced ot) into a mixture of 1500 litres of water, 432 kilos. zinc dust, 720 kilos. of formaldehyde (30 per cent.), d 510 kilos. of ammonia (20 per cent.); the mixture is ated for about three-quarters of an hour almost to 100° C., hilst adding a further 168 kilos. of zinc dust, and is then ltered; the liquor contains zinc aminomethylsulphoxylate d a nearly equal amount of the aminomethylsulphite. urther heating causes the aminomethylsulphoxylate to transformed more or less completely into the compound, $(CH_2OSOZn)_3$. The aminomethylsulphoxylate reacts ith sodium sulphide to give the corresponding sodium lt, and this changes slowly (rapidly on heating) into the dium salt of the above tertiary amino-derivative. By aporation *in vacuo*, the solution furnishes a very hygrospic residue. (2). 555 kilos. of aminomethylsulphurous id, prepared by introducing sulphurous acid into hexaethylenetetramine or from bisulphite, formaldehyde, mmonia, and acid, are suspended in 1000 litres of water, d the mixture is boiled for an hour with 500 kilos. of zinc st; it is then filtered, and the solution evaporated or eated with sodium sulphide as above. A substituted nino-derivative, such as phenylaminomethylsulphurous id may also be used.—F. Sodn.

lorides; Process of decomposing, by electrolysis, molten ——, and of manufacturing an alloy of lead with the metal of the salt decomposed. H. E. L. Fiévet. Fr. Pat. 408,893, Feb. 3, 1909.

USED chlorides, especially those of potassinm, sodium, d magnesium, are electrolysed in the presence of molten ad; this forms an alloy with the metal liberated at e cathode, and dry chlorine is evolved at the anode. he alloys are capable of numerons applications; that ith sodium, for instance, which is grey and brittle, teracts with water; it may be used, therefore, for the anufacture of sodium hydroxide, and, being conveniently ansported in sealed boxes, is suitable for the generation hydrogen for filling balloons, the lead being recovered such.—F. Sodn.

rnace for calcining alumina. A. Lambert. Fr. Pat. 409,036. Feb. 5, 1909.

IE furnace consists of a series of chambers arranged the principle of the Hoffmann furnace and each of the ambers contain a number of horizontal boxes or muffles ich receive the alumina in a thin layer and from which e steam can escape without mixing with the combustionses; alumina also cannot be carried away by these ses. Each chamber may at will be put in communication with the supply of combustible gas, or with the air supply, or with the chimney; the heating is, therefore, regenerative and the working of the furnace continuous. —F. Sodn.

Gaseous compounds; Process of manufacture of ——. [Obtaining oxides of nitrogen from air.] A. Vergé. Fr. Pat. 409,194, Feb. 11, 1909.

A much improved yield of oxides of nitrogen is obtained in the synthetic process by the immediate and extreme cooling of the products by means of liquid air. This is brought into such close proximity with the arc that the surrounding gases form a very restricted zone, the central portion of which is at a temperature of about 2500° C., whilst the outer part is in contact with the liquid walls of this reaction "chamber" at −200° C. Moreover, the liquid air at once removes the nitric oxide as formed, by absorbing and precipitating it in the solid form. The solid oxides may then be filtered off and treated with the necessary water, in the presence of air, to obtain nitric acid of any desired strength. One of the advantages of the process is that a low-tension arc may be employed; in fact an incandescent resistance may be used, instead of the arc, but the latter is preferred. Although described with special reference to the oxides of nitrogen, the process is claimed in its most general form, for the manufacture of any gaseous compounds which are unatable at the temperature of their formation, in consequence of the reversibility of the reaction.—F. Sodn.

Sodium sulphite; Process of manufacture of —— and its separation (hot) and consecutively the manufacture of ammonium chloride and its separation (cold). F. Duvieusart. Fr. Pat. 409,524, Nov. 23, 1909.

Sulphur dioxide and ammonia, in equivalent proportions, are passed, simultaneously or alternately, into a solution of common salt, until the sodium chloride has been converted into sodium sulphite, which, at the temperature of the reaction (about 95° C.), is deposited in the anhydrous state: the sodium sulphite is separated from the hot solution, and the clear liquor is cooled to 35°—40° C.; sulphur dioxide is then again passed in and the ammonium chloride is separated: finally, more salt is added to the mother liquor (150 kilos. for every 1000 litres), and this is treated with ammonia and sulphur dioxide, so that the cycle of operations begins afresh.—F. Sodn.

Silicon-calcium compounds containing nitrogen; Process for the preparation of —— from calcium silicide. A. Kolb. Ger. Pat. 222,237, Dec. 2, 1908.

Products varying in composition from $CaSi_2N_3$ to $Ca_{11}Si_{10}N_{10}$, according to the experimental conditions, are obtained by the action of nitrogen on finely-divided calcium silicide at temperatures above 1000° C. The greatest amount of nitrogen is fixed by first acting on calcium silicide with nitrogen at 1020°—1050° C. until no more is absorbed, then mixing the product with a further quantity of silicide, and again treating with nitrogen. (See also Kolb and Formhals, this J., 1909, 1313.)—A. S.

Sulphuric acid; Apparatus for the manufacture of ——. R. Moritz, Wasquehal, France. Eng. Pat. 11,128, May 11, 1909. Under Int. Conv., Oct. 26, 1908.

See Fr. Pat. 395,694 of 1908: this J., 1909, 473.—T. F. B.

Sulphuric acid; Apparatus for the manufacture of ——. F. J. Falding. Fr. Pat. 410,556, Nov. 22, 1909. Under Int. Conv., Dec. 31, 1908.

See U.S. Pat. 932,771 of 1909: this J., 1909, 1086.—T. F. B.

Nitrates [from nitrites]; Production of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 11,274, May 12, 1909.

See Ger. Pat. 220,539 of 1909; this J., 1910, 565.—T. F. B.

Lime-hydrating apparatus. A. J. Boult, London. From C. C. Kritzer, Chicago, U.S.A. Eng. Pat. 18,816, Aug. 16, 1909.

See U.S. Pat. 932,789 of 1909 ; this J., 1909, 1034.—T. F. B.

Barium carbonate ; Process for the purification of ——. Soc. pour l'Utilisation de l'Air et de ses Dérivés, Paris. Eng. Pat. 30,339, Dec. 28, 1909. Under Int. Conv., Jan. 21, 1909.

See Fr. Pat. 408,358 of 1909 ; this J., 1910, 627.—T. F. B.

Alkali salts ; Process and apparatus for the electrolytic decomposition of ——. J. Greenwood. Fr. Pat. 410,644, Dec. 20, 1909.

See Eng. Pat. 25,208 of 1908 ; this J., 1910, 163.—T. F. B.

Calcium carbide agglomerate. E. Jeanneret and C. Chapoy. Fr. Pat. 410,709, Dec. 27, 1909. Under Int. Conv., Jan. 22, 1909.

See Eng. Pat. 1315 of 1910 ; this J., 1910, 489.—T. F. B.

Silica ; Manufacture of gelatinous ——. A. Poulson. Fr. Pat. 410,716, Dec. 27, 1909.

See Eng. Pat. 491 of 1909 ; this J., 1909, 1198.—T. F. B.

Salts of heavy metals ; Electrolytic process of making difficultly soluble ——. C. Luckow. Fr. Pat. 410,747, Dec. 28, 1909.

See Eng. Pat. 408 of 1910 ; preceding.—T. F. B.

Erratum.—This J., 1910, 627, col. 1, title of first patent ; line 17 from top, *for* "General Electric Co.," *read* "General Chemical Co."

VIII.—GLASS ; CERAMICS.

Fish-scale effects [on glass and pottery] ; Production of ——. O. Parkert. Sprechsaal, 1910, **43,** 327.

"Perlmuttin," a product prepared from mica schist, is used for obtaining fish-scale effects on glass and pottery, the substance being applied with collodion or albumin as medium.—H. H. S.

Patents.

Glassware ; Process and apparatus for making ——. S. Forgó, New York. U.S. Pat. 958,613, May 17, 1910.

Molten glass is made to flow between directing or moulding surfaces, and a film of cool gas is interposed between these surfaces and the material, the glass being gradually reduced in thickness as it proceeds. The apparatus consists of a vessel which is divided into an inlet compartment, in which a pressure may be maintained, and an outlet compartment ; two directing members, forming a gradually contracting chamber, extend from the latter, and the gaseous film is produced on the inner surfaces of these members by making them, for instance, of porous material and constituting the inner walls of two chambers containing a vaporisable liquid.—F. Sodn.

Tiles ; Manufacture of dry-pressed ribbed and fluted ——. E. Sommerschuh. Ger. Pat. 220,384, May 8, 1909.

The face and back of the tile are dry-pressed in separate pieces which are then united by a binding material of melting-point equal to that of the glaze used.—H. H. S.

Sheet glass ; Production of ——. E. C. R. Marks, London. From J. Player, River Forest, Ill., U.S.A. Eng. Pat. 2548, Feb. 1, 1910.

See U.S. Pat. 952,354 of 1910 ; this J., 1910, 491.—T. F. B.

Furnace for spreading window glass. Soc. Anon. des Verreries et Manufacture de Glaces d'Aniche. Fr. Pat. 408,965, Feb. 4, 1909.

See Eng. Pat. 2762 of 1910 ; this J., 1910, 630.—T. F. B.

IX.—BUILDING MATERIALS.

Coal tar [for treating roads] ; "Water-soluble" —. F. Raschig. Z. angew. Chem., 1910, **23,** 973—974.

A mixture of coal tar with a small proportion of cl readily emulsifies with water, and is very suitable for t treatment of road surfaces. After drying, the tar becom insoluble, and is then not affected by rain. The mixtu of tar and clay, named "Kiton," is also very useful as tar paint since it can be applied to cold and wet surfac of all kinds, and after drying, forms a water-resista coating.—A. S.

Blast-furnace slag ; Use of —— *for paving-stone and concrete.* A. Knaff. Stahl u. Eisen, 1910, **30,** 827 828.

Paving stone prepared from the inner portions of the ma of slag, which must be quite cool before being broke was found to have a crushing strength of 761 kilos. p sq. cm. Large quantities of concrete made from bla furnace slag have been used in the erection of ironwor at Wissen. The foundations for heavy machines, boile and chimney-shafts were made of concrete containi large lumps of slag. Test pieces of a concrete consisting 150 parts of slag, 100 parts of slag-sand, and 25 parts cement, had a crushing strength of 120 kilos. per sq. c and with 32 parts of cement, 160 kilos. per sq. cm. Pie broken off from the foundation after several years hac crushing strength of 35 to 55 kilos. per sq. cm. T difference is considered to be largely due to the m careful preparation of the concrete for the original te pieces.—A. T. L.

Blast-furnace slag ; Suitability of —— *for the preparat of concrete.* H. Passow. Stahl u. Eisen, 1910, 829—836.

The use of blast-furnace slag in pieces or lumps is usua regarded as undesirable, and is sometimes forbidden the public authority in Germany. The author's te show that this opinion is not well founded. Test-bloc of concrete, 30 cm. cube, were made with four kinds slag, using 1 part of Portland cement to 10 parts o mixture of sand, gravel, and slag in equal proportio The crushing strength after 28 days, 3 months and months setting respectively was as follows :—No. 1,— 127·2, 109·8 ; No. 2,—88, 121·8, 141·2 ; No. 3,—75, 14 156·3 ; No. 4,—81·6, 117·0, 134·8 kilos. per sq. cm. as co pared with 73, 77·2 and 125 kilos. per sq. cm. for ordin concrete made with the same proportion of cement. these four slags, Nos. 1 and 2 were from one ironworks a Nos. 3 and 4 from another ; Nos. 1 and 3 were descri as suitable for making concrete, No. 2 as doubtful, a No. 4 as unsuitable, since it was known to disintegr if left in the open. Smaller test-pieces made fron part of cement and 3 parts of slag ground to the finen of ordinary sand, gave the following numbers after above periods of setting :—No. 1,—279, 347, 435 ; No —271, 291, 422 ; No. 3,—149, 231, 268 ; No. 4,— 229, 296. The corresponding figures using sand were 346, and 393. The slag is also used in the manufact of Roman and other cements. A large number of te are given, with different kinds of cement and with differ mixtures, tending to show that the slag concrete is sa factory. The average crushing strength of test-blo made with 1 part of cement and 10 parts of gravel, ov large range of cements, is as follows :—

	Portland cement.	Roman cement.	Oth cemer
	Kilos. per sq. cm.	Kilos. per sq. cm.	Kilos. sq. c
After 7 days' setting	41·7	33·2	30·
After 28 days' setting	56·7	64·2	61·
After 3 months' setting	83·5	80·5	87·

Test blocks made from lime and slag sand witl cement had a crushing strength of only 12 to 22 kilos.

, cm. after 56 days' setting, and such mixtures are refore unsuitable.—A. T. L.

Patents.

utralisatic of solutions of metallic salts [for impregnating wood]; Process for the ——. B. Diamand. Ger. Pat. 222,193, Aug. 10, 1909. Addition to Ger. Pat. 216,798, June 11, 1907 (see Fr. Pat. 396,974 of 1908; this J., 1909, 658).

STEAD of waste sulphite-cellulose lyes, waste liquors om the soda-cellulose process, or other liquors containing e extractive substances of wood, may be used to neutral- solutions of metallic salts for impregnating wood. It s been found also that in presence of the waste lyes from llulose manufacture, salts may be added to the impreg- ting solution, which would otherwise form insoluble ecipitates therewith. For example, alkali fluorides ay be added to solutions of ferrous sulphate or alu- inium sulphate, without producing precipitates, in pre- nce of the waste liquors mentioned. The salts to be lded to the impregnating solution may be pressed into iquettes and then saturated with the waste lye, or they ay be mixed with the lye first and then pressed into iquettes.—A. S.

lica bricks, ganister, and other refractory materials; Manufacture of ——. H. Brearley and F. C. Moorwood, Sheffield. U.S. Pat. 958,084, May 17, 1910.

E Eng. Pat. 14,619 of 1908; this J., 1909, 711.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

last-furnace; Behaviour of barium sulphate as an impurity of iron ores in the ——. G. V. Bianchetti. L'Ind. Chimica, 1910, **10**. 132—134.

EDEBUR and Lürmann have stated that barium sulphate of no importance as an impurity of iron ores, since in the last-furnace it is reduced to barium sulphide, which goes to the slag. The author, however, describes results ob- ined with a calcined spathic ore containing about 8½ per nt. of manganese oxide (Mn_3O_4) and 5½ per cent. of barium lphate, showing that under certain conditions (high mperature in the furnace and a highly basic slag), e reduced barium sulphide interacts with the oxide manganese to form manganese sulphide, which latter sses into the slag. In the tests quoted, only from 41 -45 per cent. of the manganese contained in the charge assed into the pig-iron, as compared with the 50 per cent. ven by Ledebur and 60—75 per cent. by Lürmann.—A. S.

itaniferous iron ore; Experiments on smelting ——. G. H. Stanley. J. Chem., Met., and Min. Soc., S. Africa, 1910, **10**, 345—352.

addition to the crucible experiments on the smelting titaniferous iron ore (see this J., 1910, 155), tests were ade in an improvised furnace 42 in. high and 9 in. ternal diameter, using silicious and titaniferous iron es, with dolomite and sand as flux. Though very fluid ags were produced, and spongy blooms of soft iron collected the hearth, no iron could be made to run. Further sts were made in a larger cupola having inside diameters 32 in. at the charging floor and 22 in. at the hearth, ut the same difficulty was encountered, the tap-hole ecoming eventually closed through the accumulation of ft iron in the hearth, although a certain amount of cast- on was tapped. The slags were very fluid, but ontained a high percentage of iron, those from the st run assaying from about 8 to 14 per cent. of ferrous xide. The results of the various experiments detailed. howed that though titaniferous ores are more refractory smelt than ordinary iron ores, the trouble is not caused y the supposed infusibility of the slags, the fluidity of hich was not noticeably affected by increasing amounts of tanium.—F. R.

Iron and steel industry; Electric furnace in the ——. G. Hooghwinkel. Electrician, 1910, **65**, 307—309.

The cost of electric power in connection with its use in the steel industry is only a small fraction, from three to eight per cent., of the total cost of production. Even a town supply at a price of from ¼d. to 1d. per unit is commercially economical, especially if the operations be so arranged so as not to coincide with the peak loads of the supply stations. By the utilisation of the waste gases from blast-furnaces and coke-ovens a cheap supply is available for operations on a large scale, this being the most economical method of utilising these waste gases. The various uses to which the electric furnace can be put, with the particular types of furnace most suited for the various productions of the steel industry are discussed. The greatest use will be for the production of rails of special steel, the present rail being quite unsuitable both chemically and physically for the great strains of express traffic. The German railway authorities have issued a specification for electric steel rails, and particulars are given of an electric steel rail made for the Metropolitan Railway of London. The electric furnace will also be used for the production of steel castings for both high grade and medium steels, superseding the crucible furnace. Castings have been made with commercial success by the Girod, Stassano, Héroult and Kjellin furnaces, and have given a 25 per cent. elongation with a 60,000 lb. per sq. in. breaking strain, 0·03 per cent. of sulphur, and 0·06 of phosphorus. The cost of the production of these castings in a 1 ton Stassano furnace was £9 a ton including all capital charges, as contrasted with the cost of pure Lancashire and Swedish iron, formerly used in the crucible furnace, of £10 a ton and the casting about £15 to £20 a ton. The electric furnace will also replace the small converter used with or instead of the open hearth furnace, and also for the production of malleable iron. Figures are given which show that in reality the supposed heavy maintenance of furnace linings and electrodes is really quite unimportant. The manufacture of special steels, ferro-alloys, etc., is especially adapted for the use of the electric furnace, while in ordnance works broken and rejected shells may be remelted and made into new ones. The conditions to be satisfied by a furnace for a particular purpose are enumerated, the manner in which furnaces of various types fulfil these conditions being detailed.—A. H. C.

γ-Iron; Determination of the curve of change of —— *into β- or α-iron.* P. Goerens and H. Meyer. Metallurgie, 1910, **7**, 307—312.

The authors bring together the previous determinations, made both by thermal and by metallographic methods, of the Ar points for irons containing different percentages of carbon. In their own experiments, six samples of iron were chosen, of carbon-content 0·16, 0·30, 0·47, 0·54, 0·70, and 0·78 per cent. They contained manganese 0·21 to 0·25, silicon 0·026 to 0·042, phosphorus 0·13 to 0·17 per cent., and only traces of sulphur. They were melted in the form of small hollow cylinders around a quartz tube, and from the solidified cylinder, discs weighing 0·5—0·8 grm. were sawn for the quenching experiments. The discs were heated in a kryptol furnace, in a fused mixture of barium chloride (65 parts) and potassium chloride (35 parts) to a temperature of 950°—1000° C., cooled to the quenching temperature, maintained at that temperature for 15 minutes (which preliminary experiments showed to be enough for the attainment of equilibrium), and then quenched. The quenching-temperatures were raised by ten-degree intervals for successive samples of the same metal, and the quenched specimens were examined microscopically. The mean of the quenching-temperature of the specimen showing traces of ferrite and of the next above showing entirely martensite, was taken as the transformation temperature. The results thus obtained were as follows:—

Carbon-content, per cent.	0·16	0·30	0·47	0·54	0·70	0·78
Transformation temperature	905°	895°	885°	855°	775° 785°	765° 795°

The indefinite results yielded by the last two metals are due to the difficulty of securing uniformity of composition when the carbon is so high; different specimens showed considerable differences in their behaviour. These results are embodied in a curve, and photomicrographs of the appearances of etched sections are given in the paper. —J. T. D.

Iron; The magnetic properties of the modifications of ——. S. Hilpert. Z. Elektrochem., 1910, **16**, 390—394.

In the author's opinion, the separate existence of β-iron is doubtful, and it is not certain that λ-iron is non-magnetic at ordinary temperatures. The loss of magnetic power is a change taking place continuously with rise of temperature, slowly at first, and more rapidly above 700° C. (see Weiss, Phys. Zeits., 1908, 9, 358). Since demagnetisation involves energy change, it is necessary to distinguish the specific heat of the non-magnetic state from that of the magnetic state, which also includes the energy required to overcome magnetic attraction. Hence when a rapid loss of magnetic power takes place, a rapid fall in specific heat is also observed. The evidence that β-iron is anything other than demagnetised α-iron is therefore incomplete. The transition at 910° C. to λ-iron is much more precise, and there is more evidence in favour of the separate existence of this modification which is certainly non-magnetic in the stable state. In the supercooled state at ordinary temperatures it is just as likely to be magnetic as α-iron. The only product the non-magnetic nature of which is beyond doubt is manganese steel and in this case it is conceivable that the presence of the foreign metal exerts retarding influence on the attainment of magnetic equilibrium similar to that exerted on the change of modification, without there being any necessary connection between the two changes.—W. H. P.

Iron-carbon system; Crystallography of the ——. A. Kroll, jun. Iron and Steel Inst., May, 1910. [Advance proof.]

The purpose of the paper is to establish the relation existing between the crystallography of pure iron and the iron-carbon alloys. The allotropy of iron was confirmed by the development, by heat tinting, of the polyhedral structures of both β- and λ-iron on the surface of a section previously etched to show the structure of α-iron. It was shown that the three structures directly traversed one another instead of coinciding as might have been expected. The explanation of the apparent solubility of hexagonal cementite, Fe_3C, in cubic iron and *vice versa*, was found in the existence of a crypto-dimorphous phase of cementite which, in the formation of mixed crystals, crystallises in the cubic system, and to which the name *solvite* is given. Quenching experiments enabled pseudormorphs of hexagonal cementite, after solvite, to be identified, these occurring in elongated cubes. Evidence pointed to the fact that solvite strives after saturation with λ-iron, and thus forms the unstable phase, troostite, the black constituent, x, which is revealed by acids in quenched and annealed steels. A crystallographical double diagram was established as stability diagram for the iron-carbon alloys, which allowed the constituents of the isomorphous system to appear intermediately as unstable tempering or deposition products, previous to the complete establishment of stable equilibrium. The crystallographical diagram, however, differs both in its nature and form from that of the purely chemical system, the stable equilibrium of which is established in accordance with special and always chemically homogeneous phases.—P. R.

Manganese [in iron and steel]; Determination of —— by the persulphate method. H. Rubricius. Stahl u. Eisen, 1910, **30**, 957.

The following procedure for the determination of manganese in iron and steel by the persulphate method has been used by the author since 1905, and has always given satisfactory results. 0·25 grm. of cuttings of the metal are dissolved in 25 c.c. of nitric acid of sp. gr. 1·2, the solution is concentrated to 12—15 c.c., treated with 10 c.c. of $N/10$ silver nitrate, diluted with water, and transferred to a 700 c.c. Erlenmeyer flask. It is then further diluted to abou 300 c.c., heated to boiling, and 10 c.c. of a 10 per cent solution of ammonium persulphate added to the boilin solution. The whole is boiled for 3—5 mins. more, cooled and after 20 mins. titrated with a solution of sodiu arsenite (1 c.c. = 0·001 grm. of manganese) prepared b dissolving 3 grms. of arsenious acid and 9 grms. of sodiu bicarbonate in 8·4 litres of water, and standardised b means of permanganate. The final point of the titratio is recognised by the appearance of a distinct green colou —A. S.

Blast-furnace gases; Cost of production of electrical pow by use of ——. R. Pokorny. Stahl u. Eisen, 1910, 3 938—944.

The author compares the relative advantages and di advantages of (double-acting four-stroke) gas-engines a steam turbines for driving the dynamos, when blast-furna gases are used for the generation of electrical pow According to his calculations, based on the requiremen of a metallurgical works consisting of five blast-furna (four in work), a steel works, a rolling mill, a Thomas al mill, and accessory establishments, the whole of the pow required could be furnished by the blast-furnace gas when gas-engines are used, but not when steam turbi are used; with the latter nearly twice the volume gas is required for the production of a given amount electrical power, as is needed when gas-engines are use The establishment costs and space required are small for a steam turbine installation, but the working cos are 10 per cent. higher than with a gas-engine plant.—A.

Iron blast-furnace slags; Black and blue ——. H. Fleissn Oesterr. Zeits. Berg- u. Hüttenw., 1910, **58**, 75—7 91—93, 104—106, 122—126, 140—142, 158—15 169—170, 186—189. Chem. Zentr., 1910, **1**, 1901—19

The view that the blue coloration of blast-furnace sla is due to ultramarine (see this J., 1910, 432) could not confirmed. Further experiments have shown that t black colour of certain slags may be due to the presence finely divided carbon as well as to that of ferrous oxi or to both; and that the blue slags are produced from t black ones by incomplete devitrification. The sla which appear blue by reflected light appear more or l brownish by transmitted light, or yellow in thin lay The two conditions necessary for the appearance of t blue colour are a turbid medium (formed by the incompl devitrification of the slag) and a dark background, furnish by the finely divided carbon. In most cases the bl particles are found between vitreous black portions a completely devitrified grey portions. If black vitre slags be intentionally devitrified by heating and sl cooling, they become first blue, then grey and sto This explanation of the blue coloration is in accord w the infrequent occurrence of blue slags. In most ca the slags are either vitreous or else completely devitrifi —A. S.

Granulating molten slag by means of air; Apparatus for— G. Jantzen. Stahl u. Eisen, 1910, **30**, 824—827

The molten slag is delivered from the blast-furnace dir into the upper end of an inclined rotating drum, and stream of slag is pulverised by means of a jet of compres air. The drum is cooled externally by means of water-j In this way the pulverised slag is rapidly cooled and is k in continual motion during its passage through the dr so that it does not adhere to the walls or form large mas The lower end of the drum projects into a chamber provi with a shaft for the removal of fine dust, and the powde slag in this chamber is taken by a conveyor to a cem making plant or elsewhere. The air-blast may be moiste to prevent the formation of slag-wool. The powde slag so obtained is of equal value for cement-making and other purposes to that obtained by the wet granulat process, and is more than twice as dense, 1 cb. m. weig 1300 kilos. as compared with 520 kilos. for wet-granula slag. In the installation used at the Buderus ironwo the drum is 1·8 m. diameter and 15 m. long, and daily output of powdered slag is 100 tons.—A. T. L.

ron-copper-nickel ; The ternary system ——. R. Vogel. Z. anorg. Chem., 1910, **67**, 1—16.

he investigation, which was chiefly micrographic although ade partly by the thermal method, had for its main bject the determination of the limits of concentration ithin which the alloys of iron, copper, and nickel cease to lidify as homogeneous masses of unsaturated ternary ixed crystals, and mixtures of saturated mixed crystals ppear instead; these concentrations are given in the rm of a curve on a triangular diagram. All the alloys re strongly magnetic at the ordinary temperature, and, in reparing those of medium concentration, glowing particles f the molten metal are violently ejected, the resulting lloys showing numerous blister-like hollows; the unaturated mixed crystals, when reheated at a temperature 0° C. below the melting point, have a tendency to coalesce, nd they exhibit great tenacity. The transformation mperatures of nickel and iron could not be established ith certainty in the alloys.—F. Sodn.

yanide ; Rapid analysis of commercial ——. R. Bell. Eng. and Min. J., 1910, **89**, 1114—1115.

he method depends on the assumption that all the otassium present must be in combination with cyanogen efore any sodium cyanide can be formed. The combined uantities of potassium and sodium are found by decompos- ng the cyanide with hydrochloric acid, evaporating dryness, weighing the mixed chlorides, and estimating e chlorine. As pure sodium and potassium chlorides ontain 60·6 and 47·6 per cent. of chlorine respectively, ach one per cent. of chlorine in the mixed chlorides, bove 47·6 per cent. will represent 7·69 per cent. of sodium hloride out of the total, the remainder being potassium hloride, from which the respective amounts of potassium nd sodium present are calculated. The final result is und by estimating the cyanogen and after satisfying e potassium, calculating the excess of cyanogen to sodium yanide. Excess of sodium is counted as carbonate unless hloride has been specially determined. Moisture is taken y loss on fusion. Silica, heavy and earth metals and ulphates should have been previously tested for. The resence of 2—3 per cent. of urea was suspected in one of the amples.—F. R.

yanide practice. E. G. Spilsbury. Trans. Amer. Inst. Min. Eng., May, 1910, 353—365.

n the "all-sliming" method for the extraction of precious etals by means of cyanide, the pulp, which consists of nely ground ore and cyanide solution, is agitated and rated by means of air blown in under pressure, or by entrifugal pumps. The efficiency of the agitation is owever, rapidly reduced, as a circular motion is imparted o the entire pulp, with the result that but slight alteration f the relative positions of the individual ore particles and he surrounding solution occurs. The improved apparatus onsists of a tank having a false bottom composed of orous silica plates bolted and cemented together, the aximum capacity of the porous diaphragm being about to 5·5 cb. ft. of air per min. per sq. ft. of area at 1 lb. ressure. The ore pulp, consisting of 2 of solution to 1 of re, is run into the tank and air is admitted from below t a pressure of from 2 to 6 lb. The pores of the diaphragm re so minute that no pressure is exerted on the air bubbles fter they have passed through, so that they rise to the urface slowly and uniformly, causing the contents of the ank to become a gently seething mass. The solution of he precious metals is very rapid and it is considered that he maximum economical extraction would be complete n about 6 hours. The results of a number of experimental ests are given. No clogging of the diaphragm by the ore lime was found to take place, though sometimes a gradual eposition of calcium carbonate decreased the porosity of he surface, but this was instantaneously removed by a ilute hydrochloric acid wash or by brushing with a wire rush. The porous silica is also used as a filtering medium. —F. R.

Gold bullion assay ; Accuracy of the ——. J. Phelps. Chem. Soc. Proc., 1910, **30**, 139.

The author has examined a number of results obtained in the assay of gold bullion from the point of view of the probable error. The following points were considered :. 1. Gold assays made in the course of routine work in the assay department of the Royal Mint. 2. (*a*) Assays of "trial plates" and comparisons of samples of "proof" gold ; (*b*) Comparison of proof gold made in the Mint laboratory with that produced by the Utrecht Mint. 3. Comparison of the results of assays made at the Royal Mint with the results of other assayers working on the same material. 4. Discussion on the same lines of results recorded in a paper by F. P. Dewey (this J., 1910, 215). The author finds that ordinary gold assays weighed to 0·05 per 1000 are subject to a probable error of +0·043 per 1000, while in the case of special assays weighed to 0·01 per 1000, the probable error of a single assay may be reduced to +0·032 per 1000. From this it is concluded that the error in the mean of 20 assays made with the greatest care should not exceed 0·01 per 1000.

Gold and silver ; Detection of small quantities of ——. G. Armani and J. Barboni. Z. Chem. Ind. Kolloide, 1910, **6**, 290—292.

The method is based on the production of colloidal solutions of the metals by reduction with formaldehyde, and is specially applicable for detecting gold or silver plating on brass or copper objects. *Silver.* A portion of the sample is treated with a small quantity of a mixture of 1 part of nitric acid of sp. gr. 1·41, and 9 parts of sulphuric acid of 66° B. This mixture dissolves the silver but leaves copper or brass unattacked. A few drops of the solution are rapidly removed, diluted with 2—3 c. c. of water, nearly neutralised with a 20 per cent. solution of potassium hydroxide, and then a mixture of 2 parts (by vol.) of a 30 per cent. solution of formaldehyde and 1 part of a 20 per cent. solution of potassium hydroxide added. In presence of a trace of silver, a more or less intense violet colour is produced. *Gold.* The sample is treated with nitric acid, the insoluble matter is digested with a small quantity of *aqua regia*, the solution diluted, filtered if necessary, treated with sulphuric acid, and evaporated, to expel chlorine and hydrochloric and nitric acids. The residue is diluted with water and treated with the formaldehyde-potassium hydroxide reagent, a fine violet coloration being produced if gold be present.—A. S.

Gold and silver ; Determination of —— in black or unrefined copper. H. Nissenson. Chem.-Zeit., 1910, **34** 539.

25 grms. of black copper are dissolved in dilute nitric acid ; the gold is filtered off, and in the filtrate the silver is precipitated with sodium chloride. The silver chloride is added to the gold. The combined precipitates are smelted with 25 grms. of litharge and a mixture of sodium carbonate, borax and tartar, in an iron crucible in a wind furnace. The regulus is extracted and the gold and silver weighed. The silver is extracted by treatment with nitric acid, first of 1·2 sp. gr. and then of 1·3 sp. gr. The gold is weighed and the silver determined by difference. The method is simple and exact. The dry method is however preferred by refiners. In this method, 40 × 2·5 grms. of the copper are placed in lead crucibles of about 10 grms. each and smelted direct in cupels with about 30 grms. of assay lead. The gold and silver are then determined as above. The author simplifies this method by weighing 8 × 12·5 grms. of the copper in a fire-clay crucible with 20 grms. (for each portion) of black flux mixture (made by mixing ordinary black flux with 2½ times the quantity of borax and sodium carbonate). After smelting the mixture in a wind furnace, 200 grms. of lead are added, and the crucible again very strongly heated for 5 minutes. The contents are poured out and after cooling, divided into 5 parts. The gold and silver are then estimated as above.

—A. Seld.

Copper in mattes; Rapid method for the determination of ——. B. Winkler. Chem.-Zeit., 1910, 34, 603.

1 grm. of the finely-powdered sample is dissolved in 10 c.c. of concentrated nitric acid and 10 c.c. of concentrated sulphuric acid, and the solution heated until fumes of sulphur trioxide are evolved. After cooling, a little water is added, and the solution boiled till it becomes clear, 0·5 grm. of potassium chlorate being added to oxidise any arsenic present. The iron is precipitated with ammonia, and after cooling, the mixture is diluted to 100 c.c. with water, and well shaken. The solution is next filtered through a dry folded filter into a dry beaker, and 50 c.c. of the filtrate are rendered very faintly acid with concentrated sulphuric acid, treated with 3 grms. of potassium iodide dissolved in a small quantity of water, and titrated with thiosulphate. For ores, 2 grms. are dissolved in 10 c.c. of nitric acid, 5 c.c. of hydrochloric acid, and 15 c.c. of sulphuric acid, and the solution treated as described above. For standardising the thiosulphate solution, 0·3 grm. of pure copper is dissolved in 4 c.c. of concentrated nitric acid, the solution heated with 5 c.c. of concentrated sulphuric acid until white fumes are evolved, then cooled, treated with 30 c.c. of water and excess of ammonia, and after making very faintly acid with concentrated sulphuric acid, the titration performed as in the actual test, a solution containing 39·18 grms. of sodium thiosulphate per litre being used.—A. S.

Sherardising [*zinc coating*] *process; Some practical experience of the* ——. J. W. Hinchley. Faraday Soc., May 31, 1910. [Advance proof.]

For the successful coating of iron or steel articles by the sherardising process (heating in a closed receptacle with zinc dust), the most important factor is the content of metallic zinc in the zinc dust used; the limits of time and temperature are comparatively wide. The best results are obtained with zinc dust containing 18 per cent. of metallic zinc. The author considers that Cowper-Coles' view that zinc is vaporised from the zinc dust and condensed on the iron or steel articles is not correct, for no deposit can be obtained from zinc vapour at temperatures below the melting point of zinc, such as are used in sherardising. In the latter process the deposition begins at a temperature just above that required to produce a film of magnetic oxide on the iron, and the deposit invariably contains iron. It is concluded that the coating is a closely adherent film of a solid solution of iron in zinc produced by the interaction of the metallic zinc in the zinc dust and the film of magnetic oxide of iron. If the proportion of metallic zinc present be low, a black film of reduced iron is formed. The zinc coating is very resistant to atmospheric corrosion, after the slight yellowish powder which is first formed, has been washed off: sherardised chain blocks have remained free from rust after use for seven years in the open air (See also Cowper-Coles, this J., 1909, 399.)—A. S.

Zinc leaf; Electrolytic formation of —— *on surfaces.* H. Freundlich and W. Novikow. Z. Elektrochem., 1910, 16, 394—400.

The authors have attempted to throw further light on the phenomenon investigated by Mylius and Fromm (Wied. Ann., 1894, 51, 593). If commercial zinc sulphate is electrolysed in a flat dish with a platinum point just at the surface of the liquid as cathode, the zinc separates as a thin lustrous film round the cathode. Mylius and Fromm discovered that oxygen was necessary for the occurrence of the phenomenon and the present authors have further established that there must also be on the surface of the electrolyte a film of some insoluble liquid. The necessary presence of oxygen is not accounted for by oxidation of the zinc, but by its favourable influence on the preliminary separation of amorphous zinc sponge. Many substances (ammonium salts, tartartic and citric acids, potassium cyanide, etc.) prevent the separation of zinc as a surface film, probably because they accelerate the transformation of zinc sponge into the crystalline variety. The separation of zinc sponge and the binding of this into a surface film by the necessary layer of non-miscible material seem to be the only phenomena involved. The binding material may be an insoluble liquid or a thin non-rigid layer of insoluble solid material so long as it gives the necessary thickness of 0·5 to 2 micromillimetres.

—W. H. P.

Thermo-electrical properties of alloys. E. Rudolfi. Z. anorg. Chem., 1910, **67**, 65—96.

The thermo-electric powers of the binary alloys of tin with cadmium and lead, of zinc with tin and cadmium, of bismuth with cadmium, lead with antimony, gold with silver and copper, copper with nickel, and platinum with palladium have been measured against copper and nickel, at a variety of temperatures and concentrations, with a view to establishing the relation between this property and the constitution of the alloys; the results are given in tables and curves. The curves showing the variation of thermo-electric power with concentration are of the same general shape as those co-ordinating hardness and electrical conductivity with concentration. The following rules apply:—(1) If the two components of a binary alloy form neither mixed crystals nor compounds, the curve is a straight line. (2) If the components form a continuous series of mixed crystals, the curve has a U-shape (3) If mixed crystals are formed only up to a certain limi of concentration, the curve is made up of two straigh lines sloping downwards towards a point on the limiting ordinate. (4) If the two components form a compound the curve, in its simplest form, consists of two straight line sloping upwards to a point on the ordinate marking th corresponding concentration. Concerning the practica use of alloys for the construction of thermocouples and thermopiles, it is remarked that, for large potentia differences, alloys which contain compounds, being ver brittle, are only to be recommended for thermopiles for thermocouples, alloys containing mixed crystal should be used, these being, as a rule, tough and not brittle Metals which, like bismuth and antimony, are very brittl do not form alloys suitable for thermocouples.—F. Sod

Colloidal metals; Preparation of —— *with the aid* *acrolein.* N. Castoro. Z. Chem. Ind. Kolloide, 1910, 283—289.

The author describes the advantages of the use of acrolei as a reducing agent for the preparation of colloidal met solutions (see this J., 1907, 1028). The solutions are stabl and the method is of general applicability. The prepan tion of colloidal solutions of gold, platinum, osmiun palladium, ruthenium, iridium, rhodium, and silver described.—A. S.

Smeltery smoke as a source of sulphuric acid. Freeland an Renwick. *See* VII.

Blast-furnace slag for paving stones and for concrete. Knaf *See* IX.

Blast-furnace slag for the preparation of concrete. Passov *See* IX.

Corrosion of metals. Committee appointed by Institu of Metals. "Times," June 2, 1910.

The Council of the Institute of Metals have decided undertake an investigation into the causes of the corrosi of non-ferrous metals by sea water, acids, &c., and by oth chemical and electroytic reactions. A committee, know as the Corrosion Committee of the Institute of Metals, h been appointed, consisting of Sir Gerard Muntz, chairmar Professor H. C. H. Carpenter, Engineer-Captain G. Goodwin, R.M., Professor A. K. Huntington, Mr. J. Milton, Mr. A. Philip, Mr. Leonard Summer, Professor Turner, and Sir William H. White. At its first meeti the committee decided for the present to confine the attention to the question of the corrosion of condens tubes in marine engines and in stationary engines usi foul water or being subject to violent electrolytic action, such as often occurs in electric power stations. Mr. G. D. Bengough is preparing an epitome of such information on the subject as is already available from previous research in the same direction, and will become a member of the committee. Prof. H. C. H. Carpenter, will act as honorary secretary to the committee.

Mineral resources of Natal. Board of Trade J., June 9, 1910. [T.R.]

Metalliferous deposits.—No large, well-developed metal mines, either of the precious or of base metals, exist in Natal. *Non-metallic deposits.*—The recently discovered mineral phosphates are of interest, and, under certain conditions, use can be made of them. A uniform grade of 40 per cent. of tri-calcium phosphate will with difficulty be maintained. *Coal* is the great mineral asset of Natal. Vast stores of bituminous and anthracite coal exist in the Upper Ecca and under the Beaufort beds, which form the surface of extensive areas of the Colony.

PATENTS.

Steel; Process and apparatus for manufacture of ——. N. E. Maccallum, Phœnixville, Pa., U.S.A. Eng. Pat. 7811, April 1, 1909. Under Int. Conv., Feb. 4, 1909.

A CONDUCTING trough, lined with refractory material, and having two or more branches radiating from a common centre, is fixed immediately below the tap-hole of an ordinary stationary open-hearth furnace. The branches simultaneously conduct the molten steel to ladles, the amount of metal flowing to each ladle being controlled by means of a guide-bar capable of dipping into the main trough at the place where the branches diverge. The guide-bar is fixed at right angles to a horizontal rod attached to the front of the furnace, and is raised or depressed or given a slight lateral movement by the rotation or lateral movement of the rod.—F. R.

Projectiles and various pieces; Method of hardening ——. P. Girod. First Addition, dated Aug. 30, 1909, to Fr. Pat. 408,441, Jan. 23, 1909 (this J., 1910, 637).

THE projectile or other metallic piece, after having been brought to its approximate form by forging, rolling and pressing, was subjected to a preliminary thermal treatment which consisted in heating it to a temperature of 450° to 500° C. and slowly cooling it in air. It is now found that, when the quality of the steel permits, the preliminary heating can be carried to a temperature of about 650° C. In the same way, the temperature of the final hardening may be raised to 750° C., and even beyond that point. Above 825° C. to 850° C., however, the increase of temperature no longer improves the hardness or the physical characteristics of the metal.—C. A. W.

Iron; Electro-deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 10,655, May 5, 1909.

THIS is essentially the addition of an auxiliary electrolysing cell to the apparatus used for the electro-deposition of iron. The auxiliary cell, which is comparatively small, is provided with iron anodes and a slowly rotating metal or carbon cathode. Owing to the high current density the iron is deposited in a flocculent form upon the auxiliary cathode, from which it is automatically removed by scrapers or other means. The electrolyte is kept in constant circulation through the whole apparatus, and is able to be maintained at the temperature required for the uniform deposition of iron in the main cell. (See Eng. Pat. 28,897, of 1906; this J., 1907, 699.)—F. R.

[*Steel*] *Furnaces; Electric* ——. J. Harden, London. Eng. Pat. 26,266, Nov. 12, 1909.

A TYPE in which the heating of the charge is effected partly by means of an electric arc or arcs, and partly by means of high resistance terminal plates in the walls of the furnace. These terminal plates are composite in character, comprising a hollow steel plate through which air or other cooling medium may be circulated, with a facing of chromite, zirconite, or other highly refractory material, and an intervening layer of carbonaceous material such as compressed carbon. The greater portion of the heat is thus developed by means of these terminal plates, without fear of melting them, and the arcs are merely employed for the desulphurisation, etc., of the steel. —B. N.

Furnace; Electric induction ——. C. Grunwald. First Addition, dated July 15, 1909, to Fr. Pat. 400,864, March 15, 1909. Under Int. Conv., Oct. 2, 1908. (See this J., 1909, 800.)

THE extremities of the auxiliary winding are bound to two points of one part of the primary winding, in such a way that the electrodynamic effects, which are produced between the primary and the fused metal, are without sensible influence on the position of equilibrium of the fused metal.—B. N.

Furnace; Electric steel ——. H. Aubry. Fr. Pat. 409,540, Nov. 24, 1909.

THE annular bath containing the metal is provided with two electrodes if continuous or monophase current is employed, and with three electrodes if the current is triphase. The electrodes are vertical, the arcs being produced between the electrodes and the surface of the bath. The current enters at one electrode and leaves by the other, traversing the metal, and producing currents in the midst of the metal, which stir up the mass and permit of the production of a homogeneous product. A slow movement of rotation may be given to the bath around a vertical axis, but this arrangement is omitted when a triphase current is employed. The bath may also be tilted for the purpose of pouring the manufactured steel and the slag.—B. N.

Iron; Electro-metallurgical process of manufacture of pure ——, *in a single operation directly from the ore.* La Néo-Métallurgie. Fr. Pat. 409,844, Feb. 27, 1909.

THE process is carried out in an arc furnace with vertical electrode, and comprises three distinct phases. The first consists in the progressive reduction of agglomerates composed of the ore to be treated, with the carbon necessary for the reduction of the oxide of iron in the upper part of the furnace, known as the zone of reduction. The second phase consists of fusion, and the third in the refining of the metal produced, these taking place in the lower part of the furnace, or zone of fusion, where the arc is produced. At the commencement of the operation, a liquid layer is formed in the zone of fusion, consisting of a melted mixture of iron ore and slag, which serves to refine the melted metal, to prevent contact of the metal with the carbon of the electrode, and also acts as a movable calorific regulator of the temperature. The pure iron may be transformed into steels of various grades by suitable additions before casting.—B. N.

Iron ores; Furnace for the enrichment of —— *by incomplete reduction.* G. Gröndal. Fr. Pat. 409,699, Nov. 10, 1909.

THE furnace is intended for the incomplete reduction of hæmatite and similar non-magnetic iron-ores, with a view to their subsequent enrichment by the magnetic separation of the magnetite produced. The apparatus comprises a vertical drying chamber of the ordinary pattern, down which the pulverised ore, alone or with carbon, is allowed to fall, its motion being controlled by revolving cylinders at the bottom. As it falls, it comes into contact with a series of tubes, through which the hot gases from the second stage of the process are passed. Reaching the bottom, the heated material passes into an inclined and rotating cylindrical furnace and is finally removed at the lower end through a closed chamber. The lower end of the furnace communicates with a small chamber into which a reducing gas is passed, and, through this chamber, a pipe carries a current of air under pressure to a point some way up the furnace. At this point, the air is distributed by a cone and, meeting the current of gas, produces a very hot flame which sweeps up the furnace and heats the ore nearly to redness. The heated ore, as it travels down the furnace, passes the air-inlet and comes into contact with the stream of reducing gas; in this way the mixture is more or less reduced.—C. A. W.

Furnace; Electric —— *[for zinc smelting]*. H. W. Hixon, Philadelphia, Pa. U.S. Pat. 957,337, May 10, 1910.

Comprises a hollow casing provided with a non-conducting lining and having upper and lower electrodes carried by the lining, and arranged to make contact with the charge, a current of electricity being passed through the latter. A two-compartment hopper is carried by the casing for receiving and preheating the charge, and by means of a shaft, a wheel upon the shaft, and a conical closure arranged to be drawn up into engagement with the mouth of the compartment, each of the latter may be opened and closed independently, thus "maintaining the vapour density" of the zinc in the furnace during the charging operation. A passage leads from the tap-hole in the lower part of the furnace to a condenser, which comprises a pocket for collecting the slag and a compartment for condensing the zinc vapours. A series of arcs may be produced immediately above the tap-hole, in order to maintain the zinc in a gaseous condition during its passage to the condenser.—B. N.

Detinning; Process of ——. C. J. Reed, Philadelphia, Pa. U.S. Pat. 958,177, May 17, 1910.

The tinned scrap is heated and agitated with a subdivided foreign body in order to pulverise the tin but not the other metals, then the latter are removed mechanically, and the tin is separated from the added foreign body by converting it into gaseous stannic chloride.—A. S.

Tantalum; Method of producing ——. J. Schilling, Assignor to Siemens und Halske Akt.-Ges., Berlin. U.S. Pat. 958,180, May 17, 1910.

An oxygen compound of tantalum, such as tantalic acid, is heated to a high temperature in an atmosphere of hydrogen in an electric furnace, and when the reduced metal is melted, the containing vessel is exhausted in order to free the tantalum from hydrogen.—A. S.

Briquetting fines of ore, furnace-dust, waste metal, waste iron, etc.; Process of ——. M. Glass, Vienna. U.S. Pats. 958,623, 958,700, and 958,701, May 17, 1910.

(1) The material is mixed with aluminium acetate solution and with quicklime, and pressed into briquettes. The heat developed by the slaking of the lime raises the temperature of the mass to about 100° C., whereby basic aluminium acetate is produced and acts as a binding agent. (2) The material is moistened with calcium chloride solution, mixed with quicklime, then moistened with water glass solution, and after addition of borax, moulded and pressed into briquettes. A basic silicate is produced and acts as binding agent. Only just sufficient calcium chloride solution and water glass solution respectively to moisten the surfaces of the mass is used. (3) The material is moistened with a solution of calcium acetate and aluminium sulphate, mixed with quicklime and with borax (to prevent oxidation), pressed into briquettes, and heated to about 100° C. The basic aluminium acetate produced acts as binding agent.—A. S.

Pyrites and pyrites residues; Method for the roasting and agglomeration of ——, *with utilisation of the sulphurous gases escaping from the furnace for the manufacture of sulphuric acid and its derivatives, the process being capable of application to the roasting, enrichment and agglomeration of pulverulent ores, carbonate ores and metalliferous residues.* H. Cornette. Fr. Pat. 409,301, Nov. 6, 1909.

The ores are first submitted to a preliminary desulphurisation in a vertical apparatus containing several floors, the material as it arrives at the bottom being fed into a horizontal rotatable cylinder, where the final treatment is effected. This cylinder is composed of refractory pieces enclosed in a metallic envelope and contains helical pieces which act as guides. During the passage along the cylinder, the ore is freed from the last traces of sulphur and gradually becomes agglomerated. It is next cooled in a chamber through which a current of air is passing in the reverse direction; the heated air being carried into the cylinder, or into the first apparatus, and employed in the oxidation. A certain amount of powdered carbon, or the corresponding quantity of gas, may be blown into the cylinder in order to assist the agglomeration of the roasted ore. In order to enrich the material, other ores may also be injected, and fluxes such as fluorspar, may be added, being either introduced into the furnace with the original ore or blown in with the carbon. The volatile products passing away from the cylinder are led through a dust chamber and along a passage where they meet the gases produced in the preparatory roasting. Finally, when sulphide ores have been employed, the gases, cooled in this way, are passed through a Glover tower into sulphuric acid chambers or employed directly for the manufacture of bisulphites.—C. A. W.

Refractory ores, particularly oxides and sulphides; Process of reducing ——. G. Boericke, Philadelphia, Pa. U.S. Pat. 958,851, May 24, 1910.

The ores are heated in presence of a reducing compound containing manganese and another reducing agent of such character, that the two agents when oxidised will form a suitable flux for the mass.—A. S.

Copper alloys; Method of making ——. G. Boericke, Philadelphia, Pa. U.S. Pat. 959,048, May 24, 1910.

Alloys of copper with vanadium, molybdenum, tungsten, chromium, or similar metal, are prepared by treating a solution of a salt of the alloying metal with copper sulphate, and subsequently reducing the precipitate thus obtained. Special claim is made for the production of alloys by treating sodium tungstate solution with copper sulphate, and reducing the precipitate obtained.—A. S.

Centrifugal filter for cyanide plants. C. Shapley, Guanajuato, Mexico. U.S. Pat. 959,173, May 24, 1910.

The filter consists of a rotating horizontal cylinder, with one end open, and provided with passages in its walls. The cylinder is lined with filtering material and the liquid to be filtered is introduced into the open end through a pipe disposed near the side of the cylinder and having openings so formed that the liquid issues in substantially the direction of rotation of the cylinder. The liquid passes through the filtering material and the passages in the wall of the cylinder into a collecting vessel. The solids are continuously removed by a scraper which extends across the surface of the filtering surface at an angle to the axis of the cylinder.—A. S.

Precious metals; Trap for ——. P. A. Brangier, Agnew, Cal., and R. Luckenbach, Philadelphia, Pa. U.S. Pat 959,300, May 24, 1910.

The apparatus consists of a sluice, the bottom of whic is formed by a series of overlapping amalgamated meta plates acting as riffles, and all agitated by means of common source of power. Suspended from above an disposed between adjacent riffle-plates are filtering-trap containing subdivided material (*e.g.* wire gauze) coate with mercury; the liquid flowing through the sluice i caused to pass through these traps. Anodes are suspended between the filtering-traps, which together wit the riffle-plates, act as cathodes, and a current of electricit is passed through the system.—A. S.

Cyaniding of precious metals; Apparatus for quick —— P. A. Brangier, Agnew, Cal., and R. Luckenbach, Philadelphia, Pa. U.S. Pat. 959,301, May 24, 1910.

The ore and cyanide solution flow through a sluice over series of superposed heated plates, alternately inclined i opposite directions. The lower end of each plate is connected with the upper end of the next lower one by a chamber. As the material is passing through these connecting chambers, air is injected into it under pressure. A current of electricity is passed through the system, certain of the plates acting as cathodes, whilst insulated anodes are set in the remaining plates.—A. S.

Aluminium alloys; Methods of obtaining ——. J. A. Boutes. First Addition, dated Nov. 11, 1909, to Fr. Pat. 395,331, Oct. 6, 1908 (this J., 1909, 480).

Aluminium alloys obtained by the method described in the original specification are defined, the compositions of those which resemble silver, iron and tin respectively in appearance and tint being given. As an example, the following compositions may be taken, the first alloy resembling silver and the second, iron or steel: (1) silver, 3; copper, 3; aluminium, 94 parts; (2) copper, 2·50; zinc, 2; nickel, 0·50; aluminium, 95 parts. By the addition of 5 to 10 per cent. of tin to the first of these, an alloy resembling tin in appearance and tint may be obtained. All these alloys retain the general characteristics of those previously described, and, in particular, possess low specific gravities.—C. A. W.

Aluminium; Solder for, and method of soldering and tinning ——. I. Gladkow, A. Nowikow, and W. Zavadzky. Fr. Pat. 409,237, Oct. 7, 1909.

Four parts of zinc are melted in a graphite crucible, 92 parts of tin are added, and finally, 4 parts of colophony. The mixture is stirred by means of an iron rod and subsequently run into moulds. The two surfaces to be soldered are carefully scraped and afterwards tinned with the above material, a soldering iron, but no acid or ammonium salt, being employed. The soldering is then effected in tho ordinary manner. The temperature required does not exceed 180° C., and the material can be employed for the soldering of aluminium to copper, brass or iron.—C. A. W.

Lead and tin: Manufacture of —— *in powder, and also oxides of the metals.* Soc. Gouthière et Cie. Fr. Pats. 409,157 and 409,485, Feb. 9 and Feb. 18, 1909.

(1). A suitable quantity of minium is heated in a cast iron boiler provided with agitators to a temperature of about 350° to 400° C. Metallic lead, to the amount of about two to three times the weight of minium, is then added in portions at a time, and the mixture well agitated. At the end of one to three hours' agitation, lead powder may be separated from the mixture by washing and successive decantations. In the alternative, the process may be continued for several hours until the whole of the lead has been transformed into oxide. For this purpose minium is preferable, but, in the manufacture of powder, this oxide may be replaced by litharge, lead carbonate, lead sulphate, or even by-products such as anhydrous sodium sulphate. (2). Tin powder is formed by the addition of two to three parts of the metal in small portions to one part of tin powder or oxide which has been previously heated to about 250° to 300° C. The mass is agitated, and, at the end of one or two hours, the tin powder may be separated by washing and decantation. By continuing the heating and agitation for several hours, the whole of the tin may be transformed into oxide.—C. A. W.

Separating comminuted ores or other solid matter from liquids; Means for ——. A. J. Arbuckle, Johannesburg. U.S. Pat. 958,068, May 17, 1910.

See Fr. Pat. 393,990 of 1908; this J., 1909, 356.—T. F. B.

Ores and carboniferous earths; Process of treating ——. A. A. Lockwood, Assignor to the L. and S. Synd., Ltd., London. U.S. Pat. 959,239, May 24, 1910.

See Eng. Pats. 26,264 of 1908, and 8287 of 1909; this J., 1910, 95.—T. F. B.

Steel; Apparatus for manufacturing ——. N. E. Maccallum, Assignor to F. P. Norris, Phoenixville, and The Phoenix Iron Co., Philadelphia. U.S. Pat. 959,146, May 24, 1910.

See Eng. Pat. 7811 of 1909; preceding.—T. F. B.

Metals soluble in alkalis [tin]; Process for separating —— *from waste and alloys containing them.* G. Spitz. Fr. Pat. 410,901, Dec. 15, 1909. Under Int. Conv., Dec. 17, 1908.

See Eng. Pat. 28,551 of 1908; this J., 1910, 161.—T. F. B.

Brass; Process for preparing a substitute for ——. S. Frank. Fr. Pat. 409,926, Dec. 3, 1909. Under Int. Conv., Jan. 18, 1909.

See U.S. Pat. 935,900 of 1909; this J., 1909, 1142.—T. F. B.

Iron; Process for extracting —— *from ores, and for preparing iron alloys.* A. S. Ramage. Fr. Pat. 410,145, Dec. 8, 1909.

See U.S. Pat. 949,004 of 1910; this J., 1910, 360.—T. F. B.

Burning blast-furnace gases. U.S. Pats. 958,428 and 958,429. *See* IIa.

XI.—ELECTRO-CHEMISTRY.

Relation of nitric oxide formation to the electrical and thermal properties of short continuous-current arcs with cooled anodes. Holwech. *See* VII.

Patents.

Battery; Electrical storage ——. A. W. Somers and R. J. Crowley, Bradford. Eng. Pat. 5062, March 2, 1909.

The positive electrode consists of a changeable rechargeable lead grid or grids provided with a paste formed of red lead and sulphuric acid. The whole is baked, treated with sodium silicate and again baked. The negative element is formed from zinc, treated with a preparation obtained from sodium carbonate, sulphuric acid and mercury. The electrolyte is obtained from sodium carbonate and sulphuric acid, the sodium sulphate formed being crystallised, and the crystals added to sulphuric acid so as to form an acid sodium sulphate solution, the positive element and the electrolyte thus containing a common element, namely, sodium. The elements are separated by perforated non-conducting casings.—B. N.

Electrolyte for primary or secondary galvanic batteries, applicable also as an electrolytical resistance for electric currents of any order. G. Schauli, London. Eng. Pat. 10,791, May 6, 1909.

Flaked rice, acacin, bassorin, ceresin, dextrin, lignin, lichenin, cellulose, tragacanth, phytocolla or glutin, paramylum or inulin is soaked and mixed with cold water till pulpy, then heated and 20 per cent. of zinc chloride mixed with it. 80 per cent. of ammonium, aluminium or magnesium chloride, or other metallic chloride, is then mixed with the mass.—B. N.

Element; New galvanic ——. C. F. G. A. Heil. Fr. Pat. 409,586, Nov. 25, 1909. Under Int. Conv., Nov. 27, 1908.

The battery is provided with two liquids, the depolarising electrolyte being separated from the one in which the zinc electrode is immersed by means of a porous carbon electrode. The side of the latter turned towards the zinc is provided with fine pores, whilst the pores on the opposite side are coarser; or the pores may be enlarged in any convenient manner on the surface.—B. N.

Resistance-conductors ; Preventing surface oxidation of ——. J. T. H. Dempster, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 957 193 May 10, 1910.

The conductors are coated with a readily oxidisable substance, for example, with carbon.—A. T.-L.

Furnace ; Electric ——. H. A. Danne, Clarkesburg, W. Va. U.S. Pat. 958,855, May 24, 1910.

The furnace comprises a stack, a crucible in communication therewith, and a shaft extending from the upper portion of the stack into the crucible. A central electrode, composed of a number of vertically-disposed cylindrical sections, which increase in diameter in a downward direction, is supported from the upper portion of the stack, and a "series of groups of annularly disposed electrodes" surround the central electrode, and are supported from the upper part of the crucible. Each group is arranged in a different horizontal plane, and adjacent to the outer upper edge of each section of the central electrode.—B. N.

Furnace ; Electric ——. A. Helfenstein. Fr. Pat. 409,020, Nov. 13, 1909.

The furnace has several baths, working independently of each other, and the lower electrodes are connected by a massive lateral conductor between the baths, or the lower electrodes and the conductor may be formed in one piece.—B. N.

Furnace ; Electric resistance —— with great concentration of energy and continuous working. V. Popp. Fr. Pat. 409,244, Oct. 15, 1909.

The furnace comprises an outer thick refractory mass, forming an inner cavity in which is a U-shaped "resister," of carbon, metal, etc., according to the temperature to be obtained, surrounding the crucible containing the material to be treated. The "resister" is separated from the outer mass and the crucible by refractory bars of carbon or other suitable material. Refractory blocks form a door to the furnace, for the introduction or withdrawal of the crucible, and for observing the progress of the action.—B. N.

Electrolysis of liquids ; Vessel destined for the —— and, in particular, of water. A. Cauchemez. Fr. Pat. 409,753, Nov. 27, 1909.

The electrodes consist of perforated sheet-iron, and are arranged concentrically, the space inside the inner electrode and the space between the outer electrode and the walls of the outer sheet-iron vessel being filled with clippings of sheet-iron. The two electrodes thus afford a large surface, and are brought near to each other, facilitating the disengagement of gas with small consumption of energy. The outer vessel is in metallic connection with the outer electrode, or may form the electrode itself, thus avoiding the formation of local parasitical currents, which affect the purity of the gases evolved. The electrodes are separated by an insulating envelope of porous fibres, such as asbestos, in the form of a sack, closed or not at the base, and woven in such a form as to present roughnesses or channels for the escape and separation of the gases. The outer vessel may also be surrounded by an envelope of wood, with the object of maintaining the temperature of the liquid at the point corresponding with the minimum of electric resistance.—B. N.

Material, more or less plastic or solid, particularly useful as electric insulator. R. Dumoulin. Fr. Pat. 409,846, Feb. 27, 1909.

Insulating substances, such as quartz, kaolin, glass, porcelain, etc., preferably in a finely divided state, are agglomerated with adhesive gummy or resinous substances, either vegetable, mineral, or industrial in origin, which may be ordinarily fluid or previously melted or dissolved. The mixture obtained is, if necessary, mixed with fatty insulating substances, such as oils, fats, waxes, etc., liquid or previously melted, the proportions of the three elements being varied according to the consistency required in the final product, which may, if required, be finally compressed. The preceding adhesive insulating substances may be replaced by fatty substances, modified by chemical agents so as to confer upon them the agglutinating power necessary, with or without the addition of other adhesive or sticky substances, such as gums, resins, etc.—B. N.

Electric furnaces. A. Helfenstein, Vienna. Eng. Pat. 26,845, Nov. 18, 1909.

See Fr. Pat. 409,020 of 1909 ; preceding.—T. F. B.

Metallic filaments for incandescence lamps. Fr. Pat. 409,608. *See* IIb.

Carbon filaments. Fr. Pat. 409,906 *See* IIb.

Electrolytic manufacture of salts of heavy metals which are insoluble or hardly soluble in the electrolyte. Eng. Pat. 408. *See* VII.

Decomposing molten chlorides by electrolysis. Fr. Pat. 408,893. *See* VII.

XII.—FATS ; OILS ; WAXES.

Copra ; Drying of ——. A. Dommes. Tropenpflanzer, 1910, 14, 288—297.

In order to obtain perfectly white copra the fleshy part of the cocoanut must be brought as soon as possible after removal from the nut into a drying chamber where it is submitted to a temperature of from 60° to 70° C. When surface moisture has evaporated, the temperature of the drying chamber may be lowered about 10°, but should not sink below 50° C. Towards the end of the drying process the temperature may be again raised to 70° C. The cocoanut shells may be used as fuel for heating the drying chamber and the latter should be so constructed that cold draughts of air do not enter, but proper ventilation is provided. Fresh copra yields from 60·1 to 65·7 per cent. of dry copra ; 1000 unselected nuts gave about 235 kilos., and 1000 selected nuts about 270 kilos. of dry copra. Nuts which have germinated yield 90 kilos. less copra than the quantities just mentioned.—W. P. S.

Fats ; Contribution to the chemistry and analysis of ——. A. Heiduschka. Z. angew. Chem., 1910, 23, 990—992.

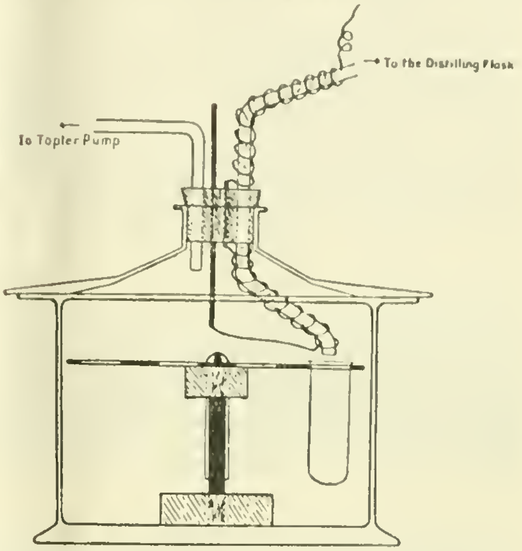
The author determined the Reichert-Meissl and Polensk values of a number of pure fatty acids (formic, acetic propionic, butyric, caproic, caprylic, capric, lauric myristic, palmitic, stearic, oleic, and linolic acids), usin Arnold's method (Z. Unters. Nahr. Genussm., 1907, 148 The results obtained showed that the acids may be divide into three classes :—(1) Acids of low molecular weigh and considerable solubility in water : during the dis tillation the composition of the vapour phase chang continuously, and in the case of the dilute solutions use in this method of analysis, there is an approximate relatio ship between the composition of the vapour and liqui phases. (2) Acids of high molecular weight, practicall insoluble in water : the acid and water behave as individu substances during the distillation, and for a given vapo pressure the vapour phase has a constant compositi independent of that of the liquid phase. (3) Acids whi are intermediate to those in groups (1) and (2). Althou the results obtained with the pure acids cannot be appli directly to the case of mixtures of fatty acids from natur fats, they may afford useful indications of the compositi of such mixtures. For instance it was found possi to prepare a mixture of acids (oleic acid, 10 ; lauric aci 55·4 ; myristic acid, 16·4 ; caproic acid, 0·55 ; capryl acid, 6·65 ; capric acid, 11 per cent.), which showed t same saponification value, Reichert-Meissl value, Polenske value, molecular weight of Reichert-Meissl acids, of Polenske acids, and of non-volatile acids as the fatty acids from coconnut oil.—A. S.

Oleic acid; Isomerisation of —— by displacement of the double linkage. A. Arnaud and S. Posternak. Comptes rend., 1910, **150**, 1525—1528.

ACCORDING to Saytzeff (J. prakt. Chem., 1887, **35**. 386; also this J., 1888, 442), if the iodostearic acid obtained by treating oleic acid with hydriodic acid be boiled with alcoholic potassium hydroxide, a mixture of acids is produced composed mainly of oleic acid and a solid isomeride of the same, different from elaïdic acid. Saytzeff considered this second acid, which melted at 44°—45° C., and yielded a dihydroxystearic acid melting at 77°—78° C., to be formed from oleic acid by the displacement of the double linkage from the 3.4 to the 2.3 position, and he named it iso-oleic acid. It is more generally held, however, that in oleic acid the double linkage is in the 9.10 position (see this J., 1906, 1055, 1158); and Ponzio (this J., 1904, 942) and Le Sueur (this J., 1905, 97), who have prepared the Δ-2.3-iso-oleic acid by the action of alcoholic potassium hydroxide on α-bromostearic acid, found that it melts at 58°—59° C., and yields a dihydroxystearic acid melting at 126° C. The author has repeated Saytzeff's work, starting with 700 grms. of oleic acid, and has found that the final reaction product is much more complex than stated by that author. By pressing the mixture of acids, a liquid and a solid portion were obtained, and from the latter by fractional precipitation with alcoholic sodium hydroxide, ordinary (Δ-9.10-) elaïdic acid was separated in the form of its sodium salt. From the residue, by treatment with bromine and then with alcoholic potassium hydroxide, a mixture of T-9.10- and T-8.9-stearolic acids was obtained, thus indicating the presence in the original mixture of Δ-8.9-elaïdic acid. Δ-8.9-Elaïdic acid prepared by partial hydrogenation of the corresponding stearolic acid, was obtained in the form of plates, which were slightly soluble in cold alcohol, melted at 53° C., and yielded a dihydroxystearic acid melting at 98·5° C. From the liquid portion of the original mixture, oleic acid and hydroxystearic acid of m. pt. 83°—84° C. were isolated. The iso-oleic acid of Saytzeff is thus not a definite compound, but a mixture of different acids. At least three different reactions take place when a molecule of hydriodic acid is combined with a molecule of oleic acid and then removed by means of alcoholic potassium hydroxide. (1), Transformation of oleic acid into elaïdic acid, its stereochemical isomeride; (2), displacement of the double linkage towards the carboxyl group, from the 9.10 to the 8.9 position; (3), replacement of iodine in the iodostearic acid by hydroxyl.—A. S.

Distillation of fats and fatty acids; Apparatus for the —— in the vacuum of the cathode light. J. Campbell Brown. Chem. Soc. Proc., 1910, **26**, 149—150.

THE apparatus (see fig.) consists essentially of a desiccator made with a broad flange, on to which the lid was very carefully ground by means of carborundum powder. Inside the lower portion of the desiccator a circular iron plate was fitted on glass bearings in such a way that it could revolve very freely. The best method of doing this was found to be as follows. A cork, or, as was afterwards used, a block of lead carrying a pointed glass rod, was cemented to the bottom of the vessel in an exactly central position. The plate was fitted by means of a cork cemented firmly to it, with a glass tube which would pass freely over the rod, and the sealed end of which rested on the point of the latter. The plate was pierced near its rim with eight holes, each of which carried a test-tube, and each of these tubes could be brought in turn beneath the delivery-tube by means of a magnet worked on the outside of the vessel. The lid of the desiccator was fitted with a tightly-fitting rubber cork, through which passed the delivery-tube and the exit-tube, and also two thick brass rods, the use of which will be explained later. In the earlier experiments this cork was fitted with a mercury tube, but it was found that this was unnecessary, and that the same end could be obtained by lubricating the stopper with a small amount of glycerol. The delivery-tube was sealed to the flask, which contained the substance to be distilled, whilst the exit-tube was sealed to a Töpler pump. On the exit tube was sealed a vacuum tube, through which the passage of an electric discharge was used to determine the vacuum. On testing the apparatus, it was found to hold a vacuum, in which the green fluorescence was visible, for at least two hours, and as it was intended to keep the pump at work throughout each experiment, this was considered quite satisfactory. In the distillation of acids, the melting point of which was in the neighbourhood of 70°, a difficulty was met with. The acid solidified in the delivery-tube inside the desiccator, and this brought the distillation to an abrupt close. This difficulty was surmounted by wrapping the delivery-tube with resistance wire both inside and outside the receiver, and keeping the tube hot by passing a current through the wire. In order to prevent the acid from solidifying in the portion of the tube which passed through the stopper, the tube was heated for about twenty minutes before the experiment was started, and the difficulty was in this way overcome. The brass rods previously mentioned were used to convey the current through the stopper. The working of the apparatus will be better understood by reference to the figure, which shows an elevation of the receiver, and a plan of the evolving plate. Many experiments were carried out with it, and in all these it worked extremely well. Its advantages are that it occupies an extremely small space, and that a distillate can readily be divided into any number of fractions, it is very easy to manipulate, while at the same time very high vacua indeed can be maintained in it over a comparatively extended period.



"*Narras,*" *a foodstuff of German S.W. Africa.* Grimme. *See* XIXA.

Production of flax in Canada. Oil, Paint, and Drug Rep., May 30, 1910. [T.R.]

THE production of flax in Canada in 1909 was approximately 5,000,000 bushels. There has been an enormous increase in the flax output since 1900, when the acreage was 23,086 and the total production in Canada was 172,242 bushels. The conditions in the Northwest provinces of Canada are very favourable for the production of flaxseed. The production in Canada is not yet sufficient to meet the demands of the oil mills, hence large quantities are imported from the United States and from

Argentina. The quantity brought into Canada last year was about 500,000 bushels. Besides this a large quantity of linseed oil is imported which could be profitably made there if the crop of home-grown seed were sufficiently large. The Canadian Government has, in the interest of Canadian agriculture, imposed a duty of ten cents per bushel on flaxseed, and as long as the demand so largely exceeds the supply there is a great inducement to farmers to take up the sowing of flax on a larger scale. There are three large linseed oil mills in Montreal, one at Baden, Ontario, and one at Winnipeg. The combined capacity of these mills is large and all the oil they manufacture finds a market in the Dominion. The oil cake is partly used in Canada and partly exported to Great Britain.

Patents.

Fats; Treatment of —— with a view to the manufacture of stearine and oleine. C. Dreymann. Fr. Pat. 409,913. Dec. 3, 1909.

The dark-coloured fatty acids are pressed first in the cold and then hot, and the resulting stearine and oleine separately distilled. Or the fatty acids may be pressed in the cold and separately distilled, and the solid portion then pressed with the aid of heat. The products thus obtained are stated to be much less coloured than those given by the usual process.—C. A. M.

Mixing and simultaneously pulverising two substances; Process and apparatus for ——. [*Production of soap powder and vulcanised oil.*] N. Reif. Ger. Pat. 222,140, Dec. 15, 1907. (See Fr. Pat. 397,412, this J., 1909, 802.)

The process is intended especially for the mixing and pulverisation of substances which immediately interact to from solid products. For the preparation of soap powder for example, sodium carbonate in the form of powder, paste, or solution, is introduced through the pipe, *m*, into the mouthpiece, *b* (see Fig. 1), of the nozzle, *a*, whilst through the pipe, *g*, and the slits, *d*, hot molten soap is forced in under high pressure. By means of the helix, *c*, a rotatory motion is imparted to the molten soap and in turn by the latter to the sodium carbonate, whereby the two substances become intimately mixed. The mixture issues through the annular opening, *n*, and falls to a powder, drying being assisted by a jet of superheated steam issuing from the nozzle, *p*. For the preparation of vulcanised oil, the apparatus shown in Fig. 2 may be used. The sulphur chloride is supplied through the pipe, *i*, and enters the mouthpiece, *b*, through the channels, *l*. The oil is forced in under high pressure through the pipe, *g*, a rotatory motion being imparted to it by the helix, *c*. The vulcanised oil issues through the annular opening at the apex of *b* and is neutralised by a strongly cooled alkaline solution discharged through the nozzle, *p*.—A. S.

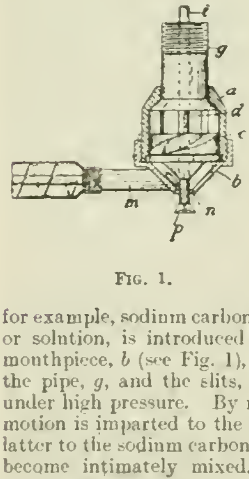


Fig. 1.

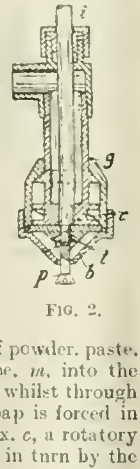


Fig. 2.

Glycerin; Decolorising of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 16,260, July 12, 1909.

The glycerin in any state, or in any stage of the process of manufacture, is treated whilst hot with hydrosulphites or formaldehyde-sulphoxylates. The treatment may be carried out with or without the addition of such agents as zinc, zinc oxide or magnesium oxide. Insoluble compounds, such as "decroline" (basic zinc formaldehyde-sulphoxylate) are recommended, so as not to increase the ash of the glycerin.—A. T. H.

Glycerin; Process for decolorising ——. Badische Anilin und Soda Fabrik. Fr. Pat. 410,824, Dec. 30, 1909. Under Int. Conv., May 29, 1909.

See Eng. Pat. 16,260 of 1909; preceding.—T. F. B.

Depilatory preparations for toilet use. [*Shaving cream.*] J. Lütje, Altona, Germany. Eng. Pat. 26,822, Nov. 18, 1909. Under Int. Conv., Nov. 24, 1908.

See Ger. Pat. 216,250 of 1908; this J., 1909, 1314.—T. F. B.

Saponaceous paste; Neutral ——. Nauton frères et de Marsac, and T. F. Tesse. Fr. Pat. 410,293, March 10, 1909.

See Eng. Pat. 9441 of 1909; this J., 1909, 1259.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead; Manufacture of —— in Russia. L. Falk. Chem.-Zeit., 1910, 34, 557—558.

Russia uses annually about 32,000 tons of white lead, which is supplied partly by home works and partly by imports. Works in the Baltic Provinces, St. Petersburg, S. and W. Russia chiefly use the German chamber process. Foreign competition is keen in Poland and the South despite a duty of 0·75 rouble per pud (about 4s. 11d. per cwt.). The essentially Russian white lead industry is centred at Jaroslaw, and supplies Siberia, the North, Moscow, and the Volga region with a product selling at about 6s. 6d. per cwt. more than the foreign product or that produced by the chamber process, but of very superior quality. It is made as follows:—Litharge, obtained by heating lead in a reverberatory furnace and containing 25—40 per cent. of metallic lead, after hand-sifting, is well mixed on special work tables, with 4—5 per cent. of solid lead acetate, moistened with a little water, and made into semi-globular heaps of 5—5½ cwt. each (called "kubiki"). They are well beaten down and allowed to remain over night. The heaps are then cut up finely with iron knives, the masses spread on linen-covered frames and exposed at about 40° C. to the slow action of carbonic acid gas, generated by coke ovens in the same room, the proportion of gas being so small that the air can be inhaled for a short time. After 3 days the frames are emptied on to the tables, the masses moistened with water, again made into heaps and allowed to remain over night. In the morning they are again cut up finely, spread on the frames and exposed again to carbonic acid gas for 3 days In continuous working 3—4 hours only are allowed daily for these operations, the room being ventilated previously. The above process is repeated during 3—5 months, the water used being increased gradually from one-half t four pails per heap, but an excess must be avoided, as it causes an undesirable caking together of the mass. In the first 2½—4 months the heaps are floury masses of variou shades and easily divisible; in the last 2 weeks they become white and very pasty. The process is considere finished when a sample gives no indication of sandy litharg or metallic lead when rubbed between the fingers. The product is then kneaded with water by hand until homogeneous paste is obtained. Mechanical kneadin has so far been found unsatisfactory. Metallic lead i threads is sometimes used instead of litharge: it i moistened with lead acetate solution and treated as above but the carbonating is effected in special chambers with a increased supply of carbonic acid gaa; the product, know as Jaroslaw chamber white lead, is not, however, of such high value as that obtained from the oxide. The industry is controlled by a strong syndicate. The annual production is 9300—10,800 tons. Cases of lead poisoning amongst the workers are stated to be very frequent but statistics are not obtainable. Jaroslaw white lead is characterised by its great covering power. It contains 10·8—11 per cent. of carbonic acid.—A. Sbld.

White lead; Theory of the formation of —— and a new method of manufacture. L. Falk. Chem.-Zeit., 1910, **34**, 567—568.

The different lead carbonates are represented by the author as derivatives of one or more molecules of the hypothetical orthocarbonic acid, $C(OH)_4$. The compound, $PbCO_3,PbO$, is stated to be obtained as a white crystalline precipitate by the action of water and carbonic acid on lead; the compound, $3PbCO_3,Pb(OH)_2$, has not been obtained pure, but appears to be formed by the prolonged treatment of normal lead carbonate with basic lead acetate solution. The compound, $5PbCO_3.2Pb(OH)_2.PbO$, is the main constituent of the valuable Russian white lead (see preceding abstract); it can be synthetically formed from its components ($PbCO_3,PbO$ and H_2O). It is only stable at low temperatures; on heating it splits up as follows:

$$5PbCO_3.2Pb(HO)_2.PbO = 2[2PbCO_3,Pb(HO)_2] + PbCO_3 + PbO.$$

The lead carbonate formed changes into basic carbonate, at a higher temperature: $3PbCO_3 + H_2O = 2PbCO_3,Pb(HO)_2 + CO_2$, the end products thus formed being ordinary white lead and lead oxide; the latter can be separated by treatment with lead acetate. In white lead making it is very difficult to regulate the various reactions taking place in the complicated chemical process, so as to ensure a product of regular chemical composition. It is pointed out that the more the reactions proceed separately and can be kept separate to the end of the process the better is the resulting product. The Russian white lead process (see preceding abstract) is stated to come the nearest to these conditions. *New process for making white lead:* White lead can be readily prepared synthetically, with a theoretical yield, from normal lead carbonate, lead oxide and water, with lead acetate as a catalyser. On the large scale the chief difficulty has been the cost of producing the carbonate. It is found now that normal lead carbonate is easily obtained by passing a current of carbonic acid gas through a basic lead salt solution, such as the basic acetate, until the liquid has a faintly acid reaction. The course of the reaction can be followed by the hydrometer; the specific gravity of the liquid sinks at first, then rises to a maximum, and falls again until the reaction reaches a state of equilibrium. The lead carbonate formed is easily separated from the liquid by filter-presses. To make white lead, 100 kilos. of the normal lead carbonate are mixed with 19 kilos. of water, 1 kilo. of lead acetate, and 40·5 kilos. of lead oxide, or with 33·7 kilos. of lead oxide if the mixture is heated. In the first case the compound $5PbCO_3.2Pb(HO)_2,PbO$ is obtained; in the latter the product, $2PbCO_3.Pb(HO)_2$. The water is quickly absorbed and the mass becomes stiff, when water must be added to keep it kneadable. 1000 kilos. of white lead are easily made in 3—4 hours. The process (which is patented in several countries) is distinguished by its speed and the regular composition of the product. (See also this J., 1905, 742, 892; 1907, 149.)—A. Sbld.

Resin acids of the Coniferæ. II. Matairesinol. T. H. Easterfield and J. Bee. Chem. Soc. Trans., 1910, **97**, 1028—1032.

The yellowish-white resin lining the heart cracks of the wood of the matai (*Podocarpus spicatus*) tree, which grows freely in New Zealand, when crystallised from hot alcohol and subsequently from 70 per cent. acetic acid, yields a substance, $C_{19}H_{20}O_6$, isomeric with the pinoresinol discovered by Bamberger (Monatsh. Chem., 1897, **18**, 481) in the exudation resins of *Pinus larico* and *P. vulgaris*. This new compound, which has been named *matairesinol*, differs from podocarpic acid, which forms the greater part of the heart-resin of *Podocarpus cupressinum*, in being only sparingly soluble in alcohol. It contains two hydroxy- and two methoxy-groups, just as pinoresinol does; the third pair of oxygen atoms in matairesinol is lactonic, whilst in pinoresinol the nature of the third pair has not yet been determined. Unlike pinoresinol, matairesinol forms no sparingly soluble potassium salt, its salts, with the exception of the heavy metal derivatives, being easily soluble in water. Matairesinol melts at 119° C., and has the optical rotation, in acetone solution, $[\alpha]^{15}_{D}$ 4·89°. It is not appreciably soluble in light petroleum spirit. In other solvents the following values (grms. per 100 grms. of solvent) were observed. Acetone (12° C.), 179; chloroform (12°), 35; ethyl acetate (12°), 27; methyl alcohol (12°), 16·7; ethyl alcohol (18°), 9; amyl alcohol (12°), 4·6; toluene (12°), 1·9; and lower values for ether, benzene, and water. Sodium hydroxide dissolves the compound in the cold, but hot sodium carbonate solution only dissolves it slowly. From alkaline solutions mineral acids precipitate the original lactone (matairesinol), but acetic acid precipitates the corresponding hydroxy-acid, matairesinolic acid, $C_{19}H_{22}O_7,3H_2O$, which is easily soluble in alcohol, ammonia, and sodium carbonate. Matairesinol cannot be distilled without decomposition, even under reduced pressure (20 mm.).—A. S.

Linoleum; Analysis of ——. F. Fritz. Chem. Rev. Fett- u. Harz-Ind., 1910, **17**, 126—127.

Ulzer and Baderle have stated that the proportion of "linoleum-cement" in linoleum may be estimated by heating the finely powdered material with benzene in a sealed tube at 150° C. The author finds that the "cement" is not completely dissolved by this treatment and that better results are obtained if, after heating, the residue is extracted with a mixture of benzene and chloroform. The nature of the residue may be qualitatively and in some measure quantitatively determined by a subsequent microscopical examination.—J. A.

Production of aldehydic resins by carbonising wood in closed vessels. Duchemin. *See* III.

Patents.

Varnishes; Method of increasing the drying properties of ——. J. Niedzielski and J. A. V. Bourgeois, Âiné. Fr. Pat. 408,902, Oct. 14, 1909.

A solution of manganese borate in turpentine oil, with or without the addition of organic salts of other metals, is mixed with the varnish.—C. A. M.

Sizing material [from resins]; Manufacture of ——. B. Borchardt. Fr. Pat. 408,972, Nov. 12, 1909.

Resins soluble in alcohol, such as Manila copal, sandarac and the like, are incorporated with a proportion (up to 10 per cent.) of one or more fatty oils, and the mixture heated until of a thick consistency and kept at the temperature required for this purpose, for 30 minutes to an hour, being meanwhile constantly stirred.—C. A. M.

Turpentine; Process and apparatus for the manufacture of ——. L. B. Castets. Fr. Pat. 409,026, Nov. 13, 1909.

The crude turpentine is heated *in vacuo* and meanwhile mechanically agitated. The apparatus used for the purpose contains mechanical stirring arms and has its outlet connected with a reflux condenser, so that the heavier volatile substances fall back into the heating chamber, whilst the most volatile constituents pass on to a second condenser. After sufficient heating of the material, air is admitted into the apparatus, and the mass is allowed to stand for the solid impurities to deposit, after which the water and solid impurities are separately drawn off, and the turpentine is transferred to the still. It is stated that by this method a maximum yield of very white turpentine may be obtained.—C. A. M.

Anti-rust composition. C. Pauling. Fr. Pat. 409,569, Nov. 24, 1909.

The composition, which is designed for use on fire-arms, consists of a mixture of glycerin, soap, free alkali, and alcohol, and is prepared as follows :—A fatty oil such as castor oil is completely saponified by means of alcoholic potash or soda ; the liquid is then heated with pure glycerin and a further quantity of aqueous alkali hydroxide or carbonate is added. Finally the liquid is clarified by the addition of alcohol. The object of the addition of soap is to increase the covering power of the glycerin medium.—E. W. L.

Lac ; Process and apparatus for the treatment [purification] of ——. W. A. Freymuth. Fr. Pat. 409,794, Nov. 30, 1909.

The crude stick-lac is crushed, and mixed to a paste with water ; colouring matters are then removed by repeated washings with water in a special form of apparatus, and with or without the addition of chemicals to the washing water. The washed lac is introduced into a hydro-extractor (see following abstract) where it is melted by heat and filtered from impurities. The fused lac is well mixed, and is allowed to cool slowly during the process. By this means the resin and wax of the product are caused to form a completely homogeneous plastic mass.—E. W. L.

Hydro-extractors for the treatment of lac. W. A Freymuth. Fr. Pat. 409,795, Nov. 30, 1909.

The lac, which has previously been treated according to the method described in the preceding abstract, is introduced into the basket of the hydro-extractor, steam and air or other gas under pressure being also admitted, so as to raise the temperature to from 90° to 135° C.—according to the age and quality of the lac. The lac is melted and passes through the filtering medium of the basket, impurities remaining behind. The purified lac is projected into an annular trough, which is fixed on the inner wall of the outer casing of the hydro-extractor. Into this channel the lac is directed by two flanges projecting outwards, and bolted on to the top and bottom edges of the basket in such manner that the lac only leaves the revolving basket through a narrow annular space mid-way between the top and bottom of the basket. —E. W. L.

Linoleum ; Process and apparatus for the manufacture from fibrous materials of a mass similar to ——. N. Reif. First Addition, dated Nov. 26, 1909, to Fr. Pat. 393,868, Sept. 2, 1908 (this J., 1909, 152).

In order to retard the formation of the "oil-rubber" and so render it more resistant to the effect of the high temperature to which it is afterwards exposed, coal-tar oils, or mixtures of their components—phenol, naphthalene, paraffin wax, etc.—may be added to the mass.—E. W. L.

Ultramarines ; Manufacture of ——. F. Bellet, Paris. Eng. Pat. 11,755, May 18, 1909.

See Fr. Pat. 400,103 of 1909 ; this J., 1909, 992.—T. F. B.

Electrolytic manufacture of salts of heavy metals [lead chromate, Prussian blue, and white lead], which are insoluble or hardly soluble in the electrolyte. Eng. Pat. 408. *See* VII.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Cold vulcanisation ; Theory of ——. B. Bysow. Z. Chem. Ind. Kolloide, 1910, 6, 281—283.

In some preliminary experiments, pieces of Para rubber of approximately equal weight (0·5 grm.), thickness (0·5 mm.), and area, were vulcanised for ½ hour in petroleum benzine solutions of sulphur chloride containing 0·6, 1·2, 1·8, 2·4, 3·0, and 3·6 grms. of sulphur chloride respectively per 100 c.c. On plotting the percentages of sulphur in the vulcanised rubber (from 1·39 to 5·38) as functions of the concentration of sulphur chloride, practically a straight line was obtained, from which it would appear that the absorption of sulphur by the rubber was in accord with Henry's distribution-law. Further experiments, however, showed that even with solutions containing only 0·1 grm. of sulphur chloride per 100 c.c., equilibrium was not attained until after 1 hour. Pieces of rubber were therefore next vulcanised for 2 hours in solutions containing 0·0125, 0·025, 0·0375, 0·05, 0·075, and 0·1 grm. of sulphur chloride per 100 c.c., with the following results :—

Concentration of sulphur chloride, grms. per 100 c.c.	Sulphur in rubber.	
	Found.	Calculated.*
	per cent.	per cent.
0·0125	0·17	0·16
0·025	0·21	0·22
0·0375	0·25	0·28
0·05	0·36	0·32
0·075	0·41	0·39
0·1	0·45	0·45

* The values were calculated by means of the simplest equation of the parabola $\frac{C^2}{C_1}$ = const., but the mean of four determinations gave the value n = 1·97 for the exponent.

These results indicate that the process is one of adsorption and is governed by the concentrations and not by the absolute quantities of the substances. That the percentage of sulphur in the vulcanised rubber is independent of the absolute quantities of raw rubber and sulphur chloride was confirmed by direct experiments. The sulphur chloride is adsorbed as such. Cold vulcanisation cannot be effected with a solution of sulphur in benzene, since according to the theory of adsorption, only substances that diminish the surface tension of the solvent are adsorbed. Sulphur increases somewhat the surface tension of benzene, but if the author's view be correct, then cold vulcanisation could be effected with sulphur, provided a solvent of rubber and sulphur be found, of which the surface tension is diminished by sulphur.—A. S.

Patents.

Rubber ; Process of producing ——. O. Chute and F. L. Randel, New York. U.S. Pat. 957,495, May 10, 1910.

The "crude vegetable material" containing rubber is freed from resin by extraction with a volatile solvent adapted to extract resin but having substantially no solvent power for rubber, *e.g.*, ethyl acetate, and the rubber is separated from the remaining impurities by maceration with water.—E. W. L.

Rubber waste [vulcanised] ; Regeneration of ——. A. L. Chodorowski. Fr. Pat. 409,482, Nov. 22, 1909.

One part by weight of the waste rubber is heated, for from one to three hours at a temperature of 150°—200° C., with 3 parts by weight of aniline, the operation being conducted in an autoclave. It is advisable to agitate the mixture during the process in order to hasten solution. The solution is filtered (if necessary), and the aniline is removed from the filtrate by steam-distillation, preceded with advantage by distillation at 125° C. under reduced pressure. The regenerated rubber forming the residue is finally washed with water. Instead of being separated by distillation the rubber may be precipitated from the aniline solution by means of a liquid soluble in aniline, but in which rubber itself is insoluble, as for example alcohol in the proportion of two volumes of the latter to one of aniline.—E. W. L.

Rubber and resistant materials ; Products made from mixtures of ——. A. Metz. Fr. Pat. 409,737, Nov. 25, 1909.

It is claimed that mixtures of rubber with silicon carbide, boron carbide, ferrosilicon, emery, bauxite or similar

materials, vulcanised in the ordinary way, are highly resistant to wear by friction, and are thus very suitable for use in the manufacture of such articles as rubber shoes, shoe-soles, tyres, horseshoe pads, rubber paving, etc.
—E. W. L.

XV.—LEATHER ; BONE ; HORN ; GLUE.

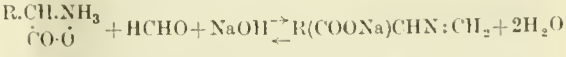
Sulphide of arsenic with lime ; Effect of temperatures on the reaction of commercial ——. L. E. Levi and E. V. Manuel. Hide and Leather, May 7, 1910.

The value of arsenic sulphide when added to lime to assist in unhairing depends on the amount of sulphide soluble in alkali present and also largely on the state of division. Stasny (this J., 1906, 858) has shown that calcium hydrogen sulphide is formed and that this is the active agent in removing the hair. Experiments were carried out to observe the effect of different temperatures in the reaction between lime and arsenic sulphide. Pure lime made from marble was used in the experiments, while the arsenic sulphide was the usual commercial article. At room temperature there was scarcely any reaction between the substances. One part of arsenic sulphide was mixed with 10 parts of lime and the solution filtered and tested by the method suggested by Stiasny. A portion was titrated with $N/10$ hydrochloric acid till neutral to phenolphthalein which represents the hydroxyl compounds corresponding to the lime concentration; methyl-orange was then added, and the titration continued till a permanent precipitate of yellow arsenic sulphide was produced which represents the amount of sulphydrate present. The product obtained by the precipitation with acid was found to consist of a mixture of arsenic oxides and sulphides, while calcium sulphoxyarsenate was probably the soluble compound formed at the same time. The reaction at higher temperatures with varying proportions of the two substances was then studied. With a proportion of 0·2 grm. of arsenic sulphide to 10 grms. of lime, "the percentage of arsenic sulphide used up as $Ca(SH)_2$" ranged from 51·05 at 50° C. to 82·0 at 100° C. With 0·5 grm. of arsenic sulphide to 10 grms. of lime, the proportions ranged from 74·25 per cent. at 50° C. to 83·54 per cent. at 100° C. With higher proportions of arsenic sulphide (1 grm. and 2 grms. to 10 grms. of lime) the temperature exercised less effect on the amount transformed (about 85 per cent. and 82 per cent. respectively for all temperatures between 50° and 100° C.). At the higher temperatures and the latter proportion of arsenic sulphide to lime, a large quantity of a brown compound was formed which showed on analysis a composition of 66·25 per cent. of arsenic and 18·80 per cent. of sulphur. It appeared that metallic arsenic was formed in the reaction and that the non-metallic compound was of the liver of sulphur type of compounds. The maximum yield of calcium hydrogen sulphide is obtained when the proportion of arsenic sulphide to lime does not exceed 1 of the former to 10 of the latter.—D. J. L.

[*Tanning.*] *Limes ; Old* ——. E. Stiasny. Collegium, 1910, 181—187.

Formaldehyde reacts with amino-acids forming methyleneamino-acids; the former react almost neutral, but the latter allow of a sharp titration with phenolphthalein, and since the amino-acids are the final degradation products of hide substance, the method is proposed for the control of lime and soak liquors. Sulphides which are often present in the liquors, react with formaldehyde, increasing the alkalinity of the solution. It has been proposed, therefore, to remove them by precipitation with zinc sulphate; this however, in the case of limes introduces a considerable error owing to the precipitation of hide substance. The following method is now used: 50 c.c. of the filtered lime liquor are neutralised with 10 per cent. acetic acid in presence of phenolphthalein, then $N/10$ iodine solution is added from a burette until in slight excess. $N/5$ sodium hydroxide is next added until the phenolphthalein is reddened, and the titration continued after the addition of 10 c.c. of neutral 40 per cent. solution of formaldehyde. The figures obtained bear no ratio to the total nitrogen by the Kjeldahl method; this is explained by the fact that the degradation products of hide substance are present in very different proportions, and only those amino-groups connected with carboxyls are estimated. By this reaction the degree of hydrolysis of the nitrogenous matter present may be estimated, by first taking the formaldehyde titration of the solution, then thoroughly hydrolysing a known quantity by boiling for 6 hours with 20 per cent. hydrochloric acid and repeating the titration. The last figure will represent the maximum hydrolysis of the protein matter, and the ratio of the first figure to this will give the degree of hydrolysis. As an example, 50 c.c. of 1 per cent. gelatin solution were neutralised, then 10 c.c. of neutral 40 per cent. formaldehyde solution added and the liquid titrated with $N/5$ sodium hydroxide: 0·5 c.c. was required and as 50 c.c. of the gelatin solution correspond to 89 mgrms. of nitrogen, 1 c.c. of sodium hydroxide corresponds to 178 mgrms. of nitrogen. 25 c.c. of the gelatin solution were now hydrolysed by boiling under a reflux condenser for 8 hours with 20 per cent. sulphuric acid. After neutralising and adding 10 c.c. of formaldehyde solution, 7·6 c.c. of $N/5$ sodium hydroxide were required, that is 1 c.c. corresponds to 5·8 mgrms. of nitrogen; thus the degree of hydrolysis of the original gelatin is $\frac{5{\cdot}8}{178}$ or 1/30, and any intermediate degree can be determined in a similar manner. It will thus be seen that this method represents a step further in the differentiation of dissolved hide substance in limes.

By experiment it was found that the products of complete hydrolysis of gelatin require 1 c.c. of $N/5$ sodium hydroxide for 5·8 mgrms. of nitrogen, as a result of the formaldehyde titration. For Witte peptone the factor was 7·2, and it will evidently be different for the different proteins, yielding a characteristic figure for each. This is explained as follows:—If only mono-amino acids are present, each c.c. of $N/5$ sodium hydroxide will correspond to 2·8 mgrms. of nitrogen found by the Kjeldahl method, because each atom of nitrogen present will combine with 1 mol. of formaldehyde and liberate one carboxyl group, which can be titrated with alkali:—



$$\underset{\dot{C}O\cdot\dot{O}}{R.CH.NH_3} + HCHO + NaOH \rightleftarrows R(COONa)CHN:CH_2 + 2H_2O$$

This leads to an equilibrium as indicated; thus it is necessary to use excess of formaldehyde and titrate until there is a distinct reddening of phenolphthalein. With diamino acids, as lysine, two amino groups are present, but only one is in connection with a carboxyl group; thus each c.c. of $N/5$ sodium hydroxide used will correspond to 5·6 mgrms. of nitrogen. Arginine contains one amino group and one guanidine group which does not react, therefore, of the four nitrogens present only one reacts; thus 1 c.c. of $N/5$ sodium hydroxide will correspond to 11·2 mgrms. of nitrogen. In this manner the factor $\frac{\text{mgrms. of nitrogen}}{\text{c.c. } N/5 \text{ NaOH}}$ will give some idea as to the relative amount of these different protein degradation products in old limes. The lower the factor, the more simple are the compounds present.—A. I'. H.

Hide ; The sensitiveness of raw, sweated, limed, and puered —— *to lime water, salt, and acetic acid.* G. Abt and E. Stiasny. Collegium, 1910, 189—199, 205—212.

A piece of hide was washed for three days in changes of fresh water, shaved and cut up into bands of 100 grms. each. These pieces were then treated as follows:—No. 1 was cut up small and weighed into three lots of 30 grms. each, which were placed in 400 c.c. flasks. To the first was added 300 c.c. of lime water; to the second 300 c.c. of 10 per cent. salt solution, and to the third 300 c.c. of $N/9{\cdot}7$ acetic acid. As a preservative a few c.c. of chloroform and toluene were added to each before closing. The other pieces were subjected to the same treatment after the processes enumerated for each. Group 1.—Two pieces, Nos. 2 and 3, were sweated, unhaired, washed in cold water, and one (No. 3) was also puered. Group 2.—One piece (No. 4), was sweated, unhaired, washed, passed into lime, and then superficially delimed with acetic acid. Group 3.—One piece, No. 5, after the same treatment as No. 4, was finally puered. Group 4.—Four pieces, Nos. 6, 7, 8, 9, were limed, unhaired, washed in water. No. 7 was then superficially delimed with acetic acid, No. 8 was drenched, and No. 9 was delimed, and drenched. Group 5. —Two pieces, Nos. 10 and 11, were limed, unhaired and washed, No. 10 being puered, and No. 11 delimed and puered. Groups 1 to 5, after being treated as described, were washed, weighed and cut up; from the total weight the quantity equal to 30 grms. of green hide was calculated, each lot being then treated as described. At the end of seven days the liquors were drawn off and analysed, fresh solutions being added, and two further fractions being taken, the first after 24 days and the second after a further period of 26 days. The nitrogenous matter present in solution contains, like skin, 17·85 per cent. of nitrogen, and from the figures obtained by extraction with lime it is concluded that lime not only has a solvent action, but also attacks the collagen and proteins of the hide, forming alkali-albumins, albumoses, peptones and amino-acids. It is also suggested that the absorbed lime forms a protective coating on the fibres which modifies the capacity of chemical action of the surfaces to which it adheres. The high weights obtained in the first extractions of the green and sweated hides decrease rapidly; they are due to putrefaction, which is very active after sweating, and also present in the green hide. The extractions were without doubt enriched by substances already dissolved by bacterial action before contact with the lime, the action of which, in conjunction with the antiseptics, arrested it. Another noteworthy fact is that the green hide loses more substance than the sweated hide, whilst the figures obtained in the salt extraction show that fermentation was more active in the latter. The difference is due to a small quantity of matters other than collagen, such as liquefied conjunctive and epithelium cells, blood, lymph, and more especially mucoid substance. In comparing the skins treated by lime on the one hand, and salt on the other, it is seen that lime has a much greater antiseptic action on sweating bacteria, and that the puering organisms are even more sensitive, the extractive matter being even less than after liming. This fact is remarkable since the contrary effect is produced with salt and acetic acid, in which the puering bacteria continue to develop. It is also surprising that the extractive matter after puering is even less than what might be considered normal. Perhaps the puer carries away by washing a small quantity of matter rendered soluble by the lime and retained by the hide. With the acid and salt this factor is small enough to be masked by the continued putrefaction, which acts in an opposite sense. Drenching gives about the same results as puering. Liming after sweating reduces the quantity of matter extracted, but without doubt, the total loss, including that which remains behind in the limes, is greater.

The degree of hydrolysis by the lime was next investigated. Neutralisation gave a slight flocculent precipitate of alkali-collagen. On filtering, saturating with salt, and adding acetic acid, an abundant precipitate of primary gelatoses was obtained: ammonium sulphate produced a further precipitate of secondary gelatoses, and tannin gave still another of more soluble gelatoses and gelatopeptones. At this stage the presence of amino-acids could not be affirmed, but it is certain that the hydrolysis had proceeded far. By titrating with formaldehyde before and after complete hydrolysis, it is seen that more than half the acid functions are already in the free state, and that the hydrolysis has proceeded farthest in the second extraction, where also the extractives are highest, this action being at a minimum where the bacterial action is at a maximum. The absorbed lime does not appear to have any action on the hide, but behaves as though it were in the solid state and incapable of reaction. The salt has no solvent action upon the hide, but only dissolves the decomposition products of other agents, viz., bacteria and lime. The loss in the sweated skin is from 16—20 per cent., as against 1 per cent. and less for that passed through the lime. This is due to the fact that putrefaction continues to take place in spite of the salt and other antiseptics; lime therefore is a better antiseptic even than chloroform and toluene, whilst salt has little or no effect. The salt extractions of the limed skins gave very little yield, whether the hide was sweated or not, especially when it was not puered; they moreover introduced lime into the salt solution, there by rendering it alkaline, whilst the green and sweated pieces made the solution slightly acid. The alkalinity was slight, but also the weights of the substance dissolved were low, part being probably due to previous bacterial action, and the rest to the action of the lime on the collagen. The weights obtained from the puered skins were about twice those from the pieces which had not been puered, and in the case of the sweated skin the difference was considerable. The degree of degradation of the collagen is very advanced for the sweated skins, but in all other cases it is very slight; that is the hydrolysis of the matter extracted by the salt has not proceeded so far as in the case of that extracted by the lime water; on the other hand, a heavier precipitate is obtained by acidifying and saturating with salt. Thus the greater part of the substance in solution consists of primary gelatoses. The skins extracted in acetic acid became strongly plumped and brittle, and the substance in solution was present mainly as acid-albumins precipitated on neutralising, and as primary gelatoses precipitated by salting out. The results of titration with formaldehyde were practically negative. The puer, in all cases, increased the soluble matter to a considerable extent. The extract from the sweated skins showed an enormous difference from the salt extract, which was about 4·5 times higher, that is, the acetic acid has a much greater capacity for checking the action of the sweating organisms, and is even superior to lime in this respect.

According to Reimer, coriine may be distinguished from the substance of the hide fibre by the following reactions:—The former is soluble in lime water and in 10 per cent. salt solution, but is precipitated in solutions more or less concentrated than this, whilst the latter dissolves in dilute acetic acid, and is precipitated by potassium ferrocyanide. It can now no longer be admitted that acids or alkalis dissolve the true protein matter unless it is first decomposed. On adding the sulphuric acid necessary to hydrolyse the solutions, a turbidity was produced, which was less abundant for the salt, and at a maximum, sometimes for the lime, and sometimes for the acetic acid, but it disappeared on heating. This was rathe surprising, since it is not a reaction of gelatin, and was n more to be expected from the products of the attack o the collagen. The acetic acid solution had different characteristics from the salt and the lime extracts. It yielded a precipitate with potassium ferrocyanide, an mercuric nitrate, also, no change occurred on heating Acid collagen is probably its chief constituent. Th precipitate formed on neutralising does not dissolve i lime, and only with difficulty in sodium carbonate solution the substance is only slightly soluble in the presence o salts, and is easily re-precipitated, the collagen having bee only slightly broken down. The matter dissolved in th salt and the lime is very soluble in alkalis, neutral media and perhaps even in distilled water, which only goes t prove that it may be of different origin from the aceti acid extractive, and more especially that it is in a mor advanced state of decomposition. It will thus be see that the interfibrillar substance is only composed of th products of hydrolysis by the action of bacteria or lim on the collagen: this action is more or less advance in some cases an albumose and in others a gelatose bein produced. This fact may explain some of the characte attributed by Reimer to coriine, and perhaps the propert of its solubility in 10 per cent. salt solution. The gelati and their ultimate decomposition products belong almo entirely to the anti-group of Kühne; the albumose whic corresponds to collagen must then be a heteroalbumose these bodies are almost insoluble in water, but are solub in saline solutions of medium concentration. On dilutir the salt solutions used for extraction, they gave no pr cipitate, perhaps because they were too weak, or th hydrolysis was too advanced, though it may be that corii contains one atom of oxygen and two molecules of wat more than gelatin, but the albumoses are richer in oxygen than the albumins from which they are derived; true coriine does not give the characteristic reactions of the albumoses, but nor does gelatin, and it is therefore natural enough that other derivatives of collagen do not give them. No difference has been found between the products of hydrolysis by bacteria and lime. It is also to be noted that the substance of the conjunctive fibres is less decomposed by bacterial action than by lime, but in the case of the sweated skin extracted with salt, the decomposition proceeded very far, due no doubt to the duration of the fermentation allowing several species of bacteria to succeed each other and further the degradation by their combined action. The lime was more strongly retained by the skin than the acid, and in the first digestion the least quantity was fixed. In the second this effect was sometimes equal to, and sometimes greater than, the third. On the contrary, most acid was absorbed in the first extraction, although that in solution in the water taken up for plumping must be taken account of. But the most interesting fact is that in both cases, most is absorbed by the puered skins; this may be due to the fact that they are purged better, and it is reasonable that this property would favour the absorption of tannin.—A. T. H.

Leather analysis; The matter soluble in water in ——. J. G. Ritter. Collegium, 1910, 187—188.

The author draws attention to some cases of vegetable tanned sole-leather analyses, which have come under his notice, in which the amount of matter soluble in water is excessive. He concludes that the cause is not retanning in strong liquors, or adulteration with glucose and mineral salts, but that the leathers must have been treated, either before or during the tanning process with solutions of salt, in order to increase the speed of tanning and the amount of tannin absorbed, and thus to give a high "tanning figure." A microscopic examination showed a fair amount of uncombined tannin between the fibres, and after treatment with water the leather became soft and spongy.—A. T. H.

Osyritrin (violaquercitrin) in Osyris abyssinica; Note on the occurrence of ——. S. J. M. Auld. Chem. Soc. Proc., 1910, **30**, 146—148.

In an examination of "Pruimbast" or "Cape Sumach," *Osyris compressa* (*Colpoon compressum*), A. G. Perkin (this J., 1898, 40) separated a glucoside, *osyritrin*, which he later showed to be identical with violaquercitrin, isolated previously by Mandelin (Jahresber. 1883, 1369) from *Viola tricolor*. Samples of Cape sumach have been examined at the Imperial Institute from time to time, and no difficulty has been experienced in separating the osyritrin from them. Recently a considerable consignment of the leaves and stalks of *Osyris abyssinica*, Höchst, has been received for examination from the Transvaal. The material as received gave a much deeper coloured extract than Cape sumach, and produced a darker leather of rather poor quality. The aqueous extract, on keeping, deposited a certain amount of solid matter, but this did not appear at all similar to the crystalline deposits previously obtained from *Osyris compressa*. The new material was therefore examined more closely.

The Tannins.—Analysis showed that the leaves contained about 23 per cent. of tannin. The leaves were extracted with water and the extract evaporated to a small bulk, when there separated a quantity of solid matter consisting of colouring principle and the phlobaphen of the tannin. The aqueous solution was fractionally precipitated with lead acetate, and the last fraction washed and decomposed with hydrogen sulphide. After removal of the lead sulphide and the excess of hydrogen sulphide, the solution was evaporated to dryness. It yielded a reddish-brown tannin of the catechol series. This tannin is much darker than that previously obtained from *Osyris compressa*, and it also shows more readiness to lose water and form the phlobaphen.

Extraction of the Colouring Matter.—The coarsely-ground leaves were thoroughly extracted in a Soxhlet apparatus with 90 per cent. alcohol, and the residue, after removing the spirit, was poured into water. The green mass which separated was filtered off, and after drying, was extracted separately with light petroleum and alcohol. The alcoholic extract set to a viscid, semi-solid mass on concentration. By pouring into excess of boiling water it was possible to separate a large quantity of dark brown insoluble matter of a phlobaphen nature, and on cooling the aqueous solution, a dirty brown solid deposit was obtained, which, after repeated precipitation with water from alcoholic solution, yielded a mass of small crystals. These were purified by several crystallisations from dilute alcohol and finally from boiling water. A further quantity of the same substance was obtained by deposition from the main filtrate containing the tannin. The substance formed small, greenish-yellow needles, melting at 189—190°, after softening at 185°—186 (osyritrin melts at 186°). Analysis of the substance and of its products of hydrolysia with dilute acid showed that it is identical with osyritrin.

Tan bark as a boiler fuel. Myers. *See* IIa.

Patents.

Tanning apparatus. J. B. Koogler, Assignor to C. H. Robinsteen, Indiana, Pa. U.S. Pat. 957,350, May 10, 1910.

A drum is immersed to the axle in a liquor vat; its lattice periphery is so built as to allow the liquor only to flow in, whilst an exit is provided by an arrangement of slots in the drum-heads.—A. T. H.

Hides, skins, etc.; Degreasing —— by means of volatile solvents. H. A. Deroy fils. First Addition, dated July 20, 1909, to Fr. Pat. 394,201, Sept. 11, 1908 (this J., 1909, 211).

The goods to be treated may be either sprayed with, or soaked in several changes of the solvent, after which they are dried in a vacuum without steam, heating being effected by means of hot water pipes, or worms. In the apparatus itself, the pneumatic pump is fitted with a reflux condenser which prevents the expelled air from carrying away the solvent.—A. T. H.

Carroting skins; Machine for ——. L. Beaulieu. First Addition, dated Nov. 13, 1909, to Fr. Pat. 397,904, Dec. 16, 1908 (this J., 1909, 882).

In the improved machine the supporting table is divided into several parts arranged at different levels; the fluted rollers and brushes are so mounted, that when the skin is fed into the machine it presents a curved surface to both, the top roller acting on a convex surface of the skin, and the brushes acting on a concave surface. In this manner the hair is most efficiently bristled and smoothed, and the liquid applied penetrates to the roots.—A. T. H.

Gelatine and glue liquors; Process of clarifying and decolorising —— and apparatus for carrying out said process. J. H. Utley, Camden, N.J., U.S.A. Eng Pat. 28,297, Dec. 3, 1909. Under Int. Conv., Dec. 12, 1908.

The apparatus consists of a closed, water-jacketed, copper vessel connected with steam and hot water supplies, and fitted with the necessary gauges. Both the top and the bottom of the vessel are equipped with filter plates and a screen, the whole being enclosed in an iron vessel. The copper vessel is three-quarters filled with ground charcoal, and steam is blown upwards through it; it is then washed by passing hot water through it in the opposite direction. The warm "gelatine liquor" is now run in from a tank above the apparatus, passes through the charcoal and has its exit at the bottom, whence it is run away to the concentrating apparatus. This process produces a colourless liquor which is free from deleterious matters. The charcoal is revivified by again steaming and washing with hot water, the process thus being continuous.—A. T. H.

Tanned hides and skins; Treatment of ——. G. B. M. Spigne, Genoa, Italy. Eng. Pat. 10,667, May 5, 1909.

See Fr. Pat. 397,650 of 1908; this J., 1909, 721.—T. F. B.

Gelatinous or colloidal liquids or products; Process and apparatus for clarifying and decolorising ——. J. H. Utley. Fr. Pat. 410,111, Dec. 7, 1909. Under Int. Conv., Dec. 12, 1908.

See Eng. Pat. 28,297 of 1909; preceding.—T. F. B.

Transforming leather, horn, hoofs, etc. into manure. Fr. Pat. 409,318. *See* XVI.

XVI.—SOILS; FERTILISERS.

Soil solution; Introduction to the study of the ——. F. K. Cameron. J. of Phys. Chem., 1910, **14**, 320—372, 393—451.

The author states that the study of the soil solution is of the first importance in the investigation of the relation of the soil to plant growth, and he gives an outline of the present knowledge of the chemical principles involved, together with a discussion of the essential physical and biological factors. The subject is treated under the following headings:—Soil management or control; soil analysis and the historical methods of soil investigation; the plant-food theory of fertilisers; the dynamic nature of soil phenomena; the film water; the mineral constituents of the soil solution; absorption by soils; the relation of plant growth to concentration; the balance between supply and removal of mineral plant nutrients; the organic constituents of the soil solution; fertilisers; alkali.—A. S.

Soils; Heat transference in ——. H. E. Patten. U. S. Dept. Agric., Bureau of Soils. Bulletin No. 59, 1909.

The direct determination of the heat conductivity of a soil is rendered impossible by the changes in structure, degree of hydration, etc., produced by the heating. To study the effect more thoroughly the author has heated an otherwise insulated column of soil at one end, and observed the effect on a series of thermometers at equal distances along the column. By observing particularly the behaviour of one thermometer sufficiently far from the heat source, the diffusivity can be obtained from the two factors, (1), rate of rise of temperature, and (2), rate of change in temperature gradient. The diffusivity, when multiplied by the heat capacity of unit volume, gives the conductivity. This experimental method has numerous sources of error but it nevertheless yields figures which give useful information on the important factors in heat transference. To establish the effect of water, experiments were made with coarse quartz and quartz flour, and then the method was extended to the following soils, Hudson river sand, Podunk fine sandy loam, Leonardstown silt loam, and a muck soil containing 25 per cent. of organic matter, all at varying moisture contents. Curves are given showing the variation in each case of: (1), apparent specific volume, (2), diffusivity, and (3), conductivity, with increase in moisture content. It is found that addition of water to a soil gradually increases its conductivity by promoting contact between the grains, the rate of transfer being greater at a water-soil than at an air-soil surface. After a certain moisture content is reached, the conductivity must of course fall again, since water itself has a much lower conductivity than soil grains. The curve of diffusivity shows a maximum value in each case, corresponding to a higher water percentage in the case of the finer soils. Beyond this there seems to be evidence that water assists heat transference by breaking up the soil and producing smaller grains, which help to fill in and make contact in the spaces between the larger ones. This is shown by the fact that maximum diffusivity does not occur with maximum apparent specific volume but at a slightly higher water content. The muck soil showed in general lower absolute values for conductivity and diffusivity than the sandy soils, though the difficulty in getting even distribution of moisture prevented the obtaining of really comparable results. A final experiment with graded carborundum to determine separately the effect produced by variation in the size of grain showed that a maximum conductivity and a minimum specific volume was obtained with a powder composed of grains about 0·45 mm. in diameter.—W. H. P.

Commercial fertilisers; Composition of ——. M. Whitney. U.S. Dept. Agric., Bureau of Soils. Bulletin No. 58, 1910.

The author discusses the legal aspects of the analysis of commercial fertilising mixtures, suggesting various measures for the protection of the farmer and for the development of natural resources. The chief of these is that the study of a rational system of fertilisation should be pursued and that the sale of special brands (for particular crops) and standard brands of fertiliser should be prohibited unless they agree with current scientific opinion as to what should be their composition. The bulletin has appendices containing illustrative extracts from standard works on fertilisers, and an extended summary of the results of fertiliser inspection in several States.—W. H. P.

Phosphates; Palmaer's process for working up low-grade —— *into phosphate fertilisers.* Ebbinghaus. Chem.-Zeit., 1910, **34**, 586.

Although in Sweden there are large quantities of phosphatic raw materials, these are of such a low-grade character that the demand for crude phosphate for the manufacture of superphosphate has hitherto only been satisfied by importation from abroad. In 1908, about 976,000 tons of a value of about £276,000 were imported. The processes of Wiborgh and Nilsson for the production of a phosphate suitable for agricultural purposes by fusing crude phosphate with sodium carbonate have not proved remunerative with Swedish crude phosphates owing to their poor quality. The author draws attention to the suitability for Swedish requirements of Palmaer's process (see U.S. Pat. 748,523 of 1903; this J., 1904, 124), which has proved successful in practice in Norway. In this process a solution of sodium chlorate or perchlorate is electrolysed; the acid liberated is utilised for dissolving the crude phosphate and from the solution, dicalcium phosphate is precipitated by the caustic soda also produced in the electrolysis, the sodium chlorate or perchlorate being regenerated. It is stated that crude phosphates of practically any phosphorus content can be successfully treated, yielding Palmaer-phosphate containing 35 per cent. of citrate-soluble phosphoric acid at a cost of about 6s. per cwt.—A. S.

Cyanamide and derivatives; Chemical and physiological experiments with ——. F. Reis. Biochem. Zeits., 1910, **25**, 460—493.

To estimate cyanamide and dicyanodiamide in solution, an ammoniacal solution of silver acetate is added to precipitate the cyanamide, the precipitate being collected and a Kjeldahl nitrogen determination made. Potassium hydroxide is added to the filtrate and precipitates the colourless silver salt of dicyanodiamide, nitrogen being also determined in this precipitate. Weak acids have no decomposing influence on cyanamide, and dicyanodiamide is formed only in alkaline solution and then only on heating to above 65° C. None is formed at 45° C., a probable summer temperature in the upper layers of soil exposed to the air. Change occurs only in presence of oxides hydroxides and carbonates of the alkali and alkaline-earth metals. The soil will absorb much less cyanamide than ammonia. Iron oxide has a marked action on cyanamide, the product formed being urea. Probably the action is catalytic, as cyanamide forms no compound with iron oxide. Cyanamide, the active valuable constituent o crude nitrolime, is a strong poison acting injuriously on bacteria, moulds, seedlings and growing plants so long as these have no other source of nitrogen available. It is likewise an animal poison. Certain micro-organisms can make use of cyanamide when it is present to the extent of less than 1 grm. per 1000 grms. Some soils appear to have a direct action on dilute cyanamide solution. Dicyanodiamide, dicyanodiamidine, and diguanide in solutions containing less than 0·1 per cent. are assimilated by certain micro-organisms. The influence of these substances in vegetation was tested in a soil of quartz sand so as to eliminate secondary effects due to the soil. When added to the soil before sowing as the only source of nitrogen, the compounds mentioned proved very poisonous. When added to well-established plants dicyanodiamidine sulphate proved of some slight value as a source of nitrogen, whereas dicyanodiamide and diguanide sulphate were without either positive or negative effect. All three compounds acted injuriously towards germination and cyanamide totally destroyed the power to germinate. Inasmuch as nitrolime has been proved to be a valuable fertiliser it must be transformed in the soil into an assimilable form. The supposed conversion into dicyanodiamide is not possible. It is possible that oxides of iron and other soil constituents act upon cyanamide to produce urea which undergoes further change by the agency of micro-organisms into ammonia and nitric acid.—E. F. A.

Patent.

Leather, horn, hoofs and analogous materials ; Process for rendering ——, in order to transform them into manure. J. Leroux and L. Gatinois. Fr. Pat. 409,318, Nov. 11, 1909.

The process essentially consists in treating the animal matter with superheated steam, in a closed vessel, at a temperature depending upon the nature of the required product.—A. T. H.

XVII.—SUGARS ; STARCHES ; GUMS.

Sugar products ; Precipitation of lævulose by basic lead acetate in the clarification of cane —— containing considerable quantities of reducing sugars. H. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1910, **27**, 945—948, 1070—1076.

It is well known that basic lead acetate precipitates part of the reducing sugar from solutions of crude sugar products such as cane molasses. Minz considers, however, that though addition of basic lead acetate causes a decrease in the reducing power of solutions of cane molasses, this is due, not to removal of lævulose, but to the influence of the excess of lead on the reducing power. The author now shows that basic lead acetate precipitates reducing sugar (lævulose in the form of lead lævulosate) from solutions of crude cane products such as cane molasses, and that the decrease in the reducing power is fully accounted for by the amount of reducing sugar in the lead precipitate together with that removed by the water used for freeing the precipitate from sucrose. The proportion of lævulose precipitated varies with the amount of basic lead acetate added, and is decreased by diluting the molasses solution prior to addition of the lead reagent. The author also shows that in certain cases, normal lead acetate precipitates a small quantity of lead lævulosate from solutions of molasses containing reducing sugars. He concludes, from his observations, that the use of clarifying agents should be abandoned in determining reducing sugar in cane, as well as in beet products.—L. E.

Immersion refractometer ; Temperature correction tables for use with the —— in the determination of the dry substance of sugar factory products. V. Staněk. Z. Zuckerind. Böhmen., 1910, 34, 501—508.

The dry substance content of sugar factory products of low concentration, such as thin juice, diffusion waste water, etc., may be accurately and rapidly determined by the immersion refractometer, as E. von Lippmann (this J., 1908, 698) and others have pointed out. The tables constructed by Hübener (*loc. cit.*) giving the percentage of dry substance corresponding to the scale divisions on the Pulfrich instrument, however, hold good only for 17·5° C. The author has now drawn up a temperature correction table by means of which the scale division reading made on the Pulfrich immersion refractometer at the prevailing room temperature may be adjusted to 17·5° C. and the corresponding percentage of dry substance then read on the Hübener table.—J. P. O.

Composition of the sugar of grapes. Roos and Hugues. *See* XVIII.

Patents.

Beetroots, canes, and sugar-products ; Treatment of —— with a view to extracting sugar, glucose, and by-products. A. E. Vasseux. Fr. Pat. 409,389, Nov. 19, 1909.

The raw material, *e.g.*, beetroot pulp, is treated with sulphuric or other mineral acid, or with an organic acid, or with suitable acid salts, in a manner similar to that followed in the distillery, but in rather smaller proportion. The material is submitted to diffusion at a temperature not exceeding 60° C., and preferably in an apparatus which permits the return of the press-water. If the diffusion is carried out rapidly and at a low temperature, not more than 4—8 per cent. of the sucrose is hydrolysed ; the invert sugar is not lost. The juice obtained is neutralised, filtered, and worked up in the ordinary way. The treatment with acid gives a juice of higher purity ; after neutralisation and filtration, or after treatment with lime and carbonatation, the juice is more mobile, and colourless ; the pulp is richer in nutrient material and the waste syrups may be used for brewing purposes. Claim is also made for the application of the juice obtained by the process and acidified afresh, to the manufacture of a white and pure yeast similar to that obtained with cereals in the distillery.—L. E.

Beet juice ; Process for obtaining —— and press-residues of low water-content. M. Korn. Ger. Pat. 221,333, Dec. 4, 1980.

The beets are cut into slices and are then frozen before being pressed.—A. S.

Sugar juice ; Apparatus for the purification and decolorisation of ——. Maschinenfabr. Grevenbroich. Ger. Pat. 221,785, March 14, 1909.

The apparatus consists of a tall vessel in which a number of plates or bars of zinc, of any desired form, are arranged one above the other, preferably on a rotating shaft. The juice enters at the bottom and flows upwards through the chamber. It is subjected in turn to the action of steam supplied through a perforated ring-pipe, sodium carbonate solution supplied through a distributing jet, and sulphurous acid. The latter is supplied to a chamber disposed at the side of the vessel above the sodium carbonate inlet ; the walls of the chamber are perforated, and perforated tubes project from it towards the opposite wall of the vessel. The juice next comes in contact with the zinc plates mentioned, whereupon the sulphurous acid and sodium carbonate act on the zinc, with formation of sodium hydrosulphite, which exerts its known reducing and decolorising action.—A. S.

Sugar cane ; Apparatus for treating ——. A. and S. Wynberg, Amsterdam. U.S. Pat. 958,790, May 24, 1910.

See Eng. Pat. 2219 of 1909 : this J., 1909, 1322.—T. F. B.

Amorphophallus species ; Process for rendering the root substances of —— or their mucilaginous products, insoluble in water. Mertens und Co. Ger. Pats. 222,153, and 222,154, Feb. 14 and 17. 1909. Additions to Ger. Pat. 207,636, Nov. 20. 1907 (see Fr. Pat. 393,426 of 1908 ; this J., 1909, 103).

The mucilaginous products of amorphophallus roots or tubers are rendered insoluble in water by treatment with ammonia or its salts, or with alkali salts of organic acids (carbonic acid, acetic acid, etc.), or with various basic inorganic salts (*e.g.*, sodium nitrate or nitrite, or cuprammonium oxide), or with mixtures of neutral salts with alkalis.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Barley and malt ; Detection of the sulphuring of ——. J. Brand. Chem.-Zeit., 1910, **34**, 540.

The aqueous extract of the barley or malt is distilled with phosphoric acid and the distillate titrated with $N/100$ iodine. The titrated liquid, acidified with hydrochloric acid, should give with barium chloride a distinct precipitate of barium sulphate. Samples of sulphured malt examined by the author required 1·2—3 c.c. of $N/100$ iodine (equal to 0·4—1 mgrm. of sulphurous acid) per 100 grms. of malt. The distillate from unsulphured malt is found to consume 0·3—0·4 c.c. of the iodine solution per 100 grms. When only small quantities of sulphurous acid are present, and using 100—200 c.c. of water, almost all the acid is found in the first 5 c.c. of the distillate. For exact work the distillation must be carried out in a current of carbon dioxide, but the above method is recommended for rapid testing.—A. Sbld.

Extract and colour of malt ; Influence of low and high curing temperatures on the ——. A. Wlokka. Woch. f. Brau., 1910, **27**, 268—271.

The imposition of a tax upon malt has forced brewers in Germany to seek for means of increasing the yield of extract obtained from the malt mashed. It has been suggested that by the employment of higher heats in curing, the moisture content of malts could be reduced and the extract correspondingly increased. This has been tested by the author on parallel steepings of barley dried off on similar kilns at 65° and 71° R. (178° and 192° F.). He finds, on the average, that the moisture is reduced slightly, from 3·1 to 2·6 per cent., and that the extract is increased from 77·03 to 77·09 per cent., but on calculating the extract on the basis of dry malt solids this amounts to an absolute loss of 0·32 per cent. The colour of the malt is increased to the extent that a 10 per cent. wort has a colour equal to 2·46 c.c. of $N/100$ iodine solution instead of 2·12 c.c.—R. L. S.

Invertase ; Action of ——. N. Masuda. Z. physiol. Chem., 1910, **66**, 145—151.

Salkowski (this J., 1909, 951) succeeded, by extracting yeast with chloroform-water at 0° C., in preparing extracts free from yeast-gum and yet capable of exerting a strong inverting action on sucrose. The author has now found that on adding yeast-gum to solutions of invertase free or nearly free from the same, the inverting power was distinctly increased, although only to a small extent. On keeping invertase solutions (yeast extracts) the activity increased considerably (about 70 per cent.) in the first 24 hours and then decreased very slowly ; the growth of bacteria had no effect on the activity. Solutions kept for several months and which had become quite putrid, still exhibited considerable activity. Slightly more invert sugar was produced in 10 per cent. than in 5 per cent. sucrose solutions by the action of invertase ; the quantity of invert sugar also increased with the concentration of invertase but not proportionally.—A. S.

Enzymes ; Rendering —— inactive and the production of anti-enzymes in the presence of collodion and other membranes. A. E. Porter. Biochem. Zeits., 1910, **25**, 301—304.

As the result of an examination of the enzymes, pepsin, trypsin, rennet, steapsin, ptyalin, emulsin and takadiastase, it was found that all of them, with the exception of the last-named, become inactive in contact with a collodion membrane. Except in the case of ptyalin, an anti-enzymic power is developed, which is specific, being limited to preventing the action of the enzyme from which it was produced. Stomach extracts rendered inactive in this way, however, prevent the action of pepsin, trypsin and rennet. Water does not extract from the collodion membrane any substance having this property, which is also shown, though in less degree, by gelatin, reed, and white of egg membranes. The formation of anti-enzyme is less, the purer the enzyme taken.

—R. V. S.

Fermentation ; Studies in —— III. Rôle of diffusion in fermentation by yeast cells. A. Slator and H. J. S. Sand. Chem. Soc. Trans., 1910, **97**, 922—927. (See this J., 1906, 227 ; 1908, 241.)

Under ordinary conditions of fermentation, the yeast cells are sufficiently supplied with sugar by diffusion ; the authors have examined the limiting conditions under which the apparent velocity of the reaction would be influenced by convection currents produced by evolution of gas or by external means. If a spherical yeast cell of radius R, is placed at the centre of a spherical vessel of infinite radius, on the boundary of which a concentration, C, of sugar is maintained, and the cell removes a quantity of sugar, F, by chemical action per unit time, the maximum conceivable difference of concentration between the surface of the yeast cell and other parts of the liquid that might arise if no stirring took place, is given by the equation $C—C_1=\frac{F}{4\pi\kappa R}$, C_1 being the concentration of sugar at the surface of the yeast cell, and κ the diffusion-coefficient of the sugar. If C_0=concentration of sugar at the centre of the yeast cell, $C_1—C_0=\frac{F}{8\pi\kappa R}$, gives the maximum difference of concentration in the yeast cell, and, with maximum stirring of the liquid, it also gives the maximum difference of concentration arising throughout the system. Addition of these equations gives $C—C_0=\frac{3F}{8\pi\kappa R}$, which gives the maximum difference of concentration in the system with minimum stirring, *i.e.*, value three times as great as that with maximum stirring. The value of F for brewery yeast, determined with the apparatus previously described (this J., 1906, 227 ; 1908, 653), was found to be about 3×10^{-14} grm. /sec. at 30° C., dextrose being used in the determination. From this, it is found that the maximum difference of concentration brought about in the system with stationary, uniformly distributed cells, is about 1·3 mgrms. per litre, two-thirds of which difference can be removed by stirring. Hence, diffusion supplies the cell efficiently with sugar unless the concentration falls below 1·3 mgrms. per litre ; with maximum stirring, one-third of this concentration will suffice. With a 5 per cent. solution of sugar, the activity of a yeast cell which could just entirely ferment all the sugar diffusing into it would have to be, with maximum stirring, 120,000 times as great as that of brewery yeast, and with minimum stirring, 40,000 times as great as that of brewery yeast. The greater the yeast cell, the more slowly is it supplied by diffusion with sugar ; it is calculated, that with maximum stirring of the solution, yeast cells of radius 1·4 mm. (the material of the cell having the same activity as that of brewery yeast) would just ferment all the sugar diffusing into them from a 5 per cent. solution of dextrose ; with minimum stirring, the radius would be 0·8 mm.—L. E.

Furfural in alcoholic fermentation ; Disappearance of —— C. J. Lintner. Chem.-Zeit., 1910, **34** 552.

The conditions under which furfural may be formed in brewery mashes have been studied by Windisch (this J., 1898, 593), who found that the decoction process is more favourable to the production of furfural than the infusion process, and that although the aldehyde is volatile with steam, it was not expelled in the boiling process in fact further quantities were sometimes produced Furfural, though present in worts, is never detected in beers, but disappears during fermentation ; beers fermented from worts abnormally rich in furfural tend to acquire an unpleasant "bready" odour. Hitherto no explanation of the transformation undergone by furfural during fermentation was forthcoming, but the author has now observed that the products of the action of aqueous sulphuretted hydrogen on furfural possess the same "bready" odour, even when extremely dilute. If sulphuretted hydrogen gas be passed through a 20 per cent. aqueous solution of furfural, a milky emulsion of *polythiofurfural* is produced, which coagulates to a soft elastic mass on the addition of acid. Polythiofurfural itself is not likely to be the cause of the peculiar odour mentioned; more probably this odour is due to sulphuretted decomposition products, *e.g.*, mercaptans. It is well known that many varieties of yeast under certain conditions produce appreciable quantities of sulphuretted hydrogen in the course of alcoholic fermentation, and it is very probable that the disappearance of the furfural from the wort during fermentation is due to the production of sulphur derivatives.—J. F. B.

Sugar of grapes; Composition of the ——. L. Roos and E. Hugues. Ann. Falsific., 1910. **3**, 202—204.

The authors find that fully ripe grapes from American vines contain, in the great majority of cases, appreciably more lævulose than dextrose; in eleven different kinds of grapes examined, the ratio of lævulose to dextrose varied from 1 : 0·87 to 1 : 0·97, and in three other kinds from 1 : 1·01 to 1 : 1·05. On the other hand, grapes from French vines generally contained more dextrose than lævulose, the latter predominating in only three specimens out of fourteen different kinds examined. It was also found that during the ripening period, lævulose is formed more rapidly than is dextrose. (See also this J., 1909, 668).—W. P. S.

Aldehydes in alcohol; Determination of ——. *Preparation of standard aldehyde solution.* L. Ronnet. Ann. Falsific., 1910. **3**, 205—206.

For the preparation of a standard aldehyde solution for use in the colorimetric determination of aldehydes, Rocques has recommended that ammonia-aldehyde be employed and he purifies the compound before use by washing it with ether and then drying *in vacuo* over sulphuric acid. The author points out that this treatment of the ammonia-aldehyde causes changes in the composition of the compound which vitiate its employment for the preparation of standard aldehyde solutions. When subjected to reduced pressure over sulphuric acid, aldehyde-ammonia, which may be regarded as the hydrate of triethylidenetriamine, loses one molecule of water and forms ethylideneimine; the latter then polymerises with the formation of a triple molecule. At the end of four days the dissociation is practically complete. The ammonia-aldehyde compound may, however, be dried over sulphuric acid without undergoing change if the pressure be not reduced, and the author recommends that the compound, after being washed with ether, be dried by placing it over sulphuric acid in a desiccator for about 24 hours. Standard aldehyde solution may also be prepared from pure acetaldehyde which is obtained by distilling a mixture of paraldehyde and concentrated sulphuric acid; the acetaldehyde should be distilled immediately before being required for use, and it is only necessary to prepare a few cubic centimetres of the substance at a time.—W. P. S.

Patents.

Yeast; Production of ——. H. Braasch. Neumünster, Germany. Eng. Pats. 27,360, Nov. 24, 1909, and 29,114, Dec. 13, 1909. Under Int. Conv., Nov. 24, and Dec. 21, 1908. Additions to Eng. Pat. 10,458, May 3, 1909 (see Fr. Pat. 404,183 of 1909; this J., 1910, 104).

(1). The process previously described is modified in that the low temperature, previously used throughout the fermentation, is only used whilst the increase of yeast occurs, a stage which lasts 16—19 hours. During the subsequent stage, *i.e.*, the stage of maturation of the yeast, the temperature is raised to the fermentation temperature of 25°—30° C., hitherto usual in the known aëration process and kept at this point until the maturation of the yeast is complete. The whole process is thus shortened by 7 to 10 hours without diminution of the yield. (2). Claim is made for the use of a pitching yeast consisting chiefly of budding associations of 2—4 cells. The wort used in growing the pitching yeast may then be fermented until its sp. gr. is but about 1·2° Balling, or if necessary, only until its sp. gr. is 1·7° or 2·0° Balling. Under certain conditions, it may be desirable to use a yeast containing budding associations of say 5—8 cells.—L. E.

Malting apparatus. C. J. Erdmann, St. Louis, Mo. U.S. Pat. 957,664, May 10, 1910.

The apparatus includes a box with longitudinal guide-slots in the side walls, and a main agitator-shaft extending transversely of the box and working in the guide-slots. A driving spur-wheel and side plates are mounted on the main agitator-shaft. Auxiliary agitator-shafts are journaled in the side plates, and are fitted with spur-wheels which engage with the driving spur-wheel. Pinions, fixed to the main agitator-shaft, engage with rack bars which are secured to the side walls over the guide-slots. A bevel gear-wheel is fixed to the main agitator-shaft. The apparatus also includes a drive shaft, bracket bearing arms, each having a trip arm provided with an opening, and a carriage loosely fitted to the drive shaft. Bevel pinions, "splined" to the drive shaft, engage alternately with the bevel gear wheel. A shifter rod, having end collars, is mounted on the carriage; depending arms, sliding on the shifter rod, engage the bevel pinions. Springs surround the shifter rod between the sliding arms and the end collars; "dogs" are pivoted to the carriage, each having a shoulder adapted to engage a depending arm, and an inclined face adapted to ride on a trip arm.—L. E.

Amyloid [for conversion into alcohol]; Process for the manufacture of ——. M. Mendelsohn and E. Frankl. Ger. Pat. 220,634, Sept. 9, 1908.

Substances rich in cellulose, especially wood meal, are treated with a mixture of sulphuric acid and sodium sulphate, or with sodium bisulphate, and the amyloid is subsequently precipitated by dilution with water, and separated from the liquid. It is stated that by this method, little or no dextrin is formed, and that the resulting amyloid when saccharified and fermented, yields a spirit nearly free from fusel oil.—A. S.

Yeast; Process for producing dry —— *from wort.* H. Braasch. First Addition, dated Nov. 24, 1909, and Second Addition, dated Dec. 6, 1909, to Fr. Pat. 404,183, April 30, 1909.

See Eng. Pats. 27,360 and 29,114 of 1909; preceding.
—T. F. B.

XIXa.—FOODS.

"Narras," an important native foodstuff of German South West Africa. C. Grimme. Tropenpflanzer, 1910, **14**, 297—302.

"Narras" food is obtained from the fruit of *Acanthosicyus horrida*, a member of the *Curcubitaceæ* family. The fruits weigh up to 1·5 kilos. each, and the inner pulpy portion is divided into 10 segments, like an orange. The pulpy portion is cooked, separated from the seeds and dried into cakes; thus prepared the food contains:—water, 13·51; ash, 13·70; proteins, 9·65; fat, 8·75; non-nitrogenous extractives, 44·91 (including reducing sugars, 18·68); and crude fibre, 9·48 per cent. The cooked seeds separated from the pulp are also used as food after being decorticated and ground to a flour; these cooked seeds contain:—water, 5·59; ash, 3·75; protein, 32·32; oil, 46·30; non-nitrogenous extractives, 9·00; and crude fibre, 3·54 per cent. The oil extracted from the cooked seeds has the following physical and chemical characters:—solidifying point, −14° to −17° C.; refractive index, 1·4628; saponification value, 181·4; acid value, 1·0; iodine value, 116·6. The raw seeds, which consist of about 40 per cent. of shell and 60 per cent. of kernel, yield an oil almost identical in character with that obtained from the cooked seeds.—W. P. S.

Casein; Rate of solution of —— in solutions of the hydroxides of alkalis and of alkaline-earths. T. B. Robertson. J. of Phys. Chem., 1910, **14**, 377—392.

When casein is shaken, or stirred up, in a solution of a hydroxide an alkali or of an alkaline-earth, it dissolves rapidly at first, but later, and especially after the solution has become acid in reaction towards litmus, with extreme slowness. Experiments were therefore carried out with the view of ascertaining the time-relations of this phenomenon and their dependence upon the mass of casein or of hydroxide present in the mixture. The results of these experiments show that the amount of casein dissolved is related to the time which has elapsed since the casein was introduced into the solution according to the equation, $x = \mathrm{K}t$, where x is the number of grms. of casein dissolved, t is the time, and K and m are constants which depend upon the concentration and kind of hydroxide solution employed, and upon the total mass of casein in the mixture. The rapidity of the solution is, within the limits of the accuracy of the determinations, unaffected by temperature, for temperatures varying from the ordinary temperature up to 30° C. Solutions of the hydroxides of potassium, sodium, lithium, and ammonium, of equal concentration, dissolve casein at approximately the same rate. Solutions of the hydroxides of the alkaline-earths dissolve casein much more slowly; strontium hydroxide dissolves it most rapidly, calcium hydroxide more slowly, and barium hydroxide more slowly still. The amount of casein dissolved by a solution of potassium hydroxide in a given period of time is directly proportional to the concentration of the potassium hydroxide. Further, the rapidity with which casein is dissolved by a given solution of a hydroxide of an alkali increases with the mass of the casein present in the mixture. At first the increase in the velocity of the solution with increasing mass of casein is rather large, but as the mass of casein is still further increased, the increase in the rapidity of solution is less. It is suggested that the factor which determines the rate of solution of casein in solutions of the hydroxides of the alkalis and of the alkaline-earths may be the velocity with which the particles of casein are penetrated and wetted by the solvent.—W. P. S.

Ergot in flour; Quantitative determination of ——. R. Bernhart. Z. Riech- und Geschmackst., 1910, 2, 122—123.

The amount of ergot in flour can be determined as follows Two hundred grms. of flour are boiled with dilute hydrochloric acid (not less than 2 per cent.) till all the starch is converted into sugar. The solid matter is filtered off through silk, and washed. The filter whilst still moist is dipped, first into dilute, then into 98 per cent. alcohol. The residue is extracted with acetone and carbon tetrachloride to remove the fat. It is then shaken with strong, freshly prepared ammoniacal copper oxide for half an hour, diluted with ten times its volume of water and the insoluble matter filtered off through silk, and washed with dilute hydrochloric acid. The substance so obtained is boiled for an hour with 3 per cent. potassium hydroxide solution, and dissolved in concentrated hydrochloric acid. After 12 hours, the liquid is rapidly filtered through asbestos, and poured into 50 times its volume of ice-cold water. The precipitate is collected, washed, dried, and weighed. The substance so obtained is chitin, which is present to the extent of 2·305 per cent. in ergot.—F. Shdn.

Dairy wastes disposal. See XIXB.

Patents.

Chocolate; Emulsified —— and method of preparing the same. S. T. Achor, Kennett Square, Pa., U.S.A. Eng. Pat. 10,777, May 6, 1909.

The chocolate is prepared by heating 50 lb. of commercial cocoa (containing its natural quantity of fat) to a temperature of 100°—130° F., and adding 75 lb. of granulated sugar to the molten mass. After thorough mixing, 50 lb. of unsweetened condensed milk are added and the whole is stirred while the temperature is raised to 212° F. When sufficient water has evaporated off to reduce the mass to a viscous condition, the source of heat is removed, but the stirring is continued until the mass assumes a creamy consistence. The mixture is then poured into moulds so as to produce slabs about 1 in. in thickness.—W. P. S.

Cocoa powder; Process for the manufacture of ——. F. E. F. Neumann, Wandsbek, Germany. Eng. Pat. 481, Jan. 7, 1910. Under Int. Conv., Jan. 12, 1909.

Roasted and decorticated cocoa beans are ground to the fineness of coarse meal which is then subjected to a preliminary pressing in order to remove a portion of the cocoa fat. The pressed mass is next ground to a fine powder and again pressed. The coarse meal obtained by the first grinding may be treated with alkalis or solutions of the same, before being pressed.—W. P. S.

Chocolate and cocoa; Process of manufacturing readily soluble —— for use in the preparation of beverages. H. Langen. Fr. Pat. 409,692, Nov. 4, 1909.

Powdered cocoa, from which a portion of the fat has been removed, is added to a boiling solution of sugar contained in a closed vessel which is provided with a stirring device. The mixture is stirred until cold, the moisture escaping in the form of vapour being conducted to a condenser The mass of chocolate thus obtained may be mixed with a suitable proportion of milk powder and then pressed ir moulds.—W. P. S.

Flour; Process for improving ——. F. Tildesley, A. B Ritchie, and E. J. Watkins, London. Eng. Pat. 14,931 June 26, 1909.

The flour is treated with a halogen compound o phosphorus, such as phosphorus trichloride, phosphoru pentachloride, etc., or a mixture of the same with sulphu trioxide, nitric acid, nitrous acid, iodic or other haloge acid, formic, acetic, propionic, or benzoic acids, alcohol aldehydes, or ketones. The reagent is supplied to the flou in a gaseous state, and for this purpose an inert gas, such a air, nitrogen, or carbon dioxide, is bubbled through, o passed over the surface of, the mixed reagents and is the conducted to a chamber where the flour to be treated is ke in a state of agitation. In the case where powdered pho phorus compounds, such as phosphorus pentachloride, ar employed, the inert gas is first passed through absorbe material saturated with water and the moistened gas then passed over the surface of the pentachloride. Th inert gas, now charged with the vapours of hydrochlor acid and phosphorus oxychloride resulting from th decomposition of the pentachloride, is conducted to th chamber containing the flour.—W. P. S.

Coffee beans and the like; Method of destroying the to constituents of ——. H. Evers, Zurich, Switzerlan Eng. Pat. 20,215, Sept. 3, 1909. Under Int. Con Sept. 8, 1908.

The coffee berries are placed in an autoclave from whi the air is then exhausted. Heat is now applied external to the autoclave and when the temperature has risen 60°—70° C., superheated steam is admitted so as to p duce a pressure of from 5 to 6 atmospheres in the ves the temperature being thus increased to 160° C. T steam is then exhausted quickly from the autoclave a this exhaustion is repeated at intervals, the temperat meanwhile being maintained at 100° C. Coffee ber thus treated retain their aromatic constituents but rendered non-poisonous.—W. P. S.

Coffee berries free from caffeine; Process of obtaining ——. L. Klein. Fr. Pat. 409,700, Nov. 11, 1909.

Unroasted coffee berries are placed in a closed vessel provided with a stirring device and, after the addition of a solution containing calcium hydroxide and sodium carbonate, the whole is heated to a temperature of about 200° C. for 1 hour. The berries are then dried and partially roasted at a temperature of 160° C., after which operation they are again heated with the alkali solution as described above. The berries are now washed and dried. To remove the caffeine as far as possible from the berries, the latter, before the final washing, may be treated with ether. About 12 kilos. of calcium hydroxide and 1 kilo. of sodium carbonate may be used for every 100 kilos. of coffee berries.—W. P. S.

Yeast; New process for manufacturing baker's —— in clear worts. E. A. Barbet. Fr. Pat. 409,040, Feb. 6, 1909.

Maize or rye is submitted to a steeping process of less duration than that employed in malting, and is then heaped in a couch of sufficient thickness to insure a rise of temperature, and the modification of the grain by the action of the cytase. The grain, thus softened, is then bruised, in which process, the husks are not much broken, since they have been rendered elastic by moisture. The material is then saccharified, the mash, in the case of maize, being first heated to boiling under slight pressure. The whole mash is then fermented at a temperature of 50°—54° C. with a lactic ferment prepared in the pure culture apparatus described in Fr. Pat. 290,988 of 1899; a lactic acid-content of 2 grms. per litre, or more, may thus be obtained. Prior to clarification, it is advisable to heat the acidified wort to about 67° C. with steam by means of a silent injector. Vinasse, previously heated under pressure and freed from coagulated matter by decantation, is employed in the clarification. The clear liquor from the clarifying back is sterilised by boiling in a heater from which it passes to a vessel wherein the matter coagulated by the heating is allowed to settle; the clear liquor is decanted off, cooled, and fermented by the aeration process with a pure yeast culture from the apparatus described in Fr. Pat. 290,988 of 1899.—L. E.

Alimentary products [meats, fruits, etc.]; Process and apparatus for preserving ——. The Electric Meat Curing Co. Fr. Pat. 409,255, Oct. 26, 1909.

The articles to be preserved are placed in a brine-bath and submitted to the action of an alternating electric current, a magnetic field being at the same time produced in the bath. For the latter purpose, electro-magnets supplied with a continuous current of electricity are fitted at opposite sides of the bath. (See also Eng. Pat. 23,183 of 1908; this J., 1909, 670.)—W. P. S

Meat powder; Process of extracting —— from the carcases of animals, fish, etc. H. Schirm and J. G. Grotkass. Fr. Pat. 409,675, July 5, 1909. Under Int. Conv., July 7, 1908.

The carcase is placed in a closed vessel which is provided with a steam jacket, and is there subjected to the action of benzene vapour. The benzene is obtained from a reservoir situated above the heating vessel and passes through a vaporiser before entering the vessel. The excess of benzene vapour and steam escape at the top of the vessel and are conducted to a condenser and separator, the benzene thus recovered being returned to the reservoir. The benzene vapour removes the fat from the carcase and this fat is drawn off from the bottom of the vessel; the fat contains a small quantity of benzene which may also be recovered. A stirrer is fitted in the vessel and the action of the benzene vapour may be increased by raising the pressure in the vessel, means being provided for this purpose. As the fat is removed, the stirrer gradually disintegrates the flesh, and at the end of the operation a dry, fat-free meat powder is obtained.—W. P. S.

Flour, and process of making flour. C. Herendeen, Chicago. U.S. Pats. 958,494, 958,495, and 958,496, May 17, 1910.

See Eng. Pat. 1444 of 1909; this J., 1910, 293.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Dairy wastes disposal. Quarterly Bull., Ohio State Board of Health; through Surveyor, 1910, 37, 231.

Investigations made by the Ohio State Board of Public Health, in co-operation with the U.S. Geological Survey, showed that wastes from skimming stations, and from butter and cream factories require special treatment, if discharged into small streams, in order to prevent pollution. The waste is of two kinds, the comparatively pure cooling water, and the milky and putrescent waste from the washing operations. In a creamery, the total volume of waste water is 1·5 galls. per 1 lb. of butter made, or 1 gall. if only the churn and floor washings are considered. When the volume of the wastes is more than one-thirtieth of the minimum flow of the stream into which it is to be discharged, sedimentation is insufficient, and experiments were made on sand-filtration of the tank-effluent. The rate of filtration was 35,500 to 54,600 galls. per acre per 24 hours. A scum soon formed on the liquid and increased to a thickness of 18 inches. A partial purification only was effected. In further experiments, in order to destroy free lactic acid, which prevents certain bacterial actions, soda ash was added to the wastes. The purification was more complete, but was still insufficient to give a stable effluent.—A. T. L.

Bacteria; Death rate of —— in oxygen of various concentrations and at different temperatures. T. Paul, G. Birstein and A. Reuss. Biochem. Zeits., 1910, 25, 367—400.

Staphylococcus pyogenes aureus was employed in the investigation, and the bacteria were manipulated with the aid of shot by the method of Krönig and Paul, which was found to be very suitable. It was found that the rate of disinfection of dry bacteria in mixtures of oxygen and nitrogen proceeds according to the formula of a monomolecular reaction, the active mass of the disinfecting gases being constant throughout the experiment. With the aid of that formula a constant of the velocity of disinfection can be calculated for each temperature and concentration of gas, and this forms a convenient measure of the disinfecting power. The constants are approximately proportional to the square root of the concentration of the oxygen. The velocity is doubled or trebled for a rise in temperature of 10°. The temperature coefficient is not, however, constant, but between 18° and 37° C. continuously decreases; this may be connected with the phenomenon of adsorption. —R. V. S.

Patents.

Water; Process for softening ——. J. D. Riedel, Akt.-Ges. Fr. Pat. 409,006, Nov. 13, 1909. Under Int. Conv., Jan. 18 and Mar. 26, 1909.

The water is treated with barium, calcium or magnesium hydroxide and sodium hydroxide or carbonate, according to the nature of the "hardness," and is then filtered through a layer of a natural or artificial zeolite.—W. P. S.

Filtration [of water]; Process and apparatus for ——. O. E. Schiedt. Fr. Pat. 409,259, Oct. 27, 1909.

During filtration, the water is kept in a state of constant agitation by means of compressed air or other gas. Means may be provided for directing ultra-violet rays against the water while it is being filtered, in order to destroy noxious germs. The filtering elements are self-contained and may be replaced at any time in the cistern containing the water being filtered. They consist of vertical cylinders of porous artificial stone filled with compressed sand. They may be cleansed separately while the filter is in operation by means of air, steam and water.—J. W. H.

Liquids [water, etc.]; Apparatus for clarifying and purifying ——. E. Abresch. Fr. Pat. 409,526, Nov. 23, 1909.

The liquid, such as waste-water or the like, is delivered into a chamber where the heavier impurities settle out.

and are removed through an opening at the bottom of the chamber. The latter contains a number of tubes provided with baffle-plates; the water passes from the chamber upwards through these tubes and oily matters are separated and collected under the baffle-plates, the latter being provided with flanges for retaining the oil. Ozonised air may be introduced into the tubes in order to sterilise the water passing through them. The baffle-plates are removable, so that the oily matters may be discharged when necessary, and means are also provided for removing oil which floats on the surface of the liquid in the main chamber. The ends of the tubes may be closed or opened by means of a sliding plate fitted across the chamber. The water rising in the tubes may be discharged into a filter chamber placed below the above-mentioned clarifying chamber. The liquid enters the filter chamber through a perforated hollow shaft. This shaft carries a number of superposed horizontal plates between which filtering material is packed, the whole being enclosed by perforated plates. The water, after passing through the filtering material, leaves the chamber through the central pipe. —W. P. S.

Sewage sludge; Method of and apparatus for treating ——. A. Hindle and P. H. Whitaker, Blackburn, and J. J. Knewstubb, Penrith. Eng. Pat. 19,483, Aug. 25, 1909.

The apparatus consists of a number of tanks divided into compartments by means of perforated vertical partitions; several perforated vertical pipes are arranged in each compartment, the lower ends of these pipes resting upon half-pipes or other suitable drainage devices. In each compartment is placed a layer of straw, stable litter, or the like, the straw being drawn up the side of the tank and around the perforated pipes. A quantity of the sewage sludge is delivered into the different compartments so as to form a layer about six inches in depth; another layer of straw is placed on the surface of the sludge, and a further quantity of the latter is admitted, the surface of this also being covered with straw, and so on until the compartments are filled. The tanks are not filled at one operation, but successive layers are deposited therein from time to time. The liquid portion of the sludge drains away through the perforated pipes and partitions, and the dry sludge may be removed from the tanks through doors or slides which are provided for the purpose.—W. P. S.

Air; Materials for purifying ——. E. S. Spencer, London. Eng. Pat. 10,261, April 30, 1909.

The air to be purified is brought into intimate contact with a viscous fluid consisting of a solution of "glucose" containing about 1 per cent. of a soluble fluoride or a smaller quantity of sulphurous acid. In certain cases the "glucose" may be mixed with 0·05 per cent. of potassium hydroxyquinolinesulphonate. Instead of "glucose," a non-drying oil such as lard or castor oil, may be used. —W. P. S.

Cleansing fluid for use as a sheep-dip or for disinfectin, or like purposes; Manufacture of a ——. W. G. Little, East Grinstead, Sussex. Eng. Pat. 27,006, Nov. 20, 1909.

Eleven cwt. of castor oil and 11 cwt. of sodium hydroxide solution of 30° Tw. are heated together at a temperature of about 200° F., until the oil is completely saponified. To the mixture are now added 9856 lb. of creosote and the whole is again heated until a clear liquid is obtained, whereupon 50 galls. of commercial cresylic acid are added and well stirred into the mixture. The resulting product is a transparent liquid containing upwards of 80 per cent. of creosote and forms a very stable emulsion when mixed with water.—W. P. S.

Incinerating plant [refuse destructor]. E. F. Price, Lancaster, and T. F. Bennett, Philadelphia, Pa., Assignors to J. F. Keller, Lancaster, Pa. U.S. Pat. 958,308, May 17, 1910.

The incinerating plant or destructor comprises a main furnace chamber with a smaller initial furnace chamber in communication therewith through an opening in the front wall. The main furnace chamber is surmounted by a drying chamber for the crude refuse, and is separated from the latter by an inclined plate having channels to collect liquid. The liquid runs off the lower end of the inclined plate on to projecting bricks in the back wall of the main furnace chamber. The plate can be withdrawn to admit the dried refuse into the furnace. A downtake flue leading to the stack is arranged at the back of the main furnace chamber, and communicates therewith by a series of openings. The flue is also connected to the upper part of the drying chamber.—A. T. L.

Fabrics with disinfecting and sterilising properties; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 222,292, Dec. 17, 1908.

Textile fabrics are impregnated with mixtures of collodion and substances which easily generate formaldehyde, *e.g.* a mixture of 3 parts of barium peroxide and 1 part of paraformaldehyde.—T. F. B.

Filtering water; Process and apparatus for ——. O. E. Scheidt, St. Petersburg. Eng. Pat. 24,811, Oct. 28, 1909.

See Fr. Pat. 409,259 of 1909; preceding.—T. F. B.

Water; Process of purifying and sterilising ——. A. Baudry, Kief, Russia. U.S. Pat. 958,848, May 24, 1910.

See Eng. Pat. 21,668 of 1903; this J., 1904, 725.—T. F. B.

Waste waters; Process and apparatus for separating suspended matter from ——. Ges. f. Abwässerklärung. Fr. Pat. 409,948, Dec. 4, 1909.

See Eng. Pat. 20,179 of 1909; this J., 1910, 448.—T. F. B.

Waste waters freed from ammonia; Process and apparatus for purifying ——. J. Radcliffe and E. Blackburn. Fr. Pat. 410,051, Dec. 6, 1909.

See Eng. Pat. 16,924 of 1908; this J., 1910, 24.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Quinine; Action of chlorine and ammonia on ——: *thalloquinine, rubroquinine, erythroquinine, leucoquinine, rusioquinine, and melanoquinine.* E. Comanducci. Chem. Zentr., 1910, 1, 1885.

By the oxidation of quinine salts with chlorine or other oxidising agents, with subsequent addition of ammonia, the following compounds have been obtained, according to the experimental conditions:—(*a*) thalloquinine (Andrè) of the composition, $C_{15}H_{20}O_5N_2$, according to Brandes; (*b*) erythroquinine (Vogel); (*c*) rusioquinine, $C_{24}H_{60}O_{16}N_3$ (Brandes); (*d*) melanoquinine, $C_{26}H_{36}O_{12}N_3$ (Brandes); and (*e*), a white compound (Andrè), which was not analysed. By the action of chlorine and ammonia on quinine at the ordinary temperature, the author has obtained two new compounds, *rubroquinine* and *leucoquinine* in addition to thalloquinine. For the production of the thalloquinine reaction, the quinine derivative must contain a phenolic oxygen atom connected to a naphthalene or quinoline nucleus. For the preparation of thalloquinine, 10 c.c. of a quinine solution are treated with 8·3 c.c. of chlorine-water, and after agitating for about 18 seconds, 7·5 c.c. of ammonia solution are quickly added. The greenish precipitate after being dried over sulphuric acid *in vacuo*, melts at 130° C.; it is slightly soluble in chlorine-water, and is re-precipitated with a somewhat darker colour by rapid addition of ammonia, whilst by adding a smaller quantity of ammonia, drop by drop, a red precipitate is produced. Rubroquinine, m. pt. 118°—120° C., is obtained as a violet-coloured precipitate by adding 10 c.c. of chlorine water to 10 c.c. of a quinine solution, shaking for

1 minute, then adding 2·5 c.c. of ammonia solution, drop by drop, with agitation, and after a red colour is produced, adding a further 5 c.c. of ammonia. It is soluble in acids and chlorine-water, and is re-precipitated from its solution in the latter by addition of ammonia. Leucoquinine, m.pt. 138° C., is prepared in a similar manner to rubroquinine from a neutral quinine sulphate solution, except that the ammonia is added rapidly five minutes after the chlorine-water. It is soluble in acids, and slightly soluble in chlorine-water; on adding ammonia to its solution in the latter, a rose-coloured precipitate is produced.—A. S.

Gnoscopine (dl-narcotine); Resolution of ——. (Preliminary note.) W. H. Perkin, jun., and R. Robinson. Chem. Soc. Proc., 1910, **30**, 131—132.

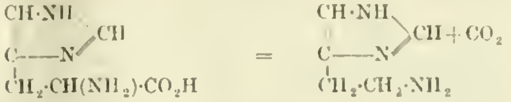
The authors have succeeded in resolving gnoscopine by the fractional crystallisation of its *d*-bromocamphorsulphonate from ethyl acetate. When liberated from their salts by treatment with alcoholic ammonia, the alkaloids exhibited the following properties in chloroform solution. *l*-Narcotine from gnoscopine, $[\alpha]_D = -199·8°$; *d*-narcotine from gnoscopine, $= +199·9°$; *l*-narcotine from opium, $= -199·9°$. All these specimens melted at 174—175° (uncorr.) On mixing hot alcoholic solutions of *d*- and *l*-narcotine, crystals of gnoscopine, melting at 230° C., separated at once. A short time since (this J., 1910, 371), the authors described a synthesis of gnoscopine from cotarnine and meconine, and as Salway (Chem. Soc. Proc., 1910, **30**, 98) has lately synthesised the former substance, the synthesis of the inactive and active modifications of narcotine is now complete.

Papaverine and cryptopine. A. Pictet and G. H. Kramers. Ber., 1910, **43**, 1329—1335.

Commercial papaverine gives a bluish violet coloration when dissolved in cold concentrated sulphuric acid. Carefully purified papaverine and the synthetic alkaloid dissolve in the acid without coloration. This is due to the presence in the commercial base of about 4 per cent. of cryptopine. When commercial papaverine is converted into the acid oxalate, and crystallised from alcohol, cryptopine can be isolated from the mother-liquors. Pure cryptopine, $C_{21}H_{23}NO_5$, dissolves in 80 parts of boiling 95 per cent. alcohol, and in 455 parts of the same alcohol at 15° C. It crystallises in short transparent prisms, which melt at 218° C. without any darkening. The alcoholic solution has only a feeble alkaline reaction to litmus. The base resists the action of nascent hydrogen, and contains two methoxyl groupings and one methylenedioxy grouping in the molecule. It gives many of the colour reactions of commercial papaverine.—F. Shdn.

Ergot extracts; A third active principle in ——. (Preliminary note.) G. Barger and H. H. Dale. Chem. Soc. Proc., 1910, **30**, 128—129.

In addition to the active principles previously described by the authors as present in ergot and its extracts, namely, ergotoxine and *p*-hydroxyphenylethylamine (this J., 1907, 483; 1909, 1324), a third active principle has now been isolated. The relative abundance of this principle in dialysed extracts suggested that it was wholly or partly produced by micro-organisms, and this supposition was confirmed by physiological experiment. It was also found that commercial extracts of meat and of yeast have a similar activity in smaller degree. Applying Kutscher's method (Z. Unters. Nahr. Genussm., 1905, **10**, 528; 1906, **11**, 582) for separating bases from meat-extract, the authors obtained the active principle from *ergotinum dialysatum* as a silver compound by adding silver nitrate in excess and then baryta. The hydrochloride of the physiologically active base, obtained from this silver precipitate, is readily soluble in cold methyl alcohol, less so in hot ethyl alcohol, and very sparingly so in cold ethyl alcohol. After suitable purification, a minute quantity of a crystalline picrate, melting at 220°—230°, and a picrolonate, very sparingly soluble in boiling water and melting at about 250° C., were obtained. The base regenerated from either salt gave Pauly's reaction with *p*-diazobenzenesulphonic acid. It is considered to be β-iminazolylethylamine, produced from histidine by loss of carbon dioxide



in the same way that *p*-hydroxyphenylethylamine in ergot extracts is produced from tyrosine. This provisional identification is supported by the facts that (1) the properties of the hydrochloride, picrate, and picrolonate above described correspond closely with those of the salts of β-iminazolylethylamine synthesised by Windaus and Vogt (Ber., 1907, **40**, 369), and quite recently obtained by Ackermann (Z. physiol. Chem., 1910, **65**, 504) by the putrefaction of histidine, and (2) the authors' base and that prepared by Ackermann exhibit the same physiological action.

Vanilla from Tahiti. H. Gautier and A. Kling. Ann. Falsific., 1910, **3**, 200—201.

The authors have examined four samples of vanilla pods from Tahiti and found them to contain the following quantities of vanillin:—

	1.	2.	3.	4.
	per cent.	per cent.	per cent.	per cent.
Vanillin, in the moist pods	0·753	1·01	0·730	0·938
Do. in the dry substance	1·32	1·21	1·30	1·56
Water	43·00	16·70	43·50	39·20

The results show that this kind of vanilla generally contains less than 1 per cent. of vanillin, calculated on the moist or original substance. Attention is drawn to the fact that the pods have a greasy appearance due to the presence of a thin coating of cocoanut oil; this oil is applied for the purpose of rendering the pods less brittle and to protect them against the attacks of insects (vanilla mites).—W. P. S.

Trifolium incarnatum [carnation clover]; Constituents of the flowers of ——. H. Rogerson. Trans. Chem. Soc., 1910, **97**, 1004—1015.

The dried flowering tops of the carnation clover (*Trifolium incarnatum* L.) were extracted with alcohol, and the extract was distilled with steam, when a small amount (0·029 per cent.) of an essential oil was obtained. The portion of the alcoholic extract soluble in water gave a sugar, which yielded *d*-phenylglucosazone. The following substances were also isolated from the aqueous liquid: benzoic and salicylic acids; pratol, $C_{16}H_{12}O_4$, quercetin, $C_{15}H_{10}O_7$; and a new glucoside of the latter, $C_{21}H_{20}O_{12},3H_2O$, m. pt. 242°—245° C., which has been named *incarnatrin*. The portion of the alcoholic extract insoluble in water consisted of a green resinous material, the amount of which was equivalent to 4·1 per cent. of the weight of the dried flowers. The following compounds were isolated from it: an alcohol, $C_{34}H_{69}OH$, m. pt. 72°—74° C., and for which the name *incarnatyl alcohol* is proposed; hentriacontane; a phytosterol, $C_{27}H_{46}O$, m. pt. 135°—136° C., $[\alpha]_D = -41·7°$ in chloroform; trifolianol, $C_{21}H_{34}O_2(OH)_2$, m. pt. 295°—300° C., $[\alpha]_D = -44·1°$ in pyridine; and a mixture of fatty acids, chiefly palmitic, stearic, and linolic acids.
—F. Shdn.

Bergamot oil; Terpineol of m. p. 35° C., nerol and dihydrocumin alcohol in ——. F. Elze. Chem.-Zeit., 1910, **34**, 538.

In the commercial preparation of terpeneless bergamot oil, 25 per cent. of a fraction rich in esters (68 per cent. as linalyl acetate) was obtained, which on saponification with alcoholic potash (1 : 3), distilling the mixture with steam, and then fractionating *in vacuo*, gave an oil with the following constants: sp. gr. at 15° C., 0·890; $a_{100} = -10°$. This oil was heated in a boiling water bath with equal weights of benzene and phthalic anhydride for 1½ hours. The resulting product was separated from excess of phthalic acid with low-boiling petroleum spirit and the solvent driven off. The residue was dissolved in dilute sodium carbonate solution, freed from oily compounds with ether, and the phthalic ester precipitated with dilute sulphuric acid (1 : 3). The oily phthalic esters thus obtained were saponified with alcoholic potash, the alcohols distilled over with steam, and then carefully fractionated *in vacuo*. A small quantity of dihydrocumin alcohol was obtained. The chief component of the alcoholic mixture is nerol, mixed with a small quantity of geraniol which could not be separated from it by treatment with calcium chloride. The portion of the benzene solution which did not react with phthalic anhydride, after freeing from the solvent and distillation with steam, was submitted to direct distillation. The fraction distilling at 215°—225° C. had a decided odour of terpineol: its melting point was found to be 35° C. —A. Seld.

Bergamot oil; Adulteration of —— with esters of citric acid. O. Wiegand and K. Rübke. Z. angew. Chem., 1910, **23**, 1018—1019.

Bergamot oil is valued according to its content of linalyl acetate as determined by the saponification value. The authors have found that triethyl citrate has been used as an adulterant, as it has a high saponification value and does not materially affect the other constants. The presence of citric acid esters may be detected by the turbidity of the solution during saponification, or by precipitation as calcium citrate. A still better method is that of Denigès which consists in oxidising the citric acid to acetonedicarboxylic acid with dilute potassium permanganate, whereupon the addition of mercuric sulphate produces a voluminous precipitate. (See also this J., 1899, 522).—G. W. Mc. D.

Lavender oil from Lavandula latifolia. J. Slaus-Kantschieder. Tätigkeitsber. K. K. Landw. Lehr- u. Versuchsanst. in Spalato, 1909. Chem.-Zeit., 1910, **34**, Rep., 276.

Specimens of *Lavandula latifolia* from Dalmatia yielded 1·81 and 1·96 per cent. respectively of a light yellow oil of sp. gr. 0·9084 and 0·9083, *i.e.*, about the same as that of spike-lavender oil. *Lavandula latifolia* grows wild in Dalmatia, and its cultivation appears worthy of consideration in view of its high yield of essential oil.—A. S.

Oil from Calamintha nepetoides. J. Slaus-Kantschieder. Tätigkeitsber. K. K. Lehr- u. Versuchsanst. in Spalato, 1909. Chem.-Zeit., 1910, **34**, Rep., 276.

A light green oil of very pleasant mint-like odour can be obtained, with a yield of 1·01 per cent., from *Calamintha nepetoides*.—A. S.

Light; Chemical action of ——. [Camphor and fenchone.] G. Ciamician and P. Silber. Ber., 1910, **43**, 1340—1350.

Camphor was dissolved in a mixture of alcohol and water, and exposed to the action of daylight in sealed flasks for several months. The principal products isolated, besides unchanged camphor, were an aldehyde and an unsaturated ketone both of the same composition, $C_{10}H_{16}O$. The former is campholene-aldehyde. The ketone boils at 203°—204° C., and gives a semicarbazone melting at 151°—152° C. Fenchone when treated in a similar manner yielded carbon monoxide, an oil boiling at 175°—180° C., and a glycol, $C_{10}H_{18}O_2$, which crystallised from benzene in leaflets, m. pt. 138°—139°C. Pinacolin under the prolonged action of light gave acetaldehyde and, apparently, butylene.—F. Shdn.

Alcohol and sulphuric acid; Dynamics of the reaction between ——. R. Kremann. Monatsh. Chem., 1910, **31**, 245—274.

The equilibrium concentration of the components in the reaction, $C_2H_5OH + H_2SO_4 \rightleftarrows C_2H_5HSO_4 + H_2O$, is determined by the expression: $K = \frac{C_{alcohol} \times C_{acid.}}{C_{ester} \times C_{water}}$

This expression gives reasonably constant values for K, which is apparently independent of temperature. The substitution of other values (based on the data as to the formation or dissociation of hydrates) for the effective concentrations of water and acid leads to much less satisfactory agreement between the values for K. Dynamic experiments on the reaction between ethyl hydrogen sulphate and pure water show that the velocity is proportional to the concentration of hydrogen ions and is very abnormally increased by a rise in temperature The velocity at 66° C. is over 4·5 times the velocity at 55° C The velocity of reaction between alcohol and sulphuric aci depends largely whether the original solution is aqueou or practically free from water. In the latter case th velocities in both directions are about 50 times as grea as in the former. Both velocities are considerably affecte by raising the concentration of sulphuric acid. There i first a rather indefinite decrease and then a sharp rise due primarily but not entirely to the increase in con centration of hydrogen ions. The formation of hydrate has also an effect on the velocity though not on th equilibrium. The temperature-accelerations are agai much greater than usual.—W. H. P.

Alcohol, ether, water, sulphuric acid, and ethyl hydroge sulphate at 0° C. Quaternary and quinternary system R. Kremann. Monatsh. Chem., 1910, **31**, 275—284

The limiting concentrations of complete miscibility a 0° C. (where chemical reaction may be assumed to b absent) in ternary, quaternary, and quinternary system of the above substances have been determined and repr sented by a diagrammatic method.—W. H. P.

Reunion essential oils. For. Off. Ann. Ser. No. 4450. [T.R.

Several essential oils have been experimentally distille in Réunion. Champaca oil is very difficult to disti 1 kilo. of flowers yielding only 1·25 grm. of oil. Th price of the finest oil varies between £100 and £12 per kilo., but the Réunion product only realised £52 pe kilo. last year. The oil is known as yellow champac while that from *Michelia longifolia* is known as whi champaca. Over-production has again sent the pric of ylang-ylang oil down by £6 per kilo., in addition t which large plantations of ylang-ylang have lately bee started in the Comoro Islands, and it is believed tha when these come into bearing prices will fall much low than they are at present. The exports and the avera prices realised have been as follows: 1907, 1,164 lb. (£2 per kilo.); 1908, 2,477 lb. (£18); and 1909, 3,982 lb. (£12 The price of Réunion geranium oil last year varied betwe 22f. (17s. 6d.) and 25f. (£1) per kilo. The syndicate geranium-planters have refused to sell, owing to t small stock in hand—viz., 4,000 kilos. (8,800 lb.)—and t reduction in the quality of African distilled. The expor during the past four years have been as follows: 190 32 tons; 1907, 31 tons; 1908, 34 tons; and 1909, 57 ton The average price of the oil of vetivert distilled was abo £1 per kilo., and the output was higher—viz., 1,810 kilo against 1,210 kilos. in 1908 and 1,928 kilos. in 1907.

PATENTS.

Perfumes; Substances for fixing ——. Dr. Schmitz u Co. Ger. Pat. 221,854. April 29, 1909.

A "fixing agent" for perfumes should be a good solve for the perfume, stable, of high boiling point and l melting point, and preferably odourless. These conditio are fulfilled by the esters of glycollic acid in which t alcoholic hydrogen atom is replaced by an aliphatic or aromatic acidyl, or by an alkyl, aryl, or alkaryl group. The esters may be used singly or in combination. They are either odourless or possess faint floral odours.—T. F. B.

Monochloro-acetyl chloride from dichlorovinyl ether ; Process for producing ——. Consortium f. Elektrochem. Industrie. Ger. Pat. 222,194, July 1, 1909.

Cooled dichlorovinyl ether is saturated with dry hydrogen chloride; the product is allowed to stand for 24 hours, and is then heated, the trichloro-ethyl ether being decomposed into ethyl chloride and monochloro-acetyl chloride, which is separated from the residue by fractional distillation.—T. F. B

Isobutyl ester of para-aminobenzoic acid. W. Grüttefien, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 958,110, May 17, 1910.

See Ger. Pat. 218,389 of 1909; this J., 1910, 452.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Development of silver bromide-gelatin plates in hot countries. L. J. Bunel. Bull. Soc. Franç. Phot., 1910, **1**, 174—177.

In developing gelatin-bromide plates in hot climates, it is preferable to use either diaminophenol in acid solution, or metol-quinol in presence of acetone and in absence of alkali hydroxide or carbonate. The addition of potassium or sodium sulphate to the developer has been found to be the best means of rendering the gelatin insoluble and preventing its "frilling." In order to avoid the rapid formation of colonies of bacteria during the final operations, the only effective means is to conduct them as quickly as possible; antiseptics (formaldehyde, etc.) are of no use for the purpose. Suitable formulæ are given for making up diaminophenol and metol-quinol developers and a combined fixing and hardening bath, containing, in addition to thiosulphate, potassium metasulphite, and chrome alum, 0·5 per cent. of potassium cyanide, which prevents precipitation of sulphur.—T. F. B.

Asphaltum ; Increasing the sensitiveness of —— to light. E. Valenta. Phot. Corresp., 1910, **47**, 238. Phot. J., 1910, **34**, 225—226.

Asphaltum is heated, on a water-bath, with 6 to 8 per cent. of its weight of sulphur chloride, diluted with four or five volumes of carbon bisulphide: when evolution of hydrochloric acid has ceased, a portion of the solvent is distilled off and the residue is diluted with benzene; the solution is then ready to be coated on metal plates. The plates thus formed are practically equal in sensitiveness to those coated with bichromated albumin.—T. F. B.

Screen plates ; Some experimental methods employed in the examination of ——. C. E. K. Mees and J. H. Pledge. Phot. J., 1910, , 197—221.

In testing the relative value of colour-screen plates, the plate as a whole must be examined (*a*) for colour; in order that pure whites can be obtained, the screen should be of a neutral shade, which is obtained by adjusting the areas of the filter units, not by altering their depth of colour; (*b*) for total visual absorption. The examination of the optical properties includes a test for invisibility, *i.e.*, as to whether the grains are evenly mixed and distributed; and a test of resolving power. The filter units themselves should be examined, first, for evenness of colour; second, for spectral absorption—the filters should preferably transmit red light of wave-length 5900 upwards, green 5900 to 4900, and blue 5000 downwards. The size of the units is of importance; the limits should be, for "regular" screens, $\frac{1}{800}$ in. to $\frac{1}{300}$ in. and for irregular grain screens, $\frac{1}{2000}$ in. to $\frac{1}{400}$ in. The emulsion is examined in the same way as for ordinary plates, the spectrum test being of great value. The compensating screen (used in the objective) and the emulsion must be correctly adjusted to the filter, so that a scale of greys can be accurately rendered. The final effective speed of a screen-plate depends directly on the speed of the emulsion, and inversely on the retarding power of the screen and the compensator. The effective speeds of the Autochrome, Thames, Dufay, and Omnicolore plates are, respectively, 1·5, 10, 2·5, and 2.—T. F. B.

Patent.

Photographic colour-screen negatives containing one series of continuous colour lines ; Process for copying ——. Vereinigte Kunstseidefabrik. Ger. Pat. 221,916, Jan. 19, 1909.

This process relates to the copying of negatives containing colour screens consisting of a series of parallel, continuous lines of one colour, the interstices being filled with squares (broken lines) of the other two colours. When such negatives are copied through screens made in the same manner and in the same colours, the colour of the continuous lines always predominates in the copies. But if the copying screen is prepared so that the colour of its continuous lines is that of one of the sets of spaces between the continuous lines of the negative screen, and if the continuous lines of the two screens are caused to cross one another when printing, the colour values in the resulting prints will be correctly rendered.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosives ; New—placed on permissible list—(U.S.A.). Eng. and Min. J., June 4, 1910, 1187.

The following explosives are announced as acceptable for use in coal mines:—Ætna coal powder, D, Ætna Powder Co., Chicago, Ill. Coal special No. 3-B and Coal Special No. 3-C, Keystone Powder Co., Emporium, Penn. Eureka No. 2-L. F., Tunnelite No. 6-L. F., and Tunnelite No. 8-L. F., G. R. McAbee Powder and Oil Co., Pittsburg, Penn. Titanite No. 3-P, Waclark Titanite Explosive Co., Corry, Penn. Trojan coal Powder A, Trojan Powder Co., Allentown, Penn. Detonite special, Detonite Co., Cincinnati Ohio. Monobel No. 2, Monobel No. 3, Carbonite No. 4, and Hecla No. 2, E. I. du Pont de Nemours Powder Co., Wilmington, Del. Kanite A, W. H. Blumenstein Chemical Works, Pottsville, Penn.

Patent.

Arrangements for feeding paper into the nitrating vessels in the manufacture of nitrocellulose. Fr. Pat. 409,220. *See* V.

XXIII.—ANALYTICAL PROCESSES.

Combustion calorimeter [calorimetric bomb] ; Calibration of the —— and method of working. W. A. Roth. Annalen, 1910, **373**, 249—266.

The author's experiments with the calorimetric bomb (the Präzisionsmodell of Hugershoff, of Leipsic, was used) show that results which are accurate to within 0·1 per cent. may be obtained with comparatively simple apparatus. The calibration of the instrument, both thermally and electrically is described, and the use of naphthalene for the thermal method is recommended; a very good Beckmann thermometer being employed for measuring the temperature. The heat lost to or gained from the surroundings is calculated by observing the temperature at half-minute intervals before, during, and after the combustion, applying the change of rate per degree (obtained by dividing the total change of rate by the observed rise in temperature) to give the proper correction for each interval. The only other corrections necessary are (1) for the heat given out by the combustion of the ignition thread, (2) for heat generated electrically in igniting the thread, (3) for nitric acid formed during combustion (determined by titration, using Congo red as indicator), and (4) for any slight amount of soot deposited. These amounted, in the author's experiments, to about 1 per cent. of the heat of combustion, and the error is not more than 0·04 per cent.—F. Sodn.

Iodine; Determination of small quantities of ——, with special reference to the iodine content of the thyroid gland. A. Hunter. J. Biol. Chem., 1910, **7**, 321—352.

The author has worked out a method for the estimation of the minute quantities (usually about 0·1 per cent.) of iodine in thyroid gland, and by means of it obtains more accurate results than were possible with Baumann's method. The dry substance is strongly heated with twenty times its weight of a mixture of equimolecular quantities of potassium and sodium carbonates, containing ⅛ mol. of potassium nitrate. The mass is then dissolved in water, treated with an excess of sodium hypochlorite and acidified. The excess of chlorine is removed by boiling, and potassium iodide is added: this leads to the liberation of a quantity of iodine corresponding to the amount of iodate present in the solution. The iodine is titrated with thiosulphate and starch. By means of a series of controls it is shown that the iodine originally present is quantitatively converted into iodate by the means of fusion employed.—R. V. S.

Radium; Determination of ——. S. J. Lloyd. J. of Phys. Chem., 1910, **14**, 476—481.

Some irregularities having been noticed in determining radium by means of the emanation method, the author carried out an investigation of the conditions necessary for the accurate determination of radium by this process. Briefly, the latter consists in boiling the solution containing the radium to expel all emanation present, sealing the solution up for a definite length of time, usually several days, to permit the emanation to accumulate, and then drawing off the emanation into a gas-electroscope where its activity is measured. Since in a radium solution which has been freed from emanation the latter grows to half value in 3·75 days, it is possible to calculate the maximum value for the activity from the formula $I = I_0(i - e^{-\lambda t})$, where I is the activity observed (the reciprocal of the time of discharge of the electroscope), I_0 the maximum activity, λ the decay constant, and t the time. The electroscope used is standardised from time to time on a solution containing a known amount of radium, and it is therefore possible to determine the actual quantity of radium present in any case. It was found that for the accurate determination of radium by the emanation process, the presence of hydrochloric or nitric acid is essential. If barium sulphate or carbonate be present in the solution, prolonged boiling or repeated determinations are necessary to ensure the extraction of the total emanation. The retention of emanation by freshly precipitated barium sulphate is probably mechanical only; recrystallisation under the influence of heat releases the radium, and permits the removal of the emanation.—W. P. S.

Volumetric determination of sulphuric acid and sulphates. Repiton. *See* VII.

Determination of manganese [in iron and steel] by the persulphate method. Rubricius. *See* X.

Rapid analysis of commercial cyanide. Bell. *See* X.

Detecting small quantities of gold and silver. Armani and Barboni. *See* X.

Determining gold and silver in black copper. Nissnson. *See* X.

Determining copper in mattes. Winkler. *See* X.

Analysis of linoleum. Fritz. *See* XIII.

Old limes. Stiasny. *See* XV.

Precipitation of lævulose by basic lead acetate in clarification of cane sugar products. Pellet. *See* XVII.

Detecting sulphuring of barley and malt. Brand. *See* XVIII.

Determining aldehydes in alcohol. Preparation of standard aldehyde solution. Ronnet. *See* XVIII.

Determining ergot in flour. Bernhart. *See* XIXa.

Patent.

Photometer. H. Bryhni, Børsen, Norway. U.S. Pat. 959,051, May 24, 1910.

See Eng. Pat. 19,768 of 1907; this J., 1907, 1255.—T. F. B.

Trade Report.

Japanese Customs Tariff. Board of Trade J., June 2, 1910.

The Japanese Customs Bill and Tariff (see this J., 1910, 522) have been passed by the Japanese Diet, with certain amendments including those shown in the subjoined statement. The date at which the new Law is to be put in operation is to be determined by Imperial Ordinance.

[Additions to the text of the Proposed Tariff are printed in italic type.]

No. in New Tariff.	Articles.		Rate of duty.	
			Originally proposed.	Adopted by the Diet.
			£ s. d.	£ s. d.
154	Acid, acetic	per ton	13 12 0	18 14 0
205	Borneo camphor, and blumea or ngai camphor *and artificial Borneo-camphor or borneol*	per cwt.	3 3 0	21 5 0
236	Indigo, natural—			
	(1) Dry	per cwt.	1 16 8	56 5 0
	(2) Liquid or in paste		10% *ad val.*	20% *ad val.*
237	Artificial indigo—			
	(1) Dry	per cwt.	1 18 0	3 8 0
	(2) Liquid or in paste		10% *ad val.*	20% *ad val.*
243	Alizarin dyes, aniline dyes and other coal tar dyes, not otherwise provided for	per cwt.	0 7 9	0 12 0
362	Printing paper—			
	(1) Art paper	per ton	5 8 8	4 1 6
	(2) Other:—			
	(A) Coloured in the paste	per ton	2 14 4	2 0 9
	(B) Other:—			
	(*b*) Weighing more than 58 grammes per sq. metre	per ton	3 16 0	3 8 0
386	Baryta paper, albuminized paper, and sensitized papers for photography—			
	(4) "P.O.P." (including inner packings)	per cwt.	6 19 2½	Cancelled.
469	Mercury *and bismuth*		Free.	Free.

Books Received.

A.B.C. Five-figure Logarithms and Tables for Chemists, including Electro-Chemical Equivalents, Analytical Factors, Gas Reduction Tables, and other Tables Useful in Chemical Laboratories. By C. J. Woodward, B.Sc. E. and F. N. Spon, Ltd., 57, Haymarket, and Simpkin, Marshall, Hamilton, Kent & Co., Limited, London. 1910. Price 2s. 6d. net. Spon and Chamberlain, 123, Liberty Street, New York, U.S. America. Cornish Brothers, 37, New Street, Birmingham.

Pocket-book size, containing 69 pages, chiefly of tables, and an alphabetical index. In the introduction, the use of logarithms is concisely explained. Then follow a series of logarithm tables and other tables for use in chemical and metallurgical laboratories.

fficial and Provisional Methods of Analysis. [U.S. Department of Agriculture, Bureau of Chemistry. Bulletin No. 107 (revised).] Association of Official Agricultural Chemists. Edited by Harvey W. Wiley, Secretary of the Association. Government Printing Office, Washington, U.S. America. 1910.

vo volume, containing 260 pages of subject matter, ith 11 illustrations, and an alphabetical index. The official nd provisional methods of analysis given, are included nder the following heads:—I. Analysis of fertilisers. I. Soils. III. and IV. Insecticides and fungicides. V. Tanning materials. VI. General methods for the nalysis of foods and feeding stuffs. VII. Methods for the nalysis of cattle foods. VIII. Cereal foods (in preparation). X. Canned vegetables. X. Saccharine products. XI. ugarhouse products. XII. Fruits and fruit products. XIII. Wine. XIV. Beer. XV. Distilled liquors. XVI. inegar. XVII. Meat and meat products. XVIII. airy products. XIX. Edible fats and oils. XX. ocoa and cocoa products. XXI. Tea. XXII. Coffee. XXIII. Flavouring extracts. XXIV. Spices. XXV, ondiments other than spices. XXVI. Baking owder and baking chemicals. XXVII. Methods or the detection and determination of food preservaives. XXVIII. Colouring matter. XXIX. Drugs. XXX. Reference tables. Appendix with various further methods.

utlines of Organic Chemistry. A book designed especially for the general student. By F. J. Moore, Ph.D. John Wiley & Sons, New York, U.S. America. Chapman and Hall, Limited, London, 1910. Price 6s. 6d., net, or $1.50.

mall 8vo volume, containing 308 pages of subject matter, 14 illustrations, and an alphabetical index.

nnual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions, 1909. Volume I. [Cd. 5,159.] Price 5s. 2d.

his is the first volume of the statement of the oversea rade of the United Kingdom for the year 1909, and contains abstract tables showing the total imports and exports f every article which is separately enumerated in the fficial classification (as well as the total values for 1909 f the leading articles not so enumerated), together with etailed tables showing the quantity and value of the imports nd exports of each article consigned from and to each ountry, figures being given in each case not only for the ear 1909, but for each of the four preceding years. Imorts are throughout the tables in this volume credited the countries from which they were consigned to the nited Kingdom, and exports to the countries of final estination so far as known.

irst Report of the Departmental Committee on Petroleum Spirit. Report and Appendices. [Cd. 5175.] Price 6d.

his is a report of the Departmental Committee appointed n 19th December, 1908, to inquire into the sufficiency of the existing regulations relating to the storage, use and conveyance of petroleum spirit; and to report what further precautions, if any, were in their opinion desirable as tending to diminish the dangers attendant thereon. The present report deals with the various questions upon which evidence has been given before the Committee, with the exception of those relating to harbours. (See page 744.)

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

13,098. Sheppee and Shippey. Pumps for viscous liquids, etc. May 30.

13,121. Hocking. Evaporators or distilling apparatus. May 30.

13,181. Epstein. *See under* XVIII.

13,246. Lloyd. Centrifugal separators for separating solids from liquids. June 1.

13,317. Canda. Furnaces. [Fr. Appl., Dec. 21, 1909.]* June 1.

13,328. Richmond, and Lister and Co., Ltd. Centrifugal emulsors. June 1.

13,392. Epstein. *See under* XVIII.

13,470. Glass and Glass. Drying apparatus for liquid and pasty substances. June 3.

13,497. Jäger. Evaporating or concentrating under vacuum. June 3.

13,506. Seitz. Filtering and the production of filtering media. June 3.

13,712. Bird. Still heads. June 7.

13,825. Lake (Branch). Compressing air, gas, or other gaseous fluids.* June 7.

14,020. Matthews and Strange. Apparatus for separating matters by means of solvents. June 9.

Complete Specifications Accepted.

12,463 (1909). Lennox. Revolving drying machines. June 8.

12,465 (1909). Lennox. Apparatus for drying bricks, briquettes of peat, coal, etc., salt, chemicals, etc. June 8.

13,440 (1909). Pawle. Vacuum filters. June 15.

28,625 (1909). Justice (Binney). *See under* X.

28,836 (1909). Boult (Low). Centrifugal separating apparatus. June 15.

2426 (1910). Baldwin. Separating dust, smoke, etc., from gases. June 15.

7813 (1910). Watkin. Pyrometers, thermometers, etc. June 15.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

13,054. Grice's Gas Engine Co., Ltd., and Purser. Bituminous suction gas producers. May 30.

13,234. Smith. Gas retorts. June 1.

13,327. Koppers. *See under* VII.

13,518. British Thomson-Houston Co. (General Electric Co.). Arc light electrodes. June 3.

13,699. Gewerkschaft des Steinkohlenbergwerks Lothringen, and Uhde. *See under* VII.

14,013. Roelofsen. *See under* VII.

14,100. Vistour. Automatic regulation of suction gas-producers. [Fr. Appl., June 12, 1909.]* June 10.

14,116. Wolfram Lampen A.-G. Decarbonising filaments for use in metal filament glow lamps. [Ger. Appl., June 26, 1909.]* June 10.

Complete Specifications Accepted.

10,400 (1909). Böhm. Incandescence bodies for gas lighting. June 8.

10,484 (1909). Schniewind. Coke ovens. June 15.

12,465 (1909). Lennox. *See under* I.

13,331 (1909). Lesmüller. Flash-light powder. June 15.

16,871 (1909). May. Gas purifiers. June 15.

17,914 (1909). Goldstein and Hampe. Manufacture of highly absorbent or porous carbon or carbonaceous material. June 15.

19,924 (1909). Lumsden. Gas producers. June 8.

23,767 (1909). Oligny, and Peat Gas and Coal Co. Peat gas plants. June 15.

24,443 (1909). Muller and Bonnet. Manufacture of incandescent mantles. June 8.

26,124 (1909). Otto und Co. Removing tar from hot gases from coke ovens, gas retorts, etc. June 15.

29,568 (1909). Ziegler. Production of gas from domestic and street refuse and sludge. June 8.

III.—TAR AND TAR PRODUCTS.

Applications.

14,094. Johnson (Badische Anilin und Soda Fabrik). Manufacture of 2.3-dimethyl-1.3-butadiene. June 10.

Complete Specifications Accepted.

24,299 (1909). Newton (Bayer und Co.). Manufacture of tetranitromethane. June 8.

544 (1910). Ullmann. Manufacture of chlorinated anthraquinone sulphonic acids. June 8.

9743 (1910). Kalle und Co. Manufacture of an amino-oxynaphthalene sulphonic acid. June 15.

IV.—COLOURING MATTERS AND DYES.

Applications.

13,225. Wechsler. Manufacture of colouring matter from carbohydrates and the like. May 31.

13,792. Levinstein. Azo dyestuffs and their manufacture. June 7.

Complete Specifications Accepted.

14,311 (1909). Newton (Bayer und Co.). Manufacture of dyestuffs. June 8.

14,820 (1909). Newton (Bayer und Co.). Manufacture of acid wool dyestuffs. June 8.

28,170 (1909). Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. June 8.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

13,100. Newton (Bayer und Co.). Manufacture of lustrous threads, wires, and bands. May 30.

13,692. Lindsay. Pyroxylin compounds or compositi and method of making same. [U.S. Appl., June 1909.]* June 6.

Complete Specification Accepted.

14,016 (1909). Wells, and British Xylonite Co. P paration of xylonite or celluloid to form the raw mate for making combs, etc. June 15.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

13,588. Meister, Lucius, und Brüning. Dyeing ind and similar dyestuffs. [Ger. Appl., June 7, 190 June 4.

13,740. Psarski. Dyeing machines.* June 7.

13,911. Johnson (Badische Anilin und Soda Fabr Production of discharge effects on fibre and discharg pastes for use therein. June 8.

14,054. Furneaux. Apparatus for dyeing or scour fabrics, yarns, wool, or other fibrous substances. June

Complete Specifications Accepted.

8270 and 10,911 (1909). Niblett. *See under* XIX.

13,276 (1909). Naylor and Naylor. Dyeing mach June 15.

25,222 (1909). Textil Maschinenfabrik B. Cohr Dyeing apparatus. June 8.

VII.—ACIDS; ALKALIS; SALTS; NON-METAL ELEMENTS.

Applications.

13,086. Serpek. Manufacture of aluminium nitri May 30.

13,088. Serpek. Manufacture of pure alumina means of aluminium nitride.* May 30.

13,097. Johnson (Badische Anilin und Soda Fab Manufacture of ammonia. May 30.

13,187. Behrens and Behrens. Separation of carb acid from gaseous mixtures.* May 31.

13,327. Koppers. Separation of ammonia from tillation gases.* June 1.

13,415. Salt Union, Ltd., and others. Treatment brine.* June 2.

13,600. Barton. Manufacture of lead oxide. June

13,699. Gewerkschaft des Steinkohlenbergwerks L ringen and Uhde. Separation of ammonia from gas June 6.

13,935. Ashcroft. Electrolytic treatment of halo salts of the alkali metals or their derivatives and halog June 8.

13,936. Ashcroft. Electrolytic manufacture of fu anhydrous caustic potash. June 8.

13,013. Roelofsen. Recovery of ammonia from gases or other distillation gases.* June 9.

13.023. Haber. Manufacture of ammonia. [Appl., Sept. 13, 1909.]* June 9.

14,093. Johnson (Badische Anilin und Soda Fabr Manufacture of nitrides. June 10.

Complete Specifications Accepted.

12,465 (1909). Lennox. *See under* I.

14,313 (1909) Newton (Bayer und Co.). Manufact of a double compound of zinc hydrosulphite and sodi sulphite. June 15.

16,053 (1909). De Bechi and Blythe. *See under* X.

24,709 (1909). Johnson (Badische Anilin und S Fabrik). Manufacture of derivatives of formaldeh sulphoxylic acid. June 15.

4684 (1910). Norris. Manufacture of alkaline formates. June 15.

6063 (1910). Soc. d'Electro-Chimie, and Hulin. Apparatus for the electrolytic production of alkali metals. June 15.

7092 (1910). Imray (Soc. Chem. Ind. in Basle). Precipiation of alkaline earth oxalates. June 8.

9848 (1910). Ges. f. Chem. Industrie in Basel. Manuacture of anhydrous hydrosulphites. June 8.

VIII.—GLASS; CERAMICS.

Applications.

13,326. Sedergreen. Glass and other furnaces. June 1.

13,597. Mygatt. Manufacture of glassware.* June 4.

3,857. Tidy. Kilns for burning pottery, earthenware, lazed or enamelled bricks, tiles, etc.* June 8.

Complete Specification Accepted.

1790 (1910). Benedictus. Glass. June 8.

IX.—BUILDING MATERIALS.

Application.

13,970. Heaton. Manufacture of bricks. June 9.

Complete Specifications Accepted.

13,183 (1909). Lodge. Manufacture of cements from lag. June 15.

24,620 (1909). Soc. Anon. des Ciments Français. Rotary furnaces for treating cements. June 8.

2628 (1910). Rhodin. Manufacture of slag cement. une 8.

3740 (1910). Hartmann and Schwerdtner. Preseration of wood. June 8.

X.—METALS, METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

13,058 and 13,059. Stobie. Metallurgical furnaces. May 30.

13,072. Brooks. Deposition of silver on copper or its lloys. May 30.

13,394. Beauchamp. Treatment of concentrated pulerised sulphide zinc ores. June 2.

13,446. Goldschmidt. Removal of zinc from zinc-coated aterial. [Ger. Appl., March 18, 1910.]* June 3.

13,488. Island. Extracting precious values from ores.* une 3.

13,503 and 13,504. Richardson. Manufacture and eatment of steel. June 3.

13,667. Cowper-Coles. Manufacture of armour plate. une 6.

13,668. Cowper-Coles. Armour plate. June 6.

13,669. Cowper-Coles. Apparatus for electro-deposition iron. June 6.

13,934. Poldihutte Tiegelguszstahlfabrik. Smelting urnaces. [Ger. Appl., June 11, 1909.]* June 8.

14,192. Brooke and Mackintosh. Alloys. [Addition No. 15,384 of 1909.] June 11.

Complete Specifications Accepted.

1639 (1909). Fabr. Chem. Gravüren Luppe und Heilonner. Imparting black coatings to metals. June 8.

13,073 (1909). Dellwik. Agglomerating fine ores, talliferous residues, etc. June 15.

13,081 (1909). Halvorsen and Johansen. Extraction iron and iron alloys. June 15.

13,291 (1909). Ruthenburg. Smelting sulphide ores, etc. une 8.

13,330 (1909). Ackermann. Manufacture of a soldering flux. June 15.

13,557 (1909). Gayley. Drying air for blast furnaces, converters, etc. June 15.

16,053 (1909). De Bechi and Blythe. Dissolving impure tin or tin alloys to obtain tin or tin compounds. June 15.

17,382 (1909). Keller. Carburisation of steel. June 15.

18,610 (1909). Hoff. Heating, melting, refining and extracting metals and other substances. June 8.

28,625 (1909). Justice (Binney). Filters for metallurgical and other uses. June 8.

287 (1910). Soc. Electrométallurgique Française. Manufacture of pure nickel. June 15.

XI.—ELECTRO-CHEMISTRY.

Applications.

13,817. Herbst and Ziegler. Production of insulating material from peat.* June 7.

13,935 and 13,936. Ashcroft. *See under* VII.

13,946. British Thomson-Houston Co. (General Electric Co.). Electric insulating material. June 8.

Complete Specifications Accepted.

13,295 (1909). Nathusius, and Westdeutsche Thomasphosphat-Werke. Electric furnaces. June 8.

14,660 (1909). Thum. Electrolytic apparatus. June 15.

26,251 (1909). Härdén. Electric furnaces. June 15.

6063 (1910). Soc. d'Electro-Chimie, and Hulin. *See under* VII.

XII.—FATS; OILS; WAXES.

Application.

13,748. Fowler. Extraction of greases from bones. June 7.

Complete Specification Accepted.

5620 (1909). Macpherson and Heys. Detersive and emulsive agent and the manufacture thereof. June 15.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

13,128. Ljubarski. Extraction of resin oil from wood May 30.

14,022. Read. Apparatus for the manufacture of lamp-black. June 9.

Complete Specifications Accepted.

20,038 (1909). Simson. Luminous paints or compositions. June 8.

25,944 (1909). Coleman. Plant for heating or treating varnish, etc. June 15.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

13,090. Simpson. Purification of crude rubber. May 30.

13,201. Crude Rubber Washing Co., Ltd., and Dessau, Apparatus for removing foreign matter from india-rubber. gutta-percha, balata, etc. May 31.

13,204. Rankin and Clarkson. Treatment of the latex obtained from rubber and analogous trees. May 31.

13,425. Crude Rubber Washing Co., Ltd., and Dessau. Apparatus for removing foreign matter from india-rubber, gutta-percha, balata, etc. June 2.

14,021. Matthews and Strange. Treatment of raw products containing caoutchouc, gutta-percha, etc. June 9.

14,040. Heinemann. Production of isoprene. June 10.

14,041. Heinemann. Polymerisation of isoprene. June 10.

14,095. Johnson (Badische Anilin und Soda Fabrik). Manufacture of substances resembling caoutchouc. June 10.

Complete Specification Accepted.

19,016 (1909). Smith. Substitute for india-rubber. June 15.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

13,133. Kron. Tanning or production of leather.* May 31.

13,432. Lamb and Hall. Treatment of hides and skins. June 2.

13,718. Fowler. *See under* XII.

XVI.—SOILS; FERTILISERS.

Application.

13,545. Klauser (Wolters). Production of manure from peaty or moory soil. June 4.

Complete Specification Accepted.

9275 (1910). Coates. Production of antitoxin materials and their application to soils. June 15.

XVII.—SUGAR; STARCHES; GUMS.

Applications.

13,225. Wechsler. *See under* IV.

13,255. Fielding. Manufacture of dextrine, British gums, etc. June 1.

13,320. Sluka. Machine for transforming boiled sugar into a creamy paste. [Austrian Appl., Feb. 1, 1910.]* June 1.

Complete Specification Accepted.

16,834 (1909). Soc. Anon. Raffinerie Moderne Proc. Natta. Crystallisation of sugar from concentrated juices. June 15.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

13,108. Reinhardt. Production of malt grist for brewing purposes. [Ger. Appl., May 29, 1909.]* May 30.

13,129. Henri, Helbronner, and von Recklinghausen. Manufacture of wine and other potable liquors. [Fr. Appl., June 4, 1909.]* May 30.

13,181 and 13,392. Epstein. Distillation or rectification and the utilisation of the residue. May 31 and June 2.

Complete Specifications Accepted.

13,294 (1909). Perrot and Goris. *See under* XIX.

14,266 (1909). Elmassian. Preparation of an extract of malt in dry form. June 15.

3574 (1910). Justice (Schneible Co.). Manufacture of fermented liquors. June 8.

XIX.—FOODS. WATER PURIFICATION; SANITATION.

Applications.

13,630. Brooke. Apparatus for purifying fluids. June 6

13,865. Springborn. Treatment of milk. June 8.

13,877. Koch. Apparatus for purifying sewage water. [Addition to No. 23,668 of 1908.]* June 8.

13,969. Bell and Tuke. Apparatus for purifying sewage or other liquids. June 9.

14,127, 14,128, and 14,129. Henri, Helbronner, and von Recklinghausen. Sterilisation of liquids. [Fr. Applns., June 11, 1909.]* June 10.

Complete Specifications Accepted.

8270 and 10,911 (1909). Niblett. Disinfectant and deodorising compound also applicable for bleaching. June 15

13,294 (1909). Perrot and Goris. Rendering inactive th ferments in vegetable and animal organisms. June 8.

15,079 (1909). Hogermann and Wellensick. Purificatio of waters, particularly waste waters. June 8.

16,757 (1909). Rollason. Conditioning or improvin the quality and colour of flour. June 8.

20,445 (1909). Abt, Diehl, and Bayer. Treatment o effluents. June 15.

22,193 (1909). Thresh. Apparatus for purifying water June 15.

29,568 (1909). Ziegler. *See under* II.

XX.—ORGANIC PRODUCTS; MEDICINAL SUB STANCES; ESSENTIAL OILS.

Applications.

13,485. Meister, Lucius, und Brüning. Manufacture derivatives of oxyarylarsinic acids. [Ger. Appl., June 1909.]* June 3.

13,677. Newton (Bayer und Co.). Manufacture *beta-gamma*-dimethylanthrene. June 6.

13,755 and 13,756. Plimmer. Manufacture of therapeut substances. June 7.

14,016. Sefton-Jones (Wülfing). Digestive remedy. June 9.

14,040. Heinemann. *See under* XIV.

Complete Specifications Accepted.

13,902 (1909). Skita. Manufacture of camphen June 15.

18,540 (1909). Buer. Obtaining lecithin from the see of leguminous plants. June 15.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

13,235. Woodiwiss. Colour photography. June 1.

13,404. Burnett. Manufacture of photographic d plates. June 2.

13,430. Dawson and Finlay. Colour photograph June 2.

Complete Specification Accepted.

13,331 (1909). Lesmüller. *See under* II.

XXII.—EXPLOSIVES; MATCHES.

Applications.

13,956. Silberrad. Explosives. June 9.

14,137. Silberrad. Explosives. June 11.

Complete Specification Accepted.

21,931 (1909). Johnson (Chem. Fabr. Griesheim-Elektro Igniting compositions for matches. June 8.

Journal of the Society of Chemical Industry.

No. 13, Vol. XXIX. JULY 15, 1910. No. 13, Vol. XXIX.

Official Notice.

INTERNATIONAL EXHIBITION, TURIN, 1911.

An International Industrial Exhibition will be opened in Turin in April, 1911, and will remain open for about seven months. The Exhibition grounds are situated on either side of the River Po, and occupy the whole of the Valentino Park, an area of 247 acres, of which about 62 acres will be covered by buildings. The site allotted to the British Section occupies about 220,000 sq. ft., immediately adjoining the International and Machinery Halls. The facilities for transport will be similar to those afforded for the Brussels Exhibition (see this J., 1909, 684).

The handling of exhibitors' goods within the Exhibition will be undertaken without further charge beyond that made for space occupied, provided that they reach the Exhibition not later than March 1, 1911, in the case of machinery, and March 10, 1911, for other exhibits. The general service in this respect will be as at Brussels.

As regards show cases, stands, &c., it is proposed to continue the policy inaugurated in connection with the Brussels Exhibition, with such modifications as experience suggests.

The charges for space in the British Section include the use of show cases, stands, platforms, railings, and screens, the storage and return of empty packing cases, and the handling of goods within the Exhibition. They vary from 6d. per sq. ft. for screen or wall space, to 2s. 6d. for platform space, and 6s. 6d. for isolated show cases, per square foot.

Motive power will be supplied at the following rates:—

Steam	3½d. per 100 lb. (176 lb. per sq. in.).
Gas............	2s. 6d. per 1000 cb. ft.
Electricity......	2d. per kilowatt-hour (220 or 6400 volts).

Gas and electricity will be available for lighting at the rate of 3s. 6d. per 1000 cb. ft., and 4d. per kilowatt-hour respectively. Water at a pressure of 60 lb. per sq. in. can be obtained from the town mains at a cost of 1¼d. per 100 gallons.

It is stated that a Royal Decree will be issued, according protection to exhibits shown at the Exhibition.

A general catalogue, containing particulars of all the exhibits, will be issued by the Exhibition Authorities, and will be printed in Italian.

Forms of application for space and further information may be obtained from the Director of the Exhibitions Branch, Board of Trade, Queen's Anne's Chambers, Broadway, Westminster, S.W.

London Section.

Meeting held at Burlington House, on Monday, June 6th, 1910.

DR. J. LEWKOWITSCH IN THE CHAIR.

DIFFERENTIAL DISTILLATION.

BY J. LOUIS FOUCAR., B.SC., F.C.S.

Some time ago I designed the column, a sectional drawing of which is seen in Fig. 1. It consists, essentially, of a helical septum, or septa, (*a*), which traverses the annular space, (*b*), betweentwo concentric cylinders, (*c*) and (*d*). The inner cylinder, (*c*), can be used as a thermostat in various ways, for example, by allowing a suitable substance to boil therein under the necessary pressure; so that the column may be used as a constant-temperature still-head for the preparation of specially pure substances, for which there is an ever increasing demand. It is not necessary or desirable to fit the column itself with a reflux condenser, but it is preferable to make this an accessory part of the thermostatic device, and directly attached at (*e*) to this inner cylinder.

Assuming that we start with the column cold, and without making use of the inner cylinder, the action of the column may be described as follows:—On suitably changing the temperature and pressure of the substances contained in the vessel, vapours are evolved, and pass up the spiral passage. The vapours normally tend to condense in the order of their boiling-points, that is, the vapour of the substance of highest boiling-point will condense first, and the liquid so condensed will flow backwards down the spiral, some upon the upper side, or top, of the spiral passage, and some upon the lower side, or bottom. In condensing, the latent heat of condensation is transmitted both upwards and downwards through the material of the inclined septum, and the latent heat evolved in one spiral turn causes the re-volatilisation of some of the constituent or constituents of lower boiling-point in the already condensed liquid which is flowing down the upper side of the inclined plane in the spiral turn immediately above it and in that which is flowing down the underside of the inclined plane immediately below. Thus a continuous, simultaneous differential vapourisation of the relatively lighter constituent, or constituents, and condensation of the heavier constituent, or constituents, takes place, with the result that, by choosing suitable conditions, the constituents may be successively isolated. The apparatus can, of course, be used as a continuous still in the same way as modern alcohol and ammonia stills. Its function in this case is substantially as already described.

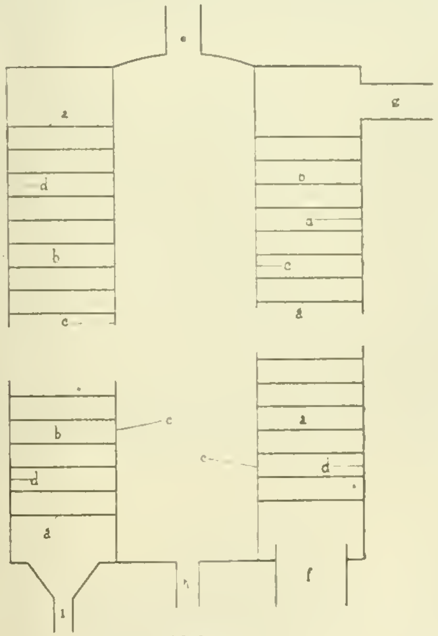


FIG 1.

In Fig. 1 (*f*) is the vapour inlet, (*g*) the vapour outlet, (*h*) the run-off for the liquid in the thermostat, and (*i*) the return for the refluxed liquid.

One of the many advantages of this column is that if we start cold we may not only work entirely without the usual reflux condenser, but can actually lag the column without any loss of efficiency. Experiments have demonstrated the truth of this assertion. As it is of considerably smaller size than other columns of like capacity and efficiency, it is evident that a great saving in fuel consumption is effected by its use. It is perfectly continuous in action throughout its whole length, and those mathematicians among us who have studied the counter-current will tell us that this is the only way to obtain the maximum efficiency out of such an interaction-tower. I have hence called it the "differentiator" column, and its function "differential distillation."

The advantages of this appliance over others of like character are as follows :—

(1). Smaller size required.

(2). Moderate cost.

(3). No clogging or blocking possible.

(4). No back-pressure thrown on to the still, except that due to the mere height of vapour in the column—a great advantage in the distillation of substances which can, or must, be distilled under reduced pressure.

(5). Saving in fuel.

(6). Increased purity of products.

(7). Great sensibility and consequent easy control.

(8). On completion of the distillation and subsequent cooling of the column, the latter retains no liquid, as it is able to drain completely. This is of great advantage, as every practical distiller must know.

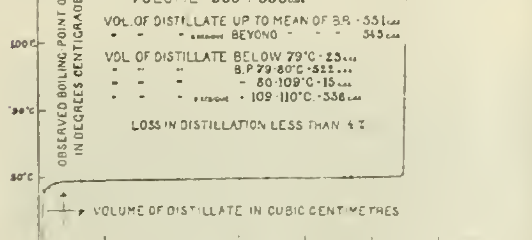
(9). Simplicity of construction and consequent reliability and lowness of the costs of maintenance.

(10). Safety.

Other advantages could be enumerated. The only possible disadvantage of which the author has any knowledge or suspicion is the comparative intimacy of contact, which may not be quite so good as in dephlegmators. What is meant is this. The column will have a steady temperature-gradient falling from the still to the outlet of the still-head. At any point in the still-head this temperature will correspond to a certain and calculable composition of the mixed vapours. This is what one may term the static equilibrium. When the apparatus is at work, however, the two counter-currents will cause the equilibrium to lag behind its corresponding temperature, and the measure of this lag, which the author intends to investigate under various conditions, should be of very great interest. In dephlegmators, properly designed and properly used, the kinetic equilibrium—if one may so call it—should very nearly approach the static, and in this one respect they may possess the only advantage over the "differentiator" column.

I have effected a most difficult separation of three isomeric substances by systematic fractional distillation with the use of my apparatus, a result which, so far as I am aware, has not been previously achieved by distillation alone.

FIG 2



Professor Sydney Young used for the test of a still-head a mixture of equal weights of benzene and toluene. It was, however, more convenient for me to work with equal volumes of those substances, prepared from commercial 90 per cent. benzol by means of a "differentiator" column, which is not fitted with any thermostatic device. The curve (Fig. 2) gives the volumes of the distillate in cubic centimetres as ordinates and the temperature in degrees Centigrade of the vapours condensing as abscissae. The intermediate fraction, whose volume is independent of the volume of the material with which the experiment was conducted, was only 15 cubic centimetres, or in this particular case less than $1\frac{1}{2}$ per cent. by volume of the whole. Had I used twice the volume, the intermediate fraction would have been no larger, but the proportion would have been less than $\frac{3}{4}$ per cent. by volume. The rate of distillation was about 250 cubic centimetres per hour, but considerably faster than this when only pure benzene or toluene was being run.

Discussion.

The Chairman said no doubt Mr. Foucar had carried out the process on a larger scale than was represented; in what manner had it been applied to hydrocarbons? They did not want to know what happened with the separation of the three isomers; but, what were the advantages to be obtained in actual commercial work.

Mr. E. Grant Hooper said he understood the author had not made any examination of the distillates; but he should like to ask him whether he had ever put through the apparatus again the separate fractions that he had obtained in such a separation as he had illustrated in the paper.

Mr. P. H. Joselin referred to Lord Rayleigh's constant temperature device as being in some respects similar to the new apparatus, but claimed that the latter was economically more efficient than an immersed spiral in that it effected direct heat interchange between successive layers of vapour and liquid. It might be objected that there was nothing to cause immediate change, simply an uninterrupted passage; but the length of this passage compensated for the absence of the scrubbing action which was a feature of the Coffey and other still-heads. While those depended on a relatively small number of layers of liquid through which the ascending vapours passed, this gave an indefinite number of tiny steps, accomplishing the same purpose without increasing the pressure by the condensation in the still-head of large quantities of liquid, requiring subsequent re-distillation.

The Chairman said that about 25 years ago he had a similar spiral column with a number of these spirals one above the other, with a view to removing some solid substance which was carried over with the vapours; but in that case, although the solid substance ought to have dropped out after two or three turns of the spirals, it did not: it was carried over a long way and contaminated the distillates. Perhaps two volatile organic substances with very different boiling points might not be so obstreperous.

Mr. T. H. Durrans said he had used one of these columns on a commercial scale for the fractionation of a complex liquid containing isomers with very close boiling-points, for which still-heads of more usual types were almost useless, and he had obtained very satisfactory results indeed. That liquid contained about 30 per cent. of one particular isomer, and he had been able to obtain up to 90 per cent. of that constituent, which he considered very satisfactory.

Mr. Foucar, in reply, said Mr. Durrans had answered the question as to the commercial use of this appliance. With regard to the separation of solid substances which the Chairman had mentioned, of course the whole question was one of fractional distillation, and it entirely depended, not only on the boiling points, but on the densities and miscibilities, and in the absence of full details he could not give an opinion upon the matter. He had examined the distillates most carefully, both as to the boiling point and chemically; but, for the sake of brevity, he did not give the results: they corresponded with what would be commercially pure benzine, distilling within less than half a degree, and pure toluene about the same degree of purity.

Both Lord Rayleigh and Professor Young considered that the intimacy of contact was a matter of no importance;

although it might not be as close as it was in the dephlegmator, it was nearly the same, or at any rate the difference was inappreciable.

THE PRODUCTION OF FORMIC ACID BY THE ATMOSPHERIC OXIDATION OF TURPENTINE.

BY C. T. KINGZETT, F.I.C., F.C.S., AND R. C. WOODCOCK, F.I.C., F.C.S.

There are a number of references in chemical literature, including those noted at foot,* to the alleged production of formic acid from oil of turpentine by its atmospheric oxidation. According to one of these, crystals of lead formate are sometimes formed when oil of turpentine is kept in lead vessels, and Laurent refers to granular crystals of zinc formate said to have been observed on the covers of zinc boxes in which oil of turpentine had been kept. In none of these references, however, so far as we have been able to ascertain, have any analytical figures been given satisfactorily establishing the identity of formic acid resulting as a direct product of the oxidation of turpentine.

Having observed a considerable formation of crystalline matter in galvanized iron tanks which were in use for the storage of air-oxidised Russian turpentine, we made an examination of it. The substance in question was of a dirty reddish brown colour, due to the association of oxide of iron and other impurities, from which it was purified by boiling with hot water. The crystalline matter readily dissolved, leaving the impurities behind. The white crystals resulting from some twelve successive recrystallisations, were analysed and found to consist of practically pure zinc formate, responding perfectly to all the well-known qualitative tests and furnishing upon analysis the appended figures.

The method of analysis was as follows: The zinc was estimated in the usual way, by precipitation with sodium carbonate and weighed as oxide. The formic acid was estimated in accordance with the method described by Franzen and Greve (J. prak. Chem., 1909, 20. 368, 389; see also "Analyst," 1910, 29). This process depends upon the reduction of mercuric chloride to mercurous chloride by formic acid, the precipitated mercurous chloride being dried and weighed subject to the usual precautions.

In the earlier experiments, the determinations of formic acid were not as satisfactory as could be desired, and it was conjectured that this might possibly be due to some solvent action of the zinc chloride which is formed, upon the mercurous chloride. The zinc was therefore removed by precipitation with sodium carbonate and the filtrate containing the formic acid in the form of sodium formate was used for the determination. The results thus obtained were perfectly satisfactory and closely agreed with theoretical requirements, as shewn below. The water was determined by drying in a water oven at 100° C.

Zinc formate has the composition $(H.COO)_2Zn, 2H_2O$.

	Theory for $ZnC_2O,H_2,2H_2O$	Found	
		No. 1	No. 2
Zinc	34·15	34·18	34·19
HCO_2	47·03	46·95	46·89
H_2O	18·82	18·78	18·78
	100·00	99·91	99·86

The percentage of formic acid was also estimated by dissolving the crystals in water, acidulating with dilute sulphuric acid and distilling the mixture, the distillate being titrated with $N/10$ soda (using phenolphthalein as an indicator) with the following results:—

	Theory.	Found	
		No. 1	No. 2
HCO_2	47·03	47·10	47·01

As bearing upon the method of formation of the formic acid thus identified, it is apparently to be regarded as a cleavage product of some change that slowly occurs in the body of the air-oxidised oil. The oxidised oil in question consisted of some thousand gallons which had been prepared in the presence of water, so that any formic acid originally present in the turpentine or produced during the process of oxidation, would have passed into the watery solution, and it was after separation from the watery portion that the practically dry oil was placed in the storage tanks in which the zinc formate was produced.

When American or Russian turpentine is oxidised in the presence of water, the aqueous solution reveals an increasing acidity during the process and as the result of a further examination of this matter we find that the acidity results from the presence of acetic and formic acids in admixture. In the case of one such aqueous solution resulting from the oxidation of Russian turpentine, 100 c.c. took 6 c.c. of normal soda to neutralise. Two litres were made alkaline with sodium carbonate and evaporated to about 200 c.c.; this was then filtered to free from separated oily matter, the clear filtrate made acid with sulphuric acid and then distilled. The distillate exhibited the characteristic reactions of formic and acetic acids, the presence of formic acid being demonstrated by the silver nitrate reduction test and by the reduction of mercuric chloride to mercurous chloride. The presence of acetic acid was proved by first removing the formic acid by boiling with mercuric oxide until the reaction was complete (according to the equation $HgO + HCOOH = Hg + CO_2 + H_2O$), and it was found that the filtrate gave the characteristic reactions of acetic acid.

In order to obtain some quantitative appreciation of the relative quantities of acetic and formic acids present in the aqueous solution above referred to, a further quantity was taken of which it was noted that 100 c.c. required 5·2 c.c. of normal soda; 1½ litres of this fluid was acidulated with sulphuric acid and then distilled, and the distillate made up to 1½ litres again; 250 c.c. of this being then taken and treated with mercuric chloride to determine the formic acid present by taking the weight of the precipitated mercurous chloride. Four experiments gave the following results:—1,420, 1·388, 1·290, and 1·303 grms. shewing an average of 1·349 grms., equal to 0·0527 grm. of formic acid in 100 c.c. Now, as this amount of formic acid would neutralise 1·14 c.c. of normal soda, whereas 100 c.c. of the liquid took 5·2 c.c. the difference may be regarded as representing the acetic acid present, namely, 0·2436 grm. per 100 c.c. The formic and acetic acids thus shewn to be present to an appreciable amount in the aqueous solution resulting from the oxidation of Russian turpentine in the presence of water, are no doubt the immediate results of the oxidation process, as was further evidenced by an examination of the Russian turpentine yielding the oxidised oil.

In order to ascertain to what possible extent the formic acid could have been derived from the original Russian turpentine, 150 c.c. of the latter was washed with an equal bulk of warm water, with constant agitation, during a period of half an hour, when the total acidity of the water was found to be 0·675 normal soda. The turpentine on being washed a second time with its own bulk of water during a further half-hour, gave a washing, the total acidity of which required 0·15 normal soda. Similar results were obtained upon an examination of another batch of Russian turpentine, and a batch of Swedish turpentine examined on the same lines gave a washing the total acidity of which amounted to 0·3 c.c. of normal soda.

In order to ascertain whether turpentine vapour acts upon zinc, portions of zinc foil were suspended above turpentine in covered test-glasses. Samples of good quality of commercial American, Swedish, and Russian turpentines respectively were employed, and after a period of nine weeks it was found that practically no action had taken place. Similar experiments were then made in the presence of aqueous vapour, the turpentine being placed in small beakers, surrounded with water in test glasses.

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* Watts' Dictionary of Chemistry, 1882, vol. II., p. 683, and 1877, vol. V., p. 921; Gmelin's Handbook of Chemistry, 1860, vol. XIV., pp. 245, 249; Journ. Chem. Soc., of June, 1874, p. 516 (C. T. Kingzett), and March, 1875, p. 6 (C. T. Kingzett); "Analyst," vol. 33, p. 225 (J. H. Coste).

zinc foil being suspended above the liquids and the glasses being covered as before. Using American or Swedish turpentine, in four weeks there was a decided action, and in the case of Russian turpentine, a piece of foil 12×3 cm. increased in weight by 0·011 grm. This foil was covered with a thin white incrustation which, upon microscopical examination, shewed to be a mass of minute crystals: these were tested qualitatively and found to be zinc formate.

We hope to carry the investigation further, and in the meantime desire to express our acknowledgements to Mr. W. G. Carey, F.C.S., A.I.C., for the assistance he has given us in conducting the analytical work involved in this investigation.

Discussion.

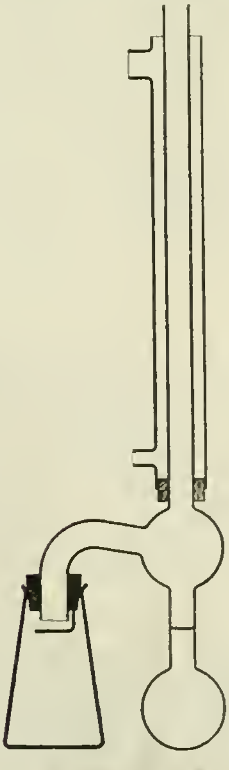
Mr. J. H. Coste said that he had found formic acid to be present in turpentine which had been allowed to stand without being protected from the action of the atmosphere. He had been asked what would be a suitable varnish for protecting tanks in which turpentine was kept. Could the author suggest a suitable material?

Mr. Kingzett said he had not observed that there was any particular corrosive action on the tanks in which turpentine was stored, except at the line of contact where there was exposure to the air and aqueous vapour, and even that was very insignificant. Some little further action was liable to take place at the bottom of the tank, where sometimes a little water accumulated. He did not know of any protective coating which could be relied upon, for the simple reason that all such mixtures were practically soluble in turpentine.

PROPOSED METHOD FOR THE ESTIMATION OF BUTTER AND COCOANUT FAT IN MARGARINE.

By S. H. Blichfeldt.

The recent introduction of palm kernel oil and cocoanut oil as materials for the manufacture of margarine, has necessitated the devising of some method by which these substances may be estimated in presence of other fats occurring in margarine, which may possibly include butter fat as a constituent. The methods hitherto available for the analysis of margarine and butter fat, though not altogether useless, have proved incapable of furnishing reliable results in dealing with such mixtures; the present communication includes an account of experiments undertaken in the Monsted Laboratory, Southall, with a view to improving these methods, and a detailed description of a method designed with a view to solving the problem under consideration.



One defect in Polenske's method is that appreciable quantities of the insoluble acids settle in the tube connecting the distilling flask with the condenser. The washing out of the condenser tube, receiving flask, and filter with water is not only a tedious process, but may also involve considerable experimental errors, as it often happens that an appreciable quantity of sparingly soluble acids are dissolved by the water and thus lost.

To overcome these difficulties, the condensing apparatus shown in the accompanying diagram was designed.* The side tube, the condenser tube and receiver are all in one piece. The whole of the distillate consisting of water and fatty acids at a temperature of 60°—70° C. collects in the lower bulb. After removing the condenser jacket, an excess of $N/10$ sodium hydroxide is added to the distillate, the warm alkaline liquid is shaken up in the receiver and condenser tube to dissolve all volatile acids, and transferred to a 200 c.c. graduated flask. The apparatus is then rinsed with warm water and the rinsings are added to the main portion. The total volatile acids, soluble and insoluble, may be determined by titrating the excess of alkali by means of sulphuric acid, using phenolphthalein as indicator. The proportion between the soluble and insoluble acids may be determined as follows:—The volatile acids are liberated from their sodium salts by the addition of an equivalent quantity of sulphuric acid, the liquid is made up to 200 c.c. with water and set aside to cool in order that the insoluble acids may separate. It is then filtered clear and the soluble acids are determined in 150 c.c. of the filtrate by titration. The insoluble acids are determined by difference. The following values were thus obtained:—

	Total volatile acids.	Soluble.	Insoluble.
Butter	32	28	4
Cocoanut oil	22	8	14
Palm kernel oil	15	5	10

A large number of analyses was made by this method; the results though more trustworthy than those obtained by the Polenske method, were nevertheless, far from satisfactory.

In dealing with mixtures containing small percentages of cocoanut oil or palm kernel oil, great difficulty was experienced in obtaining clear filtrates containing the soluble acids A further defect appeared in the fact that when the percentage of cocoanut or palm kernel oil present in the mixture was small, a larger proportion of the sparingly soluble acids passed into solution than when higher percentages of these oils were present. This defect was aggravated by the dilution of the distillate to 200 c.c. The accompanying curves illustrate this point; had the ratio of the insoluble to the soluble acids produced by the same cocoanut oil in different mixtures been constant, these curves would have appeared as straight lines, whereas in reality, the ratio is seen to vary with the quantity of volatile acids produced by the fatty mixtures.

In order to obtain a clear filtrate and also, if possible, to get a more constant ratio, it was decided to try the method of precipitating silver salts from the neutral solution. The silver salts filter easily, giving a perfectly clear filtrate, but what is still more important is that the ratio between the volatile acids giving soluble and those giving insoluble silver salts affords a much better means of characterising the fats dealt with.

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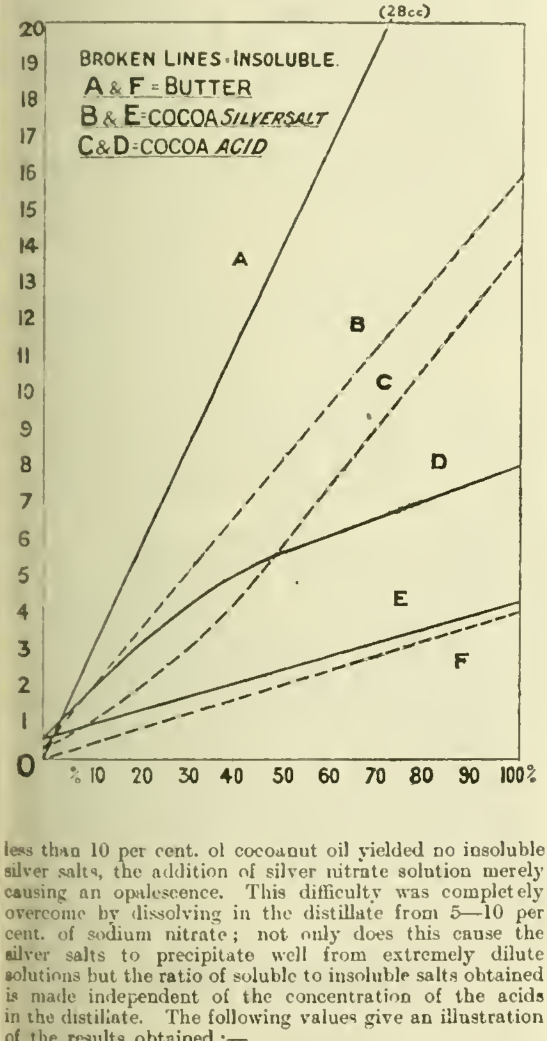
* The complete apparatus is made by F. E. Becker & Co., 17-27, Hatton Wall, E.C.

In the case of palm kernel oil for which the value of the total volatile acids is approximately 15, the ratio of the soluble to the insoluble silver salts was found to be 3 : 12, whereas the ratio obtained by the method of precipitating the insoluble acids was 5 to 10. The ratio of silver salts for cocoanut and palm kernel oils, however, were found to vary as in the previous cases, with the percentage of these oils present in the mixtures. Mixtures containing less than 10 per cent. of cocoanut oil yielded no insoluble silver salts, the addition of silver nitrate solution merely causing an opalescence. This difficulty was completely overcome by dissolving in the distillate from 5—10 per cent. of sodium nitrate; not only does this cause the silver salts to precipitate well from extremely dilute solutions but the ratio of soluble to insoluble salts obtained is made independent of the concentration of the acids in the distillate. The following values give an illustration of the results obtained :—



	Total volatile acids.	Silver salts. Soluble.	Silver salts. Insoluble.
Butter	32	29	3
Cocoanut oil	20	4	16
Palm kernel oil	15	3	12

These figures must be regarded as subject to variation as the fats themselves vary in composition. Thus, in the case of butter, the values for the total volatile acids and for the acids forming soluble silver salts will probably vary in much the same way as the Reichert-Meissl value.

Cocoanut and palm kernel oils also give values which vary within certain limits and depend to some extent upon the nature of the refining process which the oil has undergone Nevertheless it appears that the ratios between the soluble and insoluble silver salts are fairly constant and characteristic, and should the author's results be confirmed by other investigators, it seems probable that they will afford a ready and accurate means of estimating butter fat in mixtures containing cocoanut and palm kernel oils. On the other hand, the ratios afford no means of differentiating between cocoanut and palm kernel oil.

In submitting the following detailed account of the improved method, the author would request those who may be led to examine it further, either to communicate to him or publish their results in order that a decision may be arrived at as to its applicability.

Improved method.—The filtered fat (20 grms.) is weighed accurately in a 300 c.c. Jena flask and treated with 8 c.c. of a 50 per cent. aqueous solution of caustic potash and 25 c.c. of glycerol. The mixture is cautiously heated over a naked flame until saponification sets in, and should be constantly shaken, while great care should be taken to avoid overheating. The product, which should be of a straw yellow colour, is cooled and made up with distilled water to 200 c.c. Of this soap solution, 50 c.c. (equivalent to 5 grms. fat) is measured into a 300 c.c. Jena flask, and 50 c.c. water added, then treated with 50 c.c. of sulphuric acid solution containing 25 c.c. of concentrated acid per litre, and 1 grm. of coarsely powdered pumice is added. The flask is now connected by means of a perforated rubber stopper with the condensing apparatus shown in the diagram. The outlet tube for the condenser water at the top should be made larger than the inlet tube. A small glass plate is attached to the rubber stopper to prevent the mixture in the flask from being carried over by splashing.

The rate of distillation is regulated so that the distillate will fill the receiver to the mark in about 20 minutes, this volume representing 100 grms. of water at 65° C.

When the distillation is completed, the flask and condenser jacket are removed and the side tube " B " is closed by a cork. A few drops of phenolphthalein and a known excess of $N/10$ caustic soda solution are run in through the condenser tube which is then closed with a cork. The volatile acids dissolve completely in the alkali on warming the apparatus in the water bath and shaking well. The excess of alkali present should be 5—10 c.c. The resulting solution of sodium salts of the volatile acids is transferred to a 200 c.c. measuring flask, the condenser is rinsed out several times with warm water and the rinsings are added to the main portion. After cooling, the volatile acids are determined by titrating back the excess of alkali with $N/10$ sulphuric acid.

The insoluble silver salts are now precipitated by adding $N/10$ silver nitrate solution and 20 grms. of pure sodium nitrate is added and dissolved. The liquid is made up to 200 c.c. shaken repeatedly during 5 minutes and filtered into a 175 c.c. measuring flask. To 175 c.c. of the filtrate is added a volume of $N/10$ sodium chloride solution, equivalent to seven-eighths of the volume of silver nitrate solution previously added whereupon the excess of sodium chloride is determined by titration with $N/10$ silver nitrate solution using potassium chromate as indicator. (About 5 drops of a saturated solution.)

The number of c.c. of silver nitrate solution multiplied by eight-sevenths gives the equivalent of the acids which yield insoluble silver salts. By subtracting this value from the equivalent of the total volatile acids, the equivalent of the acids giving soluble silver salts is obtained.

A large number of analyses is made in our laboratory in accordance with these methods, and the following examples taken from the Laboratory Journal illustrate the results obtained.

In conclusion, I wish to thank Mr. Omoe for the assistance which he has rendered me in performing the numerous analyses for the purpose of testing the methods described in this paper.

	Palm kernel oil.	Cocoanut oil.	Cocoanut oil, butter and other fats.
Soda solution used	25·0 c.c.	30	25
Sulphuric acid solution used in titrating back	9·6 c.c.	9·3	13·3
Soda solution used in neutralising volatile acids	15·4 c.c.	20·7	11·7
Equivalent found in blank analyses (to be deducted ...	0·6 c.c.	0·4	0·3
Equivalent of volatile acids ...	14·8 c.c.	20·3	11·4
Silver nitrate solution	24 c.c.	24	16
N/10 sodium chloride solution added to 175 c.c. of filtrate ..	21 c.c.	21	14
Excess of sodium chloride found in solution................	10·4 c.c.	14·1	6·6
The silver salt precipitated....	11·9 c.c.	16·1	7·5
Equivalent of volatile acids ..	14·8 c.c.	20·3	11·4
,, insoluble salts	11·9 c.c.	16·1	7·5
,, soluble salts	2·9 c.c.	4.2	3·9

Butter fat figure, obtained by deducting one-quarter of the cocoa fat figure from the soluble equivalent. $3\cdot9 - (\frac{1}{4} \times 7\cdot2) = 2\cdot1$.

Cocoa fat figure, obtained by deducting one-seventh of butter fat figure from the insoluble equivalent. $7\cdot5 - \frac{1}{7} \times 2\cdot1) = 7\cdot2$.

Analyses of margarine. (Composition unknown.)

Insol.	Sol.	Cocoa fat figure.	Butter fat figure.	Cocoa fat.	Butter fat.
7·5	3·9	7·2	2·1	c: 40%	c: 7·5%
8·4	2·2	8·4	—	c: 50%	—
16·9	3·9	16·9	—	c: 100%	—
12·6	3·0	12·6	—	c: 80%	—
4·2	3·2	3·9	2·2	c: 25%	c: 8%

Analyses of fat and fat mixtures. (Composition known.)

Insol.	Sol.	Cocoa fat figure.	Butter fat figure.	Cocoa fat.	Butter fat.
4·2	26·1	—	26·1	—	c: 100%
15·3	3·6	15·3	—	c: 100%	—
14·8	5·8	14·4	2·2	c: 90%	c: 8%
13·7	6·7	13·1	3·4	c: 80%	c: 13%

The result obtained varies from the actual composition within 2 per cent.

Analyses of margarine. (Composition unknown.)

Insol.	Sol.	Cocoa fat figure.	Butter fat figure.	Cocoa fat.	Butter fat.
8·9	2·3	8·9	—	c: 55%	—
11·2	2·8	11·2	—	c: 70%	—
4·7	1·6	4·7	—	c: 30%	—
14·4	3·6	14·4	—	c: 90%	—
9·6	2·3	9·6	—	c: 60%	—
4·2	3·3	3·9	2·3	c: 25%	c: 8%
4·8	1·4	4·8	—	c: 30%	—
10·1	2·9	10·1	—	c: 65%	—
8·5	4·4	8·2	2·3	c: 50%	c: 8%
13·7	3·7	13·7	—	c: 85%	—
6·9	4·6	6·6	2·9	c: 40%	c: 10%
0·4	0·5	—	—	—	—

Discussion.

The Chairman said the apparatus and method of of analysis were certainly very elegant, and the underlying principle was sound. There would be in the first instance the usual objection to any new apparatus which was especially difficult to overcome in a case like butter, where millions of analyses had been made by the established Reichert process. The method of clearing the filtrate by adding sodium nitrate was a great advantage; but how the result would compare with the so-called adopted figures and the limits within which they varied, could not be solved by one operator alone. Every butter analyst ought to try and compare this method with the results of the standard method. The apparent advantage was that in the case of cocoanut oil and palm kernel oil, the volatile soluble and volatile insoluble acids seemed to stand in the definite proportions of 4 to 16, and 3 to 12. That might be so for silver salts; but by using this method they lost at once the very distinct difference between the cocoanut oil and the palm kernel oil, namely, the difference in the Reichert-Meissl values and in the titration numbers of the insoluble volatile acids. As Mr. Blichfeldt pointed out, his method did not attempt to differentiate between palm kernel oil and cocoanut oil; but this was becoming every day more and more important.

Mr. E. Grant Hooper agreed with the Chairman that the silver salts really promised to be useful in the way of effecting a separation of the soluble fatty acids. He asked if the author having effected such a separation had decomposed the silver salts and determined the refractions of the two classes of acids.

Mr. E. R. Bolton said that if figures were obtained for butters giving abnormally high and low values respectively, then the probable delicacy of the process would be a mere matter of calculation. Had the author made experiments with cocoanut "stearine" or palm kernel "stearine"? These would contain less soluble and insoluble volatile acids, and probably also in different ratios, which might considerably alter the figures. As these products were largely on the market they should not be lost sight of. The chief use of this method seemed to be to find if margarine contained more than the legal limit of 10 per cent. of butter fat.

Mr. Blichfeldt, in reply, said they had not yet tried to determine refraction of the different acids, but they intended to do so; and that was certainly the next question to be settled. Of course the soluble silver salts from butter fat varied in the same way as the Reichert-Meissl and Polenske values. His calculation was based entirely on the ratio, and it seemed to be more constant. If a butter had a low Reichert-Meissl figure, say, down to 25, the insoluble would come down as well in many cases. If in cocoa fat the ratio of 1 to 4 was altered to 1 to 5, which they had never found, the figure would come down to 1·8, instead of 2·1. He believed cocoanut stearine was not much used in England, and he had had no opportunity of analysing it. It would raise the melting point in the margarine; but the manufacturer seemed to have other ways of doing that, which were less expensive, so that it was not generally used.

Nottingham Section.

Meeting held at Nottingham, on Wednesday, May 18th, 1910.

MR. S. J. PENTECOST IN THE CHAIR.

THE DETERMINATION OF PHOSPHORIC ACID BY MEANS OF STANDARD SILVER NITRATE.

BY JOHN M. WILKIE, B.SC., A.I.C.

Considering the facility with which phosphoric acid can be determined by means of a standard silver solution, it is somewhat remarkable that the method has not received more attention. Perrot (this J., 1888, 311) precipitated silver phosphate in presence of acetic acid and determined the residual silver after filtration with standard sodium chloride. Clark (this J., 1888, 311) investigated Perrot's method with the idea of making it available for the analysis of commercial phosphates. After adding excess of silver he nearly neutralised the acid solution, leaving it but faintly acid to litmus. The precipitated silver phosphate was then filtered, washed with hot water, dissolved in hot dilute nitric acid, and the silver determined by Volhard's method. Holleman (this J., 1894, 763, 843) converted phosphoric acid or an alkali phosphate to the dialkali salt by means of caustic soda, and precipitated the silver phosphate in presence of sodium acetate. The residual silver was then determined by Volhard's method in an aliquot part of the filtrate. In my previous paper (this J., 1909, 68) I stated that the results obtained by me when using Holleman's method were in all cases slightly high. Since that time Liebermann (Analyst, 1909, 361) has somewhat modified the Holleman method; he adds a considerable amount of nitric acid to the phosphoric acid solution, adds excess of normal silver nitrate and then ammonia until litmus paper shows an amphoteric reaction, and finally determines residual silver after filtration by Volhard's method. Of course it is obvious that any successful method must be founded on Holleman's lines, as filtration and washing are to be deprecated for several reasons. It might be here mentioned that Baxter & Jones (Chem. News, 1910, 1,161), in connection with a determination of the atomic weight of phosphorus, have recently investigated the constancy of composition of the precipitate obtained when disodium phosphate and silver nitrate interact. They find the silver phosphate thus obtained is of constant composition, a rather important point in connection with the use of silver nitrate for the determination of phosphoric acid.

Some preliminary work was done to decide under what conditions the determination should be carried out. If the method was to be available for the analysis of commercial phosphates considerable amounts of free nitric acid must of necessity be present, and so the particular alkali and indicator to be used are important points. Liebermann uses litmus as indicator but, while Holleman neutralises with soda, Liebermann employs ammonia. As indicator, phenolphthalein has considerable advantages over litmus; it can be used in the solution, and the end point from colourless to pink is sharp and easy of recognition (compare this J., 1909, 464). Ammonia, while it cannot be used with phenolphthalein, has advantages over soda in that it does not precipitate silver oxide, and a few experiments were made with $N/10$ ammonia, using methyl red as indicator. Non-constant results were obtained, and the dye was precipitated by the silver phosphate, which is not the case with phenolphthalein; even when more dye was added after practically all the silver had been precipitated the end point was difficult to observe. In some of the experiments the neutral solution was filtered directly for the determination of the residual silver; in others varying amounts of acid were added. As the end point was so obscure and the results were not commensurable with the trouble involved, the use of ammonia was not further persisted in. It is here worthy of mention that silver phosphate is very readily soluble in dilute ammonia, thus constituting a grave source of danger.

Holleman's method was then investigated, and with the conditions of working adopted in my previous paper, the high results then obtained were confirmed. Experiments were then undertaken, in which the excess of silver used, the mode of addition of the silver, and the time of standing and the amount of shaking previous to filtration, were all independently varied. In the course of this work, in which a great number of determinations were made, it appeared on many occasions that the problem had been solved. But on further investigation the results obtained were shown to be fortuitous. Ultimately it was found that though silver phosphate was appreciably soluble under the conditions of working adopted, the effect was masked by the compensation due to co-precipitated silver acetate. If the acetate was increased, increasingly high results were obtained. To get over this trouble the silver was added in two moieties, enough was added in the first instance to nearly precipitate all the phosphoric acid, and after vigorous shaking the remainder of the silver was then added. But no better results were obtained in this way. In all these cases, after neutralisation to phenolphthalein had been effected, decinormal sulphuric or nitric acid was added in amount required to give the di- or mono-alkali salt or some intermediate acidity. Finally, from a consideration of the theoretical aspect of the case, a very small amount of sodium acetate was used, the phosphoric acid solution was just neutralised to phenolphthalein and an amount of decinormal sulphuric or nitric acid was added which bore a simple relation to the amount of acetate added. The sodium acetate has a great value in that it weakens the stronger acid so much that the great bulk of the silver phosphate is precipitated long before the solution is neutral to phenolphthalein, and consequently the end point is much more distinct and more freedom is given as to the particular excess of silver added. In the method as finally worked out this action of the acetate, owing to diminished concentration, is very much weakened, and consequently some other mode of neutralisation was demanded when large quantities of nitric acid were present. Phenolphthalein was added to the phosphoric acid solution, and then strong caustic soda solution cautiously until just pink. The pink tint was then discharged with dilute nitric acid added drop by drop. In the case of solutions containing calcium no special indicator is required, for the precipitated calcium phosphate serves the purpose admirably. In this case the nitric acid was added until the precipitate just dissolved.

Excess of silver nitrate is added to the solution thus prepared, then 10 c.c. of approximately decinormal sodium acetate, and then highly dilute caustic soda (approximately decinormal prepared extemporaneously by diluting the strong solution already referred to) is added with shaking until the solution was just pink, phenolphthalein being the indicator, the final adjustment being made with $N/10$ sodium hydroxide or sulphuric acid. To the solution thus prepared is added 2 c.c. $N/10$ sulphuric acid, and the whole adjusted to volume (150 c.c.) and thoroughly mixed. After filtering the residual silver is determined in an aliquot part (100 c.c.) of the filtrate by Volhard's method.

The results obtained in presence or absence of nitrates (initially added as nitric acid) calcium salts, sulphuric acid, etc., were excellent. The method is rapid and accurate and admirably adapted for the determination of phosphoric acid, alkali or calcium phosphate, but is not available in the presence of appreciable amounts of aluminium or iron. Chloride, if present, must be allowed for. As it is necessary to filter the precipitated silver chloride and determine residual silver in an aliquot part of the filtrate, it is much simpler and just as accurate to add excess of sulphuric acid to the phosphate solution and evaporate on the water bath. After adding nitric acid the determination is made as above. It might be here mentioned that my method of titration of the acetic acid liberated, when phosphoric acid or a soluble phosphate is treated with silver nitrate and sodium acetate, is not affected by co-precipitation of silver acetate.

Some determinations by the modified silver method. (I regard as decinormal a phosphoric acid solution containing 1/30 grm. molecule per litre.)

c.c. $N/10$ H_3PO_4 taken.	c.c. $N/10$ Ca present.	c.c. $N/10$ NaCl present.	c.c. $N/1$ HNO_3 present.	c.c. $N/10$ $AgNO_3$ added.	c.c. $N/10$ H_3PO_4 found.
35·11	—	—	15	39·00	35·09 (1)
35·11	30·0	—	30	42·00	35·13 (2)
23·41	0	—	15	26·00	23·46 (3)
23·41	10·0	—	15	26·00	23·42 (4)
23·41	10·0	5·0	15	26·00	23·43 (5)
23·41	0	—	15	28·00	23·43 (6)
23·41	25·0	—	10	26·00	23·39 (7)
11·71	0	—	0	13·00	11·69 (8)
11·71	15	—	10	15·00	11·73 (9)

In exp. (5) HCl was expelled by evaporation with sulphuric acid.

The high result in exp. (3) was obtained when the method had first reached its final form and is given to show the kind of result likely to be obtained by a worker not accustomed to the method.

The only difficulty of the method is due to precipitated silver oxide giving high results and obscuring the end point. If the soda used in the final neutralisation is about decinormal no difficulty is experienced, more especially if the precipitate be given a few seconds to settle, so that the colour of the supernatant liquid may be observed. If preferred, much stronger soda may be used, provided the precaution is taken to add it drop by drop with constant shaking, but the use of weak soda is recommended. Within limits the determination appears to be independent of the excess of silver used—a minimum excess of 10 per cent. is advisable—with a large excess of silver the difficulty due to precipitation of silver oxide is of course accentuated.

In conclusion, I have to express my indebtedness to Messrs. Boots, Ltd., for the use of their laboratory in which the work was carried out.

NEW METHODS FOR THE ANALYSIS OF COMMERCIAL PHOSPHATES.

BY JOHN M. WILKIE, B.SC., A.I.C.

For a short account of some of the methods for the determination of phosphoric acid I must refer to my previous communication (this J., 1909, 68). As there mentioned, innumerable modifications of the two chief methods for the determination of phosphoric acid (the ammonium magnesium phosphate and the ammonium molybdate methods) have been suggested from time to time. Quite recently the determination of the ammonium content of these two compounds has again been suggested as a convenient procedure, the ammonia being determined by interaction with a standard hypobromite solution; Brandis (this J., 1910, 455), working on ammonium magnesium phosphate and Artmann (this J., 1910, 455), on ammonium phospho molybdate. In both cases washing of the precipitated phosphoric acid compound is involved. A curious modification of the ammonium molybdate method due to Grete (this J., 1888, 771, and 1909, 1105), in which glue is used, may also be mentioned. Liebermann (Analyst, 1909, 360), has modified Holleman's method by substituting ammonia for soda and employs the method for the determination of phosphoric acid in urine after preliminary precipitation as ammonium magnesium phosphate. The method worked out by me in the paper already referred to depended upon titration of the acetic acid liberated when phosphoric acid or a soluble phosphate was treated with silver nitrate in the presence of sodium acetate. The method of course is strictly an acidimetric one, and though admirably adapted for the determination of phosphates of known constitution, was unsuited for the analysis of commercial phosphates because of two factors—uncertainty as to the constitution of the particular phosphate and as to the presence or absence of other acids. For the present assuming that phosphoric acid and its calcium salts alone are present, dissection is possible if (1) the whole of the undisplaced hydrogen can be determined, (2) the total phosphoric acid can be determined. Consider the simple case of the calcium salt, $CaHPO_4$, we have for the non-displaced hydrogen

$$CaHPO_4+CH_3COONa+3AgNO_3=$$
$$Ag_3PO_4+Ca(NO_3)_2+NaNO_3+CH_3COOH.$$

That is, speaking in terms of c.c. of decinormal solutions of baryta and silver nitrate, the non-displaced hydrogen will be one third of the total phosphoric acid present, and the calcium will be given by difference. In the case of the precipitated calcium phosphate of commerce somewhat more calcium is always present than corresponds to the formula, $CaHPO_4$, but this in no wise interferes with the method just outlined, for, still speaking in terms of c.c. $N/10$, the baryta titration will correspond truly to the undisplaced hydrogen and the difference in the baryta and silver titrations will correspond to the total calcium present.

In the case of superphosphates it is generally sufficient, when the method is applicable, to determine the phosphoric acid by the silver method, since the constitution of the salt is not desired. With the phosphates used in this country this is a very convenient and accurate process, but in the presence of considerable quantities of iron and aluminium the silver method is not available. The methods of analysis here available are somewhat different from those previously mentioned. Littmann (Chem. News, 1900, 80, 178) neutralised to methyl orange, added sodium citrate and then neutralised to phenolphthalein. Emmerling's well-known method consists in neutralising to methyl orange to give the free phosphoric and sulphuric acids and in titrating the free acid and monocalcium salt by running the superphosphate solution, previously mixed with excess of calcium chloride, into standard soda, using phenolphthalein as indicator. Emmerling (this J., 1888, 343) has also suggested another form of the second titration in which the soda is run into the mixed superphosphate and calcium chloride solutions. This second method of Emmerling's is of more than usual interest, as both Kohn (Analyst, 1908, 376) and Cooksey (Proc. Roy. Soc. of N.S.W., 41, 163) have apparently independently rediscovered the method (cf. Doherty, Analyst, 1908, 273). Emmerling's process is simple and rapid and available in the presence of aluminium and iron.

In the method of this type which I have worked out, I replace the second titration of Emmerling with a determination of the total undisplaced hydrogen in the manner already referred to. Considering a plain aqueous solution of phosphoric acid, we have for the methyl orange titration, $H_3PO_4+NaOH=NaH_2PO_4+H_2O$ (1) and for the undisplaced hydrogen determination,

$$H_3PO_4+3AgNO_3+3CH_3COONa=$$
$$Ag_3PO_4+3NaNO_3+3CH_3COOH \quad (2)$$

That is $(2)—(1)=RH_2PO_4=2000$ c.c. $N/1=$

$$\frac{CaH_4P_2O_8}{2}=\frac{Ca_3P_2O_8}{2}.$$

Of course this method, suitably applied, is available not only for superphosphates, but also for all phosphates. Titration (1) is to be regarded as positive when the original substance is acid—when standard alkali must be added to produce neutrality to methyl orange—and negative when the original substance is alkaline and standard acid must be added to produce neutrality to that indicator. Titration (2) is always positive, but in the case of tribasic calcium phosphate is, of course, zero. Perhaps this becomes more clear if one considers the case of that salt ($Ca_3P_2O_8$) in somewhat greater detail. Under suitable conditions four equivalents of nitric or other acid are required to produce neutrality to methyl orange

$$2Ca_3P_2O_8+8HNO_3=2CaH_4P_2O_8+4Ca(NO_3)_2. \quad (1)$$

Also there is no undisplaced hydrogen in tribasic calcium phosphate that is titration (2) is zero.

As to the conditions under which this second method is available we have to consider two cases, soluble and insoluble phosphates. In the first case taking 26 per cent. superphosphate as a type, 9·309 grms. is shaken with 400 c.c. of water and the total volume made up to 500 c.c. in the usual way. Twenty-five c.c. of the filtrate is transferred to a porcelain dish and titrated in presence of methyl orange until all trace of pink has gone. Let us suppose m c.c. of $N/10$ sodium hydroxide are required. Another 25 c.c. of the filtrate is then transferred to a Jena flask along with 15 c.c. $N/10$ sulphuric acid and boiled a few minutes; after cooling in running water, 30 c.c. of approximately $N/10$ silver nitrate, 30 c.c. of $N/5$ sodium acetate, and a few drops of phenolphthalein are added, and then baryta is run in until a permanent pink tint is produced (cf. this J., 1909, 68). After allowing for the added sulphuric acid, whose function is to prevent precipitation of calcium salts during the boiling to expel carbon dioxide, suppose p c.c. of $N/10$ baryta solution were required. We then have per cent. $Ca_3P_2O_8=(p—m)\ 10/6$. In an actual determination on 26 per cent. superphosphate, $p=18·93$; $m=2·5$ giving per cent.$=$ 27·38 (as $Ca_3P_2O_8$).

For the total phosphate content, 9·309 grms. is dissolved by the aid of nitric acid so as to give a total volume of 500 c.c. Portions of 25 c.c. of the filtered solution are treated precisely as above except that a little more silver nitrate is added. The percentage of tricalcic phosphate is obtained in the same manner.

Of the insoluble phosphates steamed bone meal may be taken as a type, 6·206 grms. is ignited, dissolved by the aid of nitric acid, and after addition of water the volume is adjusted to 500 c.c. The actual determination is carried out in precisely the same manner, save that filtration is unnecessary and if portions of 15 c.c. are used about 27 c.c. of $N/10$ silver nitrate is sufficient. If 15 c.c. of the solution are used we have per cent. $Ca_3P_2O_8 = (p - m)\ 100/24$. On a sample containing 68 per cent. $Ca_3P_2O_8$ the values 29·6 and 45·9 were obtained for m and p, respectively, giving 67·9 per cent. of $Ca_3P_2O_8$. It wilt be noticed that the only difference between the method as actually carried out in practice and that outlined in theory is that a certain amount of nitric acid is present. This added acid will effect both titrations to exactly the same extent, so that their difference will still be a correct measure of the phosphoric acid present (RH_2PO_4). The method is not affected by the presence of hydrochloric acid or chlorides other than that more silver nitrate will require to be addded.

In the absence of aluminium and iron in appreciable amount the results obtained are excellent. Of course in the methyl orange titration the end point requires some practice. I find that every trace of pink must be discharged; any misgivings as to the end point may be set at rest by running in the soda in distinct excess, then taking back with acid and again discharging the pink tint with soda.

The process does not leave much to be desired on the score of rapidity, as after preparation of the solution, two determinations of free acid alone need to be made.

It may be of interest to devote some little attention to the case of phosphates containing considerable aluminium and iron. As is well known normal aluminium salts are neutral to methyl orange but function as the corresponding acids to phenolphthalein. In view of this it may be well to investigate the theoretical conditions of Emmerling's method, which it will be remembered is available in the presence of aluminium and iron. If we have a solution containing a c.c. of $N/10\ Al_2(SO_4)_3$ and p c.c. of $N/10\ H_3PO_4 (p > a)$ and titrate with $N/10$ soda and methyl orange, and assuming $AlPO_4$ neutral to methyl orange we have for the number of c.c. $N/10$ NaOH required

$$\text{Tm.o} = a + \frac{p - a}{3} = \frac{2a + p}{3} \quad (3)$$

and assuming the method to hold in the presence of aluminium salts the number of c.c. of $N/10$ alkali required in the phenophthalein titration less the number of c.c. consumed in the methyl orange titration must be as previously shown. $2/3\ p = \text{Tp.p.} - \text{Tm.o.}$ (4) Where Tp.p. and Tm.o, indicate respectively the number of c.c. $N/10$ soda or baryta.

Giving for the number of c.c. actually required in the phenolphthalein titration by addition of (3) and (4), $\text{Tp.p} = p + 2/3a$.

It is manifest that the method of double titration just developed is identical in theory with that of Emmerling, silver nitrate being substituted for calcium chloride. In actual determinations by this method where

$$a = 10{\cdot}0 [\text{c.c.} N/10\ Al_2(SO_4)_3]$$
$$p = 23{\cdot}41 [\text{c.c.} N/10\ H_3PO_4]$$

the following values were obtained :—

Tm.o	Tp.p	Tp.p—Tm.o	3/2(Tpp—Tm)=p
14·5	30·14	15·64	23·46
14·5	30·12	15·62	23·43
14·5	30·16	15·66	23·49

If the mean value of 30·14 be taken we obtain 23·46 instead of the theoretical 23·41. In the presence of calcium salts the same kind of results are obtained as is seen from the following figures. It is to be understood that all figures are in terms of c.c. of $N/10$:—

$N/10$ Ca	$N/10 = a$ $Al_2(SO_4)_3$	$N/10 H_3PO_4$ p.	Tm.o	Tp.p.	(Tp.p—Tm.o) 3/2=p
20	10·0	23·41	24·3	40·02	23·58
20	10·0	23·41	24·3	39 86	23·34
20	10·0	23·41	24·3	39·86	23·34

The high values of Tm.o and Tp.p in this case are due to the fact that the standard calcium solution contained excess of nitric acid. Similar results were obtained in the presence of iron salts (ferric chloride was used in experiment (1), ferric nitrate in the others).

$N/10$ Ca	$N/10$ Fe‴	$N/10\ H_3PO_4$ p	Tm.o	Tp.p	(Tp.p—Tm.o) 3/2=p
20	10·0	23·41	23·4	39·08	23·52
20	10·0	23·41	23·0	38·50	23·25
20	10·0	23·41	23·0	38·46	23·19

In one experiment containing both aluminium and iron I obtained :—

20	10Fe‴ } 10Al }	23·41	29·5	45·28	23·67

These titrations just cited, though of considerable theoretical interest, are somewhat misleading, in that they give no indication of the care that must be taken. The end point in the phenolphthalein titrations requires considerable practice, and must be observed under very narrow conditions. The baryta is run in until a permanent deep pink tint is obtained which stands shaking for several minutes, 2—3 c.c. of $N/10$ sulphuric acid are then added and the whole shaken briskly for some little time to dissolve any precipitated silver oxide, baryta being finally added, very gently rotating after each addition until the first indication of pink. With amounts of aluminium or iron nearer to those likely to occur in practice the difficulty is not so acute.

The "Undisplaced hydrogen silver method" finds its greatest use in the case where dissection of the phosphatic material is desired but is available in its complete form only when the orginal material is alkaline to methyl orange. Fortunately this is shown in the determination itself, for all that is needed is that speaking in terms of c.c. of $N/10$, the undisplaced hydrogen should not exceed two-thirds the silver nitrate consumed in the silver titration, thus showing that the original substance is neutral or basic to methyl orange. Chloride, if present, must be determined and allowed for. It finds its most complete application in the examination of the precipitated phosphates of commerce in which the content of true precipitated phosphate ($CaHPO_4$) is of importance. The method also enables one to readily determine the amount of phosphatic residue left on ignition, a point of some importance in the case of the phosphates used in medicine. Of course, it has one great advantage, in that the phosphate determination does not depend upon mere acidimetry, for while the undisplaced hydrogen determination can be effected with great accuracy, the same cannot be said of the methyl orange titration.

The mode of application of the method is as follows :—6·206 grms. is dissolved by means of nitric acid and the volume of the solution adjusted to 500 c.c. 10 c.c. (= 0·1241 grm.) is transferred to a platinum dish, and after the addition of 5 c.c. of normal sulphuric acid the whole is evaporated to dryness on the water bath. The moist crystalline residue is reduced to powder by means of a glass rod and when the odour of nitric acid is no longer perceptible, the walls of the dish are washed down with a few c.c. of water and the whole again evaporated; the contents of the dish are then transferred to a Jena flask or bottle by the aid of water and 24 c.c. approximately $N/10$ silver nitrate solution added. The titration is then carried out as usual with baryta after addition of 30 c.c. of $N/5$ sodium acetate and phenolphthalein.

For the PO_4 determination, 10 c.c. is transferred to a 150 c.c. graduated flask and diluted somewhat, a few drops of phenolphthalein are added and then caustic soda free from chloride cautiously until a permanent precipitate is formed; the precipitate is then dissolved by aid of a few drops of dilute nitric acid and 25 c.c. of $N/10$ silver nitrate finally added. If no precipitate or turbidity forms, the absence of chloride is ensured. After adding 10 c.c. of approximately $N/10$ sodium acetate, highly dilute soda (about $N/10$) is added until a permanent pink tint is just developed, 2 c.c. of $N/10$ sulphuric acid is then added and the volume adjusted to 150 c.c. After thorough mixing, the residual silver is determined in 100 c.c. of the filtrate by Volhard's method.

If *b* c.c. of *N*/10 baryta are needed in the first titration (allowance being made for the normal sulphuric acid added) and s c.c. of *N*/10 silver nitrate in the second we have :—

$$\text{per cent. CaO} = \frac{(S-b) \cdot 002805 \times 100}{\cdot 12412} = (S-b)2 \cdot 26$$

$$\text{per cent. } P_2O_5 = \frac{S \times \cdot 002367 \times 100}{\cdot 12412} = S \times 1 \cdot 907,$$

If *b* is less than *S* 3, then the only constituents are the *di* and *tri* phosphates ($CaHPO_4$, $Ca_3P_2O_8$) and we can express directly in terms of these :—

$$\text{per cent. } CaHPO_4 = \frac{b \times \cdot 01361 \times 100}{\cdot 12412} = b \times 10 \cdot 966$$

$$\text{per cent. } Ca_3P_2O_8 = \frac{(S-3b) \cdot 00517 \times 100}{\cdot 12412} = (S-3b)\frac{100}{24}$$

With the above procedure chloride if present must be determined and allowed for. If *c* c.c. of *N*/10 Cl are present in the quantity worked on, *b* and *s* become respectively *b* + c and *s*—*c*. If only little chloride is present as has been the case in the samples that have come under my notice it is much simpler to expel hydrochloric acid before carrying out the silver determination, in the same manner as in the first titration, save that the exact amount of sulphuric acid added need not be known. After adding a little nitric acid the contents of the dish are completely transferred to the graduated flask, and the determination completed exactly as already described. Any error due to expelled chloride affects the undisplaced hydrogen determination alone. This will be more clear if the figures obtained in an actual determination are considered. (The substance worked on was a precipitated phosphate supplied for horticultural purposes.) The values obtained for *b* and *s* were 6·37 and 21·14 respectively (chloride expelled in both determinations). Making use of the factors just given we obtain

$CaO=33 \cdot 38$, $P_2O_5=40 \cdot 31$: $CaHPO_4=69 \cdot 9$, $Ca_3P_2O_8=8 \cdot 5$. Total P_2O_5 as $Ca_3P_2O_8=88 \cdot 08$.

On ignition to constant weight over a Mèker burner 26·43 per cent. was lost, corresponding to 73·57 per cent. non-volatile residue (CaO, P_2O_5), against 73·69 by the titration method (sum of 33·38 and 40·31). On the assumption that no non-volatile impurities are present the error involved by neglecting chloride is thus seen to be 0·1 per cent.

Chloride was then determined and found to be equivalent to 0·05 c.c. of *N*/10 on the quantity (0·124 grm.) worked on. Applying this correction (c) *b* becomes 6·42(6·37+·05) while *s* is of course unaffected. The new figures are then: $CaO=33 \cdot 27$($P_2O_5= 40 \cdot 31$) : $CaHPO_4=70 \cdot 4$, $Ca_3P_2O_8=7 \cdot 8$, whence the non volatile residue (sum of CaO and P_2O_5)= 73·58, which is identical with that actually found on ignition (73·57). The excellent agreement thus shown is curious in the light of the chloride found which if originally present as calcium chloride, would correspond to an additional 0·13 per cent. CaO.

A possible solution of the discrepancy was the presence of ammonium salts and this appeared to be the correct one. On distillation with excess of soda 10 grms. yielded ammonia equivalent to 3·4 c.c. of *N*/10 acid corresponding to 0·04 c.c. of *N*/10 on 0·124 grm.; which is practically identical with the amount (0·05 c.c. *N*/10) of chloride actually present. It is to be understood that both these methods brought before your notice to night are of general application. The undisplaced hydrogen silver method enables one in the case of calcium phosphates free from other bases to directly determine the phosphoric acid and its combined calcium oxide by two simple titrations. The acidimetric method enables one to determine the phosphoric acid content by two titrations with standard alkali, and when the condition of the material worked on permits, the lime content as well. Both portions of the solution used in the determination are evaporated with a known volume of standard sulphuric acid in the manner already described. After making allowance in each case for the added sulphuric acid we have, using the same nomenclature as before, Tp.p—Tm.o=RH_2PO_4 and $\frac{3}{2}$(Tp.p—Tm.o)=total; PO_4=S. That is, we are now in possession of the figure supplied by the silver titration in the "undisplaced hydrogen silver" method (s). As we have also the undisplaced hydrogen figure (b) we are able to calculate as before. These methods are available for most kinds of manure mixtures but are not available for basic slag. In the case of ammonium phosphate or mixtures containing ammonia it is of course necessary to expel the ammonia. In some cases this is very conveniently done by evaporating a portion of the nitric acid solution to dryness and after adding excess of soda to again evaporate once or twice, finally taking up in acid and treating in the usual manner (cf. Wilkie, this J., 1909, 980). Of course ignition is available, but in this case it is advisable to add some sodium hydroxide so as to ensure that no meta-or pyro-phosphates are formed on ignition.

Some "undisplaced hydrogen" determinations.—The mode of working was as described—after expelling volatile acids by evaporation with standard sulphuric acid the residual acidity was determined with baryta after addition of silver nitrate and sodium acetate.

c.c. *N*/10 H_3PO_4 taken.	c.c. *N*/10 Ca.	c.c. *N*/10 H_2SO_4.	c.c. *N*/10 NaCl.	c.c. *N*/10 $Ba(OH)_2$.	c.c. *N*/10 Residual acidity due to H_3PO_4			
					Not corrected for Cl.		Corrected for Cl.	
						Theory		Theory
23·4	20·0	50·0	—	53·4	3·4	3·4	3·4	3·4
23·4	20·0	50·0	5·0	48·4	1·6 (alk)	(1·6)	3·4	3·4
23·4	20·0	50·0	5·0	48·35	1·65(alk)	(1·6)	3·35	3·35
23·4	—	—	—	23·4	23·4	23·4	23·4	23·4
11·7	10·0	30·0	—	31·7	1·7	1·7	1·7	1·7
11·7	—	25·0	—	36·7	11·7	11·7	11·7	11·7

Where possible all evaporations should be done in platinum because owing to the rapid evaporation contamination with ammonia is not so acute a danger. When hydrochloric acid was present porcelain basins were used. The crystalline residue of calcium sulphate must be reduced to powder by rubbing with a glass rod in order to facilitate escape of nitric acid and enough sulphuric acid should be added to give a moist residue after crushing. All distilled water used in the actual titrations must have been freed from carbon dioxide by boiling. In these titrations it is convenient to have the standard baryta solution somewhat stronger than *N*/10. I find 3*N*/20 a very convenient strength, and when prepared in the manner suggested by me (this J., 1909, 68) the titer does not appear to alter over a comparatively wide range of temperature. In conclusion I desire to express my indebtedness to Messrs. Boots, Ltd., for the use of their laboratory in which the work was carried out.

Discussion.

Mr. S. R. Trotman thought that chemists who had occasion to use the laborious "official" method of determining phosphoric acid, would be grateful to Mr. Wilkie for putting within their reach a simple method which might, at any rate, be used for control experiments.

Mr. J. Golding said that Prof. Grete had shown him the volumetric method for the estimation of phosphoric acid referred to by Mr. Wilkie, and he felt bound to say what a very accurate and rapid method it was in Prof. Grete's hands. Speaking as an agricultural analyst under the Fertilisers and Feeding Stuffs Act, all these rapid methods were closed to him, as the Board of Agriculture and Fisheries had fixed official methods by which phosphates were to be determined under the Act. For phosphoric acid in milk ash he had tried the Emmerling method mentioned as used by Doherty and published in the Analyst (vol. 33, p. 273). For rapidity this left nothing to be desired and the results were very fairly in agreement with gravimetric determinations.

Mr. Wilkie, in reply, said it was because of the exceedingly time-consuming nature of the usual methods for the determination of phosphoric acid that he was led to investigate the matter. He considered that in the past justice had not been done to the silver method, which, in the absence of aluminium and iron, was highly accurate when properly applied. The constancy of composition of the silver phosphate was an important feature of the modified Emmerling method he had worked out.

Yorkshire Section.

THE SYNTHESIS OF A GLAZE, GLASS OR OTHER COMPLEX SILICATE.

Part VI.—The Quadruple-oxide Mixture of Soda, Lime, Alumina and Silica.

BY JOHN W. COBB, B.SC.

The double and triple-oxide mixtures possible in synthesizing $Na_2O.CaO.Al_2O_3 10SiO_2$ having been treated in Parts I.—V.,[*] the quadruple oxide mixture constituting, on fusion, the glass or glaze, remained for final examination.

It was made up in the form $Na_2CO_3 + CaCO_3 + Al_2O_3 + 10SiO_2$, supplying the bases as carbonates, and was heated, extracted, and analysed, according to the methods employed throughout. The results are collected in Table XVIII. in which the headings have the same meanings as before.

From Table XVIII., it is seen that some inter-action had taken place at 800° C., resulting in the formation of a little non-resistant substance, as evidenced by soluble silica, and of a resistant compound as indicated by the lessened quantity of soluble soda and lime. The mass at this stage was hardened, and contained carbon dioxide. At 1000° the inter-action had increased, and the carbon dioxide was completely expelled, while at 1150°, with little further chemical change, a fused and honeycombed mass resulted. Raising the temperature still higher to 1300° and 1400° increased the insolubility of the mass to 97, and finally, to 99 per cent.; the fusion became gradually more complete, for although the "heating" was melted and sunk down at 1300°, it was opaque from microscopic white undissolved particles, but at 1400° it was a transparent glass, with some enclosed gas-bubbles, but no undissolved white particles; high insolubility and completeness of fusion were associated, and the importance of maturing a glaze after running it attested.

Long-period heatings were made with this mixture at several temperatures as befitted the importance attaching to the final stage.

At 800° C. the long-period heating differed from the one hour heating at the same temperature in containing no carbonate; the sulphur oxides in the furnace gases had evidently been at work, since 4·2 per cent. sulphuric oxide was present, an amount which lessened as the temperature rose. The soluble silica had reached its maximum in this heating, 4·7 per cent., and the soda and lime had begun to enter insoluble combination.

At 1000° the results were not noticeably different from

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[*] This journal, 1910, pp. 69, 250, 235, 399, 608.

Table XVIII.

Soda, lime, alumina, and silica ($Na_2CO_3 + CaCO_3 + Al_2O_3 + 10SiO_2$).

$Na_2CO_3 + CaCO_3 + Al_2O_3 + 10SiO_2$ contains
Na_2O 6·8 per cent.
CaO 6·2 „
Al_2O_3 11·2 „
SiO_2 66·1 „
CO_2 9·7 „

$Na_2O + CaO + Al_2O_3 + 10SiO_2$ contains
Na_2O 7·6 per cent.
CaO 6·8 „
Al_2O_3 12·4 „
SiO_2 73·2 „

Where heated	Time (hours)	Temp. °C	Soluble in N HCl				SiO_2 in Na_3CO_3	Total sol. SiO_2	Total sol.	Total insol.	Appearance and notes.
			Na_2C	CaO	Al_2O_3	SiO_2					
	Blank		6·8	6·1	0·2	0·2	0·3	0·5	13·6 + CO_2	† 77·7	Contained CO_2
Muffle	1	800	3·3	5·2	0·4	0·9	1·0	1·9	10·8 + CO_2	† 86·9	Hardened. Contained CO_2
Works Furnace	24	800	3·2	4·2	0·5	1·6	3·1	4·7	12·6	† 82·2	SO_3, 4·2%, No CO_2. Hardened.
njector	1	1000	0·6	1·8	1·2	1·1	1·2	2·3	5·9	† 94·2	Hardened. No CO_2
Works Furnace	12	1000	0·6	1·4	0·7	0·8	1·3	2·1	4·8	† 94·1	$SO_3 = 1·3$ per cent.
njector	1	1150	0·7	1·0	1·2	1·5	1·5	3·0	5·3	† 95·3 * 94·1	Fused and honeycombed. No CO_2
Works Furnace	24	1150	0·4	2·0	0·5	1·1	0·9	2·0	4·9		Stony fusion, slightly honeycombed, sunk down.
„	24	1150	0·7	2·1 2·2 2·2	0·5 0·6 0·4	0·9 0·8 1·0	1·7 1·1	2·6 1·9	5·9	† 93·1 * 93·0	$SO_3 = 1·1$ per cent. $SO_3 = 1·3$ per cent.
njector	1	1300	0·5	0·3	1·0	0·9	1·1	2·0	3·8	† 96·7 * 96·2	Fused, honeycombed, sunk down with microscopic opaque white particles included.
„	1	1400	0·1	0·1	0·1	trace	0·6	0·6	0·9	† 98·5 * 99·1	Transparent glass containing gas-bubbles, but no undissolved particles.

† Determined. * By difference.

1400°. 10 grms. extracted with normal hydrochloric acid and Sodium carbonate solution gave 0·3 per cent. in solution.
The SO_3 is in no case included in the "Total soluble" matter.

those of the one hour heating at the same temperature excepting that 1·3 per cent. of sulphur trioxide, absorbed from the furnace gases, was present.

The long-period heating at 1150° C. contained 1·2 per cent. of sulphur trioxide and also more soluble lime than the corresponding one hour heating, as was determined by several heatings and analyses. This greater persistence of soluble base, particularly lime, had been noticed in the long-period heatings of the triple-oxide mixtures, and the explanation there given (Part V. this J., 1910, 608) can be accepted here, *viz.*, that some of the base, having combined earlier with sulphuric oxide in the furnace gases, was not so quickly brought into insoluble combination later. The phenomenon has a direct bearing on works practice.

The course of inter-action just traced for the quadruple-oxide mixing at the various temperatures was strikingly similar to that of the triple-oxide mixings described in Part V. of this study (this J., 1910, p. 608–14). There was the same formation of an insoluble compound at low temperatures, increasing at higher temperatures with the resultant production of an acid resistant mass.

The passage from the double-oxide to triple-oxide mixtures disclosed a new course of inter-action, but the triple-oxide and quadruple-oxide mixtures were fundamentally similar; there was nothing to suggest the formation of a special quadruple oxide compound.

To clear this point a mixture was made of the formulæ $Na_2SO_4 + CaSO_4 + Al_2O_3 + 10SiO_2$ and the temperature at which it began to give off sulphur oxides, on heating in a current of dry air, was determined, and compared with corresponding temperatures for other mixings; the temperatures were :—

$Na_2SO_4 + CaSO_4 + Al_2O_3 + 10SiO_2$	925°—945°C.
$Na_2SO_4 + CaSO_4 + 10SiO_2$	930°—950° C.
$Na_2SO_4 + Al_2O_3 + 10SiO_2$	935°—955° C.
$CaSO_4 + Al_2O_3 + 10SiO_2$	1000°—1020°C.

These figures give no support to the view that a special quadruple-oxide compound was formed. The temperature of evolution of sulphur oxides was practically the same as found already for the triple-oxide mixing, $Na_2SO_4 + CaSO_4 + 10SiO_2$, which was contained as part of the quadruple-oxide mixing. The triple-oxide compound holds its place as the fundamental glass or glaze unit.

Systematically, $Na_2O.CaO.Al_2O_3.10SiO_2$ can be considered as derived from each of the triple oxide mixings in turn, by the introduction of the fourth oxide, and the effect of each introduction can be studied by comparison of Table XVIII. with the corresponding Tables for the triple-oxide mixtures (Part V.; this J., 1910, p. 608—613). The change in the soda-lime-alumina mixing effected by adding silica was radical. The free volatilisation of soda was prevented, and also the persistence (at high temperatures in the long period heatings) of sulphates formed by combination with sulphur oxides in the furnace gases. Instead of a non-resistant aluminate, increasing in quantity with rising temperature, an acid resistant compound made its early appearance, and at higher temperatures the whole became insoluble.

The influence of silica on fusibility was marked by the production of a transparent glass instead of a slightly coherent powder. No other single oxide had so much influence; the changes due to any one of the other oxides were rather in degree than kind.

Alumina, entering the soda-lime-silica mixture formed a little soluble aluminate and increased fusibility.

Lime added to the soda-alumina-silica mixture, $Na_2CO_3.Al_2O_3.10SiO_2$ (*cp.* Table XV. Part V., this J., 1910, p. 609) increased the resistance to acid attack of the high temperature product. A more marked effect was realised on adding soda to the lime-alumina-silica mixture (*cp.* Table XVI. Part V.) for in that case the formation of insoluble matter in quantity was transferred to lower temperatures.

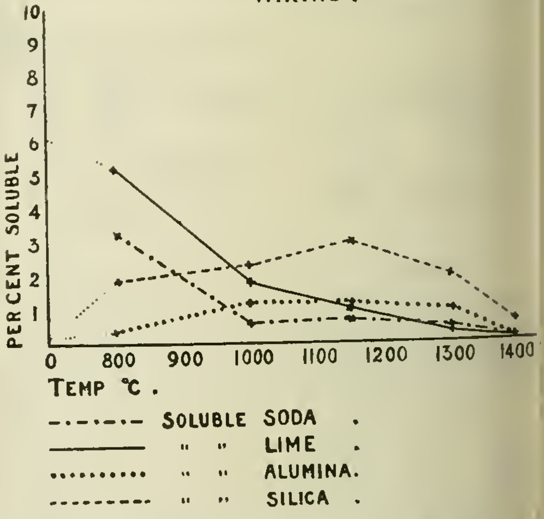
The use of four oxides instead of three was of little or no importance in increasing non-volatility or resistance to acid. Apparently fusibility was increased but it was desirable to decide that more clearly.

Influence on Fusibility.—Accordingly mixtures were made up to correspond with the formulæ, $Na_2CO_3 + 10SiO_2$, $Na_2CO_3 + CaCO_3 + 10SiO_2$, $Na_2CO_3 + Al_2O_3 + 10SiO_2$, and $Na_2CO_3 + CaCO_3 + Al_2O_3 + 10SiO_2$, the mixtures of the synthesis interesting in this connection. They were not made up directly from the oxides, but $Na_2CO_3 + 10SiO_2$ was first mixed, calcined at 1150° for 24 hours, ground dry, and used as a basis, the following mixings being actually used :—

Formula mixed.	Weights mixed.		Formula calcined.
$Na_2O.10SiO_2 + CaCO_3$	$Na_2O.10SiO_2$ Carbonate of lime	662 parts 100 ,,	$Na_2O.CaO.10SiO_2$
$Na_2O.10SiO_2 + Al_2O_3$	$Na_2O.10SiO_2$ Calcined alumina	662 ,, 102 ,,	$Na_2O.Al_2O_3.10SiO_2$
$Na_2O.10SiO_2 + Al_2O_3 + CaCO_3$	$Na_2O.10SiO_2$ Carbonate of lime Calcined alumina	662 ,, 100 ,, 102 ,,	$Na_2O.CaO.Al_2O_3 10SiO_2$

The constituents being thus rendered practically insoluble in water could be tested by moistening, pressing into pyramids of the Seger type, using the minimum of water, and burning together. The results are made clear by the accompanying photograph of the pyramids after burning (Fig. 2) in which contractions of obvious meaning are used instead of full formulæ.

The introduction of either lime or alumina to the $Na_2O.10SiO_2$ mixing increased the fusibility, and that of lime and alumina together increased it further. Thus the quadruple-oxide mixing was more fusible than any one of the triple-oxide mixings, and the function of the fourth oxide was determined.*


CURVE 9.
SILICATE SYNTHESIS
QUADRUPLE-OXIDE MIXING.

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* In a paper "The Fluxing Power of the common Oxides," by J. W. Cobb and C. A. King, the subject of fusibility has been separately treated (Trans. Eng. Cer. Soc., 9, 41).

Summarising, the quadruple-oxide mixing of the glass, glaze, or complex silicate, which was to be synthesized, was not chemically very different in its behaviour from some of the triple-oxide mixings; its advantage did not lie in non-volatility or resistance to acids, but in fusibility.

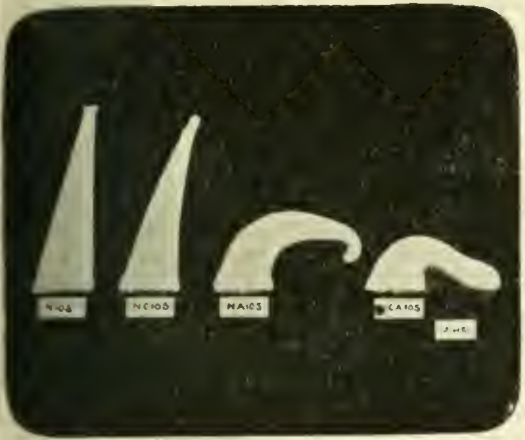

Fig. 2.

In the combination of non-volatility and fusibility when hot, and resistance to acids when cold, the defining qualities of a glaze or glass chosen for this investigation, the final quadruple-oxide mixture was the best of the synthesis. It may again be mentioned that other essential qualities of a glaze or glass, such as resistance to devitrefication and crazing, are untouched by this study.

In order that the condition as to solubility of each constituent, at different temperatures, in the quadruple-oxide mixture can be traced, curve 9 has been prepared. The percentages of soluble matter are plotted vertically and the temperatures of heating horizontally.

The initially soluble constituents, lime and soda, proceed steadily with rising temperature to insolubility as the glass is formed. The initially insoluble alumina and silica form small quantities of non-resistant compounds at intermediate temperatures, which lessen and tend to extinction as the final glass stage is reached.

General Summary.—A summary may be made of the whole synthesis showing the gradual development of the essential qualities; it is given in Table XIX.

TABLE XIX.

	Mixing.	Properties.†	
Double oxide-mixtures.	$Na_2CO_3 + CaCO_3$	Volatile, fusible with white residue,	non-resistant.
	$Na_2CO_3 + Al_2O_3$	,, infusible	,, ,,
	$Na_2CO_3 + 10SiO_2$	Non-volatile, somewhat fusible,	resistant and non-resistant portions.
	$CaCO_3 + Al_2O_3$	,, infusible	non-resistant.
	$CaCO_3 + 10SiO_3$	,, ,,	,, ,,
	$Al_2O_3 + 10SiO_2$	,, ,,	resistant.
Triple oxide mixtures.	$Na_2CO_3 + CaCO_3 + Al_2O_3$	Volatile, infusible	non-resistant.
	$Na_2CO_3 + CaCO + 10SiO_2$	Non-volatile, fusible	resistant.
	$Na_3CO_3 + Al_2O_3 + 10SiO_2$	,, ,,	,,
	$CaCO_3 + Al_2O_3 + 10SiO_2$	,, fusible with difficulty	resistant after strongly heating.
Quadruple oxide-mixture.	$Na_2CO_3 + CaCO_3 + Al_2O_3 + 10SiO_2$	,, most fusible	resistant.

† *Infusible* signifies showing little or no signs of fusion on taking to a high temperature, say 1300° C.
Volatile signifies appreciable proportion volatile on taking to a high temperature, say 1300° C.

Thus the essential qualities of a glaze or glass have been found to attach to its chemical composition. No double-oxide mixing in the synthesis had these qualities, nor the triple-oxide mixing without silica. The triple-oxide mixing of lime, alumina, and silica, was non-volatile and acid resistant, but not sufficiently fusible; while the triple-oxide mixings containing silica and soda, with alumina or lime were possessed of the fundamental attributes, being non-volatile and fusible, while hot, and resistant to acid when cold. The final quadruple-oxide mixing was even more fusible and combined the three essential qualities most completely; its greater fusibility suggested the possible advantage in that direction, which might be secured by still further complication of composition.

Another mixing—a glaze in practice.—In this investigation the root-principle has been to build up the glass or glaze from its simple oxide constituents, or in some cases oxides combined with volatile acids, as carbonates or occasionally sulphates. This is the practice in glass-making on the working scale, but in making a pottery glaze, as a rule the constituents, when mixed, are already combined to some extent. Thus a glaze such as $Na_2O.CaO.Al_2O_3 10SiO_2$, or say $K_2O.CaO.Al_2O_3 10SiO_2$ would be made in practice from such a mixing as $K_2O.Al_2O_3.6SiO_2 + CaCO_3 + 4SiO_2$ *i.e.*, from potash felspar, calcium carbonate, and silica, in the proportions of the formula. In this case an insoluble triple-oxide compound is present from the outset and the interaction between this and the other constituents, on heating, is likely to be different in some degree, from that occurring between the simple constituent oxides. For this practical reason an addendum was made to the primary synthesis by making up a mixing of the approximate formula, $K_2O.Al_2O_3.6SiO_2 + CaCO_3 + 4SiO_2$, and subjecting it to the processes of heating, extraction, and analysis. The results are collected in Table XX.

The felspar used was extracted for a week with normal hydrochloric acid, but not with sodium carbonate. Potash was substituted for soda because the potash (orthoclase) felspar is the insoluble alkali compound in general use, and no wide difference in behaviour between potash and soda was held to be likely.

A comparison of Tables XVIII. and XX. shows that the entrance of lime into insoluble combination was delayed by the altered form of the original mixing. At 800° the carbon dioxide had been driven off and a little soluble silicate formed, but the mass was unchanged in appearance. At 1000° more soluble silicate had formed, and the appearance of a little soluble potash and alumina pointed to a slight interaction between the felspar and the other constituents, presumably the lime. At this stage the "heating" was very slightly hardened and contained its maximum of solubles, for at 1150° with the mass much shrunken, and in stony fusion; more than half the lime was insoluble; interaction to form an insoluble compound of lime had commenced.

Table XVIII. has shown that when all the oxides were presented as such (or as carbonates) the lime began to go into insoluble combination much earlier; the weakening of the active chemical affinities in the mixture now under consideration, which results from supplying the potash, alumina and silica, already combined in a staple triple-oxide compound, is a sufficient explanation of this difference.

TABLE XX.

Felspar, Lime, and Silica.

$K_2O.Al_2O_3.6SiO_2 + CaCO_3 + 4SiO_2$.

Where heated.	Time (hours)	Temp. °C.	Soluble.			SiO_2 soluble in		Total sol. SiO_2	Total sol.	Total insol.	Appearance and notes.
			K_2O	CaO	Al_2O_3	HCl	Na_2CO_3				
	Blank		0·4	6·0	—	—	1·4	1·4	—	83·9 †	Contains CO_2
Muffle	1	800	0·6	6·2	0·2	0·4	1·5	1·9	8·9	90·8 † 91·1 *	Unchanged. No CO_2
Injector	1	1000	0·7	6·0	0·6	1·4	1·7	3·1	10·4	89·5 † 83·6 *	Very slightly hardened, maximum soluble.
..	1	1150	0·7	2·7	0·8	0·8	1·8	2·6	6·8	92·5 † 93·2 *	Stony fusion, much shrunk. SO_3 nil.
..	1	1300	0·6	0·6	0·8	—	0·6	0·6	2·1	97·3 † 97·9 *	Opaque fusion containing microscopic white particles.
..	1	1400	—	trace	trace	—	0·3	—	0·7†	99·3 *	Transparent glass with gas bubbles but no undissolved particles.
Works furnace	24	1150	0·2	0·8	0·4	—	1·6	1·6	3·0	96·6 † 97·0 *	Opaque fusion, shrunk from crucible sides glazed on surface. SO_3=nil.
..	24	1150		1·3	0·2	0·6	0·9	1·5	—	——	Another heating.

† Determined. * By difference.

The lime did not find an entry to insoluble combination until partial fusion facilitated inter-action.

From this temperature upwards the results were very much the same as obtained from the oxide mixing of Table XVIII. The soluble matters were much lessened at 1300° and at 1400°, amounting to only 1 per cent.; at the former temperature the glass was opaque from microscopic undissolved particles, and at the latter was clear and transparent, with no white particles, but some included gas bubbles. The long-period heating at 1150° contained less soluble matter than the corresponding oxide mixing of Table XVIII., although generally similar. It contained no sulphur trioxide, and presumably on that account, less soluble lime.

Summarising, the felspar-lime-silica mixing behaved differently from the direct quadruple-oxide mixture, inasmuch as a higher temperature was required before the lime became insoluble, but at the higher temperatures the two mixtures were very similar.

Tests of insolubility have been made throughout this study by subjecting the heatings to the action of normal hydrochloric acid for 24 hours. It seemed advisable for comparison to deal in the same way with commercial products. Two samples were chosen, ground, sieved, and extracted in the usual manner. They were A, broken Kali glass bottles, and B, broken Jena glass chemical apparatus, such as beakers and flasks; the results obtained were :—

	A	B
	per cent.	per cent.
Soluble in cold normal HCl in 24 hours ...	0·8	0·8
„ „ hot 5 per cent. Na_2CO_3 solution in 15 mins..............................	1·1	0·6

The quantities of soluble matter can be seen by comparison with the Tables of Parts V. and VI., to be of the same order as those obtained under the same treatment from the glasses and glazes made in the progress of this synthesis.

The synthesis has now been carried through on the lines laid down in Part I., and it is hoped that the mode of formation of a glass or glaze has been rendered somewhat less obscure. At the same time many questions which the tabulated results suggest to the author, and no doubt to others, have not been answered or even discussed, and much work lies waiting to be done in elucidation of what is scientifically fundamental to the glass and pottery industries.

To avoid possible misunderstanding the author would like to make one or two explanations.

In mixtures containing soda there was always some slight volatilisation, and the soda has been taken as non-volatile when the volatilisation was so small as not to affect appreciably the chemical analysis.

The temperatures have been taken throughout with a thermo-couple calibrated against the melting point of copper in air, taken as 1065° C. The long-period heatings at 1150° C. were at that temperature, as determined by a thermo-couple, for about 24 hours, but "to Seger cone 8 or 9" would be for some purposes a more useful description of the heating; since the temperature published for Seger cone 9 is 1310° C., and in the industry these temperatures are freely used, the explanation is necessary. In the slowly heated kiln or furnace, used industrially, the author has never found the temperature corresponding with cone 9 to approach 1310° C.

With regard to the significance of the summation to 100 when complex silicates are analysed and the results calculated to percentages of normal oxides, something has been said in the introduction (Part I. this J., 1910, p. 70). One consequence is that oxygen cannot be deemed replaced by another element in such substances. Generally the chemistry of complex silicates formed at high temperatures, under oxidising conditions, is simplified in the same way as carbon chemistry would be, if the compounds of carbon and hydrogen to be considered were limited to such as contain just so much oxygen as would convert the carbon into carbon dioxide, and the hydrogen into water. On examination this seems to abolish the use of double linkages between silicon (or carbon) atoms, and closed chains, in the construction of graphic formulæ for such compounds. Practically, it justifies the use of oxide formulæ.

The author would like, in conclusion, to thank again the directors of the Farnley Iron Co., in whose laboratory the experimental work has been carried out, and Mr. C. A. King, M.Sc., his chief assistant, for valuable assistance in analysis and experiment generally, and in the preparation of drawings.

Obituary.

CHARLES HANSON GREVILLE WILLIAMS, F.R.S.

C. H. Greville Williams was born at Cheltenham, Sept. 22nd, 1829, and was the son of S. Hanson Williams, a solicitor. He died June 15th, 1910. His professional career was commenced as first assistant to Prof. Anderson of Glasgow University, and after some years spent in research work, he removed to Edinburgh, where he undertook a tutorial class under Dr. Lyon Playfair. Subsequently (1857 to 1859) he became lecturer in chemistry at the Normal College, Swansea. In 1859, he returned to Glasgow, this time as chemist in the chemical factory of Messrs. Miller. In 1863 he migrated to Greenford Green, to the works of Messrs. Perkin, and here he remained until 1868. Shortly after, he entered into partnership with M. Edouard Thomas, at the Star Chemical Works, Brentford, where he and his partner were engaged in the manufacture of coal-tar dyestuffs until the year 1877. After this date, Greville Williams somewhat changed his course, now becoming photometric supervisor to the Gas Light and Coke Company, with whom he remained until 1901. Subsequently, as old age advanced and physical strength decreased, he retired into the country, seldom meeting his old friends and acquaintances, and interesting himself in the study of the ancient Egyptian language and the translation of inscriptions. Thus, in his later years, he became an almost complete recluse, and, sad to say, this isolation was largely due to straitened circumstances, and the silence—to the pinch of poverty. Greville Williams' researches on isoprene, and cryptidine (probably a dimethylquinoline), on bases from bituminous shale, from the Boghead cannel, and from the products of the destructive distillation of cinchonine, also on beryl, demonstrate clearly that he was a chemical investigator of a high order. For further evidence in the same direction, a mere reference to Lunge's last edition of his work on "Coal Tar and Ammonia," pp. 38, 173, 230, 232, 234, 235 and 236, may suffice. To quote the words of his friend, Prof. Sir Arthur Church, to whom the writer is indebted for most of the present sketch, "he made many interesting discoveries, and has left a considerable record of thoroughly sound work." C. Greville Williams was elected F.R.S. in June, 1862. His chief literary work was "A Handbook of Chemical Manipulation" (Van Voorst, 1857), of which a supplement appeared in 1879.

Perhaps the highest testimony of all is contributed in the closing words of Sir Arthur Church's memoir of Williams: "The writer has lost a friend of nearly sixty years' standing—a friend of rare quality and of high Christian character."

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

eat-insulating materials; Experiments with ——. Eberle. Z. Ver. deutsch. Ing., 1910, 54, 635—638. Chem.-Zeit., 1910, 34, Rep., 264. (Compare this J., 1904, 478; 1905, 802; 1909, 836.)

xperiments made to test the efficiency of several on-conducting coverings for steam pipes, under the same onditions, gave the following results, compared with the are steam pipe :—

Covering.	Pressure of steam (saturated) in atmospheres.	Percentage of heat saved.	
		Pipe flanges not covered	Flanges covered.
ieselguhr	3—13	78·0	82·8
iatomite (burnt)	3—13	76·2—78·5	83·2—85·4
ilk (on burnt diatomite)	1·3—6·7	79·3—79·8	84·7—86·3
ork	3·3—13	79·7—80·6	87·1—87·7
atent guhr composition	3·4—13	78·8—80·7	87·8—89·1
lass wool	3·3—13·3	82·6—82·9	90·0—90·6

A. Sald.

Patents.

urnaces. T. F. F. Lee, New York. Eng. Pat. 12,906, June 1, 1909. Under Int. Conv., June 27, 1908.

cylindrical boiler is provided on both sides of the urnace chamber, which has a contracted opening communicating with the heating flues, with segmental fuel chambers or hoppers through which the fuel is continuously fed into the furnace chamber. Air is admitted to the furnace through the fire-bars at the bottom and also through a number of adjustable openings in the outer side of each hopper. The air entering the latter openings forms a down draught and carries with it the gases and vapours from the "green" coal into the furnace, where they are completely burnt. The coal is coked during its downward passage and smokeless and complete combustion is claimed to be attained.—W. H. C.

Covering [for steam pipes, boilers, etc.]; Non-conducting ——. T. Lonsdale and Lonsdale Bros., Ltd., Blackburn. Eng. Pat. 13,693, June 11, 1909.

Silicated cotton, slag wool, asbestos, or the like, is applied in the wet state to the surface to be covered, after steeping in a mixture of 2·5 parts of sodium silicate, 2·5 of starch, and 95 of water.—O. R.

Cooling water. D. M. Clark, London. From Ges. der Tentelewschen Chem. Fabr., St. Petersburg, Russia. Eng. Pat. 27,938, Nov. 30, 1909.

The liquid to be cooled is caused to flow downwards through a narrow annular chamber formed by a double wall of laths, those on the outside being inclined upwards and outwards, and those on the inside upwards and inwards. The space between the laths is filled with coke and the lower part of the chamber is boarded in and provided with an outlet for the cooled liquid. A current of air is drawn horizontally through the falling liquid by a fan placed at the top of the central space enclosed by the annular coke chamber.—W. H. C.

Centrifugal separators with filtering apparatus. R. Haddan, London. From Aktiebolaget Separator, Stockholm, Sweden. Eng. Pat. 30,069, Dec. 23, 1909.

A FILTERING drum having a perforated wall lined with filter-cloth is mounted above and rotated with a centrifugal separator having a solid wall. The liquor to be separated is fed into the lower drum and the separated liquid flows upwards into the centre of the upper filtering drum and passes through the filter cloth.—W. H. C.

Grinding or mixing emulsions or the like. Altonaer Margarine-Werke Mohr und Co., Ges. m.b.H., Altona-Ottensen, Germany. Eng. Pat. 1227, Jan. 17, 1910. Under Int. Conv., June 29, 1909.

IN order to prevent the pressure exerted by the liquid to be treated from increasing the friction between the spindle and the bearings, the former is driven by a pulley fixed at the middle, and is provided at each end, with a rotating friction disc, which co-operates with a fixed grinding surface and has its blades curved in opposite directions, so that the torsional action of the liquid at each end tends to turn the spindle in the same direction, thus lessening the power required to drive the spindle.—W. H. C.

Settling or other vats or vessels ; Introducing and distributing mixtures of solids and liquid in ——. A. J. Arbuckle. Johannesburg, Transvaal. Eng. Pat. 2307, Jan. 29, 1910.

THE apparatus consists of a number of concentric inverted, truncated cones with upward and downward cylindrical extensions. The mixture is fed between an inner upright cone and the innermost inverted cone and the solids slide down the surfaces of the cones and are removed by helical blades to an outlet at the bottom of the vessel. The clear liquid overflows over the upper edge of the outermost conical vessel into a launder or gutter which surrounds it.—W. H. C.

Filtering apparatus. C. M. Chamberlain, Denver, Colo. U.S. Pat. 959,461, May 31, 1910.

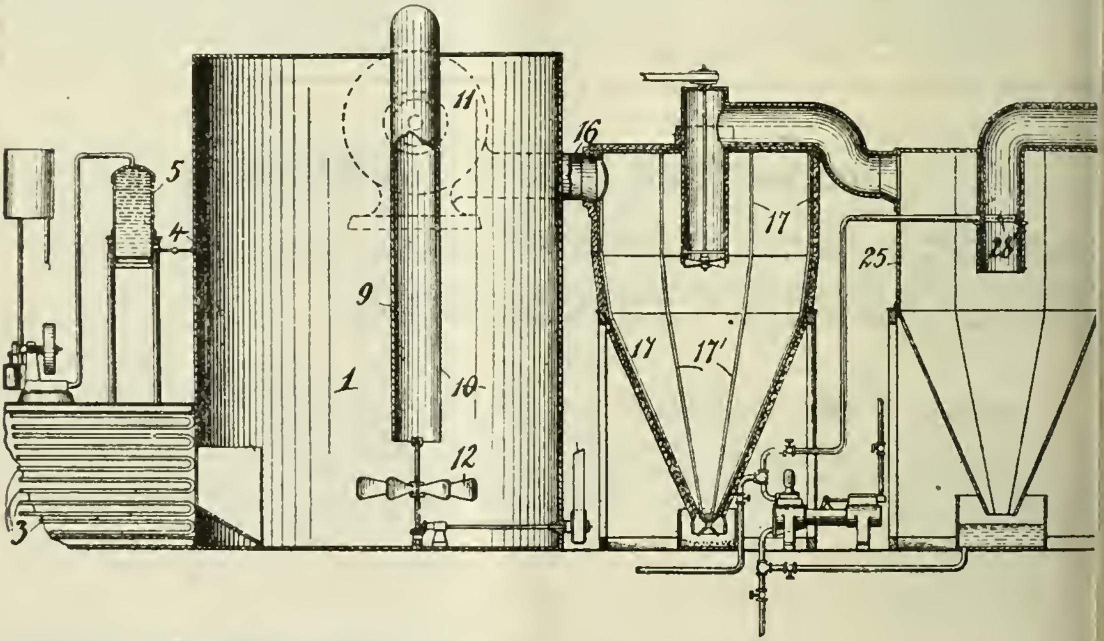
A NUMBER of filter trays are arranged one above the other in a frame. Each tray is provided with a filter bed which divides it into an upper and a lower compartment. The upper compartments are filled from a common reservoir which contains the liquid to be filtered and the lower compartments are connected to a vacuum pump and discharge into a common receiver.—W. H. C.

Desiccating and kilning ; Apparatus for ——. A. Potti
Fr. Pat. 409,960, March 2, 1909.

THE material is fed into a rotary drum provided wi radial partitions which divide the interior into secto The drum is placed in a chamber at the top of a dryi tower, and the material after passing through it, fa into a similar drum placed below. From the seco drum the material is discharged into a distributi apparatus which feeds it on to the uppermost of a seri of curved shelves. These shelves are alternately inclin in opposite directions and are supported by cross rods the upper ends about which they can oscillate. Th lower ends are free and rest on projections from t opposite wall of the drying chamber. By means of ca placed below the shelves, the latter receive intermitte blows which cause them to vibrate and to shake t material downwards from shelf to shelf to the outlet at t bottom of the chamber. The drying is effected by a curre of hot air or gas which passes upwards through the dryi chamber.—W. H. C.

Desiccation of fluid substances. D. R. Henricks. Fr. P
410,133, Dec. 8, 1909.

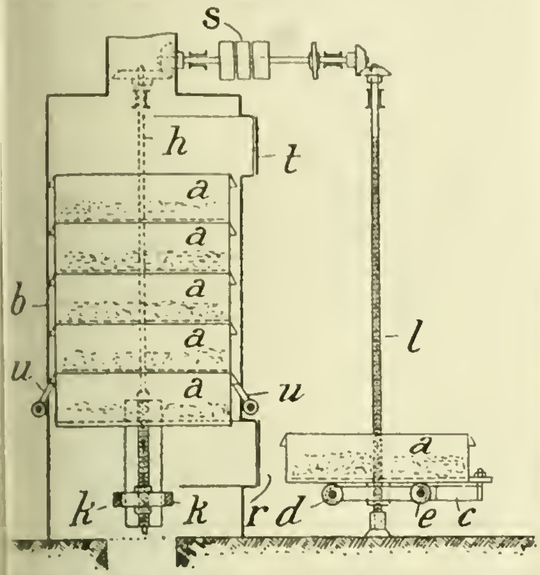
THE liquid to be desiccated is injected into the chamb 1, from the reservoir, 5, through the atomising jets,



Air, heated by passing over the steam-heated pipes, enters the lower part of the chamber, 1. The air a particles of desiccated material are kept in motion by t fan 12, and are withdrawn from the chamber, 1, by t fan, 11, through the opening, 10, in the pipe, 9. The fan, injects the mixture through the pipe, 16, tangentia into the conical collecting chamber, 17, provided wi radial baffles, 17′. The solid particles are driven to t wall by the centrifugal force and collect at the bottom the cone, from which they are discharged. The air pass on to the second conical chamber, 25, which it al enters tangentially and the particles of dry mater which it still contains are washed out by a spray of liqu from the jets, 28′.—W. H. C.

Desiccating column ; Counter-current ——. Textil-Ma chinenfabrik B. Cohnen. Fr. Pat. 410,506, Dec. 1909.

THE material to be dried, contained in a tray, *a*, is plac on the platform, *c*, which is moved over the rollers, *d*, through the door, *r*, into the drying column, *b*. T vertical screwed rods, *h*, *l*, are then put in motion by t pulleys, *s*, and both the platforms, *c*, *k*, are moved upwar but at different speeds, the platform, e, being moved to he top while k, is only moved the height of one tray. The top tray is removed through the door, t, on to the latform, c, and the motion of the screws reversed. The latform, r, returns to the lowest position and the tray ontaining the dried materials is removed and replaced y a fresh tray containing wet material. The platform, is also lowered, but the trays are kept in position by the tches, u, u.—W. H. C.



terilising, drying, or carbonising substances out of contact with the air. L. Teisserenc de Bort. Fr. Pat. 410,171, Dec. 9, 1909.

he apparatus comprises a horizontal metallic casing vided by removable partitions or doors into four comrtments. The casing is arranged in conjunction with furnace so that the first compartment is moderately ated, and the second is heated to the highest temperare required. The third and fourth compartments are ovided with means for cooling. The substances to treated are placed in wheeled receptacles on rails hich run through the length of the casing, and are passed succession through the heating and cooling compartents.—A. T. L.

xtraction of gases and vapours from vacuum apparatus. E. Josse and W. Gensecke. Fr. Pat. 410,046, Dec. 6, 1909.

he apparatus is especially applicable to multiple connsers in which gases are liquefied. The refrigerating quid is caused to enter the apparatus through an injector hich is so constructed that it aspirates the gases and pours from the refrigerator and carries them forward ith the refrigerating agent. They are discharged through ecial valves placed between the injector and the outlet r the refrigerating liquid.—W. H. C.

corporating liquids with gases. M. Paschka. Fr. Pat. 410,640, Dec. 20, 1909.

he liquid and gas are passed in the same direction through vertical column or a serpentine tube filled with a spongy aterial which presents a large surface and breaks up e current of gas and liquid, so that they are intimately ixed. The liquid leaves the bottom of the apparatus oroughly impregnated with the gas.—W. H. C.

y extracts of plants, leaves, flowers, roots and in general all vegetable and animal materials; Process and apparatus for the manufacture of ——. L. Bourdet. Fr. Pat. 410,965, Dec. 9, 1909.

e materials are extracted with a suitable solvent of w boiling point, in an extractor or percolator, either *in vacuo* or in the presence of an inert gas. The extraction may be effected in the cold or at any higher temperature below 100° C. The extract passes from the extractor to a still placed below, in which the solvent is distilled off. In the case of extraction in the cold, the liquid extract is first collected in an intermediate reservoir interposed between the percolator and the still.—W. H. C.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal mines in the United States; Accidents in the ——. U.S. Geol. Survey, June, 1910.

The greatest danger to which the coal miner is exposed is that from falls of roof and coal, and this danger is materially increased from the weakening of the roof and the shattering of the coal left as supporting pillars when excessive charges of powder are used. In 1909 out of the 2,412 men killed 1,191 were victims of falls of roof or coal, and of the 7,979 non-fatal injuries 3,280 were due to this cause. Only 14 per cent. of the deaths and less than 5 per cent. of the injuries were due to explosions of dust or gas, or combinations of the two. In the explosions that occurred last year 341 were killed and 331 injured. In the accidents due to windy or blown-out shots and to explosions of powder or dynamite 108 were killed and 217 injured. Falls of coal and roof killed 1,191 and injured 3,280, while in the accidents due to miscellaneous causes 759 were killed and 3,875 injured. In 1908 the corresponding figures were, from gas and dust explosions, 396 killed and 326 injured; from powder explosions and windy shots, 73 killed and 179 injured; from falls of roof and coal, 1,080 killed and 2,591 injured; and from miscellaneous causes, 901 killed and 3,676 injured. A similar relation is shown by the statistics for a series of years. During the last three years the total number of deaths for which the causes have been assigned was 30,276 and the number of non-fatal accidents was 72,585. Of these, gas and dust explosions killed 4,045 and injured 4,491 (two-thirds of those injured being in the anthracite mines of Pennsylvania); powder explosions and windy shots killed 1,989 and injured 4,367; falls of roof and coal killed 14,510 and injured 31,621; and 9,732 deaths and 32,106 injuries were due to other causes. The explosions in the anthracite mines show a much smaller rate of mortality than in the bituminous mines. This is probably due to the comparatively inert character of anthracite dust, which does not propagate cumulative explosions, such as are likely to occur in bituminous mines when initiated by an explosion of fire damp, or otherwise. Explosions in the anthracite mines are in consequence more localized and attended with comparatively fewer fatal results.

Waste gas from coke ovens; Utilisation of ——. Times, June 29, 1910.

The Little Hulton Urban District Council Bill, which authorizes the transfer of so much of the gas undertaking of the Salford Corporation as is within the council's area, and empowers the council to supply gas in their district, passed on June 28 through the House of Lords. It is proposed to utilise, for the first time, the waste gases from coke ovens for the purpose of a public supply of gas. Under an agreement scheduled to the Bill, Lord Ellesmere contracts to supply the district council annually with not less than eight million cubic feet of gas from his coke ovens, the gas from which is at present running to waste. The agreement, which is for 35 years, may be determined after that period by either party giving five years' notice, and, in that event, the council are to have the option of purchasing Lord Ellesmere's gas plant.

Balloon gases; Preparation of ——. O. Sackur. J. Gasbeleucht., 1910, 53, 481—488.

Oechelhauser prepared a gas of 0·225 density (air = 1), by passing coal gas through vertical retorts filled with small coke and wood charcoal, and heated at the lower part to 1400° C. The composition of the gas was as follows:—

	Coal gas.	After treatment.
	Per cent.	Per cent.
Carbon dioxide	1·3	0·0
Carbon monoxide	5·3	7·3
Hydrogen	59·6	80·7
Methane	24·7	6·9
Nitrogen and oxygen	6·5	5·1
Heavy hydrocarbons	2·6	0.0

The lifting power of the gas (at sea-level) was 1000 kilos. per 1000 cb. m. (62½ lb. per 1000 cb. ft.) as compared with 1200 kilos. (75 lb.) for hydrogen. The increase in volume was slight owing to losses through the retort walls. The cost of conversion was 2—3 pfennig per cb. m. (6·65—9·97d. per 1000 cb. ft.) The Rincker-Wolter process consists in injecting liquid hydrocarbons downwards through a bed of coke previously brought to a high temperature by an air-blow. The process yields a gas containing 96 per cent. of hydrogen, and having the density 0·13, at a cost of 5 pfennig per cb. m. (16·6d. per 1000 cb. ft.). The apparatus can be worked so as to yield normally a gas richer in hydrocarbons and suitable for lighting and heating, while the light gas can be made when required. Various processes for preparing hydrogen by reactions in aqueous solution have been suggested for military purposes with a view to reducing the weight of reagents required. The Russian Army in Manchuria used aluminium and caustic soda, requiring 4·1 kilos. of reagents (other than water) per cb. m. of hydrogen (256 lb. per 1000 cb. ft.), as compared with 6·4 kilos (400 lb. for 1000 cb. ft.) using iron and sulphuric acid. The reaction between calcium hydride and water, $CaH_2+2H_2O=2H_2+Ca(OH)_2$, requires only 0·9 kilo. (56 lb. for 1000 cb. ft.). The hydride is prepared by passing hydrogen over the heated metal obtained by the electrolysis of fused calcium chloride. In use, the hydride is placed in a series of connected vessels, and water is admitted only to the first, the other vessels serving to decompose water and steam carried over with the gas. The action of silicon on caustic soda,

$$Si+2NaOH+H_2O=2H_2+Na_2SiO_3,$$

requires 2·28 kilos. of reagents per cb. m. of hydrogen (142 lb. per 1000 cb. ft.). Part of the caustic soda may be replaced by lime, calcium silicide, or calcium hydride. A portable apparatus is now on the market capable of generating 120—300 cb. m. (4240—10,590 cb. ft.) of hydrogen per hour by this process. Another class of processes depends on the decomposition of steam or the removal of the heavier constituents from water-gas. Frank's process consists in passing water-gas over calcium carbide:—$CaC_2+CO=CaO+3C$. The carbide also removes nitrogen, and the lime removes carbon dioxide. According to another process, the water-gas, with addition of steam, is passed over lime at 450°—500° C., whereby the carbon monoxide is replaced by hydrogen:—$CaO+CO+H_2O=CaCO_3+H_2$. Other methods of preparing hydrogen on the large scale are:—(1). passing steam over iron; (2). decomposition of acetylene by heat; (3). electrolysis of aqueous solutions.—A. T. L.

Paraffin wax from petroleum, lignite, and shale. J. Marcusson and G. Meyerheim. Z. angew. Chem., 1910, **23**, 1057—1060.

In the authors' experience Graefe's method (Z. angew. Chem., 1905, **18**, 1580) of distinguishing between the paraffin wax from petroleum and that obtained from lignite or shale does not always give reliable results, and is not applicable to crude waxes, since crude petroleum paraffin wax may also give pronounced colorations with sulphuric acid. A determination of the iodine value or of the refractive index is also inconclusive, the differences in each case being too small to afford a proof of the origin of the wax. A means of distinguishing between the two kinds of wax, however, may be based upon the fact that the oily constituents separated from petroleum paraffin wax have an iodine value of only 3 to 12, whereas the corresponding oils from lignite or shale paraffin waxes have iodine values of 18 to 31. In applying the test, 100 grms. of the wax are dissolved in 300 c.c. of warm ether, and the solution treated with the same volume of 96 per cent. alcohol. In the case of very oily crude waxes, 50 grms. of the wax and half the quantities of reagents are used. The vessel is cooled in running water, and the precipitated paraffin wax is collected on a Buchner's funnel with the aid of suction. The filtrate is distilled, the residue dissolved in 50 c.c. of ether, and the solution treated with 50 c.c. of 96 per cent. alcohol, and cooled to —20° C. to separate the wax as completely as possible (as in Holde's method of determining paraffin wax). The filtrate from this second deposit is evaporated, and the residue treated with petroleum spirit of low boiling point to remove resinous constituents. The filtrate from these is evaporated, and the iodine value of the oily or (in some cases) semi-solid residue, is determined by Waller's modification of Hübl's method.—C. A. M.

Carbenes [asphaltum]; Formation of ——. D. B. W Alexander. J. Ind. Eng. Chem., 1910, 2, 242—245.

In the determination of carbenes in asphaltum—given by the difference between the amounts soluble in carbor bisulphide and in carbon tetrachloride—it was found tha the amount soluble in carbon tetrachloride was less whe the beaker containing the asphaltum and the carbo tetrachloride was exposed to light. Experiment showe that when the treatment with this solvent was carried ou in the dark, a greater amount of the asphaltum dissolved but that on exposing the filtrate to direct sunlight, carbene came out of solution. To determine if these bodies wer produced by the action of sunlight alone, a sample o asphaltum was exposed as a thin film to direct sunlight fo 7½ hours, and then treated with carbon tetrachloride, a unexposed sample being treated alongside under the sam conditions. The amounts dissolved were practicall identical, thus proving that carbon tetrachloride takes a active part in the formation of carbenes. Moreover, sepa ated carbenes were found to contain chlorine. Furthe experiments showed that harder asphaltums gave the large amounts of carbenes, other conditions being identical.
—T. St.

Studies in asphalt. Frankforter. *See* IX.

Patents.

Briquettes; Process of manufacturing ——. T. G. Wilson, Vancouver, B.C. U.S. Pat. 958,950, May 2 1910.

Finely divided coal is heated to a temperature of 13 to 180° F., in a closed mixer, and sprayed, whil under agitation, with molten asphaltum which has bee previously freed from oil by boiling.—W. E. F. P.

Wood-charcoal; Process and apparatus for the economic production of ——, *and for making [fuel] briquettes fro small charcoal.* Huilerie et Savonnerie de Luria Fr. Pats. 409,916, Mar. 1, 1909, and 410,395, Mar. 1 1909.

(1). The patent relates to a boiler furnace for burnin olive marc, sawdust, and other waste products, in suc a manner as to obtain charcoal as a by-product. Th furnace is divided by a vertical wall into two chamber each having a brick floor inclined downwards towards th charging end. Both chambers open at the other en into a flue leading to the boilers. In working, the furna is first brought to red heat, and the wastes to be bur are thrown in as a thin layer: the volatile constituents a thus consumed, and as soon as the flame disappears, a fre layer of the waste is thrown on to the charred fuel. Th charcoal formed is removed every three hours The tw chambers are used in turn. (2). Charcoal obtained described above is ground to powder, mixed with 24 p cent. of water, 15 per cent. of sodium silicate, and 3 p cent. of hydraulic lime, and pressed into briquettes. Aft drying in air for two or three days the briquettes are rea for use.—A. T. L.

oking coal ; Process for ——. S. B. Sheldon, Buffalo, N.Y. U.S. Pat. 959,080, May 24, 1910.

HE procedure is the same as that usually followed in oking plants of the gas-fired, regenerative type, except hat the coal is pre-heated, first at a non-coking temperaure in the supply bin, and then at a coking temperature in ts passage to the actual coking chamber.—W. E. F. P.

as producer. W. Climie, Newton, Scotland. Eng. Pat. 13,026, June 3, 1909.

s a gas producer of the water-jacketed type, having proision for the recovery of the by-products resulting from he combustion of the fuel, the producer is provided with central uptake and a rotatable grate, the latter being ater-jacketed and capable of being raised and lowered intervals to prevent the fuel from hanging ; the fuel is enly distributed in the inner chamber by means of a volving rake. From the fuel chamber short pipes extend terally through the water-jacket and communicate with d boxes attached to the outer casing, the openings being ntrolled by doors from the outside. By means of a rtical pipe passing through the centre of the fuel chamber, spray of water is maintained in the off-take box, the ses and water passing thence to a collecting tank, which, ting as a water-seal, serves as a scrubber for the gas, e latter being forced through the water by means of an ector operated by the steam generated in the waterket.—W. E. F. P.

as producers. T. Lumsden, Gateshead. Eng. Pat. 19,924, Aug. 31, 1909.

a gas producer of the under-fed type, the combustion amber is provided with hollow trunnions, and is suitably ounted, so that it may be inverted for the purpose of arging. The trunnions communicate with the interior of e chamber and serve as passages for the supply of air d steam, and for the exit of the gas generated.

—W. E. F. P.

s-making apparatus. P. A. Emanuel, Aiken, S.C. U.S. Pat. 959,324, May 24, 1910.

HE apparatus consists of a horizontal, cylindrical retort, sembling a tubular boiler in construction and operation, tached to a furnace at one end, and to a smoke stack at e other by means of a cylindrical adapter. Upper and wer doors, fitted with valved pipes for the exit of the seous products, serve respectively for charging and scharging the retort ; while, the furnace and adapter ing each mounted on wheels, the whole apparatus may detached from the smoke stack in one piece. Provision also made for supporting the retort in position when tached from the other parts of the apparatus.

—W. E. F. P.

s generators ; Process for utilising part of the gases rich in carbonic acid from ——. Uihlein und Co. Fr. Pat. 410,282, Nov. 26, 1909. Under Int. Conv., Nov. 28, 1908.

applied to the heating of gas retorts, the process nsists in passing the combustion products from the st of a series of gas-fired retort-ovens through a gas oducer which is charged with hot coke from the retorts. e carbon dioxide is thus reduced, with the formation of o volumes of carbon monoxide, and the gas obtained ves for heating a second oven. The combustion oducts from this oven are passed through coke in the oducers belonging to the next two ovens, and the oducts from these are used in the next four, the gases aily passing to the stack.—A. T. L.

rtical retorts ; Manufacture of gas in ——. C. Bolz. Fr. Pat. 410,411, Dec. 16, 1909.

order to reduce the temperature at the charging atform and at the same time to utilise some of the at of the retort gases, the retorts are not completely ed with coal, and the uppermost part of the retorts is oled by a current of air which is afterwards used for combustion. The heating gases circulate around a part of the retorts immediately above the level of the charge, to ensure complete carbonisation.—A. T. L.

Coal-gas ; Arrangement of purifying plant for ——. Soc. d'Éclairage, Chauffage et Force Motrice. Fr. Pat. 410,149, Dec. 8, 1909.

THE purifiers are arranged along one-half of a suitable shed, the other half providing a free space in which the spent material can be spread out and exposed to air for revivification. A travelling-crane is arranged overhead for removing and replacing the covers. The crane carries a grab for charging and discharging the purifiers and for working the spent material.—A. T. L.

Oils [crude petroleum] ; Process for the treatment of ——. J. H. Parker, Los Angeles, Cal. U.S. Pat. 958,820, May 24, 1910.

THE crude petroleum is fractionated, under pressure, by successive treatments in a series of heated chambers maintained at successively increasing temperatures, the vapour from one chamber passing to the next under a definite difference of pressure between the two chambers. At intervals, a portion of the vapour is withdrawn from each chamber, at a definite pressure, and condensed.

—W. E. F. P.

Fuel briquettes ; Manufacture of ——. W. F. Collins, London. U.S. Pat. 960,509, June 7, 1910.

SEE Eng. Pat. 17,545 of 1907 ; this J., 1908, 930.—T. F. B.

Travelling distilling apparatus for the manufacture of ammonium sulphate. Fr. Pat. 410,591. *See* VII.

Treating refuse and sludge for the production of gas. Eng. Pat. 29,568. *See* XIXb.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

PATENTS.

Fuel for gas fires. J. L. Foucar, London. Eng. Pat. 12,785, June 1, 1909.

FUSED silica is employed in place of the fireclay blocks usually employed. The material is dustless and has high radiating power.—H. H.

Electric incandescent lamps ; Manufacture of metallic filaments for ——. R. Jahoda, Vienna. Eng. Pat. 15,496, July 2, 1909. Under Int. Conv., May 10, 1909.

IN order to reduce the amount of organic binding material required to form a filament sufficiently strong to withstand handling prior to the final removal of the carbon, small quantities of copper or silver or of oxides or hydroxides of copper or silver are added to the paste formed of the difficultly fusible metal or metals and the binding agent. The copper or silver are volatilised during the final treatment.—H. H.

Incandescence electric lighting ; Manufacture of metallic filaments for ——. C. H. Weber, Berlin. Eng. Pat. 18,808, Aug. 16, 1909.

SMALL quantities of tellurium or selenium are incorporated with the tungsten or other refractory metal composing the filament. This is effected by the addition of the metalloid, or its dioxide, to the metallic paste before the extrusion of the filaments ; or by heating ordinary metallic filaments in an inert atmosphere containing telluride or selenide of hydrogen. When the dioxide of the metalloid is employed, the raw filaments are heated in an atmosphere containing sulphur dioxide to effect its reduction. It is

claimed that, although the finished filaments contain only traces of the metalloid, they are stronger and more flexible than those prepared by the usual methods.
—W. F. F. P.

Incandescence bodies for gas lighting. C. R. Böhm, Berlin. Eng. Pat. 10,400, May 1, 1909.

See Fr. Pat. 400,444 of 1909; this J., 1909, 973.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Reduction with metallic calcium and absolute alcohol. C. Marschalk and F. Nicolajewsky. Ber., 1910, 43, 1700—1702.

The results of the reducing action of metallic calcium in absolute alcohol upon several organic substances are given in this paper. Benzophenone is converted into diphenylcarbinol. Benzoveratrol, veratroylveratrol, and veratroylhydroquinonedimethylether are reduced to the corresponding leuco-derivatives. Similarly, tetramethyl-*p*-diaminobenzophenone is reduced to a carbinol. Cumarone is reduced to cumarane, naphthalene and anthracene to the respective dihydro-derivatives, quinoline to tetrahydroquinoline. Pyridine gives considerable quantities of ammonia and a base smelling of piperidine.—F. Shdn.

Patents.

Distillation of oils, fats, and analogous substances, especially tar, tar oils, and resin oils; Continuous process for the fractional ——. H. Hirzel Ges. m.b.H. Fr. Pat. 410,630, Dec. 20, 1909.

The product to be distilled is run, at an uniform rate, into a long, horizontal, flat-bottomed retort, on the bottom of which is a number of baffle-plates, so placed that the liquid must follow a tortuous course through the retort. In each of the compartments formed by these baffles, a perforated steam-pipe is fixed, and the inlet and outlet for the liquid to be treated are placed in such a way that, though the steam pipes are covered, there is only a slight depth of liquid in the retort. The retorts are heated directly, and three or more may be connected together, and all heated by the same furnace, so that several fractions may be taken off at the same time.—T. F. B.

Chlorinated anthraquinonesulphonic acids; Manufacture of ——. F. Ullmann, Berlin. Eng. Pat. 544, Jan. 8, 1910. Under Int. Conv., May 10, 1909.

By treating chloroanthraquinones with fuming sulphuric acid in presence of mercury or a mercury compound, chloro-anthraquinonesulphonic acids are obtained, which differ entirely from those formed when mercury is absent. For example, a new sulphonic acid, the potassium salt of which forms small yellow crystals, sparingly soluble in cold water, but readily soluble in boiling water, is obtained by heating 5 parts of β-chloro-anthraquinone with 6 parts of fuming sulphuric acid (containing 18 to 20 per cent. of anhydride) and 0·5 part of mercuric sulphate, to 150°—160° C., for three to four hours; the mass is boiled with water and the unsulphonated material filtered off. The new acid crystallises from the filtrate on cooling.—T. F. B.

Indoxyl, etc.; Process of making ——. M. Mugdan and W. Herrmann, Assignors to Consortium f. Elektrochem. Industrie, Nuremberg, Germany. U.S. Pat. 960,671, June 7, 1910.

Arylglycines are converted into indoxyl and its derivatives by introducing them, together with alkaline-earth silicides, into melted, anhydrous alkali hydroxides.
—T. F. B.

Thio-derivatives of diarylamines or their derivatives; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 410,382, Dec. 15, 1909.

When a diarylamine or a derivative of a diarylamine is heated with sulphur, in presence of a catalytic agent, and with or without a suitable solvent, it is converted into the corresponding thio-diarylamine. For example, for the preparation of thiodiphenylamine, 8·4 parts of diphenylamine, 3·2 parts of sulphur, and 1·2 parts of anhydrous aluminium chloride are heated to 130°—160° C.; large quantities of hydrogen sulphide are evolved, and when the mass has become solid, it is washed with water and then with dilute alcohol. Other suitable catalysts for the purpose are ferric chloride, antimony chloride, cuprous iodide, etc.—T. F. B.

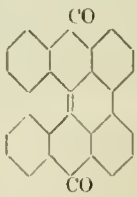
Thionaphthene derivatives; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 221,466, Oct. 13, 1907. Addition to Ger. Pat. 205,324, Oct. 3, 1907 (see this J., 1909, 134).

3-Oxy-(1)-thionaphthene or one of its derivatives is obtained by treating acetylene-*bis*-thiosalicylic acid or its homologues or derivatives (used in the process described in the principal patent) with alkalis or alkali alcoholates, with or without addition of a reducing agent.—T. F. B.

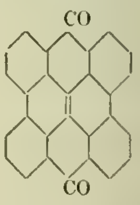
IV.—COLOURING MATTERS AND DYES.

meso-Benzdianthrone (Helianthrone), meso-Naphthodianthrone and a new method of preparing Flavanthrene. R. Scholl and J. Mansfeld. Ber., 1910, 43, 1734—1746.

1 : 1′-Dianthraquinonyl, prepared by converting 1-aminoanthraquinone into 1-iodoanthraquinone by the diazo-reaction and heating this with copper powder, is converted by reducing agents, preferably copper powde and concentrated sulphuric acid, into 1 : 9 : 1′ : 9′- or *meso*-Benzdianthrone (I).



I.



II.

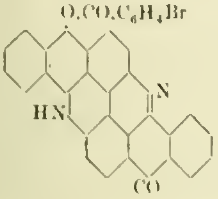
This is a vat dyestuff giving with alkaline sodium hydro sulphite a green vat from which cotton is dyed in the sam shade which, however, turns to yellow on exposure to the air. The colour is intensified by heating the dye material with bromine-water. The tetrabromo-derivativ also forms a vat from which cotton is dyed in gold-yellow shades. Dyestuffs of the same type are obtained by similar reduction of 2 : 2′-dimethyl-1 : 1′-dianthraquinony (yellow) and diamino-*a*-dianthraquinonyl (violet brown) When *meso*-benzdianthrone is heated with anhydrou aluminium chloride for three-quarters of an hour at 140°—145° C., it is converted into 1 : 9 : 8 : 1′ : 9′ : 8′-or *meso* naphthodianthrone (II), which with zinc and hydrosulphit gives an orange to flesh-red vat from which cotton is dye in orange red shades changing to yellow in the air. 1 : 1′ Dianthraquinonyl, on nitration, yields a mixture o dinitro-derivatives which by subsequent reduction i converted into Flavanthrene, but only traces are obtained
—J. C. C.

meso-Benzdianthrone (Helianthrone]; Some products o reduction of ——. J. Potschiwauscheg. Ber., 1910, 43 1746—1748.

When *meso*-Benzdianthrone (see preceding abstract) i shaken for 10 hours with zinc dust and acetic anhydride it is converted into diacetyldihydro-*meso*-benzanthron which is a brown powder. Boiling for 4 hours with thes agents, and subsequent hydrolysis, converts *meso*-benzd anthrone into a tetrahydro-derivative, a black brown powde insoluble in sodium hydrosulphite, and when the heatin is prolonged for 10 hours, the product being then hydr lysed, a hexahydro-derivative is obtained which is a dar brown powder.—J. C. C.

Flavanthrene; The blue vat of ——. J. Potschiwauscheg. Ber., 1910, 43, 1748—1750.

When Flavanthrene is treated with sodium hydrosulphite and sodium hydroxide it yields a blue vat containing dihydroflavanthrene hydrate. The author now finds that when this compound is treated with *p*-bromobenzoyl chloride in alkaline solution, mono-*p*-bromobenzoyldihydroflavanthrene



is produced. It crystallises from nitrobenzene in yellow needles.—J. C. C.

Acyl-aminoanthraquinones and anthraquinone mercaptans and their behaviour with vegetable fibres. C. Seer and R. Weitzenböck. Monatsh. Chem., 1910, 31, 371—377.

The authors have condensed a number of aminoanthraquinones with anthraquinone-2-carboxyl chloride. The condensation product with 2-aminoanthraquinone dyes cotton from the vat in pale yellow shades, but those from aminoanthraquinones containing an amino-group in the ortho-position to the carbonyl group produce bright shades varying from yellow to red and brown. Benzoyl-1-anthraquinone mercaptan has no affinity for vegetable fibres.—J. C. C.

Thiazine dyestuffs of the anthraquinone series. Experiments on the preparation of ——. V. E. Laubé and J. Libkind. Ber., 1910, 43, 1730—1734.

By condensing 1-aminoanthraquinone with 1-chloro-2 : 4-dinitrobenzene by boiling in nitrobenzene solution in the presence of copper acetate or copper powder for 4—6 hours, 2′ : 4′-dinitro-1-anilinoanthraquinone is obtained, which is readily reduced by sodium sulphide to the corresponding diamino-compound. By heating this with 2 parts of sulphur and 5—6 parts of sodium sulphide for 6 hours at 150°—200° C., a sulphide dyestuff is obtained which dyes cotton in fast green shades. By a similar series of operations 2′ : 4′-diamino-2-anilinoanthraquinone furnishes a sulphide dyestuff which gives fast brown shades on cotton.—J. C. C.

Patents.

Acid wool [*azo*] *dyestuffs; Manufacture of* ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,820, June 24, 1909.

See U.S. Pats. 953,033, 953,034, and 953,035 of 1910; this J., 1910, 554. In general, the diazo-compounds of aminoaryl ethers are combined with 2.8.6-aminonaphtholsulphonic acid or its derivatives substituted in the amino group.—T. F. B.

Dyestuffs dyeing on a mordant and their intermediate products; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 410,116, Dec. 7, 1909. Under Int. Conv., March 4, 1909.

Claim is made for the azo dyestuffs obtained by combining diazotised *o*-aminophenolsulphonic acids with 1 : 3-dihydroxyquinoline. They dye wool from an acid bath in yellow to red shades which become fast red to bluish red on being chromed. An example illustrates the preparation of a dyestuff using 2-aminophenol-4-sulphonic acid. It gives bright yellowish brown shades on wool which on chroming become red.—J. C. C.

Anthracene series; Process for making derivatives [*thio-ethers*] *of the* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 410,152, Dec. 8, 1909. Under Int. Conv., Dec. 14, 1908.

When anthraquinone derivatives containing negative substituents are heated with aliphatic mercaptans, anthraquinone thio-ethers are produced. Thus, 1-aminoanthraquinone-4-thio-ether is obtained by heating to 75° C. for six hours, in an autoclave, a mixture of 10 kilos. of 1-amino-4-chloroanthraquinone, 3 kilos. of ethyl mercaptan, 2 kilos. of sodium, and 100 kilos. of alcohol; the thio-ether separates on cooling. The sulphonic acids of these thio-ethers dye wool yellow and red shades from acid baths.
—T. F. B.

Vat [*thioindigo*] *dye and process of making.* A. Schmidt and E. Bryk, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 959,617, May 31, 1910.

o-o-Diaminothioindigo and its dihalogen derivatives are obtained by reducing the corresponding dinitrothioindigo or *o-o*-dinitro-*p-p*-dihalogenthioindigos. On treatment with alkaline reducing agents, such as hydrosulphites, the products yield vats from which wool and cotton are dyed dark blue to black shades.—T. F. B.

Dyestuffs obtained by the treatment of heather. X. F. Debedat. Fr. Pat. 410,559, "Nov. 25, 1910."

When heather is extracted with alkaline water and the solution either evaporated to dryness or acidified, a dyestuff is obtained to which the name "Heather carmine" is given. The mother liquors from the latter mode of isolation contain a dyestuff giving orange rose shades. According to the part of the plant extracted, the dyestuff obtained varies in shade from brown to rose and purple. It may be applied to wool, silk or cotton by the aid of a mordant such as alum, and may also be used for the preparation of paints.—J. C. C.

Monoazo dyestuff; Yellow —— *and its manufacture.* Akt.-Ges. f. Anilinfabr. Fr. Pat. 410,639, Dec. 20, 1909.

The dyestuff obtained by combining diazotised *p*-chloroaniline-*m*-sulphonic acid with 1-phenyl-3-methyl-5-pyrazolone in alkaline solution dyes wool from an acid bath in deep yellow shades which are very fast to light.—J. C. C.

[*Diphenylnaphthylmethane*] *dyestuffs; Manufacture of* ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,311, June 18, 1909.

See Ger. Pat. 216,305 and Fr. Pat. 404,800; this J., 1909, 1309, and 1910, 207.—T. F. B.

Dyes of the anthracene series; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 15,848, July 7, 1909.

See Addition of July 13, 1909, to Fr. Pat. 400,653 of 1909; this J., 1910, 412.—T. F. B.

Anthraquinone dye; Gray ——. W. Mieg, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 960,182, May 31, 1910.

See Ger. Pat. 213,501 of 1908; this J., 1909, 1082.—T. F. B.

Vat [*thioindigo*] *dyestuffs; Process of making* ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 28,170, Dec. 2, 1909. Under Int. Conv., Dec. 24, 1908. Addition to Eng. Pat. 16,584, July 19, 1907.

See Addition of Nov. 15, 1909, to Fr. Pat. 390,484 of 1907 this J., 1910, 687.—T. F. B.

Vat [*indigo*] *dye and process of making same; Green* ——. H. Kraft, Assignor to Soc. of Chem. Industry in Basle, Switzerland. U.S. Pat. 960,098, May 31, 1910.

See Ger. Pat. 210,828 of 1908; this J., 1909, 790.—T. F. B.

Sulphur [sulphide] dye and process of making same ; Brown ——. G. List, Offenbach on Maine. Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 960,652, June 7, 1910.

See Eng. Pat. 2627 of 1910 ; this J., 1910, 412.—T. F. B.

Sulphide colours and process of making same ; Blue ——. R. Herz and E. Saul, Frankfort on Maine, Assignors to Cassella Color Co., New York. U.S. Pat. 960,919, June 7, 1910.

See Eng. Pat. 17 352 of 1908 ; this J., 1909, 650.—T. F. B.

Anthraquinone-acridones and anthraquinone-di-acridones. F. Ullmann. Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pats. 961,047 and 961,048, June 7, 1910.

See Eng. Pat. 12,653 of 1909 ; this J., 1910, 267.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Alcohol from sulphite-cellulose waste lyes ; Production of —— *in Skutskär, Sweden.* G. Ekström. Papierfabrikant, 1910, 8, 582.

An experimental plant for the production of alcohol from sulphite-cellulose waste lyes at Skutskär, Sweden, began operations on May 24, 1909, the waste lyes from a cellulose works of 5000 tons capacity being treated. In March, 1910, 2130 litres of spirit of "normal strength" were produced per 24 hours (total for the month, 49,027 litres). In April the production was 2120 litres per 24 hours (total, 50,980 litres). In consequence of the favourable results, the plant is now being extended to deal with the waste lyes from the whole production of the Skutskär cellulose works (20,000 tons per annum). —A. S.

Celluloid ; Fire-risks with ——. A. Panzer. Z. angew. Chem., 1910, **23**, 1080.

Allusion is made to the flameless decomposition of celluloid (this J., 1909, 1061), which when once started in any part of the mass continues as an exothermic process. The products formed in the flameless decomposition consist of a heavy white smoke and an oily and carbonaceous residue. The heavy smoke contains combustible gases which form explosive mixtures with air, and are the cause of the dreaded explosive flame (*stichflamme*) in fires. It is this which prevents the fire brigade from entering a room where the flameless decomposition is taking place, and compels it to restrict its activity to extinguishing surrounding objects set on fire by the flame. The oily product consists in the main, of camphor nitrate—a fact which shows that the camphor constituent of the celluloid remains intact in the flameless decomposition. The carbonaceous residue must be regarded as a decomposition product of the nitrocellulose of the celluloid. Celluloid dust is not explosive even in oxygen, and the specific phenomena of the burning of celluloid must be attributed to its flameless decomposition.—C. A. M.

Production of alcohol from henequen bagasse in Yucatan. *See* XVIII.

Nitration of cotton and contribution to knowledge of cellulose. Piest. *See* XXII.

Patents.

Artificial silk ; Manufacture of ——. H. Bernstein, Philadelphia. U.S. Pat. 960,791, June 7, 1910.

Cellulose filaments which have been formed by coagulating cuprammonium cellulose solutions by means of acid, are wound on cylinders which are rotated in baths of water warmed to 25°—50° C., with or without applying pressure, and then washed with cold water to remove the traces of solvent. The process may be carried out by treating the rotating cylinders with "a vapour or fine spray of water at 25°—50° C., under pressure."—T. F. B.

Artificial silk [from collodion] ; Machine for spinning ——. L. Morane. Fr. Pat. 410,267, Oct. 28, 1909.

In the apparatus claimed, the spinning nozzles are arranged in two rows in partly rectilinear chambers, the number of nozzles in each chamber being the same as the number of filaments to be wound together on a bobbin to form the thread. Each chamber may be pivoted at one end so that the nozzles can be brought close to the workman for repairs, etc. The collodion enters the chamber through a filter at the pivoted end, the supply being regulated exactly by means of a suitable valve. To assist in the regulation a portion of the supply tube for the collodion is formed of a piece of thick glass tubing, and immediately in front of this glass tube, drops of coloured collodion are injected into the main supply of collodion, a colour being used which is destroyed by the bath subsequently used for treating the threads.—A. S.

Artificial silk ; Process of making ——. Soc. Anon. "Le Crinoïd." Fr. Pat. 410,827, Dec. 30, 1909.

The addition of formaldehyde to the solutions of sodium hydroxide or carbonate used to coagulate cuprammonium cellulose solutions, is said to produce a more powerful coagulation, to form stronger threads, and to facilitate the recovery of copper from the spent baths. The most suitable additions for concentrated alkaline baths, to be used at 30°—45° C., are from 1·5 to 5 per cent. of 40 per cent. formaldehyde.—T. F. B.

Volatile substances ; Recovery of —— *from the atmosphere in [artificial silk, smokeless powder, etc.] factories.* A. Collard. Fr. Pat. 410,555, Dec. 18, 1909. Under Int. Conv., Dec. 21, 1908, Mar. 3 and 11, 1909.

The patent relates to apparatus for the recovery of ether, acetone, alcohol and similar vapours, by bringing the air into intimate contact with a suitable absorbing liquid. In one form, the apparatus comprises a scrubbing column and a gas-washer ; the absorbing liquid is sprayed with the air into the lower part of the scrubbing column, a supply of pure absorbing liquid is admitted at the top of the column, and a third supply of pure liquid is admitted to the washer. Distilling, rectifying and condensing apparatus are also provided for separating the ether, acetone, etc. from the absorbing liquid.—A. T. L.

Cellulosic materials of all kinds ; Process which gives to —— *the properties of cotton cellulose.* C. Schwalbe. Fr. Pat. 410,460, Dec. 21, 1909.

The cellulose of wood, straw, hemp, jute, esparto, bamboo, etc., is said to be converted into a product possessing the chemical and physical properties of cotton cellulose, by treating it with gaseous oxides of nitrogen, or with solutions of nitrous acid, nitric acid, perchloric acid, hydrogen peroxide, sodium peroxide, or other oxidising agent, which treatment is followed by digestion with an alkaline solution when the oxidising agent does not generate sufficient alkali for the purpose. The oxidising agents are preferably employed in 0·5 to 1 per cent. solutions. The products obtained may be used for the manufacture of high-class writing and absorbent papers, artificial silk, nitrocellulose, etc.—T. F. B.

Pyroxylin [nitrocellulose] ; Recovery of the nitrogen and sulphur compounds from the sulphydrate solutions used to denitrate ——. Soc. Anon. Hongroise pour la Fabr. de la Soie de Chardonnet. Fr. Pat. 410,652, March 18, 1909.

The solutions of alkali or alkaline-earth sulphydrate which have been used for the denitration of nitrocellulose, and which contain sulphides and nitrites, are added to excess of mineral acid (*e.g.*, the acid which has been used for the nitration) ; the hydrogen sulphide and the nitrous anhydride thus evolved interact, sulphur being precipitated and nitric oxide set free.—T. F. B.

Cellulose; Purified hydrated —— and method of manufacturing it. A. Pellerin. Fr. Pat. 410,776, Dec. 28, 1909.

A PURE hydrated cellulose, suitable for the production of artificial silk, films, explosives, etc., is obtained by forcing a solution of cellulose xanthate (prepared from wood pulp, cotton, rags, etc.), through a filtering tissue or through numerous capillary openings into a precipitating bath and then passing the filamentous coagulum in succession through different washing and purifying baths. —A. S.

Hydrated basic copper salt, intended specially for the solution of cellulose; Manufacture of a ——. P. Friedrich. Fr. Pat. 410,882, Dec. 10, 1909. Under Int. Conv., Dec. 15, 1908.

IN the precipitation of copper as hydrated oxide, a certain amount of alkali carbonate is introduced; this gives a product, by means of which the solution of cellulose can be readily effected with very little ammonia. For example, to 370 grms. of powdered crystallised copper sulphate, dissolved in two litres of water, are added, 130 c.c. of sodium hydroxide solution (40° B.), diluted with 1500 c.c. of water; 25 grms. of sodium bicarbonate, dissolved in water, are next introduced and then a further 45 c.c. of sodium hydroxide (undiluted). The precipitate is mixed with 200 grms. of finely divided cellulose, and the mixture, pressed as dry as possible, is worked into a homogeneous pulp with 600 c.c. of ammonia (sp. gr. 0·888). On adding 48 c.c. of sodium hydroxide solution the whole immediately dissolves, forming a viscous solution, very suitable for the manufacture of artificial silk, etc.—F. SODN.

Foil; Artificial ——. Soc. Anon. des Celluloses Planchon. Fr. Pat. 410,721, Mar. 19, 1909.

ARTIFICIAL hair prepared by any process is converted into foil by passing between rollers such as are used in the preparation of metal foil.—A. S.

By-products [from wood, etc.]; Means for recovering ——. P. M. Hamlin, Pittston, Pa., Assignor to C. H. Unverzagt, New York. U.S. Pat. 960,542, June 7, 1910.

THE invention relates to the recovery of by-products in the manufacture of wood pulp. The wood, in the form of chips, is treated with steam in a digester provided with a valve operated so as to maintain a sufficient steam pressure for the digestion of the wood fibre. At a certain period a limited portion of the steam, carrying with it the volatilised by-products, is discharged through the valve, and passed in succession through (1) a tubular heater maintained at a higher temperature than the digester, (2) an air-cooled condenser provided with perforated baffle-plates, in which the resins and heavier oils are condensed, and (3) a tubular water-cooled condenser in which the lighter products are separated. In the last condenser, the cooling water passes through and the vapours around, the tubes, so that the condensed products cannot clog the tubes.—A. S.

Paper pulp and half-stuff; Process for the manufacture of —— from sphagnums. P. Egoroff and A. Remmer. Fr. Pat. 410,835, Sept. 20, 1909.

PEAT moss composed mainly or entirely of *Sphagnum cymbifolium*, is dried, freed from foreign substances, beaten by hand and, preferably after mixing with one-fourth of its weight of flax (*Linum usitatissimum*), or "Typha," digested for 3—5 hours under a pressure of 8—9 atmospheres. It is then treated in a beating engine in the usual manner, washed, and transferred to the paper-making machine. The flax is mixed with 10—15 per cent. of calcium bisulphite and 15—20 per cent. of lime, treated with steam and water, and then freed from its ligneous stem, before being added to the sphagnum pulp.—A. S.

Celluloid-like mass; Process for preparing a ——. J. Stocker and F. Lehmann. Ger. Pat. 222,319, June 22, 1907. Addition to Ger. Pat. 202,133, May 14, 1907 (see this J., 1908, 1174).

PRODUCTS resembling celluloid are obtained by heating together agar-agar or similar gelatinous substance, casein, a wax, and castor oil or poppy-seed oil. The agar-agar is dissolved in water, an alkaline solution of casein is added, the greater part of the water is evaporated, and the other components are incorporated with the hot mixture. —T. F. B.

Esters of hydrolysed cellulose, soluble in water; Process for preparing —— C. Claessen. Ger. Pat. 222,450 July 8, 1908.

CELLULOSE is converted into esters which are soluble in water, dilute alcohol, dilute acetone, and glycerin, but insoluble in pure alcohol or acetone, ether, and benzene, by treatment with anhydrides of fatty acids at temperatures of 70°—80° C., in presence of acid sulphate of pyridine or its homologues, or quinoline sulphate. If the esterification is carried out in presence of a suitable solvent, such as glacial acetic acid, the ester is obtained in the form of a clear, viscous solution, from which it may be precipitated by means of alkalis or ammonia. For example, 2·5 grms. of cellulose, 15 grms. of glacial acetic acid, 12 grms. of propionic anhydride, and 4 grms. of acid pyridine sulphate are heated at 70° C. for four days; the product is a clear, viscous mass. The aqueous solutions of this ester are liquid when warm, and gelatinise on cooling. Sulphates of aniline and bases other than pyridine also act as "contact substances," but do not give soluble esters.—T. F. B.

Size for papermakers. Composition for treating paper. A. W. Harrington, Brooklyn, Assignor to the A. W. Harrington Co., New York. U.S. Pats. 960,318 and 960,319, June 7, 1910.

SEE Eng. Pat. 9652 of 1908; this J., 1909, 671.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Cotton cloth; A peculiar cause of damage in ——, during bleaching. F. Ulzer and F. Ziffer. Mitt. K. K. Techn. Gewerbe-Museums, 1910, **20**, 19—20.

IT is difficult to ensure that no lubricating oil shall come into contact with pieces during weaving, and to avoid subsequent trouble in the bleaching, the manufacturer of the goods in question employed nothing but a saponifiable oil as lubricant. This oil had a rather high acid value, and during the bleaching, damaged places appeared at intervals in the weft, coinciding with the parts which it was evident had been contaminated with oil. The presence of oxycellulose and of copper was proved in the fibres surrounding the damaged places. The oil had dissolved some metal from the brass parts of the loom and during bowking, the copper soap thus produced had been converted into copper oxide; this had acted as a catalytic agent in the bleaching bath, causing an excessive local evolution of oxygen. That this was the cause of the tendering was proved by the results of parallel trials, and it is evident that for loom lubrication, only such oils should be used as tend to remain practically neutral.—F. M.

Thickenings for printing-colours from a colloid-chemical standpoint. E. Justin-Müller. Chem.-Zeit., 1910, **34**, 598—599.

THE thickenings used in printing are to be regarded as colloidal solutions, which may be divided into three classes:—(1). Those colloidal solutions which appear quite clear and, when sufficiently dilute, pass through a Schleicher and Schull filter paper, are classed as homogeneous. Thickenings prepared with gum arabic and the better qualities of Senegal gum belong to this class. They print well, without clogging the printing roller, show good penetration, and can be readily washed out. (2). Solutions composed of at least two phases, a "sol" or homogeneous solution, and a "gel" or gelatinous phase, and sometimes containing also uncombined water, are termed heterogeneous or disperse colloidal solutions: they may be irreversible (i.e., permanently heterogeneous) or reversible, that is, capable of becoming homogeneous under certain conditions. The chief member of this class is gum tragacanth thickening. A 10 per cent. solution of this gum which has been boiled for 24 hours, can be separated into its two phases, a clear solution and a residual gel, by filtration. The good qualities of the tragacanth thickening are due to its homogeneous phase, but it does not penetrate so well as thickenings of the first class, owing to the gel phase being partly retained on the surface of the material and sometimes clogging the printing roller. (3). In the third class the author places "micella-sols" or colloidal solutions which are entirely retained by a Schleicher and Schull filter paper. Starch paste is a typical member of this class. Even a 1 per cent. freshly-prepared solution of wheat starch, although clear and capable of passing through a filter whilst boiling, becomes turbid so soon as the temperature falls somewhat, and is then retained by the filter. Thickenings belonging to this class, although strictly speaking heterogeneous, may in practice be considered homogeneous, owing to the extremely fine state of distribution of the micellæ or ultramicrons throughout the medium. They are retained on the surface of the material to a greater extent than those of classes 1 and 2, and hence yield more intense colours, but they do not wash out well, especially after drying. In acid starch thickenings, the effect of the acetic acid is to increase the fineness of division and distribution of the micellæ, and on prolonged boiling even to convert a small portion of the starch into a soluble homogeneous phase. Thickenings prepared with roasted (modified starches) and artificial gums (British gum, etc.) are intermediate between classes 1 and 2 or 2 or 3, according to their quality or conditions of preparation. In presence of caustic soda, they can be converted into homogeneous collodial solutions.—A. S.

Patents.

Stannic chloride solutions [for silk dyeing works]; Process of regenerating ——. J. Weber, Essen-on-the-Ruhr, Germany. U.S. Pat. 958,986, May 24, 1910.

Solutions of stannic chloride, which have been used in silk dyeing, are purified by the addition of sulphuric acid in sufficient quantity to precipitate any calcium or lead which may be present, and anhydrous stannic chloride is then added to concentrate the solution.—F. Sodn.

Sulphide colours [in dyeing, etc.]; Process of fixing ——. L. Lichtenstein, Königinhof-on-Elbe, Austria-Hungary. U.S. Pat. 960,975, June 7, 1910.

The fibres to be dyed or printed are impregnated with a solution of an animal colloid, and this is precipitated on the fibre, which is then dyed or printed with a sulphide dyestuff. The last two processes may be combined by adding the colloid-precipitant to the dye-bath or printing paste.—T. F. B.

Dyeing textile yarns; Apparatus for ——. F. H. Daniell and J. C. Hebden. Fr. Pat. 410,551, Nov. 4, 1909. Under Int. Conv., July 28, 1909.

The dye-vat is divided into upper and lower compartments by a perforated false-bottom. The cops or balls of yarn, wound on compressible bobbins (see Fr. Pats. 408,400 and 408,480; this J., 1910, 623), are arranged on supports so that the axial openings of the tubes register with the perforations of the false bottom. In the upper part of the dye-vat is a movable plate supported from a screwed spindle so that it can be forced down, compressing the bobbins or holding them in place if they have been compressed before being placed in the vat. The bobbins are compressed until the yarn shows uniform density throughout. The dye-liquor is forced by means of a pump through a heating chamber into the lower compartment of the dye-vat, through the compressed yarn into the upper compartment, and thence back to the heating chamber. (See also U.S. Pat. 942,166 and Fr. Pat. 408,424; this J., 1910, 209, 623.)—A. S.

Dyeing by pulverisation; Apparatus for ——. L. Mascelli. Fr. Pat. 410,743, Dec. 28, 1909.

The machine is specially suitable for dyeing leather. The material to be dyed is carried by an endless belt below a lever which sets in action the device for forcing the atomised liquor (mordant, dye-liquor, etc.) through a jet on to the travelling material. The latter then passes below rotating brushes. Several series of levers, spraying nozzles and brushes may be arranged in succession, so that mordanting, dyeing, etc., may be performed in the one apparatus.—A. S.

Dyeing apparatuses. Textil-Maschinenfabrik B. Cohnen, Grevenbroich, Germany. Eng. Pat. 25,222, Nov. 2, 1909. Under Int. Conv., Nov. 2, 1908

See Fr. Pat. 408,488 of 1909; this J., 1910, 623.—T. F. B.

Aniline black on fibres and fabrics; Production of ——. A. G. Green, Leeds. U.S. Pat. 959,516, May 31, 1910.

See Fr. Pat. 386,381 of 1908; this J., 1908, 683.—T. F. B.

Dye-vats; Apparatus for charging ——. B. Mayoux and C. Verchère, Izieux, Assignors to C. Corron, St. Chamond, France. U.S. Pat. 960,662, June 7, 1910.

See Eng. Pat. 3114 of 1907; this J., 1908, 278.—T. F. B.

Silk-like effects; Compound for producing ——. L. Lilienfeld, Vienna. U.S. Pat. 960,100, May 31, 1910.

See Eng. Pat. 2998 of 1907; this J., 1908, 279.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Abraham's hypothesis [of the circulation in sulphuric acid chambers]. H. Rabe. Z. angew. Chem., 1910, 23. 1115—1117.

Replying to Meyer's criticism of his former communication (this J., 1910, 149), the author points out that Porter's experiments (this J., 1903, 476), have little or no bearing on the likelihood of the motion of the gases in the chambers being in reality in accordance with Abraham's supposition, since the gases used by Porter did not react with evolution of heat, as do the gases in the chambers. The sulphuric acid spray recommended by the author helps the circulation, both mechanically and through its influence on the temperature of the gases; and it is of advantage, from both these points of view, in tangential as well as in rectangular chambers.—J. T. D.

Phosphoric acids; Transformation of ortho-, pyro-, and meta- —— *into each other by heating.* D. Balareff. Z. anorg. Chem., 1910, 67, 234—241.

Orthophosphoric acid at low temperatures appears to exist in double molecules and its dehydration gives first pyrophosphoric acid: $(H_3PO_4)_2 \leftrightarrows H_4P_2O_7 + H_2O$, and then metaphosphoric acid: $H_4P_2O_7 \rightleftarrows 2HPO_3 + H_2O$. As would be expected from these equations, the temperature of transformation rises when the vapour pressure of water in the surrounding atmosphere rises, the increase in the water concentration moving the equilibrium towards the left. Since rise in temperature also assists the transformations: $(H_3PO_4)_2 \rightleftarrows 2H_3PO_4 \rightleftarrows 2HPO_3 + 2H_2O$, it is to be expected that the temperature of formation of pyrophosphoric acid will rise more rapidly than that of metaphosphoric acid. This is found by experiment to be the case, although owing to the volatility of metaphosphoric acid the experiments could not be carried on at temperatures where the two steps would disappear and orthophosphoric would be converted directly into metaphosphoric acid, without forming the intermediate pyrophosphoric acid at all.—W. H. P.

Nitric acid ; Electrolytic reduction of ——. H. E. Patten and W. J. McCaughey. Amer. Electrochem. Soc., May, 1910. Met. and Chem. Eng., 1910, **8**, 348.

FURTHER experiments made with a view to elucidate the course of the electrolytic reduction of nitric acid (see this J., 1908, 575), showed that hydroxylamine can be reduced electrolytically to ammonia at a copper cathode in presence of copper sulphate, sulphuric acid, and hydrochloric acid. Nitrogen is liberated at a fairly constant rate at the anode, whilst at the cathode it is set free rapidly at first, but less quickly later. The amount of nitrogen produced in the early stages of the process at the cathode is such as to indicate that hydrazine is first formed and then subsequently oxidised by hydroxylamine, with production of nitrogen. The initial rapid evolution of nitrogen can also be observed in the electrolytic reduction of nitrate under similar conditions, and indicates that the hydroxylamine formed by the reduction of the nitrate, also may be educed to hydrazine.—A. S.

Hydrocyanic acid ; Quantitative colorimetric determination of small amounts of ——. E. Berl and M. Delpy. Ber., 1910, **43**, 1430—1431.

QUANTITIES of 4 to 0·04 mgrm. of hydrocyanic acid n 1 c.c. of liquid can be estimated colorimetrically within 5 per cent. by the following method. The solution is endered alkaline by 1 : 1 potassium hydroxide solution, voiding great excess. An oxidised solution (1 : 30) of errous sulphate is now added, so that at least 2 mols. of errous sulphate are present for each molecule of hydroyanic acid ; the liquid is allowed to remain at the ordinary emperature for 10 minutes, with frequent shaking, hen boiled for 2–15 minutes according to the amount f hydrocyanic acid, allowed to cool, and made acid with 0 per cent. hydrochloric acid. After 5 hours, if the liquid s not coloured, it is made up to 100 c.c., well shaken, nd the tint of the mixture compared with those of similarly nade mixtures containing known amounts of hydrocyanic cid ; if the liquid is coloured, it is carefully poured off rom the settled Prussian blue precipitate, and distilled ater added to take its place. The comparison tubes an be kept for several weeks without change of tint. f the solution be too dilute to show a colour in this way, can be shaken out with ether after acidifying, and the ther shaken with a small quantity of alkali ; the con entration of the cyanide is thus increased.—J. T. D.

odium nitrate statistics ; Shipments, consumption, stocks, and prices from 1908 *to* 1910. W. Montgomery and Co., London. June 30, 1910. [T.R.]

Sodium chloride ; Electrolytic decomposition of ——. J. Billiter. Z. angew. Chem., 1910, 23, 1072—1073.

A HIGH degree of utilisation of the current increases the life of the carbon, which usually forms the anode material Thus when about 90 per cent. of the current theoretically available is utilised, a further increase of 2 to 3 per cent. may double the life of the carbons. In addition to carbon (artificial graphite) only platinum and iron oxide need at present be considered as anode materials. The former, owing to its high price, can only be used where a high current density is available at a cheap rate. The supertension (*Ueberspannung*) with iron oxide electrodes is considerably greater even than with platinum, but the price permits of the use of larger electrodes. The use of these electrodes, however, is restricted to currents of low intensity, and is only specially advantageous in cases where cells are used which in consequence of the lower utilisation of the current would rapidly destroy the carbon anodes. The following means of obtaining a higher utilisation of current are available :—(1) Mechanical separation of the space between the anode and cathode ; (2) Preparation of dilute cathode lyes ; (3) Maintaining a high concentration of chloride (especially in the vicinity of the anode) ; (4) Increasing the temperature of the bath ; (5) Rapid removal of the cathode products ; (6) Restriction of the accumulation of the OH-ions in the direction of the anode by a corresponding movement of the whole electrolyte in the opposite direction ; (7) Formation of amalgam as the primary cathode product. In the Griesheim-Elektron method the conditions 1 to 4 are observed ; in that of Hargreaves and Bird, the conditions 3 to 6 ; in the bell method, conditions 1 to 3 and 6 ; in Billiter's first method, conditions 1 and 3 to 6 ; in Billiter's second method, conditions 1, 3, 4, and 6 ; and in the mercury method of Castner and Kellner, condition 7. Except in the case of 6, non-porous diaphragms may be used. These have a long life, but have a relatively high resistance, so that only dilute lyes (about 1- to 1·5-*N*) can be obtained with a fair utilisation (82 to 84 per cent.) of current. Porous diaphragms of asbestos or asbestos composition permit of the application of condition 6, with a consequent considerable increase in the utilisation of current, but they only last for a relatively short time (1 to 3 months) when used in the vertical position, owing to their being splashed on one side by the acid liquid in the anode compartment (anolyte). If horizontal diaphragms are used the acid layer may be kept off and the life of the diaphragms very greatly prolonged. Such cells, however, naturally require much more space. In the bell method no diaphragm is used. The cells are of the simplest construction, but have extremely low current capacity, so that many thousands are required in a plant of average size. Billiter has recently constructed cells without diaphragms which have a high current capacity and automatic feeding arrangement, so that they require little or no attention. The mercury method gives excellent results, yielding concentrated lyes free from chloride, with a high utilisation of current. The plant, however, is expensive and, requiring

					1908.	1909.	1910.
hipments from South American Ports to all parts for the six months ending 30th June	Tons				964,000	767,000	956,000
Ditto do. for the twelve months ending 30th June	,,				1,852,000	1,819,000	2,289,000
float for Europe on 30th June	,,				355,000	220,000	272,000
tocks in U.K. Ports :—		1908.	1909.	1910.			
Liverpool	Tons	5,600	6,000	6,500	17,000	13,000	19,000
London	,,	3,200	1,400	2,100			
Out Ports	,,	8,200	5,600	10,400			
tocks in Continental Ports on 30th June	Tons				75,000	172,000	122,000
onsumption in U.K. for the six months ending 30th June	,,				62,000	70,000	77,000
Do. in Continent do. do.	,,				963,000	995,000	1,171,000
Do. in U.K. for the 12 months do.	,,				99,000	111,000	118,000
Do. in Continent do. do.	,,				1 233,000	1,307,000	1,530,000
Do. in United States do. do.	,,				315,000	358,000	516,000
Do. in other Countries do. do.	,,				55,000	46,000	78,000
Do. in the World do. do.	,,				1,702,000	1,822,000	2,242,000
sible supply on 30th June (including the quantity afloat for Europe and Stocks in U.K. and Continent)	,,				447,000	405,000	413,000

a minimum tension of 4·5 volts, needs a cheap source of power.—C. A. M.

Alkali chloride electrolysis; New mercury cell for ——. J. Whiting. Amer. Electrochem. Soc., May, 1910. Met. and Chem. Eng., 1910, **8**, 350—354.

THE chief difficulty in the successful use of mercury cells for the electrolysis of alkali chlorides is that of removing the sodium amalgam uniformly and continuously from the electrolytic chamber. The cell devised by the author (see U.S. Pat. 877,537 of 1908; this J., 1908, 232) consists of a shallow concrete box divided into two compartments by a concrete partition. The bottom of the larger or decomposing compartment is divided by low glass partitions into sections having V-shaped bottoms sloping slightly towards median slots, the latter extending through the concrete partition into the smaller or oxidising compartment, where they turn upward and are closed by poppet-valves. The other ends of the slots communicate with a common channel or distributing level, which is connected by means of another channel extending through one of the side walls of the cell, with a stoneware rotary pump at one end of the oxidising chamber. The floor of the decomposing chamber is covered with mercury, which is maintained at a common level by means of the distributing level. The current flows through perforated Acheson graphite anodes disposed in the sections of the decomposing compartment, then through the brine covering the mercury and the mercury itself to iron rods partly embedded in the concrete floor. After about two minutes, one of the poppet valves is opened by the action of a cam, and the whole of the sodium amalgam contained in the corresponding section of the decomposing compartment flows into the oxidising chamber, after which the valve closes. The empty section fills again with mercury from the distributing level. Each cell is emptied and re-filled in turn, so that the working is practically continuous. The chlorine evolved at the anodes has a purity of 98 per cent. In the oxidising chamber, the sodium amalgam flows in a zigzag path over graphite plates covered with water or caustic soda solution, pure mercury flowing into a pit at the bottom, from which it is returned to the distributing level by means of the rotary pump. A galvanic couple is formed between the graphite and the sodium amalgam, leading to decomposition of the latter. In order to maintain effective contact between the graphite and the amalgam, holes of $\frac{1}{4}$-in. diameter and $\frac{1}{2}$-in. deep, are bored at frequent intervals in the graphite slabs and are filled with pure mercury before electrolysis is commenced. For the supply of brine to the cell, cup-shaped receptacles equal in number to the sections of the decomposing compartment, are formed in the concrete cover of the cell. From the bottom of each cup a glass tube extends downwards between the anodes to below the surface of the mercury. The brine is supplied to one of the cups, overflows into a common channel, and fills each cup in turn. When the sodium amalgam flows out of a section, the glass tube becomes unsealed, and a definite quantity of brine flows in.

An installation of these cells, with a capacity of bleach liquor, equal to 5 tons of bleaching powder per day and in addition, 2 tons of pure caustic soda, has been in use since January at the works of the Oxford Paper Co., Rumford, Me., U.S.A. Each cell is about 6 ft. square, and contains five sections. It is operated with a current of 1200—1400 ampères (100 ampères per sq. ft. of active anode surface. The voltage across the terminals is about 4, and the current efficiency is 90—95 per cent. Special advantages claimed for the cell are accessibility, simplicity, and capability of being shut down and restarted without notable loss of efficiency.—A. S.

Magnesium chloride and oxygen; Reversible reaction between ——. W. Hirschkind. Z. anorg. Chem., 1910, **67**, 113—148.

IN the reaction, $MgCl_2+\frac{1}{2}O_2 = MgO+Cl_2$, the equilibrium constant is

$$K_p = \frac{p_{Cl_2}}{\sqrt{p_{O_2}}} = \frac{Cl_2}{O_2}\sqrt{p_{O_2}}.$$

where p is the partial pressure in atmospheres. By passing a gas mixture containing a large excess of oxygen over magnesium chloride or a 50 per cent. mixture of oxide and chloride, the author obtained values for K_p in the issuing gas agreeing with those of Moldenhauer (this J., 1907, 46), *e.g.*, K_p at 665° C. = 2·59. Extension of the observations however showed that this value could not be obtained by starting with an excess of chlorine. By the same method it was found that another value, 3·18 at 665° C., is obtained when the original gas is pure or nearly pure chlorine, and also when the original gas contains only a very slight excess of oxygen over the equilibrium value. By a statical method (heating the oxide or chloride in a vessel containing a mixture of the gases and noting the change in composition) the value 2·97 was obtained from both sides, which agrees fairly well with the 3·18 in the dynamical method. The magnitude of the constant and its temperature coefficient correspond with a heat of reaction of about 6000 cals. at constant pressure, which does not agree very well with the usually accepted value of 7700 cals. In some experiments evidence was found of chlorine becoming adsorbed by the magnesium oxide without liberating the oxygen which would be produced if reaction took place. It was also found that when the same solid was used for a long time, the value of K_p at a fixed temperature fell considerably. This is probably due to a slow reaction between solid magnesium chloride and magnesium oxide with formation of oxychloride.—W. H. P.

Zinc oxychlorides. Driot. Comptes rend., 1910, **150**, 1426—1428.

BY the action of zinc oxide on zinc chloride solutions, two oxychlorides were obtained: $ZnCl_2,4ZnO,6H_2O$ and $ZnCl_2,ZnO,1{\cdot}5H_2O$. The first is a white amorphous body, which loses 5 mols. of water at 200 C., but the last mol. is only driven off at a high temperature together with hydrochloric acid and zinc chloride. The second oxychloride is a microscopically crystalline body, losing 1 mol. of water at 230° C., and the remainder at a very high temperature, hydrochloric acid being also given off. To prepare these bodies in a pure state, it is necessary to leave the precipitated zinc oxide in contact with the solution of zinc chloride for several months, removing the solid mass from time to time to pulverise it, or the oxide can be dissolved by warming the solution and allowing it to precipitate again on cooling. Both were dried by suction, and then by pressing first between porous plates and finally for several days between filter paper. The constitution of these oxychlorides does not vary with alterations in the temperature. With the exception of the first of these bodies, which has been previously discovered, no indications were obtained of the eight oxychlorides found by previous experimenters.—A. SELD.

Tartar products; Analysis of ——. Methods adopted by the Seventh Inter. Cong. Appl. Chem., London, 1909. P. Carles. Ann. Chim. analyt., 1910, **15**, 231—232.

THE crude tartrate should be carefully sampled, ground, and passed through a sieve having a mesh of 0·5 mm. *Determination of the bitartrate.*—A weighed portion of 2·35 grms. of the sample is boiled for 5 minutes with 400 c.c. of water in a 500 c.c. flask, then cooled, diluted to the mark, mixed and filtered; 250 c.c. of the filtrate are heated to boiling and titrated with *N*/4 potassium hydroxide solution, using litmus paper as indicator. The potassium hydroxide solution is standardised under the same conditions with pure potassium bitartrate. *Determination of total tartaric acid.*—In cases of tartrates containing upwards of 45 per cent. of total tartaric acid, 6 grms. of the sample are taken for the determination; where the tartaric acid falls below 45 per cent., 12 grms. of the sample are used, this quantity being also taken for the analysis of calcium tartrates. The weighed portion of the sample is thoroughly mixed with 18 c.c. of hydrochloric acid of sp. gr. 1·10; after the lapse of 15 minutes, the mixture is rinsed into a 200 c.c. flask with water and diluted to the mark. The solution is then poured through a filter. 100 c.c. of the filtrate are heated to boiling and 10 c.c. of 66 per cent. potassium carbonate solution are added slowly. The mixture is heated for about 20 minutes and the liquid together with the precipitate is transferred to a 200 c.c. flask, cooled, and diluted to volume. After filtering, 100 c.c. of the filtrate are evaporated to a volume of 15 c.c., 3·5 c.c. of glacial acetic acid are added, drop by drop, and the mixture is stirred for 5 minutes; at the end of 10 minutes, 100 c.c. of 95 per cent. alcohol are added, the stirring is continued for 5 minutes, and, after the lapse of a further 10 minutes, the liquid portion is poured through a filter, the precipitate is washed three or four times by decantation with a little alcohol, then brought on to the filter and washed with alcohol until the washings are free from acidity. The filter, together with the precipitate is then placed in a flask, boiled with 300 c.c. of water for 1 minute, and the hot solution is titrated with *N*/4 potassium hydroxide solution, using litmus paper as indicator. The following corrections are made for the volume of the insoluble matter: for tartrates containing 20 per cent. of total tartaric acid 0·8 is deducted from the total percentage of acid found; for 30 per cent. tartrates, 0·70, and for 40 per cent. tartrates, 0·6. In the case of samples containing 50, 60, and 80 per cent. of tartaric acid, 0·25, 0·15, and 0·1 per cent. is deducted, respectively.—W. P. S.

Oxygen; Commercial ——. E. A. Le Sueur. Met. and Chem. Eng., 1910, **8**, 231—236.

An atmosphere containing 40 per cent. of oxygen and upwards, can be obtained by fractional condensation from air under moderate pressures. An apparatus constructed in 1900 comprised a heat-interchanging device for cooling compressed air, the air then expanding and driving a turbine wheel of the de Laval type. The turbine shaft drove a centrifugal pump of special construction, and by forcing the same water in a closed circuit through a throttling device, the rise in temperature was a measure of the heat abstracted from the expanding air. The mixture discharged from the turbine consisted of gases rich in nitrogen and a liquid rich in oxygen. The heat-interchanger was provided with three passages, for the compressed air, and for the liquid and gaseous portions respectively of the mixture discharged from the turbine, so that two currents of gas, one rich in nitrogen and the other rich in oxygen were obtained at the hotter end of the apparatus. The same apparatus was used for obtaining liquid air, by leading the mixture discharged from the turbine through a drum containing a coil in which air was compressed to 400 or 500 lb. per sq. in. In later experiments a reciprocating engine, exhausting at —300° F., was used in place of the turbine. With cheap power, and making 1 million cub. ft. per day, the cost of oxygen in a 40—50 per cent. atmosphere would be about 14 cents (7d.) per 1000 cub. ft.—A. T. L.

Fluorine; Laboratory apparatus for the preparation of ——. G. Gallo. Atti R. Accad. dei Lincei, Roma, 1910, [5], **19**, I., 206—212. Chem. Zentr., 1910, **1**, 1951—1952.

A small simple apparatus for the electrolytic preparation of fluorine is described. A 50 c.c. platinum crucible, which serves as cathode, is provided with a cover of sulphur, to the underside of which is fixed a cylinder of platinum, provided near the bottom with small holes, and closed below by a plate of platinum or sulphur. In its upper end, the cylinder has a plug of fused calcium fluoride to protect the sulphur cover from the action of the fluorine. A spiral platinum wire anode and a copper tube for leading off the fluorine pass through the plug of calcium fluoride, and a copper tube for the hydrogen passes through the sulphur cover. Both of the copper tubes are formed into oils, outside the crucible, and are immersed in a mixture of ice and salt. The crucible is immersed in a refrigerating iquid (methyl chloride), and 3—4 grms. of potassium louride and the desired quantity of anhydrous hydrolouric acid are introduced through a hole in the sulphur over. This hole is then closed by a plug of sulphur, the oint being made tight by fusing the sulphur at the unction. Electrolysis is effected with a current of 0 volts and 2—3 ampères. If, in the preparation of the anhydrous hydrofluoric acid, the skin should be attacked, subcutaneous injection of sterilised, 1 per cent. solution of sodium hydroxide is advisable, in order to prevent suppuration below the skin. (See also this J., 1890, 186 1899, 1019; 1900, 534; 1901, 259, 481).—A. S.

Argon and nitrogen; Purification of ——. F. Fischer and O. Hähnel. Ber., 1910, **43**, 1435—1442.

To remove from argon, prepared by the method of Fischer and Ringe (this J., 1908, 768), possible traces of air and nitrogen, the authors pass it over red-hot calcium. The apparatus for circulating the gas is practically the same as that figured in the paper just referred to, save that there is no external connection to the air, and that for the vessel containing calcium carbide there is substituted an iron tube containing metallic calcium which is heated in a combustion furnace. The portions of the iron tubes, which project from the furnaces are water jacketed, and the corks are surrounded by jackets filled with mercury, so as to preclude all possibility of entrance of air. All the glass stopcocks in the apparatus are also provided with mercury joints, both at their upper and lower extremities, and the stoppers of the gas-holders are similarly protected. The whole apparatus, other than the gas-holder containing the argon, is exhausted by the Töpler-pump, and the circulation is then set up by the automatic rise and fall of the mercury in the circulating pump and continued as long as desired. The density of the argon so purified was found to be 19·945. Nitrogen, similarly circulated over heated metallic copper, was found to have a density of 14·018. A bright glow was observable in the apparatus whilst argon was being circulated, but none during the circulation of nitrogen. —J. T. D.

Carbon monoxide; Observations on the action of heat on ——. A. Gautier. Comptes rend., 1910, **150**, 1383—1388.

Carbon monoxide was circulated through a porcelain tube heated to temperatures ranging from 820° to 1300° C., and having an inner one of glass which was cooled by a rapid current of cold water. Small quantities of moisture and carbon dioxide were formed; these are ascribed partly, at any rate, to the action of the hydrogen present in the carbon monoxide (to the extent of 0·21 per cent. after two treatments with cuprous chloride), and this action is being investigated. No trace, however, of carbon or other deposit was observed. The author concludes that carbon monoxide at a temperature of 1300° C., under ordinary pressure, in porcelain tubes, and in the absence of organic matter and metals, undergoes no appreciable dissociation, no carbon being set free.—A. Sbld.

Patents.

Formic acid; Method of making ——. H. Howard, Boston, Mass. U.S. Pat. 960,927, June 7, 1910.

A formate is mixed with sulphuric acid, the mixture being cooled, if necessary, to prevent appreciable decomposition of the formic acid, and the product is then submitted to distillation, which may be carried out under reduced pressure.—F. Sodn.

Caustic potash; Manufacture of anhydrous ——. Chem. Fab. Griesheim-Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 29,494, Dec. 16, 1909. Under Int. Conv., Mar. 26, 1909. Addition to Eng. Pat. 29,491 of 1909 (this J., 1910, 488).

Caustic potash solution is evaporated until it contains not less than 92 per cent. of potassium hydroxide, then cooled below 220° C. with constant stirring, and a suitable quantity of less concentrated caustic potash "melt," containing say about 85 per cent. of potassium hydroxide, is added to it, little by little. When the mixture has cooled down to about 140° C., it is treated in a hydro-extractor, whereupon solid potassium hydroxide of 99·5 per cent. purity is obtained.—O. R.

"Urao" [natural sodium carbonate]: Method of refining ——. N. Wrinkle and R. G. Paddock, San Francisco, Cal., Assignors to Natural Soda Products Co. U.S. Pat 959,678, May, 31, 1910.

Crude "urao" is broken into small pieces and washed with the mother liquors of a subsequent operation to remove insoluble and organic matter; the purified pieces are then dissolved in hot water, the solution is filtered and evaporated, and sodium carbonate is crystallised out of the mother liquor, which consists chiefly of sodium chloride and sulphate.—O. R.

Sodium hydroxide and sodium salts; General process of manufacture of —— by means of sodium silicate. L. P. Basset. Fr. Pat. 410,038, Mar. 4, 1909.

The process consists in decomposing a strong solution of sodium silicate by means of lime or by adding the minimum quantity of acid or acid salt necessary to give the desired salt; the product is then heated to 200° C., to render the silica insoluble, and, after lixiviating with water, the filtered solution is allowed to crystallise. For example, to prepare sodium carbonate, sodium bicarbonate (2 mols.) is intimately mixed with a solution of sodium silicate (1 mol.) of 45° B.; for sodium sulphide, a concentrated lye of sodium hydrogen sulphide is made to react with the sodium silicate; and for sodium hydroxide, slaked lime is added, calcium silicate in this case being obtained as a residue.—F. Sodn.

Borates containing active oxygen; Process for treating [preparation of stable] ——. Chem. Werke vorm. H. Byk, Charlottenburg, Germany. Eng. Pat. 475, Jan. 7, 1910. Under Int. Conv., Mar. 1, 1909.

The addition to perborates of small quantities of the bases or salts of magnesium, the alkaline-earths, or zinc, or of a silico-fluoride, is claimed to retard the evolution of oxygen, *i.e.*, to increase the stability of such perborates very considerably at 70°—80° C. In the case of magnesium and zinc salts, only a fraction of the equivalent proportion of the salts in question need be added, thus $\frac{1}{6}$th of an equivalent of magnesium sulphate added to 1 equivalent of sodium perborate at a concentration of 1 per cent., suffices to cause 98 per cent. of the active oxygen to remain in combination after 25 minutes' heating at 70°—80° C.
—O. R.

Dolomite; Process of treating [preparation of magnesia from] ——. J. J. Gathy, Mons, Belgium. Eng. Pat. 779, Jan. 11, 1910. Under Int. Conv., Jan. 12, 1909.

Finely powdered, calcined dolomite is treated with concentrated calcium chloride solution with formation of magnesia and calcium oxychloride. The latter, which is soluble in hot water, is separated from the insoluble, hydrated magnesia, and is carbonated by means of furnace gases with regeneration of calcium chloride.—O. R.

Oxalates; Manufacture of ——. Ges. für Chem. Ind. in Basel, Basle, Switzerland. Eng. Pat. 8093, April 4, 1910. Under Int. Conv., Aug. 19, 1909.

An alkali formate is introduced, little by little, into a fusion vessel (*e.g.*, an iron heating pan), previously heated to a temperature above 400° C.; at this temperature, which is maintained during the reaction, the formate is, in 15-30 minutes, converted almost quantitatively into oxalate, in the form of a light powder. 150—200 kilos. of formate per sq. m. of heating space is a suitable proportion.
—F. Sodn.

Hydrated sodium carbonate and sodium tannate; Composition of ——. W. E. Ridenour, Assignor to Franklin Chem. Works, Philadelphia, Pa. U.S. Pat. 958,893, May 24, 1910.

An amorphous composition is claimed which is made by mixing sodium carbonate (*e.g.*, soda ash), water, and a little tannin extract, the water being added gradually, with stirring, and in insufficient quantity to form a crystalline hydrated sodium carbonate. Suitable proportions for the mixture are 500 lb. of soda ash, 120—200 lb. of water, and 10—50 lb. of tannin extract in solution.—F. Sodn.

Aluminous materials; Process of purifying ——. L. E. Saunders, Niagara Falls, N.Y., Assignor to Norton Co., Worcester, Mass. U.S. Pat. 960,712, June 7, 1910.

Aluminous materials, especially those containing silicon and metals capable of alloying therewith, are fused in the presence of carbon, in excess of that required to reduce the associated impurities, so as to give aluminium carbide and, in the case specified, an alloy rich in silicon and poor in carbon; the impurities are then separated, and the molten aluminium carbide is oxidised by means of an oxidising gas, which may be blown through the bath.
—F. Sodn.

Lead oxide [litharge]; Process of transforming metallic lead into ——. Bergmann und Simons, Ges. m. b. H. and Lindgens und Söhne. Fr. Pat. 409,944, Dec. 4, 1909.

The charge of molten lead is mechanically agitated in a closed vessel in the presence of hot air and superheated steam, and being projected against a distribution plate suspended in the vessel, is reduced to an impalpable powder. Under the action of the mixture of air and superheated steam this is immediately and quantitatively converted into pure litharge, which is carried forward by the current of air into deposition chambers. By suitable regulation of the temperature of the mixture of air and steam, red litharge (at 250° to 300° C.) or yellow litharge (at 300° to 400° C.) may be obtained.—C. A. M.

Barium carbonate from barium sulphide and the simultaneous production of hydrogen sulphide to be used subsequently for the preparation of sulphurous acid; "Precipitate transformer" for the treatment of poor zinc ores, with a view to the continuous precipitation of ——. G. Dantin. Fr. Pat. 409,972, Oct. 16, 1909.

Three cylindro-conical vessels of cast aluminium, with gas-tight covers, are arranged stepwise, and a solution of barium sulphide, obtained in the treatment of poor zinc ores (see Fr. Pat. 408,062; this J., 1910, 637), is made to flow slowly into the top vessel and from this into the lower ones successively; a current of carbon dioxide, on the other hand, is made to enter the lowest vessel, slightly below the surface of the liquid, and is then aspirated, together with the hydrogen sulphide liberated in the reaction, into the higher vessels in turn, a partial vacuum being maintained; barium carbonate is thus continuously precipitated and, passing through a grating situated in the liquid, just below the gas delivery pipe, is deposited at the bottom of the vessel, from which, on turning a tap, it passes into an inclined pipe through and is conveyed to a decanting vessel.—F. Sodn.

Cuprous chloride and copper oxychloride; Manufacture of ——. Soc. Anon. des Etablissements Eycken et Leroy. Fr. Pat. 410,137, Dec. 8, 1909.

The method is based on the fact that when copper is treated with hydrochloric acid, in the presence of air and a small quantity of iron, ferric chloride is alternately formed and reduced to ferrous chloride by the copper, which is converted into cuprous chloride. When cement copper is employed, the iron normally present is sufficient to bring about the reaction; the copper and acid are introduced into a shallow vessel furnished with a stirrer; for 1000 kilos. of copper, containing 1 per cent. of iron and 85 per cent. of copper, 3200 kilos. of hydrochloric acid (20° B.) are required, and the mixture is stirred until all the copper is converted into cuprous chloride, which is filtered off. Pure cuprous chloride is obtained by drying the product *in vacuo*, or the oxy-chloride if it be allowed to dry in the air. A deep vessel without a stirrer may also be employed for the reaction, compressed air acting the part both of agitator and oxidiser. Scrap copper is preferably packed in a tower, down which the acid, containing ferric chloride, is allowed to trickle, a current of air passing in the opposite direction.
—F. Sodn.

Ammonium sulphate or analogous products; Apparatus for the manufacture of ——. Soc. d'Eclairage, Chauffage, et Force Motrice. Fr. Pat. 410,150, Dec. 8, 1909.

The apparatus is intended to ensure the complete absorption of ammonia or other gas by a liquid, such as sulphuric acid, and to prevent particles of liquid being carried away. It consists of a small column or other suitable arrangement, surmounting the main saturator and containing baffle-plates and a supplementary absorption chamber, in which the gas is made to bubble through a supply of fresh acid which passes thence, continuously or periodically, into the saturator.—F. Sodn.

Ammonium sulphate; Travelling distilling apparatus for the manufacture of ——. R. Davranche. Fr. Pat. 410,591, Dec. 16, 1909.

A boiler, steam-engine, pump, and centrifugal dryer are mounted on one carriage, and the distillation column, saturator, liquor reservoir, etc. on a second. The ammoniacal liquor, after being heated in the reservoir by the waste gases, which pass from the saturator through a condenser fitted with baffle-plates and cooled by the liquor, is allowed to enter the still, and the gases pass thence to the saturator in the usual way, the ammonium sulphate being withdrawn by means of a copper ladle, allowed to drain, and dried centrifugally. The apparatus is intended for temporary use in small gas works.—F. Sodn.

Copper sulphate; Continuous process for the manufacture of ——, *with the simultaneous obtainment of precious and other metals contained in the copper treated.* T. Haege. Fr. Pat. 410,857, Nov. 24, 1909.

The process is a development of that described in Fr. Pat. 256,136 of 1896, differing in that the amount of sulphuric acid in the solvent is such as to give copper sulphate solution of the desired strength, whilst the pressure of the air and steam is so regulated that the acid is completely saturated with copper, before leaving the reaction vessel; pure copper sulphate is thus continuously produced in a single operation. The reaction vessel, which is of wood, lined with lead, is open above and slopes at the bottom to facilitate the discharge of the products; there is also a perforated false bottom, and the liquor and sludge are discharged through a pipe (sealed hydrauli-ally) below this, air or air and steam being introduced hrough another pipe also opening below the false bottom ut at a higher level. The vessel is filled with copper, and this is automatically sprinkled from above by the acid liquor, steam and air being admitted below. A hot neutral or slightly acid solution of copper sulphate runs out from the vessel, and any silver, gold, and other precious metals, and bismuth, lead, arsenic, and antimony are held n suspension; the impurities are allowed to settle, and he liquor is then crystallised, no further evaporation being ecessary The mother liquor, mixed with the proper quantity of acid, is used again, any arsenic, antimony, or bismuth in solution being reprecipitated on the copper.
—F. Sodn.

Air; Process and apparatus for separating —— *into its elements.* R. P. Pictet. Fr. Pat. 409,787, Nov. 29, 1909.

Atmospheric air, previously purified and cooled, is brought into contact with liquid nitrogen, which dissolves the xygen, pure nitrogen escaping at the top of the apparatus sed. Pure, compressed, cooled nitrogen is then passed hrough a pipe, which is immersed in the solution of xygen in liquid nitrogen, and the heat of condensation f this subsiduary nitrogen serves to separate the oxygen, hich is in solution in the surrounding liquid, by evaporaion. The apparatus comprises a vertical tower containing number of indented, horizontal, baffle-plates, surrounded y a condensing worm, through which the compressed itrogen is introduced. The condenser is fitted with a ressure valve and is entirely submerged in the mixture f liquids, which is retained by the baffle-plates. The wer contains an air inlet at a point about one-third of s height from the bottom, a nitrogen outlet at the top, d an oxygen outlet near the bottom.—O. R.

Nitrogen [from air]; Process of obtaining very pure —— *by simple reflux condensation.* Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude). Fr. Pat. 410,933, Mar. 23, 1909.

Cooled and compressed air is made to enter a vessel from which arises a group of vertical condensing tubes terminating in a common head. Except for a portion of the nitrogen, the air is here condensed and, flowing back into the vessel, is sent to a small evaporator surrounding the upper part of the condensing tubes, whence it overflows into a larger evaporator (or successively into a series of these) surrounding the lower part of the tubes, where the more easily condensable portion of the air is liquefied. The temperature of the upper part is thus kept lower than that of the lower part, being cold enough to liquefy a portion of the pure nitrogen here present, in spite of the reduced pressure due to the escaping gas. The gaseous nitrogen and air rich in oxygen pass out of the apparatus through separate jacketing portions of the supplementary liquefier, in which part of the incoming compressed air is liquefied, and then through heat interchangers to effect the preliminary cooling of this air. By selecting suitable dimensions for the evaporators and tubes, 120 cb.m. of nitrogen (above 99·5 per cent. purity) may be obtained by this process from 300 cb.m. of air.—F. Sodn.

Oxygen or other gas; Process and apparatus for the continuous manufacture of ——. F. Mangiameli. Fr. Pat. 409,962, Mar. 3, 1909.

Potassium perchlorate or other gas-generating material is introduced into a number of closed retorts communicating with and grouped around a common delivery pipe, which acts also as a supporting axis and is connected with a device for regulating the production of gas. The retorts can be brought in turn over a burner by the rotation of a ratchet-wheel, the movement of which is controlled by a system of levers actuated by the rise or fall of a flexible diaphragm. When a retort is exhausted and the pressure of gas reaches a certain value, the movement of this diaphragm causes the ratchet-wheel to turn and bring a fresh retort over the burner, which is at the same time extinguished by the mechanism. As the pressure falls, the burner becomes relighted and the evolution of gas continues, the retort which has been thrown out of action being meanwhile recharged. The evolution of oxygen thus becomes continuous, and the gas is obtained mixed with the minimum amount of air.—F. Sodn.

Caustic alkalis; Process for obtaining anhydrous ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 410,238, Dec. 11, 1909. Under Int. Conv., Dec. 23, 1908, and Mar. 26, 1909.

See Eng. Pats. 29,491 and 29,494 of 1909; this J., 1910, 488, and preceding.—T. F. B.

Hydrogen peroxide; Stable composition containing ——. M. A. Queisser, Assignor to Pearson und Co., Ges. m. b.H., Hamburg, Germany. U.S. Pat. 959,605, May 31, 1910.

See Fr. Pat. 381,924 of 1907; this J., 1908, 226.—T. F. B.

Carbonic acid; Process for manufacturing ——. E. A. Behrens, Bremen. Assignor to Maschinenfabrik Surth G.m.b.H., Sürth, Germany. U.S. Pat. 960,788, June 7, 1910.

See Fr. Pat. 343,903 of 1904; this J., 1904, 1089.—T. F. B.

Separation of gases [air], etc.; Method for the ——. R. J. Lévy, Manchester, and A. Helbronner, Paris. U.S. Pat. 959,563, May 31, 1910.

See Fr. Pat. 328,984 of 1903; this J., 1903, 996.—T. F. B.

VIII.—GLASS; CERAMICS.

Glass; Eosin reaction of ——. Part II. The weathering properties of heavy glasses. F. Mylius. Z. anorg. Chem., 1910, **67**, 206—224. (See this J., 1907, 1048; 1908, 899, and 1910, 628.)

THE author discusses the validity of his iodeosin test as an indication of the resistance of the heavier varieties of glass to the decomposing action of the moisture and carbon dioxide in the air. The absorption of the eosin from its ethereal solution is a chemical action of salt formation shown by all the usual basic constituents of glass, *viz.*, potash, soda, lime, magnesia, baryta, lead oxide and zinc oxide. Absorption by alumina is extremely small, while silicic and boric acids are entirely without effect. Pure lead silicate absorbs the eosin very slowly, but alkali-lead silicate very readily, forming a layer of easily soluble alkali salt and less soluble lead salt. Heavy glasses containing lead, barium, zinc., etc. therefore, show a high eosin value at new surfaces in spite of their well-known resistance to atmospheric effects. In these cases the simple "minute-reaction" is not a fair measure of resistance to weathering. If the surface is exposed to the air for some time before the test is applied, it is found that a decrease in the alkalinity begins and continues for about a week. This is explained, with the support of careful experiments on the hydrolysis of lead-alkali silicates, as follows:—First the partial hydrolysis of the glass produces a fairly concentrated solution which contains lead as well as alkali silicate and this lead contributes considerably to the eosin absorption at a new surface. On dilution with water, however, the concentrated solution deposits complex lead silicates, and the eosin absorption is now only a measure of the alkali left in solution. This process also takes place in barium and zinc glasses, being in all cases accelerated by the action of atmospheric carbon dioxide. In support of these ideas the author also gives the results of his examination of twenty-five heavy glasses made by Schott und Genossen (Jena). The eosin numbers are given for freshly broken surfaces and for surfaces which have been rinsed with water or weathered in moist air. These numbers are compared with the results of a two-years' weathering test carried out by Zschimmer at the Jena works. From this work it is concluded that for the investigation of the weathering properties of a glass, it is advisable to determine not only the "natural alkalinity" at a newly-broken surface, but also the "weathering alkalinity" at a surface which, after being produced by fracture, has been exposed for seven days to moist pure air at 18° C. From these determinations it is possible to draw conclusions as to the chemical character, durability, and general utility of the glass, especially for optical purposes. It is to be noted that the light borosilicate glasses often give very high results for "weathering alkalinity" and very low ones for "natural alkalinity"—just the opposite of what is observed with heavy glasses. The weathering properties, as measured by the eosin absorption after a week's exposure, may vary in different commercial glasses in the ratio about 1 : 1000.—W. H. P.

PATENTS.

Glass; [Strengthened ——]. E. Benedictus, Paris. Eng. Pat. 1790, January 24, 1910. Under Int. Conv., Aug. 10, 1909.

GLASS sheets are united and strengthened by interposing between them a sheet of celluloid, the surfaces of which have been softened by the action of some solvent, and then compressing the several sheets strongly together. —W. C. H.

Glass; Method of and means for annealing ——. F. Shuman, Philadelphia, Pa., Assignor to the Continuous Glass Press Co., New Jersey. U.S. Pat. 957,477, May 10, 1910.

A BALL of molten glass is rolled into a sheet upon a flat surface, and a drawing-in tool is applied to the end of the glass first rolled, whilst it is still plastic, the sheet bein then drawn from the rolling surface over a supportin surface situated in an adjacent annealing furnace.—O. R.

Glass; Electric furnace for the continuous manufactu of ——. M. Sauvageon. Third Addition, dated De 16, 1909, to Fr. Pat. 401,744, Aug. 7, 1908 (see this J 1909, 1130 and 1200; 1910, 426).

To prevent deterioration of the glass, the electrodes a made of pure graphite very highly compressed. Thes electrodes are immersed in the bath of molten glass. —H. H.

Brick and pottery kilns; Producing heat for and furnac for firing ——. F. Cotton, Sydney, New South Wale Eng. Pat. 13,515, June 9, 1909. Under Int. Conv June 9, 1908.

A SUPPLY of completely oxidised incandescent gases f firing brick and pottery kilns is obtained by burning fu in a vertical shaft furnace, which has a closed bottom an is loaded from above, a blast of air being blown by a j of superheated steam, through tuyères, into and upwar through the deep bed of fuel, to effect complete combustio in the furnace; the incandescent gases are taken directl from above the fuel bed to the kiln, the ashes bein removed from the furnace through a door near the botton Where a multiple chamber kiln is concerned, the chambe may be successively fired by using a furnace as abov but having a refractory lining within a metal casing an mounted on a truck, so as to be movable from fire-ho to fire-hole; a boiler may also be mounted on the truck an water heating and steam superheating tubes may be en bedded in the refractory lining. The furnace is designed operate preferably with low-grade fuels and is kept fill to about one-half, the lower third of which is ashes. F a rectangular furnace with hearth area of 3 sq. ft., tw tuyères, 2½ in. in diameter, fitted with concentric stea nozzles, ⅛ in. in diameter, are suitable; and with oth furnaces, in like proportion. The steam is convenient superheated in a muffle at the top of the furnace.—F. SOD

IX.—BUILDING MATERIALS.

Subaqueous tunnelling by the freezing process. Tim Eng. Suppl. June 15, 1910.

THE area to be frozen beneath the river was enclos by a timber cofferdam backed with clay, the object of th structure being to check currents which would ha made thorough congelation of the soil very difficult. T heterogeneous material to be traversed comprised 1· mètres of mud, 3·70 mètres of quicksand, 2·29 mètres marl, and 2 mètres of solid rock, the mean temperatu being 10° C. The volume of earth to be frozen was abo 2,150 cubic mètres, one-third of this being estimated consist of water. For the reception of the circulati pipes 60 holes, 17 mètres deep, were bored, The freezi circuits were formed of flanged pipe of 134 mm. intern diameter, with an inner tube of 35 mm. internal diamet this tube being open at the lower end and constituting t flow pipe. The brine, consisting of calcium chlor solution with a density of 1·25, flowed through the inn pipes at the velocity of 70 cm. per second, and throu the outer pipes at the velocity of 4·9 cm. per second.

Cold brine was supplied from two freezing installatio the plant in each case including ammonia freezing machin on the Linde system. The average temperature of brine was —24° C. in the flow pipes and from —20° to 22° C. in the return pipes.

Soon after the plant was set to work all exposed pi were rapidly covered with ice to the thickness of 10 cm. by t freezing of moisture condensed from the air, this la acting as an excellent insulating medium. At the expi tion of some 40 days the earth was found to be thorough frozen, and a large area round the consolidated mass w reduced in temperature from 10 to 5° C. Excavation he frozen soil was performed by means of ordinary picks. The masonry and cast-iron lining were constructed as in an ordinary tunnel, and on completion those of the circulation pes which passed through the subway were withdrawn nd the holes filled up with concrete.

Refractory brick: Defects in —— and their causes. G. Rigg. Met. and Chem. Eng. 1910, **8**, 237—238.

HE defects commonly met with are fusibility, deformation and shrinkage in use, want of mechanical strength, porosity permitting penetration by vapours and by slag, liability o corrosive action, and irregularity of shape and size which necessitates wider joints than are desirable. To ecure absolute infusibility at the working temperature, he materials must be uniform in composition, and free rom pyrites and other fluxes. The other defects should e obviated by the choice of suitable materials, according o the conditions of use, and by regulating the temperature nd duration of burning, so that shrinkage reaches a maximum for the working temperature.—A. T. L.

Asphalt: Studies in —— I. C. J. Frankforter. J. Ind. Eng. Chem., 1910, **2**, 239—242.

HE material constituting the wearing surface of an sphalt pavement is made by mixing sand with an asphalt cement." This cement is made by fluxing fined asphaltum with oil. It has been generally recognised hat overheating the cement is harmful, and in actual ases observed by the author, where the cement had been eated to flashing temperature, and where the temperature f the mixture of sand and cement as dumped into the reet was above 200° C., it was found that the surface eteriorated much more rapidly at these overheated ortions than in other places. Experiments were therefore made to determine the effect of heat both on refined sphaltums and on asphalt cements as regards "ductility" ad "penetration," these properties being considered to be osely associated with the wearing capacity of asphalt avements. The "ductility" and "penetration" were oth determined according to Dow's directions (Proc. mer. Soc. for Testing Materials, 1903, Vol. 3). Obispo fined asphaltum, free from moisture, lost 2·12 per cent. weight on being heated for 15 hours in an air-bath at a mperature of 163°—165° C. The loss in ductility and netration caused by this heating, determined at 0° C., 5 C. and 46° C., in every case exceeded 79 per cent. A ment made by mixing 102 grms. of Obispo refined phaltum with 42 grms. of Obispo flux (a very viscous reenish-black oil of sp. gr. 0·98984, flashing point 125°—17° C., ignition point, 161°—162° C.) showed marked ccessive losses of ductility and penetration when heated ccessively to 130° C., 150° C., 175° C. and 200° C. imilar experiments were made with refined Trinidad phaltum, and with a cement made by fluxing 135 grms. the asphaltum with 19 grms. of heavy petroleum residue a temperature of 130° C. The falling off in ductility d penetration was of the same order as in the preceding se. The author also tested the solubility of Obispo and rinidad asphaltums in various organic solvents and ncludes that there is a great difference in the constitution the organic matter in these two asphaltums.—T. St.

ppin's cement and "pulverifuge" coating; Rendering floors impermeable and wholesome by means of ——. A. Moreau. Bull. Soc. d'Encour. pour l'Ind. Nationale, 1910, **113**, 616—619.

APS between the floor boards are first filled with a cement mposed chiefly of sawdust and magnesium chloride ompare this J., 1906, 930), and, after 2 or 3 days, the cess of hardened cement is cleaned off, and the floor is ndered impermeable by applying the "pulverifuge" ating, which is composed of vegetable wax, oil of turntine, rectified tar-oil, and thymic acid; it is put on th a brush or rag and dries in a few hours. The prered floor is not damaged by washing with water.—F. Sodn.

ast-furnace slag; Microscopical examination of —— for use in Portland cement. H. Passow. Stahl u. Eisen, 1910, **30**, 989—993.

HE chemical composition of blast-furnace slag for use making Portland cement lies between two limits, one of these, an easily reactive slag, contains from 27—31 per cent of silica, 13—20 of alumina, 50—45 of lime, 8—4 of calcium sulphide, and from 8—2 of magnesia, and the other, a poorly reactive slag, contains from 33—37 per cent. of silica, 9—12 of alumina, 51—40 of lime, 4—2 of calcium sulphide, and 3—1 of magnesia. The best material or one which can most easily be rendered glassy on granulation lies between these limits. It is very essential that the granulation of the slag by injection should be carried out so that the cooling takes place uniformly and with the maximum rapidity, in order to produce a glassy product, a comparatively slow rate of cooling producing an opaque or devitrified material which is of very inferior quality. The poorly reactive slag may be rendered glassy by rapid cooling, but requires a larger addition of clinker, and to be more finely powdered before being converted into Portland cement. The paper is illustrated by three microphotographs, and the author considers that it is highly desirable to utilise the microscope in order to determine whether the granulated slag is glassy or opaque and hence its value for use in Portland cement.—A. H. C.

Patents.

Wood and other substances and materials; Process for manufacture of a composition to be used in lieu of ——. S. J. Davies and J. Rowell, Stroud. Eng. Pat. 5270, Sept. 2, 1909.

THE composition consists of 75 per cent. of peat moss, 10 of starch, 10 of glue, and 5 of formaldehyde, phenyl alcohol [phenol], or tannic acid. Boiling water is added to the glue, starch, etc., and the finely ground, or pulped peat moss is worked into the mixture to form a thick paste which can be moulded and subjected to heavy pressure. The composition is claimed as a substitute for wood and other substances. Reference is directed to Eng. Pats. 1610 of 1873, 3004 of 1890, and 25,324 of 1902 (this J., 1903, 569).—W.H.C.

Wood; Method of preserving ——. G. Hartmann and O. A. Schwerdtner, Grossschönau, Germany. Eng. Pat. 3740, Feb. 15, 1910.

WOOD, which is attacked or threatened by dry-rot, or other destructive agents, is preserved by a coating of a solution of sodium zincate, prepared by mixing a solution consisting of 300 parts by weight of zinc chloride and 1000 parts of water, with a solution of 900 parts of caustic soda and 4000 parts of water.—W. C. H.

Tubes, crucibles, or other articles of magnesia; Manufacture of ——. H. C. Greenwood, Edenfield, Lancs. Eng. Pat. 13,697, June 11, 1909.

CALCINED magnesite, or magnesia, is fused in an electric furnace at 2000°—2500° C., the cooled product is pulverised, mixed with magnesium chloride solution, and the plastic mass obtained is shaped to the desired form in a carbon mould. The article in the mould is then baked for several hours at about 300° C., and is finally heated in an electric furnace for half an hour to an hour at 2000°—2500° C., whereby the magnesium chloride is decomposed and the magnesia fritted together.—O. R.

Refractory materials. L. Surmont and J. Montcocol. Fr. Pat. 410,785, Dec. 29, 1909.

RESIDUES obtained in the manufacture of carborundum are agglomerated by means of a binding agent such as refractory earth to form refractory bricks for furnace linings, etc. The bricks do not undergo any contraction in volume at very high temperatures.—H. H.

Stone; Artificial ——. "Progress" Vertriebsges. Technischer Specialitäten. Fr. Pat. 410,665, Dec. 23, 1909.

ARTIFICIAL stone for paving, etc., is rendered non-slipping by the addition of granulated slag or similar material and subsequent burning of the mixture.—H. H.

Building materials. Cuel, Pinguet, Le Noble et Cie. Fr. Pat. 410,932, March 24, 1910.

A MATERIAL for general building purposes is prepared by mixing solid or liquid hydrocarbons, such as bitumen, pitch, or tar, with neutral salts such as the simple or double silicates of aluminium and potassium, clays, and magnesium, sodium, barium, or calcium sulphates. The materials may be mixed in various proportions at a temperature of from 160° to 360° C. Concrete may be formed by the addition of sand or pebbles.—H. H.

Cements and like substances ; Method of and apparatus for testing ——. T. Smith and G. T. Edwards, Bamford, Derbyshire. Eng. Pat. 16,588, July 16, 1909.

The apparatus is intended chiefly for testing the hardness of set cement ; it consists of a spring balance or other pressure-indicating instrument, to the platform casing of which a frame, supporting a screw-threaded spindle carrying a drill, is rigidly attached. The cement, in the form of a block, rests upon the platform of the instrument, so that, by turning the spindle, the drill is forced into the block ; the depth to which it penetrates is accurately indicated by a device fitted to the lower end of the spindle, and the corresponding pressure is shown on the dial of the machine. Claim is made for this method of testing cements and the like, to determine the force exerted for any standard of penetration and *vice versa*, as well as for the above or any other apparatus suitable for carrying out such tests.—F. Sodn.

Slag cement ; Manufacture of ——. J. G. A. Rhodin, Muswell Hill, Middlesex. Eng. Pat. 2628, Feb. 2, 1910.

Without fusion or "sintering," considerable quantities of finely divided lime are brought into chemical combination with solid, finely divided blast-furnace slag at a temperature of about 900° C. by means of a small amount of a suitable contact substance, preferably common salt. At the same time, sulphur is removed in a volatile form from the slag by continuously passing a current of air and steam over the charge in the kiln. The hydraulic properties of the resulting cement may, if necessary, be improved by adding to the charge a small quantity of a finely divided salt of the type represented by magnesium sulphate or ferrous sulphate, and they may be rendered permanent by means of the addition of a finely divided mixture which will yield calcium aluminate at a temperature of approximately 900° C. The several processes are combined into one operation in the kiln.—W. C. H.

Cement from blast-furnace slag ; Process of manufacturing ——. W. Lessing, Post Troisdorf, Germany. Eng. Pat. 3016, Feb. 7, 1910.

Molten blast-furnace slag, either alone or mixed with lime or other cement-forming materials, is first atomised (for instance, by the process described in Eng. Pat. 19,070 of 1908 ; this J., 1908, 1153), and then the granular product is ground and mixed with lime, or is ground with lime, and burnt ; finally the clinker thus obtained is ground with a further quantity of atomised slag, with or without cement-forming admixtures. A good average ratio in which to mix the material is found to be 9 parts of the atomised slag to 1 part of clinker.—F. Sodn.

Wood ; Process for impregnating ——. M. Boucherie, Paris. Eng. Pat. 17,002, July 21, 1909.

See Fr. Pat. 401,746 of 1908 ; this J., 1909, 1132.—T. F.B.

Wood ; Process of preserving ——. J. Gerlache, Brussels. U.S. Pat. 959,505, May 31, 1910.

See Fr. Pat. 396,235 of 1908 ; this J., 1909, 476.—T. F. B.

Cements ; Rotary furnaces for treating ——. Soc. Anon. des Ciments Français, Boulogne, France. Eng. Pat. 24,620, Oct. 26, 1909. Under Int. Conv., Nov. 5, 1908.

See Fr. Pat. 395,978 of 1908 ; this J., 1909, 476.—T. F. B.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron and steel works at Hanyang, Hupe, China. A. J. Seltzer. Eng. and Min. J., 1910, 89, 1231—1234.

Although there are large deposits of excellent iron ore in almost every province of China, there is only one works where steel is produced, namely at Hanyang, Hupe. The Hanyang works comprises two 120-ton blast furnaces four 30-ton Siemens-Martin furnaces, one Wellman mixer, a reversing blooming mill, a reversing plate mill, a rail mill, and a 10-ton furnace for melting scrap. The Siemens furnaces are fed partly with cold scrap, but mostly with molten pig iron from the mixer, the duplex process being used and the pig-iron "washed" in an open-hearth furnace to remove phosphorus. The ore is obtained from Tayeh, about 90 miles distant from Hanyang and 16 miles from the Yangtse Kiang ; the main ore body appears in three hills, each 820 ft. high. Analyses of the ores have given the following results :—

	Hæmatite.	Brown ore.	Magnetite.
Iron	62	48	65
Manganese	0·3	7·0	0·13
Silica	4·0	6·0	3·0
Alumina	2·0	—	—
Sulphur	0·02	0·01	0·06
Phosphorus	0·05	0·03	0·12

Most of the ore is a hard hæmatite. At present 350 000 tons are supplied annually to the Hanyang works and 125,000 tons are sent to Japan. Next year the Hanyang works will take 500,000 tons of ore. The coke is obtained from Pinghsiang, about 186 miles from Hanyang and 109 miles from the Yangtse Kiang, where the second largest coal mines in China are situated. There is an installation of 280 coke-ovens. The coke contains 10—25 per cent. of ash, 0·3—0·6 of sulphur, and 0·06—0·25 of phosphorus. The composition of the iron and steel produced at Hanyang is shown in the following table :—

	Foundry pig-iron	Basic pig-iron.	Open hearth steel.	Finished steel.
Carbon	3·8	3·9	3·34	0·40
Silicon	2·5	0·65	—	0·085
Manganese	1·0	1·10	0·26	0·089
Sulphur	0·01	0·045	0·24	0·055
Phosphorus ...	0·02	0·25	0·045	0·028

The blast-furnace slag contains 33 per cent. of silica, 16 of alumina, 46 of lime, 2 of magnesia, 1 of iron, and 0·6 of manganese. The steel is of good quality and has been used in the construction of the Pekin and Hankow railway, the Canton and Hankow railway, and the new line being built to Chang Sha. Moreover several large shipments of pig-iron have been sent to New York, where it can be delivered for less than the price quoted in Pittsburg. A third blast-furnace, of the latest German type, 105 ft. high, 10½ ft. diam. at boshes, is nearing completion, and the foundations for another similar one are finished.—A. S.

Blast-furnace operation ; Causes of non-uniformity in —— E. B. Cook. Met. and Chem. Eng., 1910, 8, 251—253.

Irregularity of working sometimes occurs although ample care is taken to secure regularity in the composition of the charge, size of lumps, interval of charging, and of removing iron and slag, and in the temperature, humidity, and weight of the blast. The usual cause is accumulation on the boshes, which leads to irregular settling, increased fuel consumption, and decreased output. The accumulation is usually noticed from 4 to 6 months after blowing in. The trouble is more serious with magnetic ores than with hæmatites, and is increased by using an excessive blast velocity. The accumulation is least in furnaces which are blown slowly, keeping stove heats in reserve, and working with "cleaning blanks" every three or four days. The use of a dry blast lowers the zone of fusion and brings the accumulation lower down. A furnace has been erected with only 12 inches of brick on the in-wall, with the object of minimising the delay and expense of putting the furnace out for cleaning, so that this may be done more frequently.—A. T. L.

Open-hearth furnaces; Nature and influence of the heating gases on the quality of the product of ——. Terpitz. Stahl u. Eisen, 1910, **30** 1029—1032.

As the result of personal experience the author considers that the effects produced on the products of the open-hearth furnace usually attributed to an excess of hydrogen in the heating gases are not due to the action of the gas itself but to the superheating of the charge consequent on this excess. Nitrogen also is not believed to be injurious, since the whole of the appearances supposed to be due to this gas are really the effect of the treatment in the subsequent stages. With reference to sulphur it is only in most rare cases that this is absorbed by the steel. The only gases that have any influence are those produced in the bath by the oxidation and reduction reactions, the slag protecting the metal against the heating gases. The effect of hydrogen on the sides of the furnace is discussed, and the author attributes its effect to its high calorific value.—A. H. C.

Sinking heads on large castings. T. Kennedy. Assoc. Water Eng.; through Times Eng. Suppl., June 15, 1910.

The author said that large pipes were as a rule specified o be cast on end, with the upper end prolonged to form . sinking head, which was afterwards cut off. The bject of his paper was to show the advantages of this nethod and the desirability of it in nearly all large castings. Ie dealt with the results obtained in casting some large olumns about 32 ft. long weighing about 12 tons, where sinking head 2ft. 10½ in. long and weighing about 2 tons vas added. This head was afterwards cut off and broken nder the ball. It was found that the head, which vas much larger in area than the column proper, had been nost efficiently feeding the column as the molten metal n it was contracting in setting. In the large pockets eft by the receding cooling metal, there were groups of rystals of pure iron, which were grouped together so hat they all interlaced one with another, the other ingredients combining with some of the iron and forming matrix which filled the interstices. The real strength f the casting was in these interlaced groups of crystals. n the body of such a casting, these crystals existed in lentically the same form but very much smaller, due to the uicker cooling, but perfectly interlaced and homogeneous wing to the great pressure above them of the slower oling sinking head. The most deleterious impurities ontained in cast iron as it left the cupola were slag globules, ases mechanically contained in the metal, and gases occluded" or absorbed physically in the metal, all or ost of which would separate out as the metal passed from e liquid to the solid state. As the metal was being oured into the mould, still more gases were formed y the action of the hot metal on the sand of the mould; e bulk of these escaped through the cores and joints the boxes in which the mould was formed, and when nited burnt with a non-luminous flame. The remainder the impurities mentioned were of lower specific gravity an the metal proper, and if they had a free passage the mould escaped upwards to the top; if not, they mained, and the result was a porous, weak casting. hen a long column was cast on a sloping bank instead of rtically, crystals always began to form at right angles the cooling surface, with the result that millions of them rmed round the mould, and the passage of impurities s seriously impeded; if the column was cast horizontally, eir escape was impossible, and they remained in the p side of the casting.

ases in steel. P. Héroult. Amer. Electrochem. Soc., May, 1910. Met. and Chem. Eng., 1910, **8**, 332—333.

opposition to the view that the amount of gases occluded steel depends upon the opportunities presented to the metal for absorbing them in the process of manufacture, the author states that repeated experiments have shown that the quantities of gases liberated on placing the metal in a vacuum chamber are approximately the same from steels made by the Bessemer, basic and acid open-hearth, crucible, and electrical processes respectively. Blow-holes, except those due to faulty moulds, are considered to be the result of liberation of carbon monoxide by the interaction of carbon and ferrous oxide in the steel. When molten steel has partly solidified, the carbon and ferrous oxide become concentrated in the portion remaining liquid, the condition of equilibrium is disturbed, and carbon monoxide is evolved, the blowhole thus produced being filled with this gas at a high temperature. On further cooling, the pressure in the holes is diminished, and nitrogen and hydrogen are drawn into the holes from the surrounding metal, in the same way as these gases are disengaged when a piece of the solid metal is placed in a vacuum chamber. In conclusion the author states that the small quantity of gases which may be present in steel are not injurious or detrimental to the quality of the metal.
—A. S.

Iron; A comparison of the methods for depositing —— electrolytically. S. A. Tucker and E. Schramm. J. Ind. Eng. Chem., 1910, 2, 237—239.

The sulphate and chloride baths having been found much more successful than any other electrolyte, a series of experiments was made with them to find the best practical conditions for the deposition of metallic iron. The sulphate bath contained 200 grms. of crystallise ferrous-ammonium sulphate per litre. The cathodes were clean sheet iron and the anodes consisted of wrought iron bars, the distance between the electrodes being 1½ inches. The current density was varied from 0·176 to 0·88 amp. per sq. dcm. The deposit was silvery white and of a fine crystalline structure. After a while it became badly pitted. On raising the current density to 1 amp. per sq. dcm., a similar deposit was obtained, but it showed a greater tendency to form nodules. The addition to the bath of a small quantity of glycerin made the deposit smoother and more solid. The addition of magnesium sulphate and sodium bicarbonate did not improve the deposit, but increased the tendency to form a basic precipitate. A bath containing 30 grms. of ferrous sulphate crystals and 21 grms. of Glauber's salt per 100 c.c. was next tried, a current density of 1 amp. per sq. dcm. being used. The deposit was dark grey and formed large nodules, while a heavy precipitate was formed. The first chloride baths contained (I) 100 grms. of crystallised ferrous chloride and 50 grms. of ammonium chloride per litre, (II) double these quantities per litre. The stronger solution gave the higher energy efficiency at any given current density, and both chloride baths were superior to the sulphate bath in this respect. The deposit with the chloride baths was more crystalline than that with the sulphate bath. Finally a bath containing 285 grms. of ferrous chloride and 102 grms. of sodium chloride per litre was used at a temperature of 50° to 70° C. The run lasted 9 days, the electrolyte being kept in condition by the daily addition of a small quantity of hydrochloric acid to dissolve the basic precipitate formed, and by an automatic feed of water to make up for evaporation. The current density averaged about 1·6 amp. per sq. dcm. This bath gave the best and thickest deposits, the iron being gray and non-crystalline, and also it gave the best energy efficiency.—T. St.

Iron alloys; Determination of carbon in ——. F. Wüst. Metallurgie, 1910, 7, 321—322.

The iron alloy is powdered and mixed with five times its weight of a powdered alloy containing three parts of antimony and one of tin. The mixture is placed in a boat and heated in a porcelain tube to a temperature of 800°—900° C. in a stream of purified oxygen. The antimony-tin alloy melts and then alloys with the iron, causing a separation of carbon in a form which is readily oxidised. Complete combustion takes place in about ten minutes, and the carbon dioxide is absorbed by soda-lime, the apparatus being the same as that usually employed for carbon combustions. A table is given in which it is shown that the carbon content in the case of nine alloys as estimated by this method agrees accurately with that by the chromic-sulphuric acid method.—A. H. C.

Vanadium in steel; Rapid method for the detection and colorimetric determination of ——. P. Slawik. Chem.-Zeit., 1910, **34**, 648. (Compare this J., 1908, 838, 902.)

0·25 GRM. of the steel borings is dissolved in a test tube in 4 c.c. of nitric acid of sp. gr. 1·20, the solution warmed, about 0·3 grm. of solid ammonium sulphate added, and the liquid again heated until the evolution of gas ceases. After cooling, 3—4 c.c. of phosphoric acid of sp. gr. 1·40, are added and the mixture well stirred; the yellow colour changes to a faint rose. 3—4 c.c. of hydrogen peroxide are now slowly poured down the side of the tube, a reddish-brown ring being formed if vanadium is present. 0·01 per cent. can be distinctly detected. For a colorimetric determination, tubes of 30—40 c.c. capacity and graduated to 0·2 c.c. are used, and the colour obtained is compared with that given by the same weight of pure steel, similarly treated, but with the addition of a few c.c. of a standard ammonium vanadate solution (1 c.c.=0·0001 grm. of vanadium), which are added before the phosphoric acid. More reliable results are obtained by comparison with a steel containing a known quantity of vanadium. For exact determinations the following method is recommended: 20 grms. of the steel are dissolved by warming with 60 c.c. of dilute sulphuric acid (1 : 2) and 200 c.c. of water. The greater part of the free acid is neutralised by the addition to the hot solution, of zinc oxide, well triturated with water, care being taken that no grains of zinc oxide remain undissolved. Neutralisation is completed by adding moist precipitated zinc hydroxide (free from alkalinity) until a whitish turbidity remains; the mixture is then boiled for 15 min., allowed to settle, the precipitate (containing all the vanadium and a little iron) is filtered off, washed two or three times with hot water, dried and heated in a porcelain crucible till the filter is burnt. The residue is fused with sodium hydroxide and nitre in a nickel crucible. The melt is extracted with water, and the vanadium determined in the filtrate, preferably by precipitation with manganese chloride, dissolving the precipitate in hydrochloric acid, evaporating the solution with sulphuric acid, and titrating with permanganate. The results agree closely with those obtained by methods based on the separation of the iron with ether.
—A. SBLD.

Rust; Formation of ——. G. Bresch. Rev. Métal., 1910, 7, 433—446.

CURVES are given showing the relative amount of rust produced on iron in solutions of sodium chloride, potassium sulphate, sodium carbonate, sodium hydroxide and potassium bichromate at different concentrations. No trace of rust was perceptible on samples immersed in $N/500$ solution of potassium bichromate for nine months and only traces in those in $N/2000$ solution in the same time. Moreover, iron nails kept for 12 hours in a $N/100$ solution of potassium bichromate at 100° C., through which air was bubbled, showed no traces of rust. A series of experiments was made by embedding the sample in agar-agar, containing a little potassium ferricyanide, the points of attack becoming manifest by the production of local blue coloration. The extent of the protective effect of zinc was examined and also the effect of the contact of iron with glass, copper, and platinum, as well as the direct action of the electric current, and it is concluded that differences of potential between the iron and the solution with which it is contact, play an important part in the formation of rust. The following table is given :—

Action of different solutions.

	Character of solution.	Original weight.	Final weight.	Loss of weight.	Loss of weight referred to 1 grm.
		mg.			mg.
Sodium chloride (period of action—2 mos. 1/2).	Normal	846	810·5	35·5	42
	1/10 normal	809	796·3	12·7	15·7
	1/20 normal	729	718·5	10·5	14·4
	1/100 normal ...	730	723	7	9·6
	1/1000 normal .	734	729·7	4·3	5·8
	Pure water......	859	851	8	9·4
Potassium sulphate K_2SO_4 (2 months 1/2).	Normal	916·7	851·5	65·2	71·1
	1/10 normal	923	908·3	14·7	16
	1/50 normal	853·2	846·4	6·8	8
	1/100 normal ...	831·2	828·5	2·7	3·2
	1/500 normal ...	867·7	866	1·7	2
	1/1000 normal .	877·2	866	11·2	12·8
	Pure water......	849·7	841	8·7	10·2
Sodium hydroxide NaOH (7 months).	2 × normal	710	some traces of rust		
	Normal	666			
	1/5 normal	705			
	1/10 normal	679	Slight traces of rust		
	1/50 normal	669	661·7	7·3	9·1
	1/100 normal ...	659	648	11	16·7
	1/1000 normal...	651	636	15	23
	Pure water......	681	657·7	23·3	34·2

	Concentration.	Original weight.	Final weight.	Loss of weight.	Loss of weight referred to 1 grm.
					mg.
Potassium bichromate (9 months).	1/100 normal ...	684	Some traces of rust.		
	1/200 normal ...	666			
	1/500 normal ...	646			
	1/1000 normal ..	670	Slight traces of rust.		
	1/2000 normal ..	672			
	1/5000 normal ..	622	603·5	18·5	29·7
	1/10,000 normal	645	615·4	29·6	46
	1/20,000 normal	644	610	34	52·8
	1/50,000 normal	688	656·4	31·6	46
	Pure water......	750	719·5	30·5	40·7
Sodium carbonate (7 months).	Normal	769·5	some traces of rust.		
	1/2 normal	798·5	traces of rust.		
	1/5 normal	753·5			
	1/10 normal	772·5			
	1/50 normal	777·5	757·5	20	25·7
	1/100 normal	756·5	738·5	18	23·8
	1/1000 normal ..	758	741·4	16·6	22
	Pure water......	765	741·5	24	31·3

—F. R.

Iron and steel slags; Study of the metallography of ——. M. Matweieff. Rev. Métal., 1910, 7, 447—455.

A METHOD for the identification of the constituents of slags, etc., embedded in iron or steel, was evolved by the examination of synthetically prepared oxides, silicates and sulphides of iron and manganese. It was found that silicates of iron and manganese are unaffected by organic acids or when heated in hydrogen or superheated steam. Oxides of iron and manganese are attacked by hydrogen and steam, but not by organic acids; while the sulphides of the two metals are attacked by organic acids, but not by hydrogen and steam. In the case of oxides, the sample after reduction in hydrogen, is treated with a dilute alcoholic solution of ferric chloride, when a strong coloration indicates the presence of iron with manganese, and a faint coloration indicates iron alone, while manganese in the absence of iron is unaffected. Sulphide of iron is strongly coloured when treated with tartaric acid, while sulphide of manganese is only weakly attacked.—F. R.

Silver and gold; Crucible assay of pyritic concentrates for ——. G. Borrowman. J. Ind. Eng. Chem., 1910, 2, 251—252.

THE author gives details of the assay of an ore consisting of almost pure iron sulphide, using the following desulphurising agents :—(1) nitre alone, (2) preliminary roasting,

(3) iron nails, (4) nitre and iron nails. The full charges are given in all cases. It is concluded that with such an ore, the maximum amount of nitre can be used with impunity, and that where great accuracy is desired, the more troublesome nitre method should be used in preference to the convenient "nail" fusion.—T. St.

Sulphide ores; Assaying ——. F. G. Hawley. Eng. and Min. J., 1910, 89, 1221.

If 0·5 assay-ton of ore and about 84 grms. of flux be used in the assay, it has been found that a lead button of convenient size (about 22 grms.) is obtained with an ore containing 15 per cent. of pyrites. If the ore is richer in sulphides, enough nitre is added to oxidise the excess, about 2·1 grms of nitre being used for every 5 per cent. of pyrites (or equivalent quantity of other sulphides) above 15 per cent. If less than 15 per cent. of pyrites be present, flour or other reducing agent must be added instead of the nitre. The author uses the following two fluxes separately, or mixed in suitable proportions, and states that they give good results with a great variety of ores. Non-reducing flux: litharge, 15; sodium carbonate, 3·5; borax, 2·5; silica, 0·5 part. Reducing flux: litharge, 15; sodium carbonate, 4; borax, 2; flour, 0·44 part.—A. S.

Copper ores; Lebedeff-Pomeranzeff furnace for roasting ——. O. Lellep. Metallurgie, 1910, 7, 332—335.

This reverberatory furnace consists of a central hearth with a wood fire on each side, regenerators being placed externally to these. After charging one fire, the air is made to pass through its regenerator, becoming heated to about 1350° C., thence through the fire and across the hearth where a temperature of 1700° C. is reached. The gases now pass through the opposite empty grate and give up their heat to its regenerator, entering the chimney at about 600° C. As the fires are alternately charged, so the air current is reversed and this effects a very great economy from a calorific point of view. Details are given of the actual working of the furnace, with analyses of the chimney gases, slag, copper ore, and dried fuel, and calorific calculations showing the efficiency of the furnace.—A. H. C.

Cuprous chloride solutions and copper refining. M. de K. Thompson and E. R. Hamilton. Amer. Electrochem. Soc., May, 1910. Met. and Chem. Eng., 1910, 8, 347—348.

With equal conductivity of electrolytes and equal current efficiency, twice as much copper could be deposited from a cuprous solution as from a cupric solution for a given quantity of electrical energy. Solutions of cuprous chloride in sodium chloride have a lower conductivity than solutions of sodium chloride alone, but by addition of hydrochloric acid, the conductivity can be increased to approximately the same as that of the acid sulphate solution ordinarily used in copper refining; the addition of acid also prevents the solution from becoming turbid during electrolysis, and increases the current efficiency. With a solution of 25 grms. of sodium chloride in 100 grms. of water, saturated with cuprous chloride and treated with hydrochloric acid of sp. gr. 1·188 (1) till the solution just became clear, (2) in the proportion of 4·6 vols. of acid to 100 of solution, the following results were obtained with a current of 0·75 ampère per sq. dcm., copper electrodes being used and the cuprous chloride solutions being agitated by passing in hydrogen:—

	Cuprous chloride.		Copper sulphate.
	1	2	
oltage at start	2·0	0·18	0·36
,, after 2 hours	3·0	0·50	0·46
,, ,, 3 hours	0·84	0·20	0·35
ain in weight of cathode ..	2·68 grms.	3·05 grms.	1·66 grms.
urrent efficiency	80·6%	91·6%	100%

he deposits from the cuprous chloride solutions were nooth and adherent.—A. S.

Electrolytic winning and refining of metals. E. M. Chance. Amer. Electrochem. Soc., May, 1910. Met. and Chem. Eng., 1910, 8, 354.

Experiments were made on the electrolysis of a copper-iron matte containing 50 per cent. of copper, 24 of iron, and 26 of sulphur, fused sodium metasilicate being used as electrolyte. The fused matte was contained in a crucible heated in a gas furnace. An iron wire in the bottom of the crucible and in contact with the matte served as anode, and a carbon or steel rod dipping into the fused electrolyte above the matte as cathode. By suitably regulating the potential difference, copper of great purity could be deposited the iron remaining in the electrolyte as silicate. With higher E.M.F., both iron and copper were deposited, apparently as an alloy. The sulphur volatilised completely. With a nickel-copper-iron matte or speiss, the copper and nickel could be deposited selectively in succession by suitable regulation of the E.M.F., whilst the arsenic and antimony were volatilised. A sharp separation of silver and lead from silver-lead bullion can be effected in a similar manner. It is stated that copper deposited upon a steel rod by this process could only be removed by filing; the plated rod could be hammered, bent, or otherwise deformed without loosening the coating.—A. S.

Sulphur; Determination of —— *in brass and bronze.* G. Thurnauer. J. Ind. Eng. Chem., 1910, 2, 293.

Sulphur can be determined in brasses and bronzes by a method similar to the one usually employed for its determination in organic compounds. Filings which have passed through a 100-mesh sieve are fused in a wrought iron crucible with a mixture consisting of 2 parts of potassium chlorate and 1 part of sodium carbonate—1 grm. of filings to 6 grms. of mixture. For very accurate work a silver or a nickel crucible is used. The hot water extract contains all the sulphur as soluble sulphates. Excess of hydrochloric acid is added and the solution boiled to expel all carbonic acid. Ammonia is then added to neutralise excess of acid and then more hydrochloric acid till the solution is faintly acid. The sulphur is then determined as barium sulphate in the usual way.—T. St.

Bronzes; Determination of the coefficient of equivalence in the case of special zinc ——. L. Guillet and L. Révillon. Rev. Métal. 1910, 7, 429—432.

In the first part of an investigation into the influence of other elements upon copper-tin alloys, it was found that when part of the tin was replaced by zinc, the metallographical estimation, based on the area of the δ-constituent, indicated a tin content higher than that found by analysis. The coefficient of equivalence of zinc was then estimated by the formula given in a previous paper on special brasses (this J., 1906, 540, 813), but was found to be less than 0·1, showing that the effect of the addition of zinc is quite small. Zinc does not act by replacing one of the elements in the alloy, but dissolves in the copper without sensibly modifying the solubility of tin in the latter. For quantities of zinc up to 30 per cent., the alloys have similar mechanical properties to the corresponding alloys free from zinc, except that the solid solution free from zinc is harder than that containing zinc.—F. R.

Oil in the Potter [ore-flotation] process. W. E. Simpson. Mining Magazine, 1910, 2, 434—436.

The author, as the result of considerable practical experience with the Potter process for the treatment of Broken Hill sulphide ores, states that the troubles experienced in the working of that process were chiefly due to overlooking the importance of efficient aëration of the ore. It has been stated that the success of the process depends entirely upon the presence of small quantities of oil (in the exhaust steam, etc.), but completely satisfactory results have been obtained when not even the smallest quantities of oil have been present. De Bavay has shown that the success of the process depends upon the presence of a film of air around the sulphide particles and the presence of gelatinous silica produced by the action of the sulphuric acid on fluorspar and quartz present in the ore. The colloidal silicic acid has the same function as the oil in oil-flotation processes, but if the air films are destroyed, successful results cannot be obtained even with oil. The author confirms De Bavay's views and states that the requirements for success in the Potter and other flotation processes are:—(1). The sulphide particles must have clean surfaces enclosed in an air film, and be not larger than 1 mm. diam. (2). Some gelatinous or oily material for clotting the particles together must be present or added. (3). The clotted particles must be caused to rise to the surface of the liquid by some mechanical or physical means, e.g., by the mechanical entanglement of gas bubbles, the physical expansion of the air films or entangled gas bubbles, or both, either under a vacuum or by the application of heat.—A. S.

Resistor furnace: A new ——. F. A. J. Fitzgerald. Met. and Chem. Eng., 1910, 8, 317.

The author refers to experiments which have been performed at a zinc smelting works in Upper Silesia, Germany, with a 150 kilowatt furnace, in which the charge in the crucible is heated by radiation from an electrical resistor. By building the furnace with double walls, bottom, and cover, and burning fuel in the space thus formed so as to keep the temperature therein approximately the same as that of the working chamber, it is stated to be possible to almost completely prevent loss of electrically generated heat, and to effect very great economies, especially in large furnaces. Furnaces of this type have been run continuously for nearly two months, and they may be allowed to cool repeatedly, without having to make repairs. They are suitable for many other metallurgical operations besides zinc smelting.—A. S.

Electric furnaces in non-ferrous metallurgy. J. W. Richards. Met. and Chem. Eng., 1910, 8, 233—234.

The author considers that the use of electric furnaces would in many cases be advantageous from the point of view of economy and convenience, in localities where the cost of power is relatively low and that of fuel high. He then refers to leading examples.—A. T. L.

Lead plating and refining. F. C. Mathers. Amer. Electrochem. Soc., May, 1910. Met. and Chem. Eng., 1910, 8, 350.

The author has found that lead perchlorate offers great advantages for use in the electrolytic refining of lead and for lead plating. The solution has a high electrical conductivity; the deposits are smooth and dense and free from "trees"; the corrosion of the anode and the deposition upon the cathode are almost quantitative; and there is no polarisation from the anodic formation of lead peroxide. The bath should contain about 5 per cent. of lead, 2—5 per cent. of perchloric acid (see this J., 1910, 149), and 0·05 per cent. of peptone; the last-named is gradually consumed and must be replaced by a fresh quantity after about 4 days. (Without addition of peptone, good deposits can only be obtained at very low current-densities.) The free acid is slowly neutralised by chemical solution of the lead; acidity is restored by treating a portion of the electrolyte with sulphuric acid, filtering off the lead sulphate, and returning the filtrate to the bath. If the concentration of the bath be maintained and the acidity and peptone renewed, the deposits obtained after 2 months are as good as at the beginning. A current density of 2—3 ampères per sq. dcm. (18—27 amp. per sq. ft.) may be used. The deposit has a sp. gr. of 11·36 and contains 99·98 per cent. of lead. (See also U.S. Pat. 931,944 of 1909; this J., 1909, 990.)—A. S.

Tin alloys; Analysis of ——. F. Kietreiber. Oesterr. Chem.-Zeit., 1910, 13, 146—147.

The object of the author has been to avoid the determination of the tin by simple oxidation of the alloy by nitric acid and weighing as stannic oxide the undissolved portion after ignition, which either is inaccurate or involves very troublesome separations and determinations of the associated impurities. One grm. of the alloy is treated with 10—15 c.c. of strong nitric acid, and heated on the sand-bath till reaction is complete; the contents of the beaker are then transferred, with as little water as possible, to a medium-sized hemispherical porcelain basin, and evaporated to dryness on the water-bath. There are now added 25 grms. of crystallised sodium sulphide, and the basin is covered and heated on an asbestos plate with frequent stirring for about 15 minutes, or till the liquid formed by the aqueous fusion of the crystallised sulphide boils and begins to show signs of drying. Warm water is now added, and after all soluble matter is extracted, the whole is transferred to a beaker, stirred, allowed to settle, and filtered. Tin, antimony, and any arsenic, are thus separated from lead, copper, etc. The residue on the filter is washed with water containing sodium sulphide, into a basin, any remaining on the filter is dissolved in nitric acid and added to the main portion, and the whole is then treated with nitric acid and evaporated with sulphuric acid to separate the lead. The filtrate from the lead sulphate is acidified to contain about 10 per cent. of sulphuric acid, and the copper precipitated by hydrogen sulphide. Iron, zinc, etc., are determined in the filtrate from this. To the solution of the sulphides of tin, etc. is gradually and cautiously added about half its volume of concentrated hydrochloric acid, and it is allowed to stand in a warm place for some time, when all the tin, and a small portion of the antimony dissolve; hydrogen sulphide is then passed through till cold, and the liquid again allowed to stand in a warm place till it no longer smells of the gas, when it is filtered through a filter wetted with hydrochloric acid. The precipitate (all the antimony and arsenic, with a small amount of tin) is dissolved in bromine and hydrochloric acid, diluted with twice its volume of water to the same acidity as before, and the precipitation with hydrogen sulphide repeated. The antimony can be determined either gravimetrically or by Kessler's method—dissolved in hydrochloric acid at a gentle heat, the excess of hydrogen sulphide removed by addition of enough of a hydrochloric acid solution of mercuric chloride to form chlorosulphide, and the antimony titrated by permanganate. The filtrate containing the tin is made ammoniacal, then acid with acetic acid, and precipitated by hydrogen sulphide; the sulphide is converted, by treatment with nitric acid and ignition, into stannic oxide.—J. T. D.

Platinum and nickel wire; Behaviour of —— towards hydrogen at high temperatures. M. von Pirani and A. R. Meyer. Z. Elektrochem., 1910, 16, 444—447.

It has been observed that nickel and platinum, when heated to a high temperature in a current of hydrogen, undergo a permanent change, which, with nickel, shows itself in an increase of electrical resistance and, with platinum, in a lowering of the melting point and reduced ductility. This is apparently due, not to occlusion of hydrogen, but to the absorption of carbon from small quantities of adventitious organic impurities carried by the gas.—F. Sodn.

Metals; Measurement of true temperatures of ——. M. v. Pirani. Verh. Dtsch-Phys. Ges., 1910, 12, 301—348. Chem. Zentr., 1910, 1, 2006—2007.

Methods for the determination of the electrical resistance of metals at high temperatures are described, and measurements made on platinum, nickel, tungsten, and tantalum are given. The relation between the resistance and the temperature and the difference between the "black body" temperature and the true temperature are discussed, and two empirical formulæ are given by means of which extrapolation from the experimental results can be effected. It was found that under normal conditions the temperature of the filament of a tantalum lamp is 2000° C., and that of a tungsten lamp, 2100° C. Higher "black body" melting points are observed with a wire than with a bright sheet or a large mass of molten metal. With a tantalum wire the lower limit of the melting point is given as 2910° C.; the true melting point is probably about 3000° C. on the old scale, or 3100° C. on the Holborn-Valentiner scale. For tungsten the probable value of the melting point is 3250° C. on the old scale, or 3350° C. on the Holborn-Valentiner scale.—A. S.

Tungsten and molybdenum; Ductile ——. C. G. Fink. Amer. Electrochem. Soc., May, 1910. Met. and Chem. Eng., 1910, **8**, 340—341.

The author describes the properties of ductile tungsten and molybdenum, which have recently been prepared in the laboratory of the General Electric Company. Ductile tungsten is a bright, tough, steel-coloured metal which can be drawn into wire of a diameter much below one-thousandth of an inch (1 mil); the tensile strength increases as the drawing proceeds, as is shown in the following table, in which figures for molybdenum are also given :—

Diam. of wire, in mils.	Tensile strength in lb. per sq. in.			
	Tungsten.		Molybdenum.	
	1	2	1	2
5·0	460,000	490,000	200,000	260,000
2·8	480,000	530,000	230,000	270,000
1·5	550,000	600,000	270,000	310,000
1·2	580,000	610,000	—	—

Under similar conditions hard-drawn piano wire of 0·003 in. diam. had a tensile strength of 507,000 lb. per sq. in. The specific gravities of the two metals are: tungsten, 18·81; molybdenum, 10,02; the figures increase with the amount of working when the metals are drawn into wire. Hard-drawn tungsten wire has a resistivity of 6·2 microhms per c.c. at 25° C. (temperature coefficient from 0° to 170° C., 0·0051), whilst for hard-drawn molybdenum wire the corresponding figures are 5·6 (temp. coeff., 0·0050). Annealed wires give the values: tungsten, 5·0; molybdenum, 4·8 microhms. The two metals behave in a similar manner towards chemical reagents. They are readily attacked by fused oxidising salts such as sodium nitrate, potassium bisulphate, and sodium peroxide. Hydrochloric, sulphuric, and nitric acids attack tungsten very slowly, but molybdenum somewhat more quickly. 1·3638 grms. of fine-drawn tungsten wire heated for 14 hours in a mixture of chromic and sulphuric acids lost only 0·0003 grm.—A. S.

Aluminium-calcium alloys. J. M. Breckenridge. Amer. Electrochem. Soc., May, 1910. Met. and Chem. Eng., 1910, **8**, 349.

The curves representing the electrochemical potential (determined in a solution of calcium chloride in ethyl alcohol) and electrical conductivity of aluminium-calcium alloys are quite smooth and regular, with the exception of a distinct break between 32 and 34 per cent. of calcium, corresponding to a compound of the composition, Al_3Ca. This is in agreement with the results obtained by Donski (this J., 1908, 1066) in a thermal study of the alloys.—A. S.

Magnesium; Electrolytic preparation of ——. S. A. Tucker and F. L. Jouard. Amer. Electrochem. Soc. May, 1910. Met. and Chem. Eng., 1910, **8**, 333—335.

The authors' results show that metallic magnesium can be obtained by electrolysis of its molten chloride in presence of potassium chloride, preferably in a carbon or graphite crucible, but the bath is troublesome and expensive to prepare (carnallite is unsuitable). A current efficiency of 60 per cent. can be attained. The presence of magnesia is detrimental, but a small proportion of calcium fluoride tends to consolidate the metal. Changes of current-density and of temperature have comparatively little effect within wide limits. No more than traces of metal could be obtained by electrolysis of fused magnesium fluoride in presence of other fluorides, and experiment showed that magnesium is apparently dissolved by such fused mixtures. Alloys of magnesium with aluminium or copper can be easily made by electrolysis of a fused chloride bath, but the current efficiency is no better than in the production of pure magnesium, and the subsequent recovery of magnesium from the alloy by electrolysis cannot be effected satisfactorily.—A. S.

Colloidal metals; Method for the preparation of stable ——. C. Serono. Arch. Farmacol. sperim., 1910, **9**, 152—157. Chem. Zentr., 1910, **1**, 1953—1954.

If an electric current be passed through a 5 per cent. solution of purified gelatin, rendered conductive by addition of 1 per cent. of sodium chloride or sulphate, a colloidal solution of the metal used as cathode is obtained, after about 10 minutes, in the neighbourhood of the anode. With a gold cathode, the collodial solution contains 42 mgrms. of the metal per litre, and with a silver cathode, 87 mgrms. per litre. An iron cathode yields a solution of ferrous sulphate, small quantities of ferrous hydroxide, and colloidal non-dialysable iron. The collodial solutions are stable, contain no sub-microscopic particles, and remain sterile. When a porous earthenware diaphragm is used, no trace of colloidal metal is found in the cathode compartment. The colloidal solutions prepared in this way are suitable, after dilution, for medicinal purposes. —A. S.

Microscopical examination of blast-furnace slag for use in Portland cement. Passow. *See* IX.

Effect of moisture and of solutions on the electrical conductivity of soils. [*Corrosion of iron and steel.*] Davis. *See* XI.

Determining cobalt and nickel. Jamieson. *See* XXIII.

Volumetric determination of nickel and cobalt. Grossmann. *See* XXIII.

Patents.

Carburising iron, iron alloys, and mild steel, and articles thereof. W. R. Hodgkinson, Blackheath. Eng. Pat. 21,419, Sept. 20, 1909.

The articles are heated in a muffle in which a carburising atmosphere is maintained, consisting of the vapours of nitrogenous or nitrogen-containing benzenoid compounds, such as aniline, pyridine, toluidine, acetanilide or the like. Iron or steel may be sufficiently carburised under these conditions in 30 minutes at a temperature of from 650° to 800° C.—F. R.

Separating complex ores, or their concentrates; Process for ——. W. M. Martin, Redruth, Cornwall. Eng. Pats. 4531, Feb. 24, 1909, and 9360, April 20, 1909.

Complex lead zinc ores, or concentrates, are crushed and well moistened with a solution of an oxidising agent, such as sodium nitrate, and the mass heated to a dull red heat for a few minutes. The ore is afterwards crushed and the constituents separated by ordinary water concentration. The amount of sodium nitrate required has to be found by experiment, but about 2 per cent. is generally necessary for a crude ore and more for a concentrate. A similar amount of dry sodium nitrate thoroughly incorporated with the ore may be substituted for the solution.—F. R.

[*Ore*] *separating process; Electrostatic* ——. W. G. Swart, Denver, Colo., Assignor to The Blake Mining and Milling Co., Maine. U.S. Pat. 959,646, May 31, 1910.

Disintegrated zinc ore, or other ore, is treated with a solution of copper sulphate to cause a "diverse deposition" upon the different materials present in the ore, and alter their electro-conductivity. The ore is then dried and separated electrostatically.—F. R.

Sulphide ores and the like; Smelting of ——. M. Ruthenburg, London. Eng. Pat. 13,291, June 7, 1909.

Complex ores containing sulphides, or mixed with sulphide ores, are fused in an electric furnace without fluxes or reducing agents. Part of the sulphur is volatilised together with the more volatile metals, such as zinc, lead, silver, etc., but sufficient sulphur must be retained to form a matte and keep the copper out of the slag. The fumes from the furnace, with the addition of sufficient air to oxidise the sulphur, pass to a wet condensing tower, where the sulphur dioxide becomes converted into sulphurous acid, which dissolves the zinc present, leaving the lead and silver as a solid residue.—F. R.

Annealing or like processes and apparatus therefor. W. R. Kinnear, New Castle, Pa., U.S.A. Eng. Pat. 22,318, Sept. 30, 1909.

Articles to be annealed are placed in an iron box, which is furnished with a surrounding trough in which the lower edges of the lid rest. A readily fusible and oxidisable metal is contained in the trough, which on heating seals the junction between pot and lid. Any air that is drawn in during the cooling of the box, is deoxidised in passing through the molten metal. If necessary the cover can be provided with a similarly sealed vent, and the floor raised above the level of the trough to permit articles taken from a pickling bath to drain.—F. R.

Furnace; Revolving —— *for volatilising metals* [*zinc*] *from their ores.* H. H. Hughes, Springfield, Mo. Reissue 13,118, May 31, 1910, of U.S. Pat. 922,906, May 25, 1909.

The furnace consists essentially of a slightly conical retort, situated centrally in a cylindrical non-conducting furnace casing, the two being simultaneously revolved about their long axes. The retort is heated by gaseous fuel introduced between it and the furnace casing, and suitable means are provided for condensing the zinc fumes. The inner end of the retort is supported by a hollow trunnion, the latter being provided with a spiral feed for automatically charging the retort during rotation.—F. R.

Nickel hydrosilicate ores; Process of reducing ——. A. Chalas, Philadelphia, Pa. U.S. Pat. 959,460, May 31, 1910.

Finely divided iron ore is briquetted with nickel hydrosilicate ores, with or without limestone or hydraulic lime, and the briquettes are smelted with the production of nickeliferous pig iron, low in sulphur and phosphorus, and a basic slag which is subsequently chilled and crushed to enable the contained granules of metal to be recovered magnetically.—F. R.

Smelting ores; Art of ——. A. S. Dwight, San Luis Potosi, Mexico. U.S. Pat. 959,484, May 31, 1910.

The ore is heated in a vertical shaft, the upper portion of which is of greater internal diameter than the rest. An open cylinder is fixed concentrically in the enlarged portion, forming an annular space into which the furnace charges are fed. The charge slowly descends in substantially vertical lines, until the bottom of the internal cylinder is reached, when the larger particles of the charge gravitate towards the centre, resulting in a re-arrangement of the charge in which the fines are adjacent to the walls, and the coarse material is situated centrally.—F. R.

[*Lead and zinc*] *Smelting process.* E. Dedolph, Kaslo, British Columbia. U.S. Pat. 959,924, May 31, 1910.

Lead and zinc are continuously extracted from ores or slags by feeding a mixture of the material with carbonaceous matter, into one end of a horizontal revolving furnace, through which the charge slowly progresses, and causing a highly oxidising flame to pass over the charge in a direction opposed to that of the material, the oxidised metals being collected as fume. The material may be treated in two stages, one at a temperature suitable for the extraction of lead, and a second at a higher temperature for the extraction of zinc.—F. R.

Copper; Process of treating sulphide ores containing —— J. McFetridge, Vandergrift, Pa. U.S. Pat. 959,57 May 31, 1910.

Pulverised copper pyrites, sulphide ores, or matte are injected by means of an air blast into a furnac maintained at a temperature high enough to immediatel ignite the sulphur, agglomerate the ore, and convert th copper into sulphate and oxide. The agglomerated or is ground, lixiviated with dilute acid and the dissolve copper subsequently precipitated.—F. R.

[*Precious*] *metals from cyanide solutions; Precipitation* ——. S. F. Kirkpatrick, Kingston, Ontario. U. Pat. 959,757, May 31, 1910.

The solution is placed in a cylindrical tank, having conical bottom, and powdered aluminium is addec By the rapid revolution of propellers mounted on central shaft, a vortex is produced which causes the powdere metal to be drawn to the bottom and from thence pas laterally and upwardly through the solution.—F. R.

Metals; Method of reducing ——. R. J. McNitt, Assign to Roessler and Hasslacher Chemical Co., New Yor U.S. Pat. 959,785, May 31, 1910.

The metal to be reduced is alloyed, or chemically con bined with a less volatile metal or alloy, and then di tilled under reduced pressure. The residual metal alloy may be used indefinitely for repeating the process. —F. R

Filtering apparatus [*for ore slime*]. E. P., Assignor M. E. Dargin, Denver, Colo. U.S. Pat. 959,84 May 31, 1910.

The claim is for the combination of a slime-solution tan with a filter tank so arranged that the slime-solution pumped into the filter tank at a greater speed than th filtrate is removed from the latter. The excess of slim solution overflows back into the slime-solution tan In this way the contents of both tanks are kept thorough agitated. The filter tank is provided with bag filte connected to a suction apparatus.—W. H. C.

Dewatering device, and process of separating solids fro liquids [*dewatering ore pulp*]. W. A. Hendryx, Denve Colo. U.S. Pats. 960,546 and 960,547, June 7, 1910.

The ore pulp is allowed to settle, and the separated soli whilst submerged beneath the liquid are subjected continuously applied pressure to remove liquid therefro The solids are removed continuously, whilst the express liquid returns through the uncompressed solids to t main body of liquid. The apparatus consists of a ta with a conical bottom, in which the solids collect. horizontal discharge tube is connected with the botto of the conical portion. The separated solids are forc through this tube by means of a screw conveyor consisti of a shaft provided with spaced propeller blades and screw. Between the propeller blades, and secured to t tube, are fixed ribs which prevent the solids from rotati within the tube.—A. S.

Tungsten; Production of fine-metal ——. E. Thomso Swampscott, Mass., Assignor to General Electric C New York. U.S. Pat. 960,441, June 7, 1910.

Oxide of tungsten is reduced by means of hydrogen, a from the aqueous vapour produced, at least a part of t hydrogen is regenerated and returned, together with t unused hydrogen, to the main stream of hydrogen us for effecting the reduction.—A. S.

Furnace; Electric —— *and method of reducing refracto material* [*producing steel direct from ore*]. J. W. Eva Belleville, Ontario. U.S. Pats. 960,862 and 960,8 June 7, 1910.

Steel is produced direct from iron ore by first subjecti a mixture of iron ore, carbon, and flux, to the action of arc, so as to produce slag on the surface, the molten ma being afterwards heated by passing an electric curr through it after cutting off the arc. The furnace comprises a chamber, with electrodes disposed practically horizontally, so as to produce an arc approximately above the central portion of the body of the material. A second pair of electrodes is arranged at opposite sides of the centre of the furnace, entering the chamber at an angle to, and crossing the path of, the first-named electrodes. The electrodes may be individually operated at will by suitable means, one of the first-named electrodes and one of the second being adapted to produce an arc at a distance from the central portion of the material, and the second pair of electrodes may be allowed to enter the material in order to pass the current through the molten mass.—B. N.

Steel; Refining of liquid —— obtained in a furnace with non-electric heating. Soc. Anon. Electrométallurgique (Procédés P. Girod). Second Addition, dated Dec. 7, 1909, to Fr. Pat. 402,758, May 6, 1909 (this J., 1909, 1204; 1910, 361).

In the original specification, it was proposed to de-oxidise and free from gas the steel obtained in an oxidising furnace by cooling the metal to a temperature near the fusion point. It is now proposed that, before lowering the temperature, a certain proportion of reducing bodies, such as carbon, should be added to the bath in order that there may be a sufficiency in the subsequent refining. The temperature may be lowered and raised again several times before terminating the refining process, so that any gases resulting from the preliminary deoxidation, and adhering to the pasty mass as it becomes cooler, are allowed to escape. Between the successive increases and decreases of temperature, further quantities of reducing agents may be added to the bath. When the steel possesses a considerable content of phosphorus, it is advantageous to effect the elimination of that element before proceeding to the deoxidation of the metal. In this case, before proceeding to the actual cooling of the metal, it is necessary to add a further quantity of one or more of the reducing agents (carbon, manganese, silicon). The process may be applied also to the liquid steels obtained in an oxidising electric furnace.—C. A. W.

Furnaces; Electric induction ——, and arrangement to avoid ruptures therein. Poldihütte Tiegelguszstahlfabrik. Fr. Pats. 410,655, 410,656, and 410,657, Dec. 23, 1909. Under Int. Conv., Mar. 1 and 2, 1909.

(1). The part of the furnace in direct contact with the metal rests entirely or in part on a refractory layer of sand or pulverised material, the thickness of the layer diminishing advantageously in the direction towards which expansion takes place during the heating. (2). In view of the expansion taking place in the annular fusion channels of induction furnaces, there is disposed at the exterior and interior of such channels, or at one of these parts only, a buffer or lining of asbestos wool or other analogous material, which is easily compressible, slightly elastic in the compressed state and sufficiently refractory. (3). For protection against ruptures, which may form a passage for the molten metal, one or more layers of refractory material are compressed separately against the part of the furnace in contact with the metal, and may be bound to this part of the furnace below the fusion channel. Paper, or other analogous material, may be employed to separate these layers.—B. N.

Ores; Apparatus for roasting and agglomerating ——. Metallurgische Ges. A.G. First Addition, dated Dec. 22, 1909, to Fr. Pat. 384,539, Nov. 30, 1907.

An annular case, open at the top, communicates through a grating in the bottom with a series of shallow chambers placed round the circumference. The annular case constitutes the hearth of the furnace and, together with the shallow chambers beneath, is capable of revolution about a fixed centre, the whole apparatus being supported on rails. Each chamber communicates by means of a bent pipe with a fixed central bell-shaped vessel, which can itself be placed in communication with a source of suction or pressure. The lower edge of the bell dips into a trough which contains water or sand and which revolves with the apparatus. During the revolution, each portion of the hearth is made to pass under a fixed hopper, when it receives its charge of ore, the ignition being effected by means of a gas burner or by the addition of a certain quantity of incandescent ore or carbon. As the ore is carried round with the apparatus, a current of air is drawn through it, so that, when the point of discharge is reached, the desulphurisation and agglomeration should be complete. The discharge is effected by means of an inclined plane provided with lateral partitions and preferably in the form of a grating. The lower edge of this plane coming almost into contact with the hearth of the furnace, the roasted product is pushed up to the summit and finally removed, the non-agglomerated material falling back through the grating. In order to prevent air being drawn through the empty hearth as it travels towards the hopper, an arrangement is provided within the bell-shaped vessel by means of which a metal plate moves constantly over the apertures of the suction-pipes and so closes one or more chambers in succession.—C. A. W.

Metals and other substances; Process and apparatus for heating, melting, refining, or decomposing ——. Soc. Anon. des Hauts Fourneaux et Forges de Dudelange. Fr. Pat. 405,911, Aug. 11, 1909.

The material is first heated by means of coal dust, and the heated mass is then subjected, in the same apparatus, to the heating action of the electric current. This process is of value where very high temperatures are required, as in the treatment of iron or steel. The apparatus used consists of an ordinary electric furnace, provided with vertical electrodes, and also with a flue for the gaseous products and a device for introducing the coal dust by means of an air blast.—T. F. B.

Metal; Production of a light ——. W. Rübel. First Addition, dated Dec. 13, 1909, to Fr. Pat. 407,814, Oct. 12, 1909 (this J., 1910, 636).

In the original specification it was proposed to produce magnesium alloys containing up to 10 per cent. of copper, zinc, or copper-aluminium. It is now found that certain metals, especially those of the iron group, and alloys of these metals, can be employed, in the same manner, in the production of light magnesium alloys. For this purpose, an alloy of manganese and chromium, or an alloy of either metal with iron, copper, zinc, nickel, or cobalt or, finally, any one of these elements by itself may be taken, the proportion of metal added ranging from about 0·5 to 10 per cent. of the magnesium employed. All the alloys containing up to 3 per cent. of added metal can be rolled and cast easily, and the alloy of chromium and magnesium is stated to be very resistant to chemical influences.

—C. A. W.

Slags; Pulverisation of liquid ——. Buderus'sche Eisenwerke. Fr. Pat. 410,377, Dec. 15, 1909. Under Int. Conv., Dec. 28, 1908.

The stream of liquid slag as it emerges from the furnace is brought into contact with a jet of air or vapour in the usual manner. The action however is made to take place within a revolving drum inclined slightly to the horizontal. The walls of this drum may, if necessary, be kept constantly cooled with water but, in any case, the pulverised slag, when it reaches the bottom, is discharged into a bucket elevator and never allowed to accumulate. In this way, and by the quick cooling obtained in the drum, there is no tendency for the particles to agglomerate, and a uniformly fine product is obtained. The pulveriser is arranged below the slag outlet and is movable in any direction; the admission of the air is regulated by means of a sluice-valve at the rear and a narrow tuyère is provided, extending nearly to the outlet, through which, when desirable, a stream of liquid can be introduced into the blast.

—C. A. W.

Metals; Manufacture of rare —— or their alloys. P. Girod and Soc. Anon. Electrométallurgique (Procédés P. Girod). Fr. Pat. 410,403. March 13, 1909.

In the preparation of metals such as titanium, tungsten, molybdenum, vanadium, tantalum and the alloys of these metals with iron, it is proposed to add to the mixture of ore, reducing body and flux a certain proportion of some boron compound, such as a borate or boric acid. It is claimed that, by this means, the mixture is rendered more fluid, so that the separation of the metal is facilitated, and that, in addition, a layer of perfectly liquid slag is formed, which protects the metal against exterior oxidation. Moreover, the introduction of a small quantity of boron gives valuable characteristics to the metal or alloy, and this fact can be extended to the production of special tool or construction steels, a suitable proportion of an iron-titanium-boron alloy being added to an ordinary steel. —C. A. W.

Furnace; Tipping ——. L. Canda. Fr. Pat. 410,478. Dec. 21, 1909.

The claim is for a crucible furnace supported on trunnions so that the whole can be tilted to pour out the molten contents of the crucible, the spout being guided so that it always moves in a vertical line. Compressed air is supplied through a special tap which also acts as a locking device for the furnace. The air is preheated by passing through flues formed in the furnace wall and delivered into the furnace above the grate in order to consume the smoke. The crucible is supported on a perforated block of plumbago so that the bottom of the former may be properly heated. The ash-pit is movable to allow the furnace to be used as a draught as well as a blast furnace. The ash-pit is also provided with interior partitions so that if the crucible breaks, the metal will be recovered in the form of ingots in the bottom of the ash-pit.—W. H. C.

Metals; Processes of separating and refining ——. J. H. Reid, Newark, N.J., U.S.A. Eng. Pat. 12,337, May 25, 1909. Under Int. Conv., Sept. 23, 1908.

See Fr. Pat. 403,033 of 1909; this J., 1909, 1318.—T. F. B.

Metals and other substances; Process and apparatus for heating, melting, refining, and extracting ——. H. Hoff, Düdelingen, Luxemburg. Eng. Pat. 18,610, Aug. 12, 1909.

See Fr. Pat. 405,911 of 1909; preceding.—T. F. B.

Electric furnaces. H. Nathusius, and Westdeutsche Thomasphosphat-Werke, Berlin. Eng. Pat. 13,295, June 7, 1909. Addition to Eng. Pat. 7188, April 1, 1908.

See Addition of June 4, 1909, to Fr. Pat. 388,668 of 1908; this J., 1910, 221.—T. F. B.

Filters for metallurgical and other uses. P. M. Justice, London. From H. Binney, New York, Attorney for the Butters Patent Vacuum Filter Co. Eng. Pat. 28,625, Dec. 7, 1909.

See U.S. Pat. 946,862 of 1910; this J., 1910, 201.—T. F. B.

Metals; Process for imparting black coatings to ——. Fabr. Chem. Gravüren Luppe und Heilbronner, Munich, Germany. Eng. Pat. 1639. Jan. 21, 1910. Under Int. Conv., June 1, 1909.

See Fr. Pat. 403,969 of 1909; this J., 1910, 97.—T. F. B.

Metallurgical process and apparatus. M. Moore, Melbourne, and T. J. Heskett, Brunswick, Victoria. U.S. Pats. 960,987 and 960,988, June 7, 1910.

See Eng. Pat. 26,131 of 1907; this J., 1908, 813.—T. F. B.

Briquetting fines of ore, blast-furnace dust, metal waste, and analogous materials. Mannesmannröhren-Werke. Fr. Pat. 410,177, Dec. 9, 1909.

See U.S. Pats. 958,623, 958,700 and 958,701 of 1910; this J., 1910, 764.—A. S.

Cement from blast-furnace slag. Eng. Pat. 3016. *See* IX.

XI.—ELECTRO-CHEMISTRY.

Furnace electrodes. C. Hering. Met. and Chem. Eng., 1910, 8, 238—240, 329—331.

Details are given of the tests made with electrodes of carbon, graphite, iron, and copper (this J., 1909, 1206; 1910, 435), together with further experimental results and deductions therefrom. If the "electrode voltage" (*loc. cit.*) for 1° C. be represented by e, then the total voltage (E) between the hot and cold ends of the electrode (throughout the paper the word electrode is used to represent that portion which passes through the furnace walls) is $E = e\sqrt{T}$, where T is the difference in temperature between the two ends. If E be multiplied by the current in ampères, the product represents the minimum loss in watts attainable for the given temperature and current. The relation between the cross-section (S) and length (L) of the electrode, the current (I), and the difference in temperature (T) between the two ends, is expressed by $S = IL\sqrt{r \div 2kT}$, where r is the electrical resistivity and k the thermal conductivity. The "specific section" (s) for unit current, length, and difference in temperature is then $s = \sqrt{r \div 2k}$, whilst for the temperature difference, T, the expression $S^1 = \sqrt{r \div 2kT}$, holds. S^1 is called the "section per ampère per inch (or centimetre) length," and by multiplying it by the current and the length, the cross-section is obtained for which the electrode is correctly proportioned, so that no heat flows in either direction through the hot end. The experimental results obtained with carbon, graphite, iron, and copper electrodes are given in a table and in curve-diagrams, and from them the following expressions have been derived connecting the quantities E (watts per ampère) and S^1 (sq. in. of cross-section per inch length or sq. cm. per cm. length) respectively with the difference in temperature, T, between the hot and cold ends of the electrodes:—

$$E^2 = aT + bT^2; \quad S^1 = m + n/T.$$

The constants, a, b, m, and n have the following values:—

			Inches.		Centimetres.	
	a	b	m	n	m	n
Carbon	0·00373	0·000000360	0·000200	0·483	0·000508	1·23
Graphite	0·00256	0·000000710	0·000173	0·0665	0·000440	0·169
Iron	0·0000369	0·000000116	0·0000967	0·00262	0·000246	0·00666
Copper	0·0000176	0·0000000399	0·0000129	0·000888	0·0000329	0·00226

—A. S.

Electric conductivity of soils; Effect of moisture and of solutions on the ——. [*Corrosion of iron and steel.*] R. O. E. Davis. Amer. Electrochem. Soc., May, 1910. Met. and Chem. Eng., 1910, 8, 348—349.

Accepting the view that the corrosion of iron and steel pipes in the soil is an electrochemical phenomenon, the author studied the effect of moisture and different solutions on the electrical conductivity of various types of soils. The results show that dry soil offers a very high resistance to the passage of an electric current. At a depth of 2 ft. or more for a given soil or area, the electrical conductivity remains roughly constant; it increases almost directly with the percentage of moisture, the absolute increase depending upon the type of soil. In the case of soils saturated with water, the conductivity increases directly with the amount of salts in solution. In incompletely saturated soils, the resistivity increases almost in proportion to the surface area of the soil, but for fully saturated and supersaturated soils, the surface area does not exert so great an influence. The conductivity is greatly increased by sodium carbonate, and decreased by humus. Of the different types of soil, the least quantity of electrolyte is probably yielded by sandy soil and the most by clay. If the texture, content of organic matter, water content, and saturation point of a soil be approximately known, as well as the content of soluble salts in the soil solution, it is possible, by the aid of data given in the paper, to calculate roughly the current which would be produced by a given potential difference between two points in the soil.—A. S.

Formamide as a solvent for inorganic salts, and the electrolysis of these solutions. H. Röhler. Z. Elektrochem., 1910, 16, 419—436.

The solution of inorganic salts in formamide results, as a rule, in the deposition of a metallic formamide, equilibrium being established in accordance with the equation: $n\mathrm{HCONH_2} + \mathrm{MeCl_2} \rightleftarrows \mathrm{(HCONH)_2Me{\cdot}}x\mathrm{HCONH_2} + \mathrm{2HCl}$, $y\mathrm{HCONH_2} + (n-2-x-y)\mathrm{HCONH_2}$, in which, by way of example, $\mathrm{MeCl_2}$ indicates a metallic chloride. When the solution is electrolysed, using the metal as anode and a platinum cathode, the solution of the anode and deposition of metal on the cathode is usually normal, if air be excluded. Using solutions of zinc oxide and stannous chloride respectively, good deposits of zinc and tin were readily obtained. The formamides of copper, nickel, cobalt, zinc, and lead were prepared and examined, and conductivity determinations of their solutions in formamide were made. Experiments with a view to ascertaining whether formamide, like water, has a temperature of maximum density near its melting point, show that density and specific volume, between —7° and +25° C., are linear functions of the temperature.—F. Sodn.

Electrolytic reduction of nitric acid. Patten and McCaughey. *See* VII.

Electrolytic decomposition of sodium chloride. Billiter. *See* VII.

New mercury cell for alkali chloride electrolysis. Whiting. *See* VII.

Patents.

Electrolytic and similar solutions; Process of treating ——. G. A. Gabriel. Assignor to Bleach and Caustic Process Co., New York. U.S. Pat. 959,730, May 31, 1910.

During the process of electrolysis, the electrolyte is removed from the products of decomposition, evaporated to dryness, purified, and re-admitted to the electrolytic cell, in a continuous manner.—O. R.

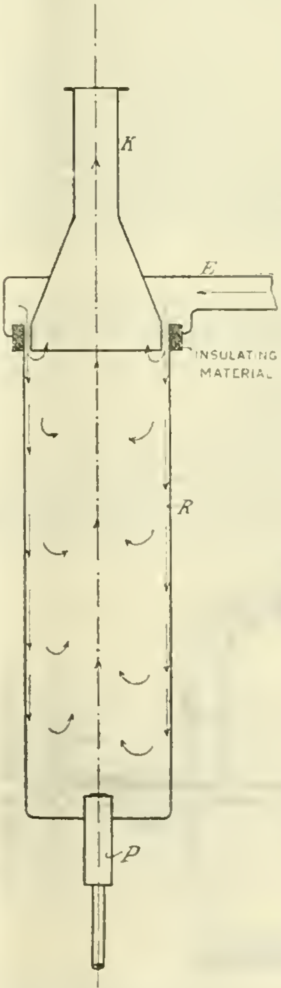
Electrolysing apparatus. C. G. R. Senemaud. Fr. Pat. 410,216, March 8, 1909.

A double diaphragm is employed, consisting essentially of a double frame supporting porous plates of porcelain, which cover openings in the frame, the latter being suitably bound to the plates. Small porous plates may thus be employed, and the thickness of the diaphragm compartment is reduced to a minimum. The electrodes are supported in grooves in the vertical sides of a frame, the electrodes thus having play to allow for expansion. The arrangement allows of the employment of carbon plates of reduced dimensions, which are interchangeable.—B. N.

Furnace; Electric ——. T. F. Baily, Alliance, Ohio. U.S. Pat. 960,773, June 7, 1910.

The furnace comprises walls of non-conducting heat-resisting material arranged to form a heating chamber, and provided with an opening constituting a means of access to the chamber. Spaced electrodes extend across the heating chamber, and are arranged in a convergent position, the electrodes being nearer to each other at a point adjacent to the opening than at other points in the chamber. A body of granular resistance material is located in the heating chamber, the portion of the material intermediate of the electrodes being of relatively small cross-section. The electrical pathway of least resistance between the electrodes lies in the part adjacent to the top surface of the resistance material.—B. N.

Arcs of great dimension; Production of stable —— *and their application in bringing about gaseous reactions.* Badische Anilin und Soda Fabrik. Fr. Pat. 410,710, Dec. 27, 1909. Under Int. Conv., June 25, 1909.



The gas enters at the tube, E, passing down along the walls of the tube, R, and returning along the length of the arc, which is produced between K and P. In an alternative form, the gas first passes through an annular space surrounding the tube R, entering the latter through tangential openings which give an eddying movement to the gas.—B. N.

Ozone generator. Soc. Anon. Sanitas Ozone. Fr. Pat. 409,461, Nov. 20, 1909.

A series of electrodes is mounted between two parallel metallic plates, which are insulated from one another. Each electrode consists of a metallic spiral, surrounded by a glass tube, and terminates at one end in a glass rod and at the other in a metallic connecting screw. The extremities of each electrode are connected with the plates, the conducting end with one plate and the non-conducting glass rod with the other, successive electrodes being mounted in reverse order. The electrodes are arranged in parallel at suitable distances from one another.—O. R.

Electrolytic apparatus with liquid anode. K. Hahn. Winkel. Assignor to Schott und Gen., Jena, Germany. U.S. Pat. 959,521, May 31, 1910.

See Fr. Pat. 404,332 of 1909; this J., 1910, 222.—T. F. B.

Metallic filaments for electric lamps. Eng. Pat. 15,496. *See* IIb.

Electric furnace for continuous manufacture of glass. Addition to Fr. Pat. 401,744. *See* VIII.

XII.—FATS; OILS; WAXES.

Linseed oil; Composition of ——. W. Fahrion. Z. angew. Chem., 1910, 23, 1106—1108.

The author has made a careful examination of a sample of linseed oil, using the oxidation method described by him (this J., 1910, 639) to separate the oleic from the linolic and linolenic acids. His results are as follows:—Unsaponifiable matter, 0·6; saturated fatty acids, 8·6; oleic acid, between 15 and 20·1; linolic acid, 30·0; linolenic acids, 38·0 per cent. These figures confirm those given earlier by him (this J., 1904, 26).—J. T. D.

Alkali soaps; Hydrolytic dissociation of —— in alcohol-aqueous solutions. D. Holde. Z. Elektrochem., 1910, 16, 436—442.

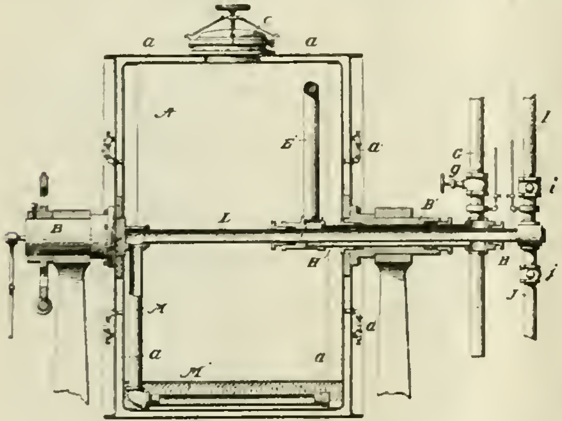
Although it has been shown that the higher fatty acids may be titrated with caustic alkalis, in the presence of 40 or more volumes per cent. of alcohol, the fatty acids can be extracted from such neutralised solutions to an appreciable extent by means of an immiscible solvent, unless the proportion of alcohol be increased to at least 80 per cent. Accurate alkalimetric determinations of these acids must, therefore, be carried out only in homogeneous systems (such as, benzene-alcohol, ether-alcohol, etc.) or in a non-homogeneous system, in which the soap solution contains, after the titration, 80 volumes per cent., or more, of alcohol.—F. Sodn.

Action of ultra-violet rays upon certain solutions used in pharmacy, and upon fatty substances, glucosides, alkaloids, and phenols. Lesure. *See* XX.

Patents.

Oils; Apparatus for extracting ——. W. J. Wells, Decatur, Ill. U.S. Pat. 954,660, April 12, 1910.

The oil-yielding material is introduced through C′ into the drum, A, mounted on the hollow trunnions B, B′, and a partial vacuum is created in the drum by suction through the pipe, G, which leads to a condenser and pump. A volatile solvent is introduced through the pipes, I, H, L, M, and collecting chamber, M′, any escaping vapours passing through G to the condenser. The drum is filled with solvent nearly to the level of the top of the pipe, E′. The valve, *i*, is then closed, the drum is rotated, and steam is introduced into the jacket, *a*. When the extraction is complete, the rotation is stopped, and with the collectin chamber, M′, in its lowest position, the valve j, is opened the solution of the oil in the volatile solvent flowin through the pipes, M, L, H, J, into a receptacle. Th flow may be accelerated by producing pressure within th drum, either by closing the valve, *g*, or by introducin steam from the jacket through one or more of the valves *a′*. The drum is next again rotated, the valves, *a′*, ar all opened, and steam is introduced from the jacket, i order to expel the solvent, the vapours passing throug G to the condenser.—A. S.



Oil; Process and apparatus for extracting ——. F. B Anderson, Assignor to the V. D. Anderson Co., Cleveland Ohio. U.S. Pats. 960,143 and 960,144, May 31, 1910.

The seed or other material is expressed, and the oil passe through a filter-press, with or without preliminary separa tion of the "foots." The latter, including the residue in th press, are gradually returned to the stock, to be presse again with the fresh material. The type of apparatu claimed for this process includes the two presses, wit means for conveying the oil to the filter-press and fo returning the "foots" to the stock as it is fed to the oil press.—C. A. M.

Oil; Process and apparatus for extracting —— fro hydrosilicates, fuller's earth, and animal or miner black which have been used to decolorise oils. Soc. Anon Huilerie et Savonnerie de Lurian. Fr. Pat. 409,91 Mar. 1, 1909.

The spent decolorising material is mixed with salt wate and the mixture heated to about 85° C. with sulphuri acid, and then treated with sodium carbonate and mechan cally agitated for a short time. The liberated carbo dioxide carries to the surface the oil contained in th material. The apparatus used consists of a tank provide with a steam coil and a revolving vertical agitator wit horizontal paddles.—C. A. M.

Hydrocarbon soaps; Art of making ——. I. V. Broe New York. U.S. Pat. 959,820, May 31, 1910.

The hydrocarbon (naphtha, etc.) is emulsified with soa or a dilute solution of soap and a relatively small quantit of ammonia, the emulsion gradually stirred into a heate mass of the soap, and the whole cooled, and, if desire granulated. Or a volatile hydrocarbon may be incorpo ated at about 120° F., with a solution containing approx mately 10 parts of soap to one part of ammonia wate the process being continued until the resulting produ contains at least 100 parts of hydrocarbon for each part soap.—C. A. M.

Soap with a basis of vaseline, mineral oil or other petroleu product; Manufacture of ——. P. A. Müller. Fr. Pa 410,894, Dec. 13, 1909.

The vaseline or other petroleum product is subjected chemical treatment prior to being boiled with the soa Thus, it may be treated with oleic acid (say 1750 part and an alcoholic solution of ammonia (say 750 parts) (say) 3500 parts of vaseline, etc.; and the resulting mixtu added to the soap in the course of saponification. T soap thus prepared may contain up to 20 per cent. of vas line, etc., and yet, it is stated, be completely soluble alcohol and in water.—C. A. M.

Candles. F. L. Schauermann, Twickenham. Eng. Pa 12,331, May 25, 1909.

The wax or other inflammable material is incorporat with chalk, with or without the addition of casein, cur or the like. The powdered chalk may be mixed with the other ingredients, and the mixture, when dry, incorporat with the wax, etc.—C. A. M.

Distillation of oils, fats, and analogous substances. Fr. Pa 410,630. *See* III.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead; Action of sulphuretted hydrogen on ——. J. F. Sacher. Chem.-Zeit., 1910, 34, 647—648.

It is found that only the lead atoms in white lead which are linked to hydroxyl groups react with sulphuretted hydrogen, a sulpho basic lead carbonate being formed. By passing the gas through a triturated mixture of 1—2 grms. of white lead and 20 c.c. of water for ½-hour, at the ordinary temperature, a product was obtained, containing only 2·55 per cent. of sulphur (= 19·01 per cent. of lead sulphide); no carbon dioxide was evolved. Repeating the experiment at 85°—90° C., the resulting product contained 5·06 per cent. of sulphur, equivalent to 37·73 per cent. of lead sulphide, 30·93 per cent. being formed by the conversion of the whole of the lead hydroxide and the remaining 6·8 per cent. being derived from the carbonate, owing to the conversion of normal carbonate into basic carbonate, with evolution of carbon dioxide, by heating the white lead with water: $3PbCO_3 + H_2O = 2PbCO_3,Pb(OH)_2 + CO_2$. Sulphuretted hydrogen was also passed through white lead triturated with absolute alcohol; the resulting product contained only 2·1 per cent. of sulphur; the analytical results agreeing well with the formula: $4PbCO_3, PbS, Pb(OH)_2$. Specimens of the products formed by the action of sulphuretted hydrogen on white lead, hermetically sealed, and exposed to sunlight for three years, did not show the slightest trace of any bleaching action.—A. Sbld.

Patents.

Red or orange lead or lead paste; Purification of ——. W. Eekford, Rhyl, Wales. Eng. Pats. 12,480, May 26, 1909, and 26,729, Nov. 17, 1909.

Ordinary red or orange lead paints, when mixed with linseed oil or the like, quickly harden owing to the presence of lead monoxide. The greater part of the lead monoxide may be removed by treating the oxides with dilute acetic acid, drying and grinding the powder with the desired oil or medium, a small proportion of lead monoxide being retained to act as drier. Or, the mixture may be ground with the oil or medium after treatment with dilute acetic acid, but without intermediate drying, it being stated that the latter may sometimes cause the reduction of red lead to monoxide.—O. R.

Ferric oxide [pigment]; Manufacture of ——. J. Gill, Pendleton, Lancs. Eng. Pat. 21,884, Sept. 25, 1909; Addition to Eng. Pat. 5618, Mar. 9, 1909 (this J., 1910, 223).

The oxidation stage of the process previously described is conducted at a higher temperature than before, the mixture of ferrous chloride and calcium carbonate being heated to 200°—220° F.: the magnetic oxide, Fe_3O_4, is thus formed. The product is washed and then calcined to ferric oxide, Fe_2O_3, any shade of which is obtained by selecting the proper temperature of oxidation. A calcination temperature of about 800° F. for 2 hours is required, as compared with 2000° F. for about 5 hours in the original process.—F. Sodn.

Ultramarine; Process of roasting —— in covered crucibles. R. Rehkop. Fr. Pat. 410,055, Dec. 6, 1909.

In the ordinary method of roasting ultramarine, the covers of the crucibles, being exposed to a high temperature, melt, with the result that a large proportion of the gaseous products formed in the process escape from the crucibles. To obviate this the crucibles are arranged in the furnace so that their closed openings project beyond the zone of the hot gases in the furnace.—C. A. M.

Product [white pigment] for use in painting. A. Monin. Fr. Pat. 410,492, Dec. 21, 1909.

A white pigment which does not turn yellow in the air is obtained by incorporating antimony oxide (say 50 per cent.), with dehydrated calcium sulphate (say 35 per cent.) and hydrated calcium sulphate (say 15 per cent.). The resulting product may be used in the same way as pure antimony oxide or white lead.—C. A. M.

Ink drying immediately after writing; Manufacture of ——. A. Rüter. Fr. Pat. 410,635, Dec. 20, 1909.

An addition is made to the ink of a neutral volatile substance, such as spirits of wine or the like, in the proportion of *e.g.* one part to five of the ink.—C. A. M.

Turpentine oil, oils, and other products; Process of extracting —— from wood. Southern Manufacturing Co. Fr. Pat. 410,753, Dec. 28, 1909.

The hot solvent (*e.g.* melted rosin) is made to circulate over the wood, which is contained in a suitable vessel, and is thence conducted to a separate chamber in which it is agitated and maintained at the same temperature, preferably by the introduction of steam superheated to approximately the temperature of the solvent as it enters the extraction vessel (163° to 190° C.). By this means better separation of the extracted products is effected than by treating the extract with ordinary steam (which cools the liquid). Subsequently the heated solvent may be returned to the extraction vessel, which, like the separation chamber, may be constructed in the form of a closed receptacle. —C. A. M.

Wood; Brown stain for ——. C. Bunnenberg. Ger. Pat. 220,022, June 1, 1906.

A concentrated ammoniacal solution of cupric oxide is mixed with four times its weight of a 4 per cent. solution of potassium bichromate. This solution is said to impart a greyish brown colour to oak, similar to that of old wood. —T. F. B.

Albuminoid substances; Process for preventing the coagulation of solutions of —— in presence of formaldehyde. W. Stadler. Ger. Pat. 222,419, May 1, 1909. Addition to Ger. Pat. 220,493, April 18, 1909 (this J., 1910, 578).

Aromatic sulphonic acids (*e.g.*, naphthalenesulphonic acids) may be used to prevent the coagulation of solutions of albuminoids containing formaldehyde.—T. F. B.

Wood; Process of extracting products [turpentine oil, etc.] from ——. F. Pope, New York, Assignor to Southern Manufacturing Co., Pittsburg. U.S. Pat. 959,599, May 31, 1910.

See Fr. Pat. 410,753 of 1909; preceding.—T. F. B.

Distillation of oils, fats, and analogous substances. Fr. Pat 410,630. *See* III.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Pará rubber exports from the Straits Settlements. Board of Trade J., June 16, 1910. [T.R.]

The following table shows the quantities of Pará rubber, the produce of the Straits Settlements, Federated Malay States, Johore, and Sumatra, exported from Singapore and Penang in the years 1908 and 1909:—

To	1908.	1909.
	Lb.	Lb.
United Kingdom	3,004,883	3,860,459
Continent of Europe	310,847	269,748
United States of America	400	22,551
Ceylon	310,489	209,642
Australia	21,419	92,363
Japan	11,868	49,670
Total	3,659,906	4,504,433

Patents.

Caoutchouc and the like ; Treatment of ——. Kautschukges. Schön und Co., Harburg-on-the-Elbe, Germany. Eng. Pat. 13 570, June 9, 1909. Under Int. Conv., April 28, 1909.

An addition of alkali or alkaline-earth lye is made to the resin solvent used in the process of obtaining pure caoutchouc, gutta percha, and the like claimed in Eng. Pat. 4692 of 1906 (this J., 1906, 940), such addition having the object of separating products (caoutchouc, resin) of a lighter colour.—C. A. M.

Rubber, guttapercha, balata, etc. ; Process for preventing —— from becoming hard and brittle. Wo. Ostwald and Wa. Ostwald. Ger. Pat. 221,310, Nov. 1, 1908.

Freshly prepared, raw rubber, guttapercha, etc., is treated with aromatic nitrogenous bases ; the substances may be applied either in solution, or in the form of liquid or vapour.—T. F. B.

Flexible and elastic plastic compositions. F. W. J. Henning and J. Wetter, London. Eng. Pat. 11,905, May 20, 1909.

Compositions of the kind described in Eng. Pat. 1083 of 1908, and consisting chiefly of a gelatinised mixture of starch, magnesium chloride, and water, may be rendered relatively waterproof by the addition, before the mixture is gelatinised, of about 0·1 per cent. of a saturated solution of ammonium or potassium bichromate, and exposing the finished product to light ; from 1 to 3 per cent. of paraffin oil may be added for the same purpose, and about 1 per cent. of rye flour may be incorporated with the mixture to increase the toughness of the latter. Waste or old material may be rendered fit for further use by finely dividing it, mixing the particles with fresh liquid composition of the above-mentioned character, macerating the mixture and gelatinising it in moulds by the application of heat.—W. P. S.

Indiarubber, gutta percha, balata, and the like ; Apparatus for removing foreign matter from ——. M. M. Dessau, London. U.S. Pat. 960,846, June 7, 1910.

See Eng. Pat. 24,438 of 1908 ; this J., 1910, 225.—T. F. B.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Acidity in tanning liquors ; Determination of ——. J. H. Yocum, T. A. Faust and G. A. Riker. J. Amer. Leather Chem. Assoc., 1910, **6**, 292—295.

The acids in tan liquors, the estimation of which is of importance, are those which have a plumping effect on the hide ; weak acids formed by hydrolysis of the tannin such as gallic acid, do not exercise any plumping effect. The principal objection to most of the methods of measuring acidity in tan liquors hitherto suggested is that, by them, gallic acid is estimated together with the other acids. In methods in which tannin is precipitated by gelatin, previous to titration, about one-quarter of the total gallic acid present is co-precipitated. The authors find that an addition of a solution of gum arabic to the gelatin solution, practically all the gallic acid is precipitated with the tannin, leaving no acids in the filtrate besides those that cause plumping. The method is as follows : To 15 c.c. of the liquor, 50 c.c. of gelatin solution (aqueous or alcoholic), and 15 c.c. of a 2 per cent. gum arabic solution are added ; the volume is made up to 200 c.c., 5 grms. of kaolin are added, and the whole is shaken thoroughly and filtered. 40 c.c. of the filtrate (=3 c.c. of original liquor) are titrated with $N/10$ caustic soda, using hæmatin as indicator. The method was tried with liquors from various tanneries with the result that, with liquors from a tannery in which scarcely any pyrogallol-tannins were used, only a very slight difference between results obtained by the gelatin and the gelatin-gum method was found, showing that, in the absence of gallic acid, the gum has no effect. With
liquors from chestnut extracts however, naturally contair
ing gallic acid, the results obtained by the gelatin-gur
method were about one-quarter lower than by the gelati
method, and were coincident with the amount of " plum
ing acid " calculated as having been actually added.
—D. J. L.

Tannin. K. Feist. Pharm. Zentralh. **49** [48] ; throug
Collegium, 1910, 219—220.

The author, in his investigation on the nature and const
tution of tannin, used Turkish gall nuts and extracte
them with different solvents. From the composition a
properties of the matters extracted, he suggests that t
tannin molecule consists of a glycogallic acid as base,
which two molecules of gallic acid are attached in t
nature of an ester.—A. T. H.

Patents.

Leather ; [Waterproofing] ——. W. K. L. Dickso
London. Eng. Pat. 22,903, Oct. 7, 1909.

The leather is soaked in a suitable liquid to render it poro
and is then dried and impregnated with a solution of gu
balata in carbon bisulphide or other solvent, with or witho
the aid of hydraulic pressure or the use of a vacuu
Reference is directed to Eng. Pats. 18,600 of 1894 a
14,839 of 1895 (this J., 1896, 729).—C. A. M.

Artificial leather ; Process for the manufacture of —
E. Reidel. Fr. Pat. 410,369, Dec. 15, 1909. Und
Int. Conv., Jan. 8, 1909.

A fabric is prepared from animal fibres, tendons, intestin
etc., by beating, compressing, and combing the latter
such a manner that the fibres cross each other alt
nately. This sheet is tanned, washed, treated wi
an aluminium compound and then coated with one
more of the following solutions : (1) 2500 parts by weig
of a viscous solution of gutta-percha, balata, etc.,
carbon tetrachloride, chloroform or the like, are mix
with 800 parts of benzene and the mixture is agitated
24 hours ; (2) the residue obtained on refining linseed
cottonseed oil, etc. ; (3) oxidised resinous oils. The
of the first composition yields an elastic product ; on
addition of the second the product becomes more so
and tenacious, whilst further treatment with the th
composition makes it very solid and durable. The co
positions may be used together or alone according to
quality and character of the product desired.—W. P. S

Glue ; Process for converting ——. C. M. Zimmerma
Cincinnati, Ohio. U.S. Pat. 961,058, June 7, 1910.

The dry glue is soaked in a predetermined quantity
water to form a jelly, and the latter is placed on a perfora
support in a closed chamber and subjected to the act
of steam. The liquid glue falls through the perforati
and is collected, and means are provided for catching
condensed water and preventing it from mixing with
liquid glue.—A. S.

Apparatus for dyeing [leather] by pulverisation. Fr. P
410,743. *See* VI.

XVI.—SOILS ; FERTILISERS.

Advisory Committee on Agricultural Science.

The President of the Board of Agriculture and Fishe
has appointed a Committee to advise the Board on
scientific questions bearing directly on the improvemen
agriculture, and especially as to the methods to be adop
(*a*) for promoting agricultural research in universi
and other scientific schools ; (*b*) for aiding scient
workers engaged in the study of agricultural proble
and (*c*) for ensuring that new scientific discoveries
utilized for the benefit of agriculturists.

The Committee will consist of his Grace the Duke
Devonshire, P.C., the Right Hon. Lord Reay, G.C.

.C.I.E., Sir Edward Thorpe, C.B., F.R.S., Mr. David
avies, M.P., Dr. J. J. Dobbie, F.R.S., Professor J. B.
armer, F.R.S., Dr. S. F. Harmer, F.R.S., Dr. R. Stewart
acDougall, M.A., Mr. T. H. Middleton, M.A., M.Sc.,
r. P. Spencer Pickering, F.R.S., Lieutenant-Colonel
avid Prain, C.I.E., F.R.S., Mr. H. S. Staveley-Hill,
.P., Mr. Stewart Stockman, M.R.C.V.S., Dr. J. J. H.
all, F.R.S., and Dr. David Wilson, M.A. Mr. Middleton
ill act as chairman of the Committee and one of the
ficers of the Intelligence Division of the Board will
t as secretary.

al humus as determined by different methods. S. Leavitt.
J. Ind. Eng. Chem., 1910, 2, 269—271.

he official American method for the determination of
umus, when followed literally, is very unsatisfactory
nd gives abnormally high results. The author compares
e results obtained by various modified methods, and
amines the cause of the differences exhibited. The
ilure of precipitation methods is due to the fact that
e organic matter extracted from soil by dilute ammonia
present as compounds of various types, and the relative
oportions of these types are widely different in different
ils. The method used by the author is to treat the soil
th 4 per cent. ammonia, and to allow the clay to settle
r several days. A portion of the supernatant liquid
siphoned off, evaporated to dryness and baked for some
urs on a steam bath. The residue is redissolved in
per cent. ammonia, filtered, re-evaporated, baked again,
solved in 4 per cent. ammonia and filtered. The
trate, which should now be quite clear, is evaporated
dryness, the residue weighed and then ignited. The
s on ignition gives the humus.—T. St.

ne superphosphate; The nitrogenous matters in ——.
G. Chardet. Ann. Chim. analyt., 1910, 15, 215—219.

he nitrogen occurring in bone superphosphate is present as
mic nitrogen, amino nitrogen (glycocoll, leucine, alanine),
sic nitrogen (arginine, lysine, histidine), ammonia,
d protein nitrogen; of these forms, the protein nitrogen
less useful as a manure than the other forms of nitrogen.
e various nitrogenous constituents of superphosphate
ay be separated and determined by the following
ocesses:—*Ammoniacal nitrogen;* 20 grms. of the
mple are distilled in the presence of calcined magnesia
the usual way. *Humic, amino, and basic and amino
rogen:* 50 grms. of the superphosphate are treated in
flask with 150 c.c. of 90 per cent. alcohol and 15 c.c.
ammonia of 22 B°., and the mixture is heated on a
ter-bath for 30 minutes; the liquid portion is then
ssed through a filter and the insoluble portion is washed
th 250 c.c. of alcohol containing 5 c.c. of ammonia,
filtrate and washings being collected in a 500 c.c.
sk. After diluting to the mark with alcohol, 100 c.c.
the alcoholic solution are evaporated to dryness and the
idue is weighed; the total nitrogen is then determined
a portion of this residue. *Humic nitrogen* is deter-
ned by evaporating 200 c.c. of the alcoholic solution
til all ammonia has been expelled, then precipitating
solution by addition of barium hydroxide and again
iling to ensure the removal of the last traces of ammonia.
e precipitate contains all the nitrogenous humic
bstances and is collected on a filter; after being dried,
nitrogen in the precipitate is determined by Kjeldahl's
thod. *Basic nitrogen:* the filtrate from the barium
droxide precipitate is treated with hydrochloric acid
phosphotungstic acid; the basic substances are thus
cipitated and the nitrogen in them is determined
the usual way. *Amino nitrogen:* the filtrate
m the phosphotungstic acid precipitate is evaporated
a volume of about 10 c.c. and then digested with sul-
aric acid for the determination of the nitrogen. *Protein
rogen:* the residue insoluble in ammoniacal alcohol
lried and weighed; a weighed portion of it is then boiled
h water containing magnesia in suspension in order
expel ammonia, and the nitrogen is determined in the
idual mixture. The following quantities of nitrogen
re found in four samples of bone superphosphate
examined.—Total nitrogen, 0·91—2·10; ammoniacal nitrogen, 0·03—0·08; humic nitrogen, 0·04—0·11; basic nitrogen, 0·11—0·31; amino nitrogen, 0·38—11·2; and protein nitrogen, 0·18—0·48 per cent.—W. P. S.

Effect of moisture and of solutions on the electrical conductivity of soils. Davis. *See* XI.

Composition of lime-sulphur spray. Tartar and Bradley. *See* XIXb.

Patent.

Potassium compounds; Process of rendering —— soluble. F. R. Carpenter. Assignor to the American Iron and Steel Alloys Co., Denver, Col. U.S. Pat. 959,841, May 31, 1910.

Feslpathic rocks are fused, suddenly chilled, and reduced to a fine powder.—O. R.

XVII.—SUGARS; STARCHES; GUMS.

Sugar; Bang's method for determining ——, and the keeping properties of the titration liquids used therefor. A. C. Andersen. Biochem. Zeits., 1910, 26, 157—164.

Jessen-Hansen (this J., 1908, 698) has observed that the titer of the copper solution used in determining sugar by Bang's method (*loc. cit.*, 1907, 161), depends on the quantity of water in which the copper sulphate is dissolved prior to addition of the solution of the other salts. The author finds that the copper solution used in Bang's method suffers a loss in content of cupric copper on storage, either in the dark or exposed to light, the loss being greater in the latter case. The solution of hydroxylamine sulphate and potassium thiocyanate employed in Bang's method does not alter when stored in the dark, but is weakened by exposure to light. Both solutions should be kept in the dark; the hydroxylamine solution may then be used to determine the amount of alteration in the copper solution. The error in the determination of sugar due to alteration of the copper solution cannot, however, be eliminated by calculation. The length of time for which the copper solution may be kept, depends on the degree of accuracy required; three months is permissible in the case of the determination of sugar in urine.—L. E.

Hydroxymethylfurfural; Constitution of ——. J. J. Blanksma. Chem. Weekblad, 1909, 6, 1047—1053. Chem. Zentr., 1910, 1, 539.

The compound produced by heating lævulose, dextrose, or galactose with a dilute solution of oxalic acid, and described as β-hydroxy-δ-methylfurfural (this J., 1909, 536), has now been shown to be ω-hydroxymethylfurfural,

$\overline{O.C(CH_2OH):CH\cdot CH:C}.CHO$.—A. S.

Hexoses; Formation of lævulinic acid from ——. W. A. van Ekenstein and J. J. Blanksma. Chem. Weekblad, 1910, 7, 387—390. Chem. Zentr., 1910, 1, 1961—1962.

In a similar manner to dextrose and galactose (this J., 1909, 536, and preceding abstract), mannose also when heated for 3 hours with a 0·3 per cent. solution of oxalic acid at 130° C., yields a small quantity of ω-hydroxymethylfurfural. The greater portion of the mannose can be recovered unaltered, just as with dextrose and galactose. Heating under pressure with a 0·3 per cent. solution of oxalic acid thus appears to afford a means of separating ketohexoses and aldohexoses: the former are converted completely into hydroxymethylfurfural and humus-substances. The Ihl-Pechmann reaction for hexoses depends upon the formation of ω-hydroxymethylfurfural: the latter when heated with 1 c.c. of 15 per cent. hydrochloric acid and 2—3 drops of a 20 per cent. alcoholic solution of diphenylamine, gives a dark blue coloration.—A. S.

Patents.

Saccharine liquids: Defecation of ——. F. E. Coombs, Natick, Mass. U.S. Pat. 958,907, May 24, 1910.

The defecating apparatus includes a conduit, means for delivering the sugar juice into the conduit, a device for equalising the flow in the conduit, a discharge for the conduit provided with a vertical slot and a sleeve or collar also provided with a slot and movable with regard to the discharge. Means for a continuous supply of milk of lime to the sugar juice, include a valve, through which a current of the milk of lime may be made to circulate, connected to a float rising and falling with the level of the sugar juice in the conduit. The mingled sugar juice and milk of lime are continuously delivered from the conduit to a receptacle; means are provided for thoroughly mixing the liquid in the receptacle, for continuously withdrawing the treated liquid from the receptacle, and for maintaining a thoroughly mixed and uniform volume of liquid in the receptacle during the continued simultaneous addition and withdrawal of liquid.—L. E.

Defecation [Sugar]: Process of continuous —— at a high temperature, with filtration. J. V. Roussel. Fr. Pat. 410,073, Mar. 5, 1909.

The cane juice from the mills is sulphited in a continuous sulphiting apparatus, and passes thence to three vessels, each holding 25—60 hl., which serve both for admixture with lime, and for measuring the volume of juice. To each vessel, 1—1·5 kilos. of phosphoric acid are added, in the form of superphosphate containing 40—45 per cent. of phosphoric acid and quite free from sulphates or free sulphuric acid. The juice is then neutralised with lime, agitated for a quarter of an hour, and pumped into a series of reheaters, and thence to a separator, its temperature now being 115°—120° C. The separator is divided into two compartments connected below by a siphon. The first compartment is fitted with an escapement controlled by a safety valve. The juice flows from the second compartment by a pipe leading directly to the filter-presses or by a pipe leading to a large mixing vessel provided with a steam escapement and gauge. The steam from the second compartment of the separator passes by another pipe to the mixing vessel and heats the juice therein. The juice from the mixing vessel can pass directly to the filter-presses, or to a pump and subsequently to the filter-presses. Twelve filter-presses may be used; of these, one receives the juice from the mixing vessel at a pressure of 0·35—0·7 kilo. per sq. cm., two receive the juice from the separator at a pressure of 1·125 kilos.; seven receive the juice from the pump at a pressure of 4 or 5 kilos., one is ready for use, and one is being emptied and cleaned. Each filter-press is provided with a three-way cock, whereby the press may be supplied with juice at one or another pressure. The juice leaves the filter-presses at a temperature of about 95° C.—L. E.

Sugar-containing plants; Treatment of ——. Fawcett, Preston & Co., Ltd. Fr. Pat. 410,135, Dec. 8, 1909.

The raw material, *e.g.*, sugar cane, is cut up in such a way as to destroy its texture, and then dried, either in the sun or preferably by artificial heat, until its weight is reduced by about 70 per cent. The dried material will keep for a very long time. The sugar may be extracted by the ordinary processes; since the sugar is present in the material in the dry state it can be extracted in the form of a very concentrated solution. The residues left after extracting the sugar and other soluble substances, consist of cellulose which may be utilised in paper making.—L. E.

Beetroot pulp or other materials; Apparatus for the continuous diffusion of ——. C. Guichard. Fr. Pat. 410,693, Dec. 24, 1909.

The apparatus includes a series of cylindrical vessels placed end to end, and separated one from another by counterpoised conical valves. Each cylinder is perforated along part of its length, the perforated portion being surrounded by an envelope. The material, *e.g.*, beetroot pulp, is introduced through a hopper, and by a rotating distributor, into the first cylinder where it completes the saturation of the juice; it is carried through the cylinder by rotating blades mounted on a shaft; under the pressure exerted by the blades, the conical valve opens, allows the pulp to pass into the next cylinder, and so on. The water, the supply of which is governed by a float, is fed into the last cylinder and travels in a direction opposed to that of the pulp. Each cylinder is connected with a heater; the juice which collects in the envelope surrounding the perforated part of the cylinder, flows into the heater where it is heated prior to its entry into the next cylinder. A three-way cock fitted to the inlet tube of the heater permits of connection being made between the heater and the corresponding cylinder or the cylinder into which the heated juice flows; if the latter connection is made, the juice may be passed repeatedly through the same cylinder. —L. E.

Starch; Process of converting —— into derivatives, dextrin, dextrose, etc. S. M. Lillie, Philadelphia, Pa. U.S. Pat. 957,237, May 24, 1910.

Starch is treated with water and acid to form a suitably mobile and acid mixture which is passed at a constant rate through heating devices, and quickly heated therein "to the desired converting temperature, with only a partial conversion, if any." The heated mixture is passed, as a uniformly moving column, through a retaining vessel for sufficient time to produce the degree of conversion desired, by the heat stored in the mixture. The neutralising agent is added continuously and in proper quantities to the liquor just before the latter is released from the converting pressure and temperature.—L. E.

XVIII.—FERMENTATION INDUSTRIES.

Malt; Determination of the diastatic power of —— and of malt extract. A. R. Ling. Chem. and Drug., 1910, **76**, 52—53.

In the method for determining the diastatic power of malt extract proposed by Harrison and Gair, 0·2 grm. of extract is allowed to act on 1 grm. of starch for half-an-hour at 40° C. (this J., 1906, 830). No account is taken of Kjedahl's observation that the diastatic power is only proportional to the mass of malt, or malt extract, if the amount of maltose formed does not exceed about 40 per cent. of the starch. Harrison has recently observed that in the case of highly diastatic extracts, the method is inaccurate, and considers that if an extract gives a value of over 250, the test should be repeated with half the quantity of extract, and that if the value is over 750, one-fourth the quantity—*i.e.*, 0·05 grm.—should be used, in which last case, diastatic values up to 2000 may be recorded. The author gives the results of determinations of diastatic power of malt extracts, using both starch paste and soluble starch, and working under the conditions of hydrolysis prescribed by Harrison and Gair; the diastatic action was arrested, not by boiling, however, but by addition of alkali. The diastatic power was calculated both by Harrison and Gair's formula, and by the author's formula, *viz.*, Lintner value $= \frac{1000}{xy}$ (cp. Report of the Malt Analysis Committee, this J. 1906, 236). The results show that though Harrison's later suggestions tend to increase the accuracy of the method, they do not entirely eliminate the inherent error of Harrison and Gair's formula. With a malt extract of diastatic power 2000 on Harrison and Gair's scale, less than 0·05 grm. of the extract should be used for the determination. The author also points out that Harrison and Gair's method is based on the erroneous assumption that the so-called stable equation of Brown and his co-workers is an absolute constant. He urges the abandonment of Harrison and Gair's scale for that of Lintner; the former records values to four places, an assumption of accuracy which is not justifiable.—L. E.

Hop resin ; Determination of —— in different kinds of hops. D. Neumann. Woch. f. Brau., 1910, **27**, 281—284.

The α-resin determined in 12 samples of Bavarian and central European hops ranged from 8·4 to 18·9 per cent. of the dry solids. It is suggested that the proportion of hops used to malt mashed should be varied according to the amount of resin found in the hops, thus securing uniformity and in many instances economy.—R. L. S.

Enzymes ; Protein as a protective agent for ——. L. Rosenthaler. Biochem. Zeits., 1910, **26**, 9—13.

The ordinary methods of preparing enzymes yield mixtures of the enzymes with protein substances. Experiments have been made to determine whether protein protects enzymes against the action of acids and alkalis, i.e., H- and OH-ions ; since protein has an amphoteric nature, it might be expected to exert a protective action against both classes of substances. It was found that with all the enzymes examined, *viz.*, δ-emulsin, σ-emulsin, diastase, and invertase, addition of protein (egg-albumin) protects the enzyme against the action of acid (sulphuric acid) and of alkali (sodium hydroxide), the protective effect being very considerable in some cases. Since the proportions of the reacting substances employed in the experiments were chosen quite arbitrarily, it is highly probable that the protective action of protein substances on enzymes in the organism, is still greater. The investigations of various workers have shown that enzyme-secreting cells contain a very high proportion of protein. —L. E.

rotein metabolism in plants in relation to alcoholic fermentation. F. Ehrlich. Landw. Jahrbücher, 1909, **5**, 289—327. Z. ges. Brauw., 1910, **33**, 301—304.

E metabolism of protein is best studied in the lower ders of plant life as the conditions are there less complex d the products of metabolism can be more readily sepa- ted from the nutrient media in which the plants have own. It appears that bacteria, moulds, algæ and yeasts n almost without exception assimilate all the ordinary trogenous compounds and convert them into protein. e larger nitrogenous molecules are reduced in size to e order of amino-acids in which form it would appear at the plant absorbs the bulk of its nitrogen. These mino-acids are of varying constitution, according to their igin, and the author has shown that the by-products of oholic fermentation owe their existence to the nontrogenous residues of such amino-acids, produced from oteins pre-existing in the nutrient medium or from tolysis of dead yeast cells. The fusel-oil and by-products, which the flavour of the potable spirituous liquors are e, thus depend in part upon the source of the saccharine lution fermented and in part upon the type of yeast ployed. Tyrosine yields after fermentation *p*-hydroxyenylethyl alcohol, which is in dilute solution extremely ter and has been recognised in a Berlin beer. Glutamic id, which is yielded in large quantity by the hydrolysis the hordein of malt, is converted almost quantitatively o succinic acid.—R. L. S.

icylic acid [in wines, etc.] ; Determination of —— by the distillation of its dilute aqueous solutions. N. C. Cassal. Chem. News, 1910, **101**, 289—290.

consequence of the inhibitory effect of alcohol and er organic substances on the volatilisation of salicylic d, direct distillation furnishes no reliable test for s compound in wines and syrups. The author accord- ly proceeds as follows :—A measured volume of the e is acidified with a few drops of strong hydrochloric d and extracted three times with 25—30 c.c. of chloro- m. The chloroform extract or emulsion is washed h an equal bulk of water and extracted three times h about 25 c.c. of water containing a few drops of *N*/1 ium hydroxide. The alkaline extract is then acidified h phosphoric acid, diluted to 100 c.c., and distilled a receiver containing 10 c.c. of water ; when the ume in the receiver reaches 100 c.c., the distillation is pped, and the salicylic acid is determined by the usual colorimetric method in an aliquot portion of the distillate. The amount of acid found in the total distillate, multiplied by the factor 5·5, gives the amount present in the wine. —F. Sodn.

Alcohol ; Production of —— from henequen bagasse in Yucatan. Chem.-Zeit., 1910, **34**, 655.

Alcohol is now obtained in Yucatan from the bagasse or refuse in the preparation of henequen fibres. The bagasse from 1000 kilos. of leaves, and measuring about 0·85 cb.m., yields on pressing 436 litres of liquor of 1·04 sp. gr. The pressed mass weighs about 96 kilos. The liquor is heated in a copper boiler with some sulphuric acid and ammonium sulphate to 120° C., and kept for one hour at 15 lb. pressure ; it is then cooled to 38° C., in another vessel, 2 litres of specially cultiv ted yeast added, the vessel closed and a current of sterilised air passed through for four hours. After five days the sp. gr. of the wort is reduced to 1·011 ; it is then distilled. A yield of 15·963 litres of absolute alcohol or 16·76 litres of 95 per cent. alcohol is obtained ; the theoretical yield of pure alcohol being 16·174 litres.—A. Sbld.

Alcohol from sulphite-cellulose waste lyes. Ekström. *See* V.

Analysis of tartar products. Carles. *See* VII.

Patents.

Malting apparatus. (1), (2), and (3), W. H. Prinz, Chicago, Ill., (4), W. H. Prinz, Oak Park, Ill., Assignor to C. A. and G. Plamondon, Chicago, Ill. U.S. Pats. 958,821—958,824, May 24, 1910.

The apparatus may comprise a number of co-axial rotating malting compartments communicating with a stationary intermediate compartment, the malting compartments being so connected that they rotate in unison. Air-conduits are provided, communicating with the malting and intermediate compartments. Again, suctional mechanism may be connected with both ends of each malting compartment for causing fresh air to flow in the same direction through the malt in each compartment, means also being provided for exhausting air from these compartments, which are externally perforated, whereas the intermediate compartment is not. Again, a number of co-axial, unperforated, malting compartments, adapted to rotate in unison, may be provided with means communicating with the inner end portions of the said compartments, near the peripheries thereof, for supplying attemperated air thereto, and with means communicating axially with the outer end portions of the said compartments for conducting foul air therefrom. Again, a number of co-axial, externally unperforated malting compartments, rotating in unison, may be provided with mechanism for supplying fresh air axially to the said compartments and causing it to flow radially therethrough.—L. E.

Malting apparatus. W. H. Prinz, Oak Park, Ill., Assignor to C. A. and G. Plamondon, Chicago, Ill. U.S. Pat. 958,825, May 24, 1910.

A malt-house is provided with a room containing a num er of compartments with perforated floors, and means, operating in the compartments, are provided for stirring the malt therein. An attemperator room with a valved opening between it and the compartment room, above the compartments, a valved outlet from the compartment room above the compartments, channels under the compartment floors, valved outlets communicating with these channels, gangways between the compartments, and channels under the gangways, means for admitting air from the attemperator room either to the channels under the compartments or to the channels under the gangways, and valved openings between the channels under the compartments and those under the gangways, are also provided.—L. E.

Malt drum ; Closed —— with central perforated tube and double envelope, the interior envelope being concentric with the exterior one, and perforated throughout. Berliner Akt.-Ges. für Eisengiesserei und Maschinenfabrikation. Fr. Pat. 409,923, Dec. 3, 1909. Under Int. Conv., Dec. 8, 1908.

The apparatus includes a central, perforated tube, an outer, closed envelope, and an inner, perforated envelope concentric with the outer one. The space between the two envelopes is divided into several chambers by radial partitions. In order that the circulation of the air through the malt shall be as uniform as possible, registers are provided to close the chambers as they pass above the heap of malt. In the interior of the central perforated tube two smaller tubes may be fitted, the object of which is to insure the exhaustion of the air from the middle region of the central tube.—L. E.

Iron vats and casks and like vessels ; Manufacture of —— for brewer's use. H. Held, Nürnberg, Germany. Eng. Pat. 21,293, Sept. 17, 1909.

Vessels, such as fermennting vats, storage casks, etc., are made by soldering or welding together flangeless iron tubular sections ; the vessels thus formed are then coated on their inner surface with a layer of copper which is electrolytically deposited on the surface of the iron. A layer of silver is then deposited on the copper and the surface of the silver, which may be polished, if desired, is coated with varnish, lacquer, or the like.—W. P. S.

Beverages ; Preparation of ——. G. Defren, Brookline, Mass. U.S. Pat. 960,841, June 7, 1910.

In order to increase the amount of extractive matter in fermented malt beverages, milk sugar is added to the wort. Claim is also made for "the addition of caramelised milk sugar inactive with respect to milk sugar to a fermentable sugar," as a step in the preparation of beverages, in order to increase the extractive matter.—A. S.

Wines and other liquids ; Clarification of ——. M. Depaty. Fr. Pat. 410,614, Mar. 17, 1909.

The clarification of wines that are deficient in tannin, or that contain foreign substances precipitable with difficulty, requires the aid of heat, but if the hot clarification be carried out in open vessels, the wine suffers in quality. In the present process, the heat employed in pasteurisation is utilised in clarification. The clarifying solution is introduced into the wine from an apparatus which is connected to the inlet tube of the pasteurising apparatus ; the wine circulates through the pasteurising apparatus, and passes through a filter fitted to the exit tube. The process is also applicable to other liquids such as musts, beers, liqueurs, etc.—L. E.

Fermented liquors ; Manufacture of ——. P. M. Justice, London. From Schneible Co., Buffalo, U.S.A. Eng. Pat. 3574, Feb. 14, 1910.

See U.S. Pat. 950,791 of 1910 ; this J., 1910, 446.—T.F.B.

Desiccating distillery slop. U.S. Pat. 958,902. *See* XIXa.

XIXa.—FOODS.

Proteolytic enzymes occurring in cereal and leguminous seeds. R. Giesen. Woch. f. Brau., 1910, 27, 308.

The results are recorded of an investigation of the enzymes occurring in the cereal and leguminous seeds which are used as cattle foods. The method employed consisted in preparing an extract of the seeds and placing drops of these extracts on gelatin plates ; after the lapse of definite periods of time, the liquid drops were removed from the plates by means of filter-paper, and observations were then made as to alterations in the surface of the gelatin. In cases where proteolytic action had proceeded, the surface of the gelatin was more or less corroded or pitted. Both kinds of seeds contain proteolytic enzymes which may be separated from the seeds by extraction with a mixture of glycerol and water. The enzymes occurring in cereals belong to the tryptic enzymes ; they are most active in neutral or alkaline solution, but not in acid solution. Those found in leguminous seeds behave differently according to the reaction of the nutrient solution ; for instance, the enzyme of tares is most active in neutral solution and less so in alkaline and acid solution, whilst the enzymes of linseed and beans act most strongly in acid and neutral solution. The enzyme found in peas is active only in neutral solution, and then but feebly. Both classes of enzymes resemble pancreatin and trypsin as regards their action on albumin. The enzymes are most active at 30°—40° C., but are destroyed at temperatures of from 55° to 70° C. The enzyme obtained from oats is very stable ; oats one year old yield an enzyme as active as that obtained from fresh oats.—W. P. S.

Antiseptic properties of copper. Springer. *See* XIXb.

Erratum. This J., 1910 ; page 778, col. 1, l. 22 from top, *for* "$x = Kt$" *read* "$x = Ktm$."

Patents.

Flour ; Conditioning or improving the quality and colour of ——. A. Rollason, Long Eaton, Derby. Eng. Pat. 16,757, July 19, 1909.

The flour is agitated in a chamber and subjected to the action of ultra-violet rays emitted by quartz mercury vapour lamps.—W. P. S.

Food ; A nutritive ——. H. Maconochie, London, and S. A. Vasey, Bromley, Kent. Eng. Pat. 20,819, Sept. 11, 1909.

Clear grape-juice is pasteurised and treated with a sufficient quantity of potassium tartrate, hydroxide, or carbonate, to convert the free tartaric acid present into potassium bitartrate ; the requisite quantity of potassium salt is ascertained by determining the acidity of the juice. The precipitated potassium bitartrate is removed by filtration. Each gallon of the filtrate is then mixed with about 0·5 lb. of dry, soluble animal or vegetable albumin ; when the albumin has dissolved, the solution is again filtered, bottled, and pasteurised.—W. P. S.

Lecithin in milk and cream ; Process for producing —— in butter making. A. Witte, Hamburg. Eng. Pat. 1744, Jan. 24, 1910.

To obtain an increased yield of lecithin in milk or cream, the pasteurised sample is quickly cooled to 2°—4° C. and kept thereat for 1—10 days, whereby the protein bodies undergo a change which makes them readily convertible into lecithin by either of the following methods : (1) The cooled milk is quickly raised to 16°—30° C. and soured once or oftener, and when mature, churned into butter. (2) The cooled milk is soured twice or oftener, then quickly raised to the butter-making temperature, and churned when mature. By both methods the yield of butter is increased also.—J. H. J.

Butter ; Process for obtaining an increased yield of ——. Fricke und Witte. Fr. Pat. 410,820, Dec. 30, 1909.

The cream is treated, at intervals of 2 hours, with quantities of acidifying agents such as cultures of lactic acid bacteria, hydrochloric acid, etc., the quantity added being from 3 to 5 per cent. of the weight of the cream. Immediately after the addition of the last quantity of acidifying agent, the cream is cooled to about 2° C., and is maintained at this temperature for from 18 to 24 hours. The temperature of the cream is then rapidly raised to about 12° C. and the cream is churned.—W. P. S.

Distillery slop ; Desiccating ——. E. H. Brinkmann and H. O. Wente, Cincinnati, Ohio. U.S. Pat. 958,902, May 24, 1910.

In the manufacture of a dry fodder from distillery slop, the latter is passed continuously through a filter-press

The filtrate is then concentrated to a syrup, mixed with the solid material which is continuously discharged from the filter-press, and the mixture dried.—L. E.

Coffee free from caffeine; Process for obtaining ——. L. Klein. First Addition, dated Nov. 27, 1909, to Fr. Pat. 409,700, Nov. 11, 1909 (this J., 1910, 779).

The coffee berries are partially roasted in a suitable drum and are then treated therein with water introduced into the drum from a vessel containing chemical agents, this vessel being heated by the furnace which supplies the heat to the drum. After the water has been evaporated and the caffeine has been extracted by the agents employed, the berries are washed in the drum, suitable arrangements being provided for introducing and withdrawing the necessary water.—W. P. S.

Ferruginous milk product; Process for manufacturing a ——. F. Stohr. Fr. Pat. 409,949, Dec. 4, 1909.

Milk containing from 5 to 8 per cent. of added lactose and from 35 to 50 per cent. of sucrose, is concentrated in the usual way to the consistence desired and is then mixed with a solution of a ferric salt, for instance, with ferric saccharate. From 3 to 8 per cent. of the latter is added, according to the quantity of iron intended to be present in the product. The mixture is then heated until the ferric iron has been reduced to the ferrous state. The ferric salt may also be added directly to the milk, the sucrose and lactose being added after the milk has been partially concentrated, or the ferric salt and the lactose may be heated together before being added to the milk; in the latter case, the sucrose may be added at any stage of the process.—W. P. S.

Lecithin; Process for extracting —— from milk, cream, etc., for the purpose of obtaining a higher yield of butter. Fricke und Witte. Fr. Pat. 410,819, Dec. 30, 1909.

See Eng. Pat. 1714 of 1910; preceding.—T. F. B.

XIXb—WATER PURIFICATION; SANITATION.

Colour of waters. Ad. Kemna. Assoc. Water Eng. York Meeting. Times Eng. Suppl., June 15, 1910.

The author when watching the gravel strainers at work at the Waelhem pumping station, noticed that sometimes after the first passage there was an increase of colour, the effluent water being slightly yellower than the inlet water. The tubes containing the water were special tubes for nesslerising having flat bottoms; they were placed in a rack and rested on two wires. It was noticed that these wires were better seen and more clearly defined through the effluent water than through the inlet water. The apparent yellower colour of the effluent water was found to be due to side illumination. The intensity of colour depended upon the thickness of the layer of water, but the rays reflected by the solids suspended in the upper strata would scarcely suffer any alteration, and would appear nearly white; this admixture of white light of course made the water look less yellow, and as the amount of reflected light was proportional to the number of reflecting particles, the more turbid water would not appear such a deep yellow as it really was, and the less turbid water would better show its natural yellow tinge. This explained the deeper colour of the filtered effluent. If the side light diminished the colour of a water, the exclusion of such side light must increase the colour. Wrapping the glass tube in black cloth or paper did increase the colour and to an unexpected degree. Another method consisted in excluding transmitted light and working with reflected light alone. This was easily done by shutting the lower end of the glass tube with a short cup of black ardboard. If now there were no suspended particles, here could not be any reflected light; in fact, pure disilled water looked as black as ink, while the greater the arbidity, the more light was visible.

Water sterilised by the ultra-violet rays; Examination of —— for hydrogen peroxide. Sterilising power of hydrogen peroxide. J. Courmont, T. Nogier and Rochaix. Comptes rend., 1910, **150**, 1453—1454.

Water in which a mercury vapour lamp of quartz was immersed was found not to contain a trace of hydrogen peroxide after 20 minutes irradiation. Cernovodeanu and Henri obtained 1·5 mgrm. per litre in 30 minutes. The bactericidal action of the rays is direct and not due to the production of hydrogen peroxide or ozone. Polluted water containing 1,800,000 coli bacilli per litre was absolutely sterilised by an irradiation of a few seconds. A litre of the same water required 80 c.c. of hydrogen peroxide of 9·8 vols. (= 1·188 grm. of hydrogen peroxide) and contact for 3 hours for sterilisation. (See also this J., 1910, 171.)—A. Sbld.

Nitric nitrogen; Influence of chlorine upon the determination of ——. R. Stewart and J. E. Greaves. J. Amer. Chem. Soc., 1910, **32**, 756—757.

Results of experiments recorded show that chlorine, when present in quantities as low as 2·638 parts per million, affects the determination of nitric nitrogen by the phenyldisulphonic acid method, less nitric nitrogen being found than is really present. When the amount of chlorine approaches 10 parts per million, the quantity of nitric nitrogen found is about nine-tenths of the quantity present; this is, apparently, a constant value, as no further decrease takes place when the amount of chlorine is raised to 30 parts per million. (See also this J., 1909, 740.)—W. P. S.

Copper; The antiseptic properties of ——. A. Springer and A. Springer, jun. Chem.-Zeit., 1910, **34**, 585—586, 595—596. (See this J., 1905, 1285.)

Milk suspected of containing antiseptics was found to contain traces of copper (about 2 mgrms. per half litre), the presence of which is ascribed to the wearing of the tin coating on the copper utensils (and to the brass fittings) in the dairy (compare this J., 1903, 435). Milk containing copper is characterised by retaining its sweet odour even when quite curdled; finally when covered with mould, it has a nut-like aroma free from any putrefactive odour. Milk in sealed bottles kept in an ice-chest, and which became sour in 10—12 days, only began to turn sour in 22—24 days if a copper salt had been added, in as small a proportion as 1 of copper in 250,000 of milk. Experiments made with putrefactive bacilli such as *Proteus vulgaris* and *Clostridium fœtidum* showed that copper salts were very strongly antiseptic; even when present to the extent of 1 in 2,000,000, a perceptible action was observed. The authors conclude that copper salts should be useful remedies, in the intestines, in cases of diseases characterised by increase of the number of putrefactive bacilli.—A. Sbld.

Lime-sulphur spray; Composition of ——. H. V. Tartar and C. E. Bradley. J. Ind. Eng. Chem., 1910, **2**, 271—277.

The authors have investigated the "lime-sulphur" solution, obtained by boiling together slaked lime and sulphur, which is used for spraying trees as an insecticide and a fungicide, both with regard to its composition and to the chemical changes which the spray undergoes when used. Methods which are stated to give accurate results have been devised for the determination of the compounds existing in the solution. The authors find that the chief constituents are the pentasulphide and the tetrasulphide of calcium, but that these compounds are so readily converted into the more stable disulphide, with liberation of sulphur, that this excess sulphur might almost be considered as being merely in physical solution. There are present also small quantities of thiosulphate, and traces of sulphite and sulphate. Free calcium hydroxide appears to be absent, as do the monosulphide and the hydrosulphide. When the solution is sprayed on trees, the carbonic acid in the air acts upon it with liberation of sulphuretted hydrogen and sulphur, but the extent of this action is small. The deposition of sulphur is almost entirely due to oxidation on the one hand, and to the mere evaporation of the solution on the other.—T. St.

Patents.

Water ; Apparatus for purifying ——. J. M. H. Lacombe, Paris. Eng. Pat. 20,737, Sept. 10, 1909. Under Int. Conv., Sept. 11, 1908.

A purifying apparatus of the volumetric type is improved by having the measuring tank placed at the top of the apparatus and divided into two compartments supplied by a rocking lever placed at the side and operated by a water balance. Under the measuring tank and combined with it is a smaller tank divided into two compartments, for measuring the volumes to be diverted to the lime saturator and to be passed to the main reaction chamber which receives the sodium carbonate solution. Valves in the compartments of the two tanks are operated alternately by the lever of the water balance, so that the water is discharged from the upper measuring compartments alternately into the lower measuring compartments, and the measured quantity is then discharged from these alternately to the lime saturator and the excess is passed through a water-wheel to the main reaction chamber. By these means an exact proportion is maintained between the volume of the crude water, the volume saturated with lime, and the volume of the sodium carbonate solution added, and also siphons are done away with.—J. H. J.

Refuse ; Furnaces for destroying ——. W. P. Hayes, West Bridgford. Eng. Pats., 11,329, May 13, 1909, and 24,897, Oct. 29, 1909.

Above the destructor cell is placed a storage hopper to which the refuse is carried from the ground level by a mechanical conveyor. The storage hopper is placed sufficiently far above the top of the cell to allow of a measuring hopper being fixed between. The measuring hopper is placed immediately over the opening in the top of the cell and the same door serves to close both. This door is made in two halves working in a liquid seal, which is sufficiently wide on opposite sides to permit of the two halves being moved apart at the same time. Each cell may be provided with storage and measuring hoppers, or one storage and measuring hopper may serve a number of cells, in which case the measuring hopper moves on rails along the top of the cells.—J. H. J.

Refuse and sludge ; Treatment of domestic and street —— for the production of gas. M. Ziegler, Moscow. Eng. Pat. 29,568, Dec. 17, 1909.

The sludge obtained from the treatment of domestic and street refuse is utilised alone, or in conjunction with such other carbonaceous substances as town's refuse, for the production of water- (or producer-) gas. The sludge, after being deprived of from 50 to 60 per cent. of its moisture, is treated with superheated steam for the recovery of its fatty constituents, and is then charged into the producer through a separate shaft in which it is completely dried before entering the combustion chamber proper. Means are provided for the withdrawal of the volatile products (ammonia, etc.) of the sludge before the latter mixes with the other refuse and before the zone of incandescence is reached ; while the producer-gas escapes from an exit situated in a lower part of the apparatus.—W. E. F. P.

Sewage or trade waste ; Purification of —— by the under-drainage system. J. Fieldhouse and Oxychlorides (1907), Ltd., London. Eng. Pat. 12,667, May 28, 1909.

The process relates to the removal of fungoid growths, deposits, etc., from the drainage pipes or tiles. For this purpose, the underground drain pipe furthest removed from the outlet of the system is provided with a vertical pipe reaching above the surface of the ground. Oxychlorides, manufactured by the process described in Eng. Pat. 5596 of 1901 (this J., 1901, 815), etc., or other chlorine compounds, or solutions containing potassium permanganate, etc., are introduced into this vertical pipe so as to fill the drainage pipes, the valve at the outlet being closed. After a suitable period of time, the valve is opened and the solution is allowed to escape, carrying with it the oxidised residue of the growths mentioned.—W. P. S.

Sewage, waste-water, etc. ; Apparatus for the biological purification of ——. Cie. Industrielle D'Assainissement. Fr. Pat. 410,217, Mar. 8, 1909.

The apparatus consists of a settling tank and a filter chamber placed adjacent to one another ; the settling tank is divided into a number of compartments by means of vertical partitions and the liquid to be treated is introduced into one of these compartments. When the first compartment is filled, the liquid passes through a perforated plate at the top, thence over the partition plate and falls into the next compartment. The liquid flows through perforations at the bottom of the second compartment, fills a third compartment and is delivered from the top of the latter on to the surface of a number of superposed filter beds arranged in the filter chambér. Means are provided for aspirating a current of air through the filter chamber.—W. P. S.

Ferments in vegetable and animal organisms ; Process for rendering inactive the ——, *and means for effecting the same.* E. Perrot and A. Goris, Paris. Eng. Pat. 13,294, June 7, 1909.

Fermentation and putrefaction, due to enzymes, are prevented from taking place in vegetable and animal substances by subjecting the latter to the action, at a low pressure, of vapours of methyl alcohol, ethyl alcohol, chloroform, acetone, ether, or similar liquids having a boiling point below 100° C. The substances are treated in an autoclave provided with a steam-jacket so that the upper part of the autoclave is maintained at a higher temperature than that of the vapours. Metallic baskets are provided inside the autoclave for containing the substances under treatment, and a cover over the upper basket prevents any condensed liquid from coming into contact with the contents of the baskets.—W. P. S.

Waters ; Process for purifying municipal and industrial ——, *more particularly waste waters.* G. Hogermann and F. Wellensick, Hanover, Germany. Eng. Pat. 15,079, June 28, 1909.

See Fr. Pat. 404,556 of 1909 ; this J., 1910, 231.—T. F. B.

Water ; Process for softening ——. R. Gans, Pankow, Assignor to J. D. Riedel, Akt.-Ges., Berlin. U.S. Pat. 960,887, June 7, 1910.

See Fr. Pat. 409,006 of 1909 ; this J., 1910, 779.—T. F. B.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Quinine salts ; Solubilities of ——. [*Erroneous statements in the United States Pharmacopœia.*] G. L. Schaefer. Amer. J. Pharm., 1910, **82**, 219.

Quinine hydrobromide is practically insoluble in ether, requiring more than 700 parts for solution, whereas in the U.S.P. its solubility is given as 1 : 16. Quinine hydrochloride requires for solution about 1000 parts of ether, not 240 as stated in the U.S.P. Quinine salicylate has the following solubilities :—In water, at 25° C., 1 : 2100 ; at 80° C., 1 : 280 ; in alcohol (94·9 per cent.) at 25° C., 1 : 23 ; at 60° C., 1 : 5 ; in ether, about 1 : 780 ; in chloroform, 1 : 10.—J. O. B.

Strychnine and its salts ; Solubilities of ——. G. L. Schaefer. Amer. J. Pharm., 1910, **82**, 220.

The solubility of strychnine in alcohol, at 25° C., is 1 : 150 ; in chloroform at 25 C., 1 : 7. Solubility of strychnine nitrate : in water at 25° C., 1 : 55 : in alcohol, 1 : 220. Solubility of strychnine sulphate : in water, at 25° C., 1 : 45 ; at 80° C., 1 : 9 ; in alcohol, at 25° C., 1 : 105.
—J. O. B.

Brucine and strychnine; Formation of amine-peroxides in the case of ——. G. Mossler. Monatsh. Chem., 1910, **31**, 329—345.

The peroxides of brucine and strychnine can be obtained by heating the bases with excess of hydrogen peroxide on a water-bath or by similar treatment of the oxides (Pictet and Mattisson, this J., 1905, 1123; Pictet and Jenny, this J., 1907, 430). Brucine peroxide forms crystals like those of the oxide; when slowly crystallised and dried in the air, the crystals contain 4 mols. of water; when quickly crystallised they contain 3 mols, and the product dried in a vacuum contains 2 mols. of water. Brucine peroxide dissolves to the extent of 9 per cent. in cold water. Its optical activity, taken in hydrogen peroxide solution, is $[a]_D$ = about — 5°. Strychnine peroxide crystallises similarly to the oxide and contains 4 mols. of water, two of which are lost in a vacuum. It forms a 1·2 per cent. solution in water. It is dextrorotatory, having $[a]_D = 9·6°$ in 95 per cent. alcohol.
—J. C. C.

Codeine and codeine phosphate; Erroneous statements concerning ——*, in the United States Pharmacopœia.* G. L. Schaefer. Amer. J. Pharm., 1910, **82**, 220.

The solubility of codeine in ether is 1 : 25 not 1 : 12·5, as stated in the U.S.P. Codeine phosphate, as met with in commerce, contains only ½ mol. of water of crystallisation. The official (U.S.P.) salt with 2 mols. of water of crystallisation exists, but it is practically impossible to produce it for commercial purposes. The salt with ½ mol. of water should receive official recognition.—J. O. B.

Amines; Researches on ——*. Alkylations with dimethyl sulphate. Synthesis of dimethylphenylethylamine.* T. B. Johnson and H. H. Guest. J. Amer. Chem. Soc., 1910, **32**, 761—770.

The authors find that dimethylphenylethylamine can be prepared from phenylethylamine by alkylation with dimethyl sulphate; the alkylation was carried out in methyl alcohol solution in the presence of sodium methylate. The method affords a means of preparing hordenine directly from phenylethylamine, since Barger has shown (this J., 1910, 108) that the base gives, by nitration at — 10° C., a *p*-nitro-derivative which may be converted into a base identical with hordenine. Alkylation does not ake place when dimethyl sulphate is allowed to act on *p*-nitrophenylethylamine in the presence of methyl alcohol and sodium methylate. Attempts to prepare secondary and tertiary amines from *p*-nitrophenylethyl amine by alkylation with methyl iodide were unsuccessful.—W. P. S.

audanum of Sydenham; Determination of the morphine in ——. F. Pancier. J. Pharm. Chim., 1910, **1**, 586—589.

HE laudanum of Sydenham, prepared according to the rench Codex of 1908, is made by adding 100 grms. of opium, grms. of saffron, and 1 grm. each of cinnamon and ove oils to 1000 grms. of 30 per cent. alcohol. After anding several days the liquid is filtered. The author nds that 1 centigram of morphine cannot be extracted om 1 grm. of this preparation, which is the strength preribed by the Codex. It seems that some morphine is tained by the insoluble residue left in its preparation.
—F. Shdn.

ydrocyanic acid in Thalictrum species. L. Van. Itallie. Pharm. Weekblad, 1910, **47**, 442—448. Chem. Zentr., 1910, **1**, 2026—2027.

crochemical and macrochemical examination of *alictrum aquilegifolium* showed that, in general, free drocyanic acid is present only in the leaves; in the nbined state it is present in the leaves, leaf stalks, ms, flowers, and seeds; the undergound portions as a e contain no hydrocyanic acid. The content of hydronic acid varies in plants collected in different seasons. hydrocyanic acid could be detected in the seeds of other cies of Thalictrum.—A. S.

Cinnamon-bark oil. C. A. Hill. Chem. and Drug., 1910, **76**, 59—60.

The author points out the value of a determination of the refractive index for detecting adulteration of cinnamon-bark oil. Of six samples of genuine Ceylon cinnamon-bark oil of the finest quality, the refractive index at 25° C., varied only between 1·5727 and 1·5767, except for one sample which was more than 9 years old and was very resinous; this gave the value 1·5797. Two samples of cinnamon-bark oil distilled in England gave the values 1·5614 and 1·5752 respectively. Figures for other specimens and for cinnamon-leaf and cassia oils, cinnamic aldehyde, eugenol, pinene, and phellandrene are also given. These show that genuine cinnamon-bark oil is distinguished from cassia oil and cinnamic aldehyde by a low specific gravity (below 1·04 at 15° C.), a low refractive index (below 1·58 at 25° C.), a low aldehyde content (below 65 per cent.), and by affording a green colour with ferric chloride (cassia oil gives a chocolate-brown colour). Adulteration with cinnamon-leaf oil can be recognised by an unduly high proportion of eugenol.
—A. S.

Essential oils; Constituents of ——*. Eksantalic acid, eksantalal, and their derivatives.* F. W. Semmler. Ber., 1910, **43**, 1722—1725.

When santalol, purified by means of its phthalic acid ester, is oxidised with permanganate, eksantalic acid, $C_{12}H_{18}O_2$, is produced. This was dissolved in methyl alcohol, saturated with hydrogen chloride, and the resulting compound reduced with sodium and alcohol. The dihydroeksantalic acid thus produced, boils at 164°—166° C. at 10 mm. Dihydroeksantalol, $C_{12}H_{22}O$, boils at 140°—132° C. at 10 mm., has the sp. gr. 0·9689 at 20° C., and n_D= 1·48905. The principal product of the oxidation of santalol by means of ozone, is the aldehyde, eksantalal, together with a solid, eksantaloxide, m. pt. 157° C. The purified eksantalal, $C_{12}H_{18}O$, boils at 109—110° C. at 10 mm., has the sp. gr. 0·9845 at 20° C., n_D = 1·48519 and a_D= +13°30′ in a 100 mm. tube. This substance can be acetylated with the formation of *enol*-eksantalal acetate, boiling at 130°—132° C. at 10 mm. When the acetate is oxidised with permanganate, noreksantalic acid, $C_{11}H_{16}O_2$, is produced. This boils at 143—145° C., at 10 mm., melts at 93° C., and a 50 per cent. solution in alcohol has an optical rotation of —12·3° in a 100 mm. tube.—F. Shdn.

Pinene hydrochloride; The rotatory power of ——. G. Vavon. Comptes rend., 1910, **150**, 1428—1430.

Each of the fractions obtained between 155° and 156° C., in the distillation of French, German and American turpentine oils, when treated with a current of dry hydrochloric acid gas, at about 30° C., gave an equal yield (about 55 per cent.) of a solid hydrochloride, which freed from the liquid, melted at 115°—120° C., and after 5 or 6 crystallisations from alcohol at 132°—133° C. The rotatory powers of the various fractions and of the pure hydrochlorides (in ethereal solution) were ascertained. These when plotted gave concurrent lines, showing that the *a*- and *β*-pinenes give the same yield of solid hydrochloride and consequently contribute an equal part in the formation of the liquid hydrochloride. The rotatory power of the hydrochloride given by a mixture can be calculated from the proportions and optical power of the two pinenes present. These results confirm the theory put forward by Semmler and developed by Ahlström and Aschan that *a*- and *β*-pinenes should give the same solid hydrochloride. Further, the yields given by the two hydrocarbons are the same.
—A. Sbld.

Ultra-violet rays; Action of —— *upon certain solutions used in pharmacy, and upon fatty substances, glucosides, alkaloids, and phenols.* A. Lesure. J. Pharm. Chim., 1910, **1**, 569—576.

Several solutions of substances used in pharmacy have been submitted to the action of ultra-violet rays from a quartz mercury vapour lamp (3 ampères, 110 volts) in order to find out if they could be sterilised. With most of the solutions it was found that they were as permeable as water to the rays. The penetration was moderate for solutions of atoxyl, caffeine, eserine salicylate, apomorphine hydrochloride, and gentiopicrin, also for olive oil. There was complete absorption of the rays by solutions of mercuric iodide, quinine bisulphate and bihydrochloride, and iron methylarsenate. Solutions exposed at a distance of 13 cm. from the lamp were in many cases decomposed. Solutions of silver nitrate, eserine salicylate, apomorphine hydrochloride, and atoxyl were darkened in less than five minutes. A longer exposure (fifteen to thirty minutes) was required to alter the appearance of solutions of morphine hydrochloride, arbutin, and guaiacol cacodylate. No appreciable alteration was produced by a thirty minutes' exposure of solutions of cocaine hydrochloride, mercuric benzoate and chloride, sodium cacodylate, calcium glycerophosphate, quinine bihydrochloride, pilocarpine hydrochloride, aucubin, and gentiopicrin, and also the artificial serums of Chéron and Huchard. Olive oil was darkened without any appreciable alteration of its physical constants. A solution of aucubin containing *Bacillus coli* was sterilised after an exposure to the rays of 30 seconds. A similar solution of gentiopicrin could not be sterilised in half an hour. When olive oil was exposed to the rays for an hour, the acid value was increased by 5 per cent. There was no change in the optical rotation after solutions of cocaine hydrochloride and pilocarpine hydrochloride had been acted upon for three hours. Reducing substances were formed in solutions of aucubin and gentiopicrin after the same time. Arbutin was hydrolysed and some oxidation took place after three hours' exposure. With methylarbutin there was less decomposition. Hydroquinone in solution darkened more rapidly under the action of the rays than a solution of methylhydroquinone.—F. Shdn.

Vapour pressure of solutions [of alcohols]; Composition and ——. M. Wrewski. J. Russ. Phys.-Chem. Ges., 1910, **42**, I—35. Chem. Zentr., 1910, **1**, 1959—1961.

The author gives, in tables, the results of the determination of the vapour pressures of mixtures of methyl alcohol and water at 39·9° and 59·44° C., of ethyl alcohol and water at 39·76°, 54·81°, and 74·79° C., and of propyl alcohol and water at 49·92°, 65·94°, and 79·80° C. The mixture of ethyl aclohol and water which distils without change of composition contains 97·6, 96·5, and 95·7 per cent. of alcohol respectively for the boiling temperatures, 39·76°, 54·81°, and 74·79° C.—A. S.

Ammoniated mercury; Determination of ——, in ointment. J. R. Rippetoe. Amer. J. Pharm., 1910, **82**, 223.

From 2·5 to 3 grms. of the ointment are treated with 50 c.c. of ether to dissolve the fat; 10 c.c. of hydrochloric acid and 10 c.c. of distilled water are added to dissolve the ammoniated mercury. The mixture is transferred to a separator, and the acid aqueous layer is drawn off. The vessels and ether are then washed with water until no reaction for chlorides is obtained. The mixed acid liquids are then treated with hydrogen sulphide and the precipitated mercuric sulphide is collected on balanced filters or in a Gooch crucible, washed, dried till of constant weight at 100° C., and weighed. The weight × 1·0837 = the weight of ammoniated mercury in the sample taken. The above method should be equally applicable to the valuation of the official ointments of red and yellow mercuric oxide, and of mercuric nitrate.—J. O. B.

Sodium sulphite, anhydrous; Suggested substitution of —— for the hydrated salt in the United States Pharmacopœia. E. Elvove. Amer. J. Pharm., 1910, **82**, 211—219.

Since commercial anhydrous sodium sulphite can be readily obtained in a higher degree of purity than the hydrated form, with 7 mols. of water, at present official in the United States Pharmacopœia [and in the British Pharmacopœia]; and the former salt is quite stable and permanent, whereas the latter rapidly deteriorates through oxidation, it is suggested that the anhydrous salt should replace the other form in future editions of the U.S.P. If this salt were made official, it would serve as a more convenient source for the preparation of sulphur dioxide and its solution, than the charcoal and sulphuric acid at present ordered in the U.S.P., in the official process for producing sulphurous acid. The anhydrous sulphite would also serve as a source for the extemporaneous preparation of sodium bisulphite, which is a very unstable salt; or for the saturated solution of the same, for employment as a reagent, which could then be prepared immediately before use. The present official recognition of the unstable sodium bisulphite would not then be necessary. At present, the official salt with 7 mols. of water, as found in commerce, often contains as much sulphate as sulphite. A batch of crystals containing 99·69 per cent. when freshly prepared, was found to have lost 20 per cent. of its available sulphite in 6 months, although kept in a stoppered bottle which was only opened occasionally.
—J. O. B.

Preparing stable colloidal metals. Serono. *See* X.

Errata.—This J., 1910, page 450, col. 2, l. 18 from bottom, *for* "calcium chloride" *read* "bleaching powder," *ibid.*, l. 33 from bottom, *for* "10° C." *read* "100° C."

Patents.

Preventive and curative substance for infectious diseases. P. Zanotti, Bologna, Italy. Eng. Pat. 12,523, May 27, 1909.

A curative and immunising preparation is obtained by subjecting pus, or the growth of solid cultures of any bacilli, or the solid parts of liquid cultures, to the action of an enzyme, such as pepsin or papayotin. A substance specially suitable for subcutaneous injection may be prepared from this fluid by precipitation with alcohol or mineral salts; if the latter be employed, the precipitate must be subsequently dialysed to remove the mineral salts.—W. P. S.

Tetranitromethane; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,299, Oct. 22, 1909.

Tetranitromethane may be prepared by treating acetic anyhdride with concentrated nitric acid at temperatures between 15° and 50° C. Acetic anhydride is slowly added to its own weight of nitric acid (containing 99·5 per cent. of HNO_3), which is constantly stirred and cooled below 35° C. When the product is poured on ice, the tetranitromethane partly separates as oil, and the remainder is obtained by distillation with steam (compare Schenck; this J., 1909, 815).—T. F. B.

Sodium glycerophosphate and a preparation containing the same; Process for the manufacture of ——. H. Sefton-Jones, London. From F. Quade, Berlin. Eng. Pat. 25,678, Nov. 6, 1908.

See Ger Pat. 217,553 of 1909; this J., 1910, 452. A product containing disodium glycerophosphate and casein may be obtained by the action of casein-sodium on monosodium glycerophosphate.—T. F. B.

Camphor; Apparatus for subliming ——. Darrasse frères, and L. Dupont. Fr. Pat. 410,489, Dec. 21, 1909.

A sublimation vessel, of glass or enamelled metal, is made in two flanged sections, the lower section containing the camphor to be sublimed. The top of the upper section may be provided with a series of projections, forming a number of small spaces in which the sublimate may collect. The two sections are not clamped together, the camphor forming a tight joint between them at the commencement of the sublimation.—T. F. B.

Colloidal sols or gels; Process of producing ——. T Svedberg, Upsala, Sweden. Eng. Pat. 12,908, June 1 1909.

See Fr. Pat. 403,592 of 1909; this J., 1910, 174.—T. F. B

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Coloured photographic print and making same. F. E. Ives, Weehawken, N.J. U.S. Pat. 960,939, June 7, 1910.

A transparent support (*e.g.*, of amyl acetate-collodion) is provided with a sensitised coating of glue soluble in water (*e.g.*, fish glue) and is then exposed, through the support, to light passing through a negative, developed with water, and dyed to produce a coloured relief print of graduated thickness (see this J., 1910, 542).—T. F. B.

Screen composed of four series of selective elements, for colour photography, and its manufacture. L. Dufay, and Soc. Anon. des. Plaques et Produits Dufay pour la Photographie des Couleurs. Second Addition, dated March 6, 1909, to Fr. Pat. 408,552, Jan. 26, 1909.

Screens having properties similar to those described in the principal patent and first addition (this J., 1910, 593, 720) are obtained if the two sets of elements, each of two colours, are prepared by different processes, or are of different form; *e.g.*, one pair of elements may consist of lines, and the second pair may be superposed by a powdering process.—T. F. B.

Polychrome screen; Process for obtaining a ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Second Addition, dated March 10, 1909, to Fr. Pat. 409,044, Feb. 6, 1909.

In preparing polychrome screens by the process described in the principal patent (this J., 1910, 720), the colours may be sprayed on the film by any suitable apparatus, their solutions being diluted if necessary. Owing to the fact that the solutions are not miscible, this can be done without the colours running into each other.—T. F. B.

Images on glass, porcelain, ceramic, metallic, or other surfaces; Reproduction of ——. M. Anthés, London. U.S. Pat. 959,692, May 31, 1910.

See Eng. Pat. 24,217 of 1907; this J., 1908, 592.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Nitration of cotton and contribution to the knowledge of cellulose. C. Piest. Z. angew. Chem., 1910, 23, 1009—1018.

The author has previously investigated the influence exerted on the nitration of cellulose, by its previous treatment, such as bleaching, mercerisation, etc. (this J., 1909, 746). The present work deals with the action on cellulose nitrate, of solutions of sodium hydroxide, barium hydroxide, ammonium sulphide, etc. (Nitration was effected with a mixed acid containing 69 per cent. of sulphuric acid, 20·5 of nitric acid, and 10·5 of water, at 20° to 25° C.). The method of experiment, in the case of a solution of sodium hydroxide, consisted in allowing 1 grm. of the cellulose nitrate to remain in contact, at ordinary temperatures, with 50 c.c. of a *N*/2 solution of sodium hydroxide for periods varying from one to ten days. The amount of sodium hydroxide remaining at the expiration of the selected period of time was determined by titration with *N*/2 hydrochloric acid. The nitrogen content of the residue remaining after this treatment was also determined. The original nitrogen content of the cellulose nitrate made from normally treated cotton was 13·16 per cent. and the solubility in ether-alcohol under 10 per cent. The cellulose nitrate prepared from highly bleached cotton had a nitrogen content of 12·71 per cent. and a solubility in ether-alcohol of 40·93 per cent., whilst that prepared from mercerised cotton contained 12·96 per cent. of nitrogen and had a solubility of 21·84 per cent. Some of the results obtained are given in the following table:—

	N/2 aqueous sodium hydroxide.						Solution of ammonium sulphide.					
Time of reaction.	Normally treated cotton.		Highly bleached cotton.		Mercerised cotton.		Normally treated cotton.		Highly bleached cotton.		Mercerised cotton.	
Days.	Residue, per cent.	Nitrogen in residue, per cent.	Residue, per cent.	Nitrogen in residue, per cent.	Residue, per cent.	Nitrogen in residue, per cent.	Residue, per cent.	Nitrogen in residue, per cent.	Residue, per cent.	Nitrogen in residue, per cent.	Residue, per cent.	Nitrogen in residue, per cent.
1							60·82	2·70	50·09	2·57	60·14	2·16
2	64·64	13·17	8·99	11·44	66·6	12·58	55·08	0·56	40·80	0·33	53·27	0·57
3												
4	34·71	13·10	1·78	9·76	43·5	12·11	51·97	0	39·35	0	52·35	trace
5	25·25	12·96										
6			0·62	0	28·42	12·13					52·83	0
7							49·75	0	39·58	0	trace	
8	14·06	12·68	1·12	0	19·96	11·96	49·44	0	37·67	0	52·15	0
9												
10	8·78	12·25	0·80	0	13·30	11·26						

Under the above conditions a *N*/2 alcoholic solution of sodium hydroxide completely decomposed cellulose nitrate in four days, leaving only about 0·5 per cent. of residue. After eight days in contact with a saturated aqueous solution of barium hydroxide, some 56 per cent. of residue remained which contained 10·6 per cent. of nitrogen. When the different cottons used for preparing the cellulose nitrates were treated in the same manner, it was found that, at the end of ten days immersion in *N*/2 sodium hydroxide solution, the amounts of the residues were as follow:—Normally treated cotton (96·97 per cent.); strongly bleached cotton (80·96 per cent.), and mercerised cotton (98·4 per cent.). The results obtained with a solution of ammonium sulphide were also very similar to the above. By the action of *N*/2 aqueous sodium hydroxide on collodion cotton containing 12·36 per cent. of nitrogen, it was found, at the expiration of four days' contact, that 30·44 per cent. of residue remained, whilst after eleven days only 9·65 per cent. remained unattacked, and this residue contained 11·15 per cent. of nitrogen. Collodion cotton was found to be completely denitrated by the ammonium sulphide solution within 48 hours, with the production of oxycellulose.—G. W. McD

Trinitroglycerin; Hydrolysis of ——, by alkalis. E. Berl and M. Delpy. Ber., 1910, 43, 1421—1429.

The hydrolysis of trinitroglycerin has not been very carefully investigated. Williamson (Roy. Soc. Proc., 1854, 7, 130), and also Railton (J. Chem. Soc., 1855, 7, 222), assumed that complete conversion into glycerol and alkali-metal nitrate took place; but methods for the determination of the nitrogen in nitroglycerin, founded on this, always gave erroneous results. The authors find that the reactions during hydrolysis are very complex, the products being nitrate, nitrite, and cyanide of the alkali metal, ammonia, always some unchanged trinitroglycerin, *a*-*a*-dinitroglycerin, mesoxalic acid, oxalic acid, carbonic acid, and other volatile acids and aldehydes. A larger or smaller proportion of the nitrogen, according to the conditions of the experiment, is found reduced to nitrous acid, hydroxylamine (doubtless a stage in the formation of cyanide), and ammonia; whilst on the other hand primary and secondary oxidation products of glycerol are found. The formation of dinitroglycerin indicates that a regular graduated hydrolysis occurs in the first place, and when that is completed, oxidation of the glycerol and reduction of the nitric acid begin. The occurrence of dinitroglycerin, and of unaltered trinitroglycerin, is of practical interest, as it shows that the conversion of nitroglycerin into non-explosive compounds by alkali is not complete.—J. T. D.

Patents.

Smokeless powders; Method for the manufacture of ——. C. Claessen. Fr. Pat. 410,239, Dec. 11, 1909.

Use is made of a cellulose nitrate which forms with nitroglycerin a fluid gelatin. Camphor or analogous non-volatile substances are added, which assist in gelatinising and remain in the powder. Nitroglycerin (24 parts) is mixed with cellulose nitrate (69 parts), ethylmethyldiphenylurea (7 parts), and also cellulose nitrate of high nitrogen content. This mixture is gelatinised according to the method of Lundholm and Sayers, and is then rolled or pressed into any desired form. The object of the invention is to dispense with the use of volatile solvents. —G. W. McD.

Detonating fuse. Soc. Anon. d'Explosifs et de Produits Chimiques. Fr. Pat. 410,252, March 9, 1909.

The detonating core of the fuse consists of tetranitromonomethylaniline or a mixture of this body with guanidine nitrate or nitroguanidine.—G. W. McD.

Matches; Igniting compositions for ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 21,931, Sept. 25, 1909.

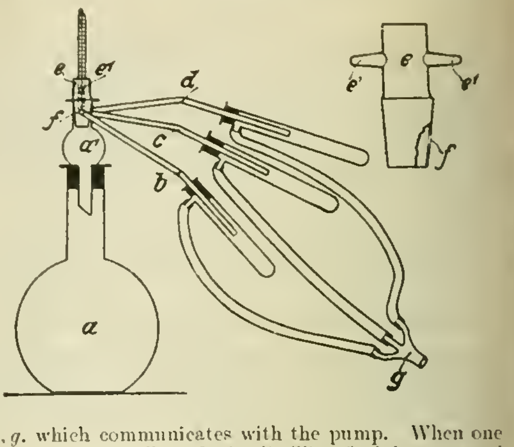
Matches made with red phosphorus, which readily ignite and burn quietly, are prepared by separately mixing: (*a*), 350 parts by weight of red phosphorus, 400 of antimony pentasulphide, and 100 each of chalk, zinc oxide and powdered glass, made into a pulp with water and ground; (*b*), 500 of glue dissolved in a suitable quantity of water, 1300 of potassium chlorate, and 50 each of chalk, zinc oxide, and powdered glass. The two mixtures are then well stirred together and the match sticks dipped as usual. —F. R.

Recovery of volatile substances from the atmosphere in [artificial silk, smokeless powder, etc.] factories. Fr. Pat. 410,455. *See* V.

XXIII. ANALYTICAL PROCESSES.

Fractionating device. A. Hahn. Ber., 1910, **43**, 1725—1727.

In the receivers for fractional distillation apparatus designed hitherto, the fractions all flow through the same condenser tube, and are separated by altering the relative position of the receiver. Each fraction thus becomes more or less contaminated by neighbouring fractions. The author's apparatus (see fig.) is designed to avoid this defect. The bulb tube, a^1, which fits into the neck of the distilling flask, *a*, carries on its upper part, three (or more) side tubes, *b*, *c*, *d*. Into a^1 fits the hollow stopper, *e*, having a side opening, *f*, whereby the distilling flask can be placed in communication with any one of the tubes, *b*, *c*, *d*, as desired. The stopper, *e*, carries a thermometer, and has projections, e^1, so that it can be easily turned. The receivers are connected by means of rubber tubing with the forked tube, *g*, which communicates with the pump. When one fraction has been collected, the distilling flask is connected with another condenser tube by turning *e*, and a screw-clamp is placed upon the rubber tubing between the pump and the receiver containing the fraction.—A. S.

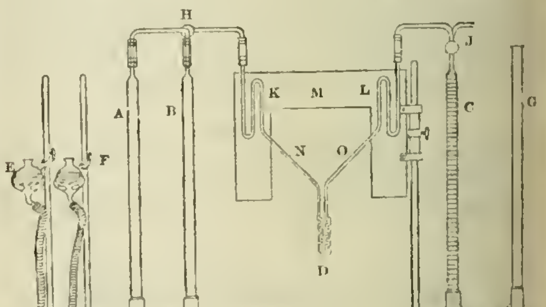


Gas analysis by condensation. E. Erdmann and H. Stoltzenberg. Ber. 1910, **43**, 1702—1707.

The authors describe experiments on the separation of gases by condensation, and subsequent measurement of the uncondensed gas, and, after volatilisation, of the condensed constituent. The apparatus used is described in the following abstract. As cooling agents, liquid air (about —190° C.), liquid oxygen (—182·7° C.), melting ether (—117·3° C.), and solid carbon dioxide and alcohol (—78·3° C.) were employed, whilst for intermediate temperatures a pentane bath was used, prepared by adding pentane gradually, whilst stirring continuously with a wooden rod, to liquid air contained in a Weinhold vacuum dish, and after the liquid air had all evaporated, adding more pentane until the liquid had the desired temperature. Results obtained with mixtures of ethylene and hydrogen, ethylene and air, ethylene and oxygen, and nitrous oxide and oxygen are given showing the accuracy of the method. (See also Inglis, this J., 1904, 643.)—A. S.

Gas analysis by condensation; Apparatus for ——. H. Stoltzenberg. Ber., 1910, **43**, 1708—1710. (See preceding abstract.)

The form and arrangement of the apparatus are clearly shown in the accompanying figure. The condenser, D,



consists of two S-shaped capillary tubes, K and L, passing gradually at N and O into a thin-walled tube of 2·5 mm. inside diameter, which at its lower part is provided with several S-shaped turns. Communication between the gas-burettes, A and B, and between B and the condenser D, is provided by means of the three-way tap, H. The tap, J, allows of communication between the burette, C, and the air or the condenser, D, respectively. After the apparatus has been tested as to tightness, the gas to be analysed, dried by means of phosphorus pentoxide, is introduced into C, and its volume noted. It is then forced through D, and partly into B, the condenser, D, being immersed at first to half the depth of the S-shaped turns, and later entirely, in the cooling agent. By alternately raising and lowering F and G, the gas is driven backwards and forwards, until the condensation of the lower-boiling constituent is complete. G is then raised until the bore of the tap, J, is just filled with mercury, and the tap is closed. By means of F and E, the uncondensed gas is then forced from D into B, and collected in A; this usually requires three successive fillings of the burette, B. The condenser, D, is now removed from the cooling agent, and the condensed gas allowed to evaporate and then collected in C and measured. After its removal, the uncondensed gas is driven over from A into C, and also measured.—A. S.

Cobalt and nickel; New volumetric method for determining ——. G. S. Jamieson. J. Amer. Chem. Soc., 1910, **32**, 757—761.

The nickel, or cobalt, is titrated with potassium ferrocyanide solution and accurate results may be obtained under the following conditions. The ferrocyanide solution employed should contain 20 grms. of the salt per litre, and is standardised by titration against a solution containing a known quantity of nickel or cobalt. A definite quantity of the latter solution (equivalent to about 0·1 grm. of the metal) is placed in a beaker, 10 c.c. of 10 per cent. ferric chloride solution and from 2 to 3 grms. of citric acid are added, and ammonia is run in with constant stirring until the mixture has a faint odour of ammonia; an excess of ammonia is to be avoided. The solution is then diluted with hot water to a volume of about 100 c.c., brought to a temperature of 65°—75° C., and the ferrocyanide solution run in slowly with constant stirring until a drop of the mixture shows a greenish coloration within 5 minutes when transferred to a white plate and acidified with nitric acid. The nickel or cobalt is precipitated as the ferrocyanide solution is added, and drops of the solution are tested only towards the end of the operation. For the determination of nickel in steel, 1 grm. of the borings is dissolved by boiling with 15 c.c. of nitric acid of sp. gr. 1·42; if the steel does not dissolve completely, a drop or two of hydrochloric acid may be added. When solution is attained, a further 10 c.c. of nitric acid are added, the solution is boiled, and 0·5 grm. of potassium chlorate is introduced. The whole is boiled, until all chlorine has been expelled, a second quantity of chlorate is added, and the boiling is repeated. The solution is then cooled, the precipitated manganese is removed by filtration, and the nickel is titrated in the filtrate as described above for the standardisation of the ferrocyanide solution. The method cannot be applied in the presence of such metals as copper, zinc, etc., which react with potassium ferrocyanide.

The author also finds the cyanide method to be trustworthy for the determination of nickel in steel. With this method Johnson (J. Amer. Chem. Soc., 1907, 29, 1201), uses a large amount of citric acid, and Campbell and Arthur (this J., 1908, 811), a large quantity of sodium pyrophosphate. The author employs both of these reagents together, but in much smaller quantity.—W. P. S.

Nickel and cobalt; Volumetric determination of ——. H. Grossmann. Chem.-Zeit., 1910, **34**, 673—674.

Nickel and cobalt when present together, may be determined volumetrically by the following method, if the proportion of cobalt be not more than 7—8 per cent. of that of the nickel—a condition fulfilled in nickel steel, rolled nickel, and other commercial products. The solution containing the two metals is treated with ammonium chloride, then rendered faintly ammoniacal, and the nickel and cobalt determined together by titration with potassium cyanide, using silver iodide as indicator (see this J., 1898, 696). Under the conditions mentioned, cobalt reacts with the cyanide in the same manner as nickel, forming the compound, $K_2Co(CN)_4$. In another portion of the solution, the nickel is precipitated with dicyanodiamidine in presence of sucrose (see this J., 1908, 715), the nickel-dicyanodiamidine is washed and dissolved in dilute hydrochloric acid, the solution treated with ammonium chloride and a slight excess of ammonia, and the nickel titrated with potassium cyanide. Results obtained with rolled nickel and Mond nickel are given.

The author has also tested the method of Carnot (this J., 1889, 639; 1896, 381), depending upon the oxidation of cobalt to sesquioxide by hydrogen peroxide in alkaline solution, and titration of the iodine liberated from potassium iodide by the sesquioxide in hydrochloric acid solution. The results showed that reliable results are obtained only when the quantity of nickel is less than 10 per cent. of that of the cobalt in mixtures rich in the latter metal, or when the quantity of cobalt is not more than 40 per cent. of that of the nickel in mixtures rich in nickel.—A. S.

Molybdenum, vanadium, selenium and tellurium; Determination of —— by means of metallic silver. C. C. Perkins. Amer. J. Sci., 1910, **29**, 540—542.

The gravimetric determination of iodine previously described (this J., 1909, 834; 1910, 594) can be applied to the determination of molybdenum, vanadium, selenium, or tellurium. The solution to be examined is added to an excess of potassium iodide acidified with hydrochloric acid, and the weight of the liberated iodine ascertained by shaking the mixture with the specially prepared electrolytic silver, in an atmosphere of hydrogen. The respective reactions are:

$$2MoO_3+4KI+4HCl=2MoO_2I+4KCl+2H_2O+I_2.$$
$$V_2O_5+2KI+2HCl=V_2O_4+2KCl+H_2O+I_2.$$
$$SeO_2+4KI+4HCl=4KCl+2H_2O+Se+2I_2.$$
$$TeO_2+4KI+4HCl=4KCl+2H_2O+Te+2I_2.$$

In the last two cases, however, the increase in the weight of the silver represents the iodine plus the element liberated. 13·49 per cent. of the increase of weight in the case of selenium, or 20·07 per cent. in the case of tellurium represents the amount of the element present. Very accurate results have been obtained.—A. Sbld.

Potassium permanganate; Apparently unlimited reaction between organic substances and ——. A. C. Sarkar and J. M. Dutta. Z. anorg. Chem., 1910, **67**, 225—233.

It is often found in estimating organic substances by potassium permanganate in warm acid solution, that if the temperature is too high the end point is not definite, and that after the substance is entirely oxidised, separation of manganese dioxide and slow but unlimited decolorisation of the permanganate takes place, along with the evolution of oxygen. The rate of oxygen evolution is far greater than with boiling acid permanganate alone, so that some catalytic or cyclic action is probable. It is known that in boiling solution manganese sulphate will reduce potassium permanganate with the formation of manganese dioxide, so that some progress beyond the ordinary end point is easily explained, but the progress made even beyond the point of complete oxidation of all the manganese sulphate is still unaccounted for. Manganese dioxide itself is found to have a slight reducing action on permanganate if the solution is slightly acid, and this reduction is favoured by adding more acid or by raising the temperature, that is by the conditions which favour the formation of more manganese sulphate from the dioxide and the acid. The authors therefore suggest that the course of reaction between a boiling solution of oxalic and sulphuric acids and potassium permanganate solution is as follows (1) $3[5C_2H_2O_4+2KMnO_4+3H_2SO_4=10CO_2+K_2SO_4+2MnSO_4+8H_2O]$ (2) $2[3MnSO_4+2KMnO_4+2H_2O=5MnO_2+K_2SO_4+2H_2SO_4]$ and (3) $2MnO_2+2H_2SO_4=2MnSO_4+2H_2O+O_2$, (2) and (3) being subsequently repeated as often as required, provided the supplies of sulphuric acid and permanganate are kept up. It is not advisable therefore to use potassium permanganate in acid solution for titrations at temperatures above about 81° C. Incidentally the validity of equation (2) is confirmed, the irregularities which have led to the suggestion of other equations being explained by the disturbing effects of equation (3) at high temperatures.—W. H. P.

Metal- and metallic-oxide-aluminas, and their value as catalysts. M. Kleinstück. Z. angew. Chem., 1910, **23**, 1105—1106.

Alumina, especially Wislicenus' "fibrous alumina" or "sprouted alumina" (this J., 1905, 294), can remove from their solutions, by adsorption, many metals and metallic oxides. The chloride (nitrate, acetate) of the metal is treated with ammonia till the precipitate formed is just redissolved, then shaken with the fibrous alumina, which is next washed, dried, and ignited. In some cases ammonium carbonate is used instead of ammonia; in some an addition of ammonium chloride is necessary; in some, *e.g.* gold, a colloidal solution of the metal can be advantageously used. The "metal-aluminas" or "metallic-oxide-aluminas" thus produced, have characteristic colours, variable with the concentration of the solution of the metallic salt used. The following list is given:—

Metal.	Colour after adsorption.	Colour after ignition.
Copper	Blue	Greenish blue
Iron	Yellow	White
Manganese	Bright yellow	Chocolate brown
Gold	Black	Bright red
Palladium	Gray	Reddish brown
Platiaum	—	Gray-brown
Chromium	Greenish blue	Ochre yellow
Cobalt	Dull rose	Grayish blue
Nickel	Dull blae	Dull blue
Silver	White	White

When mixed solutions are used, the tint due to one metal is often influenced considerably by the presence of the other; thus a very small proportion of manganese will entirely mask the blue colour of copper. Iron-alumina forms a sensitive reagent for tannin, being coloured blue by even small amounts of tannin-containing solutions. Silver-alumina is darkened by light, but regains its white colour on being ignited again, to be again darkened if exposed to light. If it be kept in an atmosphere of carbon dioxide, however, light has no visible effect on it. These aluminas are capable of effecting many reactions by their catalytic action. Thus copper-alumina, warmed, oxidises methyl alcohol vapour in air to formaldehyde, and converts hæmatoxylin in a logwood solution through which air is passed, into hæmatein; whilst if hydrogen gas be passed through a solution of alkali bicarbonate containing palladium-alumina, the bicarbonate is partially reduced to formate. Manganese-alumina rapidly resolves hydrogen peroxide, in 10 per cent. solution, into water and oxygen.—J. T. D.

Trichloroethylene; Uses of —— in analytical chemistry. L. Gowing-Scopes. Analyst, 1910, **35**, 238—244.

Trichloroethylene is a colourless liquid having a sp. gr. of 1·476 at 15° C. and a refractive index of 1·4777 at 19·8° C.; it boils at 87·5° C., and its specific heat is 0·256. It dissolves practically all organic compounds that do not contain two or more carboxyl or hydroxyl groups; a few inorganic substances, notably nitrous acid, are soluble in trichloroethylene, and the latter should prove useful for diazotisation when the presence of water is objectionable. Trichloroethylene may be used in the determination of fat in substances such as milk, etc., and, as it is non-inflammable, the extraction flask may be heated directly with a flame. It is essential that, in the case of milk and milk powder, all moisture be excluded during the determination. As a general solvent trichloroethylene appears to offer few advantages over those commonly in use; as it is an unsaturated compound it cannot be employed with oxidising agents. Whilst its solvent properties resemble those of chloroform and carbon tetrachloride, it withstands the action of alkalis much better. When inhaled, its vapour is liable to produce unpleasant symptoms.—W. P. S.

Paraffin wax from petroleum, lignite, and shale. Marcusson and Meyerheim. *See* IIa.

Colorimetric determination of small amounts of hydrocyanic acid. Berl and Delpy. *See* VII.

Analysis of tartar products. Carles. *See* VII.

Determining carbon in iron alloys. Wüst. *See* X.

Detection and determination of vanadium in steel. Slawik. *See* X.

Crucible assay of pyritic concentrates for silver and gold. Borrowman. *See* X.

Assaying sulphide ores. Hawley. *See* X.

Determining sulphur in brass and bronze. Thurnauer. *See* X.

Analysis of tin alloys. Kietreiber. *See* X.

Hydrolytic dissociation of alkali soaps in alcohol-aqueous solutions. Holde. *See* XII.

Determining acidity of tanning liquors. Yocum and others. *See* XV.

Soil humus as determined by different methods. Leavitt. *See* XVI.

Nitrogenous matters in bone superphosphate. Chardet. *See* XVI.

Bang's method for determining sugar, and the keeping properties of the titrating liquids used therefor. Andersen. *See* XVII.

Formation of lævulinic acid from hexoses. Van. Ekenstein and Blanksma. *See* XVII.

Determining diastatic power of malt and malt extract. Ling. *See* XVIII.

Determining salicylic acid [in wines, etc.] by distillation. Cassal. *See* XVIII.

Influence of chlorine on determination of nitric nitrogen. Stewart and Greaves. *See* XIXb.

Determining ammoniated mercury in ointment. Rippetoe. *See* XX.

Patents.

Apparatus and thermometer for high temperatures. Siebert und Kühn. Fr. Pat. 410,023, Dec. 3, 1909.

The claim is for a thermometer constructed of fused quartz or quartz glass. The capillary tube is made entirely of transparent quartz, but the envelope is of opaque quartz, except that portion through which the scale is to be read, which is made of transparent quartz.—W. H. C.

Gas analysing apparatus. The Underfeed Stoker Co. of America. Fr. Pat. 410,068, Dec. 6, 1909.

The apparatus which is suitable for automatically registering the percentage of carbon dioxide in flue gases, mine gases, etc., comprises a gas-measuring chamber for entrapping a fixed volume of the gas to be tested, an absorbing chamber from which liquid is displaced by the gas not absorbed, a float raised to a variable height according to the amount of gas not absorbed, and means for recording the percentage on a chart. The operations are controlled electromagnetically. The gas-measuring chamber is connected with an open vessel containing a float, and this float actuates a pulley carrying an arm which makes contact with one or other of two terminals, according as the measuring chamber is full of liquid or of gas. By this means electromagnets are excited so as to move an armature and work an escapement permitting the rotation of a cock which controls communication between the various vessels.—A. T. L.

Air or gas mixture; Process and apparatus for the examination of an —— by means of a reagent which is decolorised or changes colour. M. Arndt. Ger. Pat. 221,283. Aug. 6, 1908.

The air or gas to be tested is forced or sucked by means of a turbine through the coloured reagent, the quantity required to discharge or change the colour varying with the composition of the sample and the rate of rotation of the turbine. A disc is caused to rotate in unison with the turbine, and on this disc are scales, by means of which the quality of the sample can be observed directly.—A. S.

XXIV.—MISCELLANEOUS ABSTRACTS.

Emulsions; Separation of —— formed by shaking. R. Fanto and M. J. Stritar. J. prakt. Chem., 1910, **81**, 564—568.

The authors find that emulsions such as those formed by water and lipoid, or water and benzene, can be separated into the component liquids by the action of an electric current. For this purpose either the high tension discharge of an induction coil (spark length 5—50 mm.) may be used, or continuous current (220 volts). In the latter case a lamp resistance is also placed in circuit. The connection may be made, when a coil is employed, by connecting one pole with the tap of the funnel, the ground surface having been lubricated with water: the other terminal takes the form of a wire dipping into the liquid. With the direct current, two electrodes are moved about in the emulsion. The separation is rapid, in many cases almost instantaneous. The same result may be effected by placing the emulsion between the poles of a powerful induction coil.—R. V. S.

Cork. M. v. Schmidt. Monatsh. Chem. 1910, **31**, 347—356.

The author finds that cork is an insoluble mixture of anhydrides and polymerisation products of solid and liquid fatty acids with the residues of glyceryl esters of the same acids. Young cork most probably contains glycerides only, which gradually pass into the above compounds through fission and loss of glycerol.—J. C. C.

Trade Report.

Canadian Customs decisions. Board of Trade J., June 23, 1910.

The following have been transferred to the list of articles which may be imported duty free into Canada:—(*a*) Cotton thread, nitrate of thorium, and nitrate of cerium for use in the manufacture of incandescent gas mantles, when imported by manufacturers of such mantles, or of stockings for such mantles; (*b*) crude glycerine, when imported by manufacturers for use only in their own factories in the manufacture of refined glycerine; (*c*) soya beans and soya bean cake for use in the manufacture of cattle food and of fertilizers, when imported by manufacturers of such cattle food and fertilizers; (*d*) ground coke, when imported by manufacturers of electric batteries for use only in their own factories in the manufacture of such batteries.

The duties on preparations made from pyroxylin and wood naphtha (when imported by manufacturers for use only in their own factories in the manufacture of leather belting), have been reduced to 5 per cent., 7½ per cent., and 10 per cent. *ad val.*, respectively, under the British Preferential, Intermediate, and General Tariffs.

The above alterations took effect from June 10th last.

Dangerous trades. Home Office Report.

The Home Office has communicated to the Parliamentary Committee of the Trade Union Congress the result of inquiries which have been made with reference to certain trades which the Committee sought to have put on the list of dangerous trades. Complaint had been made as to the effect of using copper and brass. The Home Office Medical Inspector (Dr. Legge) has been unable to find that there is any ground for the assumption that either copper or brass are poisonous substances within the meaning of section 75 of the Factory and Workshops Act of 1901. When lead is used in copper works it is already necessary to provide proper washing appliances, and pending further information the Home Office inspectors will be instructed to press upon manufacturers the need of providing proper washing accommodation. As to the effect of chlorinous fumes in dye works, the Home Office has been unable to discover evidence that such fumes are dangerous.

Books Received.

Die Brown'sche Bewegung und die wahre Existenz der Moleküle. Von Prof. Dr. J. Perrin, Paris. (Deutsch von Dr. J. Donau, Graz). Sonderausgabe aus Kolloidchemische Beihefte. Monographien zur reinen und angewandten Kolloidchemie. Herausgegeben von Dr. Wolfgang Ostwald. Band I. Theodor Steinkopf's Verlag, Dresden, 1910. Price M 2.50.

8vo pamphlet, containing 84 pages of subject matter, with seven illustrations. The text is subdivided into four sections and these again into further subsections, under which the whole subject is discussed.

The Journal of the Institute of Metals. Vol. III. 1910.

A volume 360 pages, in addition to which there are 14 full page plates. The major portion of the Journal consists of a series of papers which were read at the Annual General Meeting of the Institute held in London in January, and covers 230 pages. The Journal is issued twice yearly, in June and December respectively, and is published by the Institute. It can be purchased for one guinea at the Offices of the Institute, Caxton House, Westminster, London, S.W.

Annual Report of the Chief Inspector of Factories and Workshops for the year 1909. Reports and Statistics. [Cd. 5191.] Price 2s. 6d.

This publication contains the general report of the Chief Inspector upon the work of the Factory Department in 1909, as well as statistical tables. Reports are included by the Divisional Superintending Inspectors, the principal Lady Inspector, the Inspector of Textile Particulars, the Inspector for Dangerous Trades, and the Electrical and Medical Inspectors.

At the end of the year there were upon the registers 112,479 factories and 151,270 workshops, not including men's workshops, warehouses, docks, wharves, quays, "buildings," railway lines and sidings, home work premises, and factories and workshops under the charge of H.M. Inspectors of Mines.

Analyses of Rocks and Minerals from the Laboratory of the U.S. Geological Survey, 1880—1908. Tabulated by F. W. Clarke. U.S. Geol. Survey, Bulletin 4107. Govt. Printing Office, Washington.

8vo volume of 318 pages containing in all 2420 analyses, as follows:—Igneous and crystalline rocks, 1203; sandstones, cherts, and sinters, 81; carbonate rocks, 273; slates and shales, 63; clays, soils, etc., 130; meteorites and separations from them, 62; minerals, 608. The analyses have been made at various times during the last 28 years in the laboratory of the Geological Survey, and are here collected and classified as far as possible.

*New Books.

Adressbuch der Färbereien, Reinigereien (Chemisch-Wäschereien) u. Dampfwaschanstalten im Deutschen Reiche 1909—1910. Hrsg. v. der Fachzeitschrift "Der Färber u. Wäscher" Gera-Reuss. (XIV, 11, 94 S.) 31 × 13 cm. Papiermühle, (Gebr. Vogt). Cloth M. 10.

Allen's Commercial Organic Analysis. Vol. II. 4th Ed., Entirely re-written. Roy. 8vo, pp. 530. Churchill. London, 1910. Net. 21s.

Armes, E.: The story of coal and iron in Alabama. Birmingham. Ala. [E. Armes, 1410 St. Charles St.,] 1910. 34+581 p. pls. O. cl., $5.

Barthel, C.: Methods used in the examination of milk and dairy products. 8vo, pp. 272. Macmillan. London, 1910. Net 7s. 6d.

Baskerville, C.: General inorganic chemistry. Cr. 8vo. D. C. Heath. London. 1910. 3s. 6d.

Cushman, A. S., and *Gardner*, H. A.: The corrosion and preservation of iron and steel. N. Y., McGraw-Hill, 1910. 20+373 p. il. O. cl., $4 net.

Elektrochemie; Monographien über angewandte ——. V. Engelhardt. gr. 8°. Halle, W. Knapp.

34. Bd. *Bronn*, J.: Der elektrische Ofen im Dienste der keramischen Gewerbe u. der Glas- u. Quarzglaserzeugung unter Berücksicht. der neueren wichtigeren Forschungen auf diesen Gebieten. (XIII. 360 S. m. 198 Abbildgn. u. 2 Taf.) 1910. M. 22.

35. Bd. *Betts*, A. G.: Bleiraffination durch Elektrolyse. Aus dem Engl. v. Vikt. Engelhardt. (XII. 286 S. m. Abbildgn., 135 Tab. u. Taf.) 1910. M. 18.

Erban, Dr. F.: Kartelle u. Konventionen in der chemischen Industrie. [Aus. "Appretur-Ztg."] (IV. 54 S.) kl. 8°. Gera 1910. (Papiermühle, Gebr. Vogt.). M. 1.

Fenton, H. J. H.: Outlines of chemistry with practical work. First Part. 2nd ed. 8vo, pp. 434. Longmans. London. 1910. Net 9s.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works and dissertations n the preceding lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an sterisk is affixed. The dates given are (i) in the case of Applica-ions for Patents, the dates of Application, and (ii) in the case of omplete Specifications Accepted, those of the Official Journals which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to spection at the Patent Office immediately, and to opposition ithin two months of the said dates.

I.—GENERAL PLANT: MACHINERY.

Applications.

14.279. Daubine. Process and apparatus for drying r. [Ger Appl., July 10, 1909.]* June 13.

14.382. Elmore. *See under* X.

14.487. Deacon and others. Filtering apparatus. June 15.

14.500. Ohrn. Channel kilns. [U.S. Appl., June 15, 09.]* June 15.

14.506. Sutcliffe. Tunnel kilns.* June 15.

14.591. Köhn and Münster. Vaporising the volatile nstituents of liquids.* June 16.

14,632. Parry. Method of drying saturated steam. June 17.

14,767. Grace. Method of discharging filter-presses. June 18.

15,263. McClelland. Method and apparatus for evaporting, volatilising, or distilling liquids and solids.* June 25.

Complete Specifications Accepted.

10,562 (1909). De Murrieta and Tully. Separating liquids from gases or vapours by centrifugal action. June 22.

11,422 (1909). Eijdman. Evaporating apparatus. June 22.

13,554 (1909). Gayley. Method and apparatus for drying air. June 22.

17,380 (1909). Muller and Bomhard. Purification of gases. June 29.

23,864 (1909). Dieker (Maschinenbau A.-G. Golzern-Grimma). Liquid vaporising or concentrating apparatus. June 29.

24,261 (1909). Burstall. *See under* II.

474 (1910). Paterson. Filters. June 29.

1073 (1910). Granges. Covers for autoclaves or other vessels. June 29.

II.—FUEL: GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

14,304. Soc. Franç. de Matérial Agricole et Industriel à Vierzon. Gas generators. [Fr. Appl., June 14, 1909.]* June 14.

14,390. Marks (Porges and others). *See under* III.

14,405. Koppers. Gas generator combined with gas furnaces. [Ger. Appl., July 15, 1909.]* July 14.

14,640. Franke. Plant for the manufacture of peat briquettes.* June 17.

14,768. Hutchins. Gas-producer generators. June 20.

14,897. Dor-Delattre. *See under* X.

Complete Specifications Accepted.

12,001 (1909). Knottenbelt. Petroleum oils. June 29.

13,865 (1909). Machtolf. Production of carbon black. June 22.

14,508 (1909). Ewing. Gas retorts. June 29.

17,074 (1909). Lymn. Production of gas and ammonia from peat in a gas producer. June 29.

17,380 (1909). Muller and Bomhard. *See under* I.

24,261 (1909). Burstall. Apparatus for separating suspended matter from gases, especially tar from combustible gases. June 22.

29,559 (1909). Stephen. Manufacture of artificial fuel. June 22.

2298 (1910). Nauss. Manufacture of gas suitable for filling balloons of air ships. June 29.

9892 (1910). Knottenbelt. Petroleum and other hydrocarbon oils. June 29.

III.—TAR AND TAR PRODUCTS.

Applications.

14,390. Marks (Porges, Singer, and Steinschneider). Apparatus for distilling under high vacuum oils from the petroleum, tar, and like industries. June 14.

15,125. Diehl, Levinstein, and Levinstein, Ltd. Manufacture of halogenated naphtholsulphonic acid. June 23.

IV.—COLOURING MATTERS AND DYES.

Applications.

14,448 and 14,449. Levinstein, Baddiley, and Levinstein, Ltd. Azo dyestuffs and their production. June 15.

14.735. Newton (Bayer und Co.). Manufacture of azo dyes. June 18.

15.068 and 15,070. Levinstein, Baddiley, and Levinstein, Ltd. Manufacture of azo dyestuffs. June 23.

15,069. Levinstein and Levinstein, Ltd. Manufacture of azo dyestuffs derived from halogenated naphtholsulphonic acid. June 23.

15.268. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. June 25.

Complete Specifications Accepted.

13,727 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. June 22.

13.907 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture and use of anthracene colouring matters. June 22.

14,312 (1909). Newton (Bayer und Co.). Manufacture of dyestuffs. June 22.

15,846 (1909). Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. June 29.

15,847 and 23,204 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. June 29.

23,873 (1909). Johnson (Badische Anilin und Soda Fabrik). Reduction of indigo and similar colouring matters. June 29.

8239 (1910). Johnson (Kalle und Co.). Manufacture of dibromo-isatin. June 29.

8722 (1909). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of mordant azo dyestuffs. June 29.

9173. (1909). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of disazo dyestuffs. June 29.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

14,271. Newton (Bayer und Co.). Manufacture of acetyl derivatives of cellulose. June 13.

14,364. Bayer und Co. Production of pressed or shaped cellulose compounds from cellulose esters. [Ger. Appl., July 26, 1909.]* June 14.

14,559. Hübner. Method and apparatus for the production of threads from cellulose. June 16.

14,736. Newton (Bayer und Co.). Sizing threads coated with cellulose esters. June 18.

14,948. Walker. Cellulose esters.* June 21.

15,269. Courtauld and Co., Ltd., and Napper. Manufacture of threads, filaments, strips, or films of cellulose. June 25.

Complete Specifications Accepted.

8600, 17,125 and 22,615 (1909). Mayo. Extracting grease, &c., and treating wool, skins, textiles, etc. June 22.

14,959 (1909). Farjas and Jaboin. Radiferous fibres and method of producing them. June 29.

18,087 (1909). Loewe. Manufacture of artificial silk. June 29.

19,116 (1909). Hough. Treating pulping or other liquors, to separate resinous and ligneous matter. June 22.

22,111 (1909). Ketcheson. Treatment of fibrous or cellular material. June 22.

25,771 (1909). Geller. Manufacture of paper and cardboard. June 22.

28,256 (1909). Friedrich. Production of fine artificia threads. June 29.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

14,272. Newton (Bayer und Co.). Production of fast shades on the fibre. June 13.

14,645. Spenle. Apparatus for drying proofed and like fabrics and materials. June 17.

14,736. Newton (Bayer und Co.). *See under* V.

14,779. Knecht. Improving the fastness to light of dyed or printed yarns and fabrics. June 20.

Complete Specifications Accepted.

13,790 (1909). Keller. Treatment of alkaline fluid after use for bleaching cotton and cotton goods. June 22

17,624 (1909). Newton (Bayer und Co.). Dyeing half wool. June 29.

18,481 (1909). Daniels. Apparatus for dyeing wool June 22.

19,349 (1909). Aderholdt. Drying and finishing wet dyed yarns and textile fabrics. June 29.

26,026 (1909). Daniell aad Hebden. Dyeing yarn an the like. June 22.

27,431 (1909). Cox. Apparatus for extracting th moisture from cops, cheeses, warps, &c., after bleachin or dyeing. June 22.

30,507 (1909). Schmid. Scouring wool and woolle goods. June 22.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLI ELEMENTS.

Applications.

14,268. Rollin, and Hedworth Barium Co. Manufactur of amorphous anhydrous barium hydrate. June 13.

14,381. Brauer. Process for concentrating nitric aci [Ger. Appl., June 16, 1909.]* June 14.

14,638. Vorraber. Machine for the dust-free drying an grinding of ammonium sulphate. [Ger. Appl., Dec. 1909.]* June 17.

14,800. Douzal. Ozone generator.* June 20.

14,963. Rule. Manufacture of sodium hydrogen su phide or potassium hydrogen sulphide. June 21.

15,036. Brougham (Solvay et Cie.). Manufacture ammonium sulphate. June 22.

15,194. Spence, Craig, and Spence and Sons, Lt Utilisation of certain siliceous matters. June 25.

15,285. Weltereck, and Sulphate of Ammonia Co., Lt Process of producing ammonia from peat. June 25.

Complete Specifications Accepted.

14,300 (1909). Teisset and Prat. Kessler's apparat for concentrating sulphuric acid. June 29.

17,074 (1909). Lymn. *See under* II.

29,385 (1909). Friedrich. Manufacture of a copp salt specially suited for preparing ammoniacal copp oxide. June 22.

VIII.—GLASS; CERAMICS.

Applications.

14,660. Dressler. *See under* IX.

14,897. Dor-Delattre. *See under* X.

14,989. Helliwell and Helliwell. Manufacture of abra ing or polishing powder. June 22.

Complete Specification Accepted.

14,393 (1909). Britannia Patent Firelighter Co., and Barker. Treatment of the waste products and refuse from glass works. June 29.

IX.—BUILDING MATERIALS.

Applications.

14,660. Dressler. Ovens for use in making tiles, pottery, &c., June 17.

14,661. Dressler. Power presses for the manufacture of tiles, &c. June 17.

14,891 and 14,892. Wilson and Barr. Manufacture of cement, plaster, and concrete. June 21.

14,981. Mankau. Manufacture of firebricks and the like. June 22.

Complete Specification Accepted.

11,184 (1909). J. et A. Pavin de Lafarge. Manufacture of cement. June 22.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

14,382. Elmore. Flotation processes of separating certain constituents from mixtures. June 14.

14,520. Stobie. Manufacture of steel. June 16.

14,574. Gordon. Ore roasting furnaces. June 16.

14,743. British Thomson-Houston Co. (General Electric Co.). Alloys suitable for use as electric resistance conductors. June 18.

14,823. Ettlinger. Roasting furnaces.* June 20.

14,827. Daudelin. Solders.* June 20.

14,897. Dor-Delattre. Producing crucibles and retorts for zinc furnaces, for distilling coal, &c., and producing other hollow earthenware articles.* June 21.

14,940. Smart. Aluminium alloys. June 21.

14,955. Beardmore. Manufacture of steel for armour plates, guns, &c. June 21.

14,970. Longford. Coloration of metals. June 31.

15,173 and 15,174. Richardson. Manufacture and treatment of steel. [Comprised in No. 13,503, June 3, 1910.] June 23.

Complete Specifications Accepted.

9508 (1909) Greene. Process of refining metals and alloys. June 29.

11,044 (1909). Harris (Cox). Concentrating apparatus for separating metals, ores, &c., in wet recovery processes. June 22.

13,218 (1909). Richardson. Manufacture and treatment of steel. June 22.

14,372 (1909). Parnell. Treatment of ores. June 22.

18,176 and 18,178 (1909). Martin. Separation of complex ores. June 22.

27,201 (1909). Allison (International Metal Products Co.). Iron product and open-hearth process of making same. June 29.

5709 (1909). Eickworth. Crucible furnaces. June 29.

XI.—ELECTRO-CHEMISTRY.

Applications.

14,743. British Thomson-Houston Co., Ltd. (General Electric Co.). *See under* X.

15,139. Hering. Electric furnaces. [U.S. Appl., July 6, 1909.]* June 23.

15,164 to 15,169. Thomson and Fitzgerald. Electric furnaces. [U.S. Appls., Sept. 4, 1909.]* June 23.

XII.—FATS; OILS; WAXES.

Applications.

14,461. Koller. Organic chloro-compound soaps and cleansing compositions. June 15.

14,844 and 14,942. Cassel. Crude oil soap or soap lye, and process of manufacturing same. [Austrian Appls., Aug. 21, 1909, and March 11, 1910.]* June 20 and 21.

15,288. Koller. Organic chloro-compound soaps and cleansing compositions. June 25.

Complete Specification Accepted.

15,246 (1909). Savril, Ltd., Irving, and Wilson. Washing compound or soap. June 22.

XIII.—PAINTS; PIGMENTS; VARNISHES: RESINS.

Application.

14,293. Peters. Protective coatings or varnishes. June 13.

Complete Specifications Accepted.

13,865 (1909). Machtolf. *See under* II.

14,877 (1909). Allsop. Ground for paint. June 22.

19,109 (1909). Marks (Southern Manufacturing Co.). Baths for extracting products from wood. June 29.

29,962 (1909). Falk. Manufacture of white lead. June 22.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

14,251. Banchieri. Devulcanising india-rubber, or treating reclaimed or regenerated india-rubber. June 13.

14,281. Johnson (Badische Anilin und Soda Fabrik). Manufacture of substances resembling caoutchouc. June 13.

14,830. Perkin and others. Manufacture of isoprene. June 20.

15,254. Bayer und Co. Manufacture of a substance similar to natural caoutchouc. [Ger. Appl., Sept. 29, 1909.]* June 25.

Complete Specification Accepted.

718 and 719 (1910). Banchieri. Devulcanisation of india-rubber. June 22.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

14,586. Rampichini. Moisture-proof composition of glue for treating leather. [Ger. Appl., Dec. 28, 1909.]* June 16.

14,861. Nitritfabrik A.-G. Preparation of tannic extracts and tannic acid. [Addition to No. 16,140 of 1909.]* June 20.

Complete Specifications Accepted.

8600, 17,125 and 22,615 (1909). Mayo. *See under* V.

30,173 (1909). Turnbull. Drying of leather. June 29.

5489 (1910). Kohn. Tanning processes. June 22.

XVII.—SUGAR; STARCHES; GUMS.

Application.

14,657. McMullen. Sugar-producing products and process of producing the same.* June 17.

XVIII.—FERMENTATION INDUSTRIES.

Complete Specification Accepted.

17,206 (1909). Dymond (Topf und Söhne). Apparatus for steeping, germinating, and kiln-drying malt, &c. June 22.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

14,611. Vasey. Soluble protein or albumin, and its production from meat fibre or other insoluble protein matter. [Addition to, and comprised in No. 20,766 of 1909.] June 16.

15,155. Lunt. Collecting alcohol and other volatile substances produced in baking. June 23.

15,160. Maw, Salamon, and Riley. Disinfectants. June 23.

Complete Specifications Accepted.

11,421 (1909). Eijdman. Treatment of sea water. June 22.

14,439 (1909). Williams. Treatment of sewage, foul waters, &c. June 22.

15,028 (1909). Browning and Golder. Machinery for the manufacture of casein. June 29.

17,992 (1909). Loring. Ageing and conditioning flour. June 29.

25,472 (1909). Chem. Fabrik Ladenburg. Disinfecting process. June 22.

27,775 (1909). Johnson (Chem. Fabr. vorm. Goldenberg, Geromont, und Co.). Manufacture of baking powder. June 22.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

14,482. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of non-toxic suprarenal preparations. June 15.

14,576. Müller. Manufacture of compounds of yohimbine. [Ger. Appl., March 12, 1910.]* June 16.

14,830. Perkin and others. *See under* XIV.

15,244. Wellcome and Ewins. Manufacture of a physiologically active base. June 25.

Complete Specifications Accepted.

15,303 (1909). Cross. Manufacture of a chloramine derivative. June 29.

19,766 (1909). Stapler. Manufacture of solid perfume. June 22.

29,787 (1909). Busch and von Wülfing. Preparation of albuminoid compounds of guaiacol sulphonates. June 22.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specifications Accepted.

17,009 (1909). Newton (Bayer und Co.). Machines for forming celluloid and other similar support films for photographic purposes. June 22.

29,273 (1909), 4912 and 5377 (1910). Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Manufacture of polychrome screens for colour photography. June 29.

XXII.—EXPLOSIVES; MATCHES.

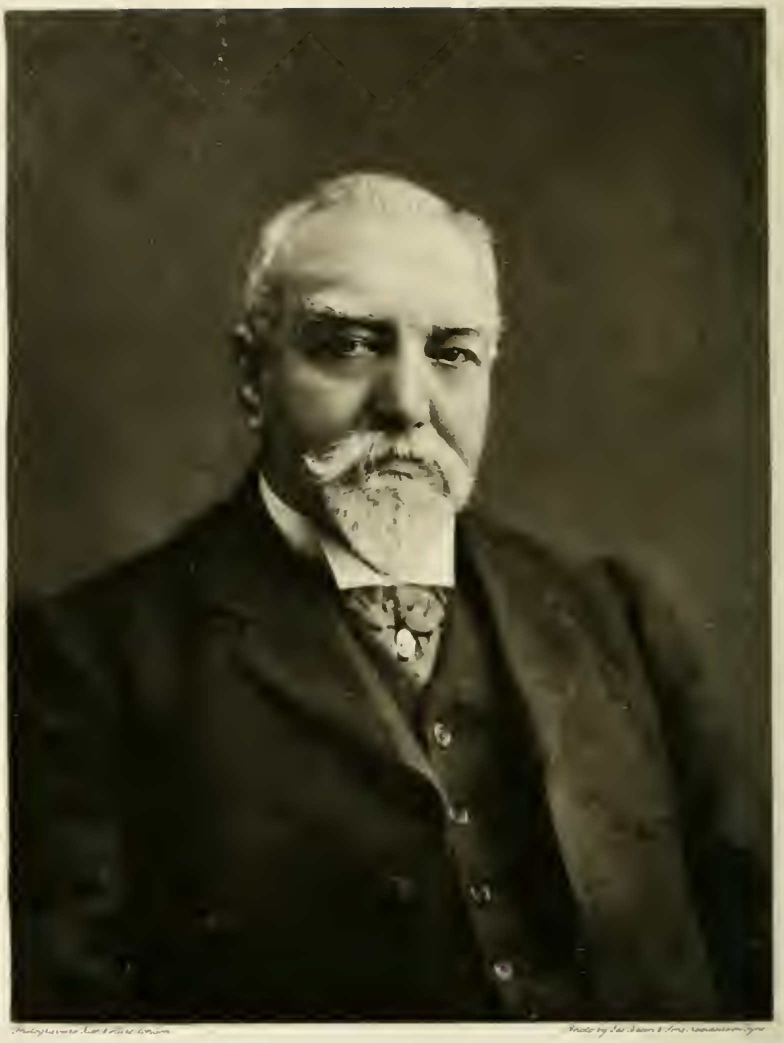
Application.

14,669. Hale. Manufacture of explosives. June 17.

XXIII.—ANALYTICAL CHEMISTRY.

Application.

14,926 Lovibond. Apparatus for use in determining the colour of liquids.* June 21.



Thos. Tyrer

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PROCEEDINGS

OF THE

TWENTY-NINTH ANNUAL MEETING.

GLASGOW.

WEDNESDAY, JULY 6TH, 1910.

The twenty-ninth Annual General Meeting of the Society of Chemical Industry was held in the Natural Philosophy Lecture Theatre, Technical College, George Street, Glasgow, on Wednesday, 6th July, 1910, the President, Prof. Ira Remsen, in the chair.

Welcome by the Corporation.

Baillie GUEST and Councillor SMITH, Convener of the Chemical Committee, attended to offer a welcome on behalf of the Corporation.

Baillie GUEST, invited by the President to address the meeting, apologised for the absence of the Lord Provost of Glasgow, who regretted his inability to be there that morning, and gave them a hearty welcome to the city. His Lordship was looking forward with keen pleasure to meeting them that night in the Townshouse. When the Town Council heard that the Society of Chemical Industry was to have its Annual Meeting in the city, they appreciated the favour, because while recognising the value of the Society, they also recognised that there were works in the city which would interest them and possibly create discussion which would afterwards be of advantage not only to their own city but to the community. They knew what chemistry had done by converting waste materials into useful commodities.

The PRESIDENT said that on behalf of the Society, he wished to thank Baillie Guest for the words of welcome he had just spoken, and to assure him that those present highly appreciated the opportunity of meeting in Glasgow. Judging from the fact that the Society met there for the third time, the previous experiences must have been wholly satisfactory.

The Minutes of the last meeting, held in London, were read, confirmed, and signed by the President.

On the motion of Mr. W. J. CHRYSTAL, seconded by Dr. G. H. BAILEY, Dr. F. J. Wilson and Mr. W. S. Denham were appointed scrutators.

The PRESIDENT then declared the ballot closed.

The SECRETARY (Mr. Charles G. Cresswell) read the Report of Council as follows :—

REPORT OF COUNCIL.

The Council has the honour to report that on learning of the death of H.M. King Edward VII, a special meeting was held for the purpose of drafting an address of sympathy and condolence for presentation to H.M. King George V. This address was printed in facsimile in the 31st May issue of the Journal. The Society was then honoured with a command to present the Address to His Majesty in person, and His Majesty's reply was published in the last issue of the Journal. The presentation was made at the second Accession Court on the 22nd June. Sir Henry Roscoe, the first President of the Society, introduced the deputation, which consisted of Mr. Tyrer, Prof. Meldola, Mr. Walter F. Reid, Mr. Grant Hooper, and the Secretary. H.M. King George has shewn his interest in Chemical Industry by opening the Seventh International Congress of Applied Chemistry immediately after the last Annual General Meeting in May, 1909, and chemical science in all its branches is assured of His Majesty's continued interest.

The Congress of Applied Chemistry was very well attended, and was in all respects a great success. It will undoubtedly tend to promote union and agreement among those engaged in the application of chemical science to industry. At the closing meeting, Mr. Whitelaw Reid, on behalf of the United States Government, invited the members to meet in America in 1912. The invitation was supported by Dr. H. W. Wiley, and by Prof. R. Meldola on behalf of the Society of Chemical Industry, and was accepted. Prof. E. W. Morley was chosen as Hon. President, and Dr. W. H. Nichols as Acting President, and the official American delegates were constituted the organising committee.

The number of members now on the register of the Society of Chemical Industry is 4299, as compared with 4323 at the last Annual Meeting. During the year 253 members have been elected, as compared with 258 last year, and the losses have been 277 as against 453 last year. There were 38 deaths as compared with 40 last year.

The names of the members removed by death are :— J. B. Alliott, R. Bannister, W. H. Baxter, H. Bianchi, A. J. S. Bles, Dr. J. Campbell Brown, M. Carteighe, Sir George Drummond, Dr. C. B. Dudley, Dr. M. Ekenberg, W. J. Finch, Prof. Charles Graham, George Hill, J. P. Ihart, R. A. Inglis, Dr. H. W. Jayne, Thos. Johnston, Col. Robt. King, Thos. Lawton, G. Lefebvre, Dr. L. Mond, Arthur G. Phillips, G. A. Pryce, Iltyd J. Redwood, H. C. Ridding, R. Wightwick Roberts, Dr. W. J. Russell, Aug. Scher, R. H. Steedman, Dr. C. E. Strunz, John Tatlock, Charles Thomas, Prof. H. A. Torrey, A. Forbes Watson, Jas. H. Wilson, Herbert R. Wing, John D. Wing, and C. I. Zimmermann.

An obituary notice of the late Dr. Ludwig Mond was published in the Dec. 31st issue of the Journal, but the Council specially desires to express its sense of the great loss which has been sustained in the death of one who, from the foundation of the Society, was continuously and closely associated with its fortunes, and who, from his distinguished position in the world of applied chemistry, and by his munificent aid to the advancement of science, must long be mourned. On the death of Dr. Mond, Dr. Rudolph Messel was appointed Hon. Foreign Secretary.

From the Council of the Society four ordinary members retire, and ten candidates having been nominated to fill the vacancies, a ballot is required on this occasion.

Since the last Annual Meeting, Standing Orders for regulating the proceedings of the Council, and Rules for the Guidance of the Publication Committee, Officers, and Sectional Committees have been prepared and issued, together with the Regulations then sanctioned.

A committee has been appointed to further the development of the scheme of general lectures proposed by Dr. Lewkowitsch. Under this scheme eight lectures have been given in London, six in Birmingham, one in Newcastle, two in Nottingham, one in Scotland, and two in Yorkshire ; and, in addition, two in Canada and three in New York, perhaps not strictly under the scheme, but in harmony with its purpose.

The Balance Sheet and Annual Statement of Account will be laid before the meeting.

The Society's medal has been awarded to Mr. Thomas Tyrer, for his distinguished services to Chemical Industry and to the Society from its foundation. He has shown his devotion in every office it was possible for him to hold, and no words would be too strong in which to express the Council's sense of his services.

On April 30th last, on the occasion of a banquet given to Prof. C. F. Chandler on his retirement from the chair of chemistry at Columbia University, the opportunity was taken to present him with an address from the Council. The address was handed to Prof. Chandler by the President in person.

Mr. Walter F. Reid and Prof. Hodgkinson have been nominated delegates to a joint committee formed for the purpose of inviting the International Congress of Mining and Metallurgy to meet in London in 1915.

Mr. Julian L. Baker has retired from the secretaryship of the London Section, and has been succeeded by Mr. J. H. Coste. The London Section marked its sense of Mr. Baker's services by making him a presentation, and the Council is glad to have this opportunity of expressing its thanks to him for his services.

The following chairmen of sections now retire from office : Dr. Milton L. Hersey, Canada ; Mr. Max Muspratt, M.P., Liverpool ; Dr. J. Lewkowitsch, London ; Mr. C. J. Potter, Newcastle ; Mr. Maxmilian Toch, New York ; Mr. D. J. Playfair, Scotland, Prof. J. A. Schofield, Sydney; and Prof. W. M. Gardner, Yorkshire. The thanks of the Society are due to them for their successful labours.

The following are the new chairmen elected to succeed them in office, viz.: Prof. W. Lash Miller, Mr. Arthur Carey, Mr. E. Grant Hooper, Mr. E. F. Hooper, Dr. C. F McKenna, Dr. Thos. Gray, Mr. Thos. Steel, and Mr. E. A. Brotherton, M.P

Mr. J. M. Collett (Gloucester), proposed the adoption of the Report, and Mr. N. H. Martin (Gateshead), seconded, and on the motion being put to the meeting it was unanimously carried.

Report of Hon. Treasurer.

The Hon. Treasurer (Mr. Thomas Tyrer) in presenting his financial report (this J., 1910, page 604, 605), said that there was no striking feature in it. The expenses of various kinds were normal. Nevertheless, the tendency to increase was obvious, and he would remind hon. secretaries and his fellow treasurers in the sections that economy with efficiency was as necessary as ever. The considerable item of excess of income over expenditure contrasted with the deficit of last year, and the attention of members was called to the fact that, in 1909, there was only a small balance due on the Decennial Index account, the expenditure on which had been a serious item for some few years. Though repetition of that expenditure would not be required for some time, nevertheless the amount to credit must be ear-marked, so to say, in view of possible expenditure, such as another Decennial Index. This again, however, must depend on the way in which the further demand for that index came. There was a huge stock of the last one for disposal, and it was surprising that its necessity to every enquiring and practical member was not more recognised. In his opinion practising members could not afford to be without the Collective and Decennial Indexes (1881—1895 and 1896—1905) for handy reference. Everyone who subscribed had for half its cost a valuable working tool. The fact that the other half came out of the Society's funds was a reasonable argument for ordering the index at the ridiculously small price fixed. With regard to the capitalised fund of over £16,000, it was invested in gilt edge securities, which had been inspected and duly certified by the auditors.

Mr. Andrew Macdonald in moving the adoption of the Report, said it was a great pleasure to him to have an opportunity of proposing a vote of thanks to the Honorary Treasurer.

Dr. Harold G. Colman seconded the motion, which was unanimously carried.

The Honorary Treasurer thanked the meeting and said it was a labour of love.

PRESIDENT'S ADDRESS.

The President then read his Address as follows :—

Permit me first to thank you for the honour you have shown me in electing me to the presidency of this great and influential Society. Unfortunately I have not been able thus far to show my appreciation in any tangible way, and my apology is due to you for the inactivity that has been characteristic of the last year, at least so far as I am concerned. It is perhaps just as well that I have not been nearer the seat of action, and that the conduct of the affairs of the Society has been left to experienced hands and minds without the slightest interference from me. If the Society has prospered during my incumbency the only way that this can be explained on the assumption that I am at all responsible is, that, like some of my countrymen and especially some of my countrywomen, I have acquired the art of absent treatment. I make no claims to the possession of skill in this art, but am quite content to acknowledge my great indebtedness to my distinguished predecessors in the chair—Professor Meldola and Mr. Thomas Tyrer—who have always been ready to do the right thing at the right time, and by so doing to relieve the titular president of all feeling of responsibility.

There is, however, one thing which the president cannot escape. He must deliver the annual address, come what may. The hour has struck, and I proceed to perform the only duty that I shall be called upon to perform. In choosing a theme I have had constantly before me the fact that this is the Society of Chemical Industry, and that my address ought to have some bearing on chemical industries. But my own life work has not been of a kind to fit me specially for such an address. I have only an elementary knowledge of the chemical industries. Of no one of them do I know enough to enable me to speak with confidence of it in detail. The next possibility is chemical training—the education of the technical chemist. On looking over the back volumes of the Society's Journal, I find that this has been a favourite subject for presidential addresses, and though perhaps more of a teacher than anything else, and therefore better qualified to speak on the subject of teaching than any other, I shall have to be satisfied with only a brief reference to my own experience as a teacher in so far as this has helped me to form an opinion as to what kind of training is best suited to the needs of the technical chemist.

But first let me remind you that there have been two previous meetings of the Society held at Glasgow—one in 1888, when Professor (now Sir James) Dewar presided, and another in 1901, when Mr. (now Sir Joseph) Swan was the president. Sir James Dewar spoke on a purely scientific subject suggested by the work of that great chemist Black, whose name adds lustre to the University of Glasgow. Sir Joseph Swan spoke on Electro-chemical Industry and, of course, his address was unusually luminous and illuminating. But there was another meeting held in Glasgow that was of interest to all industrial chemists and chemists not especially industrial. I refer to a meeting held here on October 11, 1844, the object of which was to honour the one whom I think we may fairly call the founder of chemical industry—that remarkable man, Justus Liebig. At a dinner which formed the climax of the celebration, the Earl of Eglinton and Winton, who presided, in proposing a toast to Liebig, used these words: "It is, in fact, impossible at this time to form a conception of the progress and importance of chemistry, when men like Professor Liebig stand in the lead, or those who after him will bear the banner." In replying Liebig spoke especially of the relations between science and practice, a favourite subject with him. Among other things he said: "Practical experience has an undoubted value; but it is like the ship that lacks the compass or the helmsman; it is a treasure that cannot be inherited. Science enables us to pass this treasure on to our children; it enables them to increase their wealth."

Writing in 1840 Liebig says: "In the Gewerbe Institut at Berlin, otherwise so excellent, instruction is given in skilled labour. Analyses of articles of commerce and the trades, or of minerals, are the highest that they strive for there; but these are occupations requiring but little exercise of judgment and the thinking powers. They are sufficient to make day labourers and machines." In the same year he also used these words: "It took a long time to convince technical chemists that they must acquire the highest possible scientific training in order thoroughly to understand and to conduct their technical processes, in order to introduce new processes for the manufacture of new products for which there is a demand. Now, however, they all recognise that what I have so long been preaching is right and true. Ask the manufacturers, look at their advertisements—they all want chemists thoroughly trained in the pure science. As it is in technical chemistry, so it will be sooner or later in physiology and in agriculture, the need for thoroughly and scientifically trained chemists will make itself felt."

There can be no question that Liebig exerted a controlling influence on the development of chemical industries. In looking over the back volumes of the Society's Journal, I came upon the presidential address given by Professor (now Sir Edward) Thorpe in 1895. At the close he spoke of a visit he had made to the "works of the Badische Anilin und Soda Fabrik, with their well-equipped laboratories—the like of which is not to be seen in any educational establishment in the world—and their scores of university-trained chemists at work on problems of chemical industry, needing the highest skill and knowledge for their solution." . . . He then adds, "'And to whom do you think we owe all this?' asked Professor von Baeyer of Munich, as I told him of my visit and of the profound impression it made upon me. I anticipated the answer. It was to Liebig. The little laboratory on the Lahn was as the leaven that leaveneth the whole lump. The movement which Liebig created and fostered, and which has been quickened by the labours of those who have been actuated by his spirit, has been the real factor in this wonderful development; and no ruler ever did a wiser or more beneficent act than was done by the Grand Duke of Hesse-Darmstadt when he endowed the Giessen laboratory, the first of its kind in Europe. Liebig's influence, and the influence of his method of studying and teaching chemistry, have spread throughout the civilised world, and it is only by the practical recognition of his spirit in our chemical schools and laboratories that chemistry can progress, or that the arts which are dependent on the application of chemical principles can flourish."

It was my good fortune to come under the influence of Liebig in my early years as a student of chemistry. Having studied medicine, I decided that I preferred to devote my life to the pursuit of chemistry. The name that stood out most prominently in my mind at that time, the name I had heard most about, was that of Liebig. I had read and studied his Chemical Letters, and without knowing the conditions then prevailing in Munich, I decided to get as near Liebig as possible. I wanted to see and hear that great man. On my arrival in Munich I was much disappointed to learn that Liebig did not admit students to his laboratory, although I found some consolation in the fact that he lectured regularly. For a full academic year I had the privilege of sitting at his feet and hearing him expound the elements of chemistry. I also came to know him, as a youth may know a master, and this association has been the chief inspiration of my life. This is of no special value to anyone else, but I mention the facts for a reason. Liebig impressed me so strongly that I have been led to study his life more carefully than I have ever studied a life. And the more I have studied it the more I have been interested.

Liebig taught the world two great lessons. The first was that in order to teach chemistry it was necessary that students should be taken into the laboratory. As you all know, the Giessen laboratory was not only the first chemical laboratory to which students were freely admitted, but it was also the first laboratory devoted to teaching any branch of science. The second lesson was that he who is to apply scientific thought and method to industrial problems must have a thorough knowledge of the science. The world learned the first lesson more readily than it learned the second. To-day there is unanimity in regard to the first point, and perhaps the same is true in regard to the second point, but, so far as my own country is concerned, at least, this has come about only within recent years. It may not be inappropriate in this connection to refer briefly to my own experience.

When the Johns Hopkins University was opened in 1876, it was my good fortune to be put in charge of the work in chemistry, with this simple and wholly satisfactory injunction, "Do your best work in your own way." We at once proclaimed that we intended to put emphasis upon research, that we recognised the training of youth in the methods of research as the most important work we could undertake, and now, after the experience of thirty-four years, we feel that we were right. The country was ripe for such an undertaking, and in a few years the research idea became epidemic. At present there are perhaps twenty universities in the United States that cultivate research successfully, while in 1876, and for a few years thereafter, the Johns Hopkins University was the only one of which this could be said. To be sure there are some follies committed under the name of research, but this does not detract from the value of the honest efforts that are now so widely made. I remember very well a remark made to me by one who came to consult me in regard to studying with me. He regarded me with some curiosity, and after a time he ventured to say: "Professor, I should like to enter the Johns Hopkins University, but your work doesn't seem to be practical, and others are saying the same thing." I acknowledged the truth of the observation, and added that I feared it was an incurable case, that there was in fact no prospect of my work ever becoming practical in the sense in which I supposed he used that much abused word.

Well, my work and that of my associates in chemistry has never become practical. It has for the most part had to do with things far removed from the industries, with an occasional momentary contact with the practical, and this in a sense was purely accidental. At first our graduates went almost wholly into teaching, and there was some tendency to look upon them as possibly too visionary. But that tendency soon disappeared, and our graduates were much in demand for teaching positions, and they are now widely distributed over the country. In those days the manufacturers did not often apply to us for chemists. When they did they generally stipulated that they wanted men with practical training, and, as a matter of fact, very few of our earlier graduates found places in the industries. Now to the point. At present, notwithstanding the fact that no change has been made in the general character of our training of chemists; notwithstanding the fact that this training is no more practical than it was at the beginning, the demand for our graduates for positions in the chemical industries is so great and the conditions so attractive, that it is a difficult matter to supply the demand for teachers. For the past few years nearly all our graduates in chemistry have gone into technical positions, and we could easily place as many more. An illustration or two may be instructive. Twenty years ago a student came to us without prejudice as to the particular branch of chemistry he was to follow. Before completing his course he carried out an investigation on the atomic weight of zinc and another on the action of hydrochloric acid on benzoic sulphimide. He had a scientific mind, and he delighted in the work of research. His desire was to find opportunity to devote his life to this kind of work, and he was quite willing to make sacrifices to this end. When his course was completed he did not find the kind of occupation he wanted, and in a discouraged state of mind he accepted an offer of the Standard Oil Company to serve in a minor position in one of their chemical laboratories. In a short time he began to find his work interesting, especially because problems presented themselves at every turn that called for investigation, and he was gratified to learn that his love of research had ample field for exercise. He has become the General Superintendent of the great refining works of the Standard Oil Company at Whiting, Indiana, and is happy in his occupation. All the members of his chemical staff are graduates of the Johns Hopkins University who have had the same kind of training as he had. He has told me that he does not want chemists who have had the so-called practical training. I mention this case because it is as striking a one as could possibly be selected, illustrating as it does the policy of one of the best organised chemical industries in the world, as it may fairly be assumed that the Standard Oil Company does not select its employees for sentimental reasons. I might give you other illustrations of the same kind, but I must pass on to other matters. Before doing so, however, let me tell a different kind of story though with the same moral. A friend who has a very large factory for the manufacture of chemicals, asked me some time ago to recommend to him a chemist to take charge of the scientific part of his establishment. He is an enlightened man, and has studied the conditions in the most successful chemical industries in the world. I asked him what salary he was prepared to pay, and he answered that he would pay whatever was necessary to secure the right man. He had observed that in Germany good men were often taken from the Universities and given the lead in the factories as, for example, Glaser, Laubenheimer, Bernthsen, and others, and he wondered whether some such man could not be found. I gave serious thought to this matter, but, though I broached the subject to a few men who I thought might yield to the temptation, I have not been able to find a university man, that is to say, one holding a university position who would consider such an offer as my friend made. It should, however, be borne in mind that this was probably due to a lack of confidence on the part of those approached in their own power to do what was expected of them. The moral of all this is plain. The chemical industries of the United States have to a large extent learned the lesson taught by Liebig—that their hope of success lies in the adoption of the most scientific methods possible. Further, as these scientific methods are taught at the universities better than anywhere else, it follows that not only the intellectual development of the world, but its industrial development as well, is dependent upon the work of the universities to a very large extent. That statement would have met with little favourable response a quarter of a century ago. To-day it is almost commonplace. Science and industry have become well acquainted with each other. They have formed a partnership that will never be dissolved. Each will help the other both in ways that are obvious and in ways that are not clearly defined.

Let me now turn to a subject that is at present most prominent before my countrymen. I turn to it because chemical phenomena are largely involved, and chemical industries are playing an important part, and are destined to play a more important part in dealing with the great problem which I have in mind. I refer to the conservation of the natural resources of our country. In May, 1908, a Conference of the Governors of the States, scientific men, and others, was held at the White House, which, as I suppose you all know, is the name of the official residence of the President of the United States. The Conference was called by former President Roosevelt. In the letter sent to the Governors he used these words :—

"In view of these evident facts, it seems to me time for the country to take account of its natural resources and to inquire how long they are likely to last. We are prosperous now; we should not forget that it will be just as important to our descendants to be prosperous in their time.

"Recently I declared there is no question now before the nation of equal gravity with the question of the conservation of our natural resources, and I added that it is the plain duty of us who, for the moment, are responsible, to take inventory of the natural resources which have been handed down to us, to forecast the needs of the future, and so handle the great sources of our prosperity as not to destroy in advance all hope of the prosperity of our descendants.

"It is evident that the abundant natural resources on which the welfare of the nation rests are becoming depleted, and, in not a few cases, are already exhausted. This is true of all portions of the United States; it is especially true of the larger settled communities of the East."

At this Conference addresses were made by Andrew Carnegie on "The Conservation of Ores and Related Minerals"; by James J. Hill on "The Natural Wealth of the Land and its Conservation"; and by others on "The Waste of our Fuel Resources," on "Forest Conservation," and on "Resources Related to Irrigation." The Conference lasted three days, and was from beginning to end most interesting and impressive. It set the nation thinking, and the thinking has led to action, though there is much inertia and much ignorance still to be overcome. I cannot give you an adequate idea of even the most important of the thoughts and facts presented in the principal addresses, but I will call your attention to a few thoughts suggested by a consideration of (1) coal, (2) iron, (3) petroleum, (4) forests, and (5) water.

Coal.

In speaking of our coal supply, President Roosevelt in his opening address said :—

"The mere increase in our consumption of coal during 1907 over 1906 exceeded the total consumption in 1876, the Centennial year."

Mr. Carnegie said :—

"Coal consumption is increasing at an astonishing rate. During the period for which statistics have been gathered, it has doubled in each decade; of late it has more than doubled. In 1907 the production was about 450,000,000 tons. At the present rate of increase the production in 1917 will be 900,000,000 tons, in 1927 1,800,000,000 tons, and in 1937 over 3,500,000,000 tons, or an amount in that year alone nearly equal to the production of the seventy-five years ending in 1895; and with continuation of the wasteful methods of mining, the consumption and destruction together during that one year would equal our total useful production up to the present date. And at that time —which many of us will live to see—more than one-eighth of our estimated original supply will have been consumed or destroyed."

It appears that the estimates of Mr. Carnegie are unduly pessimistic. According to Mr. M. R. Campbell and Mr. E. W. Parker of the U.S. Geological Survey: "The total production of coal in the United States at the close of 1908 was 7,280,940,265 short tons, which, including the waste in the mining and preparation, represented an exhaustion of 11,870,049,900 tons, leaving as the apparent supply still available 3,064,334,011,000 tons, or 99·6 per cent. of the original supply; that is to say, up to the beginning of 1909 only 0·4 of 1 per cent. of the original supply of coal has been exhausted. The quantity of coal still available at the close of 1908 was 7,369 times the production in that year."

But they add: "With so many indeterminate factors whose importance is realised, but cannot be measured, prophecy must possess a questionable value."

The question is before us, is before the world, what, if anything, can be done to offset this excessive use of coal? The answers are simple enough, and familiar to all who have given attention to the subject. We all know that coal is wasted to an enormous extent when used as fuel, and more economical methods of combustion are loudly called for. There is great waste also in coking. The process is still extravagant. Then the methods in mining call loudly for improvement. As Mr. Carnegie says: "The early colliers saw no value in coal in the ground, any more than early millers saw value in the flow of the stream; to them coal acquired value only through the labour of mining it, just as to the miller the stream acquired value only as head was produced by the labour of building dam and mill. So the coal taken out in the British and German collieries was a sort of treasure trove; that left in the ground was nobody's loss. Likewise in early American mining the coal mined merely yielded a return for labour, and the pillars and slack and poor coal left in the ground were nobody's affair; it was years after mining began before coal lands were thought to have any other value than as wood-lands or farm-lands." . . . "Coal mining cries out for expert knowledge whereby the full yield may be obtained without needless risk or loss."

Another check on coal consumption is found in the use of other forms of energy for heat energy. Water power is here the chief factor and, as is well known, such power is coming into extensive use for the production of electrical energy, which finds wide application in many branches of chemical industry. A striking illustration of this in the United States is to be found at Niagara Falls, and in regard to the industries which have been established there I shall have something to say further on.

Referring again briefly to coke, it appears from the last publication * on this subject that "prior to 1893 practically all of the coke produced in the United States was made in ovens or pits, and no effort was made to recover or utilise the gases and other constituents of the coal. With the construction in 1893, of what might be termed an experimental plant of by-product ovens at Syracuse, New York, another feature was added to the industry, and this feature has developed so rapidly that at the present time more than 16 per cent. of the total production of coke is obtained from retort ovens." It is clear from this statement that in the matter of coke production there is a marked movement in the direction of economy. There is an increasing demand for the by-products, gas, tar, and ammonia. In regard to coal tar, that magic substance, that Pandora's box, this is of much less economic importance in America than in some European countries. Why, it is not easy to say, though no doubt the tariff and labour are important factors. "At the present time coal-tar manufacture in the United States is confined principally to the production of creosote and of tars and tar pitches suitable for roofing papers, paving materials, etc."

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* Mineral resources of the United States, 1908, Vol. II., p. 223.

Iron.

How about iron? On this subject Mr. Carnegie speaks with feeling, and I quote from him: "The latest trustworthy estimates of our present stock of iron ore are: for the Lake Superior district, about 1,500,000,000 tons; for the Southern district (including Alabama, Georgia, Tennessee, and Virginia), about 2,500,000,000 tons; and for the rest of the United States 5,000,000,000 to 7,000,000,000 tons—making an aggregate of 10,000,000,000 tons.

"Our highest grade ore is that of the Lake Superior district, which yields about four-fifths of the current production. In 1905 its yield was over 33,000,000 tons, in 1906 some 38,000,000 tons, and in 1907 nearly 44,000,000 tons; by the end of the present decade it will average 50,000,000 tons or more. Even without further increase, the known supply will be exhausted before 1940. It is true that there are frequent reports of new ore bodies in this district; but on the other hand, the old bodies generally run far below the estimates."

It should be added that, in commenting upon Mr. Carnegie's statement here quoted, President Van Hise, of the University of Wisconsin, the distinguished geologist, takes a much more optimistic view of the situation. He says: "It appears probable that for some years to come, iron ore available in the United States will continue to be discovered more rapidly than it is exploited, and consequently the known total will increase rather than decrease. Hence the crest for known iron ore of high grade may be some years in the future." Be this as it may, it is plain that conservation is in order, and thus far there is nothing in sight to take the place of iron for many of the important purposes for which it is now being used in rapidly increasing quantity.

Natural Gas and Petroleum.

Mr. I. C. White, one of the speakers of the White House Conference, an eminent geologist resident in West Virginia, dwelt especially on "The Waste of Our Fuel Resources." He has for years been a daily witness of the awful waste of natural gas, and expresses himself strongly on the subject. He says, "The record of waste of this best and purest fuel is a national disgrace." He then continues: "At this very minute our unrivalled fuel is passing into the air from uncontrolled gas wells, from oil wells, from giant flambeaus, from leaking pipe lines, and the many other methods of waste at the rate of not less than 1,000,000,000 cubic feet daily and probably much more.

"Very few appear to realise either the great importance of this hydrocarbon fuel resource of our country, or its vast original quantity. Some of the individual wells, if we may credit the measurements, have produced this fuel at the rate of 70,000,000 cubic feet daily, the equivalent in heating value of 70,000 bushels of coal, or nearly 12,000 barrels of oil. In my humble opinion the original amount of this volatile fuel in the United States, permeating as it does every undisturbed geologic formation from the oldest to the most recent, rivalled or even exceeded in heating value all of our wondrous stores of coal."

Let me quote one more burning passage: "No one can ever approximate the extent of this waste. From personal knowledge of the conditions which exist in every oil and gas field, I am sure the quantity will amount to not less than 1,000,000,000 cubic feet daily, and it may be much more. The heating value of a billion cubic feet of natural gas is roughly equivalent to that of 1,000,000 bushels of coal. What an appalling record to transmit to posterity."

Mr. White goes on to say that the great oil producing corporations have not permitted much waste of petroleum, and also "that their handling of petroleum has been from the beginning, a model of business economy and management." But he adds: "The great mistake of the oil producing interests has been in not properly apprehending the enormous fuel value of the natural gas they were destroying."

The use of natural gas is extending rapidly, and this is plainly of importance as a check on coal consumption. The city of Baltimore, in which I live, which has a population of about 600,000, is now engaged in negotiations which will probably lead to the introduction of natural gas from the oil fields of West Virginia about 200 miles distant. The gas can be furnished at a considerably lower price than water gas, now used by us for illumination and to some extent for heating. There will be several advantages that will accrue to us from the introduction of natural gas. Our illumination will be cheaper, and the gas is a cheap fuel as compared with coal. The industries as well as households will no doubt make extensive use of it, and will find it profitable to do so. But, more than this, the substitution of natural gas for coal as a fuel will make Baltimore a cleaner city than it now is, though it has not suffered as much as many other well-known places from the curse of smoke.

I have already said that there is but little waste of petroleum as such. There is opportunity for such waste in the process of refining, but this too has been managed with such skill that only 1·5 per cent. is lost. When petroleum was first refined, kerosene was naturally the most important product, and in fact about the only product that was useful. After the kerosene was extracted from the crude oil the rest was thrown away. To-day kerosene is relatively less important than formerly. It is hard to say which can be called by-products and which the principal products. According to a well-informed correspondent, "perhaps it is not going too far to say that the most important product of petroleum to-day is the naphtha, and the lubricating oil is not far behind."

There are at present nine products or classes of products obtained from petroleum. The names of these are given in the subjoined table, together with the yield of each class in percentages and the total production in the United States for 1909 stated in barrels.

TABLE I.

Yields of Various Products from Crude Petroleum.

Kind of product.	Per cent. yield.	Amount in 1909 (barrels).
1. Kerosene	20·50	15,000,000 bbls.
2. Lubricating oils of all kinds including greases	10·00	7,500,000 ,,
3. Naphthas, all grades	15·00	11,250,000 ,,
4. Gas oil, used for enriching water gas in large cities	30·00	22,000,000 ,,
5. Paraffin wax..................	1·50	1,125,000 ,,
6. Roofing pitch	2·50	1,875,000 ,,
7. Paving pitch and road making oils	2·00	1,500,000 ,,
8. Coke	3·00	300,000 tons.
9. Fuel oil.....................	14·00	1,050,000 bbls.
	98·50	
Loss in manufacturing	1·50	
Total	100·00	

In Table II. is given a characterisation of each of the nine classes of products obtained from petroleum at present in the refineries where the highest degree of efficiency is reached.

TABLE II.

1. *Kerosene.*—This includes all oils burned in lamps, for domestic use, in railroad trains, switch and semaphore lights, miners' lamps, etc.

2. *Lubricating Oils.*—These include all oils used for general lubricating purposes, also greases which are made by mixing petroleum oils with varying percentages of aluminum, lime, lead, zinc, potassium, and sodium soaps. Chemistry has played a vital part in devising various soaps suitable for such purposes.

3. *Naphtha.*—This grade includes all petroleum products having boiling points under 175° C. At present naphtha is one of the most valuable products of petroleum and constant efforts are being made to increase the per cent. yield of it from crude oil. It is used principally in power engines, automobiles, cooking stoves, and in making varnishes.

4. *Gas Oil.*—Most of the gas plants in our cities manufacture gas by reducing steam with red hot coke or coal and enriching the resulting gases by means of petroleum which has been converted into a fixed gas by destructive distillation.

5. *Paraffin Wax.*—This substance is used principally in making candles. The wax is mixed with varying proportions of stearic acid to make the candle stiff so that it will not bend when burned in a warm room. Approximately 15,000 tons of such candles were made and consumed in the United States in 1909.

6 and 7. *Roofing and Paving Pitches.*—These are made from the so-called "Sludge Oil," which is removed from the various petroleum products by treatment with strong sulphuric acid. This sludge oil was formerly burned to get rid of it, but is now converted into products found very useful for making roofing paper and for paving purposes. Other oils used for road making are prepared by oxidizing the high boiling-point fractions of petroleum by blowing air through them at a high temperature. The use of petroleum products in road making is in its infancy, but promises to be a very important branch of the industry.

8. *Coke.*—As a result of destructive distillation of petroleum coke is produced. This substance is 97 to 98 per cent. carbon, and is used largely in making carbons for electric arc lamps.

9. *Fuel Oil.*—This is the remainder after the other products have been removed. It is used principally for heating purposes where coal is not well adapted.

It is to be noted that, in working out the problems of the petroleum industry, chemistry has played an important part. In addition to the general problems involved in refining, there is a special problem that was presented by the petroleum found in the neighbourhood of Lima, Ohio, and known as Lima oil. The deposits there are very extensive, but for a long time it was impossible to use the oil on account of the presence in it of small quantities of sulphur compounds, which gave it a disagreeable odour not adapted to the uses of the household. Chemistry solved this problem, and made available immense quantities of petroleum that otherwise could not be used.

Forests.

The forests of the United States are being rapidly, ruthlessly destroyed. Primarily the conservation of the forests is not a chemical question, and any reference to the subject here may at first appear out of place. But let us see. Forests, to be sure, cannot be preserved by chemical means. On the other hand, chemistry can and does help to prolong the life of wood after it has been applied to the uses of man. The various wood-preserving agents are, of course, of importance in this connection, and any improvement in this line bears directly upon the forest problem. Anything that tends to check the consumption of wood for railway sleepers, piling, mine timbers, and telegraph poles should be welcome. In a recent year more than 56,000,000 gallons of creosote and nearly 19,000,000 pounds of zinc chloride were used in preserving timber in the United States. "Assuming that on an average one gallon of creosote, or one-third of a pound of zinc chloride, will protect a cubic foot of timber from decay, more than 100,000,000 cubic feet of cross-ties, piling, poles, mine, and other timbers were given a treatment that will greatly increase their life and usefulness. But the amount of creosote available is inadequate. In 1908, 69 per cent. of the creosote used by the treating plants was imported. Nearly three-fourths of the imported creosote comes from England and Germany, some is obtained from Nova Scotia, and some from Scotland and Holland." According to a recent Government report: "Were all the tar produced which the coal annually coked in the United States is capable of yielding, it would distil as much creosote as is now used by the wood preservers. Unfortunately, American operators do not even get the fullest use of the limited quantity of coal-tar made in their country, for it does not pay the operators to distil coal-tar for creosote alone; so, unless they can find a market for the associated products, it is not separated."

Then again the manufacture of wood-pulp paper makes cruel inroads on our forests. This drain is partly, perhaps largely, the result of a depraved state of mind on the part of the people who seem to delight in masses of trash served up in the form of the daily newspaper, and especially the Sunday newspaper. I wish I could avoid this subject. I am filled with shame when I think of it, but this depraved state of mind is so closely connected with the forest problem that honesty compels me to mention it. Do not misunderstand me. There are many newspapers, even Sunday newspapers, in the United States which exert a wholesome influence, but besides these there are others, and they are the loudest, which tend only to lower the mental and moral condition of their readers, and the point is that these are the largest in size and circulation, and they therefore affect the forest problem most seriously. The demand for these demoralising sheets seems to be increasing, and we have to choose between the remedies. Either the moral tone of the people must be so elevated as to lead to a distaste for such stuff, or some other material must be found for paper making. The second remedy appears to be the more promising, though up to the present not much progress has been made along this line. Chemistry will be the chief agent in the solution of this problem. The United States has established laboratories to investigate the value for pulp purposes of various abundant woods, and to save the valuable spruce and poplar forests for lumber. The results of this work, according to a recent Government report, have been most encouraging. A number of wood fibres have been shown to be valuable raw material for paper.

Before leaving this subject a few statistics may be given:—

TABLE III.

Kinds and amount of wood manufactured into pulp.

Kind.	Quantity in cords.		
	1906	1907	1908
Spruce	2,507,002	2,700,853	2,159,839
Poplar	328,470	371,940	302,217
Hemlock	528,381	576,154	569,173
Pine	69,277	78,583	84,189
Cottonwood .	(1)	66,084	45,679
Balsam......	33,886	43,884	45,309
Miscellaneous	194,160(2)	125,162	140,547
	3,661,176	3,962,660	3,346,953

(1) Included with miscellaneous. (2) Includes cottonwood.

The total value of the wood used for pulp in 1907 was $32,360,276, and in 1908 it was $28,047,473.

While on the subject of wood I must refer to the distillation. In so far as the wastes of the sawmill and the forest are utilised in this process it is in the interests of economy, but plainly when good wood that might be used for other purposes is used it only increases the difficulties and does not make for conservation. As far as I have been able to learn, the wood that is used for distillation is largely waste, such as tops, sawdust, slabs, and timber too small to be profitably handled for lumber. The products obtained are wood alcohol, acetates, acetone, turpentine, charcoal, tar, etc. A correspondent has given this information: "The destructive distillation of hard woods in this country is now almost wholly conducted in connection with lumber operations or charcoal iron furnaces, and the wood used is beech, birch, and maple, very little of any other kind." . . . "The yields obtained average per cord about as follows:—

Acetate of lime	200 pounds.
Methyl alcohol (100 per cent.)	9 gallons.
Charcoal	50 bushels.
Wood tar	8 gallons.
Wood oil.............................	5 gallons.

To the chemist interested especially in the problems of the science, the methyl alcohol appeals most strongly. While not many years ago it was a very difficult matter to get this substance in anything like pure condition, it can now be obtained in any desired quantity and practically chemically pure.

Some years ago I visited Duluth at the western end of Lake Superior. That which made the strongest impression upon me was the sight of the sawmills. The scale of the operations passed all understanding, and the waste was heartrending. Slabs and sawdust formed mountains that could not be allowed to go on growing. The only help was in the energetic application of oxygen. I have a clear mental picture of an immense blast furnace, the one function of which was to destroy the waste. Well, uses are being found for this waste material, and I doubt if that furnace still continues to perform its cruel part. We have seen that distillation has come to the rescue to some extent. It begins to look as though another use may be found for sawdust. After many trials and much discouragement, the Classen process for the manufacture of alcohol from sawdust seems to be nearing success. At present there are two rival concerns at work on this problem in the United States. The yield is about 25 gallons of alcohol to the ton of dry sawdust. The most interesting fact that has been brought out in the investigations thus far carried out in this field is that sulphurous acid converts only the pseudo-celluloses or hemi-celluloses of the wood and not the true celluloses, and it is said that the residue can be used in the manufacture of paper.

Water.

The conservation of water, the wise dealing with this natural resource, is after all the fundamental economic problem of the nation, and this is being pressed home with great force. Forests, soil, energy, and water supply are intimately connected. A great struggle is now in progress in the United States that bids fair to furnish a most important political issue, a struggle between those who have the welfare of the nation as a whole at heart, and those who are actuated by greed and who represent private interests. The question before us is whether the water rights shall be allowed to pass under the control of great corporations, or shall be kept as far as possible under the control of the Government for the benefit of the people. A nice question, but not a chemical one. The problem is nevertheless connected with chemistry in so far as it involves the action of water upon the soil. Erosion and irrigation are essentially of chemical significance. But water has, of course, a more direct connection with chemical industry. There is no better illustration of this than what is going on at Niagara Falls. That many chemical industries have been there established within a comparatively few years is well known to you. So rapid has been the growth of these industries that fear has arisen that the marvellous beauty of the Falls is destined to destruction. There are those, I regret to say, who look upon this possibility without dismay, but I do not believe that the Society of Chemical Industry would be found on that side. Fortunately, both the Canadian and United States Governments have taken steps to preserve the beauty of the Falls, which I think may fairly be regarded as a valuable natural resource, the conservation of which is of importance to the people of the earth.

I do not intend to weary you with a detailed account of the Niagara Falls industries, but I have taken pains to get the latest information in regard to the amount of power there utilised and the principal uses to which it is now put. This information is by no means complete, but it may be useful and interesting to some. It is condensed in the following table :—

TABLE IV.

nion Carbide Company	35,000	h.p.
luminum Company of America	10,000	,,
astner Electrolytic Company	8,000	,,
he Carborundum Company	8,000	,,
iagara Electro-chemical Company	6,000	,,
nternational Acheson Graphite Company	2,000	,,
ooker Electro-chemical Company	6,000	,,
ldbury Electro-chemical Company	2,000	,,
or[illegible] Company	2,000	,,

The products manufactured at Niagara Falls to-day are—aluminium, sodium, caustic alkali and bleach products derived from electrolytic chlorine, calcium carbide, calcium nitrate, hypochlorite solutions, ozone, oxygen and hydrogen, artificial graphite, artificial emery (carborundum), sodium cyanide, sodium peroxide, potassium and sodium chlorate, phosphorus, ferro and aluminium alloys.

According to a statement in the "Electrical World" for October 21, 1909, "the energy from Niagara Falls is used at the rate of 126,800 horse power for electrochemical processes, 56,200 horse power for railway service, 36,400 horse power for lighting, and 54,540 horse power for various industrial services, the total being 273,940 horse power. Since the water of Niagara Falls represents probably 5,000,000 horse power, it would seem that only about 5·5 per cent. of the available power is being utilised at present."

The above statement applies to the operations on both sides of the Falls—the Canadian as well as the American.

I am aware that I have not presented anything novel in what I have said about the utilisation of the power of Niagara Falls. My main object in referring to this subject at all was to arrest attention to this use of water power as a factor in the conservation of coal and wood, but so much has been said on this subject of late years that I ought perhaps to apologise for even touching upon such elementary matters.

I was about to use the words "and now," but their technical use at or near the end of a sermon led me to fear the sigh of relief that generally follows them, and I do not want to deceive you. I am not through, but soon shall be. It was perhaps bad judgment that has led me to talk to you mainly on the conservation of the natural resources of the United States, but "out of the abundance of the heart the mouth speaketh." The subject is so important and so suggestive that I could not resist the temptation. It is well that you should know that the shoe is beginning to pinch us, and we are trying to learn the lesson of frugality and economy. It must be admitted that we have been and are still shamefully extravagant. Even the poorer of our people spend their substance as if there were no hereafter. But the day of reckoning is coming. Indeed, it has dawned. Prices of food have risen to an alarming extent, and all are wondering why. The Congress is at present engaged in an investigation with the object of discovering the causes. A new cause is discovered every day—one as satisfactory as the other. The fact is that the raising of crops and of live stock is gradually becoming more expensive as the earth becomes more thickly populated. Other courses are no doubt operative, such as cold storage, which enables the dealer to increase prices by withdrawing some of the supply of perishable material from the market in times of plenty to be brought out again in times of dearth. The tariff also probably has some effect on prices of food, though it will be difficult, I fancy, to show just how this works. Whatever may be the cause the people of my country are much wrought up over the present state of affairs and, as the public mind is not wholly scientific, it has come about that the Aldrich-Payne tariff is made to shoulder a large part of the blame. As usual, hysterics play a large part, and it now looks as though we were on the verge of a political upheaval, largely in consequence of such thinking as the people as a whole indulge in—the subject being the high price of living, and this is very intimately connected with the subject of conservation, which, in turn, as I have tried to show, and as is perhaps evident, involves chemistry.

If my address has failed to interest you ; if I have shown my unfamiliarity with industrial chemistry ; if I have rushed in where angels fear to tread, I apologise. After all the fault is yours, for you elected me President, and it became my duty to say something. I have said it. Let me add, in conclusion, that this meeting in Glasgow will always remain with me as one of the pleasantest experiences of my life. I thank you for bearing with me so patiently.

Mr. WALTER F. REID (Surrey) in moving a vote of thanks for the address, said that the President had said it was their fault for electing him as their President ;

but it was their duty to elect a member from the other side of the water. They had 1,500 members over there, and the numbers were growing, and they were only too glad to get men of distinction from the other side to fill the office. It was true, as the President had said, that they could not expect him to be there every day, because their visits were like those of the angels, few and far between. It was quite possible that in the immediate future they might be still more like angels, and they might come to them through the air in 24 hours or less. They were extremely glad to welcome the President, and thank him for his address.

Dr. G. T. **Beilby** (Glasgow), in seconding the motion, said that they were used to hearing of the great things America was doing and was going to do, and of all its enormous resources, and he thought it came to them as a rude shock to hear that these resources were so near their end, and that their cousins across the Atlantic were seriously and as a National matter taking up the question of economy. He thanked the President for his splendid address.

PRESENTATION OF THE SOCIETY'S MEDAL.

In presenting the Society's medal to Mr. Thomas Tyrer, the **President** said that the conditions under which the Society's Medal was awarded on this occasion differed somewhat from those which formerly prevailed. Prior to the granting of the Charter of Incorporation in 1907, by the late King Edward VII., services rendered to the Society apart from their scientific or technological importance or value did not constitute any qualification for such recognition. By a happy inspiration on the part of those who drafted the Charter, this obviously undesirable disability was removed, and, as the result, it was now his privilege and pleasure to give effect to the resolution of the Council which had been duly announced in the "official" columns of the Journal, namely: "that it has awarded the Medal of the Society of Chemical Industry to Mr. Thomas Tyrer for his conspicuous services to the Society and to Applied Chemistry."

It was well known that the present recipient had very special claims to the distinction in respect of the care, forethought, watchfulness, initiative and constructive ability he had always displayed in the interests of the Society in every direction since its inauguration in 1881, under the Presidency of the veteran, now the Right Honorable Sir Henry E. Roscoe.

Mr. Tyrer had filled every possible office in the Society with the admiration of his colleagues and to the entire satisfaction of the members generally, and in these circumstances it would be superfluous for him to dwell upon Mr. Tyrer's unremitting solicitude for the welfare of the Society or to give the meeting any detailed recital of his self-sacrificing labours on its behalf. The work and its results were demonstrated by the present prosperous condition of the Society, and this was the best testimonial and greatest reward which such a worker could ever receive.

He had sincere and unqualified pleasure in making this award of the Council to Mr. Thomas Tyrer, first Sectional Secretary, subsequently a Chairman; its President in 1895; who visited every section of the Society, including the American; now its Honorary Treasurer, and with one short year's interval continuously a member of its Council and Committees.

Mr. **Thomas Tyrer** said that he found it exceedingly difficult to acknowledge in terms at once simple and appropriate. Mr. Macdonald had in his incidental reference to the recipient used the word "inception." Now it was the absolute truth to say that he (Mr. Tyrer) had no part or lot in "inception," much less the "conception" of the Society of Chemical Industry. That origination occurred before he became an officer, as first Hon. Secretary of the London Section, the earliest to be formed, in 1881. In the room they had one, his one-time colleague in the Secretarial body and a past-President, Mr. Eustace Carey, who really was an original member of the group of men who were at the Society's inception. To them the credit of large ideas and high hopes belonged, and he was happy in knowing that he seconded their views and tilled the ground in which they had sown good seed, and nurtured the sturdy plant which sprang up. From the "original" minutes of the "Faraday" Club at St. Helen's, Lancashire, from which the nucleus, so to say, of the Society was evolved, it was abundantly clear that he was neither one of the "Founders" nor the "Fathers" of the Society. He was, however, thus early its loyal servant and remained so. All that had been so kindly ascribed to him was true in so far that his work had always been in good faith and a labour of love—in fact a hobby. He was honoured by being associated in work for a Society initiated by a group comprising such men as its first venerable President, Sir H. E. Roscoe, the late Dr. Ludwig Mond, now alas, passed away like so many of the first Council, Mr. Eustace Carey, happily present, and the late George E. Davis, its enthusiastic Hon. General Secretary. The history of this was recited in the "old" minute book, which he hoped would neithe be "lost, stolen or strayed." The resolution of Council awarding the Medal referred to services to Applied Chemistry. He desired to say that these were not creative or inventive, but relative, inasmuch as they included service on the Departmental Committee in respect of alcohol for industrial use; classification and insurance of goods for carriage by railway; regulations for carriage of acids, through the machinery of Chambers of Commerce and joint committees of the Society; and possibly some preliminary work on a fairly large scale on "rare" earths. This honour he felt no compunction in receiving, and he appreciated more than he could well express the friendliness and sympathy o all with whom he had been associated, and not last, no least, the loyalty of the entire staff at Westminster.

REPORT OF SCRUTATORS.

The Scrutators then presented their report stating tha 211 ballot papers had been handed in of which 10 wer spoilt. The following gentleman had been electe ordinary members of Council:

Mr. Julian L. Baker.
Dr. Edward Divers, F.R.S.
Dr. Milton L. Hersey.
Mr. D. J. Playfair.

(Signed) **William S. Denham.**
F. J. Wilson.

(The List of Council appears on page 851.)

The **President** welcomed Mr. Reid as his successo and hoped that he would find the duties of the office a pleasant as he had found them, and that it would n be necessary for him to make a journey of something lik 6,000 miles in order to give his annual address.

Mr. **Reid** thanked the Society for the honour conferre upon him.

Mr. T. L. **Paterson** said he had much pleasure in pr posing that 20 guineas be paid to the Auditors, Messr Norton, Feasey, and Slade.

Mr. W. H. **Coleman** seconded the motion, which wa unanimously carried.

Mr. T. **Fairley** said it fell to him to ask the Societ to hold its Annual Meeting next year in the City o Sheffield. He was sure that they would get a heart welcome.

Mr. **John Evans** said that, as a Yorkshire member o the Society, he had pleasure in seconding Mr. Fairley proposal. He felt certain if the meeting decided o Sheffield, the Sheffield people would give them a ver hearty welcome.

On the motion being put to the meeting, it was carrie unanimously.

Dr. **Lewkowitsch** proposed a vote of thanks to th Governor, Managers, and Council of the Technical Colle for the use of the room.

Mr. **Eustace Carey** seconded the motion, which wa carried unanimously.

Dr. G. T. **Beilby** said, on behalf of the Governo of the Institution, that it was with great pleasure th were able to welcome the Society to Glasgow, and hop their visit there would be very pleasant.

After a vote of thanks to the Chairman, the meeting djourned for luncheon provided by the Section in the reat Hall of the College.

Garden Party at Auchendennan.

In the afternoon, which was fine in contrast to the morn- g, about 100 members and ladies travelled by special ain to Balloch, at the foot of Loch Lomond, where rakes met them and conveyed them a distance of two iles along the loch to Auchendennan, the residence of r and Mrs. W. J. Chrystal. Here the party was ceived by their hosts on the lawn with a salute on the pes. The magnificant views of Ben Lomond across the ch, the rock gardens constructed in the bed of an old uarry, the specimen conifers, and the artistic contents the house were inspected in turn, after which tea was rovided in a marquee to the strains of a fine band. The arty were then photographed by Maclure, Macdonald Co., of 2, Bothwell Circus, Glasgow, and returned to wn after a most enjoyable visit.

VISITS TO WORKS.

Wednesday, July 6th.

ellpark Brewery. (Messrs. R. & J. Tennent, Ltd.)

The party, led by Mr. Angus McKay, was received Mr. H. A. Hedley, the managing director, and Mrs. edley, and entertained to afternoon tea.

The Brewery was founded in the 18th century, and of te years a plant has been added for brewing lager beer.

The principal raw material is barley malt made in the ual way, which is mashed according to the requirements the type of beer. The wort is drained off, boiled with ps, and then cooled. In the case of pale ales and uts, the wort is cooled down to 60° F., yeast is added, d the primary fermentation goes on for some three days. is then racked off into barrels or vats along with some y hops and is then allowed to mature and re-ferment from 55° to 60° F. The wort for the lager and Munich ers is cooled down to 43° F., and the primary fermenta- n, which goes on at a temperature of from 43° F. to F., occupies eight to twelve days. The yeast, which the case of ale, rises to the top, in the case of lager er, settles to the bottom, and is known as bottom (fer- entation) yeast. After the primary fermentation is ished, the beer is run off into large store casks and the condary fementation takes place at about 32° F. and, lasts long time. The refrigerating machines use carbon xide, and the steam required for all purposes is supplied six large Lancashire boilers.

e Scottish Co-operative Wholesale Society, Ltd., Shieldhall Works.

The party, led by Mr. Jas. McQueen, was received by . Alex. Gebbie, director of the chemical department, d escorted through the chemical, preserve, confectionery, d bootmaking departments, and afterwards entertained afternoon tea.

These works represent but a part of the productive terprise of the Co-operators of Scotland. Covering an a of 12 acres, they have grown to their present size e 1887. Over 3,000 persons are now employed, and s claimed that nowhere else in Great Britain are so ny industries carried on within one gateway. In rteen factories, nearly one hundred trades are repre- ed The Boot Factory employs 1,000 workers and kes 14,000 pairs of boots and shoes per week; the nting Department, besides printing, turns 1,000 tons paper per annum into bags; while the Cabinet Factory kes hundreds of suites of furniture in a year. The two iform Factories turn out thousands of suits for men l boys; the Hosiery Factory shows the latest machinery making underwear; and the Chemical Department ds out foodstuffs, boot-polishes, oils, perfumes, and igs. The Pickle Works make 600,000 bottles of pickles l sauces; the Coffee Essence Works dispose of 1,000,000 tles of coffee essence; the Tobacco Factory manu- tures 1,000,000 lb. of tobacco; the Confection Works ke 1,250,000 lb. of confectionery; and the Preserve Works 3,360,000 jars of preserves in the course of a year. This gives some idea of the position attained by the Co-operative movement in Scotland

Reception of the Lord Provost of Glasgow.

The Corporation gave a reception in the Council Chambers in the evening. The company included Lord Provost McInnes Shaw, Sir Donald McAlister, Principal of Glasgow University, President Remsen, Mr. Walter F. Reid, Dr. Beilby, F.R.S., and a number of magistrates and councillors with their ladies. Music was provided by Herr Iff's orchestra and the Glasgow Glee and Madrigal Society. In the course of the evening, in accordance with an old and excellent custom, the company assembled in the banqueting hall in order to hear, from the mouth of the Lord Provost, the reasons which had induced the Corporation to offer special hospitality to the Society. The Lord Provost spoke from the platform and was supported by several Baillies and Councillors and the President and Council of the Society.

The Lord Provost said:—It gives me very great pleasure to extend to the members of the Society of Chemical Industry a most cordial welcome to Glasgow, and to say how gratified the members of the Corporation are to have an opportunity once more of receiving in these chambers an Institution that is exercising such a far-reaching influence upon science and civilisation.

It is nine years since the Society last met in Glasgow, and in the interval which has elapsed considerable progress has been made, not only in the membership of the Society, but in the advance of knowledge in the particular direction of enquiry in which the members are engaged.

Composed as the Society of Chemical Industry is of gentlemen of the highest scientific eminence, and also of chemical manufacturers, its deliberations cannot but have an important influence in the advancement of knowledge and the encouragement of research.

By the interchange of ideas and comparison of methods which such conferences make possible, our country is enabled to keep its place in the van of invention and discovery, and the Society also affords opportunities for those engaged in this Industry to become acquainted with the march of progress and advance of thought all over the world.

In no part of the United Kingdom could the members more appropriately meet than in Glasgow, which, amid its numerous ramifications, includes some of the foremost manufactories and chemical laboratories. It has also in the past been the nursery for men who have achieved the highest eminence in the realm of investigation and science.

Apart from the numerous directions in which our industrial and mercantile community are engaged in the chemical industry, the Corporation of Glasgow itself is deeply interested in it.

If the members of the Society could afford the time to visit the Corporation Sewage Works, they would there have an opportunity of observing the manner in which a large volume of sewage is treated and disposed of, and ultimately discharged into the river a pure effluent, by means of the chemical processes to which it is subjected.

There is scarcely any department of human activity that can afford to ignore the services of the chemist, and year by year his importance as a factor in the preservation of the health of the community is being increasingly appreciated.

In associating these remarks with the name of your President, I am reminded that the Presidential Chair of your Society has always been held by men who have taken a foremost place in scientific discovery, and in the application of these discoveries to industry and commerce. I feel sure that your President for this year will worthily sustain the highest traditions of his office, and add lustre to the reputation and prestige of the Society as a whole.

President Ira Remsen, said that while he had never been in Glasgow before he already felt at home. That was a very pleasant feeling when one was three thousand or more miles away from home. That morning he had said a few feeble words in response to the welcome that was extended by one of the officials of Glasgow Corporation.

The conditions under which his remarks were then made were rather unfavourable both to warmth of expression and warmth of any other kind, but probably partially in consequence of the work that they had done that morning, the heavens had cleared and it would be difficult to record a more delightful experience than that which the Society had enjoyed that afternoon at Loch Lomond. On behalf of the Society he thanked the Lord Provost for his words of welcome. If he had had time he might have said something in regard to the functions of the Society, but he noticed that the programme said "At this hour they will kindly assemble in the Banqueting Hall for a few minutes speaking," and that had made an impression which would produce an effect. He again expressed his own great satisfaction in being able to be present at the reception and to receive the welcome. He was competent under proper circumstances to continue at some length, but under the special circumstances he would not do so.

Mr. David J. Playfair, Glasgow, joined with President Remsen in thanking the Corporation for extending the city hospitality to the Society. Glasgow was celebrated for many things. It was celebrated for the excellence of its Municipal Government, it was celebrated for its enterprise, and it was celebrated for its splendid hospitality, and as members of the Society they thanked the Corporation for their splendid hospitality. They knew that Glasgow was largely interested in a corporate capacity in Chemical Industry. They had some of the best and largest organised gasworks in the country, and the sewage works, completed so far as Glasgow was concerned, but not quite completed so far as their surrounding burghs, was bound to become the admiration of almost all those towns—and there were many of them—in which the sewage problem had proved a most serious one to tackle. The next problem that they expected the Corporation to tackle was the air, and the Society hoped—and he thought it was more likely to come from the members of their Society than perhaps from any other source—that they would be able to get advice or processes which would restore to them an air perhaps as pure as at the top of Ben Lomond, while the water running down under five bridges was as pure as the water in Lock Katrine.

The Lord Provost thanked them for the vote of thanks that they had passed. The purification of the air did not lie with the members of the Society of Chemical Industry at all, but that it lay to the hand of every citizen of Glasgow to assist. If the members of the Society could produce a smokeless fuel he was quite certain that the people of Glasgow would use it. The air at the present time was absolutely pure. They wanted only to keep the impurities out of it. He was quite satisfied that the air in and around Glasgow was the finest air that they could almost get in the world, but they, the inhabitants, in the winter time must have some heat and it was in the production of the heat that they sent the impurity in the air. If the Chemists would produce a good smokeless fuel then the whole problem would be solved. The Corporation were delighted to see the members of the Society there. They were only sorry that they had not a larger number of the citizens of Glasgow present. As they were all aware they were supposed to be in the summer months now, and he had no doubt a great many of the citizens were down on the bonnie banks of Loch Lomond or some other place like that. He thanked the Society on behalf of his colleagues for its kindness.

Thursday Morning, July 7th.

Works of the Glenboig Union Fireclay Co., Ltd.

On arrival at Glenboig station, adjoining the works, the party, led by Mr. W. G. McKellar, was received by Mr. James Dunnachie, Chairman of the Company, who has given a life's study to the utilisation of the Glenboig clay, now regarded as a standard material; while Mr. John Douglas, the manager, conducted the party through the works and explained every detail of the processes.

The Company has two works at Glenboig—the Old Works, and the Star Works—as well as factories at Cumbernauld and Gartcosh. About 1,000 hands are employed in mining the clay and in the works. The Company output includes all sorts of fireclay goods for industr purposes.

The clay is obtained from the carboniferous formatic The chief seam crops out at the Old Works, but is reach by a shaft at a depth of 500 ft. at the Star Works, so rap is tho dip. The shaft passes through several seams fireclay, but only the lower one, which has been found give satisfactory results, is utilised. The peculiarity this material is that, although the percentage of fer oxide is 1·30, the impurity is segregated in grains inste of being disseminated through the mass. The seam us is fairly uniform, but is subject to a careful selecti before passing into the mills, which are of the edge-runn type, with a perforated bottom. The pugging is also do in revolving pans, and nearly all the moulding is done hand. Where special accuracy of form is required, t moulded articles are machine-pressed when half di Large articles such as gas-retorts, of which consideral numbers are produced, have to be built up in successi rings by hand-moulding, an operation that may ta several weeks, owing to the need of letting the lower p become hard enough before adding further weight on t The operation of joining on each successive ring w watched with interest, and was carried out by scarifying a kneading the two parts together at the junction and on t foundation building up the new ring. After care drying in steam-heated sheds, the articles are fired gas in a number of communicating chambers on t Hoffmann principle. The articles already burnt cooled by passing over them the air on its passage to t burners. The gas is also brought to a high temperat by means of waste heat, so that the very high temperat required for the burning of a durable fire-brick is eas obtained. The gas is made in a regenerative produc the result of this system of burning is that large quantit of goods are made without visible smoke. This was t first successful gas-fired continuous regenerative kiln a is due to Mr. James Dunnachie's inventive skill (see t J., 1882, 504; 1891, 548).

The Britannia Pottery. (Messrs. Cochran a Fleming.)

A large party, led by Mr. J. Arnold Fleming, received at the works, in Glebe Street, Glasgow, by James Fleming, who took them round and explained ev detail of the processes. This pottery, founded in 18 covers an area of 10,000 square yards, and employs workers, and has an average output of 1,000,000 pi per week. From the "saggars" to the crates in wh the goods are packed, everything is manufactured in works, and only the coal, 50 tons of which are used da and the raw materials are obtained from outside.

Cornish stone containing a proportion of alkali, calcined French flints are finely ground and levigated various proportions according to the type of pott required. This mixture is then run into tubs containing requisite quantity of ball clays from Devon and Dorset kaolin from Cornwall, and thoroughly mixed with wa The resulting mass is filter pressed, pugged and delive to the potter. For round ware, the potter's wheel is us and for oval ware, etc., plaster moulds are employ Handles and spouts are put on afterwards. The "gree or raw ware, when dry, is fired in "saggars" (a spe of muffle) for several days at a temperature of ab 3000° F.; the resulting product is called "biscu This is sometimes printed and painted with undergl colours, after which it is dipped in ground glass, ag placed in "saggars" and fixed in so-called "glost" kil some of which contain over 200,000 pieces. In these k the ware is separated by small pieces of baked clay called various names. Finer ware, such as "Semi-China," g through a further process of decoration with gold colours after passing through the "glost" kilns. "Se China" is harder than true "China" but is not tra lucent. Lithographing and printing on the glaze is largely practised, after which the ware is fired for ab 20 hours in a "muffle" kiln. In some cases, sev firings are required. For fine mottling enamels of vary using points are used.

THURSDAY AFTERNOON.

ARKHEAD FORGE. MESSRS. WM. BEARDMORE & CO., LTD.

With the armour-plate and ordnance works at Parkhead,
e plate mills at Mossend, Lanarkshire, and the marine
gine and boiler works and shipbuilding yard at Dalmuir
the Clyde, the Company is in a position to build warships,
mplete in every main respect. The enterprise had its
igin in the work of the forge, and the subsequent develop-
ent of great steel plant led to the acquisition and creation
shipbuilding facilities. At Parkhead, the works are
ll under reconstruction, one side, containing the armour
ate factory, being only partially completed, but, on the
her side, a new ordnance factory and foundry, con-
ining a 5000 ton hydraulic press for compressing fluid
el, and a huge equipment for gunmaking, is complete.
Parkhead works date from 1835. In 1860 the Napier
mily transferred them to Wm. Rigby and Wm. Beard-
ore, the latter of whom died in 1877. His son now has
ntrol. The works had already assumed importance, and
r. Beardmore, who had been interested in the production
nickel steel for marine engines, turned his attention to
mour for warships in connection with the Harvey
mentation and chilling process. The gun shops were
ded in 1900.

The possible annual output of steel at Parkhead is
out 300,000 tons. The molten steel is conveyed in
lles, running on rails, to the compression press, being
ured into conical moulds by which lateral, in addition
vertical pressure, is secured. This particular form of
essure is known as "the Beardmore trefilage process."
e plant produces ingots up to 40 tons, while heavier
gots up to 120 tons are cast in octagonal pits. The ends
the ingots are then cut off.

In the armour shop, containing a 12,000 ton hydraulic
ess, there is plant for slabbing armour plates preparatory
rolling and for working other large castings. Here also
the re-heating furnaces, now being extended and
constructed. About 8000 tons of armour and 150,000
ns of plates and bars are being made annually at the
rkhead and Mossend Works. There is also a large
ant for carburising plates, and the shop for planing and
mming armour plates, preparatory to tempering, has
t been enlarged. The re-heating furnaces are furnished
th beds, running out on rollers, for rapid dealing with
tes, which are lifted by cranes and plunged into a bath
rape oil to be tempered, or into the sprinkling pit for
id cooling and hardening the surface.

The application of producer-gas as a source of electric,
draulic or pneumatic power is an important feature of
e works, and this involves a very large plant for recovering
r and other residuals. The ammonia is recovered as
lphate. "Washed" gas is used to the fullest extent for
naces, re-heating pits, and electric generators. A 1000 h.p.
s engine was shewn in full work. The gun shop is recent.
capacity is 20 12-in., 50-calibre guns per annum, or in
portion for guns of greater or less calibre. The forge
mprises a range of re-heating furnaces and hydraulic
sses, by which the ingots are rough-forged, and after
ng cut to length and "trepanned" (by cutting out the
d core), the tubes are forged upon mandrills.

In the new gun machine shops, every machine is run
a motor and there is no shafting. The gun tempering
p, 126 ft. high, 166 ft. long, and 66 ft. broad and looking
ide like a colossal perpendicular chapel, contains the
hardening furnaces and pits, the tempering furnace
d the shrinking pit. The heights of the furnaces and
pths of the pits are such that a tube 60 ft. long can be
lt with. The furnaces open all down the side, but
guns must be lifted nearly to the roof to be dropped
o the shrinking pits. The crane for doing this has a
ing power of 100 tons and travels on a track 94 ft.
ove the floor, while a smaller crane of 30 tons runs 54 ft.
ove the level. The lifting and lowering of the heated
es is conducted at a very high rate of speed.

The foundry is of enormous size. Castings of the
nplete breasts and sterns of warships are to be seen,
d the work of preparing the moulds, every part of
ich is studded and supported with steel nails, is of
at interest. The very wastes of such a factory supply
terial for a host of industries. For instance, the cut nail trade of the Midlands has ceased to exist since steel plate clippings were utilised as raw material.

The party was led by Mr. Quintin Moore, and conducted over the forge by the chemical staff, Messrs. Gavin, McWhirter and others.

THE ANCHOR CHEMICAL WORKS. (MESSRS. A. HOPE, JUN., & CO., LTD.)

A large party led by Mr. A. W. McLaren, visited the Anchor Chemical Works where they were received by Mr. D. W. Johnston on behalf of the firm.

The works, which were reconstructed on the latest lines some four years ago, produce hydrochloric, nitric, and sulphuric acids, salt cake and Glauber's salt.

Hydrochloric Acid.—Common salt is decomposed in the usual way by sulphuric acid in a preliminary retort from which the fumes evolved are led into earthenware towers, originally made for perforated plates, but the latter were afterwards replaced by a coke filling. The residual salt cake is then pushed forward into a roaster in which the reaction is completed. This roasted salt-cake is then neutralised by lime, and crystallised as Glauber's salt.

Nitric Acid.—Sodium nitrate is decomposed in pans of the usual type, the fumes from which are first cooled in glass pipes of considerable length, and are then finally condensed in tube condensers fitted with water-jackets. Escaping fumes are condensed in a water tower.

Sulphuric Acid.—The chamber process is used, but instead of the necessary water being introduced in the form of steam, a Benker iridium-platinum injector is used so that water enters the chamber in the form of spray. With steam, 13·6 cubic feet of chamber space for each lb. of sulphur is required, whereas the introduction of the injector has reduced this to 11 cubic feet. The Glover towers are packed with flint, and the Gay Lussac towers with coke. The whole system is worked by a fan at the chamber exit. The acid is de-arsenicated in the dilute state by hydrogen sulphide made from ferrous sulphide and sulphuric acid. The waste liquors from this are crystallised in the form of "copperas." The dilute sulphuric acid is concentrated in Kessler volvic lava evaporators.

EXCURSION TO TROON.

A party of 22 members went to Troon, where they were the guests of the Troon Golf Club. Matches were arranged between Scottish and English members of the Society and a most enjoyable day was spent.

EXCURSION TO EDINBURGH.

Dr. F. J. Wilson took a small party to Edinburgh, which visited the Castle, St. Giles Cathedral, Holyrood Palace, and other places of interest.

THE ANNUAL DINNER.

The Annual Dinner was held in the Grosvenor Restaurant on Thursday evening, July 7th, President Ira Remsen being in the Chair.

After the President had submitted the toasts of "The King" and "The President of the United States."

Mr. WALTER F. REID, President-Elect, proposed "The Society of Chemical Industry." There was no question whatever that of late years the Society had increased in importance. It was occupying now a position to which, when he had first the honour of sitting on the Council, they did not lay claim, and they were now consulted on matters of national importance. They were represented on bodies to advise the Government. They had two representatives on the Board of the National Physical Laboratory, a representative on the governing body of the Imperial College of Science and Technology, and representatives on the Board of Trade Committee for International Exhibitions. They had frequent communications from the Board of Trade, and whenever other Societies wished information or required the influence of bodies connected with their industries they were invariably referred to. That was a position of which they might all be proud. It was quite true they had never in the past pushed themselves forward in any way at all, and he thought the fact that people had come to them was one of the best proofs that they could have of the utility of the Society and of the important position which its members occupied in the industries of this country. He had made a very considerable research with the object of finding some industry in which chemistry was not represented in some way or another; he had not been able to find it, but perhaps in the future someone might. When he was young he was very fond of fairy tales, and when he read some of these wonderful transformations—when he read of Cinderella, for instance, and the wonderful transformations that took place—he could not help thinking of the transformations which were effected by the members of the Society as industrial chemists. There was hardly a compound substance in nature which the chemist could not transform if he willed into something else. Stability was an unknown property in chemistry. It only needed the will where they wanted to change a thing whether it was done or not. He thought that the chemist, when the supplies of wood had come to an end, as they were apparently about to do, might be able to produce something which was far more durable than the paper in use at the present day, and when they had done with one day's newspaper, make it up into another paper, and thus utilise the paper over and over again. Then again the industrial chemist had to look forward to the time when the surface of the earth became insufficient for the nourishment of the human race. It might not be so very long before the atmosphere itself could supply some of the nutriment, and dietetic values would be found in materials like wood, cellulose, and other products which were not now utilisable for nutriment. They had only to consider the way in which the chemists had introduced products from other sources to take the place of products of the soil. Take, for instance, the indigo industry. There was a very great struggle being fought in the East for the growth of natural indigo as against the manufacture of dyes from artificial products, but he was not sure that it was altogether a disadvantage to the human race that a large area of land should be released for producing food. He dwelt particularly upon the food question because it was one that touched all of them. As they were at present constituted they must in some way or other get food for all directly or indirectly, and he thought that the industrial chemist had not quite asserted himself as he might in the preparation of the food products that they had. The preparation of food was entirely an operation of the industrial chemist. People called themselves cooks. They were really experimental chemists, for undoubtedly, the preparation of food was a chemical operation. He did not think that the Society quite occupied the position it ought to do in regard to metallurgy, because the production of metals was entirely a chemical operation. The great bulk of the copper, for instance, that was produced in the world was produced by purely chemical means. Again, what had raised the prices of everything of late years? He believed it was the chemist, the producer of cyanides. If he had not produced cyanides cheaply and extracted the gold cheaply from the ores in the Transvaal there would not have been so great a production of gold in the world. They, as the Society of Chemical Industry, should assert themselves perhaps a little more in connection with those great industries which were arising. He was sure that their minds were widely open to these developments and increases in the importance of the Society. He was one of the original members of the Society, and he was a member of at least a couple of dozen others; but he knew of no Society where all concerned were so heartily loyal to the interest of all its members as the Society of Chemical Industry. The expressions of opinion at all their Council meetings were clear and undoubted, and they all agreed, as a distinguished statesman had said not long ago, "The majority must prevail, and those who are in the minority heartily agree in giving effect to the views of the majority." He thanked them for placing him in such a position of honour, which he would remember with pride to the end of his life. He would do his very best to leave the Society after his term of office in at least as good a position as it was at present.

The PRESIDENT, in responding, said the functions of the Society of Chemical Industry were two-fold. In the first place it seemed to work by catalysis. The contact members with each other brought about good results, a sitting in their studies by themselves they could not possil accomplish the results which the members of the Soci got by the virtue of that contact. Catalysis was an tremely vague word. It had been bandied among chemi for nearly a century. In the early part of last centu it was introduced by Berzelius. Its Greek equivalent w "action by contact." That was vague, and of late ye they had been trying to learn what action by contact w It was one thing to give a general name to a thing a cover up their ignorance, and another thing to find what they meant by that. They had at least learned t much, that it was not simply contact. That was the end their information at the beginning of the last centu It was an interchange of constituents—that was modern conception of catalysis, those constituents be of a somewhat spiritual character. The give and ta at these meetings of the Society had been remarka successful, and had attained results of the very great value to the world, and these had been reached by th contact. There was another virtue that had been reacl by the Society, and that was of an international charact The fact that there were two flourishing sections of Society in his own country had led to closer contact betw his countrymen and theirs, and that was a matter of v great value. It had been said that if all the nations of earth could come in contact with one another and le to know one another, most of the difficulties that ar between the nations of the earth would cease. They h always to go from the concrete to the general, and he lef to them to decide whether it was not true that they often had false impressions with regard to those wh they did not know. When they came to know, th impressions were entirely different. That function of Society of Chemical Industry was of the very high importance. They hoped very soon to have anot meeting in America of the Society, and he hoped that would be very largely attended by members from Brit Everything that tended to bring the citizens of the Uni Kingdom closer to the American people was devou wished for by all of them. After his address the previ day there was a remark made by his host which left a v peculiar impression on his mind. His host had put in the rôle of pessimist. That was a new rôle for h He had never been accused of belonging to that cl before. He was not a pessimist at all so far as he kn but he must recognise the truth, whatever that might As regards the material resources of the United Sta there was no question of the truth of what he said genera which was the result of the most elaborate investigati that had been made on the subject. It was simply a rec nition on the part of the United States of that unity nations which was now going forward. So far as the Uni States as a nation was concerned he was not a pessimist, an optimist. There were forces at work at the present ti of which they were perhaps only very faintly inform which were working for the highest interests of the peo of that country. There were men who were coming to front whom they welcomed, and as long as they had n like President Roosevelt, President Taft, and Gover Hughes, taking the conspicuous positions that they there was great hope for their country. The fact that th men were popular was an indication of the state of min the people as a whole. He thought it only just to country to say this and to relieve himself of the posit of being a pessimist. It had been a great pleasure to to meet so many members of the Society, and, in conclusi he thanked them for the reception they had given him

Mr. WILLIAM J. CHRYSTAL, in proposing the toast "Our Guests," said that they were indebted to their gu for coming there to meet them. Their chief guest the representative of the Glasgow Corporation, who entertained them so well and so royally the previous nig The Lord Provost had been speaking with regard to smoke in Glasgow. Chemists undoubtedly could smoke. If chemists were at the kitchen ranges in Glas there would be no smoke whatever. He supposed t would have to devise other means, however. The Sco coal was a very smoky coal, so that they were not a gether to blame for the smoke. It was the nature of als. He asked the company to drink to the health of e guests, coupled with the name of the Chief Magistrate, ilie Dunlop.

Bailie Dunlop, in responding, complimented Mr. rystal on the very kind terms in which he spoke of)ur Guests." It was nice to hear them speaking of the ntact with people in other parts of the world. The izens of Glasgow, he thought, had been fortunate in ving a Town Council who recognised that it was only its ty to extend the right hand of hospitality to all from all rts of the world who came to the city of Glasgow. thought the city of Glasgow had now got a reputation hospitality which it thoroughly deserved, and they uld agree that those were functions that did a great deal good to cement the nations together, and the more y knew, as had been said, of the different peoples of the rld, the less likelihood there would ever be of the sugtion of war or rumours of war. He thanked the proer of the toast, and hoped that the Society would not be g before they came back again.

Dr. Lewkowitsch, in proposing the toast of the Kindred Societies," first mentioned the Chemical Society. e advice which the President had yesterday so quently enjoined upon them, to combine science h industry had always been in their thoughts years past. Then came the Institute of Chemistry, ich had raised the status of professional chemists in s country. Dr. Beilby the President of the Instie, had done yeoman service in order to bring the eme of technological examinations to a successful ie. It might be mentioned that at the first those examinations only one man passed, and that n was a Scotchman. When one thought of dred Societies, one would naturally think of the Royal iety, which had always been a good friend to them, l had recognised their work by putting their Society to forefront when it came to international gatherings h as those they had had last year. When it came to pass year that an International Congress was to be held in idon, the Society of Chemical Industry organised it, l the Royal Society was the first in the long list of ieties which were put down as those societies which e gathered together to receive that Congress. So the val Society might well be called a kindred Society. y might perhaps try to compare themselves in one little r with the Royal Society, for just as the val Society was the mother of all learned and scientific ieties, so they might call themselves the Royal Society of mical Industry. Of course, the Royal Society had not ented science, nor had the Society of Chemical Industry eated chemical industry, but just as the Royal Society s the first to bring scientific men together, men of the ne thought and of the same aspirations to unite and profit m each other and offer the opportunity of putting their ughts and their researches before the Society, so their n Society had in an opportune moment brought toher a number of men who were engaged in chemical ustry, and by bringing them together had allowed them ub off their angularities and to profit from each other's erience, to learn from each other, and afford them opportunity to publish such information as they thought s safe. A number of other Societies, which they might l call kindred Societies, had been established to act as nch Societies, and each had taken up one of the subjects ich the Society could no longer exhaustively deal with. looking at the long list of the classification of their jects, it was easily seen that they had a very large mber of kindred Societies. They had Societies of chanical Engineers and Civil Engineers and Naval gineers, and then they had the Institute of Gas gineers, the Concrete Institute, the Institute Metals, the International Society of Leather mists, the Institute of Brewing, the Photophic Societies, and the Society of Public alysts, all, as it were, offshoots of their iety. The universality of the subject would allow of rge number of other Societies. They might even in the ure have an Indiarubber Society, and a Society for the er Industry. They might perhaps have a Society for alysis. The President had reminded them naturally the American Chemical Society, and in these times of international committees they ought to include as well the German, the French, the Italian, and the Russian Chemical Societies, and the Societies in Japan. He coupled with the toast of the Kindred Societies the names of Mr. P. N. Cunningham and E. George Tidd.

Mr. P. N. Cunningham, in responding to the toast, said their Societies had a community of interests, and he thought each institution hastened the time when the scientific side should be closely attached to the practical side of their industries, and that, he thought, was to be desired, because in hastening that time they were pressing forward all the industries of any country, and by doing so they were conserving the materials and methods placed in their hands, which made for efficiency in every department. They had been told that they could not always carry the scientific side along with them in industries, but he did not believe that was so. The chemists of to-day had placed nearly all their industries in the fore-front. He agreed with the President-Elect when he said that he did not know of any industry or business which had not its chemical side. He thanked them most sincerely for the manner in which they had received the toast, and for the honour they had done him in coupling his name with the toast.

Mr. E. George Tidd also responding to the toast of the "Kindred Societies," said the Institution of which he had the honour of being in the chair in the Local Section for the past twelve months, the Institution of Electrical Engineers, felt that without chemistry they would have made a very poor show in many of the commercial improvements that had taken place within the last few years. A number of the most important commercial improvements that had taken place had been conjointly carried out by means of electrical engineers, with the assistance of chemists, or by chemists with the assistance of electrical engineers. He would take one concrete example —electric lamps. The name by which the electric lamps were known was the Ediswan lamps. Could there be a happier combination than that of the name of Thomas Alva Edison coupled with the name of Joseph Swan? It was the chemist who had assisted to bring that lamp to perfection, and the electrical engineer who had taken advantage of the chemist's help in perfecting that lamp. There was no doubt that nowadays, with the wide sphere of science, one Society must help another, and he felt sure that the Institution of Electrical Engineers would be only too glad to help and give any information that the chemists asked them for. On the other hand, the Electrical Engineers, if they required chemical information, would feel that they could go to the Society of Chemical Industry and ask that information with the certainty of obtaining it. It was only by that mutual feeling and mutual assistance that science nowadays could progress. A man was honoured by being asked for advice as well as by giving it. A Society was also honoured by both being asked for and giving information. He thanked the company on behalf of his own Society, and on behalf of the kindred Societies for the kind way in which they had received the toast.

Mr. Thomas Tyrer, in proposing the toast of the Scottish Section, said that the toast of the Local Section had been proposed for 29 years, and he had had the honour of submitting it for about 26 times—the toast of the Section which had favoured them by an invitation, the realisation of which in every case had seemed to exceed the last as years had passed by. In this way a spirit of honourable and friendly rivalry had arisen which was a good thing. That rivalry had done as much almost as the scientific, industrial, and literary work which found its result in their journal. In 1904 the New York and New England Sections had attempted to show the Society something of America, not only 11,000 miles in their up-to-date trains, but some of their institutions. In the following year the Corporation of London and Municipalities of various British industrial towns returned the compliment, and the visiting members were delighted with the way in which each section of the Society showed them hospitality. It had made a great impression. Meeting for the third time in Glasgow—the previous occasions being in 1888 and in 1901—they felt very deeply in the debt of the Scottish Section for the entertainment which was being provided and was going to be provided. He re-echoed the sentiments of the President-Elect as to the position held by the Society. This had been brought about by a spirit of co-operation; many had contributed to it, and the contributions were made in the spirit of commonwealth and true democracy. The Society deserved to be considered cosmopolitan, friendly, and in some senses of the word absolutely angelic. In asking the Company to drink to the Scottish Section, he coupled with the toast the name of its Chairman, David J. Playfair.

Mr. David J. Playfair, in responding, thanked the company for the very kind way in which they had received the toast, and for the complimentary and munificent terms in which it had been presented. Those of them who were visiting Scotland for the first time must disabuse their minds of any opinion they had formed of Scottish National peculiarities. The Scottish Section was fairly representative of Scotland. There were the hard-headed men of Aberdeen, the crafty men of Fife, and the wise men of the East. To the Australian and American members it probably seemed that the Scottish territory was small and compact. It was large enough to prevent them from seeing as much of each other as they would like. It had been a great pleasure to the Section to entertain the Society, and he hoped in what remained of their meetings they would do much to cement friendships and to leave pleasant recollections.

Dr. Neave also thanked the members for their appreciation of the efforts of the Section. He had had a good deal to do within the last two or three months, in organising the meeting, but it had been a very pleasant work largely because of the great kindness shown by all those with whom he had to come in contact.

Friday, July 8th, 1910.

Clyde Excursion.

The last day of the meeting was devoted to an excursion on the Clyde. The party travelled from St. Enoch Station to Prince's Pier, Greenock, and then embarked upon the "Neptune," a fine new steamer belonging to the Glasgow and South Western Railway. The route followed differed somewhat from that of former trips, in that the left bank, or Renfrewshire side, was closely followed in the first instance. After passing Wemyss Bay, the course was along the measured mile off Skelmorlie, where a torpedo boat was being tested. Opposite Fairlie, the new Marine Stati on the Great Cumbrae was passed on the right, and th Millport, a very favourite resort. On the left was t Little Cumbrae, recently entirely freed from a plague rats by Danysz virus. It has at present only two inhabit buildings, a farmhouse and the lighthouse. The route lay southwards and diagonally across the Firth of Cly towards Arran, where the mountains, Goat Fell the chi lay sleeping in the bright sunlight. The course lay insi Holy Island and into Lamlash Bay, at which point lunche was served. The President here took the opportunity express to the Scottish Section the gratitude of the memb for their entertainment, and Mr. W. J. Chrystal replied behalf of the Section. After encircling Holy Island, north-west course was followed as far as Tarbert on Lc Fyne, and then the steamer turned back through the Ky of Bute into Loch Ridden, a place of peculiar beau before making for Rothesay and the Clyde again. excellent orchestra enhanced the enjoyment of the m perfect day it has been the Society's privilege to experie in Scotland.

Conversazione in the Glasgow and West of Scotland Technical College.

In the evening a numerous company attended at new Technical College in George Street, Glasgow, to welco the President and to inspect the new laboratories. the basement were the boiler house, workshops, ventilat apparatus, and the motive power engineering laborato On the ground floor, five-fold electric power transformat was shown in the Dynamo Laboratory, hydraulic material testing was shown in their own laboratory, confectionery was shown in the Baking School. The f floor was occupied by the Natural Philosophy and Electri Engineering Departments, while the Library was given to refreshments. In the large hall on the second floor, Iff's orchestra gave a delightful concert; vocalist, Mis Taggart. On the third floor, set apart for metallu microscopic examination of metals, the making of rib metal, and Gilbert's system of anticlastic levers (" Vilcar was shown. On the fourth floor, where chemistry, p and applied, were taught, Dr. Gray and others g demonstrations on dyeing, bleaching, and cloth print from time to time, and interesting pieces of apparatus on view. Thus ended a most excellent meeting.

Journal and Patent Literature.

Patent specifications may be obtained by post by remitting as follows :—
English.—8d. each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery L
London, W.C.
United States.—1s. each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.).
German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Drying machines; Revolving ——. A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 12,463, May 26, 1909.

A series of rectangular boxes is arranged around a central axis about which the boxes are rotated within a chamber or tunnel through which the drying medium is transmitted. The material to be dried is fed into the boxes at one end from a conical hopper, is caused to pass through them by inclined gills spaced diagonally within, and is discharged from the other end.—W. H. C.

Drying bricks, briquettes of peat, coal or other materials, salt, chemicals, sand and other analogous wet or moist materials; Machine for ——. A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 12,465, May 26, 1909.

The materials are placed on trays which are stacked one above another in a double row of drying chambers. The chambers in each row are connected together in pairs an opening in the upper part of the division walls, and chamber has an opening in the floor by which it municates with a flue beneath. A current of heated a drawn through the chambers by a fan placed above inlet end. The air enters the bottom of the first cham passes upwards through the aperture in the partition into the next chamber, down which it passes to the below and thence to the third chamber and so on to end of the row, whence it returns in a similar manner, in the reverse direction, through the other row of cham to the fan. By means of dampers the current of air be passed in either direction through the series of cham and any chamber can be cut out of the air current t emptied and recharged.—W. H. C.

Mixing or measuring liquid or other substances in def proportions; Apparatus for ——. A. Ander London. Eng. Pat. 17,340, July 26, 1909.

A rotating wheel is actuated by the main volum liquid and carries on its shaft a star-wheel provided at the ends of its arms with suspended cups having weighted stems. At their lowest position, the cups, are immersed in the second liquid and near their highest position come into contact with a striker which tilts the cups, causing them to discharge their contents into the main volume of liquor. —J. W. H.

Mixing or combining various substances; Apparatus for——. T. A. Reed, London. Eng. Pat. 5068, March 1, 1910.

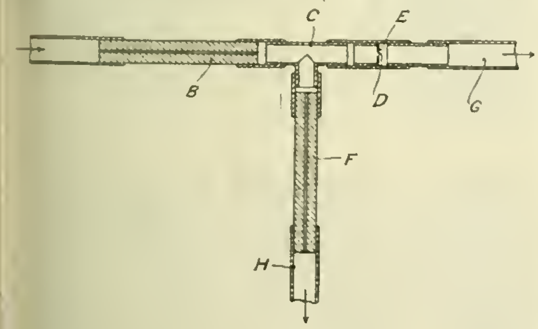
A cylindrical vessel provided with a central vertical shaft having horizontal blades, is also provided with fixed horizontal blades attached to a vertical rod at the side of the vessel. The shaft is rotated by gearing from above and fits into a removable footstep below, the blades attached to it passing between the fixed blades. The cylinder is placed within an outer vessel which may contain a heating or cooling medinm. All the parts are so arranged that they can easily be taken to pieces for cleaning purposes. —W. H. C.

Cooling liquids; Apparatus for ——. J. D. Crighton and The Klein Engineering Co. (1908), Ltd., Manchester. Eng. Pat. 18,397, Aug. 10, 1909.

In cooling apparatus in which the liquid to be cooled drops from one to another of a series of wooden laths or drip-boards, the opposite longitudinal edges of these drip-boards are notched as required and supported between pairs of uprights in series. The uprights are notched so that the falling liquid from one drip-board falls upon the flat surface of that immediately below it.—J. W. H.

Constant emissions of gas; Method of obtaining —— and apparatus therefor. H. Fahrenheim, Essen-an-der-Ruhr, Germany. Eng. Pat. 3641, Feb. 14, 1910.

When a gas is passed under constant pressure through a capillary tube in order to obtain a constant flow, variation occurs when the specific weight of the gas alters. To overcome this difficulty, advantage is taken of the fact that the rate of flow through a capillary tube has a linear variation but the rate of flow through a minute orifice in a thin plate has a quadratic variation when the specific weight changes. The gas after passing through the capillary tube, *b*, enters the T-piece, *c*, one branch of which has a second capillary tube, *f*, whilst the other is provided with a thin plate, *d*, having a minute orifice, *e*. If the specific weight of the gas decreases or increases, the rate of flow through *f*, undergoes linear variation only, whereas the emission through the orifice, *e*, increases or decreases in quadratic proportion, being inversely proportional to the square root of the specific weight of the gas. Consequently the greater part of the alteration in the rate of flow, due to change in the specific weight of the gas, is transferred to the minute orifice, *e*, and the variation in the rate of flow through *f*, becomes almost negligible. The gas issuing from *g*, is conveyed away to the outer air and that coming from *h*, is conveyed to the calorimeter or other apparatus destined to receive it.—W. H. C.



Pyrometers, thermometers, and the like. H. Watkin, Stoke-on-Trent. Eng. Pat. 7813, Mar. 31, 1910.

Modifications are claimed of that type of pyrometer which consists of a rectangular tray of refractory material provided with recesses for receiving fusible blocks. In one modification the recesses are of larger diameter than the fusible blocks and the sides of the tray are cut away to facilitate observation. In another modification one side of the tray is entirely cut away. In a third modification, a recess is formed on the under side of the tray communicating with the recesses on its upper side by means of perforations. In a further modification, instead of cutting away the sides of the tray, a removable perforated top is provided.—J. W. H.

Kiln. M. F. Swanson, Reading, Ill. U.S. Pat. 961,266, June 14, 1910.

The kiln is provided with inner and outer walls at its opposite sides. A flue extends from the exterior of the end walls, which are single walls, along the floor and communicates with the body of the kiln by means of perforations. Fire-grates and uptakes are arranged in the outer of the side walls; some of the uptakes communicate with the central flue and others with openings in the floor of the kiln.—J. W. H.

Filtration; Process of ——. E. Burt, El Oro, Mexico. U.S. Pat. 961,713, June 14, 1910.

The filtering medium is supported upon the inside of a closed vessel capable of rotation. The material is filtered under fluid pressure, while the vessel is rotating, so that a filter cake, in layers, is produced which is sufficiently firm to retain its position while being washed.—J. W. H.

Crystals; Process for improving the growth of —— by crystallisation in motion. J. Bock. Ger. Pat. 222,830, June 8, 1907. Addition to Ger. Pat. 219,749, April 21, 1906.

According to the chief patent (see Fr. Pat. 369,729; this J., 1907, 190), motion was produced in the crystallising liquid by developing steam therein, the whole or a part of the steam being condensed and returned to the liquid. It has now been found that much better growths of crystals are obtained if some of the substance which is being crystallised is dissolved in the condensed water before returning it to the crystallising liquid.—A. S.

Waste gases; Process and apparatus for utilising the energy of ——. J. Weise and F. Rieche, Assignors to R. Koepp und Co., Oestrich on Rhine, Germany. U.S. Pat. 962,108, June 21, 1910.

See Fr. Pat. 408,419 of 1909; this J., 1910, 615.—T. F. B.

Drying apparatus. W. H. Bradley, Chicago. U.S. Pat. 962,118, June 21, 1910.

See Eng. Pat. 8541 of 1909; this J., 1910, 11.—T. F. B.

Conveying and compressing materials saturated or associated with water; Apparatus for ——. International Continuous Filter Press Co. Fr. Pat. 411,115, Nov. 5, 1909.

See Eng. Pat. 23,981 of 1909; this J., 1910, 678.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES

Peat fuel; Manufacture of —— in Canada. Eng. and Min. J., June 25, 1910. [T.R.]

The Mines Branch of the Department of the Interior of the Dominion Government has established a plant for the manufacture of peat into fuel, at Alfred, Ont., about 45 miles from Ottawa. The plant was built by the Government to demonstrate the possibilities of the peat bogs, with which Canada abounds. It commenced operations on May 18th, and is now running continuously. The peat deposits at Alfred consist of about 300 acres, having an average depth of about 10 feet. The plant consists of a long peat-storage shed, two small frame houses, a blacksmith shop and a large peat machine. The latter apparatus was imported from Sweden, where there are several hundred such equipments in operation. A long trench, 19 ft. wide and 8 ft. deep, is cut in the peat, in which the peat machine is placed. A carrier conveys the peat as it is dug from the trench to a hopper. On a 600 ft. circular track in the middle of the bogs are 8 peat carriers, each of which holds 0·7 ton of peat. As each car passes the machine, the ground peat is dropped from the hopper into the machine. A 34-h.p. engine, which itself burns about 4 tons of peat fuel per day, furnishes motive power for both hopper and cable cars. The peat in the carriers is then conveyed to a field press, which spreads the peat upon the ground in long parallel rows, and it is then shaped into bricks, which are allowed to dry in the sun and air for three or four weeks, when they are stored in the peat shed ready for transportation. The cost of producing peat is said to be $1.75 to $1.80 per ton. 1·8 tons of peat equal one ton of anthracite. A peat-using plant for the production of producer gas has been established in Ottawa and receives its fuel from the peat manufacturing plant at Alfred.

Coal ; Liquids produced by the action of air on —— between 125° and 200° C. P. Mahler and E. Charon. Comptes rend., 1910, **150**, 1604—1605. (See also this J., 1910, 744.)

The water condensed from air which has been passed over heated coal presents no special features when the temperature of the latter does not exceed 100° C. When the temperature is between 125° and 200° C., however, the condensed liquid has a characteristic odour. It is plainly acid, and in it acetic acid, acetone and methyl alcohol can be identified.—R. V. S.

Coal-dust ; Ignition of —— by single electric flashes. W. M. Thornton and E. Bowden. Trans. N. Eng. Inst. Min. and Mech. Eng., 1910, **60**, 281—305.

The results of experiments on the ignition of a mixture of three typical coal-dusts from different seams of the Birtley Collieries are given in a series of tables and curves. The values of the smallest current, in ampères, capable of igniting a mixture of coal-dust and air, when interrupted by a quick-break switch, are summarised in the following table :—

Volts.	Ampères.				Alternating current power-factor.
	Direct current.		Alternating current.		
	Inductive.	Non-inductive.	Inductive.	Non-inductive.	
77	—	—	—	150	0·75
100	16·0	70·3	140·0	—	0·80
240	5·7	11·0	—	—	—
250	—	—	36·0	—	0·80
480	2·3	5·8	14·2	—	0·81
635	—	—	5·2	—	0·83

The author discusses, on the basis of his results, the most suitable conditions for the safe use of electricity in collieries.—A. S.

Coke manufacture ; Progress in the recovery of by-products in ——. O. Rau. Chem.-Zeit., 1910, **34**, 704.

The progress in the recovery of ammonia since 1900 is shown in the following table, the figures being given in terms of 1000 tons of ammonium sulphate.

	Great Britain.	Germany.	United States.	France.	Other countries.	Total.
1900 ...	217	104	58	37	68	484
1903 ...	237	140	70	52	80	579
1906 ...	294	235	60	49	80	718
1909 ...	348	323	90	54	137	952

In Great Britain the sources of production were follow :—

	Gas works.	Coke ovens.	Blast furnaces.	Gas producers.	Carbonising works (shale, et
1900 ...	145	10	17	7	38
1903 ...	152	18	19	10	38
1906 ...	160	44	22	19	49
1909 ...	171	75	19	26	57

The sources of ammonia production in Germany were :-

	Gas works.	Coke ovens.	Desaccharification of molasses.
1900	20	80	4
1903	25	111	4
1906	30	200	5
1909	40	278	5

Of the total coal supply, the proportions used in cok ovens and in gas-works in different countries are shown the following table :—

	Germany.	Belgium.	England.	United States
Coke-ovens without recovery of by-products...	4	5	10	10
Coke-ovens with recovery of by-products	16	11	2	2
Gas-works with recovery of by-products	4	4	6	1

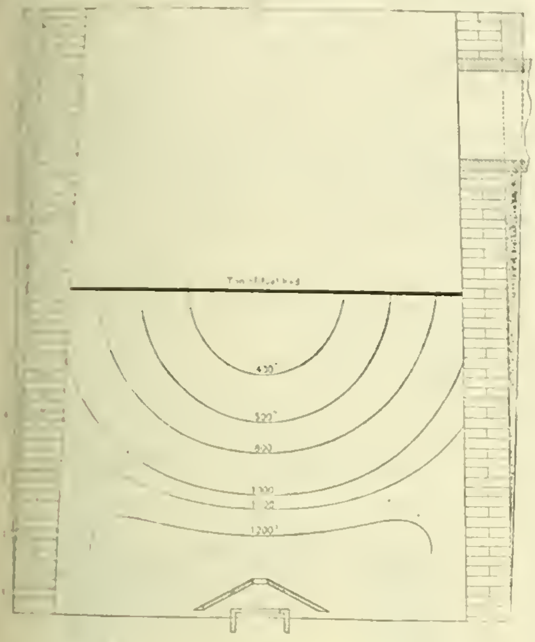
—A. S.

Carbonising in horizontal retorts. J. F. Bell (Report Carbonisation Committee of the Institution of Engineers). J. Gas Lighting, 1910, **110**, 836—838.

The author has investigated the working of horizon retorts with full charges, and compared the results w those obtained in ordinary practice with the retorts o partly filled. The same coal was carbonised in two differ works, under conditions as nearly identical as possil except that in one the average weight of coal per cha was 12 cwt. and the period of carbonisation 12 ho while in the other the average charge was 8·21 cwt. w a carbonisation period of 8 hours. The illuminat power of the gas being a less important requirement t the calorific value, the author concludes that carbon tion in filled retorts, with a longer period of distillat offers many advantages over the usual practice. yield of gas is decidedly increased, although its illuminat power is somewhat lower ; but there is a much sma proportionate reduction in the calorific value than in candle power of the gas. The production of coke. and ammonia is also improved.—W. E. F. P.

Fuel bed [of gas producers] ; Temperature differences in — J. K. Clement and H. A. Grine. U.S. Geol. Surv Bull., 393, 15—27.

In order to determine the actual conditions in the fuel- of a producer, the temperature at different heights at different distances from the axis of the producer was observed by means of a thermo-couple, and samples of gas were drawn from the same part of the fuel bed immediately afterwards. The producer was 6 ft. 6 in. diam. at the top, 7 ft. 0 in. at the bottom, and the fuel column was about 8 ft. 6 in. in height. The blast was introduced by a central tuyère. The temperature near the centre of the fuel bed was found to be 300° or 400° C. lower than in the outer regions; the maximum temperature observed, was about 1300° C. The distribution of temperature is shown by the isothermal lines in the diagram (see Fig.). The low temperature in the core of the fuel column is disadvantageous and was probably due to bad design of the tuyère. The temperature of the fuel bed should be at least 1300° C. in order to yield the highest possible percentage of carbon monoxide.—A. T. L.



Section of producer showing temperature variation for height and distance from sides of producer

Carbonisation: Experiments in ——, on the Birmingham coal test plant. W. B. Davidson (Report of Carbonisation Committee of the Institution of Gas Engineers). J. Gas Lighting, 1910, **110**, 838—845.

After a brief description of the plant, and a comparison of results obtained by testing the same coal in both small and large plants, an account is given of the actual methods employed in testing and valuing. As regards the standard of quality of the gas, the results indicated a much greater uniformity on the basis of calorific power than on that of illuminating power—a given percentage decrease in illuminating power being accompanied by a much smaller percentage decrease in heating value. Gas made in vertical retorts was compared (as to composition, calorific value and illuminating power) with that made from the same coal in horizontal retorts; and the effects due to alteration of pressure and temperature of the retorts, and of the weight of the charge and the duration of the carbonisation period were also studied. Comparison, on the same coal, of low temperature carbonisation (such as that of the "coalite" process) with ordinary high temperature practice indicated a decided commercial advantage in favour of the latter.—W. E. F. P.

Refractory materials for gas works [Temperatures in gas making plants]. (Report of the Refractory materials Committee of the Institution of Gas Engineers.) J. Gas Lighting, 1910, **110**, 857—858.

The returns received from 48 representative works in Great Britain and Ireland indicate that the various parts of retort and water-gas plants are worked at the following temperatures:—

Coal gas plants.

(2059 beds of retorts represented.)

Retorts	Average maximum	1909° F.
	,, minimum	1558° F.
Combustion chambers	,, maximum	2397° F.
	,, minimum	2212° F.
Producers	,, maximum	1966° F.
	,, minimum	1766° F.
Regenerators	,, maximum	1622° F.
	,, minimum	1220° F.

Water-Gas Plants.

(63 sets represented.)

Generator	Average maximum	1811° F.
	,, minimum	1483° F.
Carburettor	,, maximum	1391° F.
	,, minimum	1014° F.
Superheater	,, maximum	1291° F.
	,, minimum	1142° F.

The greater proportion of the determinations were made with the Féry pyrometer.

—W. E. F. P.

Lighting gas: Removal of carbon bisulphide from ——. M. Mayer and A. Fehlmann. J. Gasbeleucht, 1910, **53**, 523—528; 553—560; 577—582.

It has been found that metallic peroxides accelerate the combination of amines and carbon bisulphide to thioureas, and the present work comprises a study of this reaction, its application to the purification of lighting gas from carbon bisulphide by means of aniline, and the regeneration of the aniline from the thiocarbanilide formed, which has hitherto been a valueless commercial product. Comparatively, only small amounts of sulphur were absorbed from gas containing carbon bisulphide when the gas was passed through aniline at the ordinary temperature, or at the boiling point, but on the average from 80 to 96 per cent. of the total amount of sulphur was absorbed by one washing at the ordinary temperature with aniline in which metallic peroxides were suspended. Iron oxides, mercuric oxide, lead peroxide, red lead, manganese peroxide, lead oxide, and copper oxide were tried. The amount of sulphur absorbed by bog iron ore, merely moistened with aniline, was approximately the same as that absorbed by a suspension of the ore in aniline, and xylidine gave better results than aniline. The commercial drawbacks to the authors' process (see U.S. Pat. 926,273; this J., 1909, 830) are the cost of the aniline, and the production of an unmarketable final product, thiocarbanilide. About 70 to 80 per cent., however, of the aniline can be recovered by heating the thiocarbanilide with ferric hydroxide, the main reaction of the decomposition being represented approximately by the equation:—

$$3CS(NH.C_6H_5)_2+2Fe(OH)_3=3CO_2+6C_6H_5NH_2+2FeS+S.$$

The consumption of aniline in the process can be judged from the following example:—In order to reduce the sulphur in 100 cb.m. of a gas from 130 to 20 grms., which would correspond to the removal of 130·6 grms. of carbon bisulphide, 319·7 grms. of aniline would be required. The 100 cb.m. of gas would at the same time carry over 180 grms. of aniline, in the form of vapour; this would make a total consumption of 499·7 grms. of aniline, or for the amount of purification indicated, 100 kilos. of aniline for 20,000 cb.m. of gas. About one-third of the total amount of aniline used, is merely carried over as vapour in the gas, and can be recovered by treating the latter with sulphuric acid (18·9 kilos. for the 20,000 cb.m. of gas. Lastly, by decomposition of the thiocarbanilide, 70 to 80 per cent. of the aniline combined with the carbon bisulphide could be recovered, making a loss of about 30 kilos. of aniline for the 20,000 cb.m. of gas purified.—W. C. H.

Naphthalene; Extraction of —— by water-gas tar. C. M. Gill. J. Gas Lighting, 1910, **111**, 109—110.

The author describes briefly the satisfactory results which have been obtained by the use of water-gas tar for the removal of naphthalene from lighting gas. About 700 gallons of the tar, freed from ammoniacal liquor, are circulated, at a temperature of 52°—88° F., through a coke scrubber, 35 feet high by 20 feet diameter, and it has been found that this quantity will remove about two-thirds of the naphthalene from about 17 million cubic feet of gas.—A. S.

Tayabas petroleum. G. F. Richmond. Philippine J. Science, 1910, 5, 1—7.

A sample of crude petroleum considered typical of the oil obtained from the strata in the Tayabas Province, Philippine Islands, was found to resemble Pennsylvanian petroleum oil in containing a fairly high proportion of volatile hydrocarbons, in having a paraffin base, and in being free from sulphur. The proportion of volatile constituents boiling below 150° C. was greater than in the case of most crude petroleum oils, as is seen in the following analytical values:—Sp. gr., 0·831; initial b.-pt., 70° C.; first fraction (light oils) 70° to 150° C., 36·5 per cent.; second fraction (burning oils) 150° to 300° C., 48·75 per cent.; and residue above 300° C. (by difference), 14·75 per cent. It contained 30 per cent. of unsaturated hydrocarbons, which could be removed by treatment with acid, and in this respect too it resembled Pennsylvanian oil, which Engler (Ber., 1895, 28, 2501. This J., 1896, 191) found to contain 28 per cent. of hydrocarbons soluble in sulphuric acid. It might be described as essentially a paraffin petroleum.—C. A. M.

Petroleum and naphtha; Regulations as to importation, etc., of —— into Canada. Board of Trade J., July 7, 1910. [T.R.]

A Canadian Customs Memorandum (1,590 B) dated 10th May, 1910, gives the consolidated regulations concerning the importation, inspection, and storage of petroleum and naphtha in the Dominion. It is provided in these regulations that:—(i.) Naphtha may now be imported in tank ships. (ii.) Naphtha is to be tested for gravity only, and the expression "Naphtha" is to include gasoline and all the refined products, by distillation, of rock or mineral oil, coal, coal tar, or of any other mineral substance having a specific gravity of less than 7·75 lb. per gallon. (iii.) Packages of naphtha are to be painted red, and the word "Naphtha" legibly marked or branded thereon in some other colour, before release from Customs control, when imported in drums, barrels, or smaller packages. (iv.) Illuminating petroleum upon importation is to be tested both for flash test and gravity test before entry for duty or for warehouse, and (v.) Petroleum for illuminating purposes (except high test petroleum) shall not be imported or offered for sale or use in Canada if at a lower temperature than 85° F. it gives off an inflammable vapour, or if it weighs more than 8·05 lb. per gallon or less than 7·75 lb. per gallon. (vi.) Proper invoices are to be furnished for entries of petroleum imported in bulk in tank cars or tank vessels.

Change [through use] in the composition of refractory bricks. Blasberg. *See* IX.

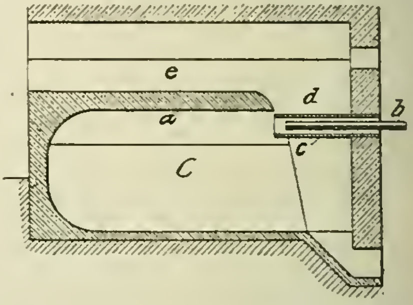
Patents.

Coke-ovens. F. W. C. Schniewind, New York. Eng. Pat. 10,484, May 3, 1909.

The battery of ovens is built upon iron pillars and frames above the ground level. Each retort chamber is large enough to produce at least twenty tons of coke at each charge and is long and deep but narrow, to allow the heat to penetrate the charge. Each chamber has a removable top, through which the coal is charged from a travelling hopper carried on a framework above the battery, and also a removable floor, through which the coke is discharged into a truck which runs on a track below. The retort chambers are heated by vertical flues at each side and a pair of regenerators is placed between each pair of retorts. The regenerators are divided horizontally into upper and lower compartments and each pair of upper and lower compartments is connected to a separate chimney shaft, one at each end of each oven, and also to an air supply main. Gas is supplied to the top and bottom of the heating flues by removable burner pipes which extend half way across the oven from each side and have burners corresponding in number to the vertical flues. The gas is supplied from a ring main which passes round the battery. When the draught is in one direction the air enters the upper part of a lower pair of regenerators, passes down and through the ports to the bottom of the vertical flues, where it meets the gas from the lower row of burners which are open. The products of combustion pass up the vertical flues and through the air ports at the top to the upper pair of regenerators, down which the gases pass and through the outlet flue to the stack on the opposite side. The damper of this stack is open and that of the one opposite closed. On reversing the dampers, shutting off the gas from the lower burners and opening the top burners, the air enters the lower part of the upper regenerators, passes upwards and meets the gas at the top of the flues. The products of combustion pass down the flues through the lower pair of regenerators to the stack at the other side.—W. H. C.

Burning powdered fuel; Apparatus for and method of ——. H. R. Barnhurst, Allentown, Pa., Assignor to H. G. Barnhurst, Catasauqua, Pa. U.S. Pats. 961,671 and 961,672, June 14, 1910.

The powdered fuel, mixed with air is injected into the furnace through the concentric pipes, *b*, *c*, and the flame and products of combustion sweep round and return upon themselves in the chamber, C, and pass through th port, *d*, into the flue, *e*. The rate of supply is so adjuste that sufficient heat remains in the gases to maintain th division wall, *a*, sufficiently hot to radiate enough heat t ignite the fuel as it enters the combustion chamber. —W. H. C.



Gas purifiers. T May, Richmond, Surrey. Eng. Pat 16,871, July 20, 1909.

Each layer of grids in a purifier is furnished with a by pass consisting of an annular trough into which a dome shaped cover supported on short legs is fitted. The annula trough is filled with water which rises above the lowe edge of the dome and seals it. When the resistance offere to the passage of the gas by the purifying material i greater than that offered by the water seal, the gas passe up through the central space and through the water sea to the next layer of grids above. A sight gauge havin a funnel through which the seal can be recharged wit water is connected to the annular trough through th purifer wall.—W. H. C.

Purifying gas and recovering ammonio, etc., therefron and utilising by-product metallic salts [iron picklin liquor] and ammoniacal liquor. F. J. Falding, Ne York, Assignor to W. R. Cathcart, Maywood, N. U.S. Pats. 961,763 and 961,764, June 21, 1910.

(1) The gas is first subjected to a preliminary scrubbin with a wash liquor containing ferrous hydroxide, produce in a subsequent stage of the process, in order to free from sulphur, cyanogen, and chlorine, and is then scrubbe with a solution of an iron salt, *e.g.*, iron pickling liquo whereby a solution containing an ammonium salt an ferrous hydroxide is produced. This solution is treate with an oxidising agent to convert the ferrous into ferr hydroxide, which is removed by filtration. The ammoniu salt (ammonium sulphate) is recovered from the filtrat (2) Gas liquor is treated with a quantity of iron picklir

liquor to precipitate its sulphides in the form of iron sulphide and sulphur, and after removal of the precipitate, is treated with a further quantity of the pickling liquor so as to produce a solution containing an ammonium salt and ferrous hydroxide, which is treated as described above.—A. S.

Waste acid from petroleum refining ; Process for the recovery of technically pure sulphuric acid from the ——. Steaua Romana Petroleum Ges. m.b.H. Ger. Pat. 221,615, June 19, 1909.

The so-called black acid, after separation from the acid tar by dilution with water in the usual way, and, if desired, after concentration, is allowed to flow continuously into pure concentrated sulphuric acid heated to the boiling point, and into which a current of air is passed. The acid vapours are condensed in suitable receptacles. In this way the organic impurities in the black acid are oxidised to carbon dioxide.—A. S.

Paraffin wax ; Cooling process for the fractional production of ——*, with simultaneous re-cooling of the liquid which has been used for the cooling.* P. Porges. Ger. Pat. 222,596, Feb. 16, 1909.

A suitable cooling agent is contained in two refrigerators, which are cooled to different temperatures (*e.g.*, — 10° and + 5° C.); these are connected, by separate pipes, with the jackets of the vessels containing the paraffin, so that a mixture at any desired temperature may be supplied to any vessel. After it has been used, the cooling mixture is passed back to the refrigerator which contains the liquid at the higher temperature (or it may be partially cooled by water first), and a portion of it is passed from the part of this refrigerator where the lowest temperature prevails, to the other refrigerator for a further cooling. —T. F. B.

Peat-preparing process and apparatus. W. H. Bradley, Chicago. U.S. Pats. 962,119 and 962,120, June 21 1910.

See Fr. Pat. 397,022 of 1908 ; this J., 1909, 693.—T. F. B.

Peat gas plants. J. D. Oligny, Ville Emard, and Peat Gas and Coal Co., Montreal, Canada. Eng. Pat. 23,767, Oct. 16, 1909.

See U.S. Pat. 938,691 of 1909 ; this J., 1909, 1240.—T.F.B.

Hydrocarbons ; Process and apparatus for gasifying liquid ——. Hydrocarbon Converter Co. Fr. Pat. 411,076, Dec. 6, 1909.

See Eng. Pat. 24,109 of 1908 ; this J., 1910, 11.—T. F. B.

Gases from coke-ovens, gas retorts, or the like ; Removing tar from hot ——. C. Otto und Co., Ges. m.b.H., Dahlhausen a/Ruhr., Germany. Eng. Pat. 26,124, Nov. 11, 1909. Under Int. Conv., Dec. 22, 1908.

See Fr. Pat. 404,569 of 1909 ; this J., 1910, 206.—T. F. B.

Gases ; Processes for separating dust, smoke, and other materials from ——. W. J. Baldwin, Brooklyn, U.S.A. Eng. Pat. 2426, Jan. 31, 1910.

See U.S. Pat. 950,607 of 1910 ; this J., 1910, 405.—T.F.B.

Paraffin butter ; Process for separating —— *from paraffin.* J. Weiser. Fr. Pat. 411,088, Dec. 18, 1909.

See Eng. Pat. 18,120 of 1909 ; this J., 1910, 408.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Wood distillation. II. Destructive distillation of pine-, fir-, birch-, and beech-woods. P. Klason, G. von. Heidenstam, and E. Norlin, Z. angew. Chem., 1910, 23, 1252—1257.

See this J., 1909, 132 ; compare also this J., 1909, 698.

Acetone ; Injurious action of sunlight on ——. Batik. Chem.-Zeit., 1910, **34**, 735.

A consignment of acetone having been rejected by the English Government owing to its failure to pass the permanganate test (a mixture of 100 c.c. with 1 c.c. of a 0·1 per cent. solution of permanganate should remain pink for ¼ hour at 15·5° C.), the author made experiments proving that even so short an exposure to direct sunlight as occurs in taking a sample, is sufficient to render the acetone incapable of passing the permanganate test. The same effect is produced by 15 mins. exposure to direct sunlight even when coloured glass vessels are used. (Compare Marshall, this J., 1904, 645.)—A. S.

Gas heating. (Second report of the "Gas heating research Committee" of the Institution of Gas Engineers.) J. Gas. Lighting, 1910, **110**, 810—818.

Under varying conditions of gas consumption, open gas-fires with ordinary fireclay "fuels" were found to radiate from 36·9 to 42·85 per cent. of the total heat evolved ; iron fret stoves radiated from 35·0 to 42·06 per cent., and a reflector stove 26·06 per cent. It was found that by varying the form of the "fuels" in a given fire, the percentage of heat radiated was raised from 40·0 to 44·73, while by modifying the composition of the "fuels" by the addition of certain metallic oxides (the form remaining the same) the radiation efficiency obtained was 48·5 per cent. as against 42·85 when "fuels" of normal composition were employed. From experiments made with a condensing stove, it was shown that the amount of sulphur acids condensed, varied with the temperature of the room, the quantity at normal temperatures being about 30 per cent. of the total ; the amount of iron dissolved from the inner surface of the tubes varied from 7·47 to 5·33 grains per 100 cb. ft. of gas consumed ; while no trace of carbon monoxide was ever found in the products of combustion. A detailed account of each series of experiments is given, the data and results being tabulated.—W. E. F. P.

Urukuri nut ; Composition of the kernel and of the distillate from the woody portion of the fruit. Frank and Gnädinger. *See* XIV.

Patent.

Arc lamp electrode. G. A. Thomson, Somerville, N.J. U.S. Pats. 961,268 and 961,269, June 14, 1910.

An electrode is claimed containing (1) metallic molybdenum mixed with metallic iron ; (2) oxide of molybdenum or oxide of molybdenum mixed with a material of greater conductivity.—J. W. H.

III.—TAR AND TAR PRODUCTS.

Aniline ; Compounds causing the red coloration of ——. *I. Effect of oxygen and ozone and influence of light in the presence of oxygen.* H. D. Gibbs, Philippine J. Science, 1910, 5, 9—16.

Experiments described in detail have shown that although a coloration may be imparted to aniline by the presence of certain impurities, the red coloration of pure aniline in the presence of oxygen is the result of oxidation, the process being accelerated by a rise in temperature and especially by exposure to sunlight, though it also goes on in the dark. The coloration may also take place independently of the presence of moisture or impurities. The products isolated from the coloured compound included azobenzene, 2.5-dianilinoquinone, dianiloquinoneanil, and azophenene. Ozone acts immediately upon aniline, with or without the presence of moisture, to form a bright red solution. Carbon dioxide is evolved in the reaction and dianiloquinoneanil is the main product. Apparently increased chemical activity could not be attributed to oxygen gas ions. The red coloration of aniline proceeds more rapidly than in the case of phenol (this J., 1909, 327).

The results indicate that to obtain the purest aniline the distillation should be carried out under reduced pressure or in an atmosphere of an inert gas.—C. A. M.

Aniline colour manufacture. Manufacture of dimethylaniline. J. Walter. Chem. Zeit., 1910, **34**, 641—642. 667—669, 681—682, 690—692, 701—704.

A DETAILED illustrated account of the technical manufacture of dimethylaniline.

Osmotic phenomena; Studies of ——. [Effect of water on the boiling point of pyridine.] W. G. Wilcox. J. of Phys. Chem., 1910, **14**, 576—595.

DETERMINATIONS of osmotic pressures of dilute solutions of lithium chloride, silver nitrate, and sucrose in pyridine gave values corresponding, on the average, to only 2·33, 3·46, and 2·41 per cent. respectively of the theoretical values calculated according to van't Hoff's theory of solutions. In the course of the work it was found that commercial pyridine contains higher homologues, in addition to water. These can be removed by oxidation with permanganate and distilling in presence of barium oxide. The boiling point of pyridine (114·3° C. at 738 mm.) is considerably affected by the presence of water, being reduced by 0·10° by 0·03 per cent. of water and as much as 3·95 by 1·1713 per cent. The effect is directly proportional to the quantity of water (up to 1·1713 per cent.), a straight line being obtained when the percentages of water are plotted against the number of degrees by which the boiling point is reduced.—A. S.

PATENTS.

Amino-oxynaphthalene sulphonic acid; Manufacture of a new ——. Kalle und Co., A.-G., Biebrich on Rhine, Germany. Eng. Pat. 9743, April 21, 1910. Under Int. Conv., May 11, 1909.

2-AMINONAPHTHALENE-1,5-DISULPHONIC acid, obtained by the further sulphonation of 2-aminonaphthalene-1-sulphonic acid, is converted into 2-amino-5-hydroxynaphthalene-1-sulphonic acid by fusion with alkali hydroxides at 210°—230° C. The new acid is with difficulty soluble in cold water, and with some ease in hot water; it exhibits a light greenish fluorescence in alkaline solution. It combines readily with diazo compounds in either acid or alkaline solutions.—T. F. B.

Nitrobenzaldehyde; Reduction products of commercial ——. A. Vagt, Mühlheim, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 961,915, June 21, 1910.

SEE Fr. Pat. 408,184 of 1909; this J., 1910, 552.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Indigo White; The condition of —— in aqueous solution. E. Knecht and J. P. Batey. J. Soc. Dyers and Col., 1910, **26**, 171—173.

IT has been shown (this J., 1910, 208) that in aqueous solution the calcium salt of Indigo White exists as a crystalloid. In continuation of their investigations the authors have prepared the mono-sodium salt, and determined its electrical conductivity. The mono-sodium salt was obtained, by adding to an alcoholic solution of Indigo White, less than the calculated quantity of alcoholic caustic soda solution, evaporating, and extracting the residue with water. The apparatus employed, permitting of the operations being carried out in an inert atmosphere, is described and illustrated. The analysis of the aqueous solution showed that the mono-sodium salt of Indigo White was present, the proportion of Indigo to caustic soda being practically 6·55 : 1. The conductivity determinations proved that the salt, in dilute aqueous solution, is an electrolyte but that it is not so strongly ionised as sodium chloride in the same degree of dilution.—F. M.

Indirubin. Part I. W. P. Bloxam and A. G. Perkin. Chem. Soc. Proc., 1910, **26**, 168—169.

IN order to study the conditions necessary for the formation of indirubin by the air-oxidation of indoxyl, the authors have devised a method for the quantitative estimation of the former colouring matter in indigo. The dyestuff mixed with purified sand is introduced into a glass tube (25 × 90 mm. approx.) closed at one end with calico, which is placed in a Soxhlet apparatus and the material extracted with pyridine. The pyridine extract is evaporated finally with the addition of hot water, and the precipitate, which consists of indirubin and a little indigotin together with impurities, is collected on asbestos, washed with dilute hydrochloric acid to remove mineral matter, with 1 per cent. alkali to dissolve Indigo Brown, and finally with 1 per cent. acetic acid solution. The crystalline residue is dried, sulphonated, and the solution of the mixed sulphonic acids analysed by means of the Duboscq colorimeter. The residual mixture of sand and crude indigotin is washed in the Soxhlet apparatus with hot 10 per cent. sulphuric acid, which removes indigo gluten and some mineral matter, and with water until free from acid; the residue is then dried and sulphonated in the ordinary manner, the product dissolved in water, the solution filtered, and titrated with permanganate or titanium trichloride. The accuracy of the process has been determined by an examination of mixtures of pure indigotin and indirubin, and the reliability of the colorimeter work, in respect of the amount of colouring matter present, by means of titanium chloride. The authors have also analysed certain special varieties of Java indigo and other indigos, and it was further pointed out that by this pyridine method a quantitative determination of Indigo Brown is also possible.

A. G. Perkin said that although the fact that dilute solutions of the indigotinsulphonic acids were decolorised by less permanganate than that required for the isatin reaction had been known for some time, the matter had not as yet been investigated. It was therefore apparent that the oxidation took place in two stages, and there was some possibility that the sulphonic acid of Kalb's (this J., 1909, 1189) dehydroindigotin might be produced in this manner. More striking in this respect were the sulphonic acids of indirubin, because under similar conditions the quantity of permanganate necessary for decolorisation was approximately only 75 per cent. of that calculated on the isatin equation. The primary product in the latter case was thus fairly stable in the presence of the oxidising agent, and attempts were being made to isolate it in the unsulphonated condition by the oxidation of indirubin itself.

Carthamine. T. Kametaka and A. G. Perkin. Chem. Soc. Proc., 1910, **26**, 181—182.

IT was suggested (this J., 1909, 1189) that carthamine, the colouring matter of safflower, possessed the formula $C_{15}H_{14}O_7$, rather than $C_{14}H_{16}O_7$, originally assigned to it by Schlieper (Annalen, 1846, **58**, 362), but further experiment now indicates that the much higher formula $C_{25}H_{24}O_{12}$ is most probably correct. Carthamine, when dried in the air, crystallises with $2H_2O$, gives with dilute alcoholic potassium acetate the salt $C_{25}H_{23}O_{12}K$, green, iridescent needles, and an amorphous benzoyl compound, probably $C_{25}H_{17}O_{12}(C_7H_5O)_7$, melting at 230—232°, has been obtained. Although Schlieper obtained a yellow substance, $C_{14}H_{14}O_9$, by boiling carthamine with alcohol, and Radcliffe (J. Soc. Dyers, 1897, **13**, 159) noticed a similar decomposition, experiment has failed to reproduce this. When carthamine is boiled with alcoholic aniline it gives a substance $C_{25}H_{24}O_{12},C_6H_7N$, long, yellow needles, melting and decomposing at 276—278°, soluble in alkalis with a yellow colour, and for which the name *aniline xantho-carthaminate* is proposed. β-Naphthylamine gives the compound $C_{25}H_{24}O_{12},C_{10}H_9N$, orange leaflets, melting and decomposing at 266—268°, and the corresponding derivative of ψ-cumidine forms orange leaflets, melting and decomposing at 290°. A molecular-weight determination of carthamine kindly carried out by Barger by his miscroscopic method gave M.W.=551, whereas the formula $C_{25}H_{24}O_{12}$ requires M.W.=516. With nitric acid, carthamine gives picric acid. When digested with boiling 50 per cent. potassium hydroxide, it yields *p*-coumaric acid and *p*-hydroxybenzaldehyde, and by the prolonged action of one per cent. alkali or strong baryta water is similarly decomposed. Hydrogen peroxide in presence of sodium carbonate also produces *p*-coumaric acid, and in a similar way the crude methylation product of carthamine yields with hydrogen peroxide, *p*-methoxycinnamic acid, and probably *p*-methoxycinnamaldehyde, and with chromic acid, anisaldehyde and anisic acid.

Congo blue and the preparation of Congo white; Investigation of ——. I. W. Fay, A. H. Tag, and M. G. Hawkins. Polytechnic Engineer (Polytechn. Inst., Brooklyn, U.S.A.), 1910, **10**, 21—32.

The authors find that the insoluble blue compound produced when a solution of Congo red is acidified, consists of the free acid. In order to precipitate the blue compound and leave a clear supernatant solution, excess of hydrochloric acid is necessary. On boiling the blue compound with aniline, two aniline salts are formed. One is insoluble in aniline and is a red amorphous substance which consists of the monoaniline salt, whilst the other which is insoluble in aniline, which is colourless ("Aniline Congo white") and is the dianiline salt.—J. C. C.

Colloids. The osmotic pressure of —— *II. Osmotic pressure of solutions of some dyestuffs.* W. Biltz and A. von Vegesack. Z. physik. Chem., 1910, **73**, 481—512.

From measurements of the osmotic pressure of Congo Red, Night Blue and Benzopurpurine, the authors find that the two former dyestuffs when in solution exist in the molecular state as well as in the form of their hydrolytic and electrolytic fission products. Congo Red and Benzopurpurine are associated in presence of electrolytes. Congo Red becomes only slightly more associated on keeping, but Night Blue and Benzopurpurine are considerably associated under these conditions. Polymerisation increases with the increased concentration of the solutions and also with the reduction of temperature.—J. C. C.

Patents.

Flavopurpurin; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 223,103, April 2, 1908. Addition to Ger. Pat. 205,097, Dec. 12, 1907 (see this J., 1909, 85).

Anthraflavic acid or anthraquinone-2·6-disulphonic acid is converted into flavopurpurin by heating under pressure with less than 20 parts of 30 to 50 per cent. alkali hydroxide solutions; solutions containing 20 per cent. of alkali or less may also be used.—T. F. B.

Anthracene colouring matters; Manufacture and employment of —— *and of intermediate products.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 13,907, June 14, 1909.

See Fr. Pat. 408,787 of 1909; this J., 1910, 621.—T. F. B.

Anthracene compound [*dye*] *and process of making it.* M. H. Isler, Mannheim, and H. Wolff, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 961,612, June 14, 1910.

See Addition of May 29, 1908, to Fr. Pat. 365,920 of 1906; this J., 1908, 1107.—T. F. B.

[*Triphenylmethane*] *dyestuffs; Manufacture of* ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,312, June 18, 1909.

See Addition of June 13, 1909, to Fr. Pat. 404,800 of 1909; this J., 1910, 412.—T. F. B.

Azo dye. O. Günther and L. Hesse, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Re-issue No. 13,121, dated June 14, 1910, of U.S. Pat. 921,105, May 11, 1909.

See Fr. Pat. 396,949 of 1908; this J., 1909, 596.—T. F. B.

Azo dye. O. Günther and L. Hesse, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Re-issue No. 13,122, dated June 14, 1910, of U.S. Pat. 921,239, May 11, 1909.

See Fr. Pat. 396,949 of 1908; this J., 1909, 596. T. F. B.

Azo dye; Green ——. J. Jansen and W. Neelmeier, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 961,354, June 14, 1910.

See Eng. Pat. 9908 of 1909; this J., 1910, 146.—T. F. B.

[*Azo*] *dyestuffs; Process for preparing new* ——, *and for developing them on the fibre.* Farbenfabr. vorm. F. Bayer und Co. Leuco. Fr. Pat. 411,599, Jan. 15, 1910. Under Int. Conv., Feb. 19, 1909.

See Eng. Pat. 11,253 of 1909; this J., 1910, 749.—T. F. B.

Leuco derivative of diethylgallocyanine. Gallocyanine dye. W. Lommel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 961,361 and 961,362, June 14, 1910.

See Eng. Pat. 20,905 of 1909; this J., 1910, 621.—T. F. B.

Vat dyes; Blue ——. W. Bauer, Vohwinkel, and A. Herre, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 961,396, 961,397, 961,398, and 961,399, June 14, 1910.

See Eng. Pat. 7819 of 1909; this J., 1910, 81.—T. F. B.

Dyestuffs of the oxazine series and their leuco-derivatives; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. First and Second Additions, dated Dec. 16, 1909, and Jan. 7, 1910, to Fr. Pat. 369,835, Sept. 18, 1906. Under Int. Conv., March 12, 1909.

See Eng. Pat. 20,905 of 1909; this J., 1910, 621.—T. F. B.

Sulphide dyestuffs; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 411,360, April 10, 1909.

See U.S. Pats. 934,302 and 934,303 of 1909; this J., 1909, 1082.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Wood pulp; Differences between cold-ground and hot-ground mechanical ——. E. Kirchner. Wochenbl. Papierfab., 1910, 41, 1995—2001.

Two systems of grinding wood for the manufacture of mechanical pulp are in vogue: the cold process of grinding consists in using a relatively low pressure and a large volume of spraying water, whilst in the hot process the logs are pressed very heavily against the stone and the quantity of water is so reduced that very high temperatures are attained at the surfaces of contact. The cold process yields a finely ground pulp, somewhat deficient in strength but serving admirably as a filling for stronger fibres, particularly in printing papers where smooth surface, flatness, regular thickness and "look-through," good density and regular shrinkage in the machine and cross directions of the sheet are required. But to ensure steady running in the manufacture and use of the paper, this pulp requires the admixture of a larger proportion of cellulose fibres than the hot-ground. By the latter process it is possible to prepare pulps with long and well isolated fibres, having almost the appearance of chemically-prepared pulps, but the fibres are less flexible than cellulose fibres. Such pulp is suitable for papers of medium quality, where economy of cellulose and a large out turn are primary considerations. It is also possible to prepare fine pulps by the hot process, and any intermediate types of pulp which may be required. The character of the pulp is controlled by many factors, *e.g.*, the hardness and "grain" of the stone, the nature of the ridges and points chipped on its surface, the quantity of water, the pressure (ranging from 200 to 5000 grms. per sq. cm.), circumferential speed, etc. The idea that hot-grinding requires more power than cold, is erroneous; the reverse is actually the case so far as equivalent types of product are concerned. In both cases it may be assumed that 40—60 per cent. of the power used is transformed into heat by friction at the grinding surface. In the cold process this heat is dissipated by the large volume of spraying water employed. In the hot process it is allowed to develop high temperatures and caused to do mechanical and chemical work. The sudden development of steam assists the disintegration by bursting apart the fibres, and exerts a chemically solvent or softening action on the ligneous matters by which they are held together.—J. F. B.

Rag pulp; Comparison between bleaching powder and electrolytic hypochlorite in bleaching ——. B. Fraass. Papierfabrikant, Fest- und Auslandsheft, 1910, **8**, 62.

The author records the results of some strictly comparative bleaching trials, with bleaching powder solution and electrolytic sodium hypochlorite solution, on rag pulps of different qualities. The concentration of the pulp was 5 per cent., and the charge of each engine was 330 kilos. of dry fibre-substance. The electrolytic liquor was slightly alkaline, but in all cases hydrochloric acid was added to the pulp during bleaching. The following numbers illustrate the economy effected by the use of the electrolytic liquor: Cotton-linen unions (*a*) bleaching powder, 4·29 kilos of active chlorine, 1050 c.c. of hydrochloric acid; (*b*) electrolytic liquor, 3·148 kilos. of active chlorine, 700 c.c. of acid. Light printed calicoes: (*a*) bleaching powder, 3·387 kilos. of chlorine, 800 c.c. of acid; (*b*) 2·032 kilos. of chlorine, 700 c.c. of acid. Trouserings (*a*) 11·037 kilos of chlorine, 4·5 litres of acid; (*b*) 8·301 kilos of chlorine, 4 litres of acid. It is remarked that in all cases the electrolytic liquor gave a brighter colour than the bleaching powder liquor; it also tended to give a softer fibre. Moreover, the pulp bleached with bleaching powder had an opportunity to undergo further bleaching whilst draining in the vats, whereas the pulp bleached by the electrolytic liquor was deprived of its residual chlorine by washing in the engine before discharging into the draining vats. The duration of the bleaching process in the engine was always the same. The electrolytic bleaching process was characterised by a relatively rapid start; the colour of the pulp then changed more slowly than in the case of that bleached with the bleaching powder solution, but later the electrolytic liquor regained the headway it had lost and its final result was superior.—J. F. B.

Cellulose; Hydration of —— in the beating process, and the nature of cellulose hydrates. J. F. Briggs. Papierfabrikant, Fest und Auslandsheft, 1910, **8**, 46—49.

The author deals with the hydration of cellulose during treatment in the papermaker's beater. He argues that the result is not a purely mechanical one and points out that the manufacture of paper depends on the specific chemico-physical relationships between cellulose and water. The water is not merely an inert suspending liquid, but enters into temporary combination with the cellulose, forming a hydrogel. The composition of the solid cellulose-water hydrogel, in presence of an excess of water, is capable of variation by mechanical or chemical means, and its control is an important factor in the production of the specific characters of the paper. As the duration of the beating process is increased, the proportion of water fixed in the solid phase of the hydrogel increases, the fibres swell, and become soft and "greasy." The hydration thus produced is to some extent reversible, and water may be expelled from the solid phase by heating the fluid pulp or by treatment with alcohol. Hydration is a colloidal phenomenon of adsorption or gel-formation between cellulose and water, and it is manifested in a progressive scale of graduated stages. The application of a molecular formula in terms of $mC_6H_{10}O_5,nH_2O$ to a cellulose hydrate has no meaning, since the proportion of water fixed in any state of equilibrium between solid liquid or gaseous phases depends on the external conditions and the previous history of the cellulose. Increased hydration, however produced, coincides with an increase in the "adsorption" capacity of the cellulose, *e.g.*, towards metallic hydroxides, dyestuffs, etc. Hygroscopic moisture is merely a special case of "adsorption" between solid-gaseous phases. Ordinary cotton cellulose is to be regarded as a cellulose hydrate of low degree of hydration it differs from highly hydrated celluloses only quantitatively not qualitatively. To explain the chemico-physical modifications observed as the result of progressive hydration, *e.g.*, increased "adsorption" capacity, the author assumes that hydration produces a sort of molecular surface distention, and that the hydrated cellulose never really regains its original degree of molecular compactness even when the hydration-water is entirely expelled and the product caused to resume the composition of $C_6H_{10}O_5$ by drying at high temperatures. The author shows that in addition to an increased adsorption capacity, hydrated celluloses are also characterised by the decreased viscosity of their solutions. He has prepared "viscose" solutions from the same sample of cotton, beaten for increasing periods, and found that the viscosities decreased as the hydration progressed.—J. F. B.

Paper; Surface dimensions of ——, and their variations. ——P. Klemm. Wochenbl. Papierfab., 1910, **41**, 1981—1985.

Paper undergoes expansion when moistened or stored in a moist atmosphere and shrinks again on drying. This property constitutes a serious source of inconvenience in many uses of paper, leading to "cockles," wavy edges and creases. Different types of paper show considerable differences in the amount of expansion on damping and in the distribution of the extension between the machine and cross directions of the sheet. It is the aim of the paper maker to keep the superficial variability of the paper as low as possible consistent with the production of the specific characters of the type of paper, and to contrive that the expansion shall be as nearly as possible equal in both directions. The author has instituted a series of determinations of the expansibility of various types of paper:—A piece 200 mm. square is cut by means of a template from the sheet of paper. This is floated on the surface of water until it is saturated and the air expelled; it is then totally immersed. The excess of moisture is next removed by blotting paper and the dimensions of the sheet are measured, the operation being repeated until no further expansion is recorded. The paper is then allowed to dry with full liberty to contract freely, in an atmosphere containing 65 per cent. of saturation-humidity, until constant dimensions are attained. Lastly it is dried at 100° C., and again measured. These observations give, for the machine and cross directions of the sheet respectively, the percentage elongation on damping, the percentage contraction (from the original dimensions on re-drying in the air and on re-drying at 100° C., the total range of variation and the ratio of variation between the two main directions of the sheet. The last-mentioned ratio is of considerable importance, especially in the case of lithographic papers which have to show accurate register of the different colours. It rarely approximates to 1 : 1 in the case of ordinary machine-made papers, but a ratio of 2 : 1 is fairly satisfactory for multicolour work. The total range of variation between saturated and re-dried (air dry) dimensions rarely falls below 0·5 per cent. for the machine direction and 1 per cent. for the cross direction, and these values may be regarded as satisfactory standards for lithographic work.—J. F. B.

Sulphite cellulose waste lyes; Transport of concentrated —— on German railways. Badermann. Z. angew. Chem., 1910, **23**, 1216—1217.

The German railway authorities have decided to recommend the inclusion of concentrated waste lyes from the manufacture of sulphite wood pulp among the substances suitable for transportation in tank-wagons. This concession has been made at the instance of the "Pionier" mill at Walsum on Rhine, which is producing a solid form of these lyes, under the name of "Zellpech," as well as a thick syrupy product, which is not so concentrated, and which at present is transported in iron drums. The value of the fluid is only M. 2—2·5 per 100 kilos., 1s. 1d. to 1s. 4d. per cwt.), and whereas the Walsum mill in 1908 dispatched 1830 tons of solid "Zellpech," it only disposed of 150 tons of the fluid. On the other hand, the fluid material is more suitable for use in the briquette industry than the solid, and it is hoped that increased transport facilities will lead to its extended employment. The "Pionier" factory expects to dispatch 35 tons daily of this fluid to a briquette mill in the current year.—J. F. B.

Purification of textile and other factory wastes. Stabler and Pratt. *See* XIXB.

PATENTS.

Wood pulp; Machine (blow-pit) for use in manufacture of soda and sulphite ——. P. B. Palmer, Orono, Me. U.S. Pat. 956,728, May 3, 1910.

THE invention relates to the construction of a blow-pit into which the pulp is blown under pressure from the digesters for the purpose of draining and washing. The blow pit consists of a horizontal cylindrical structure made of planks supported by heavy bands of metal. Along the lower portion of the horizontal cylinder, a false bottom is fitted to act as a filter through which the waste lye may drain away. This filter is constructed of planks pierced with small holes or of cocoa matting. From the upper portion of the cylinder is suspended a heavy metal plate or target against which the pulp is blown and which serves to break up any coherent particles of digested wood. A vent pipe is provided at a considerable distance from this target.—J. F. B.

Wood, straw and esparto; Preparation of akaline lyes for the digestion of ——. M. Müller. Ger. Pat. 221,366, Nov. 24, 1908.

IN the manufacture of cellulose by the alkaline process, the losses of alkali are made good by the addition of sodium sulphate to the waste lye in the course of the recovery process. A considerable proportion of this sulphate, however, escapes conversion into sulphide and subsequent causticising, and is carried round in the cycle of operations as useless ballast. It is known that sodium sulphate may be causticised by strontium hydroxide, but it is now found that if the sodium sulphate usually added be partially replaced by strontium sulphate, the production of a high degree of causticity is facilitated and a considerable economy of alkali is effected. The quantity of strontium sulphate used, should be at least 10 per cent. of that of the sodium sulphate usually employed. It is added in the form of ground native sulphate or precipitated mud, to the black lye in the last stages of the concentration process. The mixture then passes through the roasting furnace and the fused ash is dissolved in boiling water and boiled in a closed vessel under pressure. At this stage the lye undergoes a preliminary causticising, the sodium sulphate reacting with the strontium hydroxide produced in the roasting process. Afterwards causticising is completed in the ordinary way by boiling with lime. The insoluble residue of strontium sulphate, which is left after the preliminary causticising, is returned to the black lye and again performs the same functions. The strontia process may also be used for limiting the proportion of sodium sulphide in the lye, and thus reducing its odour. For this purpose, the sodium sulphate is not added to the black lye as it goes to the furnace, but is causticised separately by the strontium hydroxide prepared in the manner described and the precipitated strontium sulphate is fed with the lye into the furnace as mentioned above.—J. F. B.

Xylonite or celluloid for manufacture of combs, etc; Preparation of ——. G. E. Wells, Chingford, and British Xylonite Co., Walthamstow. Eng. Pat. 14,016, June 15, 1909.

IN the manufacture of combs and similar articles in which a large number of transverse cuts or slits have to be made, the celluloid is prepared in the usual manner and a portion only of the solvent is driven off by heat, so as to obtain a "half-seasoned" product which is then moulded into the shapes desired. Thus the celluloid is sufficiently seasoned to retain the shapes impressed upon it and yet it does not become brittle like fully seasoned celluloid. —J. F. B.

Pryoxylin compound. W. G. Lindsay, New York. U.S. Pat. 961,360, June 14, 1910.

A PYROXYLIN compound which is practically inodorous is obtained by combining nitrocellulose with benzyl benzoate.—J. F. B.

Fibrous materials; Manufacture of blocks, slabs, plates and the like from ——. E. Klewitz, Bejitza, Russia. Eng. Pat. 27,800, Nov. 29, 1909

THE beaten fibrous materials are heated by means of steam or boiling water, and the hydraulic binding agents, such as cement and the like, are then added, and the mass is intimately mixed and spread on the wire of cardboard or paper-making machines in the usual manner.—W. C. H.

Cellulose objects [fibres, etc.]; Preparation of lustrous —— from cuprammonium cellulose solutions. Hanauer Kunstseidefabrik. Ger. Pat. 222,893, May 31, 1908.

THE use of ammonium salts (*e.g.*, the sulphate) is claimed for precipitating cellulose from its cuprammonium solutions. The fibres, etc., thus obtained are completely freed from copper by washing with dilute acetic acid, and they may be rendered stronger and more lustrous by subsequent treatment with alkali.—T. F. B.

Fibrous or cellular materials; Treatment of ——. J. H. Ketcheson, St. Louis, U.S.A. Eng. Pat. 22,111, Sept. 28, 1909.

SEE Fr. Pat. 407,616 of 1909; this J., 1910, 559.—T. F. B.

Storing inflammable solutions [collodion]; Process for ——. C. Martini, Berlin. U.S. Pat. 962,036, June 21, 1910.

SEE Eng. Pat. 19,692 of 1909; this J., 1910, 337.—T. F. B.

Cellulose acetate; Process for making sheets or objects of ——. H. J. G. Reeser. Fr. Pat. 411,126, Dec. 18, 1909. Under Int. Conv., June 2, 1909.

SEE Eng. Pat. 12,976 of 1909; this J., 1910, 147.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Colours; New fast —— produced by oxidation on the fibre. H. Schmid. Bull. Soc. Ind. Mulhouse, 1910, 80, 127—132.

THE author has previously shown that Paraphenylenediamine (or Paramine) Brown is produced on cotton by oxidising the base on the fibre, also that a range of green, olive and brown shades are obtained by oxidising aminophenols (this J., 1906, 370; 1909, 88). A series of browns and olives are also obtained by oxidising mixtures of a diamine and an aminophenol. A good imitation of *Manganese Bistre* is thus produced, by steaming tissues padded or printed with the following mixture (grms. per litre): 10·5—11 grms. of Paramine extra (B.A.S.F.), 4—7 grms. of Fuscamine G. (B.A.S.F.), 20 grms. each of sodium chlorate and ammonium chloride, 1—1·5 grm. of Rongalite C, and 0·015—0·02 grm. of ammonium vanadate. The following examples are given of the use of potassium ferrocyanide

In place of the vanadate; it is found that with the former the baths keep better, the fabrics, after padding, colour less in the hot flue (or can be dried on the cylinder) and better whites are obtained. *Paramine Brown:* 12—15 grms. of Paramine extra, 20 grms. each of sodium chlorate and ammonium chloride, 5—20 grms. of potassium ferrocyanide. *Greenish-olive:* 5 grms. of Paramine extra, 15—20 grms. of Fuscamine G., 20 grms. each of sodium chlorate and ammonium chloride, 10 grms. of potassium ferrocyanide. *Paramine Black:* 25—30 grms. of Paramine extra (or 25 grms. of Paramine and 5 grms. of Fuscamine), 35 grms. each of sodium chlorate and ammonium chloride, 40 grms. of potassium ferrocyanide. Water to make 1 litre in all cases; pad, dry, steam for 10 min., wash and soap. The black stands a moderate soaping, but strong alkalis turn it brownish: It has, however, the advantage over Aniline Black in being ungreenable and in not affecting the fibre. With the above olive, coloured effects can be obtained as with Prudhomme's Black.—A. SBLD.

Turkey-Red: Clearing of —— after dyeing, by superheated water. A. Scheurer. Sealed Note No. 350, dated May 6, 1882. Bull. Soc. Ind. Mulhouse, 1910, **80**, 133—134.

IT is stated that the usual progress of clearing Turkey-Reds after dyeing, by padding in sodium sulpholeate, drying and steaming, can be replaced by simply heating with water at 120° C. It is found that the temperature at which water gives the maximum amount of clearing (120° C. for 2 hours) is that at which a similarly fixed mordant (but not dyed) is completely dehydrated; it is then attacked with difficulty by acids, and no longer attracts colouring matters. —A. SBLD.

Dyed shades; The action of light upon —— and a proposal for a standard method of testing. K. Gebhard. J. Soc. Dyers and Col., 1910, **26**, 173—178. (See also this J., 1909, 304, 1004; 1910, 84, 691.)

THE factors which must be taken into account in testing the fastness of dyed shades to light are the atmosphere, the source of light, and the nature of the dyed fibre. It is mainly the oxygen in the air which is responsible for the fading, the moisture, acid, or alkali contents of the atmosphere only influencing the rate at which fading proceeds. A pure atmosphere with a definite moisture content is stated to be one of the chief considerations to be aimed at in any standard test. As regards the source of light, the author suggests a combination of an arc lamp and a quartz-mercury vapour lamp, the one giving a light rich in rays of long wave length, the other rich in ultra-violet rays. The patterns are exposed in a circular apparatus (a sketch of which is given) and to assist in determining the amount of change which has occurred in a given time, they are photographed through suitable colour screens, the negatives developed in a standard manner and the difference between the photograph of the unexposed and exposed pattern expressed in terms of a graduated, standard scale of grey.—F. M.

Purification of textile and other factory wastes. Stabler and Pratt. *See* XIXB.

PATENTS.

Bleaching processes; Method of treating alkaline fluids after use in —— in the manufacture of cotton or cotton goods. H. Keller, Stuttgart, Germany. Eng. Pat. 13,790, June 11, 1909.

CLAIM is made for the process of clarifying and recausticising waste caustic liquors by the use of lime.—F. M.

Dyeing machine. T. F. and A. Naylor, Kidderminster. Eng. Pat. 13,276, June 7, 1909.

THE invention relates to the mechanical manipulation of hanks in the dye-vat. The apparatus consists of a vat with a suitable number of rollers, *e.g.*, five, placed longitudinally, supported in bearings on the upper edges of the vat. The rollers are geared together by wheels on the spindles at one end, so that the rotation of the middle roller revolves the others. The middle roller carries a spur wheel on i spindle at the other end; this spur wheel is rotated by pinion revolving loosely on the spindle of the next roll and operated by a windlass. The frame carrying tl bearings of the rollers can be raised above the vat lowered into the vat by means of chains passing ov chainwheels situated above and operated by a spur ar pinion, which are rotated by means of an endless ro passing over a pulley. A clutch is fixed on the wall of tl vat to hold this rope in any position desired. Means a provided for supporting the rollers in their elevat position when the frame containing the bearings is mov away for placing the hanks of yarn on the rollers.—J. F.

Wool dyeing; Apparatus for ——. T. H. Daniels, Ma chester. Eng. Pat. 18,481, Aug. 11, 1909.

THE claim refers to rotary machines of the Klaude Weldon type, the improvements permitting of the dyei of loose cotton and wool, etc. A hollow box or cage constructed in each compartment and the loose wool bei packed around these, open spaces are left which assist in tl circulation of the dye-liquors through the material. Tl cage also tends to keep the loose material in positi and there is less liability to felting.—F. M.

Cops, cheeses, warps, etc.: Extraction of moisture from — after treatment in bleaching and dyeing. J. Cox, Coln Eng. Pat. 27,431, Nov. 25, 1909.

THE spindles upon which the cops are wound are fixed trays and arranged in vacuum boxes, which are connect by wide bore pipes with a vacuum cylinder. This is co nected by a narrower pipe with a larger one, which ac as a reserve and prevents the vacuum falling too mu when the taps of the vacuum boxes are opened for a f seconds.—F. M.

Printing plates; Process for preparing iron planograp ——. H. Sefton-Jones, London. From C. J. Roed Ges. m.b.H., Leipsic, Germany. Eng. Pat. 29,5 Dec. 16, 1909.

THE plates are treated with a slightly acid solution, th imprinted with a grease colour, and etched with a soluti containing acids or acid salts of phosphorus, arsen fluorine, chromium, manganese, etc.—F. M.

Wool and woollen goods; The scouring of ——. Schmid, Basle, Switzerland. Eng. Pat. 30,507, Dec. 1909.

SEE Fr. Pat. 407,596 of 1909; this J., 1910, 558.—T. F.

Wool; Apparatus for removing the grease and yolk from — R. Vandatte and B. Lagye, Antwerp. U.S. P 961,468, June 14, 1910.

SEE Fr. Pat. 399,875 of 1909; this J., 1909, 934.—T. F.

Dyeing yarn or the like. F. H. Daniell, Franklin, N.H., a J. C. Hebden, Providence, R.I., U.S.A. Eng. P 26,026, Nov. 10, 1909.

SEE Fr. Pat. 408,480 of 1909; this J., 1910, 623.—T. F.

Dyeing acetylcellulose. E. Knoevenagel, Heidelberg, G many. U.S. Pat. 961,241, June 14, 1910.

SEE Fr. Pat. 383,636 of 1907; this J., 1908, 332.—T. F.

Dyeing; Process of —— and product thereof. R. O Assignor to Farbenfabr. vorm. F. Bayer und Co., Elb feld, Germany. U.S. Pat. 961,368, June 14, 1910.

SEE Ger. Pat. 208,845 of 1908; this J., 1909, 519.—T. F.

Printing effects on fabrics; Process for producing — L. Cassella und Co. Fr. Pat. 410,977, March 26, 190

SEE Eng. Pat. 7734 of 1909; this J., 1910, 19.—T. F. B.

[Electrolytically] producing a disinfecting and deodorising compound applicable also for bleaching. Eng. Pats. 8270 and 10,911. *See* XIXb.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Caro's acid and persulphuric acid; Synthesis of ——. J. D'Ans and W. Friedrich. Ber., 1910, **43**, 1880—1882.

By treating well cooled chlorosulphonic acid gradually with the calculated quantity of anhydrous hydrogen peroxide (compare Ahrle, this J., 1909, 363), Caro's acid and persulphuric acid, can both be prepared in accordance with the equations :—

$$(1)\ HO.SO_2.Cl + H_2O_2 = HO.SO_2.O.OH + HCl;$$
$$(2)\ 2HO.SO_2.Cl + H_2O_2 = H_2S_2O_8 + 2HCl.$$

When the evolution of hydrochloric acid appears to be complete, the mixture is allowed to gradually become warmer, and the dissolved hydrochloric acid is removed by the acid of the pump. The residual crystalline acid is best freed from mother liquor in a centrifugal apparatus. Caro's acid melts at about 45° C. with slight decomposition. When quite dry it can be kept for several days without decomposition, but gradually loses oxygen. Persulphuric acid melts somewhat above 60° C. with slight decomposition.—A. S.

Salt industry in France. P. Martell. Kali, 1910, **4**, 212—219. Chem.-Zeit., 1910, **34**, Rep. 314—315.

SALT works are found in 18 out of the 87 departments of France. These works may be grouped into the four main divisions :—(1) Eastern rock and bay salt works; (2) South-western rock and bay salt works; (3) Southern; and (4) Western sea-salt works. The most important are those belonging to the first group, and especially those in the Dept. Meurthe-et-Moselle, where in 1905 only three out of 22 salt works were idle. In most of these works borings are made, and Bergmann's process has not come into general use. The oldest and largest works are those of Rosières-Varangéville, where the salt is obtained by means of a shaft 120 m. in depth, and where blasting with compressed gunpowder is used. The rock salt is of a light grey or red colour, and, being exceptionally pure, is in demand for the soda industry. The works also produce salt by Cantenot's process. A blast of hot air derived from the fire gases is passed through a tower of tiles, and coming into contact with the finely divided brine, yields a fine deposit of salt, which is used for table purposes. Of the 12 concessions in Franche-Comté, seven are still working, whilst in the South-western group salt is produced in the departments Haute-Garonnes, Ariège, Basses-Pyrénés and Landes, where there are 25 concessions, some of which, however, are not being worked. The commercial importance of the Southern group of salt-works is far behind that of the Eastern works. Together the two groups produced in 1905 from 235 plants, 679,864 tons (metric) of salt. The sea-salt works, as in Italy, have a large output. All the departments (excepting Alpes-Maritimes) on the Mediterranean coast have sea-salt works. The best known are the Peccais works in Gard with an area of 2500 hectares (6180 acres), yielding on the average only 16 to 17 tons per hectare (6·4—6·8 tons per acre). With more energetic working the output might be trebled or quadrupled. The most important works are those of the Comp. des Produits Chim. d'Alais et de la Camargue at the mouth of the Rhone. The works of Giraud now employ the vacuum apparatus of the Swiss Schweizerhalle works, and work up the excess of salt into ammonia-soda. Magnesium and potassium chlorides are also produced in these works. The potassium chloride found in the form of carnallite is utilised in agriculture, whilst a part of it is manufactured in Salindres into potassium chlorate. The French Mediterranean salt works number about 25, but they do only a small business. The crystallisation tanks are rectangular and have wooden sides about 50 to 60 m. in length. A plant usually comprises evaporation tanks about 250 hectares (618 acres) in area for lyes of 3·5° to 8° Bé.; concentration tanks of 40 hectares (99 acres) for lyes of 8° to 24° Bé; and crystallisation tanks of 32 hectares (79 acres) for lyes of 24° to 32° Bé. About 40 days are required to attain this degree of concentration. The salt layer to be worked up contains about 55 to 70 kilos per square m. In the Southern salt works from 30·6 to 59·7 tons (metr.) of salt are obtained per hectare of area (12·4—23·7 tons per acre), whilst in Corsica the corresponding yield is 173·3 tons (metr.). Since 1865 the business of these works has been in the hands of a syndicate. The Western salt works on the coast of the Atlantic extend over a number of departments, but their output does not compare favourably with that of the Southern works, in spite of the advantage they possess in having the sea-water raised by the flow of the tide instead of by pumping. In 1905 there were 4018 sea-salt works on the Atlantic coast, with an area of 10,133 hectares (25,030 acres). This great distribution of the industry has naturally created unsound industrial conditions in many respects. The yield of salt per 1 hectare in the Atlantic salt works ranges from 1·5 to 27·9 tons (0·6—11·1 tons per acre), and is thus considerably inferior to the output of the Mediterranean works. The chief towns for the export of salt are Marseilles and Cette, whilst the export trade is principally with Belgium, Switzerland, Algiers, and Madagascar.—C. A. M.

Oxides of metals; Initial temperatures at which —— give up oxygen to reducing gases. I. W. Fay, A. F. Seeker, F. H. Lane and G. E. Ferguson. Polytechnic Engineer (Polytechn. Inst., Brooklyn, U.S.A.), 1910, **10**, 72—79.

THE authors have submitted various metallic oxides to the action of hydrogen, carbon monoxide, ammonia, and methane, at various temperatures, for a period of 6 hours and have ascertained the lowest temperatures at which the oxides begin to lose oxygen. The following results were obtained :—

Oxide.	Carbon monoxide.	Hydrogen.	Ammonia.	Methane.
	° C.	° C.	° C.	° C.
Au_2O_3	0° and below	0° and below	—	—
Ag_2O	0°	0°	—	—
Hg_2O	0°	80°	67°	220
HgO (yellow)	0° and below	50°	—	—
HgO (red)	90°	115°	157°	200—210°
Pb_2O	—	—	202°	202°
PbO_2	110°	150°	198°	45°
Pb_3O_4	150°	170°	above 300°	158°
PbO	160°	190°	299°	210°
CuO	75°	125°	225°	280°
Cu_2O	—	—	208°	230°
CoO	140°	—	—	—
ZnO	170°	—	233°	152—159°
As_2O_3	60°	—	—	—

—J. C. C.

Vinasse; Preparation of calcium tartrate from the —— obtained from dried grapes. C. Béis. Bull. Assoc. Chim. Sucr. et Dist., 1910, **27**, 1202—1206.

THE acids of the vinasse from dried grapes may be divided into two classes, *viz.*, those which form calcium salts that are relatively soluble in cold water, and those which form calcium salts practically insoluble in this medium. In what follows, the acidity due to the former class is referred to as "malic acidity," whilst the acidity due to acids of the latter class, excepting tartaric acid and potassium bitartrate, is referred to as "pectotannic acidity." In preparing calcium tartrate from the vinasse, the neutralisation of the latter with lime is based on the following considerations :—(1) The whole of the tartaric acid must be neutralised. (2) If, as is usually the case, the malic acidity is greater than that due to potassium bitartrate, a quantity of the former, at least equal to the latter, must be neutralised. (3) The amount of malic acidity left unneutralised, must

not exceed half the acidity due to potassium bitartrate. (4) The whole of the pectotannic acidity must be left unneutralised. (5) If the malic acidity is less than that due to potassium bitartrate, the deficit must be made good by addition of sulphuric, or better, hydrochloric acid. The author uses the following methods for making the requisite determinations of the acid constituents of vinasse from dried grapes:—A. *Total acidity.*—This is determined in the usual way, with phenolphthalein as indicator. B. *Potassium bitartrate.*—50 c.c. of the vinasse are rapidly concentrated to 5 c.c., then treated with 2·5 c.c. of glacial acetic acid, and stirred for some minutes; 12 c.c. of 96 per cent. alcohol are now added slowly, with constant stirring. When the liquid has become clear, it is filtered; the precipitate is washed, first with 15 c.c. of 65 per cent. alcohol, and then with 96 per cent. alcohol until the alcohol that passes through is no longer acid. The acidity of the precipitate is then determined, with phenolphthalein as indicator, nine-tenths of the value obtained being taken to be due to potassium bitartrate. C. *Free tartaric acid.*—50 c.c. of the vinasse are treated with a quantity of potassium acetate about equivalent to one-tenth of the total acid; if the dried grapes from which the vinasse is derived were very acid, a larger quantity of potassium acetate may be used. The rest of the procedure is the same as that described under B. The acidity of the precipitate, diminished by that found for the bitartrate, and multiplied by 2, gives the amount of free tartaric acid. D. *Pectotannic acidity.*—10 c.c. of the vinasse are treated with about nine-tenths of the volume of lime-water required for complete neutralisation, and the mixture is heated to boiling. If a blackish precipitate forms, the experiment is repeated, the amount of lime-water used being diminished by 1 c.c.: if a blackish precipitate is not formed, the same solution is treated with 1 c.c. more of the lime-water; this procedure is continued until the quantity of lime-water, with which the blackish precipitate begins to appear, is determined. If, say, 30 cc. of lime-water are required for this, and 35 c.c. of the lime-water are required to neutralise the 10 c.c. of vinasse completely, the pectotannic acidity corresponds to (35—30)=5 c.c. of the lime-water used. E. *Malic acidity.*—This is represented by the difference between the total acidity and the sum of the pectotannic acidity and the acidities due to free tartaric acid and potassium bitartrate.
—L. E.

Tartaric acid factories and refineries; Mother liquors from ——. P. Carles. Bull. Soc. Chim., 1910, **7**, 583—586.

THE following methods are suggested for determining the amount of tartaric acid in mother liquors which have become loaded with impurities. The salts of iron and calcium can be precipitated in the hot liquid by means of potassium carbonate, and the filtrate acidified with acetic acid. The crystals are removed when cold, washed with a solution saturated with potassium chloride and bitartrate, and weighed. The liquor can be treated with potassium ferrocyanide, and filtered. The tartaric acid can then be completely precipitated by boiling and adding chalk. The latter method can be applied in order to recover tartaric acid from old mother liquors (see this J., 1910, 694).—F. SHDN.

Tantalum sulphide. H. Biltz and C. Kircher. Ber., 1910, **43**, 1636—1645.

HYDROGEN sulphide, and also carbon bisulphide vapour carried by means of hydrogen sulphide, were passed over tantalum pentoxide at various temperatures. At no temperature was there any sensible reaction with hydrogen sulphide. Carbon bisulphide begins to react at 650° C., and at temperatures above 900° C. reaction is complete, and pure tantalum sulphide, having the formula, TaS_2, is obtained. This substance is stable at 1300° C., and begins at 1200° C. to be transformed into crystals, probably by gradual sublimation. It readily absorbs traces of moisture, which it obstinately retains.—J. T. D.

Amorphous mineral substances; Transformation of —— into crystalline products. C. Doelter. Tschermak's min. u. petr. Mitt., [2], **28**, 557—559. Chem. Zentr., 1910, **2**, 37.

MOST amorphous precipitates become crystalline when digested with water at 60°—70° C., or when agitated with water for some weeks. In one or both of these ways crystalline products were obtained from arsenic trisulphide, antimony trisulphide, and hydrosols of selenium, iron, aluminium, and manganese.—A. S.

Sulphur chloride and thionyl chloride; Action of hydrogen on —— under the influence of the electrical discharge A Besson and L. Fournier. Comptes rend., 1910 **150**, 1752—1754.

WHEN sulphur monochloride mixed with hydrogen was exposed to the electrical discharge, it was completely decomposed, yielding sulphur and hydrochloric acid Also, even without the action of the electrica discharge, sulphur monochloride was reduced by hydrogen with formation of sulphur. By the action of heat (even at the boiling point, and more markedly at 170°—180° C.) sulphur monochloride was decomposed into sulphur dichloride and sulphur. When a mixture of thiony chloride and hydrogen was exposed to the electrica discharge, sulphur monochloride, sulphur, sulphur dioxide and hydrochloric acid were detected in the reaction product. Sulphur dioxide and sulphur monochloride under the influence of the electrical discharge yielded thionyl chloride, a small quantity of sulphuryl chloride and sulphur. Under the influence of heat, sulphur dioxide and sulphur monochloride yielded thionyl chloride and sulphur.—A. S.

Determination of barium sulphate in the presence of substances which affect the result. Van't Kruys. *See* XXIII

Volumetric determination of combined sulphuric acid Roemer. *See* XXIII.

PATENTS.

Formates; Manufacture of alkali ——. W. H. H. Norris Winnington, Cheshire. Eng. Pat. 4684, Feb. 24, 1910.

IN the manufacture of alkali formate by the action o carbon monoxide on solid caustic alkali, at a temperature below that at which the formate is decomposed, say 160° C. the addition of ferric oxide to the caustic alkali is claimed as causing catalytic action and greatly increasing the speed of the reaction.—O. R.

Oxalates; Method of precipitating alkaline earth —— O. Imray, London. From Soc. of Chem. Ind., Basle Switzerland. Eng. Pat. 7092, March 21, 1910.

ALKALINE-EARTH oxalates are precipitated quantitatively when alkali oxalates are treated with an aqueous solution of a sulphide, sulphydrate, or polysulphide of an alkaline earth metal.—O. R.

Hydrosulphites; Manufacture of anhydrous ——. Ges für Chem. Industrie, Basle, Switzerland. Eng. Pat 9848, April 22, 1910. Under Int. Conv., Nov. 26, 1909.

HYDROSULPHITES containing water of crystallisation are dehydrated by means of a sodium alcoholate (methylate ethylate).—O. R.

Sulphur chloride [dichloride]; Manufacture of ——. W. O Quayle, Wilmington, Del., Assignor to The Midland Chem. Co., Midland, Mich. U.S. Pat. 961,530, June 14 1910.

GASES containing chlorine are passed through a solution of sulphur monochloride and sulphur, and the escaping vapours, containing any unabsorbed chlorine or vaporised sulphur dichloride, are passed over solid sulphur and thereby absorbed.—O. R.

Nitrogen oxides; Process for obtaining —— by combustion of nitrogen. K. von Vietinghoff-Scheel. Ger. Pat 222,629, Nov. 13, 1908.

THE patent relates to the process of obtaining nitrogen oxides by the combustion of substances containing carbon or hydrogen, or both, in a mixture of nitrogen and exces of oxygen. The yield of nitrogen oxides is stated to be increased by blowing into the reaction-chamber finely-powdered or gaseous catalytic agents. Among the catalytic agents mentioned are calcium and sodium fluorides, certain metals and metallic oxides, silica, sodium-ethyl, nickel carbonyl, and silicon chloride.—A. S.

Nitric acid ; Process for concentrating ——. E. Brauer. Ger. Pat. 222,680, June 17, 1909.

The claim is for the use of phosphoric acid or of arsenic acid, alone or mixed together, or in presence of their salts, as dehydrating agents in the concentration of nitric acid. For example, if a mixture of 50 kilos. of 65 per cent. nitric acid be distilled with 100 kilos. of arsenic acid, the first fraction has a concentration of 97 per cent., whilst 36 per cent. of the whole can be obtained at a concentration of 94 per cent., and the remaining 14 per cent. at a concentration of 47 per cent.—A. S.

Stannic chloride ; Process for the preparation of —— from tin oxide. R. Steiger. Ger. Pat. 222,838, May 4, 1909.

Finely-powdered tin oxide or tin ore is intimately mixed with wood charcoal in the proportion of two atoms of carbon to one molecule of tin oxide, and then subjected to the action of a mixture of equal volumes of carbon monoxide and chlorine at a temperature of 250°—350° C. The method is applicable to the recovery of stannic chloride from the tin residues from silk dyeing.—A. S.

Nitrites ; Process for the conversion of —— into nitrates by means of nitric acid. Badische Anilin und Soda Fabrik. Ger. Pat. 223,026, July 31, 1909. Addition to Ger. Pat. 220,539, Feb. 16, 1909.

According to the chief patent (this J., 1910, 565), nitrites or mixtures of nitrites and nitrates were converted into nitrates by treatment with nitric acid, the nitrous fumes evolved being mixed with oxygen or a gaseous mixture containing oxygen and then absorbed. In the process it is necessary that the solution be kept slightly acid, and in order that this may be effected even when the proportion of nitrite is variable, it is proposed, according to the present patent, to mix the nitric acid recovered by absorption from the nitrous fumes with a small excess of nitric acid, and use it for the treatment of a further quantity of the mixture containing nitrite or nitrite and nitrate. In this way the process may be worked continuously, the supply of nitric acid being regulated essentially by the nitrite content of the mixture.—A. S.

Zinc hydrosulphite and sodium sulphite ; Manufacture of a double compound of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,313, June 18, 1909.

See Ger. Pat. 217,038 of 1909 ; this J., 1910, 152.—T. F. B.

Hydrosulphite compound and process of making same. A. Weindel, Mülheim, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 961,391, June 14, 1910.

See Ger. Pat. 217,038 of 1909 ; this J., 1910, 152.—T. F. B.

Formaldehyde sulphoxylic acid ; Manufacture of derivatives of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 24,709, Oct. 27, 1909.

See Addition of Nov. 4, 1909, to Fr. Pat. 350,607 of 1905 ; this J., 1910, 757.—T. F. B.

Carbon or carbonaceous material ; Manufacture of highly absorbent or porous ——. R. Goldstein and W. Hampe, Berlin. Eng. Pat. 17,914, Aug. 3, 1909.

See Ger. Pat. 213,828 of 1907 ; this J., 1909, 1199.—T.F.B.

Nitric acid ; Process of making ——. F. Häusser, Kaiserslautern, Germany. U.S. Pat. 961,350, June 14, 1910.

EE Fr. Pat. 366,604 of 1906 ; this J., 1906, 1045.—T. F. B.

Alkali thiosulphates ; Process of making ——. L. Destree, Haren, Belgium. U.S. Pat. 961,760, June 21, 1910.

See Ger. Pat. 208,633 of 1908 ; this J., 1909, 473.—T. F. B.

Bicarbonate of soda ; Method of manufacture of ——. R. H. F. Finlay, Belfast. U.S. Pat. 961,945, June 21, 1910.

See Eng. Pat. 16,853 of 1907 ; this J., 1908, 898.—T. F. B.

Silicon nitride ; Process of making ——. A. Sinding-Larsen, Christiania. U.S. Pat. 962,170, June 21, 1910.

See Eng. Pat. 3732 of 1909 ; this J., 1910, 24.—T. F. B.

Aluminium nitride ; Process for making ——. O. Serpek. Fr. Pat. 411,031. April 1, 1909.

See Eng. Pat. 7507 of 1909 ; this J., 1910, 277.—T. F. B.

Dolomite ; Process for treating ——. J. Gathy. Fr. Pat. 411,396, Jan. 8, 1910. Under Int. Conv., Jan. 12, 1909.

See Eng. Pat. 779 of 1910 ; this J., 1910, 816.—T. F. B.

Ammoniacal copper oxide solution ; Processes for producing an ——. British Cellulose Synd., Ltd., and V. E. Mertz. Fr. Pat. 411,592, Jan. 15, 1910. Under Int. Conv., Jan. 16, 1909.

See Eng. Pat. 1148 of 1909 ; this J., 1910, 24.—T. F. B.

Purifying gas and recovering ammonia, etc., therefrom and utilising by-product metallic salts [iron pickling liquor] and ammoniacal liquor. U.S. Pats. 961,763 and 961,764. *See* IIa.

Method of heating carbon. U.S. Pat. 961,912. *See* XI.

IX.—BUILDING MATERIALS.

Fires : effects on building material and permanent elimination. F. B. Gilbreth. Amer. Soc. Mech. Eng. Times, Eng., Suppl., July 6, 1910.

The author remarked that in this age of "conservation" it was amazing that so little had been done to prevent destruction by fire, and to apply the lessons which were taught by every great fire. All great fires were alike; building material behaved the same in the case of fire, whatever the location. The building of the Mutual Life Insurance Company at San Francisco was a steel frame structure, eight storeys high, of the best construction in 1892, when it was erected. The laying up and filling of the joints in the brick, stone, and terra cotta were as nearly perfect as possible. The exterior wall completely enclosed the steel frame, which was put together with bolted connections. The floors were of hollow terra cotta flat arches, and the partitions were hollow terra-cotta blocks. The damage to the building, which necessitated the removal of the six upper storeys, was practically all done by fire. This building was excellent for an illustration, because it showed the good and bad points of many different kinds of incombustible materials which were used in its construction. The lessons from this and from all fires pointed to the conclusions that no structure of the future should either be built of wood or should contain any wood. A very small quantity of wood in a so-called "fireproof" building almost entirely of noncombustible materials would furnish sufficient heat to destroy it. Concrete construction was the best form for the elimination of fires, because the amount of damage done by fire in a concrete building depended upon circumstances which were within control and were predeterminable. With concrete made of properly selected fire-resisting materials practically no damage was done, except by prolonged high temperature. The results of recent tests by I. H. Woolson and J. S. Macgregor proved conclusively that a properly-designed concrete building, with as few projecting corners as possible, would withstand long periods of the hottest hard-wood fires, with no resulting damage that could not be repaired with mortar. These tests were carried out on full-sized rooms with walls of concrete made of different kinds of material. Concrete for walls could be poured in metal moulds with sufficient accuracy to permit of painting or wall-papering without further plastering or smoothing, which meant that the best of this fire-resisting material was brought to the surface of the wall where the flames would strike. If a fire did occur in a building made of concrete cast in smooth metal forms, the damage was less than in any other type of building and the danger of spreading was less. Water did not injure concrete; in fact, it improved its quality. There was no wood to swell and afterwards to shrink and crack the plastering, and no hollow spaces that the water could flow through, damaging the contents below. A concrete building was watertight from floor to ceiling, and small quantities of water could be easily handled through small scuppers, either into the air space of the vaulted wall or through the wall to the outside. The fire was never hidden by the construction; consequently no unnecessary streams of water were flooded into the building. In a concrete residence there were few parts that could not be made better and cheaper of Portland cement than of wood. There were many first-class non-combustible materials beside Portland cement that would fill every good requirement of wood and still be fireproof. The spread of a fire into adjoining parts of the same storey was possible in a concrete building only through doorways, pipe holes, etc., and a concrete wall was an ideal barrier to the spread of any fire. The work to be done to reduce fire losses to a *minimum* was so great and so important that it could never be accomplished until the Government took it in hand. The Government could aid fireproof construction by passing laws restricting the use of wood in buildings; by levying taxes, discriminating in favour of fireproof houses and against wood in construction; by teaching the people how to build fireproof houses; by establishing a Government bureau for disseminating information regarding honest and unbiassed fire tests on material, together with Government experiments on different full-size buildings —kinds, types, materials, etc.—with bulletins of the progress; and by building fireproof houses for the use of Government departments, and disseminating information concerning them by means of bulletins.

Refractory bricks; Change [through use] in the composition of ——. Blasberg. Stahl u. Eisen, 1910, **30**, 1055—1060.

A large number of analyses are given of firebricks used in blast-furnaces, copper furnaces, and coke-ovens, and of silica-bricks used in Siemens furnaces, etc. In the case of the firebricks, the exterior portions all show a considerable increase in iron (or copper) and in alkalis, as compared with the cores, which represent approximately the original composition of the bricks. The coke-oven bricks show frequently an increase in iron, and always a considerable increase in alkalis; and in many cases they contain up to 1 per cent. of carbon, produced either by by the dissociation of gaseous hydrocarbons, or by the decomposition of carbon monoxide. Evidently in all these cases the ash of the fuel is largely responsible for the increased alkali-content of the brick and its consequent lowered fusion-point; and an important point in this connection is the amount of salt contained in the water used to wash the coal. Silica bricks from Siemens furnaces all show a considerable increase of iron and alumina, and a diminution of silica: whether the latter is simply relative, owing to the increase of other substances, or partly direct through volatilisation, is not easy to determine. Silica-bricks from the chequer-work show a very considerable increase in alkalis, due no doubt to coal ash in the gases. In some instances the black colour of used silica-bricks was found to be due to carbon. The results of these analyses point to the importance of having silica bricks as little porous as possible, and of avoiding flue-dust in the gases.—J. T. D.

Gypsum; Errors in the chemical analysis of ——. G. Steiger. Bull. U.S. Geol. Survey, 1910, No. 413, 33—36.

The fact previously noticed by Hillebrand (this J., 1908,
813), that fine grinding is liable to cause serious err
in the determination of water in minerals, is special
prominent in the case of gypsum; this is dehydrated
prolonged grinding, to an extent which may affect t
results of analysis by several per cent., a sample of seleni
being found to lose about 75 per cent. of the wat
originally present, after grinding for 49 hours, and resu
of the same order obtained with gypsum. The uncerta
state of knowledge as to the products of dehydration
gypsum (ssee this J., 1907, 735) makes it impossible, ho
ever, even from the results of an accurate analysis,
deduce the exact amount of plaster obtainable from
sample of crude gypsum.—F. Sodn.

Cement burning; Combustion in ——. B. E. Eldr
Trans. Amer. Inst. Mining Eng., 1910, 449—459.

The usual method of heating rotary cement kilns
means of powdered coal injected by air, is adapted
clinkering but is not suited to an efficient calcination of t
materials in the upper portion of the kiln. The heati
in the calcining zone is mainly by radiation from, a
direct contact with, the heated walls of the kiln, where
as is well known, a slow burning voluminous flame comi
into direct contact with the material gives the m
economical result. The author therefore propo
to perform the operations separately, viz. calcination
the present rotary kiln gas-fired with long flame co
bustion, and clinkering in a special gas-fired kiln which
fitted with heat-regenerators. The use of regenerators
made possible owing to the absence of dust in the flu
Long flame combustion is produced by adding a neut
gas such as stack-gases to the producer gas or to the
supply, the burning being most intense where the gas is
actual contact with the hot solids. The author estima
from tests made with a gas-fired rotary kiln, burni
limestone crushed to pass a 0·5 in. ring, that by t
means 7·44 kilos. of cement can be produced per kilo.
coal consumed.—H. H.

Patents.

Colouring and fireproofing wood: Art of ——. W. A. H
New York, Assignor to American Mahogany Co., Mai
U.S. Pat. 961,123, June 14, 1910.

The wood is impregnated simultaneously with an alka
colouring solution and a fireproofing solution contai
ammonium sulphate and sodium phosphate. Wood t
treated and having the "grain" highly developed is a
claimed.—A. S

Cements from slag; manufacture of ——, *and appara
therefor.* T. H. Lodge, Cleveland, Yorks. Eng. P
13,183, June 5, 1909.

An "altering compound," consisting of a specially p
pared calcareous aluminium silicate, is blown, in the fo
of dust, into molten slag in a rotary furnace. The furn
is lined with chrome bricks, separated from the outer s
by slabs of cellular burnt fireclay, and the outlet end
a raised lip, and is provided with a dam-plate to c
centrate the outflow of the slag from the mixer.
"altering compound" is delivered in regulated quanti
by means of a conveyor furnished with an air-jet a
cock, and the supply is regulated by means of step
belt-cones and belts. In the furnace, the "alter
compound" is blown into the molten slag by means of
air-jet connected with one of the burners, the air and
of the other burner being directed longitudinally on
bath of molten slag. The clinker is disintegrated in a ca
like granulator furnished with rolled steel or iron bars
such a form, and placed at such an angle as to caus
strong current of air to pass outwards mixed with wa
spray produced at the periphery of the granulator.
"altering compound" dust and clinker are dried
passing the waste heat from the slag mixer through pi
in the hoppers. The "altering compound" is made
grinding lime, limestone or chalk with calcium fluori
and with highly aluminous clay or shale, with a low si
content, and moulding the mass into bricks which

burnt to about 1900° F. and then ground to a powder The compound should contain 56 to 68 per cent. of lime, and from 10 to 44 per cent. of alumina.—W. C. H.

Cement and concrete work. E. Thomas, Worcester, Mass. U.S. Pat. 958,336, May 17, 1910.

Powdered cement is agitated with water (4–6 oz. to 1 U.S. standard gallon) or preferably with a solution containing 2·5 per cent. of common salt. The cement is thus converted into a gelatinous or colloidal condition, and it is stated that if this mixture of water and colloidal cement be used instead of plain water in mixing cement mortar, concrete, etc., the resulting products after setting and hardening are waterproof.—A. S.

Acid- and fire-proof bodies; Method of producing ——. I. Schlossberg, Charlottenburg, Germany. U.S. Pat. 961,651, June 14, 1910.

See Fr. Pat. 402,428 of 1909; this J., 1909, 1200.—T. F. B.

Abrasive, refractory, aluminous product of the electric furnace, and its manufacture. Norton Co. Fr. Pat. 411,079, Dec. 13, 1909.

See U.S. Pat. 954,808 of 1910; this J., 1910, 630.—T. F. B.

Abrasive product containing alumina produced in the electric furnace, and its manufacture. Norton Co. Fr. Pat. 411,080, Dec. 13, 1909.

See U.S. Pat. 954,766 of 1910; this J., 1910, 630.—T. F. B.

Cement; Manufacture of ——. J. et A. Pavin de Lafarge, Viviers, France. Eng. Pat. 11,184, May 11, 1909. Under Int. Conv., June 13, 1908.

See Fr. Pat. 391,454 of 1908; this J., 1908, 1154.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Briquetting iron ore; Present state of the industry of —— in Germany. G. Franke. Stahl u. Eisen, 1910, **30**, 1060—1064.

In Germany there are now nine installations for briquetting iron ores, with an output of about 2,200 tons daily, and one for agglomerating (by sintering) iron and manganese ores, turning out about 130 tons daily—in all say 700,000 tons yearly. By far the largest part of this work is the briquetting of flue-dust. The German ironworks produce probably 1,500,000 tons yearly of flue-dust, containing above 35 per cent. of iron, 1—3 per cent. of manganese, and 8—25 per cent. of coke-dust. Of this about one-third, or 500,000 tons yearly, is now briquetted, but the quantity is rapidly increasing, through the improvement and cheapening of the briquetting processes. The processes now chiefly in use for flue-dust briquetting are: 1, Schumacher's, with ½—1 per cent. of magnesium chloride; 2, the Tigler Co.'s process with 6—8 per cent. of slaked lime, and in some cases 1 per cent. of blast-furnace slag; 3. Trainer's process with 4½ per cent. of cell-pitch (see this J., 1908, 466, 915); 4. the Scoria Co.'s process, with 8–10 per cent. of steamed basic blast-furnace slag, or blast-furnace slag and lime. Installations in progress are going to use one of these processes or Ronay's hydraulic high-pressure process. Process No. 1 is extremely simple, cheap to instal (£2,500—£3,000 for an output of 60 tons in 10 hours), costs little in working for wages, materials, and power, and gives at 400 atmospheres pressure, briquettes which after 24 hours are hard and yet sufficiently porous. The cost of the magnesium chloride (bought as 30 per cent. liquor) is about 3d., the total cost of briquetting about 1s. 6d. or 1s. 7d. per ton. The magnesium chloride is harmless in the furnace: its chlorine probably becomes ultimately calcium chloride in the flue-dust, and its magnesium goes into the slag. Process No. 2 also yields good briquettes with a pressure of 200—400 atm.; but the material needed is more costly, and since the materials must be ground under a collargang the working is more troublesome and costly than in the magnesium chloride process. Moreover the briquettes require some weeks' exposure to air before they become, through absorption of carbon dioxide, hard enough to be put into the furnace. Process 3 yields good briquettes, but is still more costly in materials than No. 2, and requires a pressure of at least 600 atmospheres. No results of process 4 have as yet been published. Six or seven works briquette iron ores other than flue-dust; clay-ores and washings, with mill-cinder, basic slag residues rich in iron, and purple ore, all mixed hot and pressed; purple ore and flue-dust by the lime-process; chrome-iron ore concentrate; Siegerland calcined ore, etc. At Ilsede the cost is only about 1/- per ton, through favourable local circumstances, in the clayey nature of the ore, etc.; and the use of a larger proportion of briquetted ore has been followed by better yield in the furnace, lessened coke consumption, and diminution of flue-dust. In other places results have not been satisfactory, and much experimental work is still being done to overcome difficulties due to the varying nature of the ores, etc. Agglomeration of ores is carried out at Giessen, in a rotary furnace burning coal-dust. The ores used are a local manganiferous ore (22½ per cent. of iron and 20½ per cent. of manganese), and a Siegerland spathic ore containing sulphides. Satisfactory results are obtained, as far as the workable condition of the product is concerned; but the process is costly (3/- to 4/- per ton), on account of the large consumption of coal, the time and expense in removing the frequently-recurring "rings," and the relining of the furnace.—J. T. D.

Electrical blast-furnace; Theoretical and practical significance of the ——. C. Brisker. Stahl u. Eisen, 1910, **30**, 1049—1055.

The author submits to a careful analysis the figures given in the report of the working of the electrical blast-furnace at Domnarfvet in Sweden (see this J., 1909, 1257), calculating in two instances the materials used to produce 100 kilos. of pig-iron, and the distribution of the constituents of these materials among the products of the furnace. In comparing the analysis of the gases at the hearth and at the mouth of the furnace, he finds in the latter a deficiency in carbon, whilst the ratio of carbon dioxide to carbon monoxide is higher. This is clearly due to the decomposition, in the shaft, of carbon monoxide, into carbon dioxide and carbon, the latter being deposited in the ore and afterwards aiding in its reduction. The shaft therefore, the function of which has been by no means clear, is the seat of this important, indeed indispensable, reaction, and therefore constitutes an essential part of the furnace; and the cooling of the gases as they leave the hearth (*loc. cit.*) is also necessary, since they are thus brought to the temperature most favourable to the progress of this reaction. For comparison, the working of the second charge instanced above, in an ordinary coke furnace, is calculated, and hence the energy expenditure and return in each of the three cases. From the balance sheets it appears that the efficiency of the electric furnace is 51·5 and 50·6 per cent., that of the coke-furnace 43·9 per cent., neglecting the "waste gases"; taking these into account, the three figures become respectively 65·3, 66·2, and 76·4 per cent. This is favourable to the electric furnace, when it is remembered that the figures given are results of a small experimental installation, where the losses from radiation, etc., are relatively very great. As moreover, iron of much nearer approach to purity can be made in the electric furnace than in the ordinary form, and as fine ore may be used to the extent of 75 per cent. of the whole, the electric furnace is already, where electrical energy is cheap, in a position of advantage, and has clearly a future before it.—J. T. D.

Iron; Influence of segregation on the soundness of —— F. Wüst and H. L. Felser. Metallurgie, 1910, 7, 363—384.

A Thomas steel containing 0·07 per cent. of carbon, 0·53 of manganese, 0·05 of phosphorus, and 0·061 of sulphur, and a Siemens-Martin steel containing 0·065 per cent. of carbon, 0·48 of manganese, 0·05 of phosphorus, 0·04 of sulphur, and 0·016 of silicon were cast into rectangular blocks, one of each being 1550 mm. long and 300 mm. thick, weighing 1000 kg., and two of each about 1000 mm. long and 200 mm. thick weighing 250 kg. For the mechanical tests, one of each of the smaller blocks was forged into round rods 34 mm. in diameter, whilst the remainder were used for determining the segregation. These latter were sectioned lengthwise, polished and etched, and borings were taken for analysis from sixty systematically arranged positions. The analyses are tabulated for each constituent showing the variation in composition at the different positions in the casting and hence the respective segregation. Diagrams are also given in which this variation is shown by contour lines and the paper is illustrated by macro-photographs of the etched sections. It is shown that the tendency to segregate is greatest in the case of sulphur and phosphorus, and least in the case of carbon, manganese, and copper. In the large casting the segregation of the sulphur is greater than in the smaller one, while phosphorus, carbon, and manganese behave in a reverse manner. The influence of the segregation on the tensile tests is not very marked, although a strongly segregated part shows a tendency towards less extension and contraction than the less segregated, the influence on the tenacity not being appreciable. The greatest influence appears to be on the bending strain, which is low and irregular in the highly segregated head of the ingot and is high and even in the less segregated foot. —A. H. C.

Tool steel specifications for the United States navy. Iron Age, 1909, **84**, 480—483.

STANDARD specifications have recently been adopted provisionally by the U.S. Navy Department for the purchase of high-speed tool steel and of carbon tool steel. The physical and chemical tests prescribed for high-speed tool steel are as follows :—*High heat test.*—The test piece is first heated to 1550° F. in a furnace kept uniformly at that temperature, and is then quickly transferred to a furnace in which it is rapidly heated to just below the melting-point. The test-piece is then removed and blown cold with a heavy blast of air. One end of the bar is then reduced to a V-shape on a wet emery grinder, and the V-end must test "file-hard." Failure of 10 per cent. of the bars condemns the whole. *Chemical composition.*—The steel is to be free from molybdenum and is to contain only the following substances besides iron :—Tungsten, 18·5—19·5 ; chromium, 5·25—6·00 ; vanadium, 0·10—0·35 ; carbon, 0·55—0·75 ; manganese, 0·00—0·15 ; silicon, 0·00—0·11 ; phosphorus, 0·00—0·02 ; and sulphur, 0·00—0·02. *Working test.*—A tool forged from each lot, submitted to the high heat treatment, and ground to a standard shape of cutting-edge is to be given a 20 min. lathe test on a steel forging of open-hearth nickel or carbon steel of minimum tensile strength 80,000 lb., minimum elastic limit, 50,000 lb., minimum elongation in 2 in. (cold bend through 180 degrees), 25 per cent., maximum phosphorus 0·06 per cent., maximum sulphur, 0·04 per cent. The standard $\frac{7}{8}$ in. lathe tool is to be able to take a cut $\frac{3}{16}$ in. deep with $\frac{1}{16}$ in. feed at a surface speed of 60 feet per min. Three grades of carbon tool steel are purchased. Grade A is used for finishing steel, special machine cutting tools, and for other purposes requiring high grade steel, but for which high-speed tool steel is not suitable ; Grade B for taps, dies, milling cutters, drills, forming tools, special chisels, dies, punches, etc. ; and Grade C for other work, including chisels for cold and hot work, blacksmith's tools, rivet punches, dies, shear blades, etc. The limits of composition allowed are as follows :—

	Grade A.	Grade B.	Grade C.
	per cent.	per cent.	per cent.
Carbon, not less than	1·20	1·00	0·90
Silicon, not less than	0·30	0·20	0·15
Manganese, not less than ..	0·20	0·20	0·15
Phosphorus, not more than	0·02	0·025	0·028
Sulphur, not more than ...	0·02	0·025	0·03
Tungsten, not more than ..	3·00	—	—

The physical tests to be applied to these steels will be determined later.—A. T. L.

Cementation in vacuo. F. Weyl. Chem.-Zeit., 1910, **34** 707.

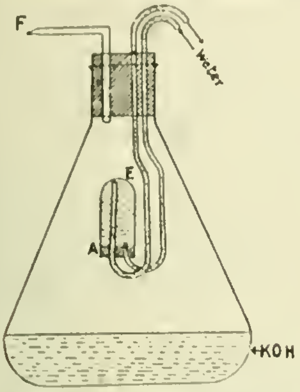
THE author has made experiments on the cementation of a pure mild steel, prepared by the electrical process, with purified natural graphite, "kish," sugar charcoal, and diamond, in a furnace in which a vacuum of a few thousandths of a millimetre could be maintained. The small quantities of gases produced during the experiments were removed continuously by means of a pump. Under the conditions described, it was found that cementation could be effected with solid carbon, but only when there was intimate contact between the iron and carbon at a sufficiently high temperature. For example when the piece of iron was placed upon small pieces of diamond, practically no cementation was effected at 1000° C., whereas there was distinct cementation after heating for 30 hours at 975° C., when diamond powder was spread over the piece of iron.—A. S.

Gases from technical irons. P. Goerens. Metallurgie 1910, **7**, 384—395.

THE previous methods employed for the extraction of the gases in iron and steel are discussed, and it is concluded that :—(1), by merely heating a mass of the metal in a vacuum all the occluded gas is not obtained, diffusion being very slow even at a high temperature ; (2), boring the metal in a vacuum only yields the gases present in the blow holes, the quantity being influenced by the size of the borings and the character of the tool ; and (3), solution in cuprammonium chloride while giving good results as regards carbon monoxide and dioxide, is valueless for the determination of hydrogen. The author employed fine shavings free from oil and chippings of the tool, and prepared in the cold to prevent loss of gas due to heating and does not obtain the gas present in the blow holes. As it was found that quartz reacted with the metal at a high temperature, the shavings were placed in a platinum boat in a quartz tube which, after evacuation, was heated in a Heræus furnace to a temperature of from 900°—950° C. The gases were collected and analysed in a special apparatus, the results being tabulated for thirty-six specimens including the various stages in the manufacture of Thomas iron, Siemens-Martin steel and electro-steel. The composition of the steel, of the gases evolved, and the percentage volume of the gases contained in 1 c.cm. of the metal are given, as well as the temperature and time of heating. A detailed account with diagrams of the apparatus used is given, and the author concludes : 1, that the apparatus described permits of the easy escape of the occluded gases, with their collection and analysis 2, that the amount of gas occluded is very decidedly influenced by the various metallurgical processes which the steel has undergone, and that in an oxidised metal the quantity of gas depends on the process employed and is smallest in Thomas steel, while in deoxidation processes either an additional quantity, or about the same quantity of gas remains in the metal.—A. H. C.

Iron and Steel ; The action of pure air and water on —— (Preliminary note.) J. A. N. Friend. Chem. Soc. Proc. 1910, **26**, 179—180.

THE following experiment has been devised, which shows in a remarkably clear and simple manner that pure water and air alone are incapable of effecting the corrosion of pure iron and steel. *A E* is a hollow cylinder (of iron or steel) closed at one end. The open end is fitted to a tightly fitting rubber stopper bearing two glass tubes as shown in the figure, and arranged in such a way that cold water can circulate freely through them. The cylinder is well polished with sand-paper, and secured as shown inside a conical flask containing about 150 c.c. of 3N potassium hydroxide solution. The air is partly removed and the vessel hermetically sealed at *F*. The flask is now placed to half its depth in a water-bath at 100°, after having been thoroughly shaken to remove every trace of carbon dioxide from its walls, etc., and a current of cold water passed through *A E*. The pressure of the air is not sufficiently reduced to allow the potash to boil nevertheless pure water vapour condenses on *A E* and drips off, thus slowly washing it free from alkali. After this process has been continued for several days, not a trace of alkali remains on *A E*, as is readily shown by



opening the apparatus and testing with phenolphthalein. Nevertheless, if the iron is pure, it remains quite bright, thus proving that pure water and pure air combined are without action on pure iron. In one of the experiments two spots of rust were formed after twenty-four hours at the bend *E*, although the rest of the metal remained bright for several days when the apparatus was opened. This rusting was undoubtedly due to traces of slag in the metal, for on repeating the experiment, after thoroughly cleaning the iron, two spots of rust formed again in a precisely similar place. Repetition with a fresh sample of steel gave no rust whatever.

Iron and steel analysis. J. F. Kohout. Chem. News, 1910, **102**, 23.

If a small quantity of potassium chlorate be added to the solution of the double chloride of potassium and copper (5 grms. to 560 grms. of the double chloride) used in the determination of carbon, the steel dissolves much more easily and completely.—A. S.

Electrolytic iron; Strength of alloys of nickel and copper with ——. C. F. Burgess and J. Aston. Bull. Univ. Wisconsin, 1910, No. 346. Eng. Series, **6**, 37—80.

The alloys were made in quantities of about 1 lb. by fusion of the metals in the desired proportions with electrolytic iron (99·97 per cent. Fe.) in magnesia crucibles in an electric furnace. Analysis of the samples after forging and machining showed very satisfactory correspondence with the composition calculated synthetically. Blank fusions with the iron alone showed an absorption of impurities aggregating very little over 0·1 per cent., so that the properties observed in the alloys are justly attributable to the nickel and copper added. The results of tests are exhibited both in tables and in curves; a summary of the most important points is given here. *Nickel-iron alloys*: Ingots were usually sound, and up to 20 per cent. of nickel forged well. Up to 75 per cent. forging was usually practicable, though in some cases there were breakages. A high temperature is needed for the high-nickel alloys. There is possibly a minimum of suitability for forging at about 34 per cent. of nickel (corresponding to Fe_2Ni). The low-nickel bars could be easily welded; and welding was possible with all the alloys, provided sufficiently high temperatures were used. Hardness was only estimated from ease of machining, sawing and filing. Low nickel bars are soft, and the hardness increases with the nickel up to about 20 per cent., whilst higher nickel bars are again soft. After annealing, the hardness was greatest about 11—13 per cent., though never enough to cause any difficulty in machining. Unannealed bars sawed half through bent to 60°, up to 2 per cent., 45° up to 8 per cent., 30° up to 10 per cent. of nickel, before breaking. Bars containing higher percentages (11—20) broke off short. At about 10 per cent. of nickel the fracture changed from fibrous to granular. Unannealed bars rise slowly in elastic limit and ultimate stress from 0 (57,000, 66,000) to 8 per cent. (71,000, 92,000), then very rapidly to 11 per cent. (148,000, 181,000), after which they fluctuate, rising on the whole to 20 per cent. (115,000, 186,000). The elongation and reduction of area rise slowly to about 6 per cent. (29·2, 65·2), then drop rapidly to 11 per cent. (7, 25·5), after which ductility again increases till at 20 per cent. the figures are 16, 59·5. At 50 per cent., the elastic limit is 76,000, ultimate stress 108,000, elongation 26·5 per cent., reduction of area 63·8 per cent. The annealed bars show the same general influence of nickel, but the tensile strength is on the whole reduced, and the ductility increased. The maximum strength is now about 18 per cent. of nickel, and the minimum ductility about 13 per cent. The results are well in accord with those of other observers for low-carbon nickel steels. *Copper-iron alloys*: These results have been already abstracted from another source, and are given in this J., 1910, 28. *Ternary alloys*: These were made with 2, 3, 4, 5, and 6 per cent. of nickel, and a percentage of copper about one-third that of the nickel. These proportions were chosen, first because the most generally useful nickel-steel contains 4 per cent. and the most generally useful copper-steel 1—1½ per cent., and secondly because the so-called Monel metal (this J., 1909, 94, 313), resulting from the direct reduction of certain cupriferous nickel ores, and forming a very cheap source of copper and nickel together, contains the two metals nearly in these proportions. The results of the tests were very striking, and showed that the values of elastic limit and ultimate stress in the ternary alloy exceeded (in some cases very considerably) those for either binary alloy, whilst the ductility was in most instances practically undiminished. The values for the alloys containing 4 per cent. of nickel and 1·3 per cent. of copper, for example, are :—

	Binary alloys.		Ternary alloy.
	Nickel. 4%	Copper. 1·3%	Nickel 4% + Copper 1·3%.
Elastic limit ...	52,100	51,600	67,600
Ultimate stress..	70,100	65,700	84,700
Elongation......	28	20	28
Reduction of area	66·7	63·1	55·6

—J. T. D.

Atacamite; Method of analysing ——. F. D. Aller, Eng. and Min. J., 1910, **89**, 1006.

One gramme of ore is gently boiled for a few minutes with 10 c.c. of a 10 per cent. solution of potassium hydroxide. The solution is just acidified with nitric acid, and again made alkaline with the potash solution, using not more than two or three drops in excess. It is then diluted with 10 c.c. of water, boiled, filtered, and the residue washed with hot water. A few drops of a weak solution of potassium chromate are added to the filtrate, which is then titrated with a standard solution of silver nitrate, 1 c.c. of which is equivalent to 1 mgrm. of chlorine. Control determinations must be made to correct for the chlorine present in the reagents.—F. R.

Aluminium-silver alloys; Electrical properties of ——. W. Broniewski. Comptes rend., 1910, **150**. 1754—1757.

The author has determined for aluminium-silver alloys: (1), the electrical conductivity; (2), the temperature-coefficient of electrical resistance between 0° and 100° C.; (3), the thermo-electric power with respect to lead at 0° C.; (4), the variation of the thermo-electric power with the temperature; and (5), the solution potential in ammonium chloride solution with respect to a carbon electrode depolarised by manganese dioxide. The results, which are given in the form of curves, show that the metals form the two compounds, Al_2Ag_3 and $AlAg_3$ (compare Petrenko, this J., 1905, 928, and Puschin, this J., 1908, 77). The alloys are resistant to external influences and hard, without showing the brittle zone characteristic of most alloys of definite molecular composition, and the author expresses astonishment that they have not yet found industrial application.—A. S.

Aluminium amalgam; Oxidation of ——. P. R. Jourdain. Comptes rend., 1910, **150**, 1602—1604. (See also this J., 1910, 349.)

The aluminium obtained by the oxidation of aluminium amalgam in the air evolves when warmed *in vacuo* a fairly constant quantity (30 c.c. per grm.) of gas, which consists entirely of carbon dioxide and oxygen. The mixture is of variable composition, containing 65—85 per cent. of carbon dioxide. The gases are not occluded in the substance, but are present in it in combination, probably as a mixture of carbonate and peroxide. Dry air, dry oxygen and dry carbon dioxide have no action on the amalgam. The presence of water is necessary, and in fact water oxidises the metal even in the absence of oxygen, hydrogen being liberated. When oxygen is present, however, most of the oxidation is directly effected by that gas. The hydrated and carbonated oxide dissolves in acids with effervescence, and the whole of the oxygen forms hydrogen peroxide, for the estimation of the latter with permanganate indicates the same percentage of oxygen as is obtained when the gas is liberated by heat.—R. V. S.

Alloys; Electrical conductivity of —— *in the fluid state.* K. Bornemann and P. Müller. Metallurgie, 1910, **7**, 396—402.

The alloys were placed in a tube closed at the ends by electrodes for the main circuit, and with intermediate electrodes from which the difference of potential was obtained. A thermo-element was also inserted and the alloy was fused by heating the tube either in an oil-bath for temperatures below 250° C., and in either a Heræus or a Kryptol furnace for higher temperatures. Quartz tubes were used for temperatures above 600° C. Curves are given showing the conductivity at varying temperatures, and for all concentrations from 0—100 atoms per cent. of the binary systems, sodium-potassium, tin-lead, and the amalgams of sodium and potassium. The author discusses the relationship between the electrical conductivity and the molecular aggregation of fluid alloys as put forward in the Liebenow hypothesis.—A. H. C.

Change [*through use*] *in the composition of refractory bricks.* Blasberg. *See* IX.

Patents.

Steel [*case-hardened*]; *Manufacture of* ——. H. A. Richardson, London. Eng. Pat. 13,218, June 5, 1909.

Claim is made for a steel containing 1 per cent. of molybdenum, 4 of nickel (or cobalt), and 0·3 of carbon. By superficial carburisation (as in the ordinary cementation process) the alloy is stated to acquire a glass-hard surface, quenching being unnecessary.—W. E. F. P.

Steel; Carburisation of ——. C. A. Keller, Paris. Eng. Pat. 17,382, July 26, 1909.

A prismatic block of compressed carbon suspended by means of a cable from one end of a balance, is introduced through the roof of a steel furnace, and is weighted sufficiently to pass through the slag and enter the bath of metal. The amount of carbon absorbed by the bath is determined at any moment by the decrease in weight of the carbon block.—F. R.

Agglomerating fine ores, metalliferous residues and the like; Method and apparatus for ——. C. Dellwik, London. Eng. Pat. 13,073, June 3, 1909.

The fine material, with or without admixture with a binding agent, is spread in a layer of suitable thickness on a conveyor and is passed through a furnace maintained at a temperature at which the surface only, of the layer of ore, is sintered into a solid mass. The material is then broken into convenient pieces and the unagglomerated material separated, and again treated. If desired the material is compressed by passing between rollers before entering the furnace.—F. R.

Pulverous iron ores and the like; Apparatus and process for preparing —— *for smelting in blast-furnaces and use in open-hearth furnaces.* S. Cornell, Duquesne, Pa. U.S. Pat. 962,006, June 21, 1910.

The fine ore is introduced into a heating chamber in which an intense flame is produced, so that the surface of the charge becomes sintered. The agglomerated crust is then broken, and discharged from the chamber, means being provided to arrest the sintered ore at or near the point of discharge, so that it is exposed whilst hot to a current of air directed towards the heating chamber.—A. S.

Filters; Vacuum —— [*for gold slimes*]. R. Pawle, London. Eng. Pat. 13,440, June 8, 1909.

An arrangement is claimed for manipulating a filter basket in the treatment of gold slimes. The filter basket is supported on arms carried by a shaft capable of rotation by worm and wheel gearing through two right angles. In one position of the arm, the basket is immersed in the sludge tank and in the extreme position in the wash tank; while in the intermediate position, it is directly over the discharge ditch. The weight of the filter basket is balanced by means of a suspended water tank, fusees or drums of varying diameter being used and an automatic discharge valve for the water when the basket reaches its highest position. Flexible pipes are provided for connecting the basket to the external conduits, two being required to conduct the gold solutions to the vacuum pump receivers, one for the introduction of water and one for admitting compressed air to discharge the residue.—J. W. H.

Ores; Treatment of ——. E. B. Parnell, Carshalton, Surrey. Eng. Pat. 14,372, June 19, 1909.

The patent describes the treatment of complex copper or cobalt ores containing gold and silver. The ore is subjected to a differential roasting—resulting in the oxidation of the iron, and the conversion to sulphate of the copper or cobalt—after which the oxide of iron is removed by magnetic treatment. The metallic sulphate is then extracted by boiling with dilute sulphuric acid, agitation and heating being effected by means of a hot blast. The residue, after being thoroughly washed, is treated with cyanide solution for the recovery of the gold and silver, the solution of which is hastened by means of a hot air blast; alternatively, the residue may be smelted, or electrically treated with cyanide and mercury for the recovery of the precious metals. In a modification for the treatment of silver ores containing iron, zinc, and cobalt, the metals are first completely oxidised by roasting, the respective oxides being successively removed by appropriate magnetic treatment. This is followed by a chloridising roast, after which the ore is subjected in an agitator to a blast of highly heated air under pressure. The silver is then recovered by ordinary methods, or by means of cyanide as already described.—W. E. F. P.

Ores; Separation of complex ——. W. M. Martin, Redruth, Cornwall. Eng. Pats. 18,176 and 18,178, Aug. 6, 1909. Additions to Eng. Pat. 4531, Feb. 24, 1909.

The original process (this J., 1910, 825) consists in heating the sulphide ore with a solution of an oxidising agent to render it more amenable to concentration. According to the present modifications, the ore may be treated in the cold with an oxidising solution and dried at a temperature slightly above 100° C., before concentration; or it may be heated with a solid oxidising agent. In the latter case, differential roasting (which, it is claimed, is only made possible by the above treatment) may precede concentration.—W. E. F. P.

Tin, or tin alloys; Dissolving of impure —— *chiefly for obtaining tin or tin compounds.* G. de Bechi, London, and F. C. Blythe, Church, Lancs. Eng. Pat. 16,053, July 9, 1909.

The tin material is first treated with hydrochloric acid to extract the tin soluble in this acid, and the residual tin is dissolved by treatment with a solution of stannic chloride according to the reaction :—$SnCl_4 + Sn = 2SnCl_2$.

The stannic chloride may be obtained by oxidising the previously obtained stannous chloride, by nitric acid or nitrates, or by sending a current of hot air through the solution either in the presence of the material to be dissolved, or in a separate chamber.—F. R.

Furnaces; Electric ——. J. Hardén, London. Eng. Pat. 26,254, Nov. 12, 1909.

The furnace is of the type described in Eng. Pat. 26,266 of 1909 (see this J., 1910, 763), the terminal plates being composite in character, and consisting of a hollow cast steel plate through which a cooling fluid is circulated, and faced with "second class conducting material" let into the furnace walls. The plates are operated by direct or alternating current independently of the electrodes, which are suspended from the roof of the furnace near to the surface of the charge.—B. N.

Electrolytic production of alkali metals; Apparatus for the ——. Soc. d'Electro-Chimie, Paris, and P. L. Hulin, Grenoble, France. Eng. Pat. 6063, Mar. 10, 1910. Under Int. Conv., May 6, 1909.

The apparatus comprises an iron vat containing the fused electrolyte, and an anode formed by two electrically connected co-axial cylindrical plates, placed one outside and the other inside a cathode disposed in the intervening space between the two cylinders. A collector-separator, situated above the cathode, consists of a sheet iron ring with edges turned downwards, "like a pump cup leather," and is provided with a collecting cup for the alkali-metal, and one or more vertical sleeves. Through these sleeves, but without touching them pass two vertical arms, which support the cathode and serve to lead in the current.—O. R.

[*Copper-chromium alloys.*] *Metal; Composition* ——. J. Naulty and J. Scanlin, Philadelphia, Pa. U.S. Pat. 959,156, May 24, 1910.

Alloys containing 50 per cent. of copper and chromium in the proportions 9 : 1, are claimed. They are stated to be as hard as steel and can be rolled, welded hot or cold, and forged. As an example: an alloy containing 45 of copper, 5 of chromium, 25 of nickel, and 25 of zinc is mentioned. In preparing the alloys, the copper is first melted and then the chromium and other metals are added in succession.—A. S.

Iron ores; Process for cleaning ——. E. F. Goltra, St. Louis, Mo. U.S. Pat. 961,121, June 14, 1910.

Iron ores with a moist clayey gangue are caused to pass through an inclined rotating cylinder, through which a hot gaseous blast is forced in the opposite direction. The gangue is thus dried and shaken loose from the ore and is carried away by the blast.—A. S.

Refractory compounds [*aluminium ores*]; *Reduction of* ——. F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 961,913, June 21, 1910.

The aluminium ore is first reduced to aluminium carbide, and the latter is mixed with a further quantity of the ore and the mixture heated electrically to above the melting point. The aluminium from the carbide and from the reduction of the ore is removed from the reaction zone and collected in a receiving chamber.—A. S.

Ores; Apparatus for the electrical treatment of ——. W. B. McPherson, Assignor to G. Borden, Los Angeles, Cal. U.S. Pat. 962,040, June 21, 1910.

The apparatus consists of a tank provided with two electrodes, a vertical central one and an outer one composed of a tube of rectangular cross-section wound in the form of a helix, so that the inner faces of the turns of the helix form a cylinder concentric with the central electrode. Means are provided for passing a heating agent through the outer electrode.—A. S.

Lead; Process for refining ——. J. Asbeck. Ger. Pat. 218,839, July 12, 1908.

The metal is heated with caustic alkali and sulphur or substances capable of yielding sulphur. Antimony, tin, and arsenic form sulpho-salts, which dissolve in the fused alkali sulphide, whilst most of the other impurities probably form first oxygen compounds and then sulphur compounds, insoluble in the fused alkali sulphide. It is stated that the whole of the impurities except silver can be removed in one operation. The process is specially useful for removing the zinc from zinc skimmings (from desilverising lead), the zinc being subsequently recovered from the zinc sulphide produced.—A. S.

Iron and iron alloys; Extraction of ——. B. F. Halvorsen and R. Johansen, Christiania. Eng. Pat. 13,081, June 3, 1909.

See Fr. Pat. 403,623 of 1909; this J., 1910, 96.—T. F. B.

Soldering flux or other purposes; Manufacture of mixtures adapted for use as a ——. W. Ackermann, Berlin. Eng. Pat. 13,330, June 7, 1909.

See Fr. Pat. 400,132 of 1909; this J., 1909, 1034.—T. F. B.

Drying by refrigeration the air supply of blast furnaces, converters, and other metallurgical apparatus. J. Gayley, New York. Eng. Pat. 13,557, June 9, 1909.

See Fr. Pat. 404,059 of 1909; this J., 1910, 95.—T. F. B.

Nickel; Process for the manufacture of pure ——. Soc. Electro-Métallurgique Française, Froges, France. Eng. Pat. 287, Jan. 5, 1910. Under Int. Conv., Jan. 6, 1909. Addition to Eng. Pat. 14,946 of 1909, dated June 27, 1908.

See Addition of Jan. 6, 1909, to Fr. Pat. 400,910 of 1908; this J., 1910, 636.—T. F. B.

Zinkiferous substances; Process for treating ——. G. Mojana, Milan, Italy. U.S. Pat. 961,514, June 14, 1910.

See Eng. Pat. 28,575 of 1906; this J., 1907, 1052.—T. F. B.

Gold; Process of refining ——. H. Wohlwill, Assignor to Norddeutsche Affinerie, Hamburg, Germany. U.S. Pat. 961,924, June 21, 1910.

See Ger. Pat. 207,555 of 1908; this J., 1909, 482.—T. F. B.

Mattes; Wet treatment of ——. J. T. Carrick, Assignor to S. Pattison, Johannesburg. U.S. Pat. 961,934, June 21, 1910.

See Eng. Pat. 21,164 of 1908; this J., 1910, 219.—T. F. B.

Metallurgical furnace. S. Z. de Ferranti, Grindleford Bridge. U.S. Pat. 962,013, June 21, 1910.

See Eng. Pat. 13,949 of 1906; this J., 1907, 878.—T. F. B.

Ores containing silver, nickel, cobalt, and arsenic; Process for treating ——. C. C. Cito. Fr. Pat. 411,177, Dec. 31, 1909.

See U.S. Pats. 949,058 and 949,261 of 1910; this J., 1910, 361.—T. F. B.

Metals, alloys, and solders for metals or alloys; Process for treating ——. Standard Alloys, Ltd. Fr. Pat. 411,545, Jan. 14, 1910.

See Eng. Pats. 1403 and 1404 of 1909; this J., 1910, 284.—T. F. B.

Cementing agents [*for steel*]; *Process for making* ——. H. Rodman. Fr. Pats. 411,574 and 411,603, Jan. 14 and 15, 1910.

See U.S. Pats. 949,443 to 949,449 and 949,549 of 1910; this J., 1910, 361.—T. F. B.

Metals; Process for sealing, annealing, and coating ——. S. O. Cowper-Coles, and Metalloids, Ltd. Fr. Pat. 411,812, Jan. 22, 1910.

See Eng. Pat. 23,181 of 1908; this J., 1910, 359.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Accumulator; Processes in the iron-nickel peroxide ——, *III. Behaviour of the iron electrode.* F. Fœrster and V. Herold. Z. Elektrochem., 1910, **16**, 461—498. (See also this J., 1907, 875 and 1908, 630.)

The authors have studied the behaviour of an iron electrode in alkaline solution with a view to explaining its use in the Edison accumulator. They find that an electrode consisting of finely-divided iron is discharged in two distinct stages when the electrolyte is 2-*N* to 4-*N* caustic potash, corresponding to two distinct E.M.F's, which differ by at least 0·1 volt. The first stage has an equilibrium potential of − 0·87 to − 0·88 volt, in 2·85-*N* caustic potash at 18° C. When discharge takes place at or near this potential, the electromotive agent is the active iron which becomes converted on transmitting the current to ferrous hydroxide (process I). The activity of the iron is due to impregnation with hydrogen caused by cathodic polarisation during charging. The hydrogen takes no part in the electrical process, but simply acts as catalyst in the transformation of free to ferrous iron. As discharge proceeds the velocity of the process is greatly diminished owing to the tendency of the iron to become passive. In the second stage process I is completed and extended owing to the activity of ferrous hydroxide, which is oxidised to the ferric state (process I.). The ferrous hydroxide may result from process I. or it may be furnished by a purely chemical reaction between iron and ferric oxide, so that the nett result of the processes in the second stage is the disappearance of iron and the formation of ferric oxide. The equilibrium potential of ferous hydroxide in presence of traces of ferric hydroxide is — 0·74 to — 0·76 volt. (2·85 *N*-caustic potash at 18° C.). The active iron in process I is only a small proportion of the total free iron, this proportion becoming greater as the metal is more finely divided. The capacity of the iron in process I shows a considerable increase as the temperature is raised, while at 75° C. process II disappears completely. The electrolytic reduction of ferrous hydroxide is only accomplished with accompanying evolution of hydrogen. That of ferric oxide is not thus accompanied in its initial stages, but before a thorough reduction can be accomplished, evolution of hydrogen begins and a large quantity of the oxide remains unreduced, probably owing to the formation of a protective film on the surface of the particles. Since the reduction of dry ferric oxide by hot reducing gases is complete, the advantage of thermal instead of electrolytic reduction in the original preparation of the active mass for the Edison accumulator is apparent. An excess of ferric oxide in the active material reduces the capacity of the electrode during process I, and in some cases this stage completely disappears. The presence of smaller quantities of iron-oxygen compounds may also greatly reduce the capacity in process I when the current density of discharge is at all high. This is avoided in the Edison cell by the application of an electrode containing a quantity of finely-divided mercury, which prevents the iron becoming passive during discharge. It has apparently no effect on the charging process. It is thus possible to obtain the same capacity for an iron electrode for very high and very widely varying current densities. The discharge is limited in practice to process I, and therefore the total capacity of this electrode is maintained much higher than that of the nickel peroxide electrode. The ferrous hydroxide resulting from process I is not reversibly reduced at ordinary temperatures, since its recharging must be accompanied by evolution of hydrogen. The nickel peroxide electrode is also not capable of being charged reversibly, although the loss of energy is not so great as with the iron. The efficiency of the accumulator is therefore not good. Efficiency and capacity however may be arbitrarily changed each at the expense of the other. The normal working conditions of the Edison cell are such that an energy yield of about 50 per cent. is obtained.—W. H. P.

Electric vacuum-furnace. O. Ruff. Ber., 1910, **43**, 1564—1574.

The essential feature of this furnace is a tube of retort-carbon, turned down till the thickness of its walls is 1—1½ mm., and provided with two slits opposite one another about the middle of its length, for visual or pyrometrical observation of the contained crucible. If it is desired to increase the resistance of the tube further, this is done not by thinning it down, but by cutting a symmetrical series of narrow short slits all over it, and thus diminishing the conducting area. Over the ends of the tube there slide well-fitting stout jackets of retort-carbon, coppered on their outer ends, where they make contact with water-cooled iron blocks to which the binding-screws for the current are fixed. The whole is covered with a non-conducting jacket, and enclosed in a water-cooled brass case. This case is furnished with two view-holes glazed with quartz-glass, and provided with the necessary connections for exhaustion. Tubes are also provided which permit either of passing various gases through the furnace-tube, or of introducing through stuffing-boxes the wires of a pyrometer into the crucible. According to the thickness of the tube, 200 ampères at 15—18 volts give a temperature in the crucible, as measured by a Wanner pyrometer, of 1000°—1300° C., and 650—700 ampères at 28—40 volts a temperature of 2000°—2700° C. Higher temperatures are not realisable on account of the rapid volatilisation of the carbon. With a good vacuum, the reducing effect of the atmosphere in the furnace is, even at the highest temperatures, very slight. By substituting water-cooled carbon electrodes for the iron blocks bringing the current, the furnace can be used as an arc-furnace. The author has used the furnace to prepare 96—97 per cent. vanadium, by reduction of rods of a paste of vanadium trioxide, carbon and starch in the tube furnace, and fusion by the arc of the sintered metal so obtained. The melting-points of various materials were determined by watching for the sinking down of cones made from them and heated in the carbon crucible: the temperature of the crucible (which was probably less than 50° different from that of the object within) was read as the melting-point. The results obtained were: platinum 1745°—1755°, commercial molybdenum 2110°, iridium 2210°—2225°, kaolin 1910°—1915°, pure tungsten 2575° C. Titanium (containing about 5 per cent. of carbon) only began to show indications of approaching fusion at 2700° C. Alumina, magnesia, and lime were found to be so readily volatile that their melting-points could not be determined *in vacuo*. In nitrogen at atmospheric pressure alumina melted at 2065°, lime *about* 2035° with formation of a felted mass of fine strongly refracting needle-like crystals; magnesia remained unmelted at 2400°, but in all probability did not reach the recorded temperature as it volatilised, even at atmospheric pressure, so rapidly. Attempts were also made to determine the electrical resistance of these oxides just below their melting-points, and to investigate the behaviour of carbon at high temperatures towards silicon tetrafluoride. In the last case no reaction was observed. —J. T. D.

Ignition of coal-dust by single electric flashes. Thornton and Bowden. *See* IIa.

Action of hydrogen on sulphur chloride and thionyl chloride under the influence of the electrical discharge. Besson and Fournier. *See* VII.

Patents.

Electrolytic apparatus. W. Thum, Grasselli, Ind., U.S.A. Eng. Pat. 14,660, June 22, 1909.

In electrolytic apparatus for the electrolytic recovery of gold, etc., the electrolytic tank is provided with an inclined floor forming the cathode, and an anode cell is supported in the tank above the higher part of the floor. The bottom of the anode cell is perforated, being preferably formed of bars arranged as a grid. Within the anode cell is placed a basket provided with a filtering bottom of canvas, and extending over the sides and bottom of the basket is a removable filtering lining. Both the anode cell and the basket are provided with side perforations near to the surface of the electrolyte in the tank. Spacing bars separate the anode from the filtering bottom or the lining, so that the latter will collect gold slimes without impeding the circulation of electrolyte through the bottom of the basket towards the cathode.—B. N.

[*Electric conductors*] *Matter; Composition of —— and method of making the same.* W. A. Phillips, St. Louis, Mo. Assignor to Rheolite Co., Milwaukee, Wis. U.S. Pat. 959,068, May 24, 1910.

A metallic conductor, such as iron, lead, etc., in a molten condition, or in the form of a compound, such as iron pyrites, is mixed with calcium, in the form of lime or one of its compounds, such as calcium carbonate, and an element, such as sulphur, phosphorus, etc., to promote fusion and combination, or the metallic conductor may be in the form of a sulphide, phosphide, etc. The calcium compound may also be mixed with a refractory substance, such as fireclay, slate, etc. The product obtained is suitable as an electric conductor where high resistance is required.—B. N.

Carbon; Method of heating ——. F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 961,912, June 21, 1910.

An arc is produced between electrodes disposed within a mass of carbon in such a manner that there is no substantial contact between the carbon and one of the electrodes, and heat is transmitted from the arc into the mass of carbon until the latter has been at least partly converted into graphite. The process may be applied to the purification of impure graphite, the impurities being volatilised.—A. S.

Arc lamp electrode. U.S. Pats. 961,268 and 961,269. *See* IIb.

Alloy for electrical resistances. U.S. Pat. 961,217. *See* X.

[*Electrolytically*] *producing a disinfecting and deodorising compound, applicable also for bleaching.* Eng. Pats. 8270 and 10,911. *See* IXb.

XII.—FATS; OILS; WAXES.

Butter analysis; Modified determination of the ethyl ester value in ——. J. Hanuš and F. Petrik. Chem.-Zeit., 1910, **34**, 736.

After esterification (see this J., 1908, 632), one fraction of 150 c.c. and one of 100 c.c. of the aqueous distillate are collected in succession, and in each the quantity of *N*/10 potassium hydroxide necessary for the saponification of the ethyl esters is determined. The sum of the two results thus obtained is the ethyl ester value, which amounts to about 80 for cocoanut oil and 18—22 for butter fat. It is stated that by this modification, 10 per cent. of cocoanut oil in butter can be detected.—A. S.

Vegetable butter in Germany; Production of ——. J. Roy. Soc. Arts, July 1, 1910. [T.R.]

The recent discovery of practical methods of converting the crude copra oil into a palatable and satisfactory vegetable butter has given great extension to the business in Germany, where the consumption of edible fats is large. The price at which cocoanut butter has recently been produced by French and German manufacturers has had a marked effect upon the sales of compounds in which American cottonseed oil is used. Seven companies are now crushing copra, and refining the oil for edible use in Germany. The importations of raw copra have more than doubled within three years, and the extension of the industry would seem to hinge more upon the ability of the crushers to obtain supplies of materials than upon the consuming abilities of the market. To obtain a first-class butter, oil of the first pressing is required, which is bleached with fuller's earth. The raw material contains 60 to 70 per cent. of fat, which is not uniform, but the mixture of several fats. The fat is either white or very light yellow, with a specific sweet odour, particularly noticeable when heated. The saponification qualities of the oil render it valuable for mixing with oils which alone would yield a very soft soap. For the manufacture of an edible fat, the difficulty has always been to eliminate the sweet odour. This is now done by treating the expressed oil with superheated steam, and then neutralising with magnesia. The substance is then washed with warm water and re-melted. According to a German patent, odour and taste are removed by neutralising the cocoanut fat with fuller's earth and lime, after which the mixture of fat and lime is heated in a digester up to 250° F. A French patent provides for neutralisation of the fat with an acid, the soap thus formed, settling in the container, while the neutral oil is drawn off from the surface. The resulting substance is pure white, transparent, and similar to lard in appearance. The product has a faint, agreeable odour; it keeps well, and does not become rancid easily.

Rape oil; Detection of —— in olive and other edible oils. M. Tortelli and V. Fortini. Chem.-Zeit, 1910, **34**, 689—690.

A method is based upon the properties of erucic acid, the characteristic fatty acid of rape and similar oils. Thus the iodine value of the "solid" fatty acids separated by the lead-ether method from olive oil is less than 8, whereas the corresponding fatty acids from rape oil may have an iodine value as high as 62. Further evidence is afforded by the melting point of these fatty acids, and by the "critical temperature of solution" of the "liquid" fatty acids. In applying these tests, 20 grms. of the oil are saponified with 50 c.c. of alcoholic potassium hydroxide solution (120 grms. of potassium hydroxide in a litre of 90 per cent. alcohol), and the soap solution exactly neutralised with acetic acid, and added little by little, with constant stirring, to 300 c.c. of a boiling 7 per cent. solution of normal lead acetate. The flask is cooled, and the deposited lead soap washed three times with 200 c.c. of warm water, and after removal of the excess of moisture with filter paper, it is treated with 80 c.c. of ether. The flask is next heated on the water-bath under a reflux condenser, with constant shaking, for 20 to 30 minutes, and is then closed and placed for an hour in water at exactly 15° C., after which the ethereal solution is rapidly filtered, and the insoluble lead soap extracted as before with 40 c.c. of ether, and then washed with 40 c.c. of ether. Finally it is washed by means of 100 c.c. of ether into a separating funnel, whilst the united extracts and washings are transferred to another separating funnel. The fatty acids in each fraction are liberated by shaking it with 150 c.c. of 20 per cent. hydrochloric acid, followed, after separation of the acid layer, by further treatment with 100 c.c. of the acid, and the ethereal solutions of the respective fatty acids are washed twice with 100 to 150 c.c. of water and evaporated. The iodine value of the solid fatty acids may then be determined by Hübl's method, and the m. pts. in the usual way. The liquid fatty acids are now dissolved in 40 c.c. of absolute alcohol, and the solution heated and treated with a slight excess of a saturated solution of sodium carbonate, and then evaporated to dryness on the water-bath and dried *in vacuo* over sulphuric acid. The dry pulverulent mass is freed from the excess of sodium carbonate by heating with agitation on the water-bath with 50 c.c. of absolute alcohol, filtering the solution through a hot filter and boiling the insoluble residue with 40 c.c. of absolute alcohol. This is once more (or if necessary, three or four times) repeated, and the united alcoholic extracts are cooled, and the alcohol separated from the white, or light yellow sodium soap, which is then thoroughly dried over sulphuric acid. The critical temperature of solution is determined by heating 0·5 grm. of the soap with 20 c.c. of absolute alcohol in a tube immersed in a flask of water, and noting the point of initial solidification on cooling the clear solution. The form of the deposit is also important. In the case of olive oil it is flocculent and gelatinous and adheres to the thermometer, whereas in the case of rape oil it consists of minute crystalline needles, which float on the surface of the liquid. The following table gives the results thus obtained with different oils and mixtures of olive and rape oils:

Oil.	Iodine value of solid fatty acids.	M. pt. of solid fatty acids.	Critical temperature of solution of sodium salts of liquid fatty acids.
		° C.	° C.
Olive oil	7·8	58—59	24—20
Rape oil	62	41—42	50—45
Olive, 50 per cent. Rape, 50 per cent.	32	47—48	40—35
Olive, 70 Rape, 30	28	48—49	35—30
Olive, 80 Rape, 20	22·1	50—51	35—30
Olive, 90 Rape, 10	12·8	54—55	34—30
Sesamé oil	9·3	55—56	20—18
Arachis oil	13	57—58	22—18
Cottonseed oil	19	57—58	16—14

A determination of the critical temperature of solution of the mixed fatty acids by Crismer's method may afford proof of the purity of olive oil. Thus the following results were obtained with 5 grms. of the respective fatty acids in 10 c.c. of 70 per cent. alcohol:—Olive oils (3), 16° to 18° C.; olive oil (old) 36° C.; arachis oil, 59° C.; rape oil, insoluble even at 80° C.; sesamé oil, 53° C.; cottonseed oil, 67° C.; and mixture of olive oil with 10 per cent. of arachis oil, 45° C.—C. A. M.

Cottonseed oil in olive oil; Detection of ——. Use of sealed tubes in Halphen's test. R. Mareille. Ann. Falsific., 1910, 3, 235—238.

It has been shown by Steinmann that Halphen's test for cottonseed oil is most sensitive when the mixture of oil and reagent is heated in a closed tube, the presence of 1 per cent. of this oil in olive oil causing the production of a distinct red coloration. The tubes containing the oil and reagent should be heated in an oil-bath at a temperature of 120 C. for 1 hour. In cases where the proportion of cottonseed oil is very small, the heating may be continued for 6 hours, but it may be mentioned that a mixture containing from 5 to 10 per cent. of cottonseed oil yields a bright red coloration within 12 minutes. Particular attention is drawn to the fact that very many fats and oils, especially olive oils, yield a red coloration when heated for some hours at a temperature above 130° C.; to avoid erroneous conclusions, care should, therefore, be taken that the temperature does not exceed 120° C. Pure olive oil exhibits only a slight yellow tint when heated with the reagent for 6 hours at 120° C., but on prolonging the heating for 24 hours, a pink coloration developes. The use of closed tubes is of further advantage, as there is no decrease of volume due to evaporation of the reagent, and the colorations obtained may be compared with those yielded by standard mixtures of olive oil with cottonseed oil in order to ascertain the quantity of cottonseed oil present in a sample.—W. P. S.

Vegetable oil used in the preparation of sardines in oil; Recognition of the nature of the ——. H. Bull and L. Saether. Chem.-Zeit., 1910, 34, 733—734.

The following indirect method of determining the iodine value of the vegetable oil used in preparing sardines in oil is described. In a tin of sardines, the oil (G) surrounding the fish consists of a mixture of vegetable oil (P) with a small quantity of oil derived from the fish by diffusion. In a similar manner the oil of the fish (S) contains a small proportion of the vegetable oil. The oil G may be regarded as a mixture of S and P, and if the percentage of S is expressed as x, then $100\,G = xS + (100 - x)P$. If x and the iodine values of G and S be known, the iodine value of P can be calculated. For the determination of x, the varying solubility of the bromine derivatives of the fatty acids in a mixture of glacial acetic acid and ether (see this J., 1909, 150) is used. Experiments with pure sprat oil and mixtures containing different proportions of olive oil, showed that results calculated from the percentage of bromides insoluble in the mixture of glacial acetic acid and ether are too low in the case of the mixtures, being 97·7 per cent. of the theoretical for a mixture containing 80 per cent. of the sprat oil, and 93, 87 and 77·1 for mixtures containing 60, 40, and 20 per cent. respectively of sprat oil. The method of correcting the values obtained in the actual determination is shown by an example. From the outer oil (G) from a tin of sardines, the fatty acids yielded 15·08 per cent. of bromides, whilst the oil (S) from the fish yielded 35·84 per cent. It is evident from the figures that G contained a proportion of S somewhere between 40 and 60 per cent. Calculation of the percentages of bromides that would be yielded by mixtures of (1), 60 per cent. of S and 40 per cent. of a vegetable oil (P) and (2), 40 per cent. of S and 60 per cent. of P, using the correction factors determined experimentally (see above) gives the values: (1), $60 \times 0{\cdot}93 \times 35{\cdot}84 = 20{\cdot}0$; and (2), $40 \times 0{\cdot}87 \times 35{\cdot}84 = 12{\cdot}47$ per cent. These values were marked on a co-ordinate system on the ordinate of which was marked percentages of S, and on the abscissa percentages of fatty acid bromides, and the value 15·08 on the line joining the two points was found to correspond to 47 per cent. of S. Hence in the case in question, the oil G contained 47 per cent. of oil S. The iodine values of the two oils were: G, 118·93 and S, 155·18, whence the iodine value I of the vegetable oil (P) used was, according to the equation mentioned above: $100 \times 118{\cdot}93 = 47 \times 155{\cdot}18 + 53\,I$ or $I = 86{\cdot}8$. Some results obtained by the method are given in a table. —A. S.

Fats and waxes; Determination of the specific gravity of ——. A. Lissner. Chem.-Zeit., 1910, 34, 657.

The author modifies the Hager-Allen method of determining the specific gravity of fats and waxes, by using (in the case of substances lighter than water) a mixture of alcohol and water of such density that a sample of the substance floats, then adding alcohol (with shaking) until the substance sinks to the bottom, when the specific gravity of the liquid is taken with the hydrometer. Water is now added till the substance rises to the surface again, when the density of the liquid is again ascertained. The mean of the two readings gives the specific gravity of the substance, which is stated to be thus more rapidly ascertained than by adjusting the liquid till of exactly the same density as the substance. For substances heavier than water, a mixture of water and glycerin (or a 10 per cent. potash solution) are similarly employed.—A. Sbld.

Oil-water emulsions; Some factors which determine the constituents of ——. T. B. Robertson. Z. Chem. Ind. Kolloide, 1910, 7, 7—10.

By shaking together equal volumes of olive oil and faintly alkaline water, a stable emulsion of oil in water is produced. On using less water, the character of the emulsion does not appreciably alter until a definite critical ratio of water to oil is reached, when suddenly instead of a viscous, creamy, white emulsion of oil in water, a relatively mobile, yellow emulsion of water in oil (or possibly an emulsion composed of a dilute emulsion of oil in water distributed in oil) is obtained. The different characters of the two kinds of emulsion becomes evident if a few grains of the dyestuff Sudan III be placed on the surface. In the case of an emulsion of water in oil, the colour, which is insoluble in water but easily soluble in olive oil, very soon spreads over the whole surface, whereas in the case of an emulsion of oil in water, it is confined to the surfaces of the globules of oil, being prevented from spreading by the intervening water. In many cases emulsions were obtained which consisted of an emulsion of oil in water distributed in oil. Experiments on the influence of the alkali-concentration on the character of the emulsions, showed that above a definite alkali concentration ($N/200$ for the pure Californian olive oil used), the critical ratio of water to oil remains constant (0·08 for the oil in question), but with lower alkali concentrations, the quantity of oil that can be held in emulsion by a given quantity of water decreases with the alkali concentration until, if the latter sinks below a certain point ($N/800$), stable emulsions of oil in water can no longer be obtained. These phenomena are explained by the author on the assumption that the effect of the alkali is due to the production of soap with the free fatty acids of the oil. So long as the alkali is present in excess, the concentration of the soap remains constant, but with lower concentrations of alkali, the quantity of soap is proportional to that of alkali, and as it decreases, the capacity of the water to envelop the globules of oil becomes smaller. As the ratio of water to oil is gradually diminished, the emulsions become more and more viscous, until at the "criticalpoint," when it may be accepted that the quantity of soap is just sufficient to envelop the oil globules, leaving intervening spaces of approximately molecular dimensions, the emulsion can hardly be regarded as a liquid. So soon as the critical ratio is passed, the quantity of soap is no longer sufficient completely to envelop the oil particles, and the system with the next greatest surface of contact is formed, *i.e.*, a mobile emulsion of water (or a dilute emulsion of oil in water) in oil.—A.S.

Carbohydrate esters of the higher fatty acids. W. R. Bloor. J. Biol. Chem., 1910, **7**, 427—430.

This is a preliminary paper dealing with the preparation of the mannitol ester of stearic acid. The ester is obtained by dissolving 10 grms. of mannitol in 75—100 c.c. of concentrated sulphuric acid, adding 30 grms. of stearic acid and heating the mixture for 3 hours at a temperature of about 70° C. The cooled mass is then extracted with ether and the ethereal solution is neutralised by the addition of sodium hydroxide, filtered, the ether is evaporated from the filtrate and the residual product is purified by repeated fractional precipitation from methyl alcohol. The substance thus obtained is pure white, semi-translucent, brittle and amorphous. It crystallises from ether at 5° C., and is insoluble in water, readily soluble in hot methyl and ethyl alcohols, ether, benzene, and chloroform; it melts at 51° C., is heavier than water, and has $[\alpha]_D^{20} = 63{\cdot}9°$. On hydrolysis the substance yields stearic acid and a brown syrup from which mannitol eventually crystallises; it has a molecular weight of 678, contains 83·8 per cent. of stearic acid, and is apparently mannitol distearate. Attention is drawn to the fact that, during the extraction with ether, a considerable quantity of ethyl stearate is formed; this dissolves in the ether together with the above-mentioned ester, and renders the isolation of the latter a matter of some difficulty.—W. P. S.

Washing powders; Determination of active oxygen in ——. E. Bosshard and K. Gwicky. Z. angew. Chem., 1910, **23**, 1153—1155.

The titration methods which have been suggested for the purpose of estimating active oxygen in the recently introduced soap powders containing perborates have been found by the authors to be unsatisfactory when applied to powders of known composition. Much better results are obtained by measuring the oxygen liberated when the powders are treated with dilute sulphuric acid and manganese dioxide. If carbon dioxide is also evolved from the powder, this may be estimated at the same time by absorption with caustic soda solution, the volume of the oxygen being subsequently determined.—J. A

Urukuri nut; composition of the kernel and of the distillate from the woody portion of the fruit. Frank and Gnädinger. *See* XIV.

Lard from wild and domestic Philippine hogs and the changes in the constants produced by feeding the animals with copra cake. Gibbs and Agcaoili. *See* XIXa.

Patents.

Oil and similar material; Apparatus for separating and filtering —— from dirt, water, and other foreign matter. H. J. Haddan, London. From The Oil and Waste Saving Machine Co., Philadelphia, U.S.A. Eng. Pat. 15,570, July 3, 1909.

The apparatus consists essentially of concentric, alternately inverted upright, rotary cones covered with filtering material. The oil to be treated is introduced through the hollow central shaft and enters the innermost inverted conical, filter chamber through holes in the shaft near the bottom of the chamber. Owing to the centrifugal force, the oil travels upwards on the first cone, downwards on the second, upwards on the third, and so on, finally accumulating in the outer casing, whence it is run off. The whole apparatus is surrounded by a steam jacket and is driven by means of a steam turbine. The mixture of oil and water may also be treated in an apparatus wherein it is projected by centrifugal force against a surface heated to a temperature sufficient to evaporate the water without decomposing the oil. (See also U.S. Pats. 926,596 and 928,280 of 1909; this J., 1909, 829 and 894).—W. P. S.

Extracted bone fat; Process for the decolorisation of ——. H. Volland. Ger. Pat. 222,669, March 13, 1908.

The fat is treated at a high temperature with barium peroxide, whereby, it is stated, a pale-coloured, almost inodorous product is obtained, which yields pale-coloured soap.—A. S.

Detersive and emulsive agent and manufacture thereof. R. Macpherson, London, and W. E. Hall, Bushey. Eng. Pat. 5620, Mar. 9, 1909.

In the process claimed in Eng. Pat. 23,546 of 1905 (this J., 1906, 938) the high temperature and strength of the alkali solution led to the loss of nitrogen as ammonia and to the production of malodorous products. This may be obviated by treating the suitable protein substance (or mixture thereof with farina) with concentrated alkali solution at a low temperature. C. A. M.

Washing compound or soap. Savril Ltd., Chester, J. B. Irving, Ballinluig, Perthshire, and E. S. Wilson, Chester. Eng. Pat. 15,246, June 30, 1909.

The soap consists of or contains a mechanical mixture of fatty acids (*e.g.* oleine) with an alkaline substance (*e.g.*, a mixture of sodium carbonate and bicarbonate or the commercial sodium sesquicarbonate) which contains carbon dioxide in a loose state of combination, and is capable of combining with the fatty acids in such a manner that on heating the soap with water, carbon dioxide is liberated and produces a rapid cleansing effect. (Reference is directed to Eng. Pats. 10,689 of 1907 and 6304 of 1908; this J., 1908, 632; 1909, 482).—C. A. M.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Turpentine of Pinus sylvestris, the colophony prepared therefrom, and French colophony; Solid constituent of ——. S. Leskiewicz. J. prakt. Chem., 1910, **81**, 403—420.

Schkateloff (see this J., 1908, 412; also Monit. Scient., 1908, **22**, 548) has expressed the opinion that all of the acids which have hitherto been isolated from the common varieties of turpentine and colophony are identical with the α-sylvic acid obtained by him from *Pinus sylvestris*, *P. marit.*, *P. taurica*, and *P. strobus*, or its transformation products. The author's experiments were made with turpentine from *P. sylvestris*, the colophony prepared therefrom, and a pale yellow French colophony. By repeated crystallisation from anhydrous acetone and finally from aqueous alcohol, care being taken that the temperature does not rise above 60° C., a crystalline acid, $C_{20}H_{30}O_2$, can be readily isolated, which the author, following Klason and Köhlers (this J., 1906, 644), names sapinic acid (Schkateloff's *a*-sylvic acid). The melting points and rotatory powers (in alcohol) of the acids from *P. sylv.* turpentine, *P. sylv.* colophony, and French colophony respectively were: 142°—144° C., $[\alpha]^{19}_D = -105{\cdot}3°$; 144°—146° C., $[\alpha]^{15}_D = -35{\cdot}16$; 146°—148° C., $[\alpha]^{19}_D = +14{\cdot}21°$. The lævo-rotation of the acid is diminished by heating, and the author concludes that the acids in the original turpentines are identical, the low lævo-rotation and dextro-rotation of the acids separated from the specimens of colophony being due to prolonged or excessive heating. Sapinic acid is easily soluble in anhydrous organic solvents, especially alcohol and glacial acetic acid; its alkali salts form semi-solid rosin soaps. When sapinic acid or colophony is dissolved in glacial acetic acid and treated with a few drops of concentrated hydrochloric acid, it is converted into an isomeric acid, *l*-sylvic acid (Schkateloff's *β*-sylvic acid), m. pt. 171°—172° C., $[\alpha]^{19}_D = -104{\cdot}2$ in alcohol, which is less readily soluble than sapinic acid in organic solvents, and yields crystalline alkali salts. The crude *l*-sylvic acid probably contains also a dextro-rotatory acid. On distillation, both sapinic acid and *l*-sylvic acid yield a third isomeric acid, *l*-colophonic acid, probably identical with Klason and Köhlers' *α*-colophonic acid (Schkateloff's *γ*-sylvic acid), which gives crystalline alkali salts resembling those of *l*-sylvic acid. *l*-Colophonic acid from *l*-sylvic acid melted at 191°—192° C. and had $[\alpha]^{16}_D = -56{\cdot}13$; that from sapinic acid melted at 190·5°—192° C., and had $[\alpha]^{17}_D = -55°$. (See also this J., 1902, 127; 1904, 328, 989; 1906, 82, 1057; 1907, 264, 1151.)—A. S.

Turpentine oil and its substitutes. I. Determination of benzine and petroleum in turpentine and pine oils by means of sulphuric acid. A. Eibner and O. Hue. Chem.-Zeit., 1910, **34**, 643—645, 657—659.

Herzfeld's method of determining mineral oil in turpentine oil (this J., 1904, 274) is modified as follows: 10 c.c. of the turpentine oil are added (1 c.c. at a time, and shaking after each addition) to 15 c.c. of sulphuric acid of 1·84 sp. gr. The mixture is allowed to stand for 6 hours, and then 7 c.c. of fuming sulphuric acid (20 per cent. of anhydride) are similarly added. After standing for 45 min. the volume separating is noted. This does not exceed 0—0·3 c.c. (= 0—3 per cent.) with pure oils; over 0·4 c.c. indicates adulteration, which is proportional to the volume separating. Less fuming acid should, however, be added to very impure oils; the amount required is ascertained by noting the volume separating from the mixture with ordinary acid, and as this volume increases from 2—6·5 c.c., the quantity of fuming acid to be added is reduced proportionately from 7 c.c. to *nil*. From this point the volume separating from the mixture of turpentine and ordinary acid, represents the exact amount of adulterant. The authors carry out the process in a special stoppered burette, shaped like a pipette, the middle portion having a capacity of 25—30 c.c. and the tube portions 10 c.c. each, both having a graduated scale to 7 c.c. in $\frac{1}{10}$ c.c., the separation after adding the ordinary acid is read off on one scale, and that after the addition of the fuming acid on the other. The method has been investigated with pure oils and oils adulterated with petroleum and benzine, but not with Sanga oil and similar substitutes; it is more rapid than the original method and the cooling with water is dispensed with. The results are stated to be accurate to within −1 to +2 per cent.—A. Sbld.

Turpentine oil; Adulteration of —— with copal oil. W. Vaubel, Z. angew. Chem., 1910, **23**, 1165.

Turpentine oil to which copal oil has been added does not dry satisfactorily but leaves an acid, oily residue which unfits it for use in paint or varnish. It is also dangerous in use, since copal oil is capable of producing strong inflammation of the hands and eyes. The presence of copal oil in turpentine oil may be detected by the smell, acid reaction and bromine value of the residue left on distillation.—J. A.

Shellac shipments from India. Chem. Trade J., July 2, 1910. [T.R.]

The shipments of shellac from Calcutta in 1909 reached the unprecedented total of 322,006 cases. For several years before 1907 the average was 145,000 cases, but in 1907 a total of 206,700 was reached, which was increased to 222,000 in 1908. That the production should increase steadily and rapidly was natural, having regard to the efforts made by the Department of Woods and Forests to give scientific guidance to native industries, and it was expected that the demand for shellac by certain industries would increase steadily. The lower prices of the last two years also would encourage its use for other purposes. Among the shippers the firm of Ralli Brothers continue to account for more than a third of the whole—namely, 119,000 cases; but the firm of Ernsthausen, Ltd., has increased its shipments threefold in three years, and now exports 94,000 cases. The United States—long the largest buyer—has absorbed most of the increased output, shipments of shellac from Calcutta to U.S. ports increasing between 1908 and 1909 by 76,000 cases.

Patents.

White lead; Process for the manufacture of ——. L. Falk, Reval, Russia. Eng. Pat. 29,962, Dec. 22, 1909.

Carbon dioxide (or gases containing carbon dioxide) is conducted under pressure into a cold solution of basic lead acetate, preferably contained in a carbonating vessel or vessels and the resulting normal lead carbonate is stirred with calculated quantities of litharge in the presence of a small proportion of lead acetate to act as a "carrier." If the process is carried out in the cold, a white lead compound of the composition, $5PbCO_3,2Pb(OH)_2,PbO$ will be formed, whereas if heat is applied the product will have the composition, $2PbCO_3,Pb(OH)_2$. Advantages claimed for this process are that the white lead, having a definite composition, will have constant properties (including better covering capacity); that it is simple and cheap; and that the stirring process only takes a few hours. (See also this J., 1910, 769.)—C. A. M.

Rosin-purifying apparatus. R. N. Perlee, Long Island City, N.Y. U.S. Pat. 961,254, June 14, 1910.

The apparatus comprises a still and a condenser, which is connected with one or more dissolving tanks, which may contain a filtering device and be connected with the still by means of a siphon. There may also be direct communication, independently of the siphon, between the still and the tanks.—C. A. M.

Carbon black; Process for producing ——. J. Machtolf, Böblingen, Germany. Eng. Pat. 13,865, June 12, 1909.

See Ger. Pat. 212,345 of 1908; this J., 1909, 1050.—T. F. B.

White lead; Process for making ——. L. Falk. Fr. Pat. 411,019, Dec. 23, 1909.

See Eng. Pat. 29,962 of 1909; preceding.—T. F. B.

Pulping or other liquor; Treatment of —— suitable for separating cellulose, resinous matter, and ligneous material or residue and for utilisation of the resinous material. W. J. Hough, Toledo, Ohio, U.S.A. Eng. Pat. 19,116, Aug. 19, 1909.

See U.S. Pat. 931,608 of 1909; this J., 1909, 1148.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Colloid-chemistry of ——. I. Theory of vulcanisation. Wo. Ostwald. Z. Chem. Ind. Kolloide, 1910, **6**, 136—155.

The author believes that fruitful results would follow the application of modern methods of colloid-chemistry to he study of rubber. In this first communication he iscusses chiefly hot vulcanisation, and shows that the vailable data can be explained much more satisfactorily y a physico-chemical theory of adsorption than by Weber's hemical addition theory. Some of the more important acts in favour of the adsorption theory are as follow :—1). In all vulcanised rubbers, whether prepared with arge or small proportions of sulphur, there is always a ertain quantity of free sulphur, increasing with the total ulphur content, whereas according to a theory of chemical ddition, it would be expected that starting with a small roportion of sulphur, the whole would be combined. 2 When vulcanised rubber is treated with a liquid, .g., petroleum spirit, which has a different solvent power or caoutchouc and sulphur, sulphur can always be xtracted so long as it can be detected analytically in the ubber, and on evaporation of the solution, separates in he form of microscopic crystals or grains. Unvulcanised ubber mixings behave in an exactly similar manner, cept that the sulphur is extracted more readily. (3). The bsorption of sulphur by the rubber is always purely dditive. (4). A continuous series of addition-products formed, and the first and last members of the series have o definite stoichiometrical composition. (5). The amount f sulphur absorbed by the rubber varies according to he previous mechanical treatment of the latter. A robable explanation of this is that by warming and echanical working, the heterogeneous phases of the ubber are rendered more homogeneous, the degree of ispersion and hence the available surface being increased nd leading to greater adsorption of sulphur. It should e possible to test the correctness of this view with the id of the ultramicroscope. (6). The absorption of sulphur ncreases with rise of temperature, and the temperature-oefficient is more in accord with that of a process of hysico-chemical adsorption than with that of a process f chemical combination. The fact that vulcanisation roceeds slowly even at the ordinary temperature is at ariance with Erdmann's thio-ozonide theory (this J., 908, 934), since thio-ozone, $(S_3)_8$, is formed only above 60 C. (7). The absorption of sulphur is not regular, he curves showing one or more changes of direction ; this of frequent occurrence in adsorption processes, being ecially well-marked in the adsorption of water by organic gels. (8). Typical adsorption proceeds in ccordance with the exponential formula, $\frac{x}{a} = k\,c^m$ here x is the weight of adsorbed substance, a is the weight f adsorbent, c is the initial concentration of the substance hich is adsorbed, and k and m are constants ; and it is own that the data of Stern (this J., 1909, 1050) and of uebener (this J., 1909, 1321) correspond better with ch a formula than with the ordinary formula for chemical ombination. The author considers that in hot vulcanisaon there is mutual adsorption of two disperse phases, iz., emulsoid rubber and the rubber distributed therein disperse form.—A. S.

ubber ; *Theory of the cold vulcanisation of* ——. F. W. Hinrichsen and E. Kindscher. Z. Chem. Ind. Kolloide, 1910, [4].

EFINITE quantities of a solution of Para rubber in benzene ere treated for three weeks with measured quantities of benzene solution of sulphur chloride, and then in a finite volume of the clear liquid, the concentration of lphur chloride was determined. From the difference etween the quantity of sulphur chloride taken and that ft unchanged at the end of the experiment, the vulcanisaon-coefficient was calculated. The results show, according to the authors, that for a given quantity of rubber, the mount of sulphur chloride absorbed is approximately nstant and independent of the excess of sulphur chloride ed. The vulcanised rubber is hence regarded as a definite emical compound of the formula, $(C_{10}H_{16})_2,S_2Cl_2$. eterminations of the sulphur in the vulcanised rubber, ter removal of the chlorine by boiling with alkali, gave, the average, 19·27 per cent., corresponding to the rmula, $C_{20}H_{30}S_2$.—A. S.

Rubber ; Colloid-chemistry of ——. *II. Further observations on the theory of vulcanisation.* Wo. Ostwald. Z. Chem. Ind. Kolloide, 1910, **7**, 45—49.

Bysow's results (this J., 1910, 770) on the cold vulcanisation of rubber support the author's view of vulcanisation as an adsorption process. The results of Hinrichsen and Kindscher (see preceding abstract), on the other hand, appear, at first sight, to be opposed to this view, since those authors could observe no distinct increase of the sulphur absorbed when the concentration of sulphur chloride was increased. The author points out, however, that the concentrations used by Hinrichsen and Kindscher correspond to that portion of the adsorption curve which approximates to a line parallel to the abscissa, and hence no noticeable differences in the quantity of sulphur absorbed could be expected. The fact that the composition of the vulcanised rubber containing the maximum proportion of adsorbed sulphur can be represented by a stoichiometrical formula, is, as the author has previously pointed out, in no way an argument against the adsorption theory. The author finally refers to the results of Reychler (this J., 1910, 422) on the absorption of sulphur dioxide by rubber, and argues that they are much more in accord with a process of adsorption than with one of solution, as preferred by Reychler.—A. S.

Urukuri nut : chemical composition of the kernel and of the distillate from the woody portion of the fruit. F. Frank and Gnädinger. Gummi-Zeit., 1910, **24**, 1328—1329.

THIS nut is the fruit of the palm *Attalea excelsa*, and is used in Brazil in the curing of rubber. The powdered kernel gives up to chloroform 73·5 per cent. of its weight of fat, which contains 56·8 per cent. of liquid glycerides and 43·2 per cent. of solid glycerides. By distillation of the kernels with steam, a substance having the properties of an alkaloid can be separated : it crystallises in small laminæ which melt at 287° C. ; the quantity is very small. The distillate also contains traces of a ketone. This fat therefore resembles in general composition that of the cocoanut.

The woody portion of the fruit gives on distillation 10·08 per cent. of tar, 46·4 per cent. of watery distillate, 29·10 per cent. of charcoal and 14·51 per cent. of gas. Both the tar and the watery distillate did not differ greatly in composition from the similar products obtained from beechwood. In the tar methylpyrogallol dimethyl ether, coerulignol, creosol, guaiacol, homopyrocatechol, a sesquiterpene and pyridine derivatives were found, whilst the aqueous distillate contained large quantities of formaldehyde and acetone, and in addition xanthogallol, homopyrocatechol, formic acid, acetic acid and propionic acid.
—R. V. S.

PATENTS.

Indiarubber ; Substitute for ——. A. Smith, Brockley. Eng. Pat. 19,016, Aug. 18, 1909.

A GUM resin, such as gum kauri or copal, is incorporated with say 6 to 8 oz. per lb. of a mixture of about 10 parts of carbolic acid and 2 parts of colza oil, which has previously been gently heated at about 90° to 100° F. The mass is thoroughly mixed in a machine for 2 to 3 hours and heated gently if required. An addition of pure indiarubber and sulphur to the mass enables it to be vulcanised in the usual way.—C. A. M.

India-rubber ; Devulcanisation of ——. L. A. M. Banchieri, Milan, Italy. Eng. Pat. 719, Jan. 11, 1910.

THE waste rubber, reduced to a fairly fine state of division is spread out on perforated trays in a chamber which can be heated by means of a steam jacket. When hot, the waste is subjected to the action of terpinol vapour and steam at 116° to 125° C. passed into the jacketed chamber from a generator in which water and terpinol are heated together, the mixed vapour being distributed through a perforated pipe passing vertically downwards through the centres of the trays. The steam and terpinol on condensation are returned to the generator through a pipe leading from the bottom of the devulcanising vessel through a

water seal. The terpinol absorbed by the waste rubber is recovered from it, by reducing the pressure in the devulcanising chamber by means of a pump, and passing the vapours through a condensing coil. The last traces are removed by blowing heated air through the devulcansising chamber. The patentee uses to produce his "terpinol," "the dihydrate of terpene, obtained in the well known way from the essences of resins from coniferæ." The dihydrate is dissolved in boiling water acidulated with hydrochloric acid, and the acid is then neutralised by alkali, the resulting liquid distilled, and the vapours condensed. The condensed product is "terpinol."
—E. W. L.

Indiarubber: Process and apparatus for the devulcanisation of ——. L. A. M. Banchieri, Milan, Italy. Eng. Pat. 718, Jan. 11, 1910.

See Fr. Pat. 407,793 of 1909; this J., 1910, 641.—T. F. B.

Indiarubber or caoutchouc; Process for regenerating and devulcanising —— *and extraction of caoutchouc from raw materials containing caoutchouc.* G. Austerweil, Neuilly, France. U.S. Pat. 961,395, June 14, 1910.

See Fr. Pat. 388,248 of 1908; this J., 1908, 951.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning: The essentials of ——. W. Fahrion. Collegium, 1910, 249—259.

The author reviews the various theories of tanning and discusses the respective merits of the chemical and physical explanations of the process. According to Robertson adsorption is not entirely a physical action, but a combination of chemical and physical processes; Freundlich, however, does not believe in the chemical theory, because chemically different substances have the same power of adsorption; and Jordis maintains that the phenomenon is not colloidal, but crystalloidal, and that the process is a normal chemical reaction. The physical theory, first proposed by Knapp 50 years ago, has been adopted by Körner, who discusses it mainly from a theoretical standpoint. The author disputes Stiasny's conclusion that the question can only be advanced through a consideration of physical phenomena. Stiasny regards the real tanning process as taking place thus: the hide first adsorbs the tannin (from its colloidal solution) which then undergoes a secondary change through the catalytic influence of the hide fibre. The author does not think that the evidence he supplies from his investigations on the nature of tanning materials by precipitation and diffusion phenomena, establishes the colloidal nature of the process. Stiasny explains the gradual increase of insoluble matter in tanned leather, as due to secondary chemical processes, oxidation, etc.; he also maintains that the chrome and chamois tannages are the results of physical changes. The author refutes this, observing that he has proved the latter to be entirely due to chemical action; he believes leather to be a salt of hide substance and tannin and that the fluctuating composition of the gelatin-tannin precipitate is due to co-precipitation. The fact that the absorption of tannin by hide powder is reversible is explained as a case of mass action. He similarly disposes of Von Schröeder's work on the parallel adsorption of acids by hide powder and charcoal as inconclusive evidence against the chemical theory. In support of his chemical view of the process, the author states that the hide is so constituted that the innermost portions are inaccessible to colloids, crystalloidal bodies only being able to penetrate so far. He defines a true tannage as one in which the ordinary chemical union takes place, the prototype of which is the aldehyde tannage. In a pseudo-tannage, the tanning agent undergoes some change before acting as such; the first reaction is a hydrolysis of the tannin by the water, in which a condition of equilibrium is established; this is disturbed by the introduction of the hide, and the tannin is deposited on the fibres. The author applies this theory to the various tanning processes and concludes that every fo
of tannage consists of a condensation between hide su
stance and tannin: in true tannages the condensati
takes place directly, in pseudo-tannages the tan
condenses, first with itself, and then with the hide.
—A. T. H.

Leather: Penetration of water through ——. U. J. Thu
and P. de Korsak. Collegium, 1910, 229—232.

For estimating the permeability of leather to wat
10 c.c. of water are drawn through a piece of leather
known thickness, by means of a vacuum of known pressu
and the results are stated as the quantity of water p
meating one cubic centimetre of leather in one minu
—A. T. H

Patents.

Tanning processes. E. Kohn, Prague, Austria. Eng. P
5489, Mar. 4, 1910. Under Int. Conv., Apr. 24, 1909

In order to obtain a substitute for tanners' liquor, hithe
obtained from animal excrements, 100 kilos. of bone pow
are mixed with about 1 kilo. of fat, 0·75 kilo. of liver of s
phur, and 1·5 to 2 kilos. of common salt. Lime present in
hides is saponified by means of this mixture, and a li
"scraping" is thus rendered possible.—E. W. L.

Bone-black filter for clarifying gelatin liquors and the h
J. H. Utley, Camden, N.J., Assignor to H. J. Webst
Camden, N.J., and W. M. Hardie, Pittsburg, Pa. U
Pat. 961,180, June 14, 1910.

A vessel, which may be of the form of an inverted trunca
cone, is provided with filtering devices at its opposite en
with means for the introduction of steam from the b
in an upward direction, and with a number of perfora
steam coils between the filtering devices. There are s
tubes for conducting the liquid to be treated downwa
through the vessel and for the alternate introduct
of hot water, all these tubes, steam pipes, etc., be
controlled by valves.—C. A. M.

Horn plates from horns; Process for the preparation of —
A. Lang. Ger. Pat. 222,936, June 16, 1909.

The horns are slit and then softened by heating in a
fatty-oil, mineral oil, or the like, in order to render th
capable of being drawn out into the form of plates.—A

XVI.—SOILS; FERTILISERS.

Fertilisers in Japan. Board of of Trade J., June 30, 19
[T.R.]

The import of bean cake into Japan in 1909 was 575,
tons, valued at £2,283,700, as compared with 461,950 to
valued at £2,220,000, in 1908. In sulphate of amm
there was a decline from 66,445 tons, valued at £898,0
to 45,835 tons, valued at £604,700, while in the case
both rock phosphate and fish guano there was a decre
of over £100,000. The imports of nitrate of soda increa
slightly.

Patent.

Antitoxin materials; Production of —— *and the ap
cation of same to soils.* L. R. Coates, Baltimore, U.S
Eng. Pat. 9275, April 16, 1910. Under Int. Co
April 26, 1909.

See U.S. Pat. 947,797 of 1910; this J., 1910, 442.—T. F

XVII.—SUGARS; STARCHES; GUMS.

*Glucose; Potassium ferrocyanide as indicator in the de
mination of* ——. E. Selvatici. Bull. Assoc. Cl
Sucr. et Dist., 1910, 27, 1179—1184.

For the rapid determination of reducing-sugar volume
cally, the author recommends the use of potassium fe
cyanide in conjunction with the Fehling's solution;

reduced copper is thus converted into white cuprous ferrocyanide, and the observation of the exact point at which the blue colour disappears is thereby facilitated. In the case of sugar products containing about 0·04 to 0·10 per cent. of reducing sugar, the following is the procedure :—52·096 grms. of the sample are dissolved in water, clarified with lead acetate, made up to 200 (Mohr's) c.c., and filtered. Part of the filtrate serves for polarisation; the remainder is freed from lead by addition of powdered sodium sulphate or carbonate, and is then used for the determination of the invert sugar. Two c.c. of Fehling's solution are diluted with water, and treated with 2 c.c. of a solution of potassium ferrocyanide prepared by dissolving 15 grms. of the pure salt in 1 litre of water; the whole is heated to boiling in a test-tube (25 cm. in length, and 3 cm. in diameter) and the sugar solution is run in, in small quantities, until the blue colour just disappears, care being taken that boiling is not interrupted during this process.—L. E.

Sugar decompositions. Synthesis of sugar from formaldehyde. W. Löb and G. Pulvermacher. Biochem. Zeits., 1910, **26**, 231—237. (See this J., 1910, 102.)

Investigations on the condensation of formaldehyde under the action of lead hydroxide are described. One hundred and fifty c.c. of a 40 per cent. solution of formaldehyde were digested with 12 grms. of lead hydroxide and 1500 c.c. of water, in a closed flask for 73 hours at 70° C. Under these conditions, a state of equilibrium is attained with compounds containing a smaller number of carbon atoms than is the case with sugar-decomposition. This is intelligible, considering that with the syntheses from formaldehyde, a fairly stable condition of the lower members must lead to an end-system rich in these members, whilst with the sugar-decompositions, there is a similar possibility that the system attains relative stability with compounds containing more carbon atoms. Hence, though the synthesis of sugar from formaldehyde, and the decomposition of sugar (dextrose), are reversible reactions (*loc. cit.*), it is quite possible that the states of equilibrium experimentally obtainable are not identical in the two cases. Under the experimental conditions above described, the formaldehyde disappears completely, and methyl alcohol and acrolein are formed in relative abundance; the latter is probably a decomposition-product of glyceryl aldehyde or dihydroxyacetone formed by polymerisation of the formaldehyde. Pentose is also formed. Since, as is well known, a hexose is formed by the action of lead hydroxide on formaldehyde, the products of sugar-decomposition may be expected to be formed in the reaction-mixture; the latter does contain saccharic acid besides acids of lower carbon-content, and formic acid. Two main systems of the prolonged reaction between lead hydroxide and formaldehyde, can be distinguished; one is subjected to the synthesis leading to the formation of hexose and pentose, whilst in the other system, decomposition of the sugars formed, occurs.—L. E.

Caramel ; Adulteration of ——. P. Carles. Ann. Falsific., 1910, **3**, 255—256.

Apart from differences in quality of caramels prepared from various saccharine materials, caramels manufactured from sucrose are not infrequently adulterated with such substances as ammonium carbonate and sodium carbonate. The use of ammonium carbonate intensifies the coloration of the caramel and its presence is not detected by determining the ash of the sample. As regards the second type of adulterant, the author has found a sample of so-called caramel to consist of :—crystallised sodium carbonate, 50 ; dry caramel, 20 ; and water 30 per cent. Caramel has the property of preventing the crystallisation of sodium carbonate, and a mixture having the above-mentioned composition has the appearance of a true syrup.—W. P. S.

Patent.

Sugar : Crystallisation of —— *from concentrated juices.* Soc. Anon. Raffinerie Moderne Procédé Natta, Malpassé-Marseille, France. Eng. Pat. 16,834, July 19, 1909. Under Int. Conv., July 22, 1908.

See Fr. Pat. 392,540 of 1908 ; this J., 1909, 33.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Barley ; Determination of the absolute extract of ——. R. Seibriger. Woch. für Brau., 1910, **27**, 321—323.

The author describes a modification of Graf's method of determining the extract of barley which gives consistent results and in which the whole of the starch present in the barley undergoes conversion. The malt extract employed is prepared by extracting 1 part of coarsely-ground pale malt or lightly kilned green malt with 4 parts of distilled water with frequent shaking for 3 hours, after which the mash is filtered bright through a pleated filter. About 150 grms. of the barley, previously dried at 50° C. if the water-content is above the normal, are ground so that about 98 per cent. consists of fine meal. Twenty-five grms. of the sample are then mashed with 100 c.c. of water at about 15° C., and 40 c.c. of the malt extract well mixed in. The covered beaker is kept overnight (about 15 hours) in a place which is not too warm, and the mixture is subsequently well stirred, heated for 1 hour at 110° C. in an autoclave provided with a thermo-regulator, and allowed to cool to 55° C., when a further quantity of 60 c.c. of the malt extract is added. The mash is then heated up in 10 minutes to 60° C., at which temperature it is maintained, with stirring, for 45 mins.; after this the temperature is raised to 70° C., at which it is kept for 45 mins., the mash being stirred as continuously as possible during the last half-hour. Finally the contents of the beaker are cooled, made up to a weight of 225 grms. with distilled water, and filtered, the sp. gr. of the clear wort being determined. To correct for the sp. gr. of the malt extract, 100 c.c. of the latter are boiled gently for 15 mins., cooled, made up to volume and filtered, the sp. gr. of the filtrate being subtracted from that of the wort from the barley mash. The applicability of this method has been tested with a large number of different barleys.
—T. H. P.

Cereals ; The toxins of ——. J. L. Baker and H. F. E. Hulton. J. Inst. Brew., 1910, **16**, 431—441.

Cereals contain a toxin harmful to the fermentative power of English top-fermentation yeast (this J., 1909, 778, 781), and not diminished by malting. It is now shown that distillers' and brewers' yeasts ferment invert sugar, maltose, and high and low starch conversion products alike. The different fermentative powers of the two types of yeast in media containing cereals, or their extracts, is therefore due to the toxins and not to any difference in the yeasts themselves. Some eight-year-old samples of cereals have been investigated ; their germinative capacity had disappeared whilst diastatic activity survived ; the toxicity was markedly less than that of new samples of grain. The entire material of an old wheat showed no toxicity, but on separating husk and endosperm, marked toxicity was apparent in both portions, though much greater in the flour. It is a general rule that all cereals when ground entire are less toxic than their endosperm ground alone. It is undetermined whether this protective influence of the husk is associated with an antitoxin or with the higher proportions of soluble mineral matters which have been shown to be protective. The cold aqueous infusions of the unmalted cereals examined were practically non-toxic, with the exception of wheat which is highly poisonous. Similar infusions of malted cereals are toxic, which suggests the dissemination of the toxin throughout the corn during germination. As coagulation by heat advances in these cold aqueous infusions, so their toxicity diminishes. It is shown that the temperature at which an infusion of malted cereal is prepared is more effectual as regards the destruction of toxin than any subsequent boiling of the infusion.—R. L. S.

Yeast juice ; Anti-protease in expressed —. E. Buchner and H. Haehn. Biochem. Zeits., 1910, **26**, 171—198.

It has previously been shown that the zymase of yeast juice is protected from the destructive action of the endotryptase in the juice, by addition of boiled yeast juice (this J., 1909, 899). It is now shown that the boiled juice retards the action of the endotryptase on the coagulable protein of yeast juice, and on gelatin, and that it also retards the action of tryptase on casein; hence, it is highly probable that zymase is a proteid substance. It is also shown that boiled yeast juice protects gelatin not only against the endotryptase of yeast juice, but also against pepsinase and tryptase, so that the protective action appears to be exerted against proteolytic enzymes in general. These results indicate that the authors' earlier view that the preservative action of boiled juice on zymase is traceable to the co-enzyme (*loc. cit.*) is untenable. It is to be concluded that boiled juice contains a distinct protective agent against digestive actions and the authors assign the name "anti-protease" to this agent. If boiled juice is boiled for several hours under a reflux condenser, the co-enzyme, but not the anti-protease, is destroyed. On heating boiled juice with dilute sulphuric acid, the co-enzyme is destroyed almost completely, whereas the anti-protease is much more resistant. The co-enzyme and the anti-protease may be precipitated from boiled juice almost completely by a mixture of alcohol and ether; on extracting the precipitate with boiling methyl alcohol, both co-enzyme and anti-protease are left almost entirely in the residue, so that a separation cannot be effected in this way. The anti-protease, unlike the co-enzyme, is not affected by potassium carbonate; both are destroyed by lipase, and they may therefore belong to the same class of substances. The anti-proteolytic property of boiled yeast juice is not due to the acidity of the latter, since the neutralised juice inhibits the action of endotryptase; again, this property does not appear to be due to the presence of amino-acids, since addition of alanine, leucine, or tyrosine, neither retards the liquefaction of gelatin by endotryptase solution, nor preserves the zymase in stored yeast juice. The anti-protease is destroyed by ignition, and by heating with water under pressure: it would thus appear to be an organic, hydrolysable substance of an ester-like nature, a view which accords with its behaviour towards lipase. The anti-protease is not formed by the action of the boiling water in the preparation of the boiled juice; if a cold, aqueous extract of acetone permanent yeast is concentrated *in vacuo*, anti-protease can be detected in the product. Hence, the anti-protease probably plays an important part in the life of the yeast, since it regulates the digestive processes. The protective influence of the anti-protease against the liquefying action of endotryptase on gelatin, appears to be due, not to a combination between the anti-protease and the endotryptase, but to a combination between the former and the gelatin.—L. E.

Alcoholic fermentation; The chemical mechanism of ——. IV. E. Buchner and J. Meisenheimer. Ber., 1910, **43**, 1773—1795. (See also this J., 1909, 1098; also 1906, 998 and 999; 1905, 246; and 1904, 262.)

The authors have frequently observed the production of lactic acid in the fermentation of sugar by yeast cell-juice; in other cases they have recorded the disappearance of added lactic acid. Hence it was suggested that lactic acid constitutes an intermediate product in the alcoholic fermentation of sugar. This hypothesis is no longer tenable, since the authors have made careful experiments with living yeast, from which they conclude that lactic acid is neither fermented nor produced by the action of living yeast. Under certain conditions, *e.g.* copious aëration, the acid may be consumed by the yeast, with the production of carbon dioxide. In order to account for the formation of lactic acid in cell-juice fermentations, the authors have investigated certain other possible intermediate products with 3-carbon chains, which are derivable theoretically from the dextrose molecule and which are readily converted into lactic acid by molecular transposition. The first of these, methyl-glyoxal, gave negative results with yeast cell-juice; no fermentation was observed but the proteins of the juice were gradually coagulated. Secondly, experiments were made with pure glyceric aldehyde and yeast cell-juice and living yeast, with the result that a perceptible, though slow and incomplete alcoholic fermentation was observed. The liquid soon turned brown with formation of a precipitate and cessation of fermentative action. Far more successful results were obtained with the closely allied body, hydroxyacetone, especially when mixtures of active c juice and boiled cell-juice containing the co-enzyme w employed. The quantity of carbon dioxide obtain from a 2 per cent. solution of the ketone in 5 days was large as that yielded by a 2 per cent. solution of dextro and it was calculated that 80—90 per cent. of the keto was fermented. With living yeast also, satisfact fermentations were recorded, 50 per cent. of the theoreti quantity of carbon dioxide being evolved in the course one day. Hence it is suggested that dihydroxyaceto may be an intermediate stage in the break-down of t dextrose molecule in the course of alcoholic fermentatio it is also probably the source from which the lactic a produced in cell-juice fermentations was derived. Furth by a process of reduction, it may be the source of t glycerol which is always formed in alcoholic fermentatio Glycerol is always produced in larger quantities in c juice fermentations than in fermentations by living yea the authors prove that its production takes place at t expense of the sugar; it amounted in some cases to much as 5—6 per cent. of the sugar fermented. quantitative experiments on the fermentation of sucrose living yeast, the authors determined an alcohol: carl dioxide ratio of 1·01, as against the theoretical ratio 1·04. The excess of carbon dioxide over the theoreti quantity is due partly to respiratory processes and par to the production of glycerol, the latter being a reduct product and carbon dioxide the corresponding oxidat product.—J. F. B.

Alcoholic fermentation; The by-products of ——. O. Ashdown and J. T. Hewitt. Chem. Soc. Proc., 19 **26**, 169—170.

Alcohol as obtained by the fermentation of dextrose dextrose-yielding materials by yeast contains numer by-products. In certain cases these may be referred substances other than dextrose, but acetic acid is proba furnished by the oxidation of acetaldehyde, which, in tu is certainly derived from dextrose, since it is produ when pure specimens of this sugar are fermented in presence of suitable nourishment, no other organic mate being added. The idea that the quantity of aldehy might depend on the available nitrogen proved unfound incidentally, support is afforded to Ehrlich's view as to source of the higher alcohols by the observation t addition of alanine diminishes the amount of these s stances. The amount of aldehyde may be diminished the addition of small amounts of formates, a result considerable interest in view of the statement of Sch (this J., 1906, 1112) that dextrose yields acetaldehyde a formate under the influence of alkali, whilst acetaldeh and formic acid yield ethyl alcohol and carbon diox with rhodium sponge as a catalyst.

Wine; Chemistry of —— and its relation to veget biochemistry. Alcoholic fermentation, and the bouquet wines. F. Scurti. Staz. sperim. agrar. ital., 1910, 105—178. Chem. Zentr., 1910, **2**, 36.

After an exhaustive historical review of the chemis of wine, the author gives the following results of analysis of an old Sicilian wine (*Castel vetrano*):—Alcol 17·3 per cent. by volume; extract, 40·22 parts per 10 total acid, 6·9; volatile acid, 2·67; tartar, 1·2; su (calculated as lævulose), 4·72; glycerol, 11·5; tannin colouring matters, 0·42; and ash, 5·9 parts per 1000. was found that the volatile esters consist chiefly of et acetate, together with ethyl isobutyrate and small qu tities of esters of caprylic and capric acids. The so-cal fixed esters consist chiefly of ethyl succinate, mixed w higher fatty acid esters, and small quantities of et malate; there is no ethyl tartrate present. Small qu tities of aliphatic aldehydes and furfural were detect The gum from wine is not an individual substance yields no mucic acid.—A. S.

Wine; Formation of acrolein in the disease of acri ("amertume") in ——. E. Voisenet. Comptes ren 1910, **150**, 1614—1616.

The first portions of the distillate obtained on distilling acrid wine which has been acidified with a few drops sulphuric acid give the reaction for acrolein which the author has recently described (this J., 1910, 584). Colorations characteristic of acrolein were also obtained with pyrogallol, resorcinol, phenol and codeine, the test being made by pouring concentrated sulphuric acid to the bottom of a test-tube containing the distillate and the phenol employed. The distillate also decolorises potassium permanganate. The acrolein is probably formed from the glycerol of the wine; the bacillus of acridity ("amertume") when grown in a fluid containing glycerol also gave the aldehyde. Acrolein is very poisonous. Quantitative determinations by means of the reagent mentioned gave 0·15 grm. of acrolein per litre in a very bitter wine in which the disease had nearly terminated, 0·10 and 0·04 grm. per litre in two others in which the disease was still in progress. It is pointed out that these results have a bearing on the production of alcohol for consumption from acrid or bitter wines.—R. V. S.

Wines and musts; Detection of hexamethylenetetramine in ——. Bonis. Ann. Falsific., 1910, 3, 250—253.

The test described by Voisenet (this J., 1910, 584) was found to be quite trustworthy for the detection of hexamethylenetetramine, or more correctly, of the formaldehyde resulting from the decomposition of this substance, in wine, etc. As little as 1 mgrm. of formaldehyde per litre may be detected by means of the test, even in the presence of considerable quantities of sulphurous acid, but it is doubtful whether there is any practical advantage to be derived from the detection of such minute traces of ormaldehyde in wine. The ordinary magenta-sulphurous acid reagent, while being slightly less sensitive than Voisenet's reagent, is sufficiently so for all ordinary requirements and is, moreover, a characteristic test for formaldehyde provided that the reagent be added to a ulphuric acid solution of the aldehyde. As traces of formaldehyde are found occasionally in wines which have not been treated with hexamethylenetetramine, it is necessary when appreciable quantities of formaldehyde are detected, to confirm the presence of hexamethylenetetramine by determining the amount of ammonia in the wine under examination.—W. P. S.

Distilled liquors: whisky (rye, Bourbon and Scotch), brandy (cognac), and gin. W. C. Holmes. Philippine J. Science, 1910, 5, 23—28.

Analyses are given of 80 samples of whiskies and brandies entering the port of Manila or bought locally, and of these not more than 10 were found to be genuine "pot-still" products (*i.e.* containing a considerable proportion of secondary distillation products). Of these 10 seven contained caramel and one contained sugar, and five were not properly matured. Only three samples answered the requirements of "straight whisky," *i.e.* which had been aged in wood for at least four years and were free from caramel or sugars. There was evidence that in some cases the character of the liquors had been changed by the addition of rectified spirits after their importation. The 3 samples of gin examined had apparently been prepared from rectified spirits and flavoured with oil of juniper or a similar compound. McGill's dilution test (Lab. Int. Rev. Dept. Canada, Bull. No. 27) was extended to the distillate made to determine volatile acids. With this degree of dilution an opalascence was obtained with nearly all the samples, but it was most pronounced in the case of those of pot-still origin, especially when there had been but little ageing.—C. A. M.

Preparing calcium tartrate from vinasse obtained from dried grapes. Bëis. *See* VII.

Mother liquors from tartaric acid factories and refineries. Carles. *See* XII.

Carbohydrate esters of higher fatty acids. Bloor. *See* XII.

Adulteration of caramel. Carles. *See* XVII.

Determination of lactic acid by the amount of aldehyde liberated therefrom. Von Türth and Charnass. *See* XXIII.

Patents.

Extract of malt in a dry form; Process for the preparation of an ——. P. H. Elmassian, Smyrna, Turkey. Eng. Pat. 14,266, June 17, 1909.

Barley is subjected to a short germination process and the green malt is mixed with a small quantity of water and ground; the emulsion thus obtained is kept in a cool place for some hours, then heated to a temperature of 45° C., and, during the next four hours, the temperature is raised gradually and continuously to 70° C. After the lapse of 1 hour, the temperature is further raised to 80° C., the wort being then filtered, and evaporated under reduced pressure until it has a sp. gr. of from 25° to 30° B. The liquid is finally dried on cylinders heated by means of steam under pressure to a temperature exceeding 106° C. —W. P. S.

Filtration process for breweries, suitable to filtering or clarifying-vats, filter-presses, wort filters, etc. A. Belgeonne, Fr. Pat. 411,715, Jan. 19, 1910. Under Int. Conv., Jan. 20, 1909.

See Eng. Pat. 5583 of 1909; this J., 1910, 510.—T. F. B.

XIXa.—FOODS.

Lard from wild and domestic Philippine hogs and the changes in the constants produced by feeding the animals with copra cake. H. D. Gibbs and F. Agcaoili. Philippine J. Science, 1910, 5, 33—43.

Samples of the fat obtained from six wild hogs gave the following values:—Acidity (as oleic acid), intestinal fat, 0·86; kidney fat, 0·28; leaf fat, 0·38 per cent.; saponification value, kidney, 197·6; leaf, 198·1; iodine value, intestinal, 54·9; kidney, 67·8; leaf, 65·8; butyro-refractometer reading at 40° C., intestinal, 48·5; kidney, 50·0; leaf, 49·5; and m. pt. of fatty acids, kidney, 37·7° C.; leaf, 38·7° C. The iodine values are lower than those given by Lewkowitsch for wild boar's fat. The effect of feeding the hogs on copra cake is shown in the following table, which gives the characteristics of the lards.

	Refractometer reading at 40° C.	Saponification value.	Iodine value (Hanus).	Iodine value of fatty acids.	m. pt. of fatty acids, titre test.
					° C.
Lard from maize-fed hogs—					
Maximum	46·0	199·0	52·7	53·8	43·8
Minimum	42·5	196·0	46·7	50·0	41·6
Mean	44·7	196·9	49·4	51·7	42·7
Lard from copra-fed hogs—					
Maximum	47·0	213·7	42·5	46·2	42·3
Minimum	44·0	204·6	32·5	36·2	39·4
Mean	45·3	208·9	37·7	41·3	40·4

The values of the lard are considerably influenced by the addition of even a proportion of copra to the food of hogs.—C. A. M.

Cheddar cheese; Production of volatile fatty acids and esters in —— and their relation to the development of flavour. S. K. Suzuki, E. G. Hastings, and E. B. Hart. J. Biol. Chem., 1910, 7, 431—458.

Whilst lactose disappears from cheddar cheese in from three to six days, depending upon the condition of the milk and the temperature of curing, the absolute amount of lactic acid present does not decrease during the ripening process, but may even increase; this increase after the lactose disappears is probably of protein origin. The lactic acid usually found in cheddar cheese is optically inactive; however, solutions of lactose, inoculated with *B. lactis acidi*, produce the optically active acid, and when inoculated with a piece of cheese, a mixture of active and inactive acids is produced. It was not found possible to separate from the cheese an enzyme capable of producing lactic acid or volatile fatty acids from the lactose ; there is present in cheese a group of acid-forming organisms which do not produce lactic acid in pure culture on a lactose medium, but which do yield volatile fatty acids. The latter are formed in increasing amounts during the ripening process, and after the lactose has disappeared. Acetic and propionic acids reach a maximum at the end of three months and then decrease, whilst butyric and caproic acids increase continually. Formic acid may be detected in whole milk cheese after five and a half months ripening, but valeric acid never seems to be present. The principal sources of acetic and propionic acids are probably lactates ; traces may have their origin in protein decomposition, or further fermentation of glycerol. Butyric and caproic acids in cheese are formed principally from fats and proteins. By steam-distilling cheese acidified with sulphuric acid, neutralising the distillate with barium hydroxide, and redistilling the solution, a "flavour solution" was obtained having an odour closely resembling that of the cheese ; this solution contained esters, ethyl acetate predominating. A pungent skim-milk cheese yielded a "flavour solution" in which ethyl caproate and butyrate were the chief compounds. The alcohol probably had its origin in the lactose fermentation, and appears to be an important factor in the production of flavour ; the agencies operative in the production of volatile acids and in the synthesis of esters are as yet undefined. Succinic acid may be isolated from cheese during the ripening process.—W. P. S.

Indian foodstuffs : Composition of ——. J. E. Q. Bosz. Z. Unters. Nahr. Genussm., 1910, **19**, 747—756.

Analyses of a large number of foodstuffs from the Dutch Indies are given in tabular form.

Modified determination of the ethyl ester value in butter analysis. Hanus and Petrik. *See* XII.

Detecting rape oil in olive and other edible oils. Torteili and Fortini. *See* XII.

Recognition of the nature of the vegetable oil used in the preparation of sardines in oil. Bull and Saether. *See* XII.

Vegetable butter in Germany ; Production of ——. *See* XII.

Purification of waste-water from dairies. Rolants. *See* XIXB.

PATENTS.

Milk and other dairy products ; Process for the determination of fat in ——. O. Wendler, Assignor to Dr. N. Gerbers Co., m. b. H., Leipzig, Germany. U.S. Pat. 961,564, June 14, 1910.

The milk is treated with a mixture consisting of one or more salts of a hydroxybenzoic acid (*e.g.*, sodium salicylate), a saccharate, and a fat-clarifying agent (butyl alcohol) ; the quantity of the fat separating from the milk is then measured.—W. P. S.

Cocoa powder ; Process of making ——. F. E. F. Neumann. Fr. Pat. 411,209, Dec. 31, 1909. Under Int. Conv., Jan. 12, 1909.

See Eng. Pat. 481 of 1910 ; this J., 1910, 778.—T. F. B.

XIXB.—WATER PURIFICATION ; SANITATION.

Textile and other factory wastes ; Purification of some ——. H. Stabler and G. H. Pratt. U.S. Geological Survey, Water Supply Paper 235, 1909.

This investigation consisted of experiments both at works and in the laboratory upon the purification of waste liquids mainly from the wool and cotton trades. For wool scouring liquor it was found that ordinary sewa purification methods were impracticable, but that tre ment by evaporation and centrifugalisation as carri out by the Smith-Leach process enabled ail the fat a potash to be recovered profitably. In the yarn bleachi trade it was found that the waste liquors from each p of the process could be best purified by mixing togetl and passing through a sedimentation tank followed filtration. In yarn dyeing establishments, the colo of the waste together with over 90 per cent. of the orga matter can be removed by filtering through sand at t rate of 100,000 gallons per acre per day. The sa object can be effected by the addition of 21 grains of li per gallon. The waste from the bleaching of cotton goo can be treated by some form of tank treatment follow by sprinkling filters or sand filters, but not conta beds. The kier liquors alone can be purified by sep treatment followed by filtration through sand at the r of 30,000 gallons per acre per day.—J. H. J.

Waste-water from dairies ; Purification of ——. E. Rolan Bull. Soc. Ind. Nord, 1910, **38**, 277—286.

Where the waste-water from a dairy consists chiefly water which has been used for washing butter, sim treatment with ferric sulphate, followed by sedimentati and filtration through bacterial beds, yields satisfacto results ; the precipitate separated may be used as manure. A more comprehensive treatment is necessa where the waste-water is mixed with sewage and oth matters and, whilst land filtration gives good results, will generally be found necessary to construct a sm biological plant to deal with the waste-water. This pla may consist of a septic tank of suitable size and a num of filter beds, means being provided for siphoning the liq intermittingly from the septic tank and distributing over the surface of the filters. A portion of the fat matters present separates on the surface of the liquid the septic tank, whilst the remainder is destroyed on t filters. It is not advisable to treat the waste-water, et with lime, as trimethylamine is liberated and this substan has an objectionable odour. In the case of factories wh casein is manufactured from the skim milk, the was waters will contain quantities of mineral acids which ha been employed to separate the casein ; such waters mu be neutralised by the addition of lime or chalk before bei mixed with the other waste-waters and treated on t filter beds.—W. P. S.

Oxygen in water ; Determination of dissolved ——. W. Jorissen. Z. anal. Chem., 1910, **49**, 424—427.

Romijn's method of determining dissolved oxygen (tl J., 1896, 674) gives entirely erroneous results with seawat or other water containing magnesium salts.—F. Sodn.

Copper salts ; Selective antiseptic action of ——. A. Spring Chem.-Zeit., 1910, **34**, 734—735.

In continuation of his work on the antiseptic properties copper salts (this J., 1910, 837), the author describes so experiments on the incubation of eggs which had be treated with a copper sulphate solution. From t results it is concluded that the preservative effect of copp salts is due to their selective action on putrefacti bacteria.—A. S.

Absorption of chloroform vapour in the air and its determin tion. Nicloux. *See* XXIII.

PATENTS.

Water ; Apparatus for use in the purification of — J. C. Thresh. Chelmsford. Eng. Pat. 22,193, Sept. 1909.

The apparatus consists of a measuring device for t reagents employed in the process described in Eng. P 3023 of 1909 (this J., 1910, 370) ; it comprises a tippi vessel which is supplied with a portion of the water means of a branch pipe, the main volume of the wat being delivered into a mixing tank. When the tippi vessel discharges, its movement operates a pivoted hollow arm, one end of which is cup-shaped and dips into the reagent solution contained in a small tank; at every discharge of the tipping vessel, a definite volume of the reagent is thus raised from the reagent tank and delivered through the hollow arm into the contents of the tipping vessel. The latter discharges its contents into a funnel placed at the top of the mixing tank where they mix with the main volume of water entering the tank. The main volume of water and the contents of the tipping vessel fall, as they enter the tank, into a cone-shaped vessel reaching nearly to the bottom of the tank, the lower edge of this vessel being oblique, so that the water circulates towards the side of the tank remote from the outlet. The reagent tank is supplied with water from a small tapped pipe on the branch pipe.—W. P. S.

Disinfecting and deodorising compound which is applicable also for bleaching purposes; Means for [electrolytically] producing a ——. J. T. Niblett, London. Eng. Pats. 8270 and 10,911, April 6 and May 8, 1909.

A SOLUTION of sodium chloride or of magnesium chloride, or the like, is passed through a suitable vessel where it is subjected to electrolysis, and the electrolysed solution is then brought into contact with the article to be treated. The vessel is provided with electrodes connected with a continuous current, and with a switch and resistance; a nozzle fitted with a tap is placed at the lower part of the vessel so that the discharge of the liquid may be regulated. If desired, the vessel may be divided into two parts by means of a partition in order that the alkaline and chlorinated compounds produced may be separated and drawn off independently. The apparatus is portable and several modifications are described. A pad of absorbent material, provided with electrodes, and saturated with aline solution may be employed instead of the abovementioned vessel, or the material itself may be saturated with the solution and then submitted to electrolysis.
—W. P. S.

Effluents; Treatment of ——. F. Abt, E. Diehl, and A. Bayer, Brünn, Austria. Eng. Pat. 20,445, Sept. 7, 1909.

SEE Fr. Pat. 406,837 of 1909; this J., 1910, 590.—T. F. B.

Formaldehyde; Apparatus for the preparation of ——. E. Huwart, Liege, Belgium. U.S. Pat. 961,721, June 14, 1910.

SEE Eng. Pat. 27,646 of 1907; this J., 1908, 1128.—T.F.B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

oca leaves; Valuation of ——. E. Bierling, K. Pape, and A. Viehover. Arch. Pharm., 1910, **248**, 303—336.

HE following methods of all those examined, give the most reliable results. 10 grms. of the air-dried, powdered aves, of known moisture content, are mixed with 4—5 c.c. l 30 per cent. ammonia, and extracted with ether in Soxhlet apparatus for 4—5 hours. A few drops of the her flowing from the drug should then give no reaction with Mayer's reagent. Or, 12 grms. of the powdered leaves a similar condition are put into a 200 c.c. flask with 120 ms. of ether and 6 c.c. of 10 per cent., or 3—4 c.c. of per cent. ammonia, and shaken vigorously and repeatedly r half an hour. The liquid is filtered till 100 grms. of trate are obtained, care being taken to avoid loss by aporation. The ethereal extract, obtained by either ethod, is shaken successively with 30, 10, and 10 c.c. 2 per cent. hydrochloric acid. The last extract should ve no reaction with Mayer's reagent. The acid extracts e filtered if necessary, and shaken out once with ether, coloured yellow. The extract is made alkaline with ammonia, and shaken with 40—50 c.c. of ether till the queous portion is colourless or no longer turbid. The queous liquid is shaken twice more with 20 c.c. of ether The ethereal solution is placed in a tared flask and the ether distilled off. The residue, after being treated twice with 5 c.c. of ether, which is driven off each time by means of a current of dry air, is dried at 100° C. till of constant weight. It is dissolved in a little ether, treated with 5 c.c. of $N/10$ hydrochloric acid, and warmed to remove the ether. The excess of acid may then be titrated with caustic soda, after the addition of 10 drops of a fresh 1 per cent. hæmatoxylin solution and 40—50 c.c. of water, or after the addition of 5 drops of iodeosine solution and some ether. If preferred the alkaloidal residue can be dissolved in 3—5 c.c. of absolute alcohol and titrated with $N/10$ hydrochloric acid, using two drops of 0·5 per cent. Methyl Red as indicator.—F. SHDN.

Kola; Determination of the caffeine in ——. Desvignes. J. Pharm. Chim., 1910, **2**, 20—22.

THE amount of caffeine in kola and its preparations can be determined by a modification of the process described in the French Codex. 15 grms. of the powdered and dried kola are mixed with 10 grms. of calcined magnesia and mixed into a paste with distilled water. This is dried at a temperature of 20°—25° C. When the drying is complete the mixture is transferred to a percolator provided with a stopcock. It is saturated with 30 c.c. of dry chloroform, which is drawn off drop by drop at the end of three or four hours into a tared flask. The mixture is extracted five or six times more with chloroform using 20 c.c. each time. When a drop of the chloroform on evaporation leaves no residue, the whole extract is distilled and the residue dried and weighed. The caffeine obtained in this way is nearly white if the chloroform used is dry.
—F. SHDN.

Cotarnine; Synthesis of ——. A. H. Salway. Chem. Soc. Trans., 1910, **97**, 1208—1219.

THE author has completed the synthesis of narcotine (this J., 1910, 781) by the synthesis of cotarnine. Myristicin (this J., 1908, 89), has already been converted into β-3-methoxy-4:5-methylenedioxyphenylpropionic acid, m. pt. 99°—100° C. (this J., 1909, 812). This acid was converted into its amide, m. pt. 129°—130° C., which by means of Hofmann's reaction was changed into β-3-methoxy-4:5-methylenedioxyphenylethylamine, $C_{10}H_{13}O_3N$. The base is a light brown oil, but the hydrochloride crystallises from alcohol and ethyl acetate in colourless needles, m. pt. 165° C. The phenylacetyl derivative of this base (m. pt. 103°—104° C. when crystallised from alcohol) was condensed by means of phosphoric oxide, when two isomeric dihydro*iso*quinoline derivatives were formed, the hydrochlorides of which melted at 192° C. and 174° C. respectively. The base corresponding to the hydrochloride m. pt. 192° C. proved to be 8-methoxy-6:7-methylenedioxy-1-benzyl-3:4-dihydro*iso*quinoline, and is a colourless oil. This was converted into its methochloride, and reduced with tin and hydrochloric acid, with the production of 1-benzylhydrocotarnine. When this latter compound was oxidised with manganese dioxide and sulphuric acid, cotarnine was produced. The dihydro*iso*quinoline hydrochloride, m. pt. 174° C., is a salt of 6-methoxy-7:8-methylenedioxy-1-benzyl-3:4-dihydro*iso*quinoline. It was taken through a similar treatment, with the formation of a new base, *neo*cotarnine, $C_{12}H_{13}O_3N$, isomeric with cotarnine. *neo*-Cotarnine hydrochloride crystallises from alcohol and ethyl acetate in yellow needles, m. pt. 185° C. The free base differs from cotarnine in not being precipitated from an aqueous solution of its hydrochloride by the addition of dilute alkali hydroxides. It crystallises from benzene in colourless prisms, m. pt., 124° C.—F. SHDN.

Quercitrin; Note on ——. C. W. Moore. Chem. Soc. Proc., 1910 **26**, 182—183.

THE glucoside quercitrin is usually stated in chemical literature to possess the formula $C_{21}H_{22}O_{12}$, and its hydrolysis, with the formation of quercetin and rhamnose, has therefore been represented as follows:

$$C_{21}H_{22}O_{12} + H_2O = C_{15}H_{10}O_7 + C_6H_{14}O_6.$$

It is evident, however, that this equation cannot be correct, inasmuch as it is now known that rhamnose possesses the formula $C_6H_{12}O_5$, but that it crystallises with one molecule of water. According to Brauns (Arch. Pharm., 1904, **242**, 561), quercitrin possesses the formula $C_{21}H_{20}O_{11}.2H_2O$, and its hydrolysis would therefore take place quite normally by the absorption of one molecule of water as follows:

$$C_{21}H_{20}O_{11} + H_2O = C_{15}H_{10}O_7 + C_6H_{12}O_5.$$

In the course of some experiments on quercitrin it was deemed desirable to confirm the formula assigned to it by Brauns (*loc. cit.*), and in this connexion some other observations concerning the glucoside may be recorded: Analysis of the air-dried and anhydrous glucoside gave results in agreement with the formula assigned to quercitrin by Brauns (*loc. cit.*). The melting points of carefully purified quercitrin have likewise been observed to differ considerably from those recorded in the literature. It has, for example, been stated (compare Brauns, *loc. cit.*) that the air-dried glucoside melts at 174°—176°, and the anhydrous substance at 168°. The correct melting points are, however, 183°—185° and 250°—252° C. respectively.

A determination of the specific rotatory power of the air-dried glucoside in pyridine gave the result: $[a]_D$ —140·9°. If to an alcoholic solution of quercitrin an excess of sodium ethoxide be added, a *trisodium* derivative, $C_{21}H_{17}O_{11}Na_3$, is precipitated. This forms a dark yellow powder, sparingly soluble in cold alcohol.

Aloïnose: Its identity with d-arabinose. E. Leger. Comptes rend., 1910, **150**, 1695—1697. (See this J., 1910, 649.)

In preparing emodin from barbaloin by the action of alcoholic hydrochloric acid, a sugar is produced. This has been previously described as a new sugar under the name of aloïnose (*loc. cit.*). Further experiments have shown it to be identical with *d*-arabinose. Barbaloin must therefore be a glucoside which hydrolyses into aloemodin and *d*-arabinose. Isobarbaloin on hydrolysis yields the same sugar.—F. Shdn.

Prunus serotina: Constituents of the leaves of ——. F. B. Power and C. W. Moore. Chem. Soc. Trans., 1910, **97**, 1099—1112.

The material used in this investigation consisted of the air-dried leaves of *Prunus serotina*, Ehrhart (wild black cherry). It was found to yield 0·0086 per cent. of hydrocyanic acid on maceration with water. The leaves contain a relatively small amount of *l*-mandelonitrile glucoside, $C_{14}H_{17}O_6N$, together with an enzyme which hydrolyses *β*-glucosides. The alcoholic extract, yielded a very small amount of an essential oil on distilling with steam, but no hydrogen cyanide. The portion of the alcoholic extract left after the steam distillation, consisted of a green resin and material which remained dissolved in the aqueous liquid. The resin, which amounted to about 5·5 per cent. of the weight of the leaves, yielded hentriacontane, pentatriacontane, ceryl alcohol, palmitic, stearic, linolic, and *iso*linolenic acids, a small amount of ipuranol, and a new crystalline substance, $C_{31}H_{48}O(OH)_2$, melting at 275°—277° C., which has been designated *prunol*. The portion of the alcoholic extract soluble in water, contained benzoic acid, quercetin, a new glucoside of quercetin, $C_{21}H_{20}O_{12}.3H_2O$, m. pt. 245° C., which has been named *serotrin*, and *l*-mandelonitrile glucoside, together with a quantity of sugar and tannin. The aqueous liquid, after heating with dilute sulphuric acid, yielded *l*-mandelic acid.—F. Shdn.

Essential oils; Constituents of ——. Noreksantalic acid. F. W. Semmler and B. Zaar. Ber., 1910, **43**, 1890—1892.

It has been shown that noreksantalic acid has the composition, $C_{11}H_{16}O_2$ (this J., 1910, 839). The methyl ester when reduced with sodium and alcohol is converted into noreksantalol, $C_{11}H_{18}O$, b.pt. 114°—117° C. at 10 mm., sp. gr. 0·9958 at 20° C., n_D = 1·49049, $[o]_D$ = —0·7° in a 100 mm. tube. Oxidation with chromic acid produces the corresponding aldehyde, noreksantalal, $C_{11}H_{16}O$, b. pt. 92°—94° C. at 11 mm., sp. gr. 0·9964 at 20 mm., n_D = 1·48301 $[a]_D$ = —30·8° in a 100 mm. tube. The *enol*-acetate is produced by the action of acetic anhydride on the latter, and boils at 110°—113° C. at 10 mm. Co sequently a CH_2- or a CH-grouping must be next to t aldehyde grouping. When the acetate is oxidised wi permanganate, teresantalic acid, $C_{11}H_{14}O_2$, m. pt. 156 (is produced. Teresantalic acid, noreksantalic acid, a sksantalic acid each possess the tricyclic nucleus of cantalol.—F. Shdn.

Essential oils; Constituents of ——. Constitution of a-santalol and a-santalene series, and of the sequiterpe ond sequiterpene alcohols. F. W. Semmler. Ber., 19 **43**, 1893—1898.

The author arrives at the following conclusions respecti the constitution of the substances isolated from sand wood oil. The lower boiling *a*-santalol is regarded belonging to a singly unsaturated tricyclic system. (the other hand, the higher boiling *β*-santalol must bicyclic and doubly unsaturated. Teresantalic acid is derivative of eksantalic acid, which is derived fr *a*-santalol. Santalene, the hydrocarbon correspondi to *a*-santalol has a composition of the camphor ty hence there is a sesquiterpene of this latter type. Formu are given explaining these relationships.—F. Shdn.

Terpenes and essential oils. 102*nd Communicati* O. Wallach. Annalen, 1910, **374**, 217—235.

The first part of the paper treats of the preparation hydroxyketones and 1·2 glycols from the nitrosochlori of semicyclic hydrocarbons; and the second part consi of observations on the nature of the terpinenes (see t J., 1910, 717).

Sesquiterpenes. IV. Gurjun balsam oil. "Caryophyllen Monoterpenes. E. Deussen and H. Philipp. Annal 1910, **374**, 105—120. (*See* this J., 1909, 1165.)

The optical rotation of Gurjun balsam oil varies betwe —10° and —130°, according to the season and locality collection. A sample of oil used by the authors had t sp. gr. 0·922 at 17° C., and optical rotation, *a* = — 44 : at 17° C. After repeated fractionations at reduced pressu two sesquiterpenes were isolated: *a*-gurjunene, which bo at 119° C. at 12 mm., and is strongly lævo-rotatory, a *β*-gurjunene, which boils at 122·5°—123·5° C. at 12 m and is slightly dextro-rotatory. The original oil, or eit of these sesquiterpenes, yields a ketone, $C_{15}H_{24}O$, oxidation with permanganate. This substance boils 175°—178° C. at 12 mm., has the optical rotation, *a* +120° to +130°, the sp. gr. 1·0160, and refractive ind n_D = 1·5303. The semicarbazide melts at 234° C., and h $[a]_D$ = +317° when dissolved in a mixture of chlo and water. The purified oil was dissolved in ether a saturated with hydrogen chloride. The hydrog chloride was then removed by means of sodium acet and acetic acid. The product was distilled over potassi and was found to be a bicyclic sesquiterpene. It boiled 129·5°—132° C. at 12 mm., and had *o* = —36°. T substance can be produced from either *a*- or *β*-gurjune and it is proposed to name it *iso*gurjunene.

The compound, $C_{15}H_{23}NO_2$, melting at 125°—125·5 found in the mother liquors left in preparing *a*-caryophyll nitrosochloride (*loc. cit.*) has been found to contain ethoxyl grouping in the molecule. The substanc therefore ethoxynitrosocaryophyllene, $C_{17}H_{29}NO_2$.

A large quantity of pinene nitrosochloride was trea with sodium methoxide. In this way a small amount a methoxy compound $C_{11}H_{19}NO_2$, was obtained, wh melts at 102° C. after crystallising from light petrole It gave a phenylurethane melting at the same temperat and when treated with hydrogen chloride in alcohol yielded *i*-carvoxime hydrochloride, m. pt. 124·5°—125·5 The substance is therefore methoxyhydro*iso*nitrosopine Pinene nitrosochloride was recrystallised several ti and then converted into the nitrolbenzylamine, m. 122°—124° C. By repeated crystallisation, a substa was separated melting at 148°—149° C., and with $[a]_D$ +96·7° in acetic ester. Pinene nitrolbenzylamine be made to form a phenylurethane, $C_{24}H_{29}N_3O_2$, melt at 189·5°—190° C. after crystallising from benzene.

—F. Shdn

Pinene ; Halogen derivatives of ——, and their transformation into hydrocarbons of the santene and cyclene series. I. Kondakow. J. Russ. Phys.-Chem. Ges., 1910, **42**, 338—355. Chem. Zentr., 1910, **1**, 2089—2090.

The author used in his experiments hydrochlorides prepared from French, Russian, Swedish and Greek turpentine oils. By removing hydrochloric acid from *d*-pinene hydrochloride by means of alcoholic potassium hydroxide (see Fr. Pat. 397,161 ; this J., 1909, 745), almost pure bornylene (b. pt. 149°—150° C., m. pt. 103° C., $[\alpha]_D$ = +15°) was obtained, contaminated by small quantities of cyclene (?), methenecamphene and isocamphene. From *l*-pinene, methenecamphene mixed with bornylene, cyclene, and *iso*cyclene was obtained. The liquid hydrochloride produced along with the solid pinene hydrochloride probably contains fenchyl chloride. The results show that the solid hydrochlorides of *d*- and *l*-pinene are mixtures in different proportions of two optical antipodes.—A. S.

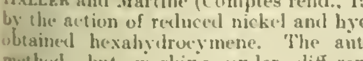
Pinonic and active pinic acids. P. Barbier and V. Grignard. Bull. Soc. Chim., 1910, **7**, 548—557.

The authors discuss the identity and relationship of the *l*-pinonic acid obtained by the oxidation of sodium *a*-campholenate, and the racemic pinonic acid produced by the oxidation of pinene. *l*-Pinene was oxidised with permanganate. The acids produced were separated by means of their sodium salts and distillation. In this way *l*-pinonic acid, $C_{10}H_{16}O_3$, was produced. It melts at 68—69° C., and has $[\alpha]_D$ = —90·55° in a 7 per cent. chloroform solution at 22° C. The oximes of this acid were prepared, also *l*-metho-ethylheptanolonide. When this acid is oxidised with sodium hypochlorite *d*-pinic acid, $C_9H_{14}O_4$, is produced, which melts at 135°—136° C., and has $[\alpha]_D$ = +70·10° in acetone. In order to prepare *d*-pinonic acid, *d*-pinene was oxidised in a similar way. The acid melts at 67°—68° C., and has $[\alpha]_D$ = +89·0° in chloroform at 25° C. When mixed with an equal quantity of *l*-pinonic acid, the racemic product melts at 104° C. The oximes and *d*-metho-ethylheptanonolide were prepared. Oxidation with hypochlorite produces *l*-pinic acid, m. pt. 135° C. Racemic pinic acid melts at 101°—102° C.—F. Shdn.

Camphor ; Production of —— in Amani (German East Africa). V. Lommel. Pflanzer, 1910 [6/7] Gummi-Zeit., Celluloid Ind. Beilage, 1910, **24**, 101—102.

The bio-agricultural station at Amani has now 3500 camphor trees ; most of those at an altitude of 1000 metres are thriving, but those planted in stony soil about 250 m. lower are growing very indifferently. The young branches and leaves are cut small and packed in a cylindrical copper boiler, 1 m. high, 70 cm. diam. and externally heated, the space (20 cm. deep) below the perforated false bottom being filled with water. Distillation is carried on for five hours, the vapour being condensed in cooled wooden vessels. The camphor is freed from oil by draining in tall glass cylinders. The average yield is 1 per cent. The leaves are the most valuable part of young trees. Fresh leaves contain 60 per cent. of moisture. Naturally dried fallen leaves contain 2·72 per cent. of camphor, fresh leaves 1·25 per cent., and artificially dried leaves 1·33 per cent.—A. Sbld.

Menthol ; A new tertiary —— ; conversion of pinene into menthene. A. Béhal. Comptes rend., 1910, **150**, 1762—1765.

Haller and Martine (Comptes rend., 1905, 1er sem., 1298) by the action of reduced nickel and hydrogen on terpineol obtained hexahydrocymene. The author by the same method, but working under different conditions, has obtained an optically inactive, tertiary menthol,  $CH_3\cdot CH<\begin{smallmatrix}CH_2\cdot CH_2\\ CH_2\cdot CH_2\end{smallmatrix}>CH\cdot C(OH)(CH_3)_2$, whether starting from active or inactive terpineol (m. pt. 35° C.). The menthol boils at 99°—100° C. at 17 mm., and at 206°—208° C. at atmospheric pressure ; sp. gr., 0·912 at 20° C. ; n_D = 1·46874 at 20° C. By the action of glacial acetic acid in presence of sulphuric acid, it yields a menthene (b. pt. 172°—174° C., sp. gr. 0·819 at 21° C., n_D = 1·45862 at 21° C.), identical with that obtained by Wallach (Annalen, **360**, 72) from *p*-methylcyclohexanone and by Auwers (Ber., **42**, 4895) from pulegone. The same hydrocarbon can also be obtained by the action of oxalic acid on the menthol.
—A. S.

Fenchone ; Constitution of ——. Bouveault and F. Levallois. Bull. Soc. Chim., 1910, **7**, 542—548.

After considering the formulæ proposed for fenchone by different observers, the authors think that Semmler's formula (this J., 1906, 826, and 1907, 1292) best represents the constitution of this substance. Starting with a large quantity of oil of fennel, they separated therefrom fenchone, estragol, and anethol. Dihydrofencholenic acid amide was prepared by heating fenchone in toluene with powdered sodium amide, and pouring the product into cold water. The properties of the amide agreed with those observed by Semmler (*loc. cit.*). The fenchone extracted from fennel oil was found to contain a small proportion of camphor.—F. Shdn.

Molecular constitution and odour ; Some relations between ——. G. Austerweil and G. Cochin. Comptes rend., 1910, **150**, 1693—1695.

Certain derivatives of citronellol have been made, with a view to studying the differences of odour thereby produced. 1·1-Dimethylcitronellol boils at 113°—116° C. at 24 mm., and has α_D = —11°38′. When largely diluted it has a rose-like and slightly camphoraceous odour. 1-Ethylcitronellol (b. pt. 125°—130° C. at 22 mm., α_D = —11°26′), when rectified, has a purer tea-rose odour. 1·1-Diethylcitronellol (b. pt. 119°—123° C. at 20 mm., α_D = —13°25′), resembles the dimethyl compound, but the rose-like odour is a little more pronounced. With 1-propylcitronellol (b. pt. 118°—122° C. at 22 mm.) and 1-butylcitronellol (b. pt. 105°—108° C. at 16 mm.) the rose-like odour becomes feebler. There appears to be a slight increase of odour with 1-phenylcitronellol (b. pt. 102°—104° C. at 12 mm.). The characteristic odour appears to be associated with the grouping $\cdot CH_2\cdot CRROH$, where R may be hydrogen, or an alkyl or a phenyl grouping, and with the presence of a double linkage. Dimethylheptenol, 3-methylnonanol, and 3·7-dimethyl-nonanol have no rose-like smell.—F. Shdn.

Organic derivatives of arsenious and of arsenic acid ; Reaction for distinguishing between ——. E. Covelli. Boll. Chim. Farm., 1910, **49**, 50—51. Chem. Zentr., 1910, **2**, 23.

The organic derivatives of arsenious and arsenic acids behave in a similar manner to the acids themselves on reduction (see this J., 1909, 1275 ; 1910, 47). Atoxyl (sodium salt of *p*-aminophenylarsenic acid) is not attacked by nascent hydrogen in alkaline solution, but in acid solution is reduced to a yellow substance. The corresponding derivative of arsenious acid is obtained by treating atoxyl with sulphur dioxide, precipitating with sodium carbonate, and recrystallising from hot water. It melts at 90° C., and is reduced by nascent hydrogen both in acid and alkaline solutions. Methylarsenic acid is reduced in acid but not in alkaline solution. On treatment with sulphur dioxide it yields a liquid, which reduces ammoniacal silver nitrate and gives a yellow precipitate on treatment with aluminium and potassium hydroxide.—A. S.

Tetranitromethane ; A simple method of preparing. F. D. Chattaway. Chem. Soc. Proc., 1910, **26**, 164.

Tetranitromethane in nearly theoretical amount can be obtained, if a suitable process be adopted, by the interaction of nitric acid and acetic anhydride. The action of nitric acid on acetic anhydride has been described as dangerously violent. This, however, is not the case unless the temperature at which they are brought together is unnecessarily high. When nitric acid attacks acetic anhydride a mononitro-derivative is probably first produced, which is so much more readily nitrated than the parent compound that action proceeds until the three hydrogen atoms of a methyl group have been replaced. The trinitroacetic acid formed by hydrolysis then slowly decomposes into carbon dioxide and nitroform, which is converted as soon as it is liberated into tetranitromethane. The methods adopted in preparing, isolating, and purifying tetranitromethane were described. The necessary operations are so simple and so easily carried out, the materials employed are so cheap, and the yield is so satisfactory as to make tetranitromethane one of the most easily procurable of organic compounds.

Cyanamide; Simple method for preparing pure ——. F. Baum. Biochem. Zeits., 1910, **26**, 325—332.

Seventy-five grms. of commercial calcium cyanamide were thoroughly stirred with 400 c.c. of water for half-an-hour. The extract was filtered off under pressure, the residue being washed with a little water, and extracted again three times, in the same way. The second, third, and fourth extracts, and a portion of fresh water, were used in succession to extract a second batch of calcium cyanamide, and so on. The solution of calcium cyanamide thus obtained, was neutralised with sulphuric acid; the liquor was then filtered under pressure from the calcium sulphate, and concentrated *in vacuo*, precautions being taken to prevent bumping. The concentrated liquid solidified on cooling; the solidified mass was extracted with ether, the cyanamide being obtained by distilling the ether from the extract. Drechsel has observed that solubility in ether does not show that the cyanamide is pure; a flocculent, amorphous substance which accompanies the cyanamide, dissolves in the concentrated ethereal solution and is precipitated on dilution with ether. A cyanamide preparation, freed from the by-product in this way, can be distilled without decomposition under a reduced pressure of about 18 mm., at a temperature of 143°—144° C.—L. E.

Hydrazine; Preparation of anhydrous ——. F. Raschig. Ber., 1910, **43**, 1927.

100 grms. of hydrazine hydrate are mixed with 100 grms. of caustic soda in small pieces in a distilling flask provided with a long condensing tube, the flask being closed by a cork stopper covered with tinfoil to protect it from the action of hydrazine vapour. The flask is now heated gradually in an oil-bath so that the temperature reaches 113° C., the boiling point of hydrazine, in 2 hours. When the caustic soda has completely dissolved, the temperature is raised to 150° C., and anhydrous hydrazine distils over, condensing to an oily liquid which fumes strongly in the air. A nearly theoretical yield is obtained. Care must be taken that the vapours are not inhaled.—A. S.

Formaldehyde; Action of red heat on ——. A. Gautier. Comptes rend., 1910, **150**, 1725—1726.

Formaldehyde when decomposed by heat at a temperature of 600°—700° C. (by passing the vapour mixed with hydrogen through a heated porcelain tube) decomposes essentially in accordance with the equation:

$$CH_2O = CO + H_2.$$

A small proportion of methane (0·37 per cent. by vol.) is also formed. In presence of iron wire, the same products are formed, but a rather larger proportion (0·8 per cent.) of methane.—A. S.

Calcium glycerophosphate. A. Astruc. J. Pharm. Chim., 1910, **1**, 490—497, 539—543, 577—582, and **2**, 11—20.

The calcium monoglycerophosphate prescribed by the French Codex does not represent the glycerophosphates actually produced by the manufacturers. These are generally mixtures of the mono- and diglycerophosphates, together with certain impurities. The presence of other phosphoric compounds is shown by comparing the weights of phosphoric acid and calcium found in the sample by the usual analytical methods, and also upon the amount of glycerophosphoric acid as estimated by titration with an alkali or by the loss of weight on ignition. The gravimetric determination of the total phosphorus and the determination of the residue left after ignition, as specified in the Codex, do not determine the amount of the official salt in commercial preparations. The author's method of titrating with an alkali and using phenolphthalein an helianthine A as indicators gives reliable results. Treatin the commercial salt with boiling alcohol, or adding stron alcohol to the aqueous solution, will not produce th official monoglycerophosphate. The pure salt can b obtained by using alcohol at a temperature not exceedin 70° C. The author considers that pure calcium glycerophosphate is neutral to phenolphthalein, and that mor than one molecular proportion of water (12 per cent.) i driven off on heating to 150°—160° C. Amongst likel impurities, citric and oxalic acids, and ammonia should b included. The incineration should not be made with previously dried sample. The results of determination of the glycerophosphoric acid, by means of total phosphorus or calcium, by the residue left on ignition, or b titrating with an alkali, should be near to one another i the salt is pure. The author concludes with some remark as to the fact that commercial preparations of this salt d not conform, as a rule, to all the requirements of th Codex.—F. Shdn.

Mercuric oxide in Unguentum Hydrarg. oxyd. flav., and o mercury in Unguentum Hydrag. ciner.; Volumetri determination of ——. L. Willen. Schweiz. Woch Chem. Pharm., 1910, **48**, 250—251. Chem. Zentr., 1910 **2**, 42.

The author's method depends upon the equations:—

$$Hg + I_2 = HgI_2;\ HgO + I_2 = HgI_2 + O.$$

A quantity of the ointment containing about 0·1 grm. o mercuric oxide is warmed with 10 grms. of petroleu spirit, and then 15 c.c. of $N/10$ iodine solution are added and the whole carefully heated till all the mercuric oxid or mercury is dissolved, whereupon the excess of iodine i titrated with $N/10$ thiosulphate, without using a indicator.—A. S.

Absorption of chloroform vapour in the air and its determination. Nicloux. *See* XXIII.

Patents.

Camphene; Process for manufacturing ——. A. Skita Karlsruhe, Germany. Eng. Pat. 13,902. June 14 1909.

Camphene free from chlorine is obtained in high yield from pinene hydrohalogenides, by heating to 150°—170° C. for five to six hours, with phenol, cresol, or naphthol, an the carbonate of an alkali or alkaline-earth metal. Th yields are higher when no water is present. For example 123 parts (90 per cent. yield) of camphene were obtained b heating 138 parts of anhydrous potassium carbonate 172·5 parts of pinene hydrochloride, and 180 parts o commercial cresol to about 160° C. for six hours.
—T. F. B.

Lecithin; Process for obtaining —— from the seeds o leguminous plants. H. C. Buer. Bonn, German Eng. Pat. 18,540, Aug. 11, 1909.

Seeds of leguminous plants are boiled with at least fou times their volume of 96 per cent. alcohol, and the extrac is evaporated to about one-fifth of its original bulk an rapidly cooled and allowed to stand for a short time, whe the fat and lecithin separate. The precipitate is now boiled with 96 per cent. alcohol until the lecithin, with portion of the fat, is redissolved; the fat is deposited o cooling, and the solution is decanted off and evaporate to obtain the pure lecithin. (Compare Ger. Pats. 200,25 and 210,013; this J., 1908, 1131 and 1909, 675.)—T. F. B

Fluorine preparations; Process for the manufacture o easily assimilable ——. J. A. Wülfing. Ger. Pat 222,716, June 29, 1909.

Fluorine preparations for pharmaceutical purposes ar made by precipitating calcium or magnesium fluoride i presence of suitable adsorbents, such as proteins or calciu or magnesium salts of inorganic or organic acids.—A. S.

Methane ; Process for chlorinating ——. J. Walter. Ger. Pat. 222,919, Nov. 5, 1909.

METHANE, freed from oxygen and containing only a small rcentage of hydrogen and nitrogen (these being removed y refrigeration, if necessary), is mixed with the requisite mount of chlorine, and subjected to the action of light, he intensity of which is gradually increased ; the mixture may be cooled between successive applications of the ight.—T. F. B.

Morphine alkaloids ; Process for preparing formyl compounds of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 222,920, May 26, 1909.

IORPHINE or allied alkaloid, or a salt thereof, is converted nto the corresponding formyl derivative by treatment vith formic acid, or the halogen derivatives of the alkaloids ay be decomposed by means of formates. Morphine is hus converted into a monoformyl derivative, the phenolic ydroxyl group not being acted upon. The formyl lerivatives of these alkaloids are less toxic than the other orresponding acidyl derivatives, and their hypnotic ffects are also less marked.—T. F. B.

erfume ; Manufacture of solid ——. A. Stapler, Charlottenburg, Germany. Eng. Pat. 19,766, Aug. 28, 1909.

EE Fr. Pat. 406,577 of 1909 ; this J., 1910, 516.—T. F. B.

uaiacol sulphonic salts ; Process of making pure ortho- and para- ——. B. R. Seifert and H. Hähle, Assignors to Chem. Fabr. von Heyden A.-G., Radebeul, Germany. U.S. Pat. 962,103, June 21, 1910.

EE Eng. Pat. 16,723 of 1905 ; this J., 1906, 335.—T. F. B.

XI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

ntensification by mercuric chloride and ferrous oxalate. The proposed substitutes for ferrous oxalate in mercurial intensification. Chapman Jones. Phot. J., 1910, **50**, 238—248.

EGATIVES intensified by ferrous oxalate, after bleaching ith mercuric chloride, according to the process recommended and used since 1888 (see this J., 1890, 546 ; 893, 983), have been found to lose no mercury during 6 years, and to be in all respects as good as when first ntensified. An exhaustive examination of proposed ubstitutes for the ferrous oxalate in this method (catechol ormaldehyde, acetaldehyde, ortol, and stannous chloride) howed that none of them, with the possible exception of ormaldehyde, was of value, the deposits frequently being oloured and containing silver-mercurous chloride. ormaldehyde in alkaline solution acts rapidly, but is ore liable than ferrous oxalate to produce stain, in ddition to which, there is the disadvantage of the double ction, the alkali replacing the halogen by oxygen, and e oxide then being reduced to the metal by the formaldehyde.—T. F. B.

PATENTS.

hotographic intensifier in solid, stable condition. Act.-Ges. f. Anilinfabr. Ger. Pat. 222,901, Nov. 26, 1907.

SOLID, stable intensifier may be prepared by mixing gether, in suitable proportions, potassium ferricyanide, anhydrous copper sulphate, and an anhydrous salt, a solution of which will dissolve copper ferricyanide (*e.g.*, sodium citrate). For example, 10 parts of potassium ferricyanide are mixed with 50 parts of anhydrous copper sulphate and 80 parts of anhydrous sodium citrate. Five parts of this mixture dissolved in 100 parts of water form an efficient intensifying solution. In order to preserve the purity of the whites of the negative, an alkaline salt (*e.g.*, 5 parts of trisodium phosphate) may be added to the mixture.—T. F. B.

Flash light powders. A. Lesmüller, Munich, Germany. Eng. Pat. 13,331, June 7, 1909.

SEE Fr. Pat. 403,722 of 1909 ; this J., 1910, 46.—T. F. B.

Polychrome screen negatives obtained by means of three-colour screen-plates containing continuous lines ; Process for copying or reproducing —— *on sensitive surfaces containing polychrome screens.* Verein. Kunstseidefabrik. Fr. Pat. 411,613, Jan. 17, 1910. Under Int. Conv., Jan. 18, 1909.

SEE Ger. Pat. 221,916 of 1909 ; this J., 1910, 783.—T. F. B.

Cinematograph films or bands ; Process for making ——. Comp. Gén. de Phonographes, Cinématographes, et Appareils de Précision. Fr. Pat. 410,986, March 29, 1909.

SEE Eng. Pat. 14,039 of 1909 ; this J., 1910, 373.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosives ; Annual report of the Chief Inspector of —— *for Western Australia for the year* 1909.

THERE were 43 reserves for magazines for explosives with a total area of 3,195 acres. There were 73 magazines, inclusive of four Government buildings, the total capacity of the whole being 1,210½ tons. Outside the reserves there were 39 magazines with a capacity of 33¼ tons, but detonator building are licensed as adjuncts to main magazines, and there were 50 of these with a capacity of some four million detonators. The nett value and quantity of the explosives imported into Western Australia during 1908 and 1909 were as follows :—

	1908.		1909.	
	lb.		lb.	Value.
Gelignite	3,261,928		2,378,100	£87,167
Dynamite	12,000		7,500	307
Blasting gelatin	438,500		370,500	20,039
Gelatin dynamite	339,852		310,250	14,300
Detonators	—	(No)	3,210,144	4,804
Fuse	—	(coils)	498,900	10,920
Blasting powder	116,500		242,217	6,163
Sporting powder	1,150		575	65
Explosives, N.E.I.	—		—	9,936
Fireworks	—		—	385
				£154,086

There was a falling off in the value of the importations to the extent of £3,340. The following table gives a comparison of the amount of explosives imported into the various states of the Commonwealth during the year 1909. The quantities are stated in pounds :—

Explosives.	Western Australia.	N.S. Wales.	Queensland.	Victoria.	South Australia.	Tasmania.
itroglycerin compounds ....lb.	3,066,350	1,325,145	1,531,280	1,753,140	554,400	434,400
lasting powder ....lb.	242,217	1,851,900	709,100	234,000	123 250	44,875
orting powder ....lb.	575	26,140	3,750	83,000	9,150	2,150
lb.	3,309,142	3,203,185	2,244,130	2,070,140	686,800	481,425

The State of Western Australia imports 27·58 per cent. of the total quantity of explosives. 2,002 tests of explosives were made, or 810 less than in the previous year, and of this number of tests 993 were samples of gelignite. In connection with the testing of explosives, an investigation was made to determine the effect of differences in composition and climatic conditions on the stability of nitro-glycerin compounds. A very large number of tests were made on samples stored in magazines in the ordinary manner, and on corresponding specimens kept in an incubator at a raised temperature and examined regularly for a period of twelve weeks, but no conclusive results were arrived at.

In the course of testing the safety fuse imported, a considerable number of samples failed to comply with the burning speed regulation in force in the State. All these consignments were withdrawn from the market and were mostly transferred to the Eastern State of the Commonwealth, where no such speed regulation exists. The fuse now in use on the goldfields possesses an accuracy and uniformity hitherto unapproached and there can be no doubt that the perfect control of mine blasting which this renders possible has contributed materially both to the safety of the miners and to the efficiency of the work done by the explosives. During the course of the year 125,000 lb. of gelignite were destroyed owing to chemical deterioration.—G. W. McD.

Explosion of electric fuse composition ; Circumstances attending an —— which occurred at the factory of Mr. F. Brain, at East Dean, Gloucestershire, on April 4, 1910. Major T. H. Crozier, H.M. Inspector of Explosives. [Cd. 5208.]

The building in which the explosion occurred was licensed for making fuse composition for electric fuses, and inserting the same into fuses. The amount of explosive allowed was 50 lb., with the proviso that all explosives exceeding 3 lb. should be kept in a cupboard at the end of the building, and effectively screened from the remainder of the building. The finished explosive was kept in glass bottles in this cupboard. Two kinds of composition were made. The one used for high tension fuses consisted of potassium chlorate, antimony sulphide, and metallic precipitate. That for low tension fuses consisted of potassium chlorate, antimony sulphide, and finely divided guncotton. The operations carried out in the building consisted of weighing and mixing the ingredients. The ingredients were weighed on a box pattern scales. Mixing was carried out by carefully sifting the ingredients by hand ; they were afterwards further mixed on a sheet of paper and at length thoroughly incorporated in a wooden drum. There was probably some 30 to 35 lb. of finished composition in the cupboard and about 30 to 36 oz. upon the bench. The building was completely wrecked by the explosion, which, examination showed, had originated where the preliminary mixing took place. One of the pans of the scales had disappeared, and no trace of it could be found. There was no sign of explosion at that end of the building where the main bulk of the composition was stored. Major Crozier finds it difficult to account for the violence of the explosion, unless the composition was confined in some way. In view of the fact that the pan of the scales had not been found, he considers that a bottle full of composition had been standing in front of the scales and that the workman had been using the pan as a scoop, or was otherwise handling it, and had accidentally dropped it or struck it against some hard substance such as the bottle or the scales. Chemical examination showed that the composition used was not unduly sensitive, and there was no reason to attribute the cause of the accident to any impurity either in the ingredients or the composition.—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Barium sulphate ; Determination of —— in the presence of substances which affect the result. M. J. van't Kruys. Z. anal. Chem., 1910, **49**, 393—419.

When barium sulphate is precipitated in the presence of calcium salts, a very appreciable amount of calcium sulphate is carried down with the precipitate, probably in a state of chemical combination, and, moreover, calcium sulphate is the only impurity found in barium sulphate precipitated from a solution containing, besides sulphate ions, salts of potassium, sodium, ammonium, magnesium, iron, or cobalt, if a sufficient quantity of calcium salts be also present. By boiling this impure barium sulphate for several hours with strong hydrochloric acid, however, the calcium sulphate, unlike other impurities, is completely dissolved, and pure barium sulphate is obtained ; the following method is, therefore, recommended for the determination of sulphate ions in the presence of any of the above metals :—A quantity of pure calcium chloride, at least double that corresponding to the sulphate ions, is added to the solution, which should not contain too much free hydrochloric or nitric acid, and, after boiling, barium chloride solution, not stronger than 10 per cent. and in amount about double that required by the equation, is added, drop by drop, with stirring : the mixture is heated to boiling, and sufficient hydrochloric acid (38 per cent.) is added to introduce at least 20 per cent. of this acid. The whole is then boiled for 3 hours over a small flame. Instead of hydrochloric acid, a mixture of 3 parts of this acid (25 per cent.) and 1 part of nitric acid (50 per cent.) may be employed, the total acid reaching at least 10 per cent., and, in this case, a little nitric acid is added occasionally during boiling. The precipitate is allowed to settle, and the liquid is poured off as completely as possible, and evaporated on the water-bath nearly to dryness, the precipitate being meanwhile boiled for a further 3 hours with 150 c.c. of 20 per cent. hydrochloric acid (or hydrochloric and nitric acids) and a few c.c. of barium chloride solution. The solution is poured off into the evaporating dish, and the boiling with acid is once more repeated. The evaporation residue is ultimately taken up with water, warmed, and added to the precipitate, the whole being then boiled for some minutes with 100 c.c. of water, and the determination is finished in the usual way. If iron salts be present, after treating the evaporation residue with water, 0·5 c.c. of hydrochloric acid and a few drops of nitric acid are added, and the mixture is boiled to ensure complete solution of the iron. The accuracy of the method depends on the fact that all the sulphate is precipitated as pure barium sulphate and that there is no mere compensation of errors as in the usual method of procedure.—F. Sodn.

Sulphuric acid ; Volumetric determination of combined —— by the barium chromate method. H. Roemer. Z. anal Chem., 1910, **49**, 490—492.

A modification of the chromate method, which is claimed to be as accurate as that proposed by M. Holliger (this J., 1910, 455) and, at the same time, more rapid, is commonly used for the determination of small quantities of sulphates in potassium salts. The sulphate present in 98 per cent potassium chloride, for example, is determined by dissolving 50 grms. of the salt in 150 c.c. of hot water, with the addition of about 4 c.c. of concentrated hydrochloric acid and 10 c.c. (for every 0·4 per cent. of sulphur trioxide content) of $N/2$ barium chloride. After boiling, the same volume of an equivalent solution of potassium bichromate (36·9 grms. per litre) is added, and then ammonia, or othe alkali, until the separation of barium chromate is complete The solution is again gently boiled, cooled, and made up to 200 c.c. ; it is then shaken and filtered from the barium sulphate and chromate, and 100 c.c. of the filtrate, which now contains a quantity of dissolved chromate exactly equivalent to the sulphate originally present, are acidified with sulphuric acid and titrated, either with ferrous ammonium sulphate solution (29·4 grms. of the crystallised salt per litre ; 1 c.c. = 0·002 grm. of sulphur trioxide) or with iodine and thiosulphate. The method is applicabl also to the determination of sulphate in water, but fo larger quantities of sulphate, Wildenstein's well-know method of titration is preferred.—F. Sodn.

Sodium and cæsium as bismuthi-nitrites ; Determinatio of ——. Part I. Determination of sodium. W. C. Bal

Sodium may be estimated, even in the presence of a very large excess of potassium, by precipitation as sodium esium bismuthinitrite (this J., 1910, 46). The precipitation is conducted in a special form of vessel, and the precipitate dried at 100° and weighed. The sodium present in complex mixtures, such as sea-water, may thus be estimated.

Tin group ; Separation of the metals of the ——. R. M. Caven. Chem. Soc. Proc., 1910, **26**, 176.

THE following modification of Walker's method (this J., 903, 111) for the qualitative separation of the metals of the tin group has been found rapid and satisfactory. The mixed sulphides are reprecipitated from their olution in alkali, collected, washed, and boiled with oncentrated hydrochloric acid according to a well-known method of separation, and the remaining arsenious sulphide, filtered off from the diluted solution, may then be dentified in the usual manner by making use of its solubility in ammonium carbonate solution. To the filtrate, ree from hydrogen sulphide and containing antimonious and stannic chlorides, potassium hydroxide is added until he hydroxides precipitated are just re-dissolved in excess of alkali. Bromine water is then added until the solution remains yellow ; thus antimonite, which would be hydrolysed in presence of ammonium chloride, is oxidised to antimonate. The addition of solid ammonium chloride irst causes the evolution of nitrogen, because of the hypobromite present ; then stannic hydroxide separates, and, after boiling, is collected. The filtrate contains only the antimony, which is precipitated as antimonic sulphide on acidifying and passing hydrogen sulphide. The advantage of this scheme of analysis is that it employs Walker's xcellent method of separating tin from antimony without postponing the identification of arsenic, which may result n small quantities of this element, present finally as arsenate, being missed by students.

Manganese ; Volumetric determination of ——. Z. Karaoglanoff. Z. anal. Chem., 1910, **49**, 419—424.

THE effect of various salts on the titration of manganese with permanganate, as in Volhard's well-known method, has been determined ; the best results were obtained with solution containing the manganese as nitrate and in the presence of silver nitrate or ferric nitrate, instead of zinc ulphate, the reaction proceeding most readily with the ormer. The results are somewhat low, as is always found n using Volhard's method.—F. SODN.

Lactic acid ; Determination of —— by the amount of aldehyde that can be liberated therefrom. O. v. Fürth and D. Charnass. Biochem. Zeits., 1910, **26**, 199—220.

T is shown, in the first place, that the iodoform method or determining acetaldehyde only gives results of practical alue if certain definite experimental conditions are dhered to. Ripper's method (see this J., 1901, 288) is much to be preferred ; under widely differing conditions, t gives results which agree very well with theory. It s also shown that the liberation of acetaldehyde from actic acid by oxidation, though not quantitative, is so uniform that this process may be used for determining he acid, Ripper's method being employed for determining he amount of aldehyde liberated. The determination s carried out as follows :—A mixture of the lactic acid olution (containing not more than 0·4 grm. of the acid) and 300 c.c. of a one per cent. solution of sulphuric acid, s introduced into a flask fitted with a 50 c.c. graduated ropping funnel containing *N*/20 potassium permanganate. he flask is attached to a condenser, the tube of which onsists of a series of pear-shaped bulbs. The condenser s connected to a stoppered, graduated receiver of 300 c.c. apacity, by an adapter, the end of which dips into 50 c.c. f water in the receiver. The stopper of the receiver arries a bulbed safety funnel which is partly filled with ater, thus forming a water-seal. The mixture in he flask is heated, and kept boiling until all the air is riven out of the apparatus and the liquid in the receiver egins to rise in the adapter. The permanganate solution then run, drop by drop, into the gently boiling solution, his addition, and the distillation, being so regulated that he liquid in the flask is decolorised before addition of the next drop of permanganate solution, and the frequency of the drops of permanganate solution is about the same as that of the drops of distillate. When the solution in the flask no longer becomes decolorised, the volume of permanganate solution added is read off ; a few more c.c. of permanganate solution are then added to the liquid in the flask, and distillation is continued until about another 100 c.c. of liquid has been collected. The receiver is detached, the contents of the safety funnel are rinsed into it, and the volume of the solution is made up to 300 c.c. ; the receiver is closed with a glass stopper, and the contents are thoroughly shaken. The solution is divided into three portions of 100 c.c. each, and each portion is treated with a known volume of an approximately *N*/10 solution of potassium bisulphite, care being taken that this is added in appreciable excess. Each mixture is shaken, and allowed to stand for at least 15 minutes at the room temperature, during which time the titer of the bisulphite solution used is determined with *N*/10 iodine solution. The excess of bisulphite solution in the mixtures above-mentioned, is then determined. For oxidation in acid solution, according to the equation,

$$CH_3.CH(OH).COOH + O = CH_3.COH + H_2O + CO_2,$$

one c.c. of *N*/10 lactic acid requires 2 c.c. of *N*/10 permanganate, and 1 c.c. of *N*/10 lactic acid yields 1 c.c. of *N*/10 acetaldehyde which corresponds to 2 c.c. of *N*/10 iodine. Hence, the volume of *N*/10 iodine corresponding to the amount of aldehyde in the distillate, should equal, theoretically, the volume of *N*/10 permanganate required to oxidise the lactic acid. Though, under practical conditions, these volumes are not equal, the amount of permanganate required for oxidation is a useful guide to the amount of aldehyde in the distillate. The authors show that the amount of aldehyde formed from the lactic acid is about 11 per cent. less than that theoretically obtainable; since 1 c.c. of *N*/10 iodine corresponds to 0·5 c.c. of *N*/10 lactic acid, *i.e.*, 0·0045 grm. of lactic acid, the error may be practically eliminated by multiplying the number of c.c. of *N*/10 iodine corresponding to the acetaldehyde by 0·005 instead of by 0·0045, to obtain the weight of lactic acid.

—L. E.

Nitrogen ; Determination of total —— by titration with formaldehyde. L. de Jager. Z. physiol. Chem., 1910, **67**, 1—7.

IN order to avoid the distillation which Kjeldahl's process necessitates, the author determines the ammonia formed by heating organic matter (urine) with copper sulphate, potassium sulphate and sulphuric acid by means of Sörensen's titration with formaldehyde (see this J., 1908, 135). The phosphates are removed by treatment with ferric chloride in the presence of sodium acetate, and the copper is precipitated as sulphide by addition of sodium sulphide. The solution is then neutralised, using phenolphthalein (not litmus) as indicator, neutralised formaldehyde is added, and the liquid is titrated with alkali, again with phenolphthalein as indicator.—R. V. S.

Peptide linkages ; Determination of the —— present in proteins or their decomposition products. V. Henriques and J. K. Gjaldbäk. Z. physiol. Chem., 1910, **67**, 8—27.

BY means of Sörensen's formaldehyde titration method the authors have investigated the conditions necessary to ensure the complete hydrolysis of protein substances. Owing to the circumstance that under energetic treatment (*e.g.*, heating to 180° C., with acid under pressure), the amino-acids themselves are apt to lose ammonia, it is not easy to say when the hydrolysis is complete, but in general, heating at 150° C. with 3*N*-hydrochloric acid for 1½ hours in an autoclave, is sufficient. Prolonged boiling with concentrated hydrochloric acid does not always destroy all the peptide linkages, and certain ferment hydrolyses were also found to be incomplete.—R. V. S.

Chloroform vapour in the air and its determination ; Apparatus for the absorption of ——. M. Nicloux. Bull. Soc. Chim., 1910, **7**, 561—567.

THE chloroform vapour in a given volume of air, say 30—100 litres, can be completely absorbed by drawing the air through a wash-bottle containing alcohol, and then upwards through a vertical tube, 1 metre long and 30 mm. diameter, filled with glass marbles. A slow stream of alcohol, 200—300 c.c. per hour, is allowed to trickle down the vertical tube. The chloroform retained by the alcohol from the wash-bottle and vertical tube can then be determined.—F. Shdn.

Indirubin. Bloxam and Perkin. *See* IV.

Preparing calcium tartrate from vinasse obtained from dried grapes. Bèis. *See* VII.

Mother liquors from tartaric acid factories and refineries. Carles. *See* VII.

Iron and steel analysis. Kohout. *See* X.

Method of analysing atacamite. Aller. *See* X.

Modified determination of the ethyl ester value in butter analysis. Hanus and Petrik. *See* XII.

Detecting rape oil in olive and other edible oils. Tortelli and Fortini. *See* XII.

Detecting cottonseed oil in olive oil. Marcille. *See* XII.

Recognition of the nature of the vegetable oil used in the preparation of sardines in oil. Bull and Saether. *See* XII.

Determining specific gravity of fats and waxes. Lissner. *See* XII.

Determining active oxygen in washing powders. Bosshard and Zwicky. *See* XII.

Determination of benzine and petroleum in turpentine and pine oils by means of sulphuric acid. Eibner and Hue. *See* XIII.

Potassium ferrocyanide as indicator in the determination of glucose. Selvatici. *See* XVII.

Determining absolute extract of barley. Seibriger. *See* XVIII.

Detecting hexamethylenetetramine in wines and musts. Bonis. *See* XVIII.

Determining dissolved oxygen in water. Jorissen. *See* XIXb.

Valuation of coca leaves. Bierling and others. *See* XX

Determining caffeine in kola. Desvignes. *See* XX.

Distinguishing organic derivatives of arsenious and of arsenic acid. Covelli. *See* XX.

Volumetric determination of mercuric oxide in Unguentum Hydrarg. oxyd. flav., and of mercury in Unguentum Hydrarg. ciner. Willen. *See* XX.

Patents.

Testing air or other gases for their content of particular gases; Process and apparatus for ——. M. Arndt. Fr. Pat. 411,310, Jan. 6, 1910.

See Eng. Pat. 462 of 1910; this J., 1910, 724.—T. F. B.

Calorimetric process and apparatus. S. W. Parr. Fr. Pat. 411,691, Jan. 19, 1910.

See U.S. Pat. 947,418 of 1910; this J., 1910, 300.—T. F. B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Carbohydrates from carbon dioxide and water in the absence of chlorophyll; Photochemical synthesis of ——, and of quaternary compounds. D. Berthelot and H. Gaudechon. Comptes rend., 1910, **150**, 1690—1693.

Oxides of carbon and water vapour have been made to react with each other by means of the light of the mercury vapour lamp. Carbon monoxide and oxygen produce a small amount of carbon dioxide, whilst the latter gas yields carbon monoxide when exposed to the rays in the presence of phosphorus. Carbon dioxide and hydrogen give water and formaldehyde (which, as is known, is capable of forming carbohydrates by successive condensations). Water can be made by the action of the rays on a mixture of hydrogen and oxygen. Water vapour itself is decomposed in the presence of carbon monoxide or phosphorus. Formaldehyde can be made directly from hydrogen and carbon monoxide. Formaldehyde is decomposed in the presence of nitrogen when exposed for several hours close to the lamp. Carbon monoxide and ammonia gas give formamide.—F. Shdn.

Books Received.

Jahresbericht über die Leistungen der Chemischen Technologie mit besonderer Berücksichtigung der Elektrochemie und Gewerbestatistik für das Jahr 1909. 55. Jahrgang oder Neue Folge. 40. Jahrgang. Bearbeitet von Dr. Ferdinand Fischer, Professor an der Universität in Göttingen. (Jahrgang 1 bis 25 von R. v. Wagner). 2. Abteilung: Organischer Teil. J. Ambrosius-Barth's Verlag. Dorrienstrasse 16, Leipzig. 1910. Price M. 1.

8vo volume, containing 584 pages of subject matter, with 69 illustrations, and alphabetical indexes of names and subject matter.

Notions Fondamentales de Chimie Organique. Par Ch. Moureu, Professor à l'Ecole supérieure de Pharmacie de l'Université de Paris, etc. Troisième Edition. Gauthier-Villars, Quai des Grands-Augustins, 55. Paris, 1910. Price 8 fr. 50.

Small 8vo. volume, containing 336 pages of subject matter, and an alphabetical index. The general subject matter is classified under the following headings:—I. Preliminary considerations and general theories. II. Carbides of hydrogen. III. Oxygen functions, *e.g.*, alcohols; phenols; aldehydes, ketones; acids; sugars, etc. IV. Nitrogen functions. V. Organo-mineral compounds. VI. Heterocyclic compounds.

Identification of the Commercial Dyestuffs, being Vol. III. of a Method for the Identification of Pure Organic Compounds by a Systematic Analytical Procedure based on Physical Properties and Chemical Reactions. Containing classified original descriptions of nearly 1,700 synthetic and natural dyestuffs, references to many allied brands, suggestions on the examination of dyestuffs in mixtures and a colour standard. By Samuel Parsons Mullikin, Ph.D., Assistant Professor of Organic Chemical Research at the Massachusetts Institute of Technology. John Wiley and Sons, New York, U.S. America. Price $5.00. Chapman and Hall, Limited, London, 1910. Price 21s. net. First edition.

Large 8vo volume containing 258 pages of subject matter, 16 pages of alphabetical index of subjects, and 5 sheets of colour standards. This may be described as a volume of analytical and colour tables for the discrimination and identification of dyestuffs, not only by means of reagents, but also by dyeing tests, verification tests, etc. The text is classified as follows:—I. Introductory and historical. II. Directions for the general analytical procedure in the examination of an unknown dyestuff. III. Use of the analytical tables. IV. Analytical tables: (i), Azines, oxazines, thiazines, indigoes, etc.; (ii), Triphenylmethane derivatives, etc.

(iii). Azo-compounds; (iv). Pyronine. Oxyketone, thiobenzenyl and indanthrene derivatives. Natural colouring matters, etc; (v). Sulphur dyestuffs; (vi). Identification of dyestuffs in mixtures.

Introduction to the Analysis of Drugs and Medicines. An elementary handbook for the beginner. By Burt E. Nelson, Chemist to the New York State Hospitals, etc. First edition. John Wiley and Sons, New York. Price $3.00 net. Chapman and Hall, Limited, London, 1910. Price 12s. 6d. net.

Small 8vo volume, containing 369 pages of subject matter, and an alphabetical index. The text is illustrated with 31 engravings. There are 12 sets of analytical and other tables, and an appendix on the subject of "Reagents." The subject matter is classified as follows:—I. Introduction. II. Apparatus and operations. III. Ultimate inorganic analysis. IV. Ultimate organic analysis. V. Determination of molecular weights, common radicles, and chemical formulæ. VI. Principles of drug analysis. Methods. VII. Analysis of medicines generally. VIII. Principles of microscopical drug analysis. IX. Systematic microscopical drug analysis. X. Assays of chemicals, crude drugs, and pharmaceutical preparations. XI. Pharmacological methods.

The Elements, Speculations as to their Nature and Origin. By Sir William A. Tilden, F.R.S., etc. Harper and Brothers, 45, Albemarle Street, London, W., and New York, 1910. Price 2s. 6d. cloth.: 3s. 6d. leather.

Duodec. volume, containing 135 pages of subject matter, and an alphabetical index. The subject matter is classified as follows:—I. The elements. II. Inter-relations among atomic weights. III. The periodic law. IV. Theories of evolution. V. Speculations.

The Relations between Chemical Constitution and some Physical Properties. By Samuel Smiles, D.Sc. Assistant Prof. of Organic Chemistry at University College, London. Longmans, Green and Co., 39, Paternoster Row, London. New York, Bombay, and Calcutta, 1910. Price 14s.

8vo volume, containing 545 pages of subject matter with 33 illustrative diagrams and alphabetical indexes of names, subjects and substances. It belongs to the series of text-books of Physical Chemistry edited by Sir William Ramsay, K.C.B., F.R.S. The subject matter is classified as follows: Mechanical Properties. I. Capillarity. II. Viscosity. III. Volume relations. IV. Specific heat. V. Fusibility. VI. Boiling point. Optical Properties. I. Refractive and dispersive power. II. Absorption of light. III. Fluorescence. IV. Magnetic Rotatory power. Electrical Property. I. Anomalous electric absorption.

Report of the Departmental Committee appointed to Enquire into the dangers attendant on the use of Lead and the danger or injury to health arising from dust and other causes in the manufacture of Earthenware and China and in the processes incidental thereto, including the making of lithographic transfers. Vol. I. Report. [Cd. 5219.] Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 5d.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

15,411. Wilde. Utilising the waste heat of combustion products and subsequently condensing them. June 27.

15,503. Epstein. *See under* XVIII.

15,820. Humphrey. Method and apparatus for raising and forcing liquids. July 1.

15,999. Hildebrandt. Fractional separation of mixed gases.* July 5.

16,156 and 16,161. Robacher. Filtering apparatus particularly for use in the cyanide process of extracting precious metals from ores. [U.S. Appls., May 13, 1910.]* July 6.

Complete Specifications Accepted.

18,452 (1909). Bary. Furnaces. July 13.

19,626 (1909). Talansier. Apparatus for emulsifying, pulverising, and homogenising liquids. July 13.

20,380 (1909). Farago. Concentration of solutions without heating them. July 13.

28,360 (1909). Abresch. Apparatus for filtering and purifying liquids. July 13.

1040 (1910). Giesserei und Maschinenfabr. Oggersheim P. Schütze und Co. Apparatus for elevating liquids. July 6.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

15,152. Ionides and Swan. Production of combustible gas. June 28.

15,707. Teed and others. Recovery of sulphur from gases. June 30.

15,861. Stobie. Gas producers. July 2.

15,877. Burkheiser. *See under* VII.

16,193. Collin. *See under* VII.

16,197. Grimshaw. Manufacture of fuel in the form of briquettes from coke breeze, anthracite, and bituminous culm. July 6.

Complete Specifications Accepted.

12,583 (1909). Bowing. Retorts for making gas and coke. July 6.

15,497 (1909). Boyer and others. *See under* XII.

15,559 (1909). Cone. Generation of gas. July 13.

15,736 (1909). Astor. Gas producer for making gas from peat. July 6.

16,647 (1909). Beasley and Bradbury. *See under* XXIII.

19,297 (1909). Hohmann. *See under* XXIII.

20,492 (1909). Duchanoy and others. Gas producers. July 6.

23,434 (1909). Visseaux. Manufacture of incandescent mantles. July 13.

28,048 (1909). Franke. Manufacture of briquettes of porous, hygroscopic fuels. July 6.

28,054 (1909). Moores. Composition for purifying air-gas. July 13.

28,467 (1909). Dicker (Underfeed Stoker Co. of America). *See under* XXIII.

29,930 (1909). Fabry. Apparatus for removing tar from coke oven gas, retort gas, &c. July 6.

11,491 (1910). Bowing. Retorts for use in making water-gas. July 6.

III.—TAR AND TAR PRODUCTS.

Applications.

15,342. Levinstein. Wyler, and Levinstein, Ltd. Diphenylamine derivative and the production of dyestuffs therefrom. June 27.

15,646. Ransford (Cassella und Co.). Manufacture of an aminophenylnaphthimidazole oxysulphonic acid and azo dyestuffs therefrom. June 29.

15,711. Raschig. Tar paint or tar coatings. [Ger. Appl., May 4, 1910.]* June 30.

16,151. Bloxam (Ullmann). Manufacture of carboxylic acids of the anthraquinone series. July 6.

16,272. Ullmann. Manufacture of derivatives of the anthraquinone series. July 7.

Complete Specifications Accepted.

14,805 (1909). Wetter (Rütgerswerke A.-G.). Meta-cresol ortho-oxalic acid ester and its production. July 6.

15,071 (1909). Lessing. Method of decomposing hydrocarbons. July 6.

22,398 (1909). Newton (Bayer und Co.). Producing *m*-aminobenzaldehyde and its salts, and the anhydrocompound of *o*-aminobenzaldehyde. July 6.

8100 (1910). Bayer und Co. Manufacture of hydrocarbons with more than one double bond. July 13.

IV.—COLOURING MATTERS AND DYES.

Applications.

15,342. Levinstein, Ltd., and others. *See under* III.

15,390. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of azo colouring matter. June 27.

15,391. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of a substantive disazo dyestuff.* June 27.

15,443. Wyler, and Levinstein, Ltd. Bromine derivatives of indigo and their production. June 28.

15,523. Meister, Lucius, und Brüning. Manufacture of a vat dyestuff of the anthraquinone series. [Ger. Appl., July 31, 1909.]* June 28.

15,646. Ransford (Cassella und Co.). *See under* III.

15,649. Johnson (Badische Anilin und Soda Fabrik). Manufacture of condensation products and dyestuffs of the anthracene series. June 29.

16,271. Johnson (Badische Anilin und Soda Fabrik). Manufacture of benzanthrone compounds. July 7.

16,440. Ullmann. Manufacture of vat-dyeing dyestuffs of the anthracene series. July 9.

Complete Specifications Accepted.

15,142 (1909). Wyler, and Levinstein, Ltd. Dyestuffs of the indigo series and their production. July 6.

17,818 (1909). Wyler, and Levinstein, Ltd. Dyestuffs derived from indigo and their production. July 13.

21,581 (1909). Johnson (Kalle und Co.). Manufacture of brominated colouring matters of the thioindigo group. July 13.

24,487 (1909). Newton (Bayer und Co.). Manufacture of acid wool dyestuffs. July 13.

24,703 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. July 13.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

15,700. Verein. Glanzstoff-Fabr. Utilising the refuse from the manufacture of artificial silk from cellulose. [Ger. Appl., Dec. 20, 1909.]* June 30.

15,752. Pellerin. Preparation of xanthic solutions of cellulose. June 30.

15,897. Carron. *See under* IX.

Complete Specifications Accepted.

15,306 (1909). Lilienfeld. Coating or printing with viscose. July 13.

18,694 (1909). Heydenhauss and others. Celluloid substitute and its manufacture. July 6.

19,963 (1909). Gernaert. Manufacture of paper. July 6.

6538 (1910). Berg and Imhoff. Preservation of tin-weighted silk. July 13.

11,729 (1910). Fabr. de Soie Artific. de Tubize. Collecting the vapours of the volatile solvents used in making artificial silk. July 13.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

15,407. Derreumaux-Bulteau. Means for dyeing fabrics. [Fr. Appl., July 21, 1909.]* June 28.

15,819. Becke. Producing multi-coloured effects i spun and woven goods. [Ger. Appl., Aug. 11, 1909.] July 1.

15,926. Grime. Producing whites and other colours c indigo blues. July 4.

16,206. Goetz. Apparatus for dyeing, bleaching, mo danting, &c., wool, cotton, and other fibrous substance July 7.

16,389. Calico Printers' Assoc., Ltd., and Bent Production of resist effects in printing on textile fabric July 9.

16,403. Hunt and Moscrop. Mouthpiece seal for stov or chambers used for developing colours on fabric July 9.

Complete Specifications Accepted.

19,213 (1909). Tate. Waterproofing fibrous material July 13.

22,604 (1909). Gilmore. Apparatus for drying fabric July 13.

25,999 (1909). Becke and Beil. Dyeing half-woolle goods. July 13.

1309 (1910). Jaumandreu. Apparatus for conveyi skeins of yarn through dyeing, bleaching, and like bath July 6.

3591 (1910). Patent Borax Co., and Bradford. *S under* XII.

7094 (1910). Ges. f. Chem. Industrie in Basel. Produ ing discharge effects on coloured grounds. July 13.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLI ELEMENTS.

Applications.

15,525. Guye and Darier. Manufacture of alk nitrates and alkaline earth nitrates. [Fr. Appl., July 1909.]* June 28.

15,707. Teed and others. *See under* II.

15,817. Christie. Manufacture of ammonium sulphat July 1.

15,877. Burkheiser. Preparation of ammonium sulphi or sulphate from gases. [Ger. Appl., July 2, 1909. July 2.

15,973. Johnson (Badische Anilin und Soda Fabrik Manufacture of ammonia. July 4.

15,991. Bernstein. Manufacture of cuprammoniu solution.* July 5.

16,169. Sefton-Jones (Quade). Production of wate soluble crystalline aluminium formate.* July 6.

16,193. Collin. Manufacture of ammonium sulpha from moist gases.* July 6.

16,275. Aluminium-Industrie A.-G. Manufacture hydrocyanic acid. [Swiss Appl., Sept. 24, 1909.]* July

16,368. Badische Anilin und Soda Fabrik. Manufactu of nitrides. [Ger. Appl., July 9, 1909.]* July 8.

16,454 and 16,455. Freeth and Cocksedge. Manufactu of ammonium nitrate from sodium nitrate and ammoniu sulphate or bicarbonate. July 9.

Complete Specifications Accepted.

12,226 (1909). Feld. Production of hydrocyanic ac from metallic cyanides. July 6.

30,380 (1909). Johnson (Badische Anilin und So Fabrik). Manufacture of ammonia. July 6.

8438 (1910). Imray (Soc. Chem. Ind. in Basl Manufacture of concentrated formic acid. July 13.

10,815 (1910). Collett and Eckardt. Converting calciu cyanamide into nitrate of lime. July 13.

11,906 (1910). Cassella und Co. Manufacture of hydrous sodium hydrosulphite. July 13.

VIII.—GLASS; CERAMICS.

Applications.

16,064. Pilkington. Drawing glass. July 5.

16,441. Bloxam (Siemens und Halske A.-G.). Man facture of glass Addition to No. 9563 of 1908.]* July

IX.—BUILDING MATERIALS.

Applications.

15,713. Sucher. Process for hardening and preserving wood.* June 30.

15,897. Carron. Rendering wood, canvas, &c., fire-resistant and water and vermin repellant. July 2.

16,028. Harms and Small. Manufacture of liquid concrete.* July 5.

16,096. Mason. *See under* X.

16,462. Chamberlain and Chamberlain. Treatment of gypsum or plaster of Paris.* July 9.

Complete Specification Accepted

15,649 (1909). Backus. Manufacture of artificial stone. July 13.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

15,507. Beck. Pyrophoric metal alloys. [Addition to No. 2876 of 1909. Ger. Appl., July 1, 1909.]* June 28.

15,664. Sefton-Jones (Prevot). Electrolytic copper process. June 29.

15,674. Zohrab, Evans, and Brown. Blast furnaces. June 29.

15,794. Adamson. Aluminium solder. July 1.

15,892. Parsons and Silberrad. Alloys. [Comprised in No. 232, Jan. 4, 1910.] July 2.

15,984. Dabritz. Hardening iron and steel.* July 4.

16,096. Mason. Manufacture of refractory bricks, blocks, &c., used in furnaces for smelting metals. July 6.

16,156 and 16,161. Robacher. *See under* I.

16,177. Duke. Alloy and its manufacture. July 6.

16,287. Clément. Separating metallic particles from pulverulent masses. [Ital. Appl., July 9, 1909.]* July 7.

Complete Specifications Accepted.

12,276 and 27,364 (1909). Wynne. Separation of ores, &c. July 6.

14,812 and 14,813 (1909). Smallwood. Furnace for heating metals and roasting, calcining, and smelting ores. July 6.

15,384 (1909). Mackintosh. Alloys. July 13.

15,913 (1909). Wasserfuhr. Protection of iron, &c., against atmospheric influences. July 13.

16,546 (1909). Landau (Landau). Apparatus for dissolving metals and other substances. July 6.

18,962 (1909). Wolff. Desulphurising and deoxidising steel. July 13.

22,140 (1909). Robertson. Extraction of tin and like oxidisable metals from ores and slags. July 13.

24,735 (1909). Harris. Electrodeposition apparatus. July 13.

29,286 (1909). McKechnie and Beasley. Separating metallic compounds from complex ores, mattes, residues, &c. July 13.

29,445 (1909). Drucker. Continuous slimes vacuum filter. July 13.

4334 (1910). Dallemagne and Dallemagne. Ore concentrating and separating apparatus. July 6.

XI.—ELECTRO-CHEMISTRY.

Applications.

16,067. Arledter. Electrolysis. July 5.

16,256 and 16,259. Lake (Standard Chemical Co.). *See under* XIII.

16,260. Lake (Standard Chemical Co.). Preparation of insulating compounds. July 7.

Complete Specifications Accepted.

14,937 (1909). Grunwald. Electric induction furnaces. July 6.

30,463 (1909). Schulte. Apparatus for electrolytically removing grease from objects to be galvanised. July 13.

845 (1910). Lacroix. Electrolysis of metallic solutions. July 6.

6596 (1910). Schott und Gen. Electrolytic apparatus with a liquid annular anode. July 13.

XII.—FATS; OILS; WAXES.

Applications.

15,829. Boult (Fleming). Treatment of glycerin.* July 1.

15,903. Crosfield and Sons, Ltd., and Markel. Conversion of unsaturated fatty acids or their glycerides into saturated compounds. [Addition to No. 1515 of 1903.] July 2.

Complete Specifications Accepted.

15,497 (1909). Boyer and others. Preparation of lubricating oils having a basis of castor oil and mineral oils. July 6.

3591 (1910). Patent Borax Co., and Bradford. Soaps and other saponaceous compounds, detergents, bleaching compounds, &c. July 13.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

15,462. De Fazi. Manufacture of colours. June 28.

16,256 and 16,259. Lake (Standard Chemical Co.). Production of resinous compounds suitable for insulating electric cables, &c. July 7.

Complete Specifications Accepted.

29,886 (1909). Marks (Southern Manufacturing Co.). Extraction of turpentine, oils, and other products from wood. July 13.

1178 (1910). Krusemann and Pool. Production of zinc white. July 6.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

15,557. Oswald and Edwards. Machinery for reducing crude rubber, &c., to a liquid or semi-liquid state. June 28.

16,286. Wassmer. Manufacture of synthetic rubber. July 7.

16,407. Bridge. Extracting rubber or gums from rubber vines, shrubs, bulbs, &c. July 9.

16,438. Campbell. Production of artificial rubber or the like. July 9.

16,456. Leemans. Dissolving vulcanised india-rubber.* July 9.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

15,797. Fölsch. Preparation of a lubricant for waterproofing leather, &c.* July 1.

15,798. Fölsch. Waterproofing leather and other materials.* July 1.

16,437. Campbell. Production of artificial leather or the like. July 9.

XVII.—SUGARS; STARCHES; GUMS.

Complete Specifications Accepted.

16,845 (1909). Soc. Anon. Raffinerie Moderne. Apparatus for concentrating and boiling green syrups. July 6.

20,025 (1909). Beckmann. Manufacture of an adhesive composition in powdered form. July 13.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

15,503. Epstein. Distillation or rectification and the utilisation of the residue. June 28.

15,504. Von Stuckrad. Manufacture of fruit wine. June 28.

15,613. Howell. Improving the dietetic value of malt beverages. June 29.

16,200. Stewart. Electrolytic extraction of wort from yeast, brewers' or distillers' grains, and brewers' spent hops, and drying yeast, grains, and spent hops. July 7.

Complete Specifications Accepted.

15,278 (1909). Porteus. Treatment of malt for mashing purposes. July 6.

15,740 (1909). Krieger. Treatment of malt returns or drafts to secure a more complete utilisation of the malt. July 6.

1195 (1910). Overbeck. De-alcoholisation of beer. July 6.

XIX.—FOODS. WATER PURIFICATION; SANITATION.

Applications.

15,729. Woosnam (Whetham). Manufacture of foodstuffs. June 30.

15,767. Candy and Candy. Purification of water. July 1.

15,827. Soc. Anon. des Nouveaux Agglomeres Combustibles. Treatment of night-soil and other refuse. [Fr. Appl., May 17, 1910.]* July 1.

15,959. Fernbach. Treatment of lemon juice. [Fr. Appl., July 3, 1909.]* July 4.

Complete Specifications Accepted.

22,864 (1909). Adams. Sewage purification plant. July 13.

26,842 (1909). Wetter (Riedel). Process for purifying water. July 13.

2073 (1901). Schilling. Apparatus for removing fat from effluents. July 13.

3969 (1910). Richardson. Purifying or clarifying water. July 13.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

15,392. Bloxam (Boehringer und Söhne). Manufacture of quinine compounds.* June 27.

15,560. Johnson (Verein. Chininfabr. Zimmer und Co.). Manufacture of esters of the hydrohalogen addition products of quinine. June 28.

15,696. Weil. Preparation of a compound of tannin, silver, and albumen.* June 30.

15,722. Johnson (Badische Anilin und Soda Fabrik). Manufacture of aromatic ammonium compounds. [Comprised in No. 30,505, Dec. 30, 1909.] June 30.

15,890. Wellcome and Ewens. Manufacture of a physiologically active base. July 2.

16,048. Wolff und Co. Manufacture of compounds containing iron, albumin, and phosphorus. [Ger. Appl., July 23, 1909.]* July 5.

Complete Specifications Accepted.

15,552 (1909). Rose and Siddall. Rotary machine for extracting essential oils from limes, lemons, oranges, bergamots, &c. July 6.

19,087 (1909). Newton (Bayer und Co.). Manufacture of ketone alcohols. July 13.

24,298 (1909). Newton (Bayer und Co.). Manufacture of β-methyladipic acid. July 6.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

16,273. Ruth. Manufacture of colour screens for colour photography. [Ger. Appl., July 10, 1909.]* July 7.

16,421. Herzka. Manufacture of photographic plates which avoid halation. July 9.

Complete Specification Accepted.

17,324 (1909). Holliugsworth. Sensitised albuminised paper for photographic purposes. July 13.

XXII.—ANALYTICAL PROCESSES.

Application.

15,408. Trezise and Sheppard. Photometers. June 27.

Complete Specifications Accepted.

16,647 (1909). Beasley and Bradbury. Recording gas calorimeter especially for the analytical examination of the products of combustion. July 13.

19,297 (1909). Hohmann. Automatic gas analysis apparatus. July 13.

28,467 (1909). Dicker (Underfeed Stoker Co. of America). Analysis of gas. July 13.

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Official Notice.

ORDER OF MERIT.

His Majesty the King has been pleased to confer the distinction of the Order of Merit upon Sir Wm. Crookes, F.R.S., a member of the first Council of the Society.

Liverpool Section.

Meeting held at The University, on Wednesday, April 13th, 1910.

DR. JAMES T. CONROY IN THE CHAIR.

THE SEPARATION OF OIL FROM CONDENSER WATER BY ELECTROLYSIS.

BY RIDSDALE ELLIS.

This paper is the result of some experiments undertaken primarily to determine the reactions which take place in the Davis-Perrett electrolytic oil separator. These experiments led to an investigation of the properties of oil emulsions, more particularly in connection with the various methods in use for separating the oil from the water.

The Davis-Perrett oil separator was designed more particularly for separating the oil from condenser water, and has, as far as I know, been hitherto used only in that connection, but it may be used equally well for separating other emulsions or suspensions, as I will show later.

Before taking up the question of the separation of the oil from the condenser water, I will first review briefly the general properties of condenser water.

As is well known, the lubricating oil, when it reaches the hot cylinder walls, is so reduced in viscosity that it rapidly runs down to the lowest point of the cylinder and is either blown away through the exhaust or carried off by the drain pipe. The oil then is carried by the steam chiefly in the form of fine spray, and only to a certain extent as vapour. In the case of saturated steam the oil is carried as thin films of oil surrounding the drops of water. The usual method of separating the oil is, of course, to pass the steam through a baffle-plate separator, the water and oil being collected and run off together. The amount of oil carried away by the exhaust steam is only one part in five or ten thousand, and hence, however high may be the boiling point of the oil, a considerable part of the oil carried by the steam must necessarily be vaporised. This vaporisation is, moreover, greater on account of the fact that lubricating oils are a mixture of hydrocarbons of various boiling points, the lowest boiling constituents of which are readily vaporised at the temperature of the steam. It is evident therefore that separators placed in the steam pipe cannot remove all the oil, however well they may be designed. Some tests made at the Massachusetts Institute of Technology on baffle-plate oil separators show that the amount of oil separated out in this way is about 75 per cent. of the total oil contained in the steam. The remaining 25 per cent. of oil goes on to the condensers and is precipitated in the water in the form of very minute globules.

Where the lubrication of the engine is normal and an oil separator is placed in the steam pipe, the condensed water should not contain more than about one part in twenty-thousand of oil, the percentage being correspondingly higher if no separator is used. The drops of oil in this very dilute emulsion are extremely small, averaging only 0·00005 of an inch in diameter, and it is on account of their extremely small size that the difficulty of separating them arises, and also gives to this emulsion the properties of suspensions and colloidal solutions. The size of the particles does not depend on the nature of the lubricating oil or on the method of their formation, for as Lewis* has shown, emulsions produced by distillation in steam contain globules of approximately the same size as those contained in other emulsions. The larger globules are, however, considerably larger than the average size found by Lewis, and probably these larger globules are those particles which were carried over mechanically by the steam, the smaller globules being those produced by condensation of the oil vapour.

A small amount of the oil contained in the water can be separated by flotation, but the velocity at which the globules rise through the water is extremely small even for those globules of average size, while, as Perrin† and others have shown in the case of gamboge and gum mastic emulsions, there is in any emulsion always a number of ultra-microscopic particles which will not separate out, however long the liquid containing them is allowed to stand.

In condenser water, after the larger globules have risen to the surface, a very stable, if very dilute, emulsion is obtained which may be kept for months without separating out completely. The chief characteristics of such an emulsion are dependent on the fact that the globules are electrically charged, which is shown by the fact that they migrate in an electric field. The striking feature to be noted with regard to the velocity of migration of these oil globules is that it is of the same order of magnitude as those of the majority of ions and of other suspensions and colloidal solutions. Not only does the close agreement between the velocity of migration of these oil globules and that of other colloidal solutions indicate that the emulsion may be treated exactly like a true colloidal solution, but the analogy is borne out by the fact that, as these oil globules are negatively charged, they can be precipitated by means of oppositely charged colloidal solutions, for example, colloidal ferric hydroxide.

Coagulation of the oil globules by means of electrolytes is impossible, owing to the extremely dilute nature of the emulsion. I might remark here that coagulation of an emulsion does not appear to involve in any way the coalescence of the oil globules, but is simply the aggregation of the minute oil globules into particles sufficiently large to be removed by filtration.

Returning now to the Davis-Perrett oil separator, this consists essentially in the electrolysis of the condenser water using iron electrodes, some electrolyte, usually sodium carbonate, being added to the water to raise its conductivity. Whatever the nature of the electrolyte, a basic salt is always produced on account of the alkali formed at the cathode. The precipitate formed entangles the oil globules, so that when the electrolysed solution is filtered all the oil is removed. Complete precipitation of the compounds of iron does not take place all at once, so that if the emulsion is filtered immediately the filtrate often contains colloidal ferrous compounds. If the emulsion is hot, as would be the case with condenser water, this colloidal solution is not formed.

If treated cold the electrolysed solution should be allowed to stand for a little time before filtering, the presence of precipitated iron compounds producing the precipitation of the remainder of the iron. I obtained an analagous result when the oil was precipitated by colloidal ferric hydroxide. In this case I found that above a certain concentration all the colloid was precipitated, however great the excess, that is, within limits. From this it appears that the presence of the coagulated colloid brings about in some way the precipitation of the excess of colloid added. The same is true in the case of electrolysis, the colloidal solution obtained being only precipitated in the presence of the coagula. With colloidal ferric hydroxide, the precipitation must occur on the surface of the oil globule, and the precipitation, which is apparently catalysed by the presence of coagulated ferric hydroxide, must continue as it began around the oil globule. The fact that the precipitation of the colloidal obtained by electrolysis only takes place in the presence of the coagula would point to the same mode of formation in the two cases. I then examined microscopically the precipitate produced, first, when the oil globules were coagulated by colloidal ferric hydroxide, secondly, when the precipitate was produced by the electrolysis of a sodium carbonate solution using iron electrodes, and thirdly, the precipitate obtained by precipitating basic ferrous sulphate in the water. The appearance of the precipitate produced in these three cases is exactly similar, which is a further proof that the electrolytic separation of the oil is extremely closely allied in its nature to colloidal coagulation, and consists in the precipitation of a positively charged compound around the negatively charged oil globules. Further, the similarity of the coagula shows that the function of electrolysis is merely to produce the precipitation in the water of a positively charged basic ferrous salt.

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* Zeit. Chem. Ind. Koll., 1909, 211.

† Comptes Rendus 1908, 967.

There have been various attempts made to separate the oil from the condenser water by precipitating substances therein, and the general idea of cleansing water from suspended impurities by means of flocculent precipitates is an extremely well-known mode of water purification. The principal substances used for the purification of water from suspended impurities are ferric and aluminium hydroxides and other voluminous precipitates.

I next made some experiments to determine whether the separation of the suspended matter depends on the electrical charges carried both by the suspended substance and by the precipitant, or whether it is merely a question of mechanical inclusion. Aluminium silicate is a good example of a flocculent precipitate, but when this substance is precipitated in an emulsion the oil is not coagulated in any way, as can be seen from the photograph, which illustrates the mechanical inclusion of the oil globules by means of aluminium silicate. The precipitate being white does not show up in the micro-photograph.

I then noticed that Pickering[*] stated that colloidal ferric hydroxide and basic salts were good emulsifiers, but that aluminium silicate would not emulsify oil at all. From these and other experiments now being made, it would appear that the electrical charges carried by the oil and by the emulsifier play an important part in the phenomena of emulsification.

While the cause of this precipitation on the surface of the oil globules is probably the difference in the electrical charges carried by the oil globule and by the precipitating substance, the surface tension at the oil-water interface will also have considerable influence. These two effects are most likely very largely inter-connected, but it should be remarked that, according to Cohen's[†] law, all substances suspended in water are negatively charged with the exception of hydroxides and basic salts. Hence the basic ferrous carbonate formed by electrolysis, and the basic ferrous sulphate formed by chemical precipitation are both positively charged, and so should precipitate on the surface of the oil globules, as has been shown to be the case.

Further, it is well known that agitating water with various substances, followed by sedimentation or filtration, will remove bacteria and other suspended solid matter. This principle has been applied to the separation of oil from condenser water by Dehne, who uses alumina for this purpose. He adds hydrated alumina made into a cream with water to the emulsion and filters the mixture. The oil is thereby retained by the alumina. Here again the electrical charges on the oil or on the bacteria or other suspended matter appear to play an essential part. If finely-powdered animal charcoal, which is positively charged, is shaken up in an emulsion and the liquid allowed to stand, the particles of charcoal carry down with them globules of oil. This is practically a case of the precipitation of two oppositely charged suspensions, and therefore analogous to the precipitation of one colloid solution by another.

If, then, oil globules will collect small particles of certai solids around them, the filtering of an oil emulsion throug a large mass of these substances should filter off the c and give a clear filtrate. This is exactly what was foun to be the case. Filtering media formed of the followin substances give a clear filtrate:—Hydroxides of iro aluminium, chromium, and calcium, barium carbonat bone black, spongy iron and fine ground coke; but whe barium sulphate, lead chloride and cotton-wool were use little or no oil was removed.

The filtration of emulsions has been recently dealt wit by Emil Hatschek[*]. He found that filtration throug magnesium or calcium carbonate would remove all the oi Now Perrin has[†] shown that barium carbonate is positivel charged, and in view of the preceding experiments it appea very probable that the separation of the oil by filtratio through calcium carbonate or causticising mud is due t the difference in sign of the electrical charges carried b the oil and the filtering medium.

In an experiment of Spring[‡] with regard to the filtr tion of a suspension of lamp black, the particles of carbo being positively charged, and the cellulose of the filt being negatively charged, all the black was retained. A litt soap solution was added to the solution when the sign the charge on the lamp black particles was changed. an when the liquid was filtered none of the carbon wa retained by the filter.

Evidently then, the essential function of an electrolyt oil separator is to provide a simple and automatic mean for precipitating in the water a basic ferrous salt, an in place of it we may use various filtering media c precipitate various flocculent precipitates in the solution.

These remarks apply almost equally well to the separatio of all suspensions, since practically all suspended particl are negatively charged and will, therefore, behave in a exactly similar way to the oil globules. For instance, have electrolysed with iron electrodes the effluent obtaine from the Bradford wool suds after the wool-grease an other fats have been removed; the result is a clear filtrat free from all suspended matter, and apparently othe effluents can be treated in a similar way. I then mad some determinations in order to find out exactly how muc of the oil is removed by this process. Since the oil in th emulsion rises gradually to the top of the liquid an adheres so strongly to the other oil particles on the surfac that these visible agglomerates cannot be completel broken up by shaking, some other substance must be use as a standard of turbidity. For this purpose soap solution of various concentrations were used.

To compare the turbidity of two given liquids, such a an oil emulsion and soap solution, by means of transmitte light is very difficult, since evidently the precision of th method decreases as the percentage of the light cut o decreases. In other words, for small concentrations o oil the determination of the amount of turbidity to an degree of accuracy becomes impossible. To overcom this trouble, and to get a quicker way of determining th content of oil, a simplified form of Richard's "Nepthelo meter" was employed. This apparatus was designed b Richards[§] for the comparison and estimation of opalescen precipitates, and depends not on the amount of transmitted light cut off, but on the amount of light reflected b the solid particles in the liquid. The light reflected i proportional to the amount of suspended material. I the simplified form used for these experiments, two test tubes are taken, the rims being cut off so that blac paper tubes can be readily slid up and down the tube The ends of these tubes are covered with black paper t cut off any reflection in the curved ends. On looking dow the black tubes into the liquid only the light reflected b the particles in the liquid is seen. The relative turbidity is then obtained by sliding up and down the black tubes until the amount of light reflected or the apparent turbidity is the same in both tubes. Then the amount of oil in each tube is of course inversely proportional to the length of tube exposed to the light.

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[*] J. Chem. Soc., 1907, 91, 2001.
[†] Ann. Phys., 1898, 64, 217.

[*] This J., 1910, 29, 125.
[†] J. de Chim. Phys., 1904, 2, 601.
[‡] Rec. Trav. Chim. Pay-Bas., 1909, 28 120.
[§] Ann. Chem. J., 1904, 31, 235.

Using this apparatus, the efficiency of separation in the Davis-Perrett apparatus was found to be over 98·5 per cent., the actual amount of oil still contained in the water after treatment being less than one part in a million. This amount of oil is so small that it is impossible to detect it by the direct comparison with distilled water, and the turbidity can only be detected by means of a Nepthelometer. I cannot give accurate figures for the separation of oil by means of filtering materials, though in the case of coke it would appear to be over 95 per cent., and a similar or higher efficiency for filtration through red ochre.

After the efficiency of the Davis-Perrett apparatus as a separator, the next question is the cost of operation. The two principal items are the electrical energy consumed and the soda or other substance added to the water.

Using an emulsion of pure oil and pure water containing 1 part of oil and 20,000 of water, which is about the maximum content of oil ordinarily obtained in condenser water, I found that the minimum amount of electricity required was about 135 coulombs per gallon of water treated. This result was obtained on a small laboratory apparatus, but is I think sufficient to show the order of magnitude of the electrical energy required and to base one or two calculations as regards cost of operation.

The following calculations were based on the assumption that bipolar electrodes are used, and that the current efficiency is 100 per cent. Where iron electrodes are used in a very dilute sodium carbonate solution the decomposition voltage is about 1·50 volts, but I found that efficient bipolar action can be readily obtained by making the holes in the plate or the spaces round the plate small. Using 50 iron plates, the current required for treating 1000 gallons of feed water per hour will be 1·75 ampères, and at 230 volts. the watts per hour will be 227—a ridiculously small amount. With electricity at 2d. a unit the cost of the current works out at a halfpenny per 1000 gallons of feed water treated. The next item is the sodium carbonate added to raise the conductivity to the necessary amount. To each 1000 galls. of feed water 1·5 lb. of sodium carbonate must be added. With carbonate at £5 10s. per ton the cost per 1000 galls. is then a fraction less than 1d. The last item is the renewal of the iron plates. As these plates are used as bipolar electrodes, they should be not used after their thickness is much less than ¼-in. However, reckoning on a twelve-hour day, the iron plates should be renewed every two years, so the cost of renewal need not be considered. These figures are based on the minimum amount of electricity and sodium carbonate, but it is evident that the cost is so slight that these amounts may be very considerably exceeded without making the cost prohibitive.

Except for the addition of the sodium carbonate solution the apparatus requires no attention, for a self-flushing filter which will cleanse itself periodically is usually installed.

The apparatus may be further simplified by adding tap-water instead of sodium carbonate solution, the calcium and other salts acting as the electrolytes. The amount of salts introduced will be less than that contained in ordinary hard water. Thus supposing the water added contained only calcium carbonate, sufficient would have to be added for the condenser water to contain 9·0 grains per gallon. Chloride solutions may be added in place of carbonate and hence sea-water may be used if desired.

There is a further consideration, and that is, what will be the effect on the boilers of a solution of a carbonate or other salt which has been electrolysed. Since alkali is always formed at the cathode and the precipitate formed is not pure hydroxide but a basic salt, there will always be a slight excess of alkali in the water introduced into the boilers. Since the water is very faintly alkaline, and since the corrosion of iron is proportional to the content o hydrogen in the water, the amount of corrosion wil probably be less than is the case in ordinary pure water.

Further, the apparatus appears to have a considerable field for use, not only in connection with the separation of oil from condenser water, for which it was primarily designed, but also for the treatment of other suspensions and colloidal solutions, and its cost in many cases would not appear to be prohibitive.

I take this opportunity of expressing my thanks to Prof. Goodwin, of the Massachusetts Institute of Technology in Boston, and also to Prof. Donnan, of this University, for their help and the many suggestions which they have made during the course of these experiments.

Discussion.

Professor F. G. **Donnan** thought that the great thing that Mr. Ellis had pointed out in this work was that the action of the Davis-Perrett electrolytic apparatus was simply the production of a basic ferrous precipitate to coagulate the oil. He presumed that a certain quantity of soda was added to the water to make it conduct. The positively charged basic precipitates were electrically adsorbed by the oil particles, and they enable the oil particles to aggregate together in groups. That seemed to him the essential point. Mr. Ellis had brought out the fact that the inventors of the process knew very little about electricity, as he had shewn that a ridiculously small number of watts are really required. The second point Mr. Ellis had made clear was that filtration was largely dependent on the electrical charges on the filtering medium and the matter filtered.

Dr. J. E. **Southcombe** said that the apparatus had given considerable trouble in the cases he knew of. In working with cylinder oils he had found that metallic soaps were produced by the oxidation of hydrocarbon oils and their subsequent action on the finely-divided particles of metal abraded from the cylinder walls. Perhaps the presence of these metallic soaps might affect the stability of the emulsion.

Mr. **Hadfield** remarked that a great amount of oil was lost by being mixed with water, and a great deal lost by emulsification. It was only mechanically mixed, and his experience was that a little water combined with some impurities carried through with the steam, caused the oil to be so mixed with the water that it could not be separated by ordinary means, and if this apparatus could be applied it would be a very good thing.

Mr. **Ridsdale Ellis** said that he had found that when he electrolysed emulsions cold he was liable to get colloidal iron substances in the filtrate. The sample he had shewn, he had had to warm before passing it through the electrolysing tank, otherwise there would be a considerable amount of colloidal iron found there. That was the principle difficulty he had found with the process. The question of the oxidation of hydrocarbon oils and the formation of metallic soaps had been brought up. He had tried evaporating some of the water obtained from the condenser, and he had found that when evaporated to a small volume a number of films were formed which separated out, and he had often wondered what was the nature of those films. Probably they consisted of metallic soaps. The question had also been brought up as to how crank chamber emulsion could be treated in order to obtain the oil from it. Experiments were made with regard to the separation of oil from a mixture of oil and water. It was found necessary to treat it with hydrochloric acid, to break down the layer of emulsifier at the surface of the globules and enable them to coalesce. The broken oil or any other oil which was emulsified could be de-emulsified by treatment with some re-agent which would dissolve the film. In some cases, as in the case of oil obtained from the steam separator, hydrochloric acid might be used. The re-agent used depended on the nature of the emulsion. The separation, or de-emulsification, was probably to some extent due to a change in the electrical charge carried by the oil particles.

London Section.

Meeting held at Burlington House on Monday, 2nd May, 1910.

MR. W. F. REID IN THE CHAIR.

THE PRINCIPLES OF TANNING.

BY DR. J. GORDON PARKER.

Innumerable new methods have been proposed and patents have been taken out during the last century for the acceleration and improvement in tanning leather, mostly by those but remotely connected with the trade. In spite of this the general outline in process of tanning sole leather is much the same to-day as carried out a thousand years ago. In short the changes which have taken place between the tanning of sole leather even 1000 years ago and to-day consist not so much in principle as in a more intelligent method of carrying out the process.

The raw material for the British tanner is the hide of oxen and cows, and is drawn from practically all parts of the globe. From the Argentine, Uruguay, China, and Africa come hides which have been dried in the sun; from America, from all parts of Europe and the Colonies, come hides in what is known as the salted condition—the hides are piled, a sprinkling of salt between each, and gradually the salt draws out the water, becomes dissolved, and diffuses into the interior. After lying in pile for some time, the excess water is thrown off, and the hides are re-salted; in this condition they frequently contain as much as 30 per cent. of salt on the original weight of the hide. From the home market the hides are usually obtained " green " or " fresh." The first process, therefore, is the soaking and cleansing to soften the fibres, remove extraneous matters, salt, blood, dirt, etc., and to bring the hide back to its natural state. In bygone days this was done by suspending the hides in a running stream by the tanyard, but now the common custom is to soak the hides in pits containing water. The hides are usually given a change of one or two waters; salted hides receive a longer treatment and several changes of water until moderately free from salt; dried hides are, after a preliminary soaking, sometimes " stocked " or " milled," in a large machine which pummels the hide and gradually breaks up the fibres, after which the hides are returned to the water. Revolving drums and other similar appliances are also used. The softening of flint dried hides is by no means an easy operation and considerable care must be exercised in bringing the hide back to its natural condition without loss of pelt substance through putrefaction, the germs of which are present in the hide. With some hides it is difficult to soften in less than 6 to 8 days, and to aid the softening process sulphide of sodium, or caustic soda is often added to the soak water. These materials have a swelling effect which accelerates the penetration of the water, and the subsequent softening of the fibres, but at the same time they slightly increase the solubility of the hide. It has been shewn that the higher the temperature at which hides are dried for preservation in foreign countries, the more difficult becomes the subsequent absorption of water, and consequent softening in the tan yard. It is very essential that hides should not only be thoroughly softened but they should be in a clean state before passing to the next process. The English tanner has a great fear of losing pelt substance by using too much water at this stage; but it is undoubtedly wrong to leave hides in a foul dirty water, and the more clean water they have the less is the loss of pelt substance. I was very much struck some three years ago when visiting the large tanneries in the United States, to note the efficient way in which their process of soaking was carried out, no hides being allowed to pass on to the next process without at least three changes of water, to which sometimes a half hour's running in a revolving drum was added. The pelt looked much healthier, there was no loss of pelt substance, and the hide gave a better leather, owing to the fibres being more open, and better prepared for the subsequent process.

The hides are placed in a saturated solution of lin containing lime in excess for the purpose of loosening tl hair and swelling the hide. This process lasts from 7 to days. The hides are laid flat one upon another in a pit co taining the necessary amount of water to which slaked lin is added in the proportion of 8 lbs. per hide. Former it was believed that the lime swelled the fibres of the hid dissolving the hair bulb or root and loosening the epiderm thus rendering the removal of the hair easy; but tl liming process is now known to be both chemical ar physical, the loosening of the hair being largely due to tl action of enzymes, and the products of bacteriologic action. Hides cannot be unhaired by sterile lime, that the process of Payne and Pullman, by which tl hides were first soaked in caustic soda and afterwards calcium chloride, so as to form lime within the fibres, w unworkable unless preceded by the soaking of the hid in a foul soak to obtain the necessary bacteriologic action. By the action of lime on hides other products ar formed, salts of amino acids and compound amines whic play a vital part in the loosening of the hair and in the turn act upon the hide and influence the quality of tl resultant pelt. The longer a lime pit is used, the mo alkaline it becomes, the quicker the loosening of the hai the greater the loss of good hide substance by solutio and the more flaccid the resulting product. Hides in tl limes are frequently hauled, the lime pit thorough plunged up in order to keep it up to strength of saturatio the hides returned, and the process repeated until the are ready for unhairing.

The scientific control of the liming process deserves f more attention than it has hitherto obtained, for in th process, to use an old tanner's expression—" the leath is made or marred." At a well-known tannery son months ago I found that from one of the pits over 24 l of dissolved hide substance was going down the drain eac time a " lime " was run off. Assuming that even only 50 p cent. of this loss could have been avoided, this would l equal to 12 lb. of dry hide substance (no unimporta matter with wet hides at 6½d. per lb.) which in the ordina course of events would have produced 24 lb. of leathe If leather trades' chemists had given as much attentio time and thought, to this part of the process as they hav to the vexed question of the method of analysis, it wou have been more beneficial to our industry. Sodium ar calcium sulphides are now becoming more largely used i conjunction with lime. These have an accelerating actio on the process and are claimed to improve the results bot in weight and firmness of texture. They have howeve a destructive action on the hair, reduce the value of tl flesh and require considerably more care and contro otherwise more serious losses may result than wit lime alone.

After the hides have been properly limed the hair removed; either by hand or by machines. The mo satisfactory machines consist of a revolving spiral roll which travels over the hides as they rest upon a rubb bed, which yields to the pressure as it is increased and th avoids damage. The reverse side of the hide is then free from superfluous flesh, consisting of a thin network coarse fibres heavily loaded with fat. This is remove on a similar shaped beam, the knife in this case being ke sharp. This by-product, together with the hide trimming including the nose, ears, shanks, tail, etc., form the ra material for the manufacture of glue and gelatine. Th hide in this condition now becomes known as pelt, and o the pelt weight the tanner bases his calculations as to valu and the probable yield in leather; he is also able to judg its quality, the fineness of the grain, etc. It is no customary to divide up the hide into " butt " or " back, shoulder and belly, a process known as " rounding." Th back is the thickest and most valuable part, used altogeth for the heavy soles of boots, belting and harness; th shoulder, being somewhat thinner, is used for light boot and ladies' shoes; while the belly is of a porous natu and is used chiefly for stiffeners, heels, insoles, and sometim even for the outer soles of the cheaper class of slipp and boots. This rounding process requires great skill an judgment to determine what size to cut the different parts, which is regulated by the growth and character of the hide. As a general rule hides should yield 50 per cent. of their pelt weight in butt, 24 per cent. of shoulder and head and 26 per cent. of belly. Some well-grown hides from the best Scotch and Hereford cattle yield 51 to 52 per cent. of butt and from best Italian hides a higher percentage is sometimes obtained. The "pelt" or rounding table weights are important, for if the liming process has been regular the tanner can gauge at this stage whether his hides have been honestly weighed and well bought, which is difficult to judge in the salted or dry condition, and whether the grain is of good, smooth texture. From these weights the tanner calculates that he should obtain 72 per cent. of finished leather from the weight of butt pelt, 52 per cent. from that of the bellies and 54 per cent. from that of the shoulder, giving a total weight in leather from the green hide of some 56 to 60 per cent. These percentages vary with different classes of tannage.

The weighed and trimmed pelt is in a swollen condition; for the lime has not only swelled the hide and opened the fibres, but also made it firm and rubbery. As a general rule the pelt contains from 2½ to 3 per cent. of lime. Before entering the tan yard proper a large proportion of the bulk of this lime must be removed and the swelling caused by the alkalinity of the lime must be reduced, otherwise a harsh, brittle, brown, blotchy coloured leather would result. Thirty years ago, or even less, tanners used to rely upon the acid early tan yard liquors to do the necessary deliming, but investigation has shown that if the liquors in the early process of tanning are too weak and contain an excess of acid, not only is the lime removed from the pelt, but pelt substance is dissolved in the form of soluble leather. It is now known to be not only safer and better, but also cheaper, to delime the pelt in a weak solution of boric or one or other of the organic acids, lactic or formic being in most common use. The pelts are suspended on poles by means of strings in a pit containing water to which the requisite amount of acid has been added. They are handled frequently to insure regularity of action or kept in continual movement by mechanical means. The deliming is for sole leather never quite complete, a trace of lime is always left in the interior of the hide, and it is usually sufficient if the hides, on leaving the deliming pit, show no pink colour to phenolphthalein when a few drops are sprinkled on the surface. After a rinse through soft water, the butts, bellies and shoulders are ready for the tan yard.

Formerly the hides for sole leather were tanned whole without rounding, and, after colouring from six to twelve weeks in weak sour liquors made from oak bark and water, were frequently handled and moved forward from time to time into liquors of gradually increasing strength. After this colouring process, the bottom of a deep pit or vat was covered with a layer of ground oakbark, and the first hide was spread out on it, grain upwards, the head and flanks turned in. This in its turn was covered with a layer of bark, another hide on top and a further layer of bark and so on, hide and bark alternating until the pit was full. Water was then pumped in to saturate the bark, and the hides were left for about two months; after which the liquor was pumped off and used to supply the colouring pits. The hides were then raised, freed from the adhering bark, and then laid in a fresh pit for a longer period with more bark and this process repeated four or five times, each time increasing the quantity of bark between each hide and the length of time of laying away, and as the hides got older, bark liquor was pumped on the dry bark instead of water and frequently a little ground valonea was mixed with the oak bark in the last layer. The hides, after from 18 months to two years, being considered tanned, were removed, rinsed through liquor or brushed to remove adhering bark, allowed to drip for a couple of days, oiled on the grain, hung up in the lofts to dry and when nearly dry laid on a wooden, rounded beam or a hollowed stone bed and hammered to flatten out the leather and render it firm. Finally they were completely dried and were ready for the bootmaker who in those days bought the hide in its whole state. The strongest liquor in the tan yard probably never exceeded 1·030 specific gravity or 30° Bk. containing perhaps at most 2 per cent. to 3 per cent of tan. How different are present conditions, where the strongest liquor in a modern tan yard often contains from 14 to 16 per cent. of tannic acid, and has a density of from 130 to 150 Bk! Then an oxhide of 80 lb. weight yielded about 30 lb. of finished leather; to-day from a similar hide a yield of close upon 50 lb. weight is obtained, which even the severest critics must still call honestly tanned leather.

With the introduction of new materials, and the gradual substitution of machinery for hand labour, the old process above described has been gradually altered.

Among the newer materials which have come into use during the past century, valonea, the acorn cup of the Turkish oak, must be the first mentioned. Although introduced into this country at an earlier period, it is only in the early forties that it began to be used in other than experimental lots to blend with oak bark; its more extended use was chiefly due to the enterprise of some West of England tanners, who having allowed a shipper to store a large quantity of this material in their bark barns until it could be sold, had permission to use what they required in their process. Using a little at a time in more or less homeopathic doses they found that not only did its use do no harm to their leather, but it actually improved it and made it firmer and more solid. With further experience came more confidence so that a larger proportion of this material was blended with the oak bark, and still the leather appeared to improve, until the whole of the shipment of over 200 tons were used and they became regular buyers. Other tanners in the district followed suit, until in the seventies, Bristol or West of England leather, chiefly tanned with valonea, had achieved a reputation for solid hard wear, especially suitable for heavy walking boots and for repairs. It was not long before tanners all over England commenced to blend with this material.

Myrobalans (often miscalled myrabolams), the fruit of the "*Terminalia chebula*," one of the Indian forest trees, which had been used by the native tanners of India for many years, soon found favour when introduced because of its power of rapid penetration, the light colour which it imparted to the leather, and its somewhat rapid souring properties.

"Terra Japonica," or gambier, was early used for the purpose of modifying the sharpness or astringency of valonea, and in West of England tannage played an important role in the early tanning stages; its special characteristic was its swelling powers, thus keeping the texture of the hides open and nullifying the contracting action of the stronger tans.

Acacia bark (mimosa) from Australia and South Africa, dividivi from India, algorabilla from South America, all of them containing over three times as much tannin as does oak bark, had a considerable influence upon the changes that have taken place. Reference has been made above to the heavy layer of bark between each hide; this was afterwards burnt or thrown away half spent, but with stronger and better tanning materials in use, it became general to put this dusting material into large pits, called leaches, lecks and spenders, in which the tannin of the bark was extracted by means of water. These leaching pits were arranged in series and the liquor pumped from one pit to the other, until by passing through successive pits of partly spent material it gained sufficient strength for use in saturating the bark between the hides, producing liquors of much greater tanning strength.

The introduction of Tanning Extract in the early seventies, however, had more effect on the method of tanning than anything else. It was first introduced from France made from chestnut wood, and later from Hungary produced from oak wood. In the manufacture of this material, the wood is reduced to fine shreds by powerful machinery and the rasped wood is afterwards extracted in large wooden vats by the aid of hot water. The resulting liquor is decolorised by means of blood which is added to the cooled liquor; the temperature is then raised and the coagulated albumen separating out carries with it the dark-red colouring matter of the bark together with some of the tan. The clarified liquor is then concentrated in large copper vacuum pans at a comparatively low temperature, and shipped to this country in concentrated form in casks containing upwards of 30 per cent. of soluble tannin ready for immediate use, for blending in with the tanners' leach liquors.

The effect of these stronger liquors was that of hide which had hitherto been tanned in one piece, the thin part became too much tanned before the thick part had had sufficient tan, with the result that "rounding" became more general. This brought about a great change; and square pits sunk in the ground became general. These were half filled with liquor of the required strength, a butt thrown in and before it had time to sink in the liquor was sprinkled with a layer of bark, a second butt quickly following to be likewise sprinkled, and so on until the pit was full. By this means a greater volume of liquor was used than bark, and as the butts became older and more tanned they passed to stronger liquors and were dusted more heavily with valonea, myrobalans and mimosa bark, instead of oak. With the use of liquors of increasing strengths came an increased yield of leather as the fibres became saturated with stronger tan. Machines began to supersede hand labour, and machines for rolling the leather instead of hammering came into general use, followed by others for scouring, stretching, and polishing the leather. Boot manufacturers began to demand an article of better finish and appearance, smooth grained and flat. For the modern boot manufacturer, the leather must be prepared flat and smoth so that it will pass with ease through his sole cutting machinery and it must be of such a quality that it can be stitched direct by machine without soaking and without the aid of the cobblers' awl.

To return now to the delimed properly prepared pelt. The butts enter the suspender pits. These are a series of deep vats containing old weak liquor graduated in strength. In these the butts are hung on poles, being frequently handled to insure regular colouring and to accelerate the tannage, moved forward to stronger liquors once or twice daily, while in some yards it is customary to have these pits connected by a pipe from the top of the strongest pit to the bottom of the vat next lower in strength; by this means the liquor may be caused gradually to flow from the strongest to the weakest to replace the tan absorbed by the "hungry" hide. Mechanical means are also employed to rock the goods. In this process, which lasts from one to two weeks, the butts absorb tannin with great rapidity, some 50 per cent. to 60 per cent. of the total tannage taking place at this stage. The butts are then taken off the poles, and laid flat in pits containing liquor, which are called "handler pits," as the butts are here handled daily from one pit to another, into a liquor of greater strength; they remain in these for about four weeks. This early stage is almost the most important in the tanning process proper, as it is here that the colour, substance, and to a large degree also, the quality of the leather is made. The liquors in the handlers and suspenders must also not only be graduated so as to contain the requisite amount of tan to keep the pelt constantly feeding, but there must be the necessary amount of organic or mineral acid to swell and keep the pelt open, and so counteract the natural astringency of the tannic acid. If the pelt is not kept open at this stage and becomes contracted, it can never be recovered, and does not take up the normal amount of tannin, producing a thin, poor leather. The blending of the materials is also of great importance; at this stage considerable amounts of myrobalans, gambier and other light coloured plumping materials are used. When the butts leave the handler, they are usually "struck through," *i.e.*, penetrated to the centre, and about 80 per cent. of the total tannage has been completed in the first six to seven weeks.

The butts are then taken to a series of pits known as "dusters" or "layers." These pits contain fresh, strong and more astringent liquors. The butts are laid flat in these pits and between each butt as it is thrown in is sprinkled a layer of tanning material, some
3 to 4 cwt. of the dry ground material being sprinkl
in between say 100 butts, which generally forms a pac
The butts are allowed to lie in the first liquor for abo
a week, again lifted and placed in a still stronger liquor f
a second week, once more lifted and the process repeate
each time increasing the strength of the liquor and increa
ing the time in the layer, with a corresponding increa
of tanning material dusted between each butt. In the ear
dusters or layers, myrobalans and bark are used, but as th
goods get older, ground valonea is substituted, unt
in the last layer the goods are left from 4 to 5 week
Thus they receive a total tannage of about six month
which is an average time for modern better class so
leather and strikes a happy medium between the 12 to
months still taken by the oak bark tanner and the thr
months or less required when a large proportion of tanni
extract is used and no oak bark. In these layers the actu
tanning which takes place is comparatively small when o
takes the long time into consideration, but the goods ga
greatly in firmness and solidity; in these pits the leath
comes directly in contact with the fresh tanning materi
and from the fresh tanning liquors is deposited bloom
ellagic acid which is an almost insoluble product produc
by the splitting up of the pyrogallol tannin; from t
catechol tans, difficultly soluble anhydrides, which are
a gummy and more or less sticky nature, also deposit. Th
deposition occurs on and in the fibres and in the interstic
of the leather and it is to the deposition of these difficult
soluble products that the resulting sole leather to a lar
extent owes its water resisting characteristics, and its fir
and solid nature. Leather which has been largely tann
by suspension with continuous handling or even drummi
never possesses this water-resisting, hard-wearing, charact
istic, as no time is given in these quick tanning process
for the deposition of these more or less insoluble matte
nor for the subsequent complicated changes which normal
occur in the interior of the butt.

The material which has been used for strewing betwe
the butts in the layers is put on to the leaches to
thoroughly spent and plays a very important part
the production of the liquors. Many tanners, howev
use this half-spent material to produce the liquors necessa
for tanning bellies and shoulders, retaining the fresh materi
for making butt liquors, the butts being the most importa
part of the hide, having a value almost double that of t
shoulders and bellies. The tannage of shoulders and belli
follow on in a similar manner to the butts, the only differen
being that as this pelt is much thinner, and in the case of t
bellies more porous and open, the time for tanning t
shoulders seldom exceeds three to four months, and f
bellies nine to twelve weeks. The strengths of the liqu
are nearly as high as those given to the butts, but genera
a blend of somewhat cheaper material is used; in oth
words, less valonea and a higher proportion of myrobala
and chestnut extract.

Among the points that specially require attent
and chemical control is the ratio of tans to non-tans
the early liquors, *i.e.*, the ratio in which the tannic a
exists in proportion to the natural acids formed partly
hydrolysis of tannins and partly by fermentation of t
glucoses ever present in all tanning materials. If t
early liquors are allowed to become too weak, stale
putrid, the pelt, instead of feeding and plumping, begins
fall, the grain becomes loose, and a pipy, flabby leather
produced; but if the liquor is allowed to become t
astringent with tannic acid with an insufficiency of t
natural organic acids (produced by ferments), the leat
will become harsh and brittle, and when finished is lia
to be hard, to crack on the grain, and to be generally o
bad colour. The speed of tannage should be control
regularly by taking small samples of the half-tann
leather as it leaves the head suspender, and again on leavi
the top handler, determining the nitrogen in it
Kjeldahl's method. In this way the progress of t
tanning may be accurately checked. New blends
material can thus be tried, additions of special materi
at this stage can be accurately tested without waiti
six or seven months before the result can be ascertain

on the finished goods. The nature of the layer liquors, which are subsequently used to make the handler and suspender liquors, must be examined, as also the leaching and extracting of the material. Whereas samples of the so-called spent tanning material from 22 of the larger tanneries in Great Britain, taken some 17 years ago, jointly with Professor Procter of Leeds, showed that over one-third of the available tannin in the material was being wasted and thrown away, recent analyses show that this waste has been reduced in many cases to below 5 per cent. It has been proved that the tannin contained in most tanning materials is not all readily soluble in cold water, and that each material appears to possess a special leaching temperature, at which the best yield of tannin is obtained. In most of the tanning materials this temperature is at least 80° C.; hence most tanners use hot water for the extraction of their tanning material.

The question of the water is of vital importance to a sole leather tanner. In a large sole leather tannery 5000 gallons of water in 24 hours is not by any means excessive. The average "hardness" of the water in the chief tanning districts of England is about 20 parts per hundred thousand. This means on 5000 gallons of water, that each day the tanner is adding 10 lb. of lime in the form of chalk to his liquors, which unites with tannin and forms useless tannate of lime, which is lost in the leaches and in the liquors. By forming insoluble products in the fibre of the tanning material it retards the extraction and diffusion of the tannic acid through the cell walls in which the tannin is contained; it also darkens the colour of the liquors and has a material effect upon the resulting leather, as it is well known that salts of tannic acid become oxidised and rapidly form dark compounds.

The drying and finishing of sole leather, as I have already indicated, was formerly simply a process of drying and hammering; to-day the shedwork of sole leather is almost a separate art, and there has grown up a body of journeymen finishers specially skilled in this process, which requires from three to six weeks, depending upon the period of the year. The butts are taken from the last layer, and after lying in pile for two to three days to drip (during this dripping process the strong tan tends to solidify, and the butts become firmer and more solid), they are scoured on the grain side by hand or machine with stone blades and brushes. The object of this scouring is to remove from this grain surface the insoluble "bloom," small particles of solid fibre, and other products which have settled on and in the grain. This process also removes a considerable quantity of the uncombined tan and presses out the strong tan liquor from the interior of the leather. It also softens and cleans the grain and renders it more supple. Up to a few years ago, the goods after scouring were simply rinsed through liquor, oiled and removed to the drying sheds, but to-day, in order to replace the weight that has been lost by scouring and if possible to add further weight, the butts are treated by a retanning process in pits containing a strong solution of some bright coloured tanning agent. For this purpose a comparatively new extract made from the wood of the quebracho tree, which grows in large quantities in the Argentine Republic, has been introduced. The wood of this tree contains over 20 per cent. of a red, very difficultly soluble tanning material. At first this material was little used, owing to the fact that it could not be made up into strong liquors. Lepetit, however, found some eight years ago that, by treating this material under pressure with sodium bisulphite, not only was it rendered easily soluble, but that the sulphite treatment bleached the objectionable red colouring matters and produced an extract which gave to the leather a warm yellow colour. This process also increased the penetrating powers of the tan, and has almost revolutionised the older methods of shedwork. This material is, therefore, largely used in the vatting of butts after scouring. The liquor in the vats is made up to great strength and then heated to a temperature of from 60° to 65° C. The butts are entered (sometimes suspended on poles, in other yards laid flat), and handled frequently; the process is continued for three to four days. This vatting or retanning not only replaces the tan which has been scoured out, but at the same time bleaches the leather to a regular even colour, transforming the natural brown of the ordinary tannage to yellow fawn. The butts, on removal from these hot pits, are lightly rinsed through a weak sumac liquor to remove the extract from the surface, are allowed to drip for 48 hours and then go to the drying sheds. Here they are carefully wiped over on the grain with a damp cloth, and then well oiled with cod oil. The oiling process is extremely important. The oil used should be suitable; it should possess the necessary drying properties, it should be pure, and should not have too high an acid value. The object of the oiling is to soften the grain, and at the same time to prevent the leather drying through the grain side, the aim being as far as possible to make the leather dry from the flesh side so that the uncombined tan liquor be not drawn out upon the surface where it would become oxidised, darken, and make the leather "cracky." The leather is then hung up in dark sheds, and a cool draught of air allowed to pass through. The slower the drying at this stage the better is the product. If it is dried too rapidly the leather is dark, blotchy, brittle on the grain, and practically unsaleable. When the butts get to a rubbery condition, *i.e.*, if the grain of the leather becomes slightly slimy so that one could write one's name with the finger on it, they are laid down in pile on one another to come to "proper condition." At this stage they are put through another machine similar to the scouring machine, but having steel or brass blades instead of stone, whereby the leather is stretched and the grain made beautifully smooth and level. The butts are again re-oiled, this time slightly, and further dried. In this condition they will stand a little more air until they begin to show signs of drying round the thinner parts, they are again laid in pile to come to "condition," and are rolled under a heavy roller to make them firm and solid: if rolled out of "condition" they "dry dark"; after the first rolling, known as "rolling on," the goods are redried. When they have taken their natural colour but are still damp in the interior, the butts are usually split down the centre into two parts, which are then known as bends. They are now re-rolled, the second rolling being called "rolling off." The bends are now taken to a heated drying room, and dried at a temperature of from 85° to 100° F. The leather thereby becomes very firm, and when perfectly dry it is brushed and polished on the grain and is ready for the warehouse, where it is sorted according to weight, colour, and quality.

This shedwork has been described in some detail, because this process in recent years has become one of the most important in connection with the manufacture of sole leather; needless to say, the time and trouble expended has also increased the manufacturing costs. Why should leather need take on an even yellow colour without irregularities, highly polished and smooth? The boot manufacturer cuts it up into soles and soaks them in water which is seldom clean. The damp sole is then stitched on to the boot, and as it passes through the various processes becomes stained with iron and grease; when firmly stitched on the boot and practically finished, it is put over an emery wheel, and the whole of the beautiful polish, colour, and finish, on which the tanner has spent so much time and money, is ground off. The boot manufacturer then paints the sole with a yellow or black varnish stain, which completely hides the colour and character of the leather, and finally polishes it. Even were it not for this custom of staining the leather, why should it be necessary to take all the care and trouble to produce leather of an even colour and regular shade only afterwards to be dirtied in the boot factory? And even if that were not the case, what difference does it make to the wearer of boots on a muddy day whether the colour of the soles be brown, black or green? This absurdity would not be so serious, were it not for the fact that, as is generally acknowledged by the trade, this vatting and bleaching seriously reduces the wearing properties and the water resisting character of the leather. The process of bleaching in hot liquors containing bisulphite of soda does to the insoluble products in the leather which have been deposited in the layers exactly what Lepetit found it did to the difficultly soluble quebracho tans; it renders soluble and removes from the leather those products which are so valuable for the production of a sole leather which would not only wear well but would also resist water. This is surely a case of science misapplied, and this fad or fashion which demands that sole leather shall be of a light yellow colour is, in my opinion, having disastrous effects. The bleaching of sole leather is one of the most unnecessary processes that has ever been introduced, and must sooner or later destroy the reputation which British sole leather has long enjoyed all over the world, as a firm, hard wearing, water resisting material, and is certainly contrary to all the accepted principles of sole leather tanning.

The chemistry of the hide is not fully understood and the exact composition of many of the tannins is not yet established. Finally the newer science of colloidal chemistry urgently demands consideration and application.

DISCUSSION.

Mr. LUTWYCHE said as a Warden of the Leathersellers' Company in 1905, and, with the support of Sir John Pound, then the Master of the Company, Sir William Perkin, who was then a member of the Court, and others, he induced the Company to interest itself in technical education in connection with the leather trades. After doing useful work at the Herold's Institution, the Leathersellers' Company founded the magnificently equipped and well directed technical college of the Leathersellers' Company in Bermondsey.

Professor H. R. PROCTER said he wished to emphasize the statement as to the great waste in the cost of production of the leather and the great injury done to the leather by the bleaching process. The substances that gave firmness and waterproofness to the leather were soluble in the bisulphite solutions used and probably were actually dissolved in combination with the base of the bisulphite. In any case they knew this solvent action took place. Occasionally this sort of thing happened to a chemist in an analysis; they used generally a Berkefeld candle for filtering the tannin extract solution. These cost money, and they could not afford to use a new candle every time, so they washed them out; but if they had been using a candle for one of these extracts containing difficultly soluble matters and washed it as well as they could and then used if for an extract solubilised with bisulphite, they might find more than 100 per cent. of the solid bodies in the extract. The extract not only went through itself, but actually dissolved out some of the previously deposited matters in the candle which all the washing had failed to get out. When people complained that the leather of the present day was not equal to that of the good old times, there was a certain amount of truth in it, but a large part of it was due, not to the fault of the tanner, but to the desire to obtain a particular colour for which there was no real object, and to the use of bleaching extracts in order to get that colour.

Mr. HINTON agreed with the author's remarks on the colouring of leather to please the eye of the shoe manufacturer. Colour had no object whatever so far as wear was concerned. He held in his hand a piece of leather tanned in an English yard in 1874; it was tanned with oak bark and valonia and it took about 15 months to tan. It was intended for the soles of shooting boots, and had weather resisting properties and all the characteristics required for hard wear. The hide from which the butt was made was off a Highland bullock. Without being very handsome to look at, it was, to his mind, the ideal of what sole leather should be. The older race of men, who had no scientific knowledge, were able to turn out really good stuff. The manager of their yard used to walk round with the foreman and put his finger into the tan pits and taste the liquor; and he was thus able to tell whether it has deteriorated or not. He did not want to pose as a *laudator temporis acti*, but he did not think there was a tan yard in existence to-day worked on scientific principles which made better leather than, if as good as, the old people turned out. To-day, if a currier wanted reliable hides to make into trace or rein bucks, he sought from the few remaining bark yards.

Dr. S. RIDEAL said that the fate of the phlobaphens, at the time when he had a little to do with tanning many years ago, was not much considered; but it seemed to him they acted as a filling material; and, when they had got in, they ought to remain in, and not be taken out by any of the solvents, such as were used for the making of light leather. He was not prepared to admit that the addition of phlobaphens by filling up the pores of the leather between the fibres was really what produced the water resisting property; it seemed to him that perhaps there were other more suitable substances, *e.g.*, rubber.

The CHAIRMAN said that in making an excavation in some old prehistoric Indian settlements in the Isla de Gobernador, a large island in the Bay of Rio Janeiro, occupied for many hundreds of years by Indian tribes before the discovery of America, he came across some skins which had been preserved in a very curious manner, namely, by vivianite or phosphate of iron; and they were blue. What the original preservative was, he did not know; but the form of the skin was very well preserved by the phosphate of iron. Again, in the bogs of Ireland, leather was very well preserved, as one would expect it to be in peat liquor. Coracles were still n use, but he had never seen one covered with leather. The fishermen in South Wales had given up the use of leather for this purpose. In the Guildhall Museum there were a number of Roman sandals which had been dug up in the City of London; they had been well preserved in the soil. The Pampas Indians prepared—he could hardly call it preserved—hides. The hides were dried in the sun, and the women would nibble a bit, and then nibble another bit, until the whole of the hide was softened. Those softened hides were a regular article of commerce with the Spaniards. Sometimes they were rubbed in grease afterwards, but the preparatory operation was chewing. With regard to the use of spent bark for fuel, at Heidelberg, the spent bark from the tanneries was often used as fuel compressed into briquettes, it made a fuel which burnt out very quickly. In the district in the Argentine where quebracho was now prepared for tanning, he had often used it as building material. There were thousands of railway sleepers made from it, it being practically imperishable. No doubt that was due to the tannin it contained. The Cowey stakes driven into the Thames, near Weybridge, in the time of the Romans, if not before, still remained fairly sound. A wood in the River Plate, called nandubay, contained a good deal of tannin; it was of a dark colour, and probably that had prevented its use for tanning. Concretions of tannin might be found in the wood itself when it was cut open. Like quebracho, it sank in water. For many years he had worked on a substitute for leather, which was now being used in large quantities. The basis was felt, which was saturated with a material which had an advantage over tannin, in that it was waterproof. He thought tanners might very well, after they had tanned their leather and made it, what they called, bulky—which he would rather call spongy—waterproof it without any disadvantage to its sale, and certainly with very great advantage to those who had to use it, in our climate. He knew it had been tried, but it had not yet come into the market.

Dr. PARKER said, in reply, that he quite agreed that in the olden days all leather was good; to-day much of the leather was indifferent in quality. But at the Leathersellers' Technical College they were to-day making as good a leather as was ever made before, under scientific principles. He well remembered Dr. Rideal's articles in the Leather Trades' Review. He had mentioned these phlobaphenes, which were deposited in the process of tanning and undoubtedly gave the leather certain valuable characteristics. There were plans for substituting other materials for phlobaphenes; in fact, rubber was now put in under pressure; and he believed Mr. Evans knew something about "reinforced leather," in which the rubber was put under pressure into the pores in order to render it waterproof. The Chairman had made some very interesting remarks on the effect of phosphate of iron. It was well known that both this material and the products of peat would produce leather; and there was a patent now being worked for leather making by what was known as peat tanning. That, however, was for the manufacture of light leather. The fact of women chewing leather to prepare it, was certainly new to him. He dare not speak of substitutes; he was too interested in leather. He should be the first to congratulate Mr. Reid upon any success made in his researches, but he liked the real thing. Much work had been done on waterproofing leather and no doubt more would be done.

Meeting held at Burlington House, on Monday, June 6*th*. 1910,

DR. J. LEWKOWITSCH IN THE CHAIR.

THE ACCURACY OBTAINABLE IN FUEL CALORIMETRY.

BY G. NEVILL HUNTLY, B.SC., F.I.C.

The economic importance of the determination of the calorific value of solid and liquid fuels is receiving increasing recognition among fuel users, and this is especially the case in the United States and on the Continent. The widely discrepant results obtained in the past in different laboratories for the same sample of coal led many engineers to regard laboratory tests as useless. These discrepancies have been traced to two causes, the imperfections of the calorimeters used and the errors of sampling. Comparisons of the various types of calorimeter (see Gray & Robertson, this J., 1904, p. 704, and Brame & Cowan, *loc. cit.*, 1902, p. 1230) have shewn that the bomb calorimeter gives more consistent results than any other form, and the Berthelot calorimeter is now by general agreement looked upon as the standard instrument. The operation of sampling is one over which the analyst has usually no control, but if carried out with due care the limits of error can be shewn to be of the same order as those of the calorimetric measurements. Consecutive determinations with a bomb calorimeter give such concordant results that there is a natural tendency to exaggerate the accuracy obtainable. Numerous bulletins of great value have been issued by the U.S. Geological Survey and by the University of Illinois embodying the results of a systematic study of various coal fields in the United States, and in all of these the calorific value is given to five significant figures (*e.g.*, 14,949 B.T.U. per lb.). These arithmetical exercises appear to be taken quite seriously by engineers, as for example in Bulletin No. 31, University of Illinois, where the corresponding boiler efficiencies are worked out to the second place of decimals, as 58·18 per cent. Similar examples could be easily quoted from our own engineering journals. It will be shewn in this paper, that apart from errors of sampling, an experimental error of 30 B.T.U. per lb. represents the limit of the most careful work, and for estimations carried out under commercial conditions errors of 150 B.T.U. per lb. may be regarded as probable.

The possible errors may be classified in three groups concerned with (1) the thermometer; (2) the correction for cooling; (3) the determination of the water equivalent.

The Thermometer.

There seems to be no work in English in which the difficulties of accurate thermometry are adequately dealt with. The only exhaustive book on the subject is that of Guillaume, "Traité pratique de la thermométrie de précision," Paris, 1889, which, although written 21 years ago, still remains the standard work on the subject.

The electrical resistance thermometer under favourable conditions undoubtedly gives a higher accuracy in temperature measurements than the mercury thermometer, but in practice, in spite of its defects, it is the latter which is generally used. Apart from the cost of equipment, the question of vibration militates seriously against delicate electrical measurements especially in chemical laboratories in large towns or in a power station. With the mercury thermometer it seems to be generally assumed that the longer the degree and the larger the number of divisions into which it is divided, the more accurate will be the readings, and hence an instrument of the Beckmann type, with a range of about 6° C. divided into hundredths of a degree, and possessing a degree length of about 30 mm., is a favourite one. Apart from the disadvantages of the German type of thermometer (see Méthodes de Calorimétrie, W. Louginine & A. Schukarew, p. 3) it was pointed out by Guillaume that no real advantage is gained by increasing the length of the degree above 10 mm., as the capillarity errors then become more important than the calibration errors, and this is especially the case in calorimetric thermometers, in which the capillarity effect is doubled if the thermometer is rising in the preliminary period and falling in the after period. The type of thermometer adopted by the International Bureau at Sèvres and constructed by Tonnelot, is made of hard French glass with a degree length of about 10 mm., and is divided on the stem into tenths of a degree. The stem is transparent so that the readings are not obscured by the thickness of the lines, an important advantage. From a thermal point of view (temporary depression of the zero) the French hard glass is only slightly inferior to Jena glass and it possesses the great advantage that fine sharp lines can be etched on it, down to 0·02 mm. wide. The author has not been able to get thermometers of Jena glass with divisions narrower than 0·06 mm., and these are somewhat ragged in outline when magnified in the telescope. When suitably illuminated and read through a telescope the division (0°·1) can be read by estimation to one-hundredth, or 0°·001 (see Guillaume on this point). An eye-piece micrometer may be used for these readings, but it will be found that after some practice the micrometer may be dispensed with. A simple way of testing the accuracy of estimation is to prolong the observations of the cooling period after a combustion and plot the results on an open scale; the deviations of the readings from the straight line will shew the errors of estimation.

Since, in spite of its defects, the short range Beckmann thermometer is very generally used, it may be worth while to point out its most obvious faults and the means of eliminating them. Tubes with a flat elliptical bore should be rejected, as the capillarity errors are very irregular and the thread descends in jerks even though the stem be constantly tapped. The lines should be as fine as possible, as with, say, three lines to the millimetre, a line 0·1 mm. wide represents an error of 0°·003 when the thread is over the line.

Instruments by different makers vary very much in the thickness of the divisions. In some thermometers of English make divided into fiftieths, the lines are so coarse that readings closer than 0°·01 cannot be made. A more serious error, and one which sometimes appears to have been quite overlooked, is due to the fact that the value of the degree is variable, and depends on the temperature at which the instrument is used. A rough correction table is given in the Reichanstalt certificates, but this only applies when the thermometer is immersed to the zero line, a condition not generally possible. Moreover, it is obvious that the value of the degree must be determined by comparison with a standard, divided in tenths, and if, as seems to be commonly assumed, the latter can be read only to hundredths, the possible error of comparison over a 6° range is 1 in 300, and as a matter of fact it may be larger than this, owing to the impossibility of checking any zero change on the Beckmann thermometer. (For another method of dealing with this, see determination of the value of the degree.)

In the determination of a temperature the thermometer reading requires to be corrected for:—1. Calibration. 2. External pressure. 3. Internal pressure. 4. Zero. 5. Correction for the fundamental interval (value of the degree). 6. Exposure correction. 7. Reduction to the normal hydrogen scale.

Calibration.—The effect of this correction is to compensate for the inequalities of the bore of the tube, and to reduce the readings to those of a truly cylindrical tube of the same mean cross-section. If the maker has endeavoured to allow for the inequalities of the bore in his graduations, an accurate calibration is difficult, if not impossible: the divisions should be equidistant and if the calibration is to be carried out to an accuracy of 1/100 of a division, the equidistance of the divisions must be of the same order of accuracy and the lines as narrow as possible. If, as on a 6° Beckmann thermometer, an accuracy of 1/10 of a division is sufficient, the mean of half-a-dozen Gay Lussac curves with threads of different lengths will be good enough; if an accuracy of 0·01 division is aimed at the operation is more delicate, the Neumann-Thiesen method requiring the least expenditure of time (see Guillaume and the Report of the B.A. Committee (1882) for details). The labour spent in the calibration is well repaid, since a comparison of the observed and calculated thread lengths clearly defines the accuracy of estimation of the observer. In this country there is some difficulty in getting a well-calibrated thermometer: the National Physical Laboratory does not undertake the calibration of thermometers, the International Bureau at Paris carries out such calibrations with the highest precision, but it would appear that the staff has been reduced and there is some difficulty in getting such work done now. The ordinary Reichanstalt certificate, such as is obtained if a thermometer is bought with a certificate, is accurate to 0·1 division only, but thermometers satisfying certain conditions can be calibrated with a higher accuracy. The B.A. Committee considered 0°·002 (0·02 division) as the limit of possible accuracy; Guillaume regards an accuracy of 0·001 (0·01 division) as attainable provided certain conditions are observed by the maker. In this connection it should be noted that the thermometers studied by the B.A. Committee were not etched with equidistant lines.

External pressure.—Since the bulb is fixed during the experiment and the time of an experiment is short, the effect of external pressure on the temperature *difference* is negligible.

Internal pressure.—If a thermometer shews a difference of n true degrees in a horizontal position, it reads $n\,(1-\beta l)$ degrees in a vertical position, where β is the co-efficient of internal pressure and l the length of the degree. For calorimetric work this may be conveniently included in the value of the degree.

Zero.—For a rise of 3° the temporary depression of the zero is of the order of 0°·003 for French glass, rather less for Jena glass. The action, however, requires time; and would be scarcely appreciable in the five minutes of an experiment; even if appreciable, the error cannot be exactly determined.

Correction for the fundamental interval.—Except by accident, no thermometer has a degree exactly 1/100 of the fundamental interval. If the instrument contains the two fundamental points this error can be determined directly. A convenient type is graduated in tenths from −2° to 52° C., then a bulb and further graduations from 98° to 102°. This forms a self-contained standard, but since the transition point of sodium sulphate is now known accurately (32°·379) a range −2° to + 34° is equally suitable for calorimetric work. This is first calibrated in principal points 6° apart in the interval (−2°, 34°) converted into the fundamental interval (0, 32°·38) and, to save labour, only such sections further subdivided into 1° intervals as may be required by the temperature range of the laboratory. For short range thermometers with variable zero, the only really practical plan seems to be an experimental determination with the bomb itself.[*] For this purpose a considerable quantity of a pure substance is prepared, such as naphthalene or benzoic acid, and every time the quantity of mercury in the bulb is altered the water equivalent is determined in the usual way, keeping the weight of water fixed. The temperature rise is corrected for calibration, radiation, fuse and nitric acid. The mean temperature of the water in the calorimeter is measured with an ordinary thermometer. In this way, a series of results will be obtained from which the apparent water equivalent can be plotte as a function of the temperature. The following corrections are thus eliminated: internal pressure, value of th degree, exposure of the stem, variations in the specifi heat of water and of the calorimeter, bomb, &c., an reduction to the hydrogen scale if the calorific value take for the naphthalene or benzoic acid has itself been expresse in that scale. It is worthy of note that the errors c calibration of the tube are *not* corrected in this way.

Exposure correction.—This correction is an uncertai one at the best. If the water equivalent is determine by the combustion of substances the heat of combustio of which is taken as known, as above, it is eliminate It is not more than one or two-thousandths of degree, and is usually neglected in calorimetric work

Reduction to the normal hydrogen scale.—This correctio just comes within the limits of error. A rise of 3 (15°—18°) measured on the scale of Jena glass 16 III. i 3°·010 on the normal scale.

These considerations lead to the conclusion that for temperature rise of 2° to 3° with a mercury thermomete of the first order completely studied before use, and afte all possible corrections are applied, an accuracy of 0·1 pe cent. to 0·2 per cent. cannot be exceeded. With a thermometer coarsely graduated and uncalibrated the error migh amount to over 1 per cent. The concordance of two c three consecutive determinations is quite misleading as criterion of the real accuracy. As illustrating this poin five determinations of the water equivalent of the sam calorimeter (by combustion of naphthalene) made a intervals of about two months with two thermometer divided into tenths, at temperatures ranging fro 8° to 20°, after fully correcting, gave for the wate equivalent at 15° C.:—(1) 2504; (2) 2497; (3) 2495 (4) 2505; (5) 2500. Nos. 1 to 3 were made with or thermometer, Nos. 4 and 5 with another. Two consecuti observations with a Beckmann 6° thermometer ga 2516, 2517 for a temperature of 15° C. The two la determinations, in spite of their close agreement, a 0·7 per cent. too high, owing to the changed value of th degree.

The correction for radiation.

This correction is second in importance only to th thermometer corrections. With a properly designed bom calorimeter it is of the order of 1 per cent. of the temperature rise. It is generally recognised that the so-calle Regnault-Pfaundler correction gives the nearest approx mation to the actual loss, but this seems to be looked upo as too complicated for technical work, and either th correction is dropped altogether (Hempel, Jakob) or a approximate empirical correction is applied. (Mahle Gramberg, Langbein, Gray and Robertson, &c.) If th observations are entered on a suitably printed or graphe log, the calculation of the Regnault-Pfaundler correctio assuming a slide rule is used, is a matter of five or si minutes at most, and it is a little difficult to understan why 30 to 40 minutes should be regarded as profitabl spent in determining the amounts of nitric acid an sulphuric acid formed in the combustion, the combined effe of which rarely exceeds 0·5 per cent. of the heating valu whilst a quarter of the time is regarded as too much f the more important cooling correction. The meaning the Regnault-Pfaundler formula does not seem to be we understood, since several authors remark that instea of using this complicated expression the simple applicatio of Newton's law of cooling is sufficient. But all expre sions for the loss by radiation, unless purely arbitrar are based on Newton's law of cooling, and the Regnaul Pfaundler formula is no exception. The latter has th advantage of including the cooling effect due to evaporatio the heating effect of the stirrer, and any other *consta* source of heating or cooling, such as a cooling effect du to a slight leak of the bomb.

All cooling corrections are based on the assumption th the temperature of the surroundings remains constant duri the experiment. This fundamental condition is satisfied b surrounding the calorimetric vessel with a double copp jacket containing at least 20 litres of water. It is *n* satisfied by using a wooden jacket, felt, or similar badly-conducting substances. The object to aim at is not so much to prevent heat losses, but to ensure that these losses shall take place in a definite manner.

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[*] See also Grützmacher. Zeits. Inst. Kunde, 1896, 202.

It seems worth while to shew upon what assumption the Regnault-Pfaundler expression is based, so that if a rougher approximation is deemed sufficient it may be derived on a rational instead of on a purely empirical basis.

Let the *loss* of temperature in time dt be + dθ.

Loss due to evaporation per minute = w.*

Loss due to heat developed by stirrer per minute = — s.

According to Newton's law, the velocity of cooling due to radiation is proportional to the difference of temperature between the cooling body (θ) and its surroundings (T) or

$$\frac{d\theta}{dt} = k\,(\theta—T),$$

[k is the "cooling constant" of the calorimeter and is evidently the rate of cooling for a 1° difference between θ and T.]

(I) Hence $d\theta=(w—s)dt+k(\theta—T)dt$.

The experimentally determined figures are :—

v = velocity of cooling at (or near) θ_o, the initial temperature ;

v′ = velocity of cooling at (or near) θ_n, the final temperature.

It should be noted that θ_n is *not* the highest observed temperature, but may be any temperature after the steady rate of cooling has set in. If v′ is determined starting from the maximum temperature, it will be too low, as heat is coming out of the bomb after the maximum temperature has been attained.

$$\text{From (I).}\quad v=(w—s)+k(\theta_o—T)$$
$$v'=(w—s)+k(\theta_n—T)$$

$$\therefore\ v—v'=k(\theta_o—\theta_n) \text{ or } k=\frac{v'—v}{\theta_n—\theta_o}$$

$$\text{Also since } v=(w—s)+k(\theta_o—T)$$
$$w—s=v—k(\theta_o—T).$$

$$\text{(II.) Hence } d\theta=vdt—k(\theta_o—T)dt+k(\theta—T)dt$$
$$=vdt+k(\theta—\theta_o)dt.$$

Hence the total correction over the principal period of *t* intervals of time is :—

$$\Sigma_{\theta_o}^{\theta_n} d\theta=vt+k(\text{area BCFD}).$$

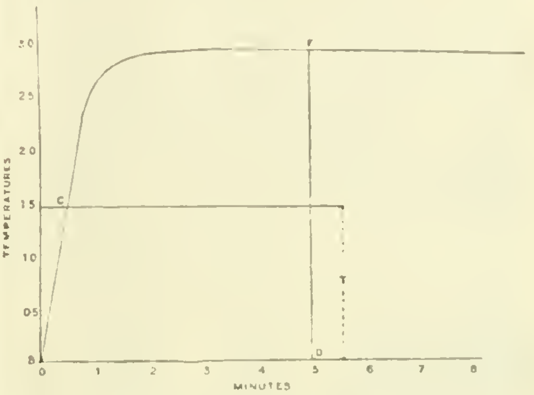
If it be noted at v and v′ are not determined strictly at θ_o and θ_n, but at the closely adjacent temperatures θ (mean temperature of the fore period) and θ' (mean temperature of the after period), the final expression is :—

$$\text{(III.)}\qquad \Sigma_{\theta_n}^{\theta_o} d\theta=vt+\left(\frac{v'—v}{\theta'—\theta}\right)(\text{area BCFD}).$$

and this is equivalent to the Regnault-Pfaundler formula, where t is the number of time intervals (minutes or half minutes) in the principal period, v and v′ being the temperature losses in the same time interval. Any cooling correction must be of this form, and the accuracy attained will depend on the degree of approximation with which the area BCFD is measured. For this purpose it is not necessary actually to plot the curve, but it is worth while doing this for a few experiments. Insufficient stirring is then brought out by the points not lying on a smooth curve ; the length of the time interval (60, 30, or 20 seconds), can also be best chosen from a study of these curves, and the effect of a given error of reading during the first two minutes determined. The area may be determined by the planimeter or by counting the squares, or any of the usual formula for approximate integration may be adopted.† The latter is more practical since the actual temperature readings are the ordinates required. The "trapezoidal" rule, half the sum of the first and last ordinates + the sum of the remainder, is a first approximation. Taking the temperatures read as ordinates, this gives the area down to zero temperature, hence tθ has to be subtracted, giving the usual Regnault-Pfaundler expression,

$$\text{Correction}=vt+\frac{v'—v}{\theta'—\theta}\left(\frac{\theta_o+\theta_n}{2.}+\Sigma_1^4\theta—t\theta\right)$$

the terms within the bracket representing the approximate integration of the area BCFD.



A more accurate result is given by the application of Simpson's or Durand's rules. From the following example it is clear that the trapezoidal rule, with one minute intervals, is good to less than 0°·001.

Correction corresponding to area BCFD. (t = 5 minutes).	(1) Planimeter	0°·0258
	(2) Durand	0·0257
	(1 min. intervals)	
	(3) Trapezoidal	0·0253
	(1 min. intervals)	
	(4) Trapezoidal	0·0256
	(½ min. intervals).	

And hence there is no advantage in employing a more exact method of integration. If the stirrer is worked at fixed rate, and the temperature curves are similar, various expressions for the mean ordinate can be found for any given instrument which will be near enough for technical work. Thus if θ_1 is the rise of temperature in the first minute, for a *particular calorimeter*, the cooling constant of which averages 0·00283, the rough correction is given by $(v+ck\theta_1)t_1$, where ck=0·004. From seven examples, taken at random, the maximum difference between $t(v+0{\cdot}004\theta_1)$ for t=5 minutes and the full Riegnault-Pfaundler correction was ±·004, and the average difference ·002. It should be noted that the term vt includes the cooling due to evaporation.

By cooling the calorimeter water below the temperature of the surroundings the total correction is reduced and as a special case may vanish. Here the term *vt* is negative, and the final correction is the sum of the negative and positive terms. It is clear that whether the correction is +0°·030 or 0°·001 a given error in the determination of either of these terms will cause the same error in the result.

(3) *The determination of the water equivalent.*

This is usually determined in one of two ways, by calculation from the specific heats of the constituents of the bomb, water vessel, stirrer and thermometer, or by burning a known weight of a definite substance whose heat of combustion is taken as known. The method of calculation gives only a rough approximation : the material of the bomb may be bronze or nickel steel of unknown composition, the weight of the enamel is unknown, and the specific heats taken as a basis of the calculation are usually the mean specific heats between 100° and about

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* According to Mahler (Bull. de la Soc. d'encouragement pour l'Industrie Nationale, 1892, p. 333), the loss by evaporation is about 1 grm. per hour. This would make w of the order of 0°·004 per minute for a water equivalent of 2500. Hence it is too large to neglect.

† (A good account of these methods is given in Integral Calculus, by D. E. Murray, p. 181-190, Longmans, Green & Co. 1898.)

15°, and hence are too high. If the water equivalent of the metal parts be taken as 350 to 400, and an uncertainty of 20 be possible, with a Hempel calorimeter (1000 grams of water), the possible error is ·3 per cent., with a larger calorimeter of water equivalent 2500, 1·6 per cent., and with W.E. 10,000, 0·4 per cent. In the latter case the rise of temperature is so small that an electrical thermometer must be used (see W. Jaeger and H. von Steinwehr, Verh. Deut. Physik. Ges., 1902, 353). As regards the second method of determining the water equivalent, a comparison of the figures obtained for the heats of combustion of pure substances shews differences of 0·3 to 0·7 per cent.

Heats of combustion (of 1 grm.) according to different observers :—

	Benzoic acid.	Naphthalene.	Cane sugar.
Berthelot and Recoura	6345	9688	
Berthelot and Louginine .	6322	9696	
Berthelot and Vielle	—	9718	3962
Stohmann	6322	9628	3955
Fischer and Wrede (1904)	6355	9668	3988
,, ,, (1908)	6328	—	3954

When it is remembered that each of these figures represents the mean of a number of observations by highly skilled observers working under the most advantageous conditions, it is clear that the determination of the *absolute* heating value of a coal nearer than 0·5 to 1·0 per cent. is not to be expected.

The third method of determining the water equivalent is by the addition of a known amount of energy measured electrically. A very full account of the calibration of a bomb calorimeter in electrical units, using a platinum thermometer is given by W. Jaeger and H. von Steinwehr (Ann. d. Physik., **21** (1906), p. 23), and this calorimeter has been used by Fischer and Wrede for determining the heats of combustion of numerous substances. These determinations must be regarded as the best hitherto made, as the probable errors are less than 1 in 2000. The values for sugar (3954) and benzoic acid (6325) appear to be the best established.

Other errors affecting the heat of combustion are discussed very fully by W. Jaeger and H. von Steinwehr in the Zeits. für Physik. Chemie. **53** (1905), p. 153, and their conclusions may be briefly cited here. They regard an accuracy of 1 or 2 parts per 1000 as the limit with mercury thermometers, and shew that the lag of the bomb need be taken into account only when the water equivalent is determined from the specific heats. The lag of the thermometer is shewn to introduce errors less than 1 part in 1000, and this the author can confirm as out of twelve thermometers the maximum error due to lag has been found to be +0·4 parts per 1000. They also discuss the error due to the variation of the water equivalent with temperature, and conclude that there is a change in the heat capacity of the whole apparatus of 1 part in 1000 for each 4° change of temperature from 15°. Since the temperature in experiments made in unheated rooms may vary between 6° and 25°, this correction can by no means be neglected. The specific heat of water itself is uncertain to 1 part in 1000, as will be seen from the following table.

Specific heat of water :

T.	Rowland.	Griffiths.	Bartoli and Stracciati.	Ludin.	Callendar and Barnes.
0°	—	—	1·0069	1·0061	—
6°	1·0036	—	1·0035	—	—
10°	1·0019	—	1·0016	1·0010	1·0018
15°	1·0000	1·0000	1·0000	1·0000	1·0000
20°	0·9988	0·9985	0·9993	0·9994	0·9987
25°	0·9971	0·9971	0·9993	0·9996	0·9978
30°	0·9962	—	1·0015	1·0003	0·9973
35°	0·9994	—	—	—	0·9971

Hence in the definition of the thermal unit not only must the degree be on the hydrogen scale, but the temperature of the water must also be defined.

The details of construction of the bomb do not much affect the accuracy of the results obtained by its use, provided it is of sufficient capacity. Bombs by some makers have the bottom of the bomb too near the base of the calorimeter vessel; this results in a pocket of water which remains out of reach of the stirrer, and consequently gets warmer than the rest, thus making the results low. The same defect is sometimes caused by an unsuitable framework to support the bomb in the calorimetric vessel. The stirring arrangements are defective in others. It is tacitly assumed in calculating the correction for cooling that the external surface of the water vessel has the temperature indicated by the thermometer, and this is not the case unless the stirrer is efficient. The stirrer should be driven by a small motor, as this secures both efficiency and regularity. As illustrating the effect of efficient stirring and a high water equivalent, the author has found that with a Hempel calorimeter used as supplied the average error of a determination, using naphthalene, was 0·5 per cent. ; with the same bomb and thermometer, but using a larger water vessel, with mechanical stirring, a large copper water jacket, and also raising the bomb an inch above the base of the water vessel, the average error of a determination was reduced to about 0·2 per cent. The Kroeker form, with two valves and fitted with a wash bottle arrangement of platinum tubes, is very convenient, as it permits of an accurate estimation of the carbon in the fuel at the conclusion of the experiment ; the estimation of hydrogen in the same instrument is not so good. The question of the lining, platinum or enamel, is of importance only as regards the life of the bomb ; it is without effect on the accuracy of the results. In either case it is better to avoid the use of iron wire for the ignition, as the particles of fused iron oxide rapidly perforate the lining. Fine platinum wire (·002 inch) with or without cotton thread or collodion wool, is effective. If too large a wire is used the amount of heat developed by its fusion ceases to be negligible.

So far, the combustion of pure substance only has been dealt with. With coal or oil there are some additional points to be considered. For a representative sample the coal should be as finely divided as possible, and with very finely divided coal the combustion would appear to be incomplete. This difficulty is got rid of by adopting the suggestion of Hempel and compressing the coal into small briquettes. The author has found that the combustion is also occasionally incomplete for another reason. The ash from certain coals is fusible, and if the amount of ash is high, the fused ash is liable to contain unburnt carbon. The maximum error due to this cause which has been observed corresponded to 3 per cent. of the calorific value. The carbon was estimated by powdering the ash and burning in a closed tube with lead chromate. As the removal of the fused ash from the platinum capsule was a matter of some difficulty, a little powdered quartz was placed in the capsule. This was found, quite unexpectedly, to reduce the amount of unburnt carbon, possibly by reducing the average size of the fused globules. In non-fusible ashes no unburnt carbon has been detected.

Sampling.—The problem of taking small samples accurately representing large bulks of solid material, has been fairly solved by metallurgists, but the necessity of applying similar methods to coal has not always been appreciated by the engineer. Bulletin No. 323 of the U.S. Geological Survey gives a description of their method of sampling a car load of coal. From 3 per cent. to 4 per cent. of the car load was taken as a sample, the whole crushed to ½-in. size, and worked down mechanically. Two independent samples gave moistures agreeing within 0·4 per cent and ash within 0·3 per cent. The calorific values are not given, but would from these figures have agreed within 0·5 per cent. Hand sampling usually has to be resorted to, and the results are not quite so good. For air-dried coals low in ash, the error of sampling should be under 0·5 per cent. Coals ith high ash (7 to 12 per cent.) may be 1 per cent. out, nd wet small coal, if not air dried on a fairly large cale before taking the final sample, may differ by 2 per ent. or more on consecutive samples. A sampling error f 0·5 per cent. to 1·0 per cent. may be looked upon as fair average. This accuracy can only be obtained when he sampling is done systematically under skilled supervision. Even oil fuel has its own sampling difficulties, wing to the frequent presence of water, an emulsion being ormed which is very difficult to separate.

The author is at present engaged on a study of the ccuracy obtainable in coal sampling by hand under rdinary conditions, and hopes to be able to communicate he results shortly.

The conclusions arrived at may be summarised as ollows :—

(1) The limit of accuracy in the comparison of the heating alues of fuels is from 0·1 per cent. to 0·3 per cent., nd this can only be reached after a most careful study f the thermometer and calorimeter and the application f numerous corrections.

(2) If the small corrections are neglected the errors may mount to from 1 per cent. to 2 per cent.

(3) The heats of combustion of the standard substances sed for the determination of the water equivalent are ot certain within 0·5 per cent.

(4) The errors due to hand sampling cannot be reduced ith certainty below 0·5 per cent., and may easily mount to 1·5 per cent. to 2·0 per cent.

Hence, so far as coal is concerned, it is at present more mportant to devise means for reducing the errors of ampling than to increase the accuracy of the calorimetric etermination.

Discussion.

The Chairman said that anyone who carried out physical bservations on instruments such as had been referred to ould be able to appreciate the large amount of work Mr. untly had brought before them, which ought specially to ppeal to the younger members. He would ask if Mr. untly thought it was ever possible in this country, s was being done in Germany and America, to buy coal y the calorific value ?

Mr. J. S. S. Brame said there were comparatively few orkers who had dealt with the question of the relative ccuracy of determinations. In a previous paper (Brame Cowan, this Journal, 22, p. 1230) the maximum error btained with the Mahler bomb calorimeter, amounted o 0·3 per cent., which was about what the author thought easonable. Gray and Robertson obtained a maximum rror at 0·7. Only one other comparison had come to his otice, by Professor Lord, where an error of 0·7 per cent. as obtained.

Most people who had a desire to preserve our coal upplies and to get the best value for money advocated he purchase of fuel on a calorific basis ; but the liability f calorific determinations to differences such that little eliance could be placed upon them had been the stumbling lock. Now they had the bomb calorimeter giving eliable results when properly worked, and there was othing against that method of purchase which was eing largely adopted in the United States and also by ome firms in this country. All these contracts were ased on a sliding scale, a premium being given for British hermal Units above the standard, or a deduction being ade if the value fell a certain amount below it. The oint was, how much should be allowed, considering the utside range of accuracy of determination, including ampling. He thought something like 50 calories or 100 ritish Thermal Units in coal having a value of 12,500 ritish Thermal Units would be the utmost accuracy one ould insist upon for the calorimeter determinations ; and he penalty could not be exacted or a bonus expected to be aid on anything much smaller. The American governent themselves admitted a 2 per cent. variation on British hermal Units, and they paid a proportionate 2 per cent. onus or deduction from the original price, and a large raction company in the States also allowed of a 2 per ent. error, which was about what he understood Mr. untly would agree to, such allowance including sampling nd calorimeter errors.

Newcastle Section.

Meeting held at Armstrong College, on Thursday, March 17th, 1910.

MR. C. J. POTTER IN THE CHAIR.

COKE MANUFACTURE.

BY ANDREW SHORT, B.SC.

The object of this paper is to give an account of the progress of Coke manufacture, and to review the methods now in use in this industry, which can now be classed as a branch of chemical industry. The importance of the industry will be seen when it is remembered that the world's production of pig iron has reached the enormous total of about 60 million tons annually, and to produce a ton of pig iron a little over a ton of coke is required. The first successful attempt to utilise coke for this purpose was made by Abraham Darby, about the year 1735, though earlier attempts had been made. Dudley having used coke for this purpose in 1619.

Coking Coals.—Coke as ordinarily known is the product of the dry distillation of certain bituminous coals, in which process the volatile portion is driven off. The coal cakes together and leaves a dense hard mass of somewhat cellular structure known as coke.

It is not every kind of coal which is capable of being made into coke. Some coals leave, on distillation, a soft friable mass which would be useless for bearing a burden in the blast furnace.

History of Coke Manufacture.[1]

Mounds.—The earliest method of coking coal was very crude, and consisted simply in piling up the coal in the form of mounds or rectangular heaps, covering the heap over with breeze (small coke), igniting the coal and allowing it to smoulder, much in the same way that charcoal is manufactured at the present time. The heat produced was sufficient to drive out the volatile matter which burnt, and ultimately a heap of coke was obtained.

Silesian stalls.—Later, these heaps were surrounded by walls having air passages at various places. The brickwork was built in the form of stalls, in which the coal was placed, covered with a layer of loam to prevent excessive waste by combustion of the upper layers of coal. Holes were pierced in the lower portion, the coal ignited by brushwood and the rate of combustion was regulated by opening or closing the air-holes in the walls.

Though these methods produced good coke, they were obviously wasteful, and ultimately what is known at the beehive oven was evolved. This type of oven is more economical and is largely in use at the present day, both in this country and in America, since it produces excellent coke, which is much prized for its silvery appearance and dense hard nature.

The Beehive oven is a dome-shaped structure, about 12 ft. diameter by 7 ft. high. In the original type it had an opening in the crown, which allowed the products of combustion to pass off into the air. At the front of the oven, several ovens being built in a row, a doorway is provided, some 4 ft. high. The coal is thrown into the oven through the door, spread on the floor of the oven to a depth of about three feet, and levelled. The door is then closed up and the coal ignited. Generally the heat of the walls is sufficient to ignite the coal. Air is admitted through a series of holes provided above the door, and the heat produced by the combustion of the volatile portion of the coal is sufficient to coke the mass. The ovens nowadays are provided with what is known as a "back-eye"—a hole in the back of the oven which communicates with a common flue built behind, and receives the hot gases from a row of ovens. Usually two rows are built back to back, with the main waste gas flue between them leading to a chimney. When the coking process is completed the door is taken down, and the coke quenched, with water, in the oven. It is removed by means of a "peel" with a long handle swung on a swivel crane. The ovens are now charged through the "top-eye" from tubs running along rails laid on the top of the ovens.

Since, with such an oven, air is admitted to the charge, in order to complete the combustion of the volatile matter, a certain amount of the coal or coke is burnt and lost. A coal which, heated in an entirely closed vessel, would yield, say 75 per cent. of coke, yields only 65 per cent. to 67 per cent. in the beehive oven, the loss being due to combustion.

In order to avoid this loss, ovens have been devised in which the coal is baked in a closed chamber, no air being admitted into the oven itself. This type of oven is known as the *Retort oven*, and amongst the earliest and most successful types were those of Coppée and Appolt.

Coppée,[2] 1861.—The Coppée oven, which was introduced in 1861, consists of a rectangular horizontal fire-brick chamber closed at each end by an iron door. In the roof of the oven holes are provided for the purpose of charging. The oven is heated by the combustion of the products of distillation. Near the roof of the oven are openings, to allow the products of distillation to pass into vertical flues arranged in the side walls between the ovens which are built side by side in rows. The air necessary for combustion is admitted through ports at the top of these flues, and the products of combustion from two adjacent ovens pass down the flues into a flue under the oven then along the sole flue of the next oven into the waste gas flue, and on to the chimney. The coke is removed from the oven by forcing it out with a ram travelling alongside, and quenched in the open, instead of being quenched in the oven, as is the case with the beehive type.

Appolt.—The Appolt oven (1862) was similar in principle, but differed radically in design,, inasmuch as it consisted of a vertical firebrick retort, some 16 ft. high by 4 ft. long, by 16 in. broad at the base, tapering to 3 ft. 8 in. by 13 in. at the top The bottom of the oven was provided with one or two hinged doors, and a charging hole was provided at the top. The gases evolved were led out of the oven through openings in the side walls leading into flues between the ovens, meeting air, and there burnt, and thus the coking was effected. No special appliance for unloading was necessary with this type of oven since on opening the bottom door the coke fell out of the oven into iron trucks running underneath. This type of oven did not however make much progress owing to high first cost, and to the cost of upkeep due partly to the difficulty of regulating the heats in the flues.

By-products.—The retort type of oven resulted in a higher yield of coke than the beehive type, but has been still further improved upon by the recovery of the valuable substances, coal tar, ammonia and benzol, from the products of distillation. The successful recovery of these constituents marks the development of the more purely chemical side of the industry, and the methods evolved for their recovery have now reached a high state of perfection. The industry now constitutes an important branch of chemical industry.

There are, however, some points in favour of the beehive type of oven. The cost of building and of upkeep is low and the coke has a very good appearance. Also the amount of waste heat available at a colliery for the purpose of steam-production is a valuable asset, and in recent trials with a battery of beehive ovens, using Stirling boilers, an average of 2 lb. of steam calculated from and at 212° F. has been raised per pound of coal carbonised.

Though the beehive type of oven does not lend itself to the successful recovery of by-products, several attempts have been made to adapt this type of ovens to recovery processes, among which attempts those of Jameson and Aitken may be mentioned.

Jameson[3] made great efforts to construct a recovery beehive oven. He used a perforated floor, connected with a common discharge pipe to which suction could be applied, thereby drawing off some of the products of distillation, the liquid portions of which condensed. Air was admitted in the usual way, and as the heat was supplied by the combustion of a portion of the volatile matter and a portion of the coal also, the yield both of coke and by-products was low.

Aitken applied suction to the bottom of the oven and forced in air mixed with the gaseous portion of the product drawn away from the bottom of the oven.

Pernolet[4] also designed an oven which was practically a closed beehive oven. The oven had a space underneath the floor which was heated by means of a fire, thus baking the coal in the oven above. The gases were led away through a hole in the top of the oven and condensed.

None of these processes have been successful.

The retort-oven, however, lends itself well to the recovery of by-products, and it is this type of oven which has come to the front of late. The first successful attempt in the by-product recovery process was made by Carvés in 1862, who modified and adapted Knab's oven for by-product recovery. Knab had in 1856 designed a retort oven heated by flues placed under the floor. Carvés added flues in the side walls. Simon added a simple form of recuperator, and this design of oven has been extensively used. The by-product recovery process, however, did not make much headway (at least in this country) until 1881, since which date the progress has been rapid, but not so rapid, in this country, as on the Continent, where no beehive ovens exist to-day. One reason for the slow growth in this country is found in the fact that iron makers considered the beehive coke to be better than retort coke, partly because of the bright silvery appearance of the former, due to its having been quenched in the oven, out of contact with the air. C. Lowthian Bell (Jour. Iron and Steel Institute, 1904), however, gives the results of tests made with beehive and retort coke, and proves that there is little difference between the efficiency of the two kinds of coke in the blast furnace. Before giving an account of the methods adopted for the recovery of the by-products it will be well briefly to indicate the various types of ovens in use.

The type of oven in use is almost exclusively the horizontal oven similar to the original Simon-Carvés and Coppée ovens, and consisting essentially of a horizontal brickwork chamber about 33 ft. long, 6 ft. 6 ins. to 7 ft. high, and 18—24 inches wide, in which the coal is coked. This is provided with heating flues, built into the side walls, and movable doors are provided at each end of the oven, and a hole in the crown leads away the gaseous products of distillation to a common main. The gases, after removal of the by-products, are led back to the ovens and burnt in

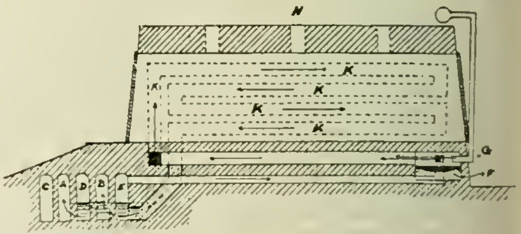

FIG. 1. Simon-Carvés Oven. Original Type.

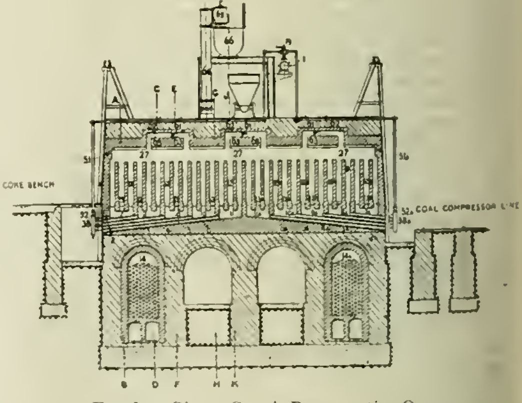

FIG. 1A. Simon-Carvés Regenerative Oven.

e side flues in order to carry out the process of coking. he ovens are usually built in batteries of 25—60, and ants are in existence which comprise up to 500 ovens.

There are various arrangements of ovens, the differences ing mainly in the arrangement of the heating flues and e methods of leading the gas into these flues.

Horizontal retort ovens may be divided into two distinct asses—(1) Ovens with horizontal heating flues (Simon-arvés type). (2) Ovens with vertical heating flues (Coppée pe). These again may be sub-divided into (a) waste eat ovens, *i.e.*, those in which all the waste heat is nverted into steam under the boilers, and (b) regenerave ovens where surplus gas is required. Most builders ave two types of ovens, regenerative and non-regenerave, according to the requirement of the buyers.

Horizontal flued ovens.—(A) Simon-Carvés original type. n this oven the walls are hollow, being formed of channel ricks, which divide the partition wall between two contiguus ovens, into four horizontal flues. Under the oven runs sole flue, and this leads up to the top horizontal flues. he gas is admitted at the end of the sole flue, along with r for its combustion. The flame travels along the le flue, up to, and along the top horizontal flue, then rough the lower flues in turn, and finally into a simple cuperator, consisting of two waste gas flues built in etween three air flues, in which the air is preheated efore coming into contact with the gas. Alternate ovens haust their waste gases into the two waste gas flues, ere being two chimneys provided for each respective ttery of ovens.

This type of Simon-Carvés oven has recently been superded by an improved type which will be described under subsequent heading, but it serves as the original type of e horizontal flued oven.

(B) Semet-Solvay[5] ovens have a somewhat similar rangement of side flues, with the exception that each en has its own set of flues: the ovens are separated from ch other by a solid wall, and the flues are placed on either de of this wall. The advantage of this method is twold; in the first place the solid wall in question, dividing each oven from its neighbour acts as a support for the superstructure and relieves from any undue strain the flues, which must be kept gas-tight. It also acts as a storage for heat, and tends to maintain the temperature of the oven when cold coal is thrown in, or during temporary stoppages of the gas supply. A feature of the Semet Solvay oven is the use of small bricks for building up the flues. It is claimed that this minimises the danger of cracks in the flues, with the consequent leakage of gas from the ovens into the flues and loss of by-products.

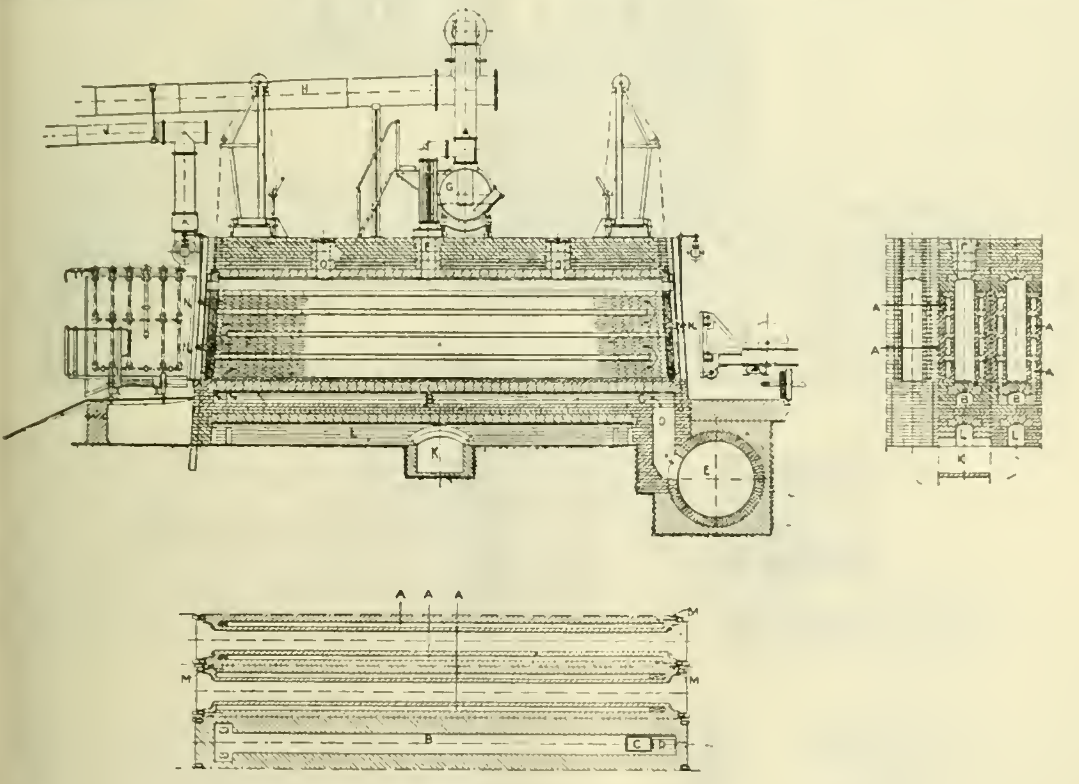

Fig. 2. Semet Solvay Oven.

The flues in these ovens are usually four in number. The gas and air enter at the end of the top flue, travel along this and slowly downwards along the other three in turn, and finally pass along a sole flue into the main waste gas flue leading to the boiler.

The air is generally led through flues built underneath the oven, and is heated up to a certain extent before entering the combustion flues. (Lately a form of continuous regenerator has been applied to this oven, the waste gas passing through small flues, between which the air passes on its way to the oven flue.)

(C) The Huessener[6] oven was the first by-product oven built in Germany. This type also has a separate set of flues for each oven with an intervening wall. The flues are built up of tongued and dovetailed bricks which are accurately fitted to each other. In this type of oven the gas enters at the sole flue, of which there are two to

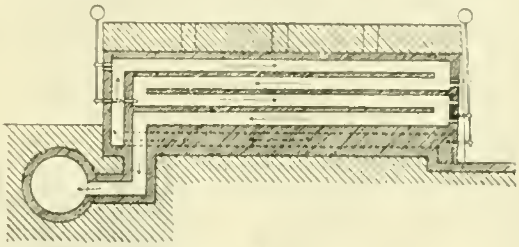

Fig 3. Huessener Oven.

each oven, one serving each set of side flues. The gas and air enter the sole flue, travelling along underneath the oven and rising through a vertical flue to the top flue. The flame then traverses the other flues, reinforced by more gas and air if necessary, and finally passes into the main waste gas flue.

Vertical flued ovens.—Coppée type.—The Coppée modern type has the flues placed somewhat similarly to those in the original type. The side wall is composed of a series of vertical flues, with a flue running longitudinally above and below. The gas is forwarded into the lower horizontal flue through a Bunsen mixing tube, and issues from a series of holes, each hole corresponding to a vertical flue. Enough air is mixed with the gas to give a non-luminous flame; combustion takes place in the horizontal chamber, the necessary air for the completion of the combustion being admitted into this chamber. Dampers are placed at intervals to regulate the supply. The hot gases pass up the vertical flues, along the top horizontal flue and down two vertical flues in the centre, thence through ports into the sole flue, and on to the waste gas main flue.

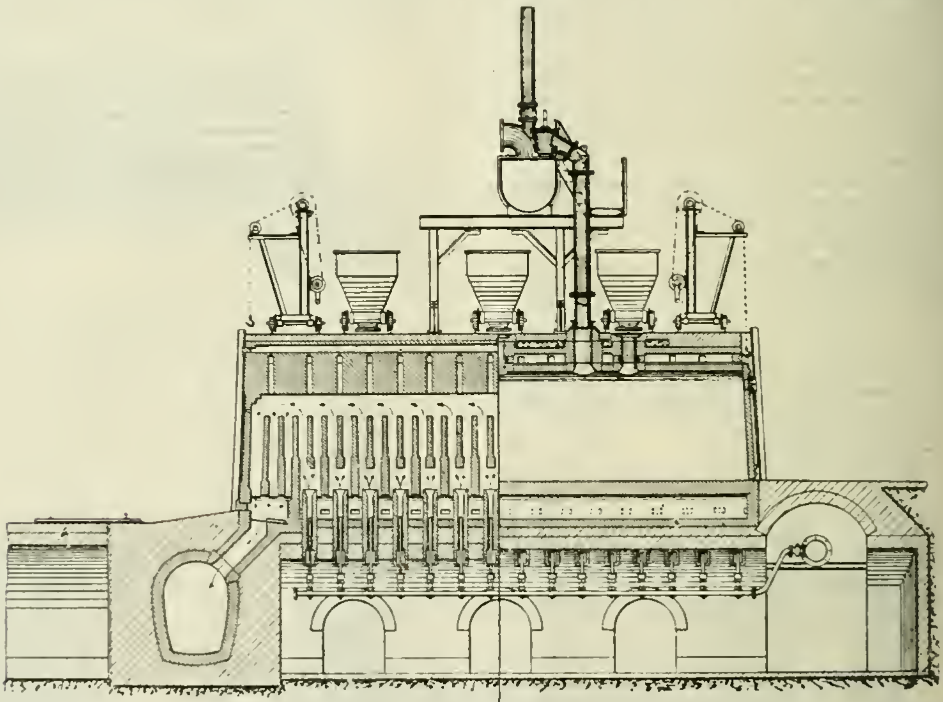

FIG. 5. Otto-Hilgenstock Oven.

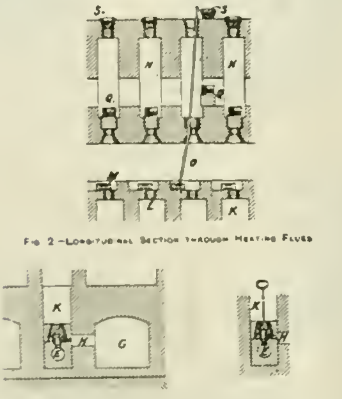

FIG. 2—LONGITUDINAL SECTION THROUGH HEATING FLUES

FIG. 3—CROSS SECTION THROUGH GAS NOZZLE

FIG. 4—CROSS SECTION THROUGH GAS NOZZLE

FIG. 4. Kopper's waste heat Coke-oven.

Koppers[7] oven.—In this oven there are 30—35 vertical flues, the supply of gas to each of which can be regulated. The gas is led into the flues by means of a fire-clay pipe running the whole length of the side walls, with adjustabl orifices of ingenious type, leading to each flue; an ai distributing channel runs along underneath the oven wit ports to each gas nozzle, where it mixes with the gas, an the flame passes into the vertical flues. The air is controlle by means of dampers at the top of each flue, and the products of combustion pass along the upper horizonta flue down two vertical flues at the end of the series, an on to the main flue.

The new Simon-Carvés type is designed to overcome thi adjustment of dampers, by placing regulators on to th sides of the oven. The gas is led through several pipe to the various points in the oven and regulated to maintain the necessary temperature. The air is regulate by dampers, which are accessible from the ends of th oven. The gas supply is also regulated from this positio and the control of heat in the flues can be regulated fro that point.

The Otto-Hilgenstock[8] oven is an extremely simple an effective design, the gas flues are replaced by a row of 15—1 large Bunsen burners, which heat up the vertical flue The gas supply is under easy control, and the air is regulated by a damper, placed at the opening leading to th main flue.

The advantage of vertical flued ovens over the horizonta flued ovens lies in the ease with which the heat can b regulated at various points along the oven by admissio or more or less gas, according to the temperature require at the different parts. Also, owing to the shorter flues, th gases have a shorter distance to travel, and consequentl a lower chimney draught is necessary. This avoids th drawing in of gases from the oven into the flues, with consequent loss of by-products.

Waste heat and surplus gas.—With waste heat ovens, th whole of the products of the combustion at a temperatur of 1700—1950° F., after leaving the oven flues, are collecte in a waste gas main, running alongside the ovens belo the ground level, and passed through boilers, where als the surplus gas, which amounts to 30 per cent. in man cases, is generally burned. Part of the steam is used on th plant, but the bulk of it is generally used for the purpos of raising electrical power, and since from 1—1¼ lb. water can be evaporated per pound of coal carbonised it will be seen that a large amount of energy can b developed in this way. Most modern coking plants have a power station in connection with the works.

With regenerative ovens the temperature of the waste gases is not great enough to enable them to be utilised with boilers, but since the quantity of surplus gas is often 50 per cent. to 60 per cent., of the total, and each ton of coal produces 10,000—11,000 c. ft. of gas of a net calorific value of something like 500 B.T.U. per c. ft., the power can be generated by the use of gas engines, which have now reached such a state of efficiency that they can be used very satisfactorily with coke oven gas, and they possess the further advantage that 2—4 times the amount of power can be developed from the gas engines than would be produced if the gas were burned under boilers and steam engines employed.

Most of the vertical flued ovens can be adapted to use with regenerators, the regenerator being of the Siemens type.

Regenerative ovens.—The most successful of the early regenerative ovens was the *Otto-Hofmann* which was practically a Coppée oven, fitted for by-product recovery and with regenerators.

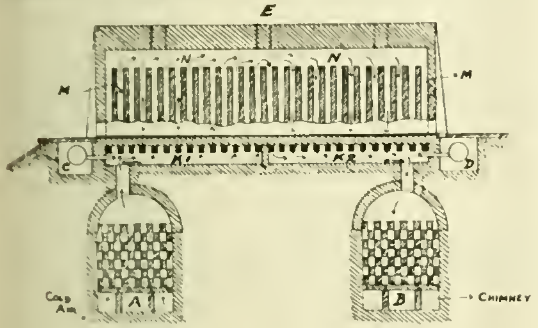

Fig. 6. Otto-Hofmann Oven.

The products of combustion from one-half of the oven wall passed along and down the other half, through regenerators, on to the chimney, the incoming air being heated by contact with hot brickwork in a second regenerator. The direction of the flow of gases was charged every half-hour. This type of oven has been largely used on the Continent and in America.

Most of the systems are a replica of the above method (Otto-Hofmann) which, however, has the disadvantage of causing expansion and contraction of the walls at frequent intervals which ultimately cause a leakage of gas. Ovens have been designed which avoid this to a certain extent if not almost entirely, some being very ingenious.

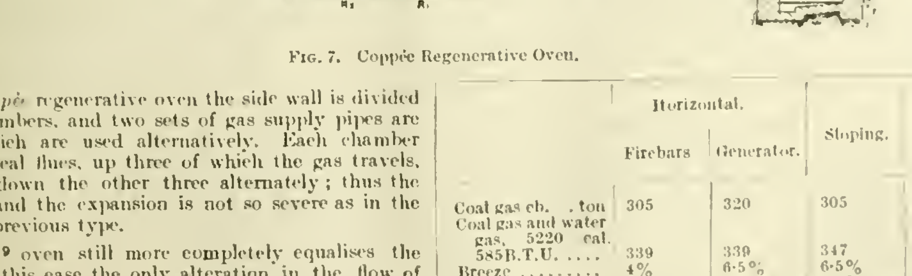

Fig. 7. Coppée Regenerative Oven.

In the *Coppée* regenerative oven the side wall is divided into five chambers, and two sets of gas supply pipes are provided which are used alternatively. Each chamber has six vertical flues, up three of which the gas travels, and passes down the other three alternately; thus the contraction and the expansion is not so severe as in the case of the previous type.

The *Collin*[9] oven still more completely equalises the heat, for in this case the only alteration in the flow of gases is that of direction in the individual flues. The gases from the combustion pass down a cavity in the brick between each flue, on to the generator, the air and gas enter (1) at the base of the flue, (2) on reversing, from the top, the air coming up through the tie-brick conduit.

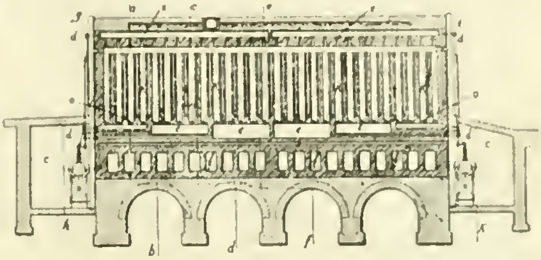

Fig. 8. Collin Regenerative Oven.

Each battery of ovens has usually a common set of regenerators, placed longitudinally running underneath the whole length of the battery. The *Koppers* ovens, however, are so designed that each oven has its separate regenerator, built underneath the sole of the oven, so that repairs to any regenerator can be carried out without interfering with the working of the battery as a whole.

Vertical retorts.—Of late years the question of carbonisation in vertical retorts has received considerable attention in the gas industry, and experiments in that direction have been rewarded with success. (See also this J., 1910, p. 471.) It is well known that in ordinary gas retorts a large amount of decomposition of the gas takes place, owing to its having to pass over the highly heated charge, and in contact with the hot walls of the retort, the result being the formation of retort carbon, and deterioration of the gas and tar, etc.

The adoption of inclined retorts has been attended with remarkable results, since they can be filled more completely than the horizontal, and ultimately vertical retorts have been adopted. Messrs. Settle and Padfield, Woodall and Duckham, Glover, and West, and others in this country have experimented in this direction. Bueb has designed a retort known as the "Dessau" vertical retort in Germany, and some interesting results have been published at various times in connection with the latter retorts.

Herr E. Körting gives some comparative figures in the Journal of Gas Lighting, Jan. 14th, 1908, p. 93, showing the result obtained in a battery of 84 "Dessau" retorts at Mariendorf; he compares results obtained from horizontal, sloping and vertical retorts, as follows, viz. :—

	Horizontal.		Sloping.	Vertical..
	Firebars	Generator.		
Coal gas cb. . ton	305	320	305	320
Coal gas and water gas, 5220 cal. 585B.T.U.	339	339	347	360
Breeze	4%	6·5%	6·5%	1·5%
Tar	4·5%	4·5%	4·5%	5%
Ammonia	2·5 Kilos.	2·4 Kilos.	2·65 Kilos	3·2 Kilos.

The tar yield is greater, and the tar better quality; the ammonia yield, however, is the most interesting being 30 per cent. higher with the vertical retort. Broadberry and Coleman, in their report to the Institution of Gas Engineers on "Dessau" retorts, using new Pelton coal, give the following results for tar, viz.:—

	Vertical Retorts.		Horizontal.
	Dessau.	Oberspree.	
Specific gravity	1·10	1·13	1·25
Naphthalene	3·6%	3·6%	9·0%
"Free" Carbon	0·4%	0·6%	28·7
Residue in retort, after distilling to 350% C.	54·3%	60·0%	72·1%

The makers of the Bueb system claim for it that 50 per cent. more ammonia is obtained, half the amount of sulphur in gas, little naphthalene, liquid tar rich in oils, and less scurf. The use of vertical gas retorts is rapidly gaining ground, and only recently the Sunderland Gas Co. have installed a number.

Vertical ovens.—Encouraged by the results in gas retorts, coke oven makers have turned their attention to vertical coke ovens, and the outcome of this has been the ***Elliott-Jones*** coke oven, which has been proved so successful on a working scale, that now a battery of these ovens is about to be constructed. The design is somewhat similar to that of the *Appolt* oven. The Elliott-Jones coke oven is a vertical rectangular chamber, wider at the base than at the top, and closed at the bottom by a door, being heated by a series of flues in the side walls. The dimensions are 19 ft. high, cross section at top 9 ft. 8 in. by 16 in., and at the base 10 ft. by 20 in. This taper allows the coke to fall out of the oven, on opening the bottom door. The gas is led away from the top by an ascension pipe in the usual way.

The flues are independent of each other, and possess a separate gas and air supply which regulates the temperature of the flue. The results obtained with an experimental full-sized oven confirm the results obtained with vertical retorts, and have been very encouraging. The tar is much thinner, and contains much less free carbon and naphthalene, than ordinary coke oven tar. The coke also is of excellent quality.

Appliances for charging and discharging ovens.—The coal, either washed or unwashed, is first crushed in a disintegrator of the Carr type, then stored in a hopper, run into a bogie, and loaded into the oven. The charge (if wet coal is used) is often stamped into a compressed cake or charge, and run into the oven in the form of a cartridge, thereby giving a closer grained coke, and a smaller percentage of breeze and ballast. If dry coal is charged, a mechanical leveller is generally used, which levels by means of a rake worked mechanically from the front of the oven.

The coke is pushed out of the oven by means of a ram fixed on a carriage, which runs along the entire length of the battery, and is generally worked electrically. The coke as it comes out of the oven is quenched, in some cases by passing through a hood placed at the oven door, and possessing sprays fixed inside, and sometimes it is quenched by a hose pipe on the coke bench.

The coke is often also discharged directly into a large car, which runs along the length of the battery, then carried away, screened, and filled into trucks.

By-product recovery.—The use of by-product ovens has very largely increased in this country, during the last ten years, and is still increasing, many ironworks now possessing by-product ovens built in close proximity to the blast furnaces. This growth is well illustrated by the official statistics of production of sulphate of ammonia, published in the annual report of H.M. Chief Alkali Inspector. It will be seen from these figures that though the sulphate of ammonia produced in gas works increased from 142,419 tons in 1900 to 165,218 in 1908, the production of sulphate of ammonia from coke ovens has increased more than six-fold, showing an increase from 10,392 tons in 1900 to 64,227 tons in 1908. The other chief by-products are tar and benzol, though owing to the low price prevailing for benzol, this recovery has not been very generally adopted.

The method of recovery up to the end of the last year or two, has been very similar in the various systems of coke ovens. The gas after leaving the oven is cooled down to atmospheric temperature, whereby the tar and some ammonical liquor produced by the water distilled from the coal, are condensed. The remaining ammonia, passing on with the gas, is absorbed in scrubbers by water, and a liquor is obtained containing ammonia to the extent of 1 per cent. to 1·5 per cent., chiefly in the form of ammonium sulphide and carbonate, with some cyanide, sulphocyanide, chloride, sulphate, sulphide and thiosulphate. The ammonia in the ammonical liquor is usually converted into sulphate of ammonia.* The gas still contains benzol vapour. This is recovered by passing the gas through washers and scrubbers fed with creosote oil, which absorbs the benzol and its homologues. This oil when saturated is distilled and crude benzol is obtained which must be further purified and distilled, ultimately yielding a variety of products.

The gases are led away from the ovens by an ascension pipe into a hydraulic main or tar main; it is here that a large portion of the tar, being easily condensed, is collected leaving this main, the gases being drawn through a series of air coolers. The *Otto-Hilgenstock Co.* have replaced the ordinary annular coolers by a serpentine gas main placed aloft. After leaving these air coolers, the gas has generally been reduced to a temperature of 60° C., or thereabouts, when it is passed through water coolers, which are constructed in a similar way to a surface condenser. Leaving these coolers the gas has been reduced to approximately the atmospheric temperature, and nearly all the tar has been removed at this stage. Some tar remains in the form of a fog, however, and this is removed in a Pelouze and Audouin tar extractor. The motive power for drawing away the gases from the oven through these various apparatus is usually a gas exhauster or a steam injector. The former (exhauster) is of the rotary type usually employed in gas works, or is some form of Root's blower. The rotary exhauster has been replaced in some plants by a *steam injector* of the *Körting type* which gives a regular pull on the ovens. When an exhauster is used the tar extractor is usually placed immediately after it; the gas sucked from the oven by means of the exhauster is then forced through scrubbers to remove the ammonia. The scrubbers are arranged in series, so that the gas rich in ammonia comes in contact with the strong liquor, on the first scrubber, and then weaker liquor, finally meeting fresh water in the last scrubber. The ammonia liquor is collected in tanks and worked up in a later process. The benzol is removed by creosote oil, circulated in scrubbers, similar to those used for the ammonia extraction, and the gas passes on to the ovens for heating purposes. The ammonical liquor is almost exclusively worked up into sulphate of ammonia, though in some cases strong liquor ammoniæ is made. The liquor is decomposed in a still heated by steam. The usual type consists of two separate stills, in the first of which the volatile ammonia compounds, *i.e.*, the sulphide, carbonate and cyanide are decomposed and carried away, the fixed ammonia salts are then decomposed by agitating the liquor, leaving the first still, with milk of lime, and passing through a second or fixed still after which the liquor passes on, freed almost entirely from ammonia. The steam and ammonia gases from both these stills, and carrying also sulphuretted hydrogen and carbon dioxide and some hydrocyanic acid, pass into a leaden bath containing diluted sulphuric acid, where the ammonia is absorbed, thus forming sulphate of ammonia, which crystallises when the solution is saturated and is removed, either by means of a steam injector or by having the saturator constructed in conical form with a draw-off cock at the base. The hot gases leaving the saturator are utilised to preheat the liquor entering the still, and thereby an economy of steam is effected; they are then either led to condensers, and oxide purifiers to remove the sulphuretted hydrogen, or are passed into the gas main, and ultimately burnt. The waste gases containing sulphuretted hydrogen are sometimes employed for the purpose of de-arsenicating the sulphuric acid used in the sulphate of ammonia plant.

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* Some quantitative chemical data are given in a paper published in this Journal in June, 1907.

Sir B. Samuelson and Sons, Ltd., have recently added a sulphuric acid plant to their works at Newport, near Middlesborough, and are making the acid necessary for the production of the sulphate of ammonia from 200 recovery ovens.

Benzol recovery.—The benzolised creosote oil is distilled by passing it in a continuous stream through stills, in which it is heated by steam up to nearly 200° C. where the benzol and its homologues are distilled off. The vapours are led off through worm condensers, and crude benzol is obtained, yielding by the retort test from 30 per cent. to 60 per cent. of distillate at 120° C. The de-benzolised oil is cooled and returned to the tank, feeding the scrubbers. The crude benzol is redistilled, and what is known as blown over naphtha is obtained. This product, still impure, is washed with strong sulphuric acid, which removes some impurities, *e.g.*, phenols, pyridine bases, some thiophen, and other bodies. After washing with water and finally with diluted alkali, and redistilling in a large still fitted with a very efficient rectifying column, various products are obtained, viz., commercial 90 per cent. benzol, toluol, xylol, and solvent naphtha. 1½ to 2 gals. of these products are obtained per ton of coal carbonised.

The distillation of tar is a branch of industry in itself, and is not often attempted at coke works. If it is done, he usual method is to distil the tar into the crude prolucts, light oil, carbolic and creosote oil, anthracene oil, and pitch, with, at the same time, the production of rude naphthalene and anthracene.

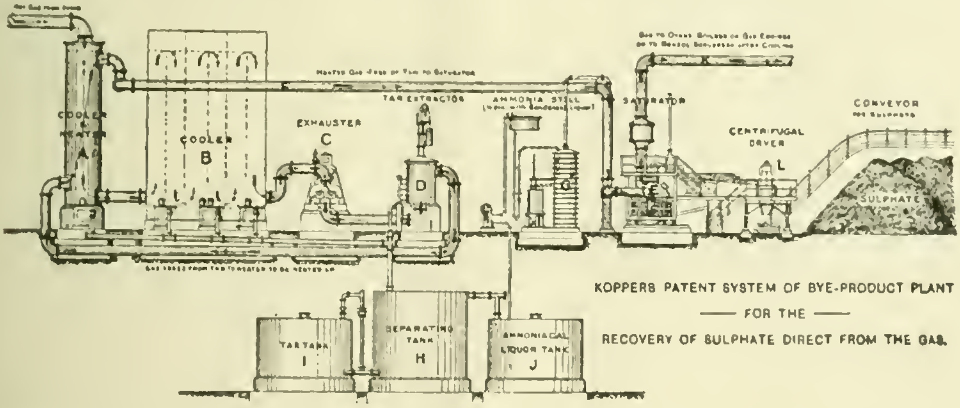
The method of by product recovery already described has een used with very slight modifications for many years, but it has several disadvantages. In the first place the apparatus s somewhat complicated, and costly. Ammonia stills and saturators are costly, and require a considerable amount of attention, and up-keep. Also a large quantity of fresh cold water is necessary for cooling and scrubbing of gases, and steam for distilling. Again, especially in inland places, the waste liquors from the ammonia stills, containing poisonous substances, such as calcium sulphide and sulphocyanide, are even after clarifying, too poisonous to be run into streams or canals. In some parts of the country the disposal of this liquid is an extremely difficult question.

Efforts have been made to simplify the recovery plant, and to avoid either partly or wholly the formation of ammoniacal liquor and consequently to avoid the injurious still waste.

These efforts have been successful, and now several systems are in use, notably the *Koppers* and the *Otto* systems, both of which are being installed in this country. The methods consist of the direct recovery of the ammonia, and remarkable developments have been made in the last year or so.

In the Koppers system the gas is first cooled down to a temperature of about 25° C., and passed through an exhauster to a tar extractor. This removes the tar, and some virgin ammonia liquor is obtained. The gas is then heated up by being passed through what is usually the air space in the first cooler. Here it is reheated, and then passed on to a large lead saturator, and is bubbled directly through a bath of sulphuric acid. At the same time the virgin liquor collected from the cooler is distilled in a small still, the ammonia driven out and mixed with the gas. There is very little effluent liquor, and the salt is free from tarry matter, which proved a source of trouble in earlier direct recovery processes. The gas is passed into the saturator at a comparatively low temperature, and the salt contains remarkably little free sulphuric acid. The Otto system is still more simple and very ingenious, for the gases leaving the oven are conveyed hot into the saturator, and no condensation of liquor is obtained. It will be seen that this is a distinct advantage, since many oven plants are charged with washed coal containing 10—12 per cent. of water. Thus 120 ovens carbonising wet coal would produce 60 tons or so of virgin liquor per day, and the disposal of the still waste from this quantity would be a difficult matter.

In the Otto system the gases leaving the ovens are passed into a vessel in which they are sprayed with tar. These tar sprays remove the tar from the gas at a temperature above the dew point of the gas, and thus no water is deposited.



KOPPERS PATENT SYSTEM OF BYE-PRODUCT PLANT
—— FOR THE ——
RECOVERY OF SULPHATE DIRECT FROM THE GAS.

Fig. 9.

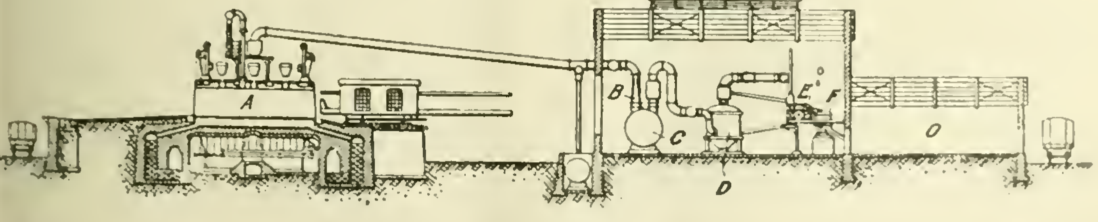


Fig. 10. Otto Direct Recovery plant.

By this simple means the gases are freed from tar, and then an exhauster draws them off, and forces the gas through a large lead-lined saturator in which the ammonia is absorbed by sulphuric acid, the sulphate formed being free from tarry matter and of good quality.

The gas is then passed on to the burners, unless it is required to remove benzol, and only then are coolers necessary. Even then no ammoniacal liquors are formed, and any condensed water, since it contains no lime salts, can be used up for quenching coke, etc. The losses of benzol due to the absorption in the scrubbing water under ordinary conditions is avoided, and an increased benzol yield will doubtless be obtained. If benzol is not extracted, no water is necessary for cooling, which in the ordinary method is a considerable item, and also the initial cost of the product plant is very much decreased. Several plants on this system are working at present in Germany, and some under construction in this country will soon be in operation.

Illuminating gas from coke ovens.—Since coke oven gas approaches very nearly to the quality of ordinary lighting gas, the question of its utilisation for this purpose has been raised at various times, and in America attempts have been made to adopt coke ovens for the purpose. Dr. Schniewind has dealt with this question very fully in a paper read before the Gas Engineers' Congress at Glasgow in 1901, showing how the quality of the gas varies at different times during the carbonisation period.

Recently arrangements have been made with a view to supplying the district of Little Hulton in this country with gas, of 550 B.T.U. cal. value, and 14 candle power, in quantities up to 400,000 cb. ft. per day from the coke ovens at the Earl of Ellesmere Collieries. A scheme is also being brought under notice in the Ruhr District of Rhenish Westphalia, where coke ovens exist in large numbers, to centralise a gas station supplied from the various coke oven plants, which if successful would result in a very cheap gas supply, and avoid the costly undertaking of many gas works in the district.

I have to thank Messrs. Christopher and Byrom for the loan of some of the drawings to illustrate this paper, and also the makers of the various types of coke ovens for kindly supplying information.

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[1] This J., 1884, 601–606.
ibid, 505–512

[2] This J., 1900, 653.

[3] This J., 1884, 104 and 511.

[4] This J., 1883, 115.

[5] This J., 1895, 792.

[6] This J., 1884, 103 and 605.

[7] This J., 1901, 882; 1904, 365 and 1020; 1905, 492; 1907, 787.

[8] This J., 1903, 618.

[9] This J., 1898, 834; 1902, 1028; 1903, 1080; 1908, 1166.

New York Section.

Meeting held at the Chemists' Club, on Friday, May 20th, 1910.

MR. MAXIMILIAN TOCH IN THE CHAIR.

ALKALOIDAL SALTS OF GUAIACOLSULPHONIC ACIDS AND CREOSOTE-SULPHONIC ACID.

BY DR. GEORGE L. SCHAEFER.

Among the long list of guaiacol and creosote compounds, very few are of practical value for medicinal purposes. Among the most important of these compounds are the salts of *o*-guaiacolsulphonic acid with organic bases. This acid was first introduced in medicine in 1897, combined with the alkaloids of cinchona bark. Combinations with various other alkaloids have also been prepared; the neutral salts of *o*-guaiacolsulphonic acid with some of the alkaloids of opium have recently been introduced with good results. These salts, about which nothing can be found in literature, are not only of value in medicine, but are also very interesting chemically. Of the various guaiacolsulphonic acids theoretically possible, so far only the *ortho*-acid has been used in medicine in the form of its compounds, and these are described in this paper. The salts of the other acids are as a rule less crystallisable and more readily soluble, which property can be used to separate the salts of the different acids with the desired base by recrystallisation from suitable solvents.

The preparation of *o*-guaiacolsulphonic acid and its salts can be carried out in the following way:—Guaiacol is treated with an excess of concentrated sulphuric acid, whereby a mixture of guaiacolsulphonic acids is obtained in various proportions. The thick, dark red liquid is diluted with water, the excess of sulphuric acid removed by means of lead oxide, barium hydroxide, or other suitable base, and the mixture is filtered off from the insoluble sulphates. The solution contains various guaiacolsulphonic acids, which are neutralised with carbonates or hydroxides of potassium, barium, calcium, or other bases, and the solution is evaporated, leaving an impure product from which the pure salt of the o-guaiacolsulphonic acid may be obtained by recrystallisation with a suitable solvent. From either of these pure salts the free *o*-guaiacolsulphonic acid may be prepared by decomposition of a solution of the salt with an acid which forms an insoluble compound with the base, the free acid being filtered off. The alkaloidal salts can be produced by neutralising the acid with the respective alkaloid, and purifying the product by filtration and recrystallisation. The amorphous salts are obtained by evaporating the solution at a very low temperature, or better, *in vacuo*. The salts may also be prepared in some cases by double decomposition between an easily soluble salt of *o*-guaiacolsulphonic acid and an easily soluble salt of the alkaloid in molecular proportions, using alcohol, water, etc., as a solvent. Most of the salts of o-guaiacolsulphonic acid and alkaloids are non-crystalline, or only crystallisable with difficulty; some, however, can be obtained in distinct, well-formed crystals, especially some salts with alkaloids of the opium group.

Salts of the opium group.

Morphine-o-guaiacolsulphonate is obtained as a grayish-white, hygroscopic powder, when the aqueous solution is evaporated and the salt dried over sulphuric acid. From a solution in strong alcohol, ether, or acetone, it may be obtained in an indefinite crystalline form, when dried *in vacuo*. It is deliquescent in air and very soluble in water and alcohol, slightly so in ether and chloroform.

Codeine-o-guaiacolsulphonate is the most important salt of this group, and has recently been largely used in medicine. It is a well crystallised, neutral salt, appearing in the market in the form of cubic crystals of various sizes, or crystalline powder, colourless and odourless. Its formula is $C_6H_3(OH)(OCH_3)(SO_3H).C_{18}H_{21}NO_3$. It does not contain any water of crystallisation, but absorbs 1—2 per cent. of moisture from the air. The perfectly dry salt contains 59·44 per cent. of anhydrous codeine, or 63·20 per cent. of U.S.P. alkaloid of codeine, with 1 mol. of water of crystallisation, and 40·56 per cent. of *o*-guaiacolsulphonic acid. It melts between 164°—165° C. to a clear liquid, which decomposes at a higher temperature. The salt is soluble in 95 parts of water at 25° C., in 450 parts of alcohol, and in 30 parts of methyl alcohol, and easily soluble in hot water. It is almost insoluble in ether and chloroform. Its neutral solutions in water or alcohol give the characteristic blue reaction for *o*-guaiacolsulphonic acid, when a drop of ferric chloride solution is added, the liquid being coloured blue at once. If the pure salt is dissolved in ten parts of hot water, the solution quickly cooled to prevent crystallisation, and a slight excess of caustic soda or potash solution added, codeine is precipitated. When this is filtered off and dried, it should respond to the requirements and tests of the U.S.P. for codeine alkaloid. The alkaline liquor or filtrate carefully neutralised with diluted sulphuric acid, and a drop of solution of ferric chloride added, will assume a deep blue coloration, indicating the presence of guaiacolsulphonic acid.

If 0·5 grm. of the salt is dissolved in 25 c.c. of hot water, the solution quickly cooled and an excess of potassium hydroxide solution added, the mixture shaken out three times with chloroform and the chloroform evaporated in a small beaker and dried at 100° C., the residue should weigh not less than 0·295 grm. of anhydrous codeine.

The salt of codeine with creosote-sulphonic acid, which can be obtained as a crystalline, white, stable powder, has a lower but not distinct melting point. Creosote being a mixture of phenols, having no definite chemical composition, yields a corresponding mixture of sulphonic acids and their salts. This compound also differs from the *o*-guaiacolsulphonate of codeine by its greater solubility. The salts of creosote-sulphonic acid with the other alkaloids are all less easily soluble. Being a mixture of various salts, they cannot be produced in uniform crystals but are obtained as a dry, amorphous or crystalline powder by evaporation of their aqueous or alcoholic solutions, or by precipitation from the alcoholic solutions by means of ether.

Ethylmorphine o-guaiacolsulphonate crystallises in white cubical crystals when the concentrated solution is allowed to stand for a long time. If prepared from an alcoholic solution by means of ether it can be obtained as a white powder after drying the precipitated salt at a low temperature or over sulphuric acid. It is soluble in water and alcohol, almost insoluble in ether. The reactions of the salt are similar to those described for the codeine salt.

Diacetylmorphine o-guaiacolsulphonate is amorphous, very soluble in water and alcohol, insoluble in ether.

Acetylcodeine o-guaiacolsulphonate.—When the alcoholic solution is allowed to stand for a few weeks, this salt can be obtained in white prismatic crystals, or if the solution is evaporated at a low temperature and the salt dried over sulphuric acid, it can be produced as a grayish powder. It is soluble in alcohol and water, sparingly soluble in chloroform, and insoluble in ether.

Meconine o-guaiacolsulphonate crystallises in beautiful, long, needle-shaped crystals, soluble in 20 parts of water and also soluble in alcohol, insoluble in ether, slightly soluble in chloroform.

Narcotine o-guaiacolsulphonate forms an amorphous mass, which, when dried over sulphuric acid, can be obtained as a yellowish amorphous powder. It is sparingly soluble in water, but easily soluble in alcohol. It is also sparingly soluble in an excess of the acid.

Narceine o-guaiacolsulphonate can be obtained from its aqueous or alcoholic solutions in small indefinite crystals. It is readily soluble in water and alcohol, almost insoluble in ether.

Salts of the cinchona group.

This group forms two series of salts, with one molecule and two molecules of the guaiacolsulphonic acid. The salts of the first series react alkaline to litmus paper, whilst those of the second series have a strongly acid reaction.

Quinine o-guaiacolsulphonate.—The basic salt of quinine, of the formula, $C_6H_4O_2.CH_3.SO_3H.C_{20}H_{24}N_2O_2$, forms a light yellowish-grey amorphous powder, sparingly soluble in water, easily so in alcohol and dilute acids. It softens when slightly warmed.

Quinine di-guaiacolsulphonate, or "Guaiaquin," is largely used in medicine. The anhydrous salt is a compound of the formula $(C_6H_4O_2.CH_3.SO_3H)_2C_{20}H_{24}N_2O_2$; it is somewhat hygroscopic, and therefore appears in the market with a few per cent. of water. It forms an amorphous, bright yellow powder or small lumps, and is easily soluble in water and alcohol. The solution is coloured blue by the addition of a drop of solution of ferric chloride. It softens at about 80° C. to a thick sticky mass, which solidifies again when allowed to cool. At about 130° C. the salt becomes liquid, showing decomposition.

Cinchonidine o-guaiacolsulphonate. — This compound shows similar properties to the basic quinine salt, but is somewhat more soluble in water, readily soluble in alcohol and in dilute acids.

Cinchonidine di-guaiacolsulphonate.—The acid salt forms a yellowish-white amorphous powder, easily soluble in water and in alcohol.

Cinchonine o-guaiacolsulphonate can be obtained from an alcoholic solution as a crystalline salt, also from a diluted solution in water. From a concentrated aqueous solution it separates out as an amorphous mass or indefinite crystals. It is more soluble in water than the other basic salts of the cinchona group. When boiled with water the salt melts, and is slowly dissolved. It is easily soluble in alcohol and dilute acids.

Cinchonine di-guaiacolsulphonate forms an amorphous yellowish powder, very soluble in water and alcohol.

Quinidine o-guaiacolsulphonate is an amorphous yellowish powder, sparingly soluble in water, easily so in alcohol and dilute acids.

Quinidine di-guaiacolsulphonate forms a yellow amorphous powder, easily soluble in water and alcohol.

Solanum group.

The *o*-guaiacolsulphonates of atropine, hyoscine, and hyoscyamine form amorphous sticky masses or, when carefully dried over sulphuric acid, they may be obtained as grayish amorphous powders, easily soluble in water and alcohol. They are best prepared from alcoholic solutions by means of ether and the precipitated amorphous salts dried *in vacuo*.

Strychnos group.

Methylstrychnine o-guaiacolsulphonate.—This salt crystallises in distinct needle-shaped crystals. It is sparingly soluble in cold alcohol and water, easily so when slightly warmed.

Methylbrucine o-guaiacolsulphonate can be easily crystallised from water or alcohol. It forms small cubical crystals, sparingly soluble in cold alcohol, more readily so in water, easily soluble in hot alcohol or water.

Strychnine o-guaiacolsulphonate separates from a concentrated aqueous solution as a thick yellowish liquid, also from an alcoholic solution to which water is added. It is somewhat soluble in water, and very freely so in alcohol. An excess of the acid diminishes the solubility in water. A cold saturated solution of the salt in water, when allowed to evaporate slowly at ordinary temperatures in an open porcelain dish, deposits some crystalline salt on the sides of the dish, while the greater part of it is obtained as an amorphous sticky mass, which when dissolved and evaporated again as before, can also be obtained as crystals.

Brucine o-guaiacolsulphonate is easily crystallised from water and alcohol, forming indistinct, small, white crystals. It separates out from its solution slowly, but nearly quantitatively, when allowed to stand for some time. It is very little soluble in water and alcohol, also in an excess of the acid. The salt, when dried at 80° C., is anhydrous, and requires for solution about 500 parts of water at 25° C., about 800 parts of alcohol at 25° C., and 30 parts of boiling water. It is sparingly soluble in boiling alcohol. Its solubility is greatly diminished when the temperature is kept below 25° C.

The great difference in the solubility of the *o*-guaiacolsulphonates of strychnine and brucine in alcohol seemed to offer a favourable method for the separation of the salts for analytical purposes. However, in carrying out experiments in this direction, I found that the solubility of the brucine salt is greatly increased when some of the strychnine salt is present, and that the guaiacolsulphonate of brucine is kept in solution even in the proportion of 1 : 20, when equal parts of both alkaloids are dissolved in alcohol or water and neutralised with *o*-guaiacolsulphonic acid. After 24 hours, the aqueous solution, 1 : 20, showed a separation of only a few drops of a thick liquid, while the alcoholic solution in the same proportion remained perfectly clear. Another experiment made side by side with the neutral salts, was carried out with an excess of the acid. These acid solutions showed a separation of a few crystals when alcohol was used, and a somewhat greater amorphous sediment from the aqueous solution. To determine if an easily soluble double salt of definite composition is formed, solutions containing both salts in different proportions have been allowed to stand for a few days, and the separated crystals as well as the remaining liquor tested. It was found that there was no double salt of distinct molecular proportions, but that the percentage of strychnine salt crystallising out with the brucine salt, is proportional to the time allowed for crystallisation, and that the easily soluble amorphous *o*-guaiacolsulphonate of strychnine, which is formed first, keeps the brucine salt in solution, and slowly takes up four molecules of water of crystallisation, forming a crystallisable salt only sparingly soluble in cold alcohol, which gradually crystallises out together with the brucine salt in various proportions, according to the time allowed to the solution to stand. While these experiments show that, in spite of the great difference in solubility, it is not possible to separate the salts by means of alcohol, it is still possible that another solvent may be found, which is better adapted for this purpose, and investigations in this direction will be carried out later.

Cocaine o-guaiacolsulphonate forms a sticky mass, which when made perfectly anhydrous and dissolved in strong alcohol, can be obtained as an amorphous powder by precipitation with ether and carefully drying the precipitated mass *in vacuo*. It is easily soluble in water and alcohol.

Caffeine o-guaiacolsulphonate does not form a real salt. From a solution of caffeine in guaiacolsulphonic acid pure caffeine crystallises out.

The following paper was also read :—

MEDICINAL CHEMICALS AND THE PHARMACOPEIA AS RELATED TO THE INDUSTRIAL CHEMIST.

BY MILTON F. SCHAAK, PH.D.

Communication.

BUILDINGS FOR EXPLOSIVES WORKS.

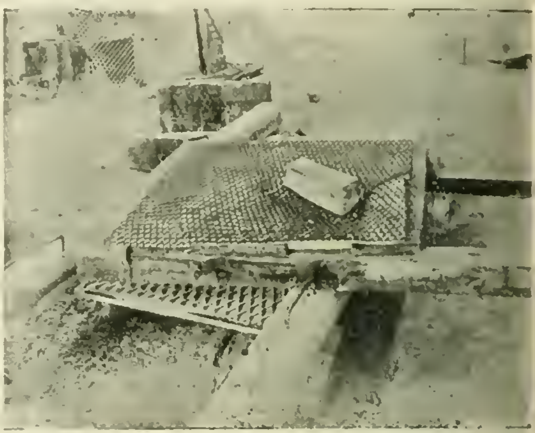
BY THE LATE OSCAR GUTTMANN, M.INST.C.E., F.I.C., F.C.S.

In the year 1908 I published an Article entitled "Explosions and the Buildings of Explosives Works" (this J., July 15, 1908, p. 669), together with a large number of photographs showing the effects of explosions. In this article I recommended that buildings for explosives factories should, in the future, be constructed of reinforced concrete, made with an aggregate of fine river-gravel. In order to prevent the roof being penetrated by flying débris it would consist of two layers of armoured concrete with a layer of sand between them. Similarly, armoured concrete was proposed for the surrounding mounds and for the passages leading through them to the buildings.

It always takes a long time for new ideas to assert themselves when they are diametrically opposed to present practice. Having been brought up with these old ideas, one is apt to regard anything new with distrust. Moreover, alterations to existing arrangements entail considerable expense ; nobody can really guarantee that the new arrangement will be a better one, and a catastrophe is therefore sometimes necessary to enforce the adoption of such alterations. As is often the case, it was in Germany that sufficient courage was plucked up to go more closely into this question. In the year 1910, on page 1 of "Die Chemische Industrie," it was recorded—this was the first intimation I received—that the authorities suggested the construction in a German powder-factory of a trial building in accordance with my proposals, in order to prevent the transmission of fire from one portion of a packing room to another, and that experiments made in this building were a complete success.

For buildings which are merely exposed to fire-risks the construction outlined by myself two years ago is more than sufficient. In the case of buildings, however, in which there is a risk of explosion it was argued that the cohesion of the armoured concrete might be so great that pieces of appreciable weight might be thrown about, and also that the massive construction of the buildings might render the effects of an explosion too great ; also that such a building might be rather expensive. Moreover, I personally do not relish the possibility of sand becoming admixed with explosive material in the event of an explosion.

In connection with the planning of various new buildings for a German factory in 1908 and 1909, it was my privilege to discuss the problems arising therefrom with Geheimrat Mente, of the Prussian Ministry of Commerce. I proposed that in the case of this factory, the walls only of the buildings be made of ordinary concrete with river-gravel aggregate, similar to that used in the experiments at Kummersdorf, this being sufficient to protect them from flying pieces of débris, and from the shock due to an explosion some distance away. The roof on the other hand, in place of armoured concrete, was to be made of light, yet strong wooden principals covered over with expanded metal, wire-netting, or similar material. To be quite on the safe side, this protective network was to be provided both on the outer and on the inner side of the main rafters and since protection against lightning was afforded at the same time by its provision, the network was connected at suitable intervals to a metal conductor going all round the building and earthed in the usual way.

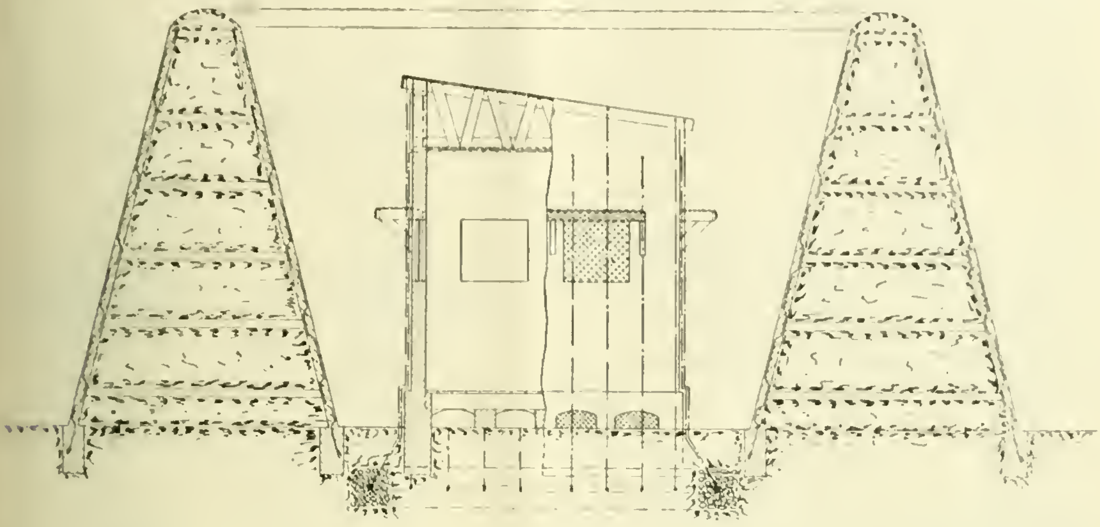


To Geheimrat Mente and to the directors of the works in question, all praise is due for the confidence they vouchsafed to this arrangement. To test its efficacy as a protection against flying débris, two wooden rafters were covered over on both sides with expanded-metal to represent a portion of a roof such as that described. The meshes of the expanded-metal measured 20 mm. by 50 mm., while the section of the metal was 3 mm. wide by 5 mm. high. A block of lead weighing 36 kg. was then allowed to drop on to the centre of the expanded-meta covering from the top of a water tower 21 metres high As shown in the photograph, the rafters were fully able to withstand this blow and only one mesh of the expanded metal was broken, the effect of the blow having been equally distributed over the whole surface, which had acted like a spring mattress. Subsequent tests have shown that wire-netting of suitable strength, the use of which is preferred by Geheimrat Mente, acts in the same way, whilst there would probably be fewer particles formed in the event of an explosion.

A roof of this kind would naturally require to be rendered rain-proof by means of a galvanized or tarred sheet-iron cover and electrical connection made between all metal parts and the wire-netting. In the case of buildings where there are no heavy pieces of machinery or long lengths of shafting, the outer covering of netting was deemed sufficient as a security against lightning. The cost of a double layer is, however, of small moment if its provision offers security against inductive effects. Geheimrat Mente has now agreed in principle that where this method of construction is adopted the network of wires carried one metre over the top of the building and stretched between poles 2 metres high on the mounds might be dispensed with altogether. A building thus results which partakes of the nature of a Faraday cage, and which while very cheap in the first cost, is proof both against lightning and against flying débris. At the same time, machinery, shafting, etc., may be firmly fixed in such a building which also complies with all other conditions to which I drew attention in my previous article.

The floor of such buildings had already been built by myself over a pit in the ground, and Mr. Sam Soddy has now pointed out to me as a result of his observations in the case of two explosions, that the shock transmitted to the earth by an explosion, to which I drew attention in my article, can be minimised by erecting a building over a pit of this description or some similar hollow. I believe that the simplest method of preventing such transmission would be to make a hollow floor communicating through a number of large openings in the walls with the outer air, thus enabling the stratum of air below the floor to escape in case of an explosion. In this way the layer of air would no longer act as a buffer, but could escape, so that only a small proportion of the shock would be transmitted to the ground.

The accompanying drawing shows a building of this kind and is self-explanatory. Its simple construction and small first cost can be readily appreciated. The principals are simply made of boarding, but are very strong. The openings in the floor are closed by wire screens, which might advantageously be removable to facilitate cleaning, while at the same time they would give facilities for carrying piping, ducts, and the like underneath the building.



Since I first developed my views regarding the action of explosions on neighbouring buildings, several explosions have occurred which have proved the correctness of my opinion. In particular, an explosion in Natal and another in Canada could hardly have been so destructive had the buildings been designed in the manner indicated above.

In order to establish beyond question my priority as regards this idea, I considered it desirable to take out a patent for it in this country.* As already stated in 1908, I deem it, however, to be my duty not only to publish proposals of this kind, which are of the greatest importance for the safety of explosives factories, but also to permit everybody to make use of them, free of all license fees, which permission I formally give herewith.

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*No. 4094 of 1909 (See this J., 1910, 375).

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Rotary furnace for chemical reactions. Soc. Auxiliaire du Commerce et de l'Industrie. First Addition, dated Dec. 30, 1909, to Fr. Pat. 407,752, Oct. 9, 1909 (this J., 1910, 614).

The mixing or oxidation takes place in a receiver of pure nickel or a suitable alloy lined with refractory material or with cast steel and heated by gas blowpipes. The receiver is either fixed or movable; in the former case the gas inlet and outlet is at either end and a nickel shaft carrying nickel stirring arms passes longitudinally through the vessel. In the latter case the inner vessel rotates about a horizontal axis which is hollow and is made of nickel and provided with perforations, the supply or discharge of gas taking place through the hollow arms.—W. H. C.

Desiccation apparatus. C. Scherf. Fr. Pat. 411,891, Jan. 24, 1910.

The materials to be dried are fed from a hopper into an upper or preliminary drying chamber through which they are caused to move by agitators attached to a horizontal shaft. From the preliminary chamber the materials pass by a shoot to a second drying chamber situated immediately below the first. A number of pairs of horizontal drums are arranged round the periphery of a frame which is rotated within the casing which encloses both the chambers. Each drum is surrounded by a heating coil and is provided with blades to move the materials through the drum. The materials pass in one direction through the first drum of each pair and return through the second and are finally discharged through a shoot.—W. H. C.

Drying machine. A. M. Schreuder, Assignor to the Philadelphia Textile Machinery Co., Philadelphia, Pa. U.S. Pat. 962,865, June 28, 1910.

THE claim is for a dryer through which a current of air is forced by a fan and which is divided into two compartments by a longitudinal partition. The material to be dried is passed on a band conveyor through one of the compartments, the other compartment serving to heat the air, being for this purpose provided with steam coils which enter and leave through the top in order not to interfere with the removal of the uprights and panels of the steam chamber when it is necessary to examine or repair the steam pipes.—W. H. C.

Drying air. J. Gayley, New York, U.S.A. Eng. Pat. 13,554, June 9, 1909.

THE air is cooled in two stages by direct contact with a cooling liquid. The air passes first up a tower, down which a spray of water cooled to about 35° F. falls. The air leaves the first tower at about 40° F., and with a constant water content and is forced by a fan or blower through a second tower. A non-congealable liquid cooled to 32° F. or lower is sprayed down the second tower and the dry gas is sent forward by means of a suitable engine. —W. H. C.

Hot air dryer. G. H. Thorp. Fr. Pat. 411,287, Jan. 5, 1910.

THE air passes first through a heating chamber and thence through the dryer proper, where the hot air passes over the material to be dried which is caused to pass through the drying chamber by an endless chain or belt. The warm air charged with moisture passes from the dryer through a cooler where it is deprived of its moisture and is then returned to the heating chamber.—W. H. C.

Evaporating apparatus. F. H. Eijdman, Ryswyk, Holland. Eng. Pat. 11,422, May 14, 1909.

THE liquid is caused to pass through the apparatus in a vertically zig-zag manner, the height to which it rises at each bend of the zig-zag diminishing from the inlet to the outlet of the apparatus. The liquid is heated by internal or external means but only during its upward and not during its downward passage.—W. H. C.

Centrifugal machine; Continuous ——. F. H. Roberts, Sterling, Colo., U.S. Pat. 962,052, June 21, 1910.

THE material to be treated is fed into one end of a horizontal perforated cylinder lined with filtering fabric, and mounted upon a hollow shaft in such a way that both the cylinder and the shaft can be rotated independently. Compressed air is admitted into the cylinder to force the liquid through the filter cloth, and the material is caused to pass through the cylinder by a flanged screw conveyor mounted on the horizontal shaft. The central portion of the shaft has a perforated casing through which water is forced through the drained cake before its discharge from the far end of the machine. The cylinder is surrounded by an outer casing divided by three vertical partitions into receptacles for the filtered liquid, for the washings and for the washed and pressed cake.—W. H. C.

Filter-press. E. W. Heller, Newark, N.J. U.S. Pat. 962,346, June 21, 1910.

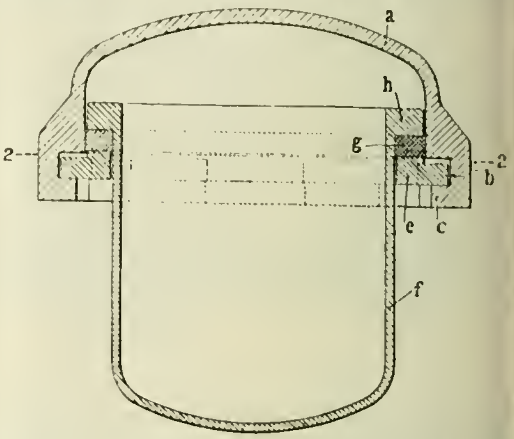
THE final pressure is put on the plates and frames by a pressure device which is inserted between the end of the jack-screw which serves for the preliminary closing of the press, and the end of the movable head, and which comes into play only after the plates have been tightened as far as possible by the jack-screw.—W. H. C.

Desiccating fluid substances. W. S. Osborne, Hyde Park, Mass. Assignor to American Desiccating Co., Maine: U.S. Pat. 962,781, June 28, 1910.

THE fluid to be desiccated is introduced in an atomised condition into a current of air, and both are maintained in motion until the material is desiccated. A whirling motion is then given to the air, to cause the desiccated particles to separate, any dry particles left in the air being collected by introducing a spray of the original liquid or water. The material thus recovered is reintroduced into the air current and redried.—W. H. C.

Covers for autoclaves or other vessels. L. Granges, Paris. Eng. Pat. 1073, Jan. 15, 1910. Under Int. Conv., Jan. 25, 1909.

A PACKING ring, *g*, is placed below the flange, *h*, of the vessel, to be closed and beneath the packing ring a toothed washer, *e*, is placed. The cover, *a*, having a channel or groove, *b*, and a toothed flange, *c*, is placed over the vessel, the teeth of the flange, *c*, passing through the spaces between the teeth in the flange of the washer, *e*, and vice-versa. The lid is then turned through a small arc, and the joint is made tight.—W. H. C.



Extracting or separating suspended matter from gases, particularly tar from combustible gases. F. W. Burstall, Birmingham. Eng. Pat. 24,261, Oct. 22, 1909.

THE gas is passed horizontally through a box or chamber in which a number of rows of obliquely inclined wires or "wire lengths" are disposed. The wires are all free at their lower ends, and are attached to cross bars at their upper ends. The washing liquid is fed on to the tops of the wires down which it flows. The passage of the gas and the liquid causes the wires to vibrate and to arrest the particles of tar in the gas.—W. H. C.

Separating liquids from gases or vapours by centrifugal action. C. de Murrieta and C. B. Tully, London. Eng. Pat. 10,562, Nov. 4, 1909.

THE claim is for the use of a trumpet-shaped passage between the fan-chamber and the baffle chamber and for surrounding the baffles with a "skirt-plate" to provide a collecting space for the gas which has passed through the baffles. The latter are made hollow and are cooled by circulating water through them or in any other suitable way.—W. H. C.

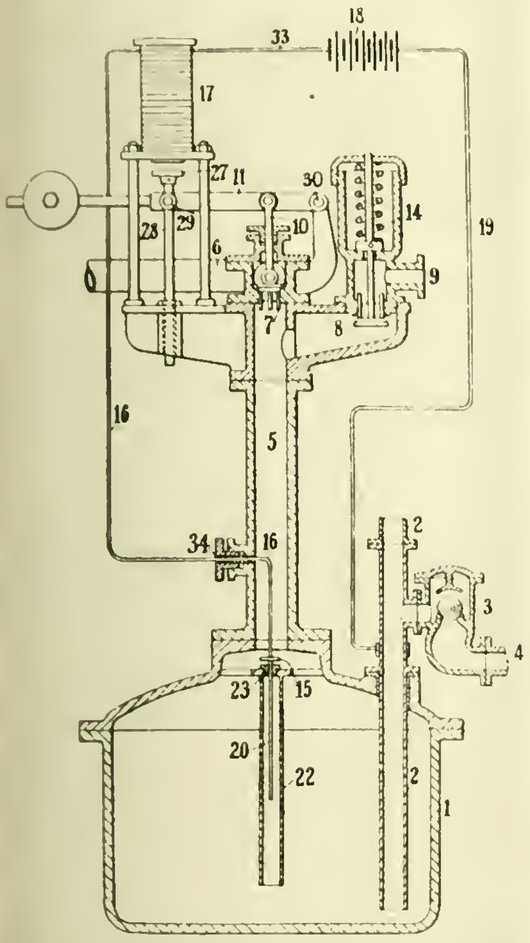
Purifying gases. A. Müller, Leipzig-Schleussig, and C. Bombhard, Berlin. Eng. Pat. 17,380, July 26, 1909.

THE gases (waste gases of all kinds) to be purified, are caused to pass through spiral flues in a tower. During their passage through these flues the centrifugal force developed, throws the dust particles to the walls, where it is moistened by water spray from suitably fixed nozzles (the water spray may contains dissolved chemicals to neutralise any acid gases present). The water serves to agglomerate the solid particles into larger masses. These pass through apertures in the walls into vacuum passages behind. From the top of the tower the gases pass downwards through a group of narrow tubes, also in communication with the vacuum chamber. The gases are dried during their passage through these tubes and pass on to the stack.—W. H. C.

Elevating liquids by means of gaseous fluid under pressure; Apparatus for ——. Giesserei u. Maschinenfabrik P. Schiltze und Co., Akt.-Ges., Oggersheim, Germany. Eng. Pat. 1040, Jan. 14, 1910. Under Int. Conv., July 20, 1909.

The apparatus is an improvement upon the automatic elevator described in Eng. Pat. 23,175 of 1908 (this J., 1909, 235), and is controlled electromagnetically. The pressure vessel, 1, is provided with a valve-controlled inlet, 4, a delivery pipe, 2, and a dipping pipe, 22, surrounding a contact wire, 20, which is insulated at the points, 23 and 34. The liquid, on entering the pressure vessel, rises to such a level and compresses the air retained in the pipe, 22, until contact with the wire, 20, takes place. An electrical circuit is thus completed, and the electromagnet, 17, excited, so that it opens the valve, 7, and admits compressed air from the pipe, 6. The automatic escape valve, 8, immediately closes, and the liquid contained in the pressure vessel, 1, is forced up the delivery pipe, 2. The compressed air maintains the electrical circuit, by supporting the liquid in the pipe, 22, until the level of the outer liquid falls below the mouth of the pipe, when the contained liquid falls, the circuit breaks, and the electromagnet, 17, releases the valve, 7, which is closed by the weight and lever shown. The pressure in the vessel thus falls, the automatic valve, 8, opens, and enables the operations to be repeated.

—J. W. H.



Agglomeration of finely divided materials. P. Claes. Fr. Pat. 411,128, Dec. 18, 1909.

The finely divided materials are mixed with a suitable proportion of lime and moulded into briquettes. The briquettes are taken directly from the press and placed at once in an autoclave, which is closed and a vacuum is produced in the same at a very rapid rate. This is necessary in order to render the briquettes porous, owing to the rapid escape of the air. Carbon dioxide under a suitable pressure is then admitted to the autoclave and the lime is rapidly carbonated. As some bicarbonate may be formed, the briquettes are placed in a heated chamber for a short time to decompose any bicarbonate into normal carbonate.

—W. H. C.

Liquid vaporising or concentrating apparatus. S. G. S. Dicker, London. From Maschinenbau A.-G. Golzern-Grimma, Grimma, Saxony. Eng. Pat. 23,861, Oct. 18, 1909.

See Fr. Pat. 408,888 of 1909; this J., 1910, 743.—T. F. B.

Gases; Process for cooling and liquefying ——. G. Hildebrandt, Berlin. U.S. Pat. 962,836, June 28, 1910.

See Fr. Pat. 384,139 of 1907; this J., 1908, 396.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Russian petroleum; Occurrence in ——, of hexahydrocymene and p-menthane. M. Tichwinsky. J. Russ. Phys.-Chem. Soc., 1909, **41**, 1136.

At least three different kinds of Russian petroleum have been found to contain (1) hexahydrocymene, C_9H_{18}, boiling at 148° C. and having the sp. gr. 0·7927 at 21° C.; (2) *p*-menthane, $C_{10}H_{20}$, boiling at 173° C. and having the sp. gr. 0·8117 at 21°. This occurrence of *p*-menthane is regarded by the author as indicating the vegetable origin of the petroleum.—T. H. P.

Natural gas and its production. H. A. Danne. Met. and Chem. Eng., 1910, **8**, 412—414.

The entire output of natural gas in the West Virginia oil-fields is estimated at 1,300,000,000 cu. ft. per day, of which about 300,000,000 cu. ft. are wasted. The thermal efficiency may attain as much as 1134 B.T.U. per cu. ft., but after compression of the gas it falls to about 900 B.T.U. owing to the deposition of liquefied hydrocarbons. In addition to the application to power purposes, the gas is also employed in zinc smelting, and in the manufacture of glass, bricks, pottery, electrodes, and lampblack. Judging from the facts that the presence of oil and gas is accompanied by the presence of coal and salt water, and that the pressure of the gas is almost invariably affected by seismic disturbances, the author puts forward the view that these hydrocarbons are generated from natural carbonaceous deposits, such as bituminous and other coal, by the natural heat of the earth's interior brought into proximity to such deposits by seismic disturbances, that they are still being generated under enormous pressure, which may be transmitted in some cases by the streams of water overlaying them, and that on the release of some of the pressure and changes in the temperature of the hydrocarbons so generated, some of their constituents are deposited in the dips of the strata and in the pockets known as oil-bearing pools.—H. H.

Foundry coke; Specifications for ——. Moldenke. *See* X.

Report of Inspector of alkali works. *See* VII.

Bomb calorimeter; Friction in the ——. Roesler. *See* XXIII.

Patents.

Petroleum and shale oil; Treatment of ——. H. W. Knottenbelt. Fr. Pat. 411,780, Jan. 21, 1910.

A process is claimed for treating the distillates from crude petroleum and shale oil. As an example, on distilling Boryslav petroleum three fractions may be obtained. The lightest fraction, 3 per cent. of the whole, is used without further treatment. The second fraction, 24 per cent. of the whole (sp. gr. 0·776—0·778 at 15° C.), is treated with an excess of nitrogen dioxide and allowed to stand from 12 to 18 hours. After washing with ferrous sulphate solution an odourless oil is obtained which may be used, it is stated, as a substitute for oil of turpentine. The third fraction, 73 per cent. of the whole (sp. gr. 0·825 at 15° C., flash pt. 65° C.), is treated with about 3 per cent. of sulphuric acid and after separation of the acid, to each 1000 parts of oil is added 1 part of ammonia (28° Be.), 1 part of "litmus in cubes," and 2 parts of water. The mixture is agitated for half an hour and allowed to stand for some hours. Finally, the slight yellow colour, which remains, is discharged by treatment with fuller's earth at 115°—150° C.—J. W. H.

Artificial fuel. G. J. Stephen, Liverpool. Eng. Pat. 29,559, Dec. 17, 1909.

Anthracite duff with or without the addition of bituminous coal, or breeze and bituminous coal, is made into briquettes or pellets with an aqueous solution of an alkaline silicate. The pellets are made of a small size, not larger than 1½ cubic inches, in order that they may be quickly and easily dried or hardened by being passed on an endless band through a heated chamber. The small size of the pellets allows the hardening to be completed in a period of about twenty minutes.—W. H. C.

Gas and coke; Retorts for the production of ——. J. Bowing, London. Eng. Pat. 12,583, May 27, 1909.

The retorts consist of narrow vertical fireclay chambers having thick walls. They are so grouped in the furnace that the narrow spaces between them serve as vertical heating flues in which the combustion of the gaseous fuel supplied from a tunnel below is completed. After the charge of coal has been introduced into the hot retorts, the heating is continued for a time until sufficient heat has accumulated in the thick walls to raise them to a temperature of from 700° to 800° C. The heating is then stopped and the carbonisation is completed by the heat stored up in the walls. When the carbonisation is complete the temperature will have fallen to about that at which the coal was charged, the coke is then withdrawn and a fresh charge introduced and the carbonisation proceeded with as before.—W. H. C.

Gas producers. M. Duchanoy, G. Bousquet and M. Davicion, Paris. Eng. Pat. 20,492, Sept. 7, 1909.

The claim is for a conical rotary grate provided with ribs and arms which serve, in conjunction with fixed arms or projections attached to the water-sealed ash-pit, to agitate and discharge the ashes from the generator. Air is supplied to the tuyère fixed to the apex of the conical grate through a vertical pipe, which passes centrally through the conical grate, and is provided with a water lute insulated by a non-conducting packing.—W. H. C.

Gas producer. Soc. anon., Houillères de Montrambert et de la Bérandière. Addition, dated April 5, 1909, to Fr. Pat. 402,949, Sept. 12, 1908.

The base of the producer dips into a conical trough filled with water and capable of continuous rotation. The inner surface of the trough forms a cone which is provided with a central capped tuyère and projecting ribs and arms to stir up the contents of the producer. A fuel distributor is claimed consisting of a "bell" trapped hopper containing a feeding paddle wheel rotated on a horizontal spindle by means of external mechanism in conjunction with a delivery shoot which turns on a vertical axis and discharges the fuel to the sides of the producer.—J. W. H.

Gas producer with agitator. Gutehoffnungshütte, Aktien-verein für Bergbau u. Hüttenbetrieb. Fr. Pat. 411,703, Jan. 19, 1910.

A horizontal section in the upper part of the producer is rotated by worm and wheel gearing. Water seals prevent the escape of gas and an agitator consisting of a cross of pipe work is fixed in the moving section and in communication with its upper water seal. Cooling water is supplied to the agitator and to the seals from the base of the producer by means of a hollow central vertical shaft.—J. W. H.

Gas suitable for filling balloons or air-ships. O. Nauss, Breslau, Germany. Eng. Pat. 2298, Jan. 29, 1910 Under Int. Conv., March 30, 1909.

Coal gas is passed through retorts containing incandescent masses of coke or other material at 1000—1200°C. It is then admitted into chambers containing nickel or cobalt as catalytic materials at 250°—300° C. The water vapour formed is separated by cooling, and the gas again passed over incandescent materials. The reactions upon which the process is based are :—

(1) $C_2H_4=C+CH_4=2C+2H_2$.
(2) $CO+3H_2=CH_4+H_2O$.
(3) $CH_4=2H_2+C$. —J. W. H.

Coal; Process for utilising unmined ——. A. G. Betts, Troy, U.S.A. Eng. Pat. 21,674, Sept. 22, 1909.

The process consists in gasifying the coal as it lies in the seam in a similar manner to that in which it is gasified in a gas producer. Shafts are sunk, boreholes made, a fire started and air and steam supplied. The gas is removed for use under a slight vacuum to prevent loss. A number of methods of working are described.—J. W. H.

Gas retorts; Improvements in ——. W. Ewing, Glasgow. Eng. Pat. 14,508, June 21, 1909.

At the lower end of a vertical retort, and separated from it by means of a movable perforated plate, a hermetically sealed chamber is provided in which the discharged coke is cooled by means of a steam jet. It is stated that the quality of the coke is improved and an increased amount of ammonia obtained together with the production of water gas.—J. W. H.

Water-gas; Retorts for use in the production of ——. J. Bowing, London. Eng. Pat. 11,491, May 27, 1909.

The retorts consist of narrow vertical chambers of fireclay or other refractory material set in a furnace with narrow spaces between each retort, forming flues, the walls of adjacent retorts serving as walls of the heating flues. The retorts are heated by gaseous fuel supplied to the heating flues from below. The retorts are charged with coal or other suitable fuel and when the fuel is incandescent, either steam or water is passed into the retorts from above. The gas generated is removed through a horizontal flue communicating with the lower ends of the retorts. This flue also serves for the removal of the ashes. The process can be rendered continuous by arranging for the fuel to be fed continuously through a hopper at the top of the retorts, and for the ashes to be removed from below. The necessary gas making temperature is maintained by the burning gas in the heating flues.—W. H. C.

Gas-retort furnace. E. L. Richa, Milwaukee, Wis. U.S. Pat. 962,051, June 21, 1910.

The regenerator chamber is constructed to have one narrow vertical chamber between two narrow chambers which enclose the centre one on each side. The outer chambers communicate with one another by passages across and through the chamber between. The combustion gases pass through the centre and the air through the outer chambers.—W. H. C.

Gas from peat; Vibratory gas-producer for generating ——. J. J. Astor, New York. Eng. Pat. 15,736, July 6, 1909. Under Int. Conv., May 10, 1909.

Part of the gas generated from the peat is utilised in gas engines which are located beneath the floor below the ash pit of the producer and which are mounted on springs in such a way that the vibrations of the gas engines are transmitted to the grate of the producer and so to the peat. In order to further assist in the evolution of the gas from the vesicles of the peat, the exhaust gases from the gas engines are passed through an ordinary gas-engine muffler placed in the ash-pit below the grate. The impulses of the explosions cause the corrugated muffler to alternately expand and contract in the space below the grate. In this way the exhaust gases alternately compress and rarefy the gas in the generator without coming into actual contact with it.—W. H. C.

Peat in a gas producer; Production of gas and ammonia from ——. A. H. Lymn, Bromley. Eng. Pat. 17,074, July 22, 1909.

A process is claimed for the production of gas and ammonia from moist peat. The blast of air and steam supplied to the producer, containing the moist peat, is superheated by burning moist peat or a portion of the gas produced in a suitable apparatus through which the blast passes.—J. W. H.

Gas scrubber (rotary). S. G. Merrick. Fr. Pat. 411,449, Jan. 10, 1910.

In a closed vessel containing water a hollow cylinder provided with an internal helix is rotated on a horizontal axis at the water level. A screen at right angles to the axis of the cylinder divides the vessel into two parts, one carrying the inlet pipe and the other the outlet pipe for the gas. The cylinder is made of conical form at the inlet side of the screen, and perforated plates are provided near the base of the vessel and at the level of the water.—J. W. H.

Briquettes of porous, hygroscopic fuels; Process of manufacturing ——. T. Franke, Berlin. Eng. Pat. 28,048, Dec. 1, 1909. Under Int. Conv., April 26, 1909.

See Fr. Pat. 409,589 of 1909; this J., 1910, 745.—T. F. B.

Hydrogen from water-gas; Method of producing ——. A. Frank, Charlottenburg, Germany. U.S. Pat. 964,415, July 12, 1910.

See Eng. Pat. 26,928 of 1906; this J., 1907, 318.—T. F. B.

Spent fire-gases from a furnace; Method of utilising —— for firing further furnaces. H. Uihlein, Nuremberg, Germany. U.S. Pat. 964,341, July 12, 1910.

See Fr. Pat. 410,282 of 1909; this J., 1910, 807.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Thorium sulphate. Barré. *See* VII.

Thorium sulphate; Decomposition of —— by water. Barré. *See* VII.

Thorium salts; Theory of manufacture of ——; The sulphate purification method. Koppel and Holtkamp. *See* VII.

Patents.

Wood distillation. H. Rasche, Assignor to F. H. Osgood, Seattle, Washington. U.S. Pat. 962,668, June 28, 1910.

Steam is first passed downwards through the wood contained in a retort and is discharged from the lower end of the latter carrying with it the turpentine. The upper part of the retort is heated externally whilst the supply of steam is maintained and the resin is distilled off. The resin after it leaves the retort is maintained in a heated and liquid condition for a time to allow any turpentine retained by it to separate.—W. H. C.

Decomposing hydrocarbons [for carbons]. R. Lessing, London. Eng. Pat. 15,071, June 28, 1909.

The hydrocarbons to be decomposed are passed, in a state of vapour, through a retort heated to a temperature of from 1000° to 1300° C. The retorts are either empty or are packed with carbon obtained from a previous operation. As no foreign contact substance is used the carbon obtained is very pure. If desired the hydrocarbons may be preheated and partially decomposed before they are allowed to enter the retort proper. In this way two different qualities of carbon are obtained. The hydrogen set free is withdrawn from the retorts and may be utilised for filling balloons or the like.—W. H. C.

Distillation-gases; Process for separating tar from hot ——, with subsequent recovery of the ammonia by passing through acid. C. Otto und Co. Ger. Pat. 223,469, Sept. 23, 1909.

Hot gases obtained by dry distillation of coal, lignite, peat, etc., are first washed with tar (*e.g.*, in the form of a spray) and then passed through acid. After leaving the acid, the gases are passed through the tar originally used for washing them, in order to separate the naphthalene from the gases and to remove the solid ammonium salts from the tar. The latter may be assisted by adding some gas liquor to the tar or by mixing the gases issuing from the acid bath with steam.—T. F. B.

Electric carbons; Manufacture of ——. R. Lessing, London. Eng. Pat. 15,647, July 5, 1909.

Coal-tar pitch or any other similar material containing free carbon is extracted with suitable solvents in such a manner that part of the original soluble or volatile constituents other than the solvent used is left behind. The resulting mass is heated to expel any solvent left and is then mixed in suitable proportions with carbon, and the mixture moulded into shape and heated or baked to consolidate the mass.—W. H. C.

Stoves, kilns, ovens, muffles, or other plant used for drying moulds and for other heating purposes; Improvements in ——. L. A. Smallwood, Birmingham. Eng. Pat. 14,814, June 24, 1909.

In drying-stoves and similar plant the flues are covered by refractory material provided with external grooves to form gutters, which are closed with metal plates from which the heat is radiated.—J. W. H.

Regenerating furnaces. A. C. Nelson and A. G. McKee. Fr. Pat. 411,474, Jan. 11, 1910.

The patent relates to a system of construction whereby bricks of ordinary commercial patterns (rectangular and conical or tapering) are used instead of the more expensive specially-moulded kinds usually employed. The regenerator described is of the vertical, cylindrical type, consisting of a central combustion chamber surrounded by a wall which forms the outer casing of the apparatus. Projections, near the base, from the interior of the outer casing and from the exterior of the combustion chamber, support a series of arches upon which a system of vertical heating flues is constructed, the annular space around the base of the combustion chamber communicating with the atmosphere by means of openings in the outer wall. Communication between the combustion chamber and the exterior of the apparatus is afforded by two radially-disposed channels passing through the annular space at the base. In the construction (details of which are shown in the twelve drawings accompanying the specification) the bricks are disposed alternately parallel and perpendicular to a vertical plane passing through the axis of the furnace.—W. E. F. P.

Furnaces; Improvements in heating and melting ——. W. N. Best, Brooklyn, New York, and J. H. Best and E. Best, Quincy, Illinois, U.S.A. Eng. Pat. 16,240, July 12, 1909.

A steam or compressed air-jet burner supplies an uniform sheet of liquid, gaseous or pulverised fuel to a combustion chamber which gradually widens to a heating chamber. Immediately underneath the burner a blast of air for combustion is delivered. The heating chamber is elliptical in vertical section to deflect the flame on to the materials to be treated. Suitable openings, doors and vents are also provided.—J. W. H.

Crucible furnaces. R. Eickworth, Witten-Ruhr, Germany. Eng. Pat. 5709, Mar. 7, 1910. Under Int. Conv., Mar. 16, 1909.

A gas-fired crucible furnace is provided with an internal constriction, in the form of an annular ring dividing the furnace into an upper and lower chamber. The lower portion of the crucible is directly heated by the gas, while the upper portion is more slowly heated by the gases passing up between the crucible and the ring.—F. R.

Incandescent electric lamp filaments; Process of making ——. W. G. Clark, New York, Assignor to Parker-Clark Electric Co., Jersey City, N.J. U.S. Pat. 963,745, July 12, 1910.

See Fr. Pat. 376,412 of 1907; this J., 1907, 1002.—T. F. B.

Filaments; Apparatus for the continuous manufacture of ——. G. Michaud and E. Delasson, Montreuil, France. U.S. Pat. 962,910, June 28, 1910.

See Fr. Pat. 378,665 of 1907; this J., 1907, 1131.—T. F. B.

Lamp-filament. W. D. Coolidge, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 963,872, July 12, 1910.

See Eng. Pat. 18,488 of 1906; this J., 1907, 1042.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Phenol; Gravimetric determination of ——. S. C. J. Olivier. Rec. Trav. Chim. Pays-Bas., 1910, **29**, 293—295.

Although the volumetric method is always to be preferred, it is sometimes necessary to employ the gravimetric method. The latter was recently modified by Mascarelli (Gaz. chim. ital., 1909, **39**, 180), who weighed the product as tribromphenol bromide. The phenol is treated with an alkaline solution of bromine, which is then acidified with dilute hydrochloric acid. After standing for 4 hours the precipitate is collected in a Gooch crucible, dried under vacuum over sulphuric acid in a dark place, and weighed. The author points out that an alkaline solution of bromine contains, besides bromide and bromate, a certain proportion of hypobromite. Sodium hypobromite at the ordinary temperature tends to decompose phenol with the production of bromoform. Comparative determinations of phenol by Mascarelli's method, using on the one hand the alkaline solution of bromine prescribed by the latter, and on the other hand a mixture of 5 mols. of sodium bromide with 1 mol. of sodium bromate, showed that Mascarelli's solution gave somewhat low results, especially when in large excess. It is preferable, therefore, to use the mixture of bromide and bromate, of the same concentration of bromine as Mascarelli's solution.—J. F. B.

Report of Inspector of alkali works. See VII.

Patents.

Removing tar from coke-oven gas, retort gas and the like. R. Fabry, Sheffield. Eng. Pat. 29,930, Dec. 22, 1909.

The tar-laden gas is caused to pass down a number of narrow vertical pipes, each of which is provided with a cast iron cap, having a number of tangential inlets arranged around the periphery of the cap, and which constitute the only means whereby the gas can enter the pipes. These tangential inlets impart a rotary motion to the gas, which owing to the narrowness of the pipes passes down them with a high velocity and a whirling motion, and the centrifugal force set up drives the particles of tar against the sides of the pipes to which they adhere and coalesce into drops which subsequently flow down the pipes to an outlet below.—W. H. C.

Removing tar from coal gases. E. Solvay, Brussels, Belgium. U.S. Pat. 963,401, July 5, 1910.

The gas is passed upwards through a gas washing scrubber built up of superposed sections having an inlet for the washing liquid or tar, and an outlet for the gas at the top and an outlet for the washing liquid and an inlet for the gas at the bottom. Temperature controlling devices are arranged so that the temperature of the washing liquid entering the apparatus and the heat of the gas both entering and leaving can be maintained at any desired point. —W. H. C.

Tar product suitable for treating roads; Process for obtaining a ——. E. Wirth. Ger. Pat. 223,588, Jan. 14, 1909.

Coal-tar pitch, preferably the so-called hard pitch, is melted with from 6 to 30 per cent. of the solid constituents of the higher-boiling coal-tar oils, for example the residues left in the purification of the crude anthracene.—A. S.

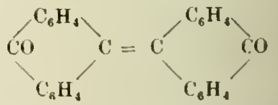
Anthraquinone; Process for preparing a reduction product of ——. Kinzlberger und Co. Ger. Pat. 223,209, Nov. 21, 1908.

When anthraquinone is treated with alkaline reducing agents (yellow ammonium sulphide excepted) at temperatures over 100° C., it is converted for the greater part into dianthranol, $C_{28}H_{18}O_2$, which has previously been obtained, in small amounts, by the action of alcoholic potash on dianthrone, which is obtained from anthranol (Dimroth, Ber., 1901, 223).—T. F. B.

Anthraquinone derivative; Process for preparing an ——. Kinzlberger und Co. Ger. Pat. 223,210, Nov. 21, 1908.

When dianthranol (see Ger. Pat. 223,209; preceding) is treated with moderately powerful oxidising agents, such as ferric chloride in acetic acid solution, alkaline permanganate, etc., it is converted into a new product containing two less hydrogen atoms.

$C_{28}H_{16}O_2$, or



This substance is obtained in the form of lemon-yellow crystals, which darken at 300° C., and melt at higher temperatures. Its solutions in hot organic solvents are of an intense green colour. On oxidation with chromic acid it is converted into anthraquinone.—T. F. B.

Indole from coal-tar oils; Process for separating ——. Ges. f. Teerverwerthung. Ger. Pat. 223,304, July 10, 1909.

Coal tar distillates containing indole, particularly those whose boiling-points lie between 220° and 260° C., are first freed from the phenolic constituents and the stronger bases (aniline, pyridine, quinoline, etc.) by known methods. The indole is then converted into one of its alkali-compounds by treatment with alkali hydroxide, or sodium, or with sodium amide or sodium in presence of ammonia, and the indole-alkali compound is separated mechanically from the hydrocarbons, and decomposed by means of water, the crude indole being purified by the usual methods. —T. F. B.

4-Nitroso-1-hydroxynaphthoyl-o-benzoic acid; Process for preparing ——. Anilinfarben- u. Extract-Fabr. vorm. J. R. Geigy. Ger. Pat. 223,306, Aug. 7, 1909.

When 1-hydroxynaphthoyl-o-benzoic acid is treated with a solution of an alkali nitrite at a temperature of about 45° C., a nitroso group is introduced into the 4-position to the hydroxyl group in the naphthalene nucleus; the nitroso-compound is obtained in the form of an alkali salt, which is decomposed by acids giving the free nitroso derivative. This is a yellow crystalline substance, of m. pt. 195° C. It is readily converted into the corresponding amino-compound by reduction.—T. F. B.

Diphenylene dioxide ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 223,367, May 26, 1909.

Diphenylene dioxide, of m. pt. 118°—119° C., is obtained by heating the alkali salts of *o*-chlorophenol either alone or in solution. Dry *o*-chlorophenol-potassium, obtained by evaporating a solution of 256 parts of *o*-chlorophenol in 232 parts of caustic potash solution containing 49·8 per cent. of hydroxide, is heated in an iron retort to 220° C. ; when the pressure is reduced to 20—30 mm. the diphenylene dioxide distils over and condenses, partly as a crystalline mass and partly in long needles. It may be purified by washing with hot, 5 per cent. caustic soda solution and water. The yield amounts to about 74 per cent. of theory.—T. F. B.

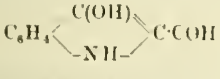
Meta-aminobenzaldehyde ; Producing salts of —— besides the anhydro-compound of ortho-aminobenzaldehyde. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22,398, Oct. 1, 1909.

See Fr. Pat. 408,184 of 1909 ; this J., 1910, 552.—T. F. B.

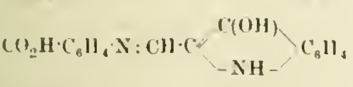
IV.—COLOURING MATTERS AND DYES

Indigo-blue and Indigo-red ; Decomposition by alkalis of ——. P. Friedländer and E. Schwenk. Ber., 1910, **43**, 1971—1975.

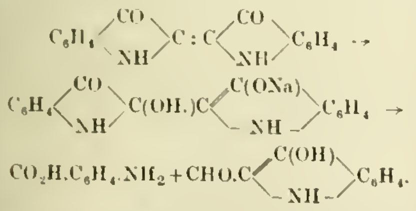
The authors have repeated Fritzsche's fusion of indigo with potassium hydroxide and find that Fritzsche's "chrysanilic acid" which can be obtained by acidifying the products of the fusion is completely separated by this reaction only after a few seconds' time although it is practically insoluble in water. When however the solution of the products is stirred vigorously into dilute hydrochloric acid, covered with a layer of ether, anthranilic acid is found in the acid liquid and indoxyl-2-aldehyde—



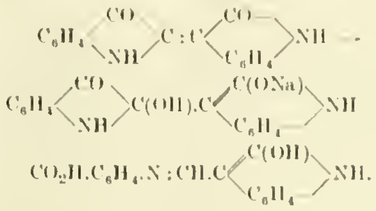
is isolated from the ether layer. Chrysanilic acid is therefore, as was proved by its synthesis, a condensation product of these two substances, and has the formula—



the decomposition of the indigo by the action of alkalis is therefore represented as follows :—



On applying the same reaction to Indigo-red a compound was obtained which when heated to 150° C. with mineral acids yielded aniline and oxindole. Now Thioindigo Scarlet R when similarly treated yields thiosalicylic acid and oxindole-3-aldehyde and it was found that the latter, when condensed with anthranilic acid, gave a substance identical with the above one obtained from Indigo-red. The decomposition of the latter is therefore represented thus :—



—J. C. C.

Colouring matters ; Adsorption of certain ——. L. Vignon. Comptes rend., 1910, **151**, 72—75.

The author has investigated the adsorption at the ordinary temperature of dyestuffs of known chemical constitution by asbestos fibres (in filaments of 6—7 mm.) and Rhone river sand. Glass tubes of 1 cm. internal diameter, 35 cm. long and tapering at the lower end were used, the lower end being plugged with a small paper cone. The tubes were filled to a height of 20 cm. with asbestos (2 grms.) or sand (25 grms.), and the dyestuff solutions (1 grm. per litre) were run in from burettes. After about 2 min. the liquids began to flow from the tubes, the appearance of each was noted, and the addition of dyestuff solution to the tubes continued until the liquid flowing away, was sufficiently coloured to admit of colorimetric comparison with the original solution. The results obtained, varied with the duration and temperature of contact, age of the solutions, presence of traces of acid or basic matter, irregular settling of the adsorbing material, etc. The dyestuffs are divided into three groups. (A). Diffusible and not adsorbable colours : picric acid, Naphthol Yellow, Naphthol Yellow S, Magenta S, Indigo Carmine. (B). Diffusible and adsorbable colours : Orange II., Malachite Green, Magenta, Crystal Violet, Methyl Violet, Rhodamine, Eosine, Methylene Blue, Safranine G. (C). Adsorbable and not diffusible dyestuffs : Congo Red, Diamine Black BH, Diamine Blue 3R, St. Denis Red, Diamine Green, Diphenylamine Blue, Alkali Blue 3B and 6B. No constant relation between the diffusing and adsorbing power was found. Only the dyestuffs of group A are really dissolved. The colours of group B, after adsorption, were in colloidal solution. The adsorbing power of inert substances with aqueous solutions of the above dyes is merely a particular phase of molecular attraction. (Compare this J., 1906, 140 ; 1909, 651 ; 1910, 345.) —A. Sbld.

Patents.

Triphenylnaphthylmethane series. Chrome dyestuffs of the ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 411,306, Jan. 5, 1910. Under Int. Conv., July 26, 1909.

The dyestuffs are prepared by condensing formaurinecarboxylic acids with primary, secondary or tertiary aromatic amines or their derivatives and oxidising the resulting leuco-compounds. On chroming wool dyed with these dyestuffs, fast red to violet shades are produced. *Example :* A mixture of 8·2 kilos. of dimethylformaurinedicarboxylic acid (prepared by oxidising methylenedi-*o*-cresotic acid), 100 kilos. of acetic anhydride and 4 kilos. of diethylaniline is heated at 100° C. until a sample is no longer coloured red on adding sodium hydroxide. The mixture is then poured into water and the leuco-compound filtered off. For the oxidation it is dissolved in concentrated sulphuric acid and treated with sodium nitrite. —J. C. C.

Triphenylmethane series. Chrome dyestuffs of the ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 411,709, Jan. 19, 1910. Under Int. Conv., May 10, 1909.

New dyestuffs, which are aurinedicarboxylic acids, are prepared by condensing methylene-disalicylic or -di-*o*-cresotic acid in the presence of oxidising agents with phenols having the para-position free and containing one or two indifferent groups in the ortho-position, or by condensing these compounds in the presence of oxidising agents first to leuco-compounds and oxidising the latter, or by condensing the carbinols with the phenols mentioned and oxidising the products. Wool dyed with these colours, when afterwards chromed, appears in fast red to blue or violet shades. *Example:* A mixture of 21·1 kilos. of methylenedi-*o*-cresotic acid and 13 kilos. of 2:6-dichlorophenol is stirred at 20—45° C. into 320 kilos. of concentrated sulphuric acid and the necessary quantity of nitrosylsulphuric acid until the foam has subsided and the evolution of oxides of nitrogen has ceased and the amount of colour formed does not increase. The mass is then thrown on ice and the dyestuff filtered off.—J. C. C.

Residues containing chromium from tar- and vegetable-dyestuff industries; Process for working-up ——. J. Hertkorn. Ger. Pat. 222,639. Dec. 25. 1908.

Dyestuff residues, containing chromic oxide or a chromium salt and a dyestuff or other by-product, are treated with a strong mineral or organic acid, and the free dyestuff is then "salted out" by addition of a suitable salt (*e.g.*, potassium sulphate), the chromium being at the same time recovered in the form of chrome alum. In a modification, the residue is treated with an organic solvent and the dyestuff recovered from the extract, whilst the chromium is recovered from the residue as described above. —T. F. B.

Dyestuffs of the indigo series and the production thereof. M. Wyler, Chorlton-on-Medlock, and Levinstein, Ltd., Manchester. Eng. Pat. 15,142, June 29, 1909.

Blue vat dyestuffs containing arsenic and bromine, which dye redder and brighter shades than the known bromo-indigos, are obtained by brominating indigo suspended in an inert solvent (*e.g.*, nitrobenzene) in presence of arsenic or of arsenious acid or their anhydrides, at temperatures between 120° and 200° C. Thus, 15 parts of indigo are mixed with 4·2 parts of arsenic, are suspended in 30 parts of nitrobenzene; 30 parts of bromine dissolved in 30 parts of nitrobenzene are added, and the mixture is agitated for six hours and then gradually heated to 120° C., and kept for 3 hours at 120°—130° C. The temperature is then raised to and maintained at 200° C. until evolution of hydrogen bromide has ceased.—T. F. B.

Indigo and similar colouring matters; Reduction of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 23,873, Oct. 18, 1909.

In the process of reducing indigo by means of iron powder in alkali hydroxide solution (this J., 1905, 1061; 1906, 424), the reduction proceeds more smoothly if the iron is first treated with dilute sulphuric acid until a considerable evolution of hydrogen commences. It is then washed several times with water.—J. C. C.

Mordant azo dyestuffs; Manufacture of ——. A. G. Bloxam, London. From Chemische Fabrik Griesheim-Elektron, Frankfurt a/Main, Germany. Eng. Pat. 8722, April 11, 1910.

Mordant azo dyestuffs are prepared by combining diazotised *o*-aminophenolsulphonic acids or their homologues or substitution products with nitro-*m*-phenylenediamine or nitro-*m*-tolylenediamine. The dyestuffs produced from diazotised o-aminophenol-4-sulphonic acid and nitro-*m*-phenylenediamine dyes wool in shades which, on chroming become reddish brown, and the dyestuff obtained from diazotised *oo*-nitroaminophenol-4-sulphonic acid and the same component produces similar shades. A table is given showing the shades produced from similarly prepared dyestuffs.—J. C. C.

Azo dyestuffs and their intermediate products; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 411,192, Dec. 31, 1909. Under Int. Conv., Jan. 18, 1909.

Dyestuffs similar to Tartrazine but faster to light and greener in shade are obtained by condensing with dihydroxytartaric acid, either phenylhydrazine-*a*-sulphonic acid, or a mixture of this with the *p*-sulphonic acid. —J. C. C.

Azo dyestuffs dyeing cotton direct; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 411,325, Jan. 6, 1910. Under Int. Conv., Mar. 22, 1909.

New brown trisazo-dyestuffs are obtained by combining a diazotised monoacetyl-*m*-diamine with an aminonaphtholsulphonic acid, removing the acetyl group, tetrazotising the product and combining with two molecules of the same or of two different *m*-diamines or their derivatives. The dyestuffs produce brown shades on cotton and can be combined either in substance or on the fibre with diazo-compounds. The shades thus produced are brown to olive, and are fast to washing. An example is given illustrating the combination of acetyl-*m*-phenylenediamine with 2-amino-8-naphthol-6-sulphonic acid, elimination of the acetyl group and combination of the tetrazotised product with *m*-phenylenediamine.—J. C. C.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 13,727, June 11, 1909. Addition to Eng. Pat. 5383, March 5, 1909 (see Fr. Pat. 402,030 of 1909; this J., 1909, 1190).

Sulphonic or carboxylic acids of aminodisazo compounds of the benzene or naphthalene series, which contain only one free amino-group and no free hydroxyl group, are converted into the corresponding symmetrical diarylurea or diarylthiourea compounds by treatment with phosgene or thiophosgene or their equivalents, such as perchloromethyl formate or hexachlorodimethyl carbonate. The new dyestuffs dye unmordanted cotton orange to red and brown shades fast to light.—T. F. B.

Azo dyestuffs; Manufacture and production of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 15,847, July 7, 1909. (See also Fr. Pat. 321,521 of 1902, this J. 1903, 209.)

The dyestuffs are prepared by combining the diazo-compounds of aminoarylsulphonamides or their derivatives with *a*-methylindole (methylketole, Pr_2-methylindole) or its substitution products, and sulphonic acids, and sulphonating the dyestuffs thus produced which do not contain sulphonic acid groups. Example: 24·8 parts of *m*-aminobenzenesulphonanilide (m. pt. 129—130° C.) are diazotised and the diazo-compound is added to a solution of the sulphonic acid obtained by sulphonating 13·1 parts of Pr_2-methylindole, containing an excess of sodium carbonate. It dyes wool from an acid bath in fast yellow shades.—J. C. C.

Azo dyestuffs; Manufacture and production of new ——. P. A. Newton, London, from Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,204, Oct. 11, 1909. Patent of Addition to Eng. Pat., 1397, Jan. 20, 1909.

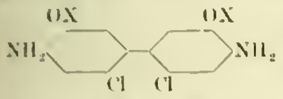
Dyestuffs of similar properties to those described in the chief patent (this J., 1909, 1309) are obtained by combining the diazo-compounds of aryl ethers of 5-nitro-2-aminophenol or their sulphonic acids with *β*-naphthylamine or its substitution products and, if necessary, eventually sulphonating the resulting dyestuffs. Red to blue dyestuffs are thus obtained which are fast to milling and light. An example is given illustrating the combination of diazotised 5-nitro-2-aminodiphenylether-4′-sulphonic acid with 2-amino-8-naphthol-6-sulphonic acid in acid solution. The dyestuff dyes wool in violet shades which are fast to milling and light.—J. C. C.

Monoazo dyestuff insoluble in water; Process for preparing a yellow ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 222,062, Jan. 16, 1909.

The diazo compound of symmetrical nitro-aminophenol methyl ether ($CH_3O : NO_2 : NH_2 = 1 : 3 : 5$), obtained by reducing the corresponding dinitro-anisol, is combined with *β*-naphthol, either alone or in presence of a suitable lake-base, and with or without the addition of Turkey-red oil, oleic acid, soap, etc. The dyestuffs obtained thus give yellow dyeings, fast to washing, light, and oxidising agents, and suitable for use in connection with indigo or similar oxidisable dyestuffs as discharge colours.—T. F. B.

Disazo-dyestuffs; Manufacture of ——. A. G. Bloxam, London. From Chemische Fabrik Griesheim-Elektron, Frankfurt a/Main, Germany. Eng. Pat. 9173, April 15, 1910.

Claim is made for the disazo-dyestuffs obtained from tetrazotised dichlorodiaminodiphenyl alkyl ethers of the general formula



(X = alkyl group)

and a naphthol or a naphtholsulphonic acid. The dyestuff obtained from tetrazotised dichlorodianisidine and β-naphthol produces bluish red colour lakes; that from the same tetrazo-compound and β-naphthol-3 : 6-disulphonic acid gives reddish violet pigment colours and that from the same tetrazo-compound and α-naphthol-3 : 8-disulphonic acid yields violet coloured lakes.—J. C. C.

Dyestuffs obtained by the treatment of heather. X. F. Debedat. First Addition dated Dec. 24, 1909, to Fr. Pat. 401,559, Nov. 25, 1909.

Before treating the plants as described in the chief patent (this J., 1910, 809), they are boiled with pure water in order to extract the erici-tannin which these ericaceæ contain.
—J. C. C.

Vat dyestuffs of the anthracene series and their intermediate products; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 411,576, Jan. 14, 1910. Under Int. Conv., Feb. 13, 1909.

Vat dyestuffs are obtained by treating di- or tri-anthrimides (except the products obtained from 1.4-diaminoanthraquinone and the 1-halogenated anthraquinones) with alkalis. Example: 5 parts of αα-anthrimide (obtained by condensing 1-aminoanthraquinone with α-chloroanthraquinone) are added to 50 parts of potassium hydroxide at 170—180° C. and the temperature is raised slowly to 220°—230° C. After keeping at this point for a short time the melt is cooled to 150° C., poured into 200—300 parts of water and a current of air blown through the solution. The precipitated dyestuff is filtered off and washed. It gives with alkaline hydrosulphite a yellowish brown vat from which cotton is dyed in yellowish brown shades turning to reddish yellow on exposure to the air, soaping or treatment with chlorine.—J. C. C.

Dyestuffs of the anthracene series and of new intermediate products used for their manufacture; Production of ——. Soc. Chem. Ind. in Basle. Fr. Pat. 411,750, April 17, 1909.

New gray vat dyestuffs are prepared by treating aminonaphthanthraquinone with condensing agents such as antimony pentachloride and submitting the product to the action of halogens. Example: A mixture of 150 parts of phthalic anhydride and 1000 parts of α-chloronaphthalene is treated gradually at 20°—30° C. with 300 parts of aluminium chloride and the whole stirred until the reaction is ended. The new chloronaphthoylbenzoic acid (m. pt. 138°—140° C.) obtained from the product (1 part) is converted into chloronaphthanthraquinone (m. pt. 158°—160° C.) by treatment at 90°—100°C. with 8 parts of concentrated sulphuric acid. When this chloro-derivative is heated with 10 parts of 20 per cent. ammonia and 10 parts of alcohol for several hours at 170°—190° C., it is converted into the corresponding amino-compound which when boiled with 2—3 parts of antimony pentachloride and 10 parts of nitrobenzene for 3—4 hours yields a dyestuff giving a blue vat from which cotton is dyed in bluish gray shades. On bromination a new dyestuff is obtained which yields a blue vat dyeing cotton in bluish gray shades fast to washing, light and chlorine.
—J. C. C.

Dyestuffs of the anthraquinone series; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Oct. 30, 1909, to Fr. Pat. 410,842 of Oct. 27, 1909.

The dyestuffs described in the chief patent (this J., 1910, 750) may be converted into vats for the purpose of dyeing cotton by treatment with alkaline hydrosulphite. They may also be used for printing. The shades produced are yellow to brown.—J. C. C.

Dibromoisatin; Manufacture of ——. C. W. Johnson, London. From Kalle und Co., Biebrich-on-the-Rhine, Germany. Eng. Pat. 8239, April 5, 1910.

Dibromoisatin is prepared by the action of bromine, or a substance yielding bromine, on isatin in the presence of sulphuric acid, with or without the use of a carrier for the bromine. Example: A mixture of 14·7 kilos. of isatin and 150 kilos. of sulphuric acid is stirred for 24 hours with 32 kilos. of bromine and then heated slowly to 40° C., maintained at this point for some time and afterwards heated to 80° C. After cooling the mass is poured on ice, filtered, washed and dried. The orange yellow dibromoisatin obtained melts at 248°—250° C.—J. C. C.

Basic dyestuffs; Process for preparing red or violet ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 222,130, Aug. 13, 1908. Addition to Ger. Pat. 218,904, Jan. 11, 1908 (see Fr. Pat. 395,793 of 1908; this J., 1909, 469).

The red compounds obtained by heating pyridine with 1-chloro-2.4-dinitronaphthalene in aqueous alcoholic solution, or its salts, when treated with dihydro-indole or phenylmorpholine or their carbon-substituted derivatives are converted into dyestuffs identical with those obtained by the process described in the principal patent.
—T. F. B.

Indigo leuco bodies; Manufacture of ——. O. Liebknecht, Assignor to Deutsche Gold- und Silber-Scheide-Anstalt vorm. Rössler, Frankfort, Germany. U.S. Pat. 963,377, July 5, 1910.

See Fr. Pat. 356,569 of 1905; this J., 1906, 14.—T. F. B.

[*Thioindigo*] *dye; Red halogenized* —— *and process of making.* A. Schmidt and E. Bryk, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 963,813, July 12, 1910.

See Eng. Pat. 16,017 of 1908; this J., 1908, 1105.—T. F. B.

Azo dye; Red ——. J. Jansen and W. Neelmeier, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 961,355, June 14, 1910.

See Fr. Pat. 410,116 of 1909; this J., 1910, 809.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Jan. 4, 1910, to Fr. Pat. 402,030, April 14, 1909. Under Int. Conv., May 21, 1909.

See Eng. Pat. 13,727 of 1909; preceding.—T. F. B.

Dyestuffs of the anthracene series; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 15,846, July 7, 1909.

See Fr. Pat. 411,576 of 1910; preceding.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Nitrocellulose artificial silk; Sulphuric acid contained in ——. P. Heermann. Mitt. kgl. Materialprüfungsamt., 1910, 28, 227—228.

Milky or chalk-like spots were found to develop in a consignment of nitrocellulose artificial silk. The spots

gradually increased until the whole skein was attacked, the fibre becoming brittle and worthless. The aqueous extract of the damaged parts was strongly acid, and gave a precipitate of barium sulphate equivalent to 1·03 per cent. of sulphuric anhydride. The undamaged parts (also a sample of the same silk not denitrated) gave an aqueous extract which was neutral and did not give a precipitate of barium sulphate, but sulphuric acid was found after heating the silk with caustic soda. The undamaged portion heated in an air-bath to 120°—130° C., quickly became acid and on longer heating at 125°—130 C., partly carbonised. Well-made nitrocellulose artificial silk showed no trace of carbonising when heated to 135°—140° C., and the aqueous extract showed no trace of sulphuric acid; only a trace of the acid was detected after heating with caustic soda. The trouble is therefore ascribed to the presence in the raw nitrocellulose of sulphuric acid, probably existing as a cellulose sulphuric ester, which was not removed on denitrating and which decomposed gradually on keeping the silk, liberating sulphuric acid.
—A. SHLD.

Function of methane in organic life. [Fermentation of cellulose and of calcium salts of fatty acids.] Söhngen. *See* XXIV.

PATENTS.

Vegetable fibres; Process of treating brittle ——. E. G. Stark, Chemnitz, Germany. U.S. Pat. 962,173, June 21, 1910.

BRITTLE vegetable fibres, such as kapok, akone, *Calotropis procera*, etc., are prepared for dyeing and spinning by treatment with organic solvents, then washing and drying at a moderate temperature. The treatment results in the extraction of incrusting substances and is carried out by means of a weak alkaline solution of Turkey red oil or soapy liquors or suds or tannins at a suitable temperature. The treated fibres are spun by specially constructed machines.—J. F. B.

Drying sized warps; Machine for ——. G. Masurel, Roubaix. Eng. Pat. 20,391, Sept. 6, 1909. Under Int. Conv., Nov. 20, 1908.

A COIL of steam pipes is arranged round the periphery of a fixed drum, and encircling these, but not in contact with them, is a slightly larger drum freely rotatable upon its axis and carrying small transverse projections upon which the warp is supported. The whole machine is surrounded by a hollow casing through which the hot gases pass as they leave the machine. The sized warps, upon entering at the bottom of the casing, pass above a row of horizontal steam pipes, and are guided on to the revolvable drum by hollow rollers, inside which fans are placed to cause as thorough a preliminary drying as possible. The air inside the machine is circulated by suitably arranged fans, and the dried warps are drawn off the revolving drum over guide rollers.—F. M.

Cotton yarns or other similar articles and products prepared therefrom; Process for treating ——. M. Murai. Fr. Pat. 411,702, Jan. 19, 1910. Under Int. Conv., Feb. 20, 1909.

THE yarn is treated with a solution of "Konnyaku" (a substance similar to starch), in water or a mixture of water and alcohol, glycerin being added to the solution. The material is then carefully rubbed until all projecting fibres on the surface of the yarn have disappeared. The stretched yarn is then immersed for 20—30 minutes in a strong solution of sodium hydroxide and is afterwards washed, neutralised with weak acid and washed again. The material thus treated has a high lustre.—P. F. C.

Paper coating and sizing composition and process. H. V. Dunham, Bainbridge, N.Y., Assignor to Casein Co. of America, N.J. U.S. Pat. 962,498, June 28, 1910.

THE composition claimed is made by mixing about 25 parts of gluten, modified by acidulating and afterwards neutralising it, in a dried and finely divided state, with about 75 parts of a dried adhesive, also in a state of fine division.
—F. SODN.

Paper [Safety]; Manufacture of ——. J. Gernaert, Brussels. Eng. Pat. 19,963, Aug. 31, 1909.

A SAFETY paper which cannot be counterfeited is made by arranging inner patterns between two still half-moist layers of paper pulp, the patterns being composed of thin coloured or uncoloured materials in the form of bands which can be cut, stamped or perforated in an ever-recurring pattern and printed, if desired, on one or both sides. The inner material may consist of metal foil, gelatin or collodion films or paper bands. The three last may be used in some cases as vehicular materials for the metal foil. The bands of inner material are fed upon the web of paper pulp and a second layer of pulp is then poured on, the inner bands being fixed by the felting of the fibres when the whole is subjected to pressure.
—J. F. B.

Paper and cardboard; Manufacture [sizing] of ——. J. Geller, Cologne, Germany. Eng. Pat. 25,771, Nov. 8, 1909.

UNSIZED or partially sized paper is treated in the form of sheets or webs with a solution of a waterproofing substance and is then pressed between hot rollers or otherwise heated and finished. Suitable solutions are prepared from paraffin, ceresin, ozokerite or other hydrocarbon, fat, oil or wax dissolved in a volatile solvent, *e.g.* benzene, the solvent being recovered during the process of heating the paper. The treatment is not intended to produce a water-repellent paper, but merely as a substitute for the ordinary sizing process.—J. F. B.

Carbonised fabric; Method of making ——. F. L. Horton, Lynn, Mass. U.S. Pat. 963,291, July 5, 1910.

A CARBONISED asbestos fabric is prepared by saturating woven asbestos fabric with a carbohydrate or other carbon compound and subsequently subjecting the impregnated fabric to a carbonising heat with exclusion of air. If a waterproof fabric be required, the fabric, after impregnation, is immersed in a waterproofing bath before carbonisation.—J. F. B.

Doom (or Doum) palm; Removing grease from, bleaching and polishing buttons, etc., made from nuts of the ——. E. Rossini, Piacenza, Italy. Eng. Pat. 1233, Jan. 17, 1910.

THE nuts of the doom palm, as substitutes for the ivory nut, suffer from the disadvantage of their rose colour and their transparency and greasiness. According to this invention, the grease is removed by steeping the buttons or other articles in a solution of 1—2 per cent. of Marseilles soap at a temperature of 50°—60° C. for 8—12 hours. The bleaching may be effected either by a slow or a rapid process. According to the former, the buttons are washed from the soap bath and treated for several hours in a cold solution of sodium aluminate at 0·25°—1·0° B. According to the rapid process the buttons are treated with a hot solution of aluminate for 3—4 hours and the bleaching is completed by means of permanganate followed by sodium bisulphite. In the polishing process the use of an alcoholic solution of colophony or lacquer is claimed.
—J. F. B.

Celluloid composition. J. W. Aylsworth, East Orange, N.J. U. S. Pat. 962,877, June 28, 1910.

THE composition comprises pyroxylin or other cellulose ester (*e.g.*, of the acetic series) combined with chlorinated stearic acid or other halogen-substituted fatty acid or its derivative.—F. SODN.

Uninflammable substitute for celluloid; Process for preparing an ——. L. L. T. Labbé. Fr. Pat. 410,973, Mar. 26, 1909.

100 GRMS. of pure cotton are treated for 10 minutes with a mixture of 950 c.c. of nitric acid (sp. gr. 1·457), 2,500 c.c. of sulphuric acid (sp. gr. 1·845) and 750 c.c. of water, the temperature of the mixture being kept below 60° C. The cotton is then thoroughly washed, dried in air and mixed with enough glacial acetic acid to form a thick

paste. A second paste is prepared by treating gelatin at 40° C. with a 10 per cent. solution of magnesium acetate, expressing the excess of water and then adding glacial acetic acid to the remaining mass until the mixture has the same consistency as the first paste. Equal volumes of the two preparations are mixed at 40° C. and a supersaturated alcoholic solution of tin protochloride is added till the mixture has the consistency of a thick syrup. After settling the clear supernatant liquor is decanted off and can be used for the preparation of either films or moulded articles by allowing the solvent to evaporate.
—P. F. C.

Radiferous fibres and method of producing the same. H. Farjas and A. Jaboin, Paris. Eng. Pat. 14,959, June 26, 1909. Under Int. Conv., Feb. 16, 1909. Addition to Eng. Pat. 14,760 of 1909, dated Dec. 14, 1908.

See Addition of Feb. 16, 1909, to Fr. Pat. 406,299 of 1908; this J., 1910, 750.—T. F. B.

Yarns and textile fabrics: Method of drying and finishing wet, dyed ——. W. Aderholdt, Cologne, Germany. Eng. Pat. 19,349, Aug. 23, 1909.

See Fr. Pat. 406,447 of 1909; this J., 1910, 420. Reference has been directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 526 of 1898, 3213 of 1899, and 12,455 of 1908.—T. F. B.

Fabrics, fibrous materials, and the like: Machines or apparatus for dewing or similarly treating ——. W. Briggs, Elland. Eng. Pat. 24,531, Oct. 26, 1909.

See Fr. Pat. 409,122 of 1909; this J., 1910, 753.—T. F. B.

Solutions [of cellulose] for spinning and other purposes; Process of producing durable ——. R. Linkmeyer, Bremen, Germany. U.S. Pat. 962,770, June 28, 1910.

See Eng. Pat. 14,112 of 1909; this J., 1910, 622.—T. F. B.

Cellulose structures: Method of manufacturing ——. R. Linkmeyer, Brussels. U.S. Pat. 962,769, June 28, 1910.

See Ger. Pat. 206,883 of 1907; this J., 1909, 362.—T. F. B.

Artificial threads; Process for the production of ——. P. Friedrich, Halensee, Germany. Eng. Pat. 28,256, Dec. 3, 1909. Under Int. Conv., Dec. 3, 1908.

See Fr. Pat. 409,789 of 1909; this J., 1910, 750.—T. F. B.

Artificial silk; Process for the manufacture of —— and apparatus therefor. B. Loewe, Paris. Eng. Pat. 18,087, Aug. 5, 1909. Under Int. Conv., Sept. 18, 1908.

See Fr. Pat. 403,242 of 1908; this J., 1909, 1310.—T. F. B.

Plastic articles of hygroscopic materials [peat, etc.]; Process of manufacturing ——. T. Franke, Berlin. Eng. Pat. 28,047, Dec. 1, 1909.

See Fr. Pat. 409,590 of 1909; this J., 1910, 752.—T. F. B.

Paper: Manufacture of ——. J. Gernaert, Brussels. U.S. Pat. 964,014, July 12, 1910.

See Eng. Pat. 19,963 of 1909; preceding.—T. F. B.

Celluloid substitute and process for manufacturing the same. H. Heydenhauss, A. Binhegyi, and K. Glaser, Vienna. Eng. Pat. 18,694, Aug. 13, 1909.

See Fr. Pat. 406,139 of 1909; this J., 1910, 417.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Colours; Determination of the fastness of —— to light. P. Dosne. Rev. Gen. Mat. Col., 1910, **14**, 193–199.

The author's method for determining quantitatively the fastness of coloured surfaces to sunlight is based on Chevreul's chromatic circle of fundamental colours (orange, blue and greenish-yellow). The proportions of the two fundamental colours (stated in sectors) required to produce with a sector of 60° covered with the sample, the sensation of white or grey (when revolving on a black ground at 1200 revolutions per minute) is first ascertained. The intensity of the grey thus produced is determined by ascertaining the white sector required to give the same intensity of grey, at the same speed, on a black ground. The same determinations are made with another portion of the sample after exposure to sunlight. A greenish-blue colour thus experimented with, was found to require greenish-yellow and orange sectors of 30° and 50° respectively, the grey produced being equal to that given by a white sector of 24°; with the exposed portion, the greenish-yellow and orange sectors required were 35° and 58° respectively, equivalent to a white sector of 31°. As, however, the sectors of the three combined colours only equalled 140° and 153° respectively, the white sectors found require calculating for the whole circle, the values 61°·7 and 73° respectively being thus obtained. The difference of 11°·3 or 17 per cent. (calculated on the original intensity of 61°·7) represents the proportion of fading of the colour by exposure. The standard colour surfaces used are pasted on thin blackened nickel discs; these are fixed to the upper end of the axis of a small cylindrical electric motor, which is covered with a cylindrical box (lined with black velvet), the upper end of which is open and surrounded by a graduated circle. A sector of 60° may be too large for some colours, whilst for browns, greys, etc., sectors of 120°—180° may be required. Reference is made to the researches of Rosenstiehl (Bull. Soc. Ind. Mulhouse, **52**, 165), and it is stated that by the use of his chromatic triangular scale, the alterations in shade as found with the coloured sectors above, can be expressed numerically. The author uses a Bellani actinometer, as modified by Besson and Thurneyssen, to indicate the amount of exposure to sunlight; the ether distilled is not measured but allowed to fall in drops, the drops in falling moving a metallic lever and establishing an electric circuit, and being thus recorded on a registering indicator. An exposure to sunlight equal to 250 drops or about 8 days is suggested. (Compare this J., 1900, 1108.)—A. Sbld.

Patents.

Grease, etc. from wool, skins, textile and other materials; Apparatus for extraction of ——. C. R. Mayo, London. Eng. Pats. 8600 of Apr. 10, 1909, 17,125 of July 22, 1909, and 22,615 of Oct. 4, 1909.

The apparatus is for the extraction of grease from wool or other materials by means of a volatile solvent, which is generally heavier than water, working under reduced pressure. It consists of one or a series of separators or extraction vessels communicating with each other and with a still for the distillation of the solvent. The separators are charged with the material to be treated and the solvent, admitted at the bottom, is caused to overflow into the upper part of the still which is also connected with a condenser. The condenser is in connection with an air pump which maintains a constant reduced pressure in the whole apparatus. The condensed solvent is passed from the condenser down through a column of liquid, which may be water, and collects in a solvent reservoir situated below the vessel containing the liquid. A sufficient head of liquid is maintained to force the solvent through the material in the separators. The suction of the pump is applied to the space above the column of liquid. The pump may then deliver the air either directly into a scrubber or else indirectly by way of a compression vessel, in which the traces of solvent vapour present in the air are deposited by condensation under pressure.—J. F. B.

Hanks in dyeing, bleaching or other baths; Apparatus for working ——. F. Jaumandren. Fr. Pat. 411,660, Jan. 18, 1910.

The hanks are hung on a thin flat support which is fastened at the ends to two endless chains which carry the support through the dye-bath. In order to ensure even dyeings the machine is provided with a device which turns each bar on its own axis and thus causes the point of contact of the support and each hank to be constantly changing. —P. F. C.

Dyeing of half-wool. P. A. Newton, London. From Farbenfabriken vorm. F. Bayer und Co., Elberfeld. Eng. Pat. 17,624, July 29, 1909.

In using the process in which the cotton and wool are dyed in an acid bath with non-basic, direct cotton dyestuffs, it has been found that in the presence of chromium compounds the wool is less strongly dyed than in the absence of such compounds. The boiling may therefore be protracted without risk of the dyestuff boiling off from the cotton on to the wool, and this permits of the material being dyed in solid shades in one bath with dyestuffs of different classes. For example, a Russian green is obtained upon 100 parts of mixed cotton and wool by dyeing in a bath which in 2000 parts of water contains 3 parts of Benzo Olive, 1·5 parts of Benzo Chrome Black Blue B, 0·5 part of Direct Yellow R, 0·75 part of Alizarine Blue B, 30—40 parts of Glauber's salt, 1·3—3 parts of acetic acid (30 per cent.) and 0·5—1 part of potassium bichromate. —F. M.

Multi-colour effects on textiles; Process for producing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 222,678, Feb. 26, 1909.

It is known that wool and other animal fibres which have been treated with acidified thiosulphate solutions, have increased affinity for basic dyestuffs. It is now found that the fibres thus treated have lower affinity than the untreated fibres for a number of other dyestuffs, *e.g.*, acid, azo, chrome, direct, and sulphide dyestuffs. These properties may be utilised to produce multi-colour effects on textiles, *e.g.*, by weaving together treated and untreated fibres, and dyeing in a single bath.—T. F. B.

Fabrics; Machine for tentering and drying ——. E. Gessner, Aue, Saxony. Eng. Pat. 5664, Mar. 7, 1910.

In machines for tentering and drying fabrics it is desirable to have some means for readily controlling the temperature of the current of air passing through the apparatus. According to this invention the temperature of the air is controlled by providing a by-pass for the air, partially surrounding the heater. Means are then provided whereby the air supplied to the chamber may be caused to pass either wholly through the heater or wholly through the by-pass, or else partially through both, into a mixing chamber in free communication with the drying chamber. A valve is provided, controlled by a lever which moves over a scale, serving to indicate the ratio of division of the current of air passing through the heater and by-pass respectively.—J. F. B.

Organo-metallic compounds specially employed in the manufacture of filaments for incandescent lamps; Process of preparing ——. Compagnie Française pour l'Exploitation des Procédés Thomson-Houston. First Addition dated Nov. 30, 1909, to Fr. Pat. 410,562, Nov. 30, 1909 (this J., 1910, 618).

This process consists in introducing a metallic colouring matter into the cells of a fibrous material, and then precipitating it in a colloidal condition, thus fixing the colouring matter and rendering it fast to washing. Example:—A fibrous material is saturated with a solution of ammonium molybdate and then treated with tannic acid. This results in the formation of an organo-metallic compound in the cells of the fibre and the addition of an electrolyte causes the mineral colouring matter to be precipitated inside the fibre in the colloidal state.—P. F. C.

Typographic plates; Process for preparing self-forming ——. H. Strecker-Aufermann, First Addition, dated Dec. 28, 1909, to Fr. Pat. 408,259, Oct. 5, 1909.

In the process described in the principal patent (this J., 1910, 269), sizing materials containing chondrin and glutin are substituted for "fish glue."—P. F. C.

Skeins of yarn and the like; Apparatus for conveying —— *through dyeing, bleaching, and similar baths.* F. Jaumandreu, Barcelona, Spain. Eng. Pat. 1309, Jan. 18, 1910.

See Fr. Pat. 411,660 of 1910.—T. F. B.

Brown, olive, and green shades on the fibre; Producing ——. H. Schmid, Mülhausen, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 963,656, July 5, 1910.

See Eng. Pat. 14,593 of 1908; this J., 1909, 519.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Alkali, etc. works; Forty-sixth annual report on —— *by the Chief Inspector. Proceedings during the year* 1909, *etc.* March 30, 1910. pp. 135. Price 6½d.

The total number of works registered in the United Kingdom on Dec. 31, 1909, was 1432, an increase of eight as compared with 1908; this includes 169 works in Scotland. The number of registered "alkali" works is 80, of which nine are in Scotland. There is again a noticeable increase in the number of works manufacturing ammonium sulphate and chloride. There have been no prosecutions, but in three cases serious warnings have been given. Back fees have been accepted from two owners of works, who had omitted to register through ignorance.

414,680 tons of burnt cupreous pyrites were treated in Great Britain during 1908 by the wet copper process, the estimated produce of valuable metals being 14,928 tons of copper, 1904 oz. of gold, and 331,745 oz. of silver; the corresponding figures in 1907 were 419,603 tons of burnt ore, 15,105 tons of copper, 1927 oz. of gold, and 335,683 oz. of silver.

In alkali waste works the results of the large scale experiments on the use of bauxite in place of oxide of iron filling for Claus kilns continue to be satisfactory, but it is considered that further trial is necessary before the superiority of the bauxite filling under all conditions of working can be held established.

An increased demand for sulphuric acid is reported from more than one district in consequence of the increased production of ammonia. Reference is again made to the Petersen "regulator" tower (this J. 1909, 520) and it is reported that one such tower has been in successful operation for two years in the North of England and another, erected last year in No. 7 District (Eastern and South-Eastern Counties) has also proved itself efficient as a controlling unit in the chamber system. In the latter case, the most responsive strength of acid to use with the regulator is given as 126° Tw., the nitre content of the regulator acid varying between 10 and 18 c.c. of nitric oxide in 1 c.c. of acid. Experiments are to be made in the direction of supplying the system with nitre by means of a nitric acid feed to the regulator. In several districts the use of fans for regulating the draught on sulphuric acid plants is said to be extending. Experiments mentioned last year on the reduction of the white fume in sulphuric acid concentrating plant by hot water treatment have met with considerable success on a practical scale, and the use of silica vessels at one works continues to give satisfaction. Small trials of artificial nitre of atmospheric origin have been made in District No. 4 (N. and E. Lancs.), but the difficulty of obtaining supplies sufficiently free from chlorides has caused its abandonment. It has also been found in this district that "spent oxide" does not always give an acid free from arsenic. Porous tiles have largely replaced the older forms of filtering bed for dearsenicated vitriol in District No. 6a (S. Wales and Mon.), and are giving excellent results. In connection with the testing of exit gases for sulphur dioxide, experience has shown that it is important to protect hydrogen peroxide from the decomposing action of light, by keeping it in bottles of brown or deep green (not blue) glass.

Considerable activity is reported in the tinplate flux works and further progress has been made in the methods of dealing with the noxious fumes evolved on calcination of the scruff; a circular letter has also been issued by the Chief Inspector to the owners of such works, indicating the steps which should be taken in order to comply with the requirements of the Act (see also Report for 1908; this J., 1909, 702), and little further trouble is anticipated from the furnace chimneys. The process which has been adopted at 19 of these works for washing flux skimmings, consists in their continuous treatment in a small tank with running water, kept hot by means of a steam jet which also provides agitation. The residue left in the tank comprises the whole of the metallic portions of the skimmings in a fairly clean condition, and the water carries away zinc compounds and any oxide of tin (tin dross) which latter is deposited in a series of settling tanks. At two works a process brought out by H. J. Bailey for smelting the scruff with a special fluxing powder has been adopted, and another process for treating scruff has been patented by J. Stephens (this J., 1910, 497).

The total quantity of white salt produced from brine and salt contained in brine used for making alkali by the ammonia soda process was, in 1908, 1,621,459 tons, which s 117,177 tons less than in 1907.

A decrease is noticed in the imports of manure materials into the United Kingdom for 1909, as compared with the preceding years; the amounts in tons for 1907, 1908, and 1909 were:—

	1909.	1908.	1907.
uano	20,321	34,417	31,278
Mineral phosphates	451,807	530,177	504,528
Sodium nitrate	90,207	145,724	113,894

The exports of ammonium sulphate in 1909 amounted o 264,000 tons, as compared with an estimated home consumption (for all purposes) of 87,000 tons, the corresponding figures in 1908 being 235,000 and 83,000 tons espectively.

A non-fatal case of "gassing" is reported in connection with an ammonium sulphate plant, and the extremely poisonous nature of the foul gases evolved in the distil- ation of gas liquor is again pointed out, moreover, he specific gravity of such gases, when cold, much exceeds that of air, so that when a seal is broken at a low evel, the gaseous content of the system will tend to empty tself downwards, air entering at any opening in the upper part of the system. Oxide heap purifiers for the absorption of sulphuretted hydrogen from these gases continue to ncrease in popularity. A plant has been erected and put nto operation for the elimination of sulphuretted hydrogen rom crude coal gas and the recovery of sulphur as a by product, by W. Feld's process (this J., 1910, 352), but it is considered too early to pronounce any opinion s to its efficiency.

Four cement works are reported to have ceased operations in District No. 7 (Eastern and South-Eastern), and he older types of kiln continue to give way to rotary kilns. At one works in the Widnes district a machine has been erected for hydrating lime and is found to be economical, and also to give a more uniform product and to reduce he nuisance from dust. A mechanical excavator has been nstalled at one of the largest chemical manure works in District No. 7, for removing superphosphate from the den, and has effected a saving both of time and labour. A ew and efficient form of condenser (designed by H. Alger f Plymouth) for dealing with the gases produced in the reatment of mineral phosphates is described. A fatality is reported in the South and South-West district at a sulphide works, and special attention is directed to the poisonous nature of sulphuretted hydrogen.

Analysis of ammonical liquors:—S. E. Linder reports that, owing to the difficulty experienced with the liquors obtained in the manufacture of "coalite" (on account of the nature of the organic bodies present), the method of estimating thiocyanate (this J., 1907, 685) has required substantial modification. The procedure now approved for the analysis of ammoniacal liquors is the following:—(1). *Free ammonia* (a) 10 c.c. of liquor are diluted to 100 c.c. and titrated with $N/2$ sulphuric acid, using methyl orange, to determine approximately the volume of acid required for distillation; (b) 10 c.c. of liquor (more, if weak) are diluted to about 300 c.c., and 150 c.c. are distilled into excess of $N/2$ sulphuric acid, the excess being titrated with $N/2$ sodium carbonate. If the distillation be carried further, errors are liable to be introduced through slow decomposition of nitrogenous bodies. (2). *Fixed ammonia.* 100 c.c. of $N/2$ sodium hydroxide are added to the residual liquor in (b) and distillation is repeated as before. (3.) *Carbonic acid.* 10 c.c. of liquor (more, if dilute) are diluted to 400 c.c., and 10 c.c. of ammoniacal solution of calcium chloride (1 c.c. = 0·044 grm. of carbon dioxide) are added; the whole is then heated for 1½—2 hours in a water bath at 100° C., the flask being provided with a Bunsen valve. The precipitated calcium carbonate is filtered off and dissolved in $N/2$ hydrochloric acid, and the excess of acid is titrated with $N/2$ sodium carbonate, the small amount of calcium carbonate left on the filter paper being best recovered by incineration and added to the solution. (4). *Chloride* is determined as described in last year's Report (this J., *loc. cit.*), 10 c.c. of boiled liquor being used. Should the organic matter resist oxidation, more peroxide must be added and the boiling continued, with addition of potassium chromate as before. (5). *Sulphur.* (a) As *sulphate.* 250 c.c. of the liquor are concentrated to about 10 c.c. on the water bath. 2 c.c. of strong hydrochloric acid are added, and the evaporation is continued to dryness. The residue is extracted with water, and the filtered solution made up to 250 c.c.; 100 c.c. of this solution are acidified with hydrochloric acid, heated to boiling, and barium chloride added, the precipitate being filtered off, after standing overnight and weighed. (b) As *sulphide, sulphite, and thiosulphate.* 10 c.c. of liquor are diluted to 500 c.c., acidified with hydrochloric acid, and titrated with $N/10$ iodine, the flask being closed and well shaken at the end of the titration to reabsorb the sulphuretted hydrogen above the solution. Thus, 10 c.c. of liquor, or more, are run into an excess of $N/5$ ammoniacal zinc chloride solution diluted to about 80 c.c.; the solution is warmed to coagulate the sulphide, filtered and the precipitate washed with water at 40°—50° C. The zinc sulphide is washed into excess of $N/10$ iodine, acidified with hydrochloric acid, (the last traces being washed through the filter with cold dilute acid), and, after complete solution of the sulphide by vigorous shaking, the excess of iodine is titrated with $N/10$ thiosulphate. It is preferred to give a united figure for sulphur as sulphite and thiosulphate, reached by subtracting from the "total sulphur," found by bromine oxidation, that present as sulphate, thiocyanate, and sulphide. (c) As *thiocyanate* (i) Ferrocyanide absent. 50 c.c. of the solution are treated with lead carbonate to remove sulphide, the lead sulphide and carbonate are filtered off and washed, and, to the filtrate, sodium bisulphite, containing a little free sulphur dioxide is added, followed by a distinct excess of a 10 per cent. solution of copper sulphate, and the solution is allowed to stand for 5—10 minutes at 70°—80° C., to coagulate the cuprous thiocyanate. The solution is then filtered, and the precipitate thoroughly washed with boiling water until the washings give no coloration with dilute potassium ferrocyanide; the residue is then digested at 30°—40° C. with 25 c.c. of a 4 per cent. solution of sodium hydroxide (free from chloride) and filtered. To the cold filtrate are added 5 c.c. of nitric acid, free from oxides of nitrogen (50 per cent. strength), followed by 1 c.c. of a saturated solution of iron alum; the solution is then filtered, if necessary, from separated organic matter, and titrated with $N/10$ silver nitrate. (ii) Ferrocyanide present. 50 c.c. of the liquor are slightly acidified with sulphuric acid, and ferric alum solution is added in sufficient quantity to impart a decided red coloration; the solution is then warmed to 60° C., filtered from Prussian blue, and washed with water containing sodium sulphate. The filtrate is finally treated as in (i) above. (d) *Total sulphur.* 50 c.c. of liquor (100 c.c., if weak) are slowly dropped into an excess of bromine (free from sulphur) covered by water moderately acidified with hydrochloric acid. The oxidised solution is evaporated to dryness on the water bath, and the residue is extracted with boiling water, filtered, cooled, and made up to 250 c.c.; 100 c.c. are then precipitated with barium chloride in the usual way. With some liquors, *e.g.*, coke oven and blast furnace liquors, oxidation with bromine yields a yellow precipitate of brominated phenols, which may retain traces of sulphate: it should be fused with the minimum amount of potassium carbonate and nitrate, or sodium peroxide, and the sulphur present included in the total sulphur. (6). *Ferrocyanide* is determined by Feld's method (this J., 1903, 1068) as follows:—To 250 c.c. of liquor acidified slightly with sulphuric acid, ferric alum solution is added in sufficient excess to impart a deep red coloration. The mixture is then heated to 60° C., and filtered, the filtrate being returned to the filter, if necessary, until a little of it shows no blue colour after adding mercuric chloride. The precipitate is washed two or three times with water containing sodium sulphate, and the filter and precipitate are then boiled for 5 minutes, with 10 c.c. of $N/1$ sodium hydroxide, and the solution is diluted to 150 c.c.; 15 c.c. of $3N$ magnesium chloride solution are then added to the boiling solution, and the determination is finished as quoted by Skirrow (this J., 1910, 319). (7) *Hydrocyanic acid* is also determined by Feld's method (*loc. cit.*), 50 c.c. of liquor being distilled with excess of a saturated solution of lead nitrate into 25 c.c. of $N/1$ sodium hydroxide. At the end of the distillation (30—40 mins. gentle boiling is sufficient, as a rule), a current of air is drawn through the apparatus for a few minutes, and the distillate is then diluted to 400 c.c., a crystal of potassium iodide is added, and the solution is titrated with $N/10$ silver nitrate. (8) *Phenols.* Skirrow's method (this J., 1908, 58), is considered very suitable.

Recovery and production of ammonia in the United Kingdom (expressed as tons of sulphate).

	1909.	1908.	1907.
Gas works	164,276	165,218	165,474
Iron works	20,228	18,131	21,024
Shale works	57,048	53,628	51,338
Coke oven works	82,886	64,227	53,572
Producer gas and carbonising works (bone and coal) ..	24,705	24,024	21,873
Total	349,143	325,228	313,281

The produce of ammonia from all sources in the United Kingdom shows an increase, except in the case of gasworks, the increase in the production from coke-ovens being very marked—over 18,000 tons. Difficulties continue to arise with river authorities in consequence of the presence of thiocyanates and phenoloid bodies in the effluent from coke oven recovery plants, and some designers of plant are directing their attention to the recovery of the ammonia by direct methods designed to obviate the need of discharging effluent liquors of the character complained of.

The output of white arsenic from Cornwall and Devon in 1909 amounted to 2865 tons, as compared with 1919 tons in 1908, but this large increase is due to exceptional circumstances which are unlikely to recur this year.

In tar works manufacturers are reported to be directing their attention more closely to the dehydration of the tar by heat, to remove water and naphtha prior to its distillation. Considerable saving of time is looked for when such a principle is successfully applied. In the Eastern and South Eastern district the quantity of tar distilled is stated to be less than before the advent of tar-surfaced roads.

Further experiments have been made on the interaction of methane and ammonia in the presence of carbon (see Report for 1908; this J., *loc. cit.*), more especially relating to the yield of hydrocyanic acid at different temperatures and varying rates of flow. The results are given in the form of tables and curves; the most important being as follows:—(1) The efficiency of wood charcoal in effecting the conversion of ammonia into hydrocyanic acid decreases with use, probably owing to the deposition on the surface of the charcoal of graphitic or other form of carbon, derived from hydrocarbons or hydrocyanic acid as a result of thermal decomposition. (2) The hydrocyanic acid so obtained is the product of a reversible reaction, controlled by temperature and accompanied by secondary reactions yielding carbon, nitrogen, and hydrogen, by thermal decomposition of ammonia and hydrocyanic acid, thus—$NH_3+C \rightleftarrows HCN+H_2$; $2NH_3-N_2+3H_2$; and $2HCN = H_2+2C+N_2$. (3). In the presence of wood charcoal coated with graphitic carbon, hydrocyanic acid possesses a high degree of stability up to a temperature of 1000° C., though at 1100° C. thermal decomposition begins to be rapid. (4) The presence of hydrocarbons, methane, and especially ethylene, is favourable, but not essential, to a high yield of hydrocyanic acid, ammonia acting directly on carbon to form the acid, in the presence of hydrogen alone as diluent. Very similar results were arrived at by G. A. Voerkelius (this J., 1909, 1122), and the two researches are regarded as affording mutual support and confirmation. Probably the working of a vertical retort of the continuous type most nearly approaches that of the laboratory tube adopted in the research, but the similarity is by no means a close one especially since the genesis both of ammonia and hydrocyanic acid in the distillation of coal is a matter of speculation. In this connection, reference is made to the work of J. McLeod (this J., 1907, 137) on the redistribution of nitrogen in the distillation of coal, and of H. G. Colman on the Glover-West vertical retort (this J., 1909, 829 1115), but it is considered that further data are required before any conclusion can be safely drawn as to the connection existing between carbonisation temperature and relation of hydrocyanic acid to ammonia in the crude coal gas as it leaves the retort.

In Scotland the number of works registered, as compared with 1908, has increased by six. An active consumption of pyrites indicates a somewhat greater demand for sulphuric acid, which, as elsewhere, is largely due to an increased production of ammonium sulphate. The Kessle concentrator continues to be the favourite for sulphuric acid in Scotland. The means adopted in the paraffin oi works for preventing the escape of uncondensed and gaseous hydrocarbons by utilising these as fuel has lessened considerably the quantity of coal required, the reduction in one works being stated as 100 tons per month: moreover the acidity of the chimney gases or smoke resulting from the combustion of the uncondensed gases and washed acid tars is less than that of the gases resulting from the burning of coal. The total shale mined in the United Kingdom during 1909 was 2,967,057 tons, and the yield of ammonium sulphate per ton of shale, 43·1 lb., the corresponding figures for 1908 being 2,892,039 and 41·5 respectively. The production of ammonia in Scotland shows an increase o 7283 tons (as sulphate) over 1908, and represents nearly one-third of the produce of the United Kingdom; more than half the Scotch total was contributed by the paraffin oi works. In connection with tar works, it is noted that a tar distillation plant of some size has been specially buil to deal with tar from producer gas, and that from this source some thousands of tons of pitch are produced annually

—F. Sodn.

Iodine; Absorption of —— by solid substances. M Guichard. Comptes rend., 1910, **151**, 236—238.

Many substances, exposed to air saturated with the vapou of iodine, absorb the element; the amount so absorbed varies specifically with the nature of the substance, and also with its physical condition and the circumstances of its preparation. Various forms of silica (flint, opal, agate) in their natural state and calcined, absorb very little—

traces up to 0·8 per cent. of their weight. Alumina from different sources, calcined up to 600° C., absorbs from 1·8 to 10·0 per cent. Fused magnesia absorbs none; calcined at 1025° C., it absorbs 0·4 or 8·5 per cent., according as it is prepared from the nitrate or the carbonate; calcined at 530° C., the corresponding figures are 5·4 and 18·9 per cent. Glucina shows similar variations of absorption with the temperature of calcination. The colours of the substances used are affected according to the amount of iodine absorbed. No doubt the differences in absorption by the same substance are due to interspaces between the particles, which lessen as the substance shrinks with higher temperature; and the cessation of absorption probably marks the disappearance of these interspaces, and corresponds with a limiting or maximum density of the substance, so that any further change of density caused by further heating is probably due to molecular transformation or change of state.—J. T. D.

Selenium in pyrites; Determination of ——. A. Grabe and J. Petrén. Kemi och Bergsvetenkap, 1910; through Papierfabrikant, 1910, **8**, 663—665, 690—692.

The determination of the minute traces of selenium occurring in iron pyrites cannot be carried out satisfactorily by a gravimetric process. The most suitable volumetric process is that of Norris and Fay (Amer. Chem. J., 1896, **18**, 703), which depends on the formation of a compound of selenious acid and sodium thiosulphate according to the equation: $H_2SeO_3+4Na_2S_2O_3+4HCl=Na_2S_4SeO_6+Na_2S_4O_6+4NaCl+3H_2O$; the presence of tellurium does not interfere. The main difficulty is the separation of the selenium from the other constituents of the pyrites in a form fit for titration. The authors have worked out the following method: 10 grms. of the granulated sample (passed through a 0·25 mm. sieve) are dissolved in a mixture of 50 c.c. of hydrochloric acid, sp. gr. 1·19, and 50 c.c. of nitric acid, sp. gr. 1·40. The substance is heated gently at first and is finally dissolved at the boiling temperature. 15 grms. of dry sodium carbonate are added and dissolved, and the solution is evaporated to dryness, the residue being heated for a few hours at a temperature slightly above 100° C. The residue is then boiled with 50 c.c. of hydrochloric acid, sp. gr. 1·19, until the evolution of nitrous fumes has ceased and only a small quantity of acid remains. The process must be repeated with more acid so long as any odour of chlorine persists. The solution is diluted with 100 c.c. of water and filtered. If the residue and filtrate show any signs of a red colour, the selenium has been precipitated by undue evaporation and must be re-dissolved in nitric acid, which must then be driven off again by boiling with hydrochloric acid. The filtrate is warmed to 50° C. and treated with a saturated solution of stannous chloride in hydrochloric acid, sp. gr. 1·19; 10—15 c.c. are generally sufficient to reduce all the iron. The selenium is precipitated, at first in a colloidal form, and is deposited by keeping the liquid nearly at the boiling point for 2 hours. The liquid is filtered warm through a small plug of asbestos in a funnel about 5 cm. in diameter. The precipitate is thoroughly washed with warm hydrochloric acid (1 part of acid, sp. gr. 1·12, to 1 of water) and is lifted back into the beaker, together with the asbestos, where it is dissolved in 10 c.c. of strong hydrochloric acid and 2 drops of nitric acid. The solution is warmed until the smell of chlorine is eliminated, then diluted to 150 c.c. and a measured volume of thiosulphate solution is added. The excess of thiosulphate is titrated with iodine (6·4 grms. per litre); 1 c.c. of this solution= mgrm. of selenium. The results may be controlled by a colorimetric method. The selenium, precipitated and separated as described, is converted into selenious acid and again precipitated by stannous chloride, this time in the cold. The red-coloured colloidal precipitate of selenium is then compared colorimetrically with a standard similarly treated. The results of the two methods are in satisfactory agreement; tellurium however interferes with the colorimetric process.—J. F. B.

Nitrous vapours; Conversion of —— into calcium salts by means of ethyl nitrite and nitrate. E. Tassilly and J. Leroide. Bull. Soc. Chim., 1910, **7**, 622—628.

Dry air was charged to the extent of 1—2 per cent., with the nitrous vapours formed by the interaction of copper and nitric acid. The vapours were completely absorbed by alcohol at a temperature of – 20° C. with the formation of ethyl nitrite and nitrate. It was found however that these esters did not give satisfactory yields of the calcium salts when their alcoholic solutions were heated with lime up to 140°—150° C.—F. Sodn.

Sulphur (combustible); Determination of —— in graphite. J. Cibulka. Chem.-Zeit., 1910, **34**, 757.

About 0·5 grm. of graphite in a platinum boat, is burnt by heating to redness in a current of dry air or oxygen in a combustion tube, about 30 cm. long, 18 mm. diameter, and fitted with asbestos plugs. The sulphur dioxide formed is received in a Lunge absorption apparatus containing a mixture of 20 c.c. of hydrogen peroxide (3 per cent.) and 20 c.c. of water. The combustion takes 1—2 hours, the air or oxygen being passed through so that 1—2 bubbles per second appear in the absorption apparatus. The sulphuric acid formed is determined by titration with $N/10$ sodium hydroxide with methyl-orange as the indicator, and under deduction of the alkali needed to neutralise any acid previously existing in the hydrogen peroxide used. The method is rapid and has been found reliable.—A. Sbld.

Ammonia-soda. The Mallet-Boulouvard System. K. W. Jurisch. Chem. Ind., 1910, **33**, 346—359; 392—398; 424—430.

A lengthy article of 29 pages, with 12 illustrations, and two large plans, describing the Mallet-Boulouvard ammonia-soda process in all detail, as carried out by the Compagnie Générale des Produits Chim. du Midi, at Sorgues.

The author expresses the opinion that the Mallet Boulouvard system has the fault of a certain rigidity. In the works described, the estimated production of alkali in 24 hours is actually furnished, but it is found that this production cannot be sensibly increased according to desire, as it can be, for example, in the case of the Solvay system. He is further of opinion that the filtering arrangements, though excellent, are costly. The wage charges were too high in the calcining department; indeed in the case of any locality where salt is cheap, some other calcination process would be preferable to the present one. The entire factory in Sorgues cost one million francs with a production of 10,500 kilos. of soda (sodium carbonate) per day. For an additional outlay of 250,000 frcs. a small Solvay plant could be erected which would yield daily from 20,000 to 25,000 kilos. of soda.

Ammonia; Formation of —— in deep-seated waters containing iron or manganese compounds. H. Noll. Z. angew. Chem., 1910, **23**, 1306—1308.

The author has carefully repeated experiments of Klut (Mitt. aus der Kgl. Prüfungsanstalt f. Wasserversorg. u. Abwasserbes. 1909, No. 12), in which pyrites, manganese blende, and ferrous sulphide were kept in contact for 24 or 48 hours with a natural water to which 20 mgrms. per litre of N_2O_5, as potassium nitrate, were added, and which was aerated with free carbon dioxide. The minerals were used both in the state as received and also after thorough washing with ammonia-free water. Control experiments were made in each case with the natural water to which no nitrate or carbon dioxide had been added. Under the conditions stated, Klut affirms that ammonia is formed. The author demonstrates that it is not.—J. T. D.

Sodium manganate and its hydrates. V. Auger. Comptes rend., 1910, **151**, 69—70.

By heating sodium permanganate with double the theoretical quantity of sodium carbonate in a silver or platinum capsule to 125° C., an abundant deposit of black crystals with a violet reflection, consisting of anhydrous sodium manganate, is formed. The manganate is stable up to 170° C., at which temperature oxygen is again given off and sodium mangani-manganate formed (this J., 1910, 347, 348). Analysis of the manganate after draining on a porous plate gave 19·0 per cent. of active oxygen (calculated 19·4 per cent.). The crystals dissolved in water rendered strongly alkaline with sodium hydroxide yield hydrates varying with the conditions of crystallisation. *Hexahydrate.*—$MnO_4Na_2,6H_2O$. This is obtained in large black prismatic crystals by crystallising from a very alkaline solution. On drying *in vacuo* over phosphorus pentoxide, the crystals lost 39·3 per cent. of water (calculated 39·5); the anhydrous product containing 19·2 per cent. of active oxygen. *Tetrahydrate.*—The preceding crystals dissolved in a 5 per cent. aqueous solution of sodium hydroxide yield large crystals of similar appearance, but containing 4 mols. of water. Analysis showed 31·3 per cent. of water (calculated 30·03) and 19·21 per cent. of active oxygen in the dry residue. *Decahydrate.*—Obtained as black needle shaped crystals melting at −17° C., when a sodium manganate solution is cooled in a mixture of ice and salt. The water was found to be 52·4 per cent. (calculated 52·1) and the active oxygen in the residue 18·5 per cent. instead of 19·4 per cent., a loss of oxygen probably occurring in drying (*in vacuo* over phosphorus pentoxide). Mixed crystals of sodium manganate and sulphate and of sodium manganate and chromate, with 10 mols. of water, are easily obtained in all proportions from mixtures of the respective solutions.

—A. Seld.

Ferrocyanides; Analysis of ——. H. G. Colman. Analyst, 1910, **35**, 295—300.

Feld's method for the determination of ferrocyanides having been stated by Skirrow (this J., 1910, 319) to yield inaccurate results, the author has investigated the alleged sources of error in the method. As the result of his experiments he finds that correct results are obtained if the boiling with magnesium chloride is not continued for longer than the specified 5 minutes; even when cyanides are present and the boiling must be continued for a somewhat longer period, 10 minutes quick distillation is sufficient to remove the hydrocyanic acid present as cyanide without expelling material quantities of hydrocyanic acid present as ferrocyanide. Skirrow found that, starting with cyanide solution and converting this into ferrocyanide, the yield of hydrocyanic acid in the subsequent analysis by the Feld method was from 3 to 4 per cent. less than that found by direct titration of the original cyanide solution; the author finds that the loss in this case averages about 0·5 per cent. Other sources of loss mentioned by Skirrow are not met with when the test is carried out under normal conditions. Generally, the results of the investigation show that the Feld method, when carried out under the specified conditions, gives results which are substantially accurate.—W. P. S.

Potassium ferro- and ferricyanide; Iodometric determination of ——. W. Mecklenburg. Z. anorg. Chem., 1910, **67**, 322—338.

Potassium ferricyanide.—The salt is dissolved in 500—750 c.c. of water, and 10—15 c.c. of concentrated hydrochloric acid (sp. gr., 1·19), 10—15 grms. of potassium chloride, 10—20 c.c. of a 10 per cent. solution of potassium iodide, and 10 c.c. of zinc sulphate solution (approximately molecular are added. The turbid mixture is allowed to stand for 3 minutes in a stoppered flask, after which some starch solution is introduced, and $N/10$ thiosulphate is added, until nearly all the iodine has disappeared; the titration is then finished after waiting again for 3 minutes. 1 c.c. of $N/10$ thiosulphate = 32·921 mgrms. of potassium ferricyanide. *Potassium ferrocyanide.*—To the aqueous solution (600—800 c.c.) 10—15 c.c. of concentrated hydrochloric acid and 40—60 c.c. of sodium acetate solution (250 grms. of crystallised salt in 675 c.c.) are added, and then $N/10$ permanganate, with shaking, until the solution is quite clear and distinctly red; then 10 c.c. of 10 per cent. potassium iodide solution are added, and, after 3 minutes, the separated iodine is titrated with $N/10$ thiosulphate (best standardised against permanganate solution). 1 c.c. of $N/10$ permanganate = 42·236 mgrms. of crystallised potassium ferrocyanide. An approximately standard solution of permanganate may also be used, and the ferricyanide produced determined as above, thus giving the ferrocyanide indirectly. To determine *potassium ferrocyanide and ferricyanide*, the above methods are combined, the solution (700—800 c.c.) being mixed with 15 c.c. of concentrated hydrochloric acid and 60 c.c. of the above sodium acetate solution and the ferrocyanide determined directly, and then a further 10 c.c. of hydrochloric acid, 10 c.c. of 10 per cent. potassium iodide, and 10 c.c. of (molecular) zinc solution being added and the total ferricyanide determined.—F. Sodn.

Ammonium bifluoride; Valuation of ——. E. Deussen. Z. angew. Chem., 1910, **23**, 1257—1258.

Titration of ammonium bifluoride (ammonium hydrogen fluoride) with barium hydroxide solution in the cold, either with or without phenolphthalein as indicator, gives too low results, whilst the method of Lenz and Deussen (Monatsh. 1907, 1145), though accurate, is too tedious in practice. The following method is recommended as rapid and reliable:—From 0·05 to 0·08 grm. of the ammonium bifluoride is mixed with a few drops of water and a large excess of standard barium hydroxide solution, in a platinum crucible, which is then covered with a watch-glass and allowed to stand under a bell-jar over-night, after which it is placed on a water-bath, which is very gradually heated until the water boils, which should take from four to five hours. The watch-glass is now removed and the crucible left on the boiling water-bath for a few minutes, until the odour of ammonia ceases to be perceptible. The contents are then transferred to a beaker, and heated at 90° to 100° C., until there is again no odour of ammonia, after which the residue of barium hydroxide and carbonate is dissolved in a measured quantity of $N/1$ hydrochloric acid and washed with a little water into the beaker. More standard hydrochloric acid is added, and the excess thereof titrated with standard barium hydroxide solution with phenolphthalein as indicator.—C. A. M.

Nitrates; Comparison of Pozzi-Escot's and Devarda's methods for the determination of ——. E. Cahen. Analyst, 1910, **35**, 307—308.

The method described by Pozzi-Escot (this J., 1910, 114 was found to be cumbersome and inaccurate, the results obtained being much too low. On the other hand, Devarda's well-known process, in which the nitrate is reduced to ammonia by the hydrogen generated from alkal hydroxide and an alloy consisting of aluminium, 45, copper 50, and zinc, 5 per cent., was found to be trustworthy The author prefers to remove the ammonia from the solution by steam distillation instead of simply distilling the mixture.—W. P. S.

Magnesium carbides. J. Novak. Z. physik. Chem., 1910 **73**, 513—546.

The study of the action of heated magnesium on acetylene (this J., 1909, 1276) has been continued, and extended to other hydrocarbons. According to the temperature employed, either or both of two well-defined carbides, MgC_2 and Mg_2C_3 are obtained, and carbon is also liberated but it is shown that the carbide is formed directly and not by the union of magnesium with free carbon. The decomposition of acetylene with formation of the compound, MgC_2 begins at about 400° C., and the production of this carbide reaches a maximum (40 per cent.) at 490° C., decreasing then rapidly; at 460° C., the carbide, Mg_2C_3, also appears The same products, in varying proportions, are obtained with other hydrocarbons, (methane, pentane, octane benzene, toluene, and xylene), but these, reacting above 530° C., give almost exclusively the compound, Mg_2C_3, very small or inappreciable proportions of the other carbide being produced; similar results were obtained qualitatively with alcohols, ketones, and aldehydes. The carbide MgC_2, decomposes rapidly at 600° C., according to the scheme, $2MgC_2 \rightarrow Mg_2C_3+C$, and at higher temperatures the carbide, Mg_2C_3, splits up, thus: $Mg_2C_3 \rightarrow 2Mg+3C$ Both carbides decompose water, the former, not readily according to the equation, $MgC_2+2H_2O=Mg(OH)_2+C_2H_2$ and the latter, with energy, giving allylene, thus

$Mg_2C_3+4H_2O=2Mg(OH)_2+C_3H_4$. When a mixture of allylene and acetylene is passed through an ammoniacal solution of cuprous chloride, containing ammonium chloride which is heated on a water-bath, the latter gas only is absorbed, and this provides a means of quantitatively separating these hydrocarbons; allylene is absorbed by ammoniacal silver nitrate solution giving a white crystalline precipitate of silver allylenide. The compound, Mg_2C_3, is said to be easily prepared, and forms a convenient source of allylene. By heating magnesium powder with sugar charcoal, the same carbides were obtained as above, but in very small yield (fractions of 1 per cent.).—F. SODN.

Thorium salts; Theory of manufacture of ——. The sulphate purification method. I. Koppel and H. Holtkamp. Z. anorg. Chem., 1910, **67**, 266—292.

THE best conditions have been investigated for carrying out the "sulphate method" of purifying crude thorium hydroxide, which depends on the relative insolubility of thorium sulphate-8-hydrate, and consists in dissolving the hydroxide in hydrochloric acid and precipitating with sulphuric acid, the sulphate being reconverted into hydroxide and the process repeated. To this end, the solubility of the 8-hydrate in sulphuric, hydrochloric, and nitric acids, at various temperatures and concentrations, and the effect of phosphoric acid on this solubility, have been studied. As a result of the investigation, it would appear (1) that it is better to precipitate the sulphate from hydrochloric than from nitric acid solution, the latter acid, at the concentrations necessarily employed, dissolving a larger proportion of the sulphate than the former, (2) that a moderate excess of hydrochloric acid is harmless, and, in fact, reduces the solubility of the sulphate, but, if nitric acid be used, excess should be avoided, (3) that, in the precipitation, about 0·5 per cent. of free sulphuric acid should be allowed, unless phosphoric acid be present, when a considerable excess may be employed, to counteract the great solvent action of this acid, and (4) that in order to ensure the precipitation of the crystalline 8-hydrate, and avoid that of the flocculent badly-filtering 4-hydrate, the temperature must in all cases be kept below 42° C. (the transformation temperature) and, in practice, should be distinctly lower, since the excess of acid and other impurities tend to lower the transformation temperature considerably; the solution also should contain less than 31·4 per cent. of thorium oxide. The paper concludes with a table and curves, showing the specific gravities and refractive indices of thorium nitrate solutions at 15° C. —F. SODN.

Thorium sulphate; Decomposition of —— by water. Barré. Comptes rend., 1910, **151**, 70—72.

THORIUM sulphate solution on heating, gradually splits up into a fibrous mass of basic sulphate resembling cotton, and free acid, the decomposition beginning about 55° C. This basic salt slowly changes into a second and very crystalline basic sulphate. The former is obtained when thorium sulphate is added to sufficient water to ensure complete decomposition and the precipitate is filtered off as soon as the first crystals of the second basic salt are noticed under the microscope; it has the formula $Th(SO_4)_2,ThO_2,6H_2O$, or $ThO(SO_4).3H_2O$. If, however, the precipitate is not filtered off, it is slowly changed into a well-crystallised salt of the formula, $Th(SO_4)_2,ThO_2.4H_2O$, or $ThO(SO_4),2H_2O$. It is very little soluble in water (0·023 in 100 at 100° C.). The basic salt obtained by Demarçay (Comptes rend., 1883, **96**, 1859) is a mixture of this basic salt and thorium sulphate.—A. SBLD.

Thorium sulphate. Barré. Comptes rend., 1910, **151**, 231—234.

AQUEOUS solutions of thorium sulphate show a specific electrical resistance and a lowering of the freezing point in accordance with the laws of Bouty and of Raoult; and these constants in the case of solutions containing 1 per cent. of potassium sulphate, indicate the existence in solution of a stable double salt, confirming the indication afforded by determinations of solubility.—J. T. D.

Zeolites; Double decompositions with artificial ——. A. Doroszewski and A. Bardt. J. Russ Phys.-Chem. Ges. 1910, **42**, 435—442. Chem. Zentr., 1910, **2**, 68.

THE authors have studied the reactions between artificial zeolites (see Gans, this J., 1909, 102) and saline solutions, determining the influence of the temperature, the solvent, and the nature of the dissolved metal ions on the velocity of the reaction in the case of a sodium-zeolite containing 42·06 per cent. of silica, 20·45 of alumina, 12·10 of sodium oxide, and 25·00 of water. It was found that calcium chloride reacted with the zeolite much more rapidly in aqueous solution that when dissolved in 65 per cent. alcohol; the velocity of the reaction was considerably increased by rise of temperature, and, in the case of the chlorides of magnesium, calcium, strontium, and barium, increased regularly with the atomic weight of the metal. —A. S.

Carbon monoxide; Action of hydrogen on ——; formation of water and methane. Action of water on the same oxide at a red heat. Applications to volcanic phenomena. A. Gautier. Comptes rend., 1910, **150**, 1564—1569. (See this J., 1910, 815.)

WHEN a mixture of hydrogen and carbon monoxide in the proportion, $CO+3H_2$, is passed through a heated tube, the former gas is reduced, even at 400° C. The production of steam attains a maximum of 27·5 c.c. per litre of carbon monoxide at 1220° C. The maximum amount of carbon dioxide (10·4 c.c. per litre of carbon monoxide) is found at 900° C. In most cases no carbon is deposited, but the production of methane can be observed. A repetition of earlier experiments on the action of water on carbon monoxide at 550°—800° C. showed the production of small quantities of formaldehyde. The author applies these results to the explanation of the composition of volcanic gases.—R. V. S.

Barium discoveries in Cumberland. Chem. Tr. J., July 23, 1910. [T.R.]

ON the High Ireby Grange estate, lodes of both barium sulphate and carbonate have been opened up. One vein of the sulphate has been traced for about 1½ miles in a northerly direction, and other veins about ¾ of a mile east and west. In some parts the lode shows from 16 ft. to 23 ft. 6 in. wide, and has been open-casted, exposing a body of barium sulphate. The analysis gives $BaSO_4=99·66$ per cent.; Si = 0·02; lime 0·03 per cent., and a trace of oxide of iron. The carbonate is 96·30 per cent. Another lode of sulphate, which is entirely within the basalt and altered ash rocks, gives crystalline sulphate of baryta of exceptionally good colour. The deposits are to be opened up, and mills for grinding, and plant for the manufacture of barium salts and lithopone is to be put down.

Waste sulphites for road making. Oil, Paint and Drug Rep., July 18, 1910. [T.R.]

WHITE waste sulphite, which is produced in the manufacture of wood pulp, has been the subject of extensive experiments by the U.S. Department of Agriculture. The material proved to be of little value in single treatment of dusty roads, but the concentrated material became a semi-permanent dust preventive and road binder. In localities where the crude liquor is produced, frequent application for an extended period might prove to be valuable in making permanent roads.

Ammonium sulphate in Germany. Oil, Paint and Drug Rep., July 18, 1910. [T.R.]

THE U.S. Consul-General in Frankfort says that the consumption of ammonium sulphate by the German farmers has increased from 284,000 metric tons in 1908 to 330,000 in 1909. The consumption of sodium nitrate is about 450,000 metric tons, so that, as far as the percentage of nitrogen is concerned, ammonia is already a trifle ahead of nitrate. The Journal of the Association of German Engineers states that the development of the last ten years point to the fact that in the near future ammonia will chiefly be used as an artificial fertilizer. Statistics show that Germany consumes its entire yearly production of 322,700 tons at home, England produces 349,000 tons, while the United States, in spite of its extensive use of coke as fuel, produces only 9,000 tons.

New German potash law. Oil, Paint and Drug Rep., July 18, 1910. [T.R.]

At the seventeenth annual convention of the National Fertilizer Association representing the entire fertilizer industry of the United States, held at Atlantic City, July 12 and 14, 1910, it was unanimously

Resolved (1) That the Bill for the regulation and control of the German potash industry, recently passed by the Imperial Government, embodies substantial repudiation of seven-year contracts held by American citizens, members of this association, and that this action on the part of the German Government is contrary to all sense of business integrity and in its operation perpetrates an international injustice;

(2) That the attitude of the Department of State in vigorously protesting against this act being so construed by the Bundesrat as to invalidate the American contracts and in insisting upon the sanctity of these contracts is heartily indorsed;

(3) That this association desires to convey to the Department of State its high appreciation of the assistance and support rendered by the department in demanding the fulfilment of the American contracts;

(4) That the secretary of this association be and is hereby instructed to forward a copy of these resolutions to the Secretary of State at Washington.

The consensus of opinion, however, was that it was unlikely that the German authorities would be induced to recede from their position and that the only thing for American buyers to do was to accept the situation and make the best of it. Hope was not altogether dead, however, that the U.S. Government would succeed. If not, it was explained, the price of potash would show no improvement, from a buyer's standpoint, over the syndicate quotations of 1909, compared with which the contract prices were about 30 per cent. lower.

Calcium borate exports from Peru. Oil, Paint and Drug. Rep., July 11, 1910. [T.R.]

The exports from the Peruvian port of Mollendo for the year 1908 included 4,400 tons of calcium borate. The borate fields, worked by a British company, lie in the close vicinity of Arequipa. At one time it was thought these were to be shut down in favour of the borate fields worked by the same company in Antofagasta (Chile), but this has so far not occurred, and, from the amount exported, it would look as if the quality of the borate continued to compensate for the relative distance from the seashore, as compared with Antofagasta, which is more favourably situated.

Potassium nitrate in Argentina. Oil, Paint and Drug Rep., July 18, 1910. [T.R.]

A recent order of the Argentine Minister of Finance directs that potassium nitrate not chemically pure, and destined for industrial purposes, imported in barrels or sacks, shall be subject to the duty of 5 per cent. fixed by the Argentine Customs Law for crude nitre. This duty, which is calculated on an official valuation fixed by tariff, is 75 c. per 100 kilos. (37 c. per cwt.), the weight of the receptacle being included for the assessment of duty.

The position of Arsenic. Oil, Paint and Drug Rep., July 18, 1910. [T.R.]

In 1907 the price of arsenic fluctuated between 5¾ and 8½ cents, with no competitors in the United States. But the high prices attracted the attention of producers who hitherto had been allowing their arsenic to go to waste. Production in the United States was also favoured by a new law, which forbade American smelting companies to let the fumes from their furnaces spend themselves in the air to the destruction of vegetation, and the process of condensation which was prescribed to meet the requirements of the law, produced liberal quantities of crude arsenic throughout the West, which the smelters were only too glad to get rid of at any price. Canadian mines also made arsenic as a by-product, which found a ready market in the United States. Efforts were made when the U.S tariff was undergoing the process of revision to place arsenic on the dutiable list and tax it at the rate of one cent a pound, but the attempt was unsuccessful, so that Canadian and Mexican arsenic, which, as by-products, can readily undersell the English and German arsenious ores, now replace the latter to a considerable extent.

Patents.

Concentrated sulphuric acid; Process of making ——. O. Proelss, Kansas City, Mo. U.S. Pats. 963,174 and 963,175, July 5, 1910.

(1). Independent portions of hot burner gases are simultaneously conducted through a denitrating and a concentrating apparatus, and are then mixed and cooled by contact with an excess of weak acid, before being discharged into the chambers. (2). Weak acid is treated in a chamber with hot burner gases, in order to concentrate it to above 63° B., and cause the deposition of the principal impurities; the concentrating process is then suspended, and the impurities are removed from the chamber by solution in a weaker acid, which may be made, whilst the first operation is in progress, by denitrating a mixture of weak acid and nitrous vitriol by an independent portion of hot burner gases, the gases from both operations being subsequently mixed and subjected to the cooling action of weak acid.—F. Sodn.

Hydrochloric acid and chlorine; Process for the preparation of —— *from calcium chloride and magnesium chloride.* M. Sandecker and L. Weiss. Ger. Pat. 223,169, Dec. 16, 1908.

For the preparation of hydrochloric acid from liquors containing calcium chloride or magnesium chloride, these are treated with boric acid or an acid phosphate of an alkaline-earth metal or of magnesium, and the solution is forced through a jet into a heated vessel. By addition of an oxidising agent, chlorine is obtained instead of hydrochloric acid. The residual liquor, if boric acid has been used, is heated with ammonium chloride, whereby ammonia is liberated and a mixture of boric acid and calcium or magnesium chloride is left, ready for the production of a further quantity of hydrochloric acid or chlorine. When an acid phosphate is used, this may be regenerated from the residual liquor by treatment with sulphur dioxide or carbon dioxide.—A. S.

Acetic acid from alcohol; Process for obtaining ——. E. A. and J. Behrens. Ger. Pat. 223,208, Nov. 17, 1908.

Alcohol is first oxidised to aldehyde by means of air in presence of a contact substance (platinum or platinised material), the aldehyde is separated by fractional distillation, and is then rendered conductive by addition of water and sulphuric acid, and oxidised electrolytically to acetic acid. A platinum anode is preferably used, and the electrolysis is stopped before the whole of the aldehyde is oxidised, as otherwise secondary reactions occur and the yield is reduced. After electrolysis, the greater portion of the acetic acid can be recovered in a pure form by a single fractionation in a column apparatus.—A. S.

Perborates and perboric acid; Process for the electrolytic preparation of ——. E. A. Pouzenc. Fr. Pat. 411,258, Jan. 4, 1910.

The process consists in the electrolysis of solutions of commercial boric acid, metaborates, orthoborates, biborates or borates generally, of a strength, for example, of 30—50 grms. per litre. The electrolytic apparatus may consist of two elongated vertical compartments, separated from each other by a porous diaphragm and terminating above and below in tubes by which the electrolyte enters and leaves each compartment; the electrodes are inserted through side arms, and suitable receivers are provided for the anode and cathode products.—F. Sodn.

Ammonia; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 411,446, Jan. 10, 1910. Under Int. Conv., April 1, 1909.

The combination of nitrogen and hydrogen at a high temperature is brought about with the assistance of osmium as a catalyst, either the metal or a compound or mixture with other substances being used. Osmium, unlike the closely related platinum, is found specially suitable for this purpose; for example, working with the finely divided metal at about 550° C., and 175 atmos., a yield of 8 per cent., by volume, of ammonia is readily obtained from a mixture of hydrogen and nitrogen (3 : 1). —F. Sodn.

Oxygen and nitrogen from liquid air; Apparatus for obtaining pure ——. Soc. l'Air Liquide (Soc. Anon. pour l'Étude et l'Exploit. des Procédés G. Claude). Fr. Pat. 410,967, Mar. 24, 1909.

The apparatus is constructed on the principle of progressive condensation and is a modification of that described in Fr. Pat. 352,856, Mar. 30, 1905 (this J., 1905, 969). In order to secure more perfect separation of the nitrogen and oxygen, the air, instead of passing first to the central tubes at B, as there shown, enters at the base of the peripheral system at E: the oxygen is therefore condensed and flows back into E, and the gaseous residue is liquefied in passing downwards through the central tubes, A. Moreover the two systems of tubes are plunged in separate cooling liquids, the central system and upper part of the outer system being surrounded by liquid rich in oxygen, flowing from the lowest plate of the rectifying column, surmounting the apparatus, and this liquid overflowing into the evaporator surrounding the lower portion of the peripheral tubes; this arrangement produces a lower temperature in the central than in the lower portion of the outer tubes, and at the same time, the evaporation of the overflow liquid gives pure oxygen which is withdrawn from the apparatus, the gas from the first evaporator passing upwards through the rectifying column. The upper part of the peripheral tubes is cold enough to bring about the condensation of pure nitrogen, and the rectification in these tubes by reflux condensation therefore ensures the liquefaction of fairly pure nitrogen in the central system. This nitrogen is not, however, sufficiently pure for some purposes (*e.g.*, the manufacture of cyanamide) and to effect further purification, the residual gas from B is made to pass upwards again through a third system of tubes arranged at the centre of the other systems and surrounded by its own evaporator, which is fed by the liquid from the rectifying column before it passes to the outer evaporators; the final rectification of the nitrogen is thus effected, and the escaping residual gas is practically pure.—F. Sodn.

Nitrogen peroxide; Process for the extraction of pure —— from mixtures of nitric oxide and air obtained electrically. Elektrochem. Werke, G. m. b. H. Fr. Pat. 411,693, Jan. 19, 1910. Under Int. Conv., Feb. 10, 1909.

The hot gases from the furnace are cooled to the ordinary emperature and then pass into a large chamber in which he nitric oxide is oxidised by atmospheric oxygen to itrogen peroxide; the temperature of the gaseous mixure is then reduced in stages (preferably three) to −65° C. n the first refrigerating apparatus, which may be mainained at −10° C., any nitric acid is condensed, in the econd the gas is cooled to −30° to −40° C., and in the hird to −65° C., when all the nitrogen peroxide separates n the solid form. The cold gases are utilised for preminary cooling purposes, and the air is preferably dried efore entering the furnace, in which case no nitric acid is produced.—F. Sodn.

Nitrous oxide; Manufacture of ——. K. Söderman. Fr. Pat. 411,785, Jan. 21, 1910.

The product of the action of oxygen upon nitrogen at a high temperature (combustion), is generally described as nitric oxide (NO), but the present invention aims at the production of nitrous oxide (N_2O). A flame of nitrogen and oxygen, produced electrically or by combustion (but not of oxy-hydrogen origin), is suddenly cooled at the point at which nitrous oxide (N_2O) is present in the maximum proportion, which is ascertained spectroscopically or in other manner. Nitrogen and oxygen are then separated from the nitrous oxide by liquefying the latter, carbon dioxide being first absorbed, if present, by milk of lime or other basic solution, and the nitrous oxide is finally purified by fractional distillation.—F. Sodn.

Nitrites into nitrates; Conversion of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 411,674, Jan. 18, 1910. Under Int. Conv., Jan. 25, Feb. 15, July 30, Sept. 6, and Sept. 29, 1909.

Aqueous solutions of nitrites, or of mixed nitrites and nitrates, are submitted to the action of nitrous gases or of gaseous mixtures containing such. Or, they are treated with nitric acid, and the nitrous gases evolved are mixed with a slight excess of oxygen or gas containing oxygen, such as nitrous gases from an electric furnace for the combustion of air, and are absorbed by water or an aqueous solution, to give nitric acid again, and, since relatively strong acid may be obtained in this way, the process may be utilised for the concentration of dilute nitric acid. To avoid making very dilute nitrate solutions, the nitrite may be decomposed by a solution of nitric acid containing nitrate, the nitrous gases evolved, after mixing with oxygen, being absorbed, for instance, by the liquor itself in a suitable tower, and in order to prevent waste of acid in the continuous production of nitrate, if the strength of the nitrite solution should vary, the nitric acid obtained by absorption may be at once mixed with fresh nitrite solution and a slight excess of nitric acid, so that the admission of acid is regulated by the concentration of the nitrite solution. If impurities, such as carbon dioxide, be present in the gases evolved by the action of acid on the nitrite, they are absorbed by alkali before the gases are mixed with oxygen. Free nitrous acid is eliminated from solution of nitrates, or other liquids containing it, by treating them with air or other gas, or by reduction of pressure, or by pulverisation of the liquid.—F. Sodn.

Hydrosulphites; Production of ——, *dry and quite stable.* Badische Anilin und Soda Fabrik. Fifth Addition, dated Jan. 5, 1910 (under Int. Conv., Nov. 24, 1909), to Fr. Pat. 341,718, Mar. 28, 1904 (this J., 1904, 909).

The caustic alkalis mentioned in previous additions (this J., 1905, 333, 1172; 1907, 407) are replaced partially or entirely by ammonia, alkali salts also being added if a hydrosulphite other than that of an alkali be used. For example, 670 kilos. of an aqueous paste of sodium hydrosulphite (containing 180 kilos. of the salt, $Na_2S_2O_4$, $2H_2O$), such as is obtained by precipitation according to Fr. Pat. 293,192, Oct. 2, 1899, is heated to 35°—40° C., and a current of ammonia is passed through until the salt is converted into the anhydrous hydrosulphite, which is then dried in the usual manner. Four other examples are given.—F. Sodn.

Aluminium fluosilicate; Method of making ——. E. F. Kern, Knoxville, Tenn., Assignor to P. S. Brown, New York. U.S. Pat. 963,156, July 5, 1910.

Aluminium silicate, silica, and hydrofluoric acid, in approximately molecular proportions, are mixed in the presence of water.—F. Sodn.

Ammonium sulphate; Manufacture of ——. R. Müller. Ger. Pat. 223,098, March 17, 1908.

The ammonium sulphate, as it comes from the saturator, is freed from acid and partly dried in a centrifugal machine in the usual manner, and then whilst the machine is rotating, a current of dry air is blown in until the sulphate contains not more than 0·1 per cent. of water. The product contains more ammonia than that obtained by the usual process and when stored in bulk does not set to a hard mass but remains pulverulent.—A. S.

Hydrosulphites; Process for the concentration of solutions of ——. Chem. Fabr. Flörsheim H. Noerdlinger. Ger. Pat. 223,260, Jan. 15, 1908.

Aqueous solutions of hydrosulphites can be concentrated to the point of crystallisation, without appreciable decomposition, by passing through them at about 50° C., a current of a suitable inert gas, *e.g.*, carbon dioxide, carbon monoxide, nitrogen, or flue gases. In order to protect the concentrated solutions and the crystals from the action of the air, hydrocarbons or similar substances which are fluid at 50° C., are added to the solutions before concentration.—A. S.

Oxygen baths; Process for the preparation of ——. M. Elb, Ges. m. b. H. Ger. Pat. 223,449, Oct. 27, 1908.

The claim is for the use of colloidal iron compounds, especially iron compounds of proteins and of their decomposition products, as catalytic agents for the liberation of oxygen from its compounds.—A. S.

Sulphuric acid; Kessler's apparatus for concentrating ——. J. Teisset, Clermont-Ferrand, and L. Prat, Paris. Eng. Pat. 14,300, June 18, 1909. Under Int. Conv., Dec. 31, 1908.

See Fr. Pat. 398,212 of 1908; this J., 1909, 937.—T. F. B.

Sulphuric acid; Method of making —— from "smelter" gases, etc. U.S. Pats. 962,493 and 963,020. *See* X.

Carbonic acid gas; Process for the manufacture of ——. A. E. Knowles, Sutton Coldfield. U.S. Pat. 963,586, July 5, 1910.

See Fr. Pat. 380,631 of 1907; this J., 1908, 23.—T. F. B.

Soda-lye evaporator. C. P. Carlson, Långbron, Sweden (E. Carlson, executrix), Assignor to J. H. Wallace and Co., New York. U.S. Pat. 964,390, July 12, 1910.

See Ger. Pat. 199,218 of 1907; this J., 1908, 956.—T. F. B.

Ammonia; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 30,380, July 5, 1909.

See Fr. Pat. 405,712 of 1909; this J., 1910, 424.—T. F. B.

Cyanides; Treatment of metallic —— for the obtainment of hydrocyanic acid therefrom. W. Feld, Hönningen on Rhine, Germany. Eng. Pat. 12,226, May 24, 1909.

See Fr. Pat. 922,409 of 1909; this J., 1909, 656.—T. F. B.

Copper salt; Process of manufacture of a —— specially suited for preparing ammoniacal copper oxide. P. Friedrich, Halensee, Germany. Eng. Pat. 29,385, Dec. 15, 1909. Under Int. Conv., Dec. 15, 1908.

See Fr. Pat. 410,882 of 1909; this J., 1910, 811.—T. F. B.

VIII.—GLASS; CERAMICS.

Lead in earthenware and china; Report of Departmental Committee on use of ——. [Cd. 5219.] Wyman and Sons, Fetter Lane, London, E.C. Price, 1s. 5d.

Three courses were open to the Committee—(a) to prohibit the use of lead altogether, (b) to make compulsory the introduction of lead, whenever used, as the insoluble bisilicate, (c) to maintain, or modify slightly, the present conditions in which lead may be used in any form subject to compensation for plumbism, under the Workmen's Compensation Act of 1906. Owing to the impossibility of expert opinion coming to any agreement on the first two points mentioned above, the Committee were obliged to leave things largely as they were. The schedule of dangerous processes has been amended and now runs as follows:—

Part I.—Lead processes. Making or mixing of frits, glazes, or colours containing lead. Dipping or other process carried on in the dipping house. Application of majolica, or other glaze, by blowing, painting, or other process. Drying after the application of glaze by dipping, blowing, painting, or other process. Ware cleaning after the application of glaze by dipping, blowing, painting, or other process. Glost placing. Preparation and weighing out of "flow" material. Ground laying, including the wiping off of colour after this process. Colour dusting and colour blowing, whether on-glaze or under-glaze, including the wiping off of colour after each of these processes. Colour grinding for colour-blowers. Lithographic transfer-making. Any other process in which materials containing lead are used or handled in the dry state, or in the form of spray, or in suspension in liquid other than oil or similar medium; provided that the stopping of biscuit ware with a material containing lead shall not be deemed to be a process included in this schedule.

Part II.—Other processes. Scouring of biscuit ware which has been fired in powdered flint. Emptying of biscuit ware which has been fired in powdered flint from the baskets or other receptacles in which it has been conveyed to the biscuit warehouse or scouring shop.

Other changes recommended in the report are very slight. Milk must be provided for women and young persons working in scheduled lead processes who commence work before 9 a.m. Mess-rooms and facilities for heating food are necessary. In a minority report by Miss Tuckwell, it is suggested that employers who adhere to the use of raw lead should be made to pay full wages to workers during absence through plumbism, instead of the half wages stipulated by the Act of 1906. The Committee are satisfied that low-solubility ware eliminates plumbism but lay stress on the fact that plumbism is not the only evil attendant on pottery-manufacture, as pulmonary diseases cause thirty times as many fatalities as lead-poisoning, and this can only be remedied by better ventilation.—H. H. S.

Lead glazes; Contributions to the knowledge of the properties of ——. H. Eisenlohr. Sprechsaal 1910, **43**, 389–391.

In a recent paper issued by the Reichsgesundheitsamt "On the knowledge of the plumbiferous glazes, and the lead extracted from them by acid liquids," the hypothesis i advanced that easily soluble lead compounds, such a lead oxide or lead monosilicate, are present in an amoun corresponding to the degree of dissociation incident to the temperature of solidification. The author has tested some stoneware glazes for the solubility of the lead according to the method given in the paper, and found marked differences in the results obtained. Samples of the glazes were powdered to pass a sieve of 5000 meshes to the square cm., and 2 grams boiled for half an hour with 100 c.c. of 4 per cent. acetic acid, in an Erlenmeyer flask, under a reflux condenser. After cooling, 20 c.c. of the filtered liquid were diluted with 50 c.c. of water, and the lead precipitated by adding an excess of a known volume of a solution of potassium bichromate, 1 c.c. of which is equivalent to 1 mgrm. of lead. After standing 10 minutes the liquid was filtered, and 5 c.c. of a 10 per cent. potassium iodide solution, and 10 c.c. of 20 per cent. sulphuric acid added, and after standing at least half an hour, the liberated iodine was determined with a standard solution of sodium thiosulphate, 1 c.c. of which was equivalent to 1 c.c. of the potassium bichromate solution, and from these data the amount of lead was determined. Experiments were made upon four glazes comprised in the formula $\begin{matrix}0{\cdot}3\mathrm{K_2O}\\0{\cdot}7\mathrm{PbO}\end{matrix}+0{\cdot}1$ or $0{\cdot}2\ \mathrm{Al_2O_3}+2{\cdot}0$ or $2{\cdot}5\ \mathrm{SiO_2}$. The components were fused in a crucible in an electric furnace and part of the mass rapidly cooled by pouring it into water, and the remainder allowed to cool slowly in the furnace. In the glazes with 2·0 molecules of silica, more lead was dissolved from the glaze with 0·1 molecule of alumina, than from the glaze with 0·2 molecule of alumina but from the glazes with 2·5 molecules of silica, the amount of lead dissolved was the same, and was not diminished by the presence of an increased quantity of alumina. The amounts of lead dissolved were independent of the percentages of lead oxide present, and in all cases were much less from the slowly cooled, than from the quickly cooled glazes. The amount of lead which can be dissolved from a glaze, rapidly cooled by pouring it into water, is, however, no criterion of the amount which would be dissolved from the same glaze, when fired on to a body. For example, a rapidly cooled glaze gave up 35·9 per cent. of its lead content to the acetic acid treatment, but only 8·4 per cent. of lead was dissolved from the same glaze when fired on to a stoneware body. Some of the glazes were remelted and tested, and the solubility of the lead decreased, as the duration of cooling was increased. When the glazes were slowly cooled, less lead was also dissolved from those which had been heated to a high temperature (1400° C.) than from those which had been heated only to lower temperatures. The amount of lead dissolved is also influenced by the nature of the other raw materials used in compounding the glaze.

As a continuation of his work on leadless glazes (this J., 1910, 491) the author finds with glazes of the general formula :— $0{\cdot}3R_2O,0{\cdot}7PbO,0{\cdot}1Al_2O_3,2SiO_2$, the melting points increase when the R_2O constituent is Na_2O, then K_2O, BaO, CaO, and MgO. Starting with the glaze $PbO,0{\cdot}1Al_2O_3,1{\cdot}5SiO_2$ and increasing the silica content by 0·25 molecule, the melting points were found to increase as the silica content increased.—W. C. H.

Cast-iron ; Enamels for ——. J. Grünwald. Stahl u. Eisen, 1910, **30**, 1201—1206.

A review of the enamel industry is given (see this J., 1909, 204, 600), and the composition of enamels for cast-iron is discussed, with special reference to the expansion and liability to crack of lead enamels. The use of appreciable amounts of baryta, and lime, or large amounts of fluorspar is not to be recommended, while the proper burning in the muffle in the absence of deoxidising gases is essential. A reliable product is only obtained by the use in the frit of the best tin oxide and natural cryolite. Enamels containing lead are very deceptive as to their brilliancy and fusibility, and the lead can be completely replaced by borax. The following are types of such replacing enamels :—

$$\left.\begin{array}{l} 0{\cdot}322\ PbO \\ 0{\cdot}579\ Na_2O \\ 0{\cdot}096\ MgO \end{array}\right\}\ 0{\cdot}067\ Al_2O_3 \left\{\begin{array}{l} 0{\cdot}419\ B_2O_3 \\ 2{\cdot}000\ SiO_2 \\ 0{\cdot}225\ F_2 \\ 0{\cdot}354\ SnO_2 \end{array}\right.$$

$$\left.\begin{array}{l} 0{\cdot}747\ Na_2O \\ 0{\cdot}220\ K_2O \\ 0{\cdot}033\ CaO \\ 0{\cdot}002\ MnO \end{array}\right\}\ 0{\cdot}374\ Al_2O_3 \left\{\begin{array}{l} 0{\cdot}68\ B_2O_3 \\ 2{\cdot}00\ SiO_2 \\ 0{\cdot}85\ F_2 \\ 0{\cdot}34\ SnO_2 \end{array}\right.$$

The lead oxide should not exceed 25 per cent., and the addition of ammonium carbonate is strongly recommended to produce a good surface. A useful cast iron is one containing 3·5 per cent. of carbon, 2·0 of silicon, 1·5 of phosphorus, and 0·6 of manganese.—A. H. C.

Patents.

Glasses and other products ; Radioactive —— *possessing permanent activity.* H. Farjas. Fr. Pats. 411,099, April 2, 1909, and 411,629, April 14, 1909.

(1). Radioactive sulphates or carbonates, or pure radium sulphate, are used in the manufacture of glasses, which may be transparent or opaque, and of any required shape. The glasses possess permanent radioactivity, and are applicable to scientific, medical and industrial purposes. (2). Radioactive substances are mixed with materials which can be brought into a liquid or pasty condition, and when left to themselves, solidify, such as pottery bodies, lime, cement, etc. With such a mixture large radioactive articles can be cast or moulded.—W. C. H.

Bricks, tiles, and other similar materials ; Continuous kiln for burning ——. J. Treuil, A. Maurs, and D. Auclair. Fr. Pat. 411,470, Jan. 11, 1910.

Pairs of passages for the escape of the hot gases are arranged at suitable distances along the kiln, one in the exterior wall, and the other in the median longitudinal wall. These passages communicate with circulation flues arranged below the floor of the kiln, and the flues in turn communicate through dampers, with an underground channel connected with the chimney. Owing to the simultaneous withdrawal of the gases, to the right and left of the chambers and the forced circulation of the hot gases in the interior and exterior walls and under the floor of the kiln, a more regular distribution and better utilisation of the heat is obtained, and the draught is increased owing to the reduction of the friction of the gases.—W. C. H.

[*Bath-brick substitute.*] *Process for converting the waste products and refuse from glass works into an article of commerce.* The Britannia Patent Firelighter Co., Ltd., and W. Barker, St. Helens, Lancs. Eng. Pat. 14,393, June 19, 1909.

Glass works refuse, consisting principally of sand, emery, pumice stone, and glass particles, is first pulverised in a rotary drier, and then passed through a refining machine to eliminate the coarse material. The fine powder, either alone or formed into bricks, is used for cleaning metallic articles or the like.—F. R.

Enamelling cast-iron articles, and especially pots and cooking utensils ; Process of ——. (Ancienne Maison Godin). Soc. du Familistère de G. Colin et Cie. Fr. Pat. 411,630, April 14, 1909.

The interior surface of the pots is polished and then oxidised into a layer of magnetic oxide of iron, to which the enamel is applied by the wet process, and as liquid as possible. —W. C. H.

Silicides ; Manufacture of metallic ——. G. Strauss, Assignor to Comp. Générale d'Electro-Chimie de Bozel, Paris. U.S. Pat. 964,459, July 12, 1910.

See Fr. Pat. 388,730 of 1908 ; this J., 1909, 948.—T. F. B.

IX.—BUILDING MATERIALS.

Quartzites ; Utilisation of —— *for refractory purposes.* F. Wernicke and W. Wildschrey. Tonind.-Zeit., 1910, **34**, 688—690, 723—727, 768—773.

The authors give a detailed review of the chief quartzite deposits in Germany, with special reference to their structures, geological formations, and to the foreign minerals with which they are usually associated. They distinguish three classes of quartz, namely, crystalline, amorphous, and weathered or secondary quartz, which has been derived by the decomposition of complex silicates. The petrographical characters of the quartzites belonging to these three classes, and the appearance of their rock sections under a microscope between crossed nicols, are described in detail. The authors conclude that the applicability of a quartzite for the manufacture of silica bricks depends chiefly upon its melting point and upon its change in volume at high temperatures. Quartzite with too low a percentage of silica, on the one hand, has too low a melting point for silica brick purposes ; pure crystalline or amorphous quartz, on the other hand, expands too much after heating and cooling, even after numerous successive operations, to make a strong or safe refractory brick. The only class of quartzite that is thoroughly suitable for making true " Dinas " silica bricks, is a weathered quartzite, containing a sufficient but not excessive proportion of natural cement, or binding material, and only a small proportion of muscovite and foreign minerals. Suitable raw material is best recognised by its appearance under the microscope between crossed nicols, and by determination of its melting point, chemical analysis being superfluous. Bricks made from 98 parts of suitable silica and 2 parts of lime, should expand about 4 per cent. after the first kilning, and in a rapidly decreasing degree on subsequent heating and cooling operations, till they reach constant volume after they have been fired for the eighth time.—O. R.

Mortar and concrete; Experiments with frozen and rethawed ——. H. Burchartz. Mitt. Kgl. Materialprüfungsamt, 1910, **28** 276—282.

Experiments were made to determine the effect of frost, if any, on the subsequent hardening properties of cement, mortar and concrete, these having been previously mixed ready for use. *Cement.*—Tests were made on two samples of cement, which had been prepared in the dry and wet ways respectively. The cements were mixed with water to a stiff paste, and the times taken for hardening to begin, and for complete setting, under the conditions given below. The temperature and humidity of the air were noted. (1). The cements were allowed to set under normal conditions. (2). They were kept as nearly as possible at a temperature of 0° C. (3). They were subjected to a temperature of −10° C. for (*a*) 3 hours, (*b*) 24 hours, and (*c*) 3 days. These frozen samples, at the expiration of the time stated, were broken up with the hammer, and after being allowed to thaw, were stirred for 3 minutes. The times for hardening and setting were measured from this point. It was found that preliminary freezing did not affect the times of hardening and setting. The samples kept at 0° C. however, were about 4 times as long as the others in reaching each stage. *Mortar and concrete.*—The same cements were used to make mortar and concrete. The mortar consisted of 1 part by weight of cement to 3 parts by weight of standard sand. The concrete was made up of 1 part of cement to 5 parts of gravel. Two classes of each were prepared, sufficient water being added to make the mixture (1). "earth-damp," and (2) wet. Test pieces were made (1) immediately after mixing, (2) after subjecting to a temperature of about −14° C. for (*a*) 3 hours, (*b*) 24 hours, (*c*) 3 days, and subsequently thawing. The test pieces were allowed to set under damp sand, some for 7 days, and the remainder for 28 days. Tensile and crushing tests were then made. The results showed that cooling for a few hours only had a negligible effect on the hardening of mortar and concrete, but that the rate of hardening was much lower after a prolonged freezing. They also showed in a striking manner that the falling-off of the rate of hardening due to the preliminary freezing was relatively much greater for the "earth-damp" than for the wet mixings.—T. St.

Thermal conductivity of fireclay; Measurement of ——. J. K. Clement and W. L. Egy. Met. and Chem. Eng., 1910, **8**, 414—416.

The test pieces were made into cylinders about 40 cm. long and 12 cm. in diameter with a hole through the centre for the reception of the heating coil and four longitudinal holes, about 3 mm. in diameter, for the reception of thermo-couples for the measurement of the temperature. The temperature inside was raised to from 400° to 900° C. during a period of from three to five hours, and the current then kept constant for two or three hours more. When the outer couple showed a temperature constant to $\frac{1}{10}$° C., the readings were taken. The cylinder was then broken across and the distances of the holes from the centre measured. From these data, together with the voltage and current readings of the heating coil, the conductivity can be calculated. It was found that in the case of two coarse fireclays the conductivity was constant at 0.00264 and 0·0036 gram calories per cm. per second per degree C. respectively, while in the case of two finer fireclays there was an increase from 0·0021 at 350° C. to 0·0022 at 600° C., and from 0·00245 at 500° C. to 0·0026 at 800° C. respectively. Knowing the thermal conductivity of brick, the dimensions of a furnace, and the outside temperatures of the walls, the quantity of heat transmitted through them may be calculated. In the case of a 210 H.P. Heine boiler this was found to be 43,400,000 calories per hour.—H. H.

Report of Inspector of alkali works. See VII.

Patents.

Cement from blast furnace slag; Process of manufacture of ——. H. Kühl. Fr. Pat. 411,016, Dec. 21, 1909 (under Int. Conv., Dec. 22, 1908), and First Addition, dated Dec. 22, 1909; under Int. Conv., Nov. 19, 1909.

Considerable quantities of gypsum are added to rapidly cooled blast-furnace slag, or to mixtures of two kinds of slag, before, during or after grinding. At the time of manufacture, or of mixing the cement, the requisite quantities of gypsum may also be produced by oxidation, or by interaction of the materials present in, or subsequently added to the slag. In any case the quantity of gypsum exceeds the limit of 2 per cent. fixed for the uniform delivery of Portland cement. A specially fused mass may be produced from the primary constituents of the cement, and a considerable quantity of gypsum added to it, or the requisite quantity of gypsum may be obtained, at the time of manufacture or of using the cement, by oxidation or other chemical reaction, from the additional materials present in the fused mass, or subsequently added thereto. A cheap calcareous cement may be made from lime mixed with larger or smaller quantities of cement, obtained from gypsum and blast-furnace slag, or from gypsum and a specially fused cement mass, or the mixture of the materials may be made at the actual time of manufacture. The cement obtained from gypsum and blast-furnace slag, or from gypsum and a mass of fused cement, may be mixed with natural or Portland cement.—W. C. H.

Stone; Artificial ——. T. M. Thom, Cheshunt, Assignor to The Lithographic Stone and Marble Co., Ltd., London. U.S. Pat. 963,337, July 5, 1910.

See Eng. Pat. 20,070 of 1905; this J., 1906, 1097.—T. F. B.

Cement; Composition of matter to be used for making acid-proof ——. H. Kayser, Darmstadt, Germany. U.S. Pat. 964,164, July 12, 1910.

See Eng. Pat. 24,718 of 1908; this J., 1909, 984.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

The lead coulombmeter, and method for the determination of tin and antimony in presence of each other. F. Fischer, K. Thiele, and E. B. Maxted. Z. anorg. Chem., 1910, **67**, 302—316, 339—356.

Solutions of the lead salts of borofluoric acid and of the complex fluoric acids containing aluminium, silicon, titanium, zirconium, tin, arsenic, and antimony have been examined, with respect to their possible application in the lead coulombmeter; only lead borofluoride and silicofluoride, and probably also the zircofluoride and stannifluoride are useful for this purpose. With (A) the borofluoride, the best electrolyte to use contains about 150 grms. of lead and the same weight of free borofluoric acid per litre, and a like concentration is suitable with (B) the silicofluoride. A solution of (C) lead *p*-phenolsulphonate (85 grms. of lead per litre) containing an equal weight of free *p*-phenolsulphonic acid, may also be used as the electrolyte. The limits of current density between which accurate results are obtained are for (A) 0·14—14·0, for (B) 0·14—11·0, and for (C) 0·14—4·9 amps. per sq. dm. Preference is given to the borofluoride electrolyte, and, on account of the high equivalent weight of lead and its wide range of accuracy, the lead coulombmeter is considered superior to that with copper. Addition of colloids (gelatin or agar-agar), to the extent of 0·1—1 grm. per litre prevents crystallisation of the deposit, and does not affect the accuracy of the result. Low temperatures work unfavourably, but a rise of temperature to 40° C. improves the character of the deposit, which is prepared for weighing by washing with water and alcohol and drying *in vacuo*. Incidentally a method of separation of tin and antimony is described in outline, depending on the fact that antimony is precipitated as sulphide from a solution of antimonifluoric acid but tin is not precipitated from stannifluoric acid. A solution containing the two metals is, therefore, first oxidised and then precipitated with hydrogen sulphide; the mixture of stannic sulphide and antimony pentasulphide is then dissolved in hydrofluoric acid, and hydrogen sulphide is passed into the solution; this precipitates the antimony as sulphide which is filtered off (using a funnel of caoutchouc or paraffined glass), and the filtrate is evaporated with strong sulphuric acid in a platinum dish, the residue being taken up with water, and the tin precipitated as sulphide.—F. Sodn.

Foundry coke; Specifications for ——. R. Moldenke. Met. and Chem. Eng., 1910, **8**, 400—401.

To obtain complete combustion, which is desirable in foundry work, the coke should be as dense as possible. It is recommended that premiums and penalties should be granted or charged based upon the following analysis of an average grade of foundry coke, viz. volatile matter 1·00 per cent., fixed carbon 85·50, ash 12·00, and sulphur 1·10 per cent., the material being rejected if these figures exceed 2·50, 15·00, and 1·30 per cent. in the case of the volatile matter, ash, and sulphur respectively, or fall below 78·50 per cent. in the case of the fixed carbon. A shatter test consisting in dropping about 50 lb. of the coke a distance of 6 ft. four times on to a cast iron plate, screening the material through a 2-in. sieve, and estimating the amount of fine coke thus produced, is recommended, the percentage of fine coke above 5 per cent. being paid for at breeze prices.—H. H.

Blast furnace; Grüner's ideal working of ——. J. W. Richards. Met. and Chem. Eng., 1910, **8**, 403—404.

Grüner's statement that the blast furnace works most economically when the largest proportion of the solid carbon of the fuel is oxidized by the blast before the tuyères, the smallest part being oxidized above the tuyères by the oxygen of the solid charges, does not hold when the amount of carbon monoxide (which must be produced at the tuyères in order to generate enough heat to effect the smelting) is insufficient to reduce the iron oxides in the charge. In such a case economy is best secured by reduction with solid carbon. Such conditions prevail in charcoal furnaces working with rich ores producing very little slag, and also where the temperature of the blast is raised above a certain point by removing moisture, introducing nitrogen oxides, or otherwise.—H. H.

Blast-furnace; Economy in fuel by air heating and drying. F. Wüst. Metallurgie, 1910, **7**, 403—415.

The opinions are discussed of various authorities on blast furnace practice upon the utility of drying and heating the air used for the blast, and the author has collected and tabulated the results obtained at many works from cold and hot blast and from damp and dry blast respectively. If the air be wet, water-gas is produced which reacts with the carbon dioxide according to the equation $CO_2 + H_2 = CO + H_2O$ producing a considerable rise of temperature in the higher parts of the furnace, so that the ferrous oxide reacts with the calcium sulphide to produce lime and ferrous sulphide and hence an iron richer in sulphur. By drying the air, a saving of at least three per cent. of heat and consequently of fuel can be effected, and if the high temperature can be restricted to the boshes its greater concentration could effect a saving even of 12 per cent. To determine the position of the oxidising zone, details of the analysis of the gases drawn off from above the tuyères are given, and graphically tabulated. The author concludes that every precaution which tends to narrow the oxidising zone above the tuyères leads to favourable yields of metal, and that drying and heating the blast are suitable means of effecting this, and that the Linde process of drying the air is very efficient. It is further suggested that in the Cowper stove, by blowing in combustible gas or dust, a blast at a temperature far higher than 800° C., consisting of oxygen, carbon dioxide, and nitrogen could be led into the furnace, which would still further restrict this oxidising zone not only producing a saving of fuel but a more rapid passage of the charge. One experiment is quoted in which 20 kilos. of dry tar per metric ton were injected into a Thomas furnace producing a temperature of 1150° C., but no details could be given owing to the fusion of the air pipes after twelve hours' running. A list of the authorities and literature consulted is given.

—A. H. C.

Hydrogen in blast furnace gas; Quantitative investigation of source of ——. R. J. Wysor and W. D. Brown. Met. and Chem. Eng., 1910, **8**, 393—394.

The authors calculate from analyses of the coke and air entering a blast furnace that the maximum quantities of hydrogen in the furnace gases which could be derived from these sources would be 1·30 and 0·72 per cent. respectively, whereas 4·3 per cent. was actually found. The additional hydrogen was not due to leakage at the water-cooled valves, and it is suggested that it may have been derived from the dissociation of the combined water contained in the iron ore, which may take place at a higher level in the furnace than is generally supposed. At the moment when the material in the furnace slips down, the percentage of hydrogen may rise to as much as 39 per cent.—H. H.

Iron and its oxides; Action of —— *at a red heat on carbon monoxide.* A. Gautier and P. Clausmann. Comptes rend., 1910, **151**, 16—22.

When carbon monoxide is passed over metallic iron (steel pianoforte wire) heated to redness, carbon dioxide and carbon are produced, but if the temperature be sufficiently high, the whole of the carbon may be taken up by the iron, with the formation of iron carbide. It was found impossible to prepare iron entirely free from oxide by passing a rapid current of hydrogen over ferric oxide heated to 700° C., but the product was used to study the action of carbon monoxide on a mixture of iron and its oxides at red heat. Carbon dioxide and carbon were produced, together with carbides of iron, ferrous oxide, magnetic iron oxide, and a small quantity of a substance soluble in hot potassium carbonate solution. Of the carbides of iron, one, probably, $Fe_{12}C$, was more readily attacked by 10 per cent. sulphuric acid, *in vacuo*, than the second, probably Fe_5C. With a given quantity of incompletely reduced iron, the production of carbon dioxide and carbon from the carbon monoxide continued indefinitely, and apparently the velocity of decomposition was accelerated by the carbon deposited. By the action of dilute sulphuric acid on the iron carbides mentioned above, methane and hydrogen were liberated, and, judging from the odour, a small quantity of cyclic petroleum hydrocarbons (naphthenes). In view of this latter result, the authors examined the action of superheated steam on the carbides, with a view of discovering a possible mode of formation of petroleum. At 500°—600° C., hydrogen, a small quantity of methane and a trace of formaldehyde were produced, whilst at 700°—800° C., more methane was formed and also carbon monoxide and dioxide. Moreover even below 500° C. indications were obtained of the production of cyclic hydrocarbons, and the quantities of the latter increased with the temperature. The authors are of the opinion that under the high pressures prevailing under natural conditions, the results described indicate a probable mode of formation of the cyclic hydrocarbons (naphthenes) of petroleum.

—A. S.

Special steels; Heat treatment of ——. L. Guillet. Revue de Métall., 1910, **7**, 489—495. (See also this J., 1909, 713.)

Special steels may be classified as follows:—1. *Perlitic steels*—the most important and frequently used. 2. *Martensitic steels*—but little used, because of the difficulty of working them. 3. *Polyhedric steels*—which are losing ground, on account of their high price, or their low elastic limit, but some of which are employed for special uses, because of their high resilience, resistance to wear, coefficients of expansion, or reputed resistance to oxidation. 4. *Carbide steels*—including all the high-speed tool steels and certain chromium steels. *Perlitic steels*: The heat treatment of these should be similar to that of ordinary steels, *i.e.* they should be quenched from a temperature slightly above the highest transformation point, having been kept at this temperature long enough to ensure complete solution of the carbide. The time of heating may be advantageously shortened by raising the temperature, but the metal must be allowed to cool again to the proper temperature before quenching. Special perlitic steels (nickel steels, etc.) cannot be treated exactly as similar carbon steels, for, first, the solution of the cementite they contain is effected with difficulty, so that the time of heating must be prolonged or the temperature raised, and second, some of them (manganese, chromium, vanadium, tungsten, molybdenum) are very sensitive to annealing, whilst others (nickel, silicon) are but little affected by it, which simplifies greatly their treatment after cementation. *Martensitic steels* as a whole are but little used; but one class of them is valuable—those, namely, which when cooled slowly show a purely perlitic structure, but when cooled quickly are martensitic, and have the corresponding mechanical properties. In quenching these steels, it is not necessary to specify the temperature precisely: it is enough that it should be well above the transformation-temperature of 350°—450° C. In regard to these steels, it must be remembered that very slight variations of composition produce very serious changes in structure, making them pass into the completely martensitic or the completely perlitic class. *Polyhedric steels:* There is a practice of quenching these steels at a very high temperature to make them more "sweet," and workable. This practice is entirely to be condemned, for it enormously lowers the elastic limit—many accidents which have occurred with high-nickel steels are attributable, in the author's opinion, to this treatment. Steel so treated shows a structure analogous to that of "burnt" steels. *Carbide steels:* The conditions of quenching should be such as to secure that after treatment no undissolved carbide remains and that the martensite formed may be extremely fine. These complex carbides dissolve in iron less easily than cementite, and each requires individual treatment—*e.g.*, the carbides in some of the tungsten and molybdenum steels dissolve at 850° C., those in certain chromium steels not below 1200° C., and those in some high-vanadium steels will not disappear at any temperature. In each case, when a certain temperature is reached, solution of the carbides will begin, and time and additional rise of temperature are then factors which may substitute one another; usually, the best treatment is short time at high temperature, (provided the steel is not injured by the high temperature), as the risk of surface decarburisation is less.—J. T. D.

Widmanstädten's figures; Artificial reproduction of —— in carbon steel. N. Belaiew. Revue de Métall., 1910, **7**, 510—521.

In certain steels which had been cooled with extreme slowness, sections were found to show Widmanstädten's figures quite as clearly as many meteorites. The author's view is that the first crystallisation from a molten steel is octahedral iron, and that when the cooling is extremely slow these octahedra have time to assume the same orientation. During cooling after solidification, secondary crystallisation sets in, and lamellæ are formed in four directions in the octahedron. According as the section taken is parallel to the face of the related cube, the octahedron, or the dodecahedron, or at an angle with any or all of these, the crossing of two sets of lamellæ at right angles, of three sets at 60°, or of different systems both cut at an angle, is seen, and it is this which constitutes Widmanstädten's figures. These figures, therefore, are not peculiar to nickel-iron alloys, but should be also discoverable in carbon-steels, the behaviour of which on cooling is generally similar to that of the nickel alloys. Osmond has even observed a similar structure in Swedish iron very slowly cooled, and martensite is probably a case of the same structure, of very small dimensions, and modified by the various orientation of the original octahedra. Such a structure is characteristic of overheated steel, and dangerous from a mechanical point of view.—J. T. D.

Cementation; Theoretical and practical observations on ——. L. Guillet. Rev. de Métall. 1910, **7**, 496—500. (See also this J., 1909, 838.)

The several factors in the process of cementation are considered. *Steel.*—The speed of penetration, or rate of increase in thickness of the cemented layer, is independent, in carbon steels, of the content of carbon. The most suitable metal for cementation should not contain more than 0·12 per cent. of carbon, 0·30 of manganese, 0·30 of silicon. *Cement.*—The cementing mixtures now most in use are: Wood charcoal and barium carbonate (60 per cent. of charcoal), potassium ferrocyanide and bichromate, wood charcoal with 10 per cent. of common salt. Theoretically, the best cement would be a bath, liquid at the temperature of cementation, in which the pieces for cementation would be immersed; but no such bath, free from the serious defect of emitting poisonous fumes, has yet been suggested. In general, the best cement is one which will act gradually, and not "brutally"; but where only a thin layer of cemented material is desired, and fragility is not to be feared, such a "brutal" cement as ferrocyanide and bichromate may be used. A good cement, too, should be constant in its effects, and not be readily exhausted: such is the charcoal and barium carbonate mixture. *Time and temperature.*—These two factors affect the thickness of the cemented layer: experiments of the author's showed that at 850° C. the thickness after ½ hour was 0·1 mm., and after 8 hours 1·5 mm., whilst the corresponding figures at 1000° C. were 0·5 mm. and 3·0 mm. Investigations have been made as to the temperature at which cementation begins; whilst these have had as yet no definite result it may be taken as established that it does not occur at a practicable rate below 850° C. The ultimate effect of cementation is dependent not only on the circumstances enumerated above, but also on the subsequent heat treatment of the metal (see following abstract).—J. T. D.

Cemented steels; Heat treatment of ——. L. Guillet. Revue de Métall., 1910, **7**, 501—510.

The aim of heat treatment of cemented products is to obtain externally the great hardness of quenched hard steel, and internally a non-fragile core. The usual practice is, in the case of objects cemented at 850° C., to cool after cementation, then quench in water from 750° C., whilst, where the cementing temperature has been 1000° C., the products, after cooling, are first quenched from 1000° C. for the regeneration of the core, then again quenched from 750° C., to harden the exterior. Experiments by the author have shown that these methods of treatment are justified. Cementation is proved to have no special effect on the core, other than prolonged heating at the same temperature; and heating at 850° C. produces no mechanical deterioration, so that no regeneration of the core is needed where that temperature has not been exceeded in the cementation. Where the temperature has been 1000° C., however, quenching of the core is necessary, and no lower temperature than 1000° C., will make the metal homogeneous in a practicable time. Hence the quenching from 1000° C.; but as this produces a martensitic structure in the exterior a second quenching from 850° C. is necessary. It is not possible to judge of a cemented piece simply by the fineness of the fracture, for the size of the grains can be altered considerably by altering the mode of breaking. Most objects, after heat treatment, are tempered; the author has found that tempering for five minutes at 200° C., gives the best results. Experiments to ascertain the possibility of transferring by cementation other elements than carbon have so far given no very definite results; bronzes of different tin-content have absorbed tin one from another, but a steel bar nickelled externally showed no penetration of nickel.—J. T. D.

Cast-iron and steel; Use of ferro-titanium with ——. L. Treuheit. Stahl. u. Eisen. 1910, **30**, 1192—1201.

The metal was melted in a cupola or other furnace, and part of a charge run into a pan, when ferro-titanium containing either 25, 15, or 10 per cent. of titanium was added. No rise of temperature could be detected after the addition. There was no appreciable difference in the percentage of metalloids present, the sulphur being diminished by 0·003 per cent., and no titanium had been absorbed. A large number of tensile tests were made but no alteration of any marked character was observed, and the author states that there was no apparent hardening effect as the result of the addition of the ferro-titanium.

The paper contains a large number of tables of the results obtained, and is illustrated by twenty microphotographs of fractures.—A. H. C.

Ferro-titanium ; Use of —— in Bessemer rails. P. H. Dudley. J. Ind. Eng. Chem., 1910, **2**, 299—301.

Ferro-titanium has been found by the author to augment the toughness and ductility of the Bessemer rails of 0·5 carbon and 0·096 phosphorus which were designed for the New York Central Lines, 1908 specifications. The first service tests were very satisfactory, and these results have now been further verified by two winters' service. Whereas the plain Bessemer rails in a 6-inch 100-lb. section had developed a number of fractures, those containing ferro-titanium under the same experimental conditions passed through the unusually severe winter of 1909 without a single failure. It was observed that by the use of ferro-titanium the setting of the ingots was improved, and that there was a direct action upon the purification of the metal. Thus, by acting as a subsidiary deoxidiser in addition to reducing a large percentage of iron oxides in the steel, the ferro-titanium also reduced a portion of the nitrogen, in this way decreasing the brittleness and adding to the toughness of the metal. For the same carbon content the ductility averages higher and runs more uniformly for a larger number of heats when ferro-titanium is used than in ordinary Bessemer steel. Plotting the elongation (under the drop test, 2000 lb. falling 20 ft.) and the ductility, has been found by the author to be of great value in rail manufacture for high speed trains.—J. P. O.

Ferrosilicon manufactured in the electric furnace. F. W. Hinrichsen. Mitt. Kgl. Materialprüfungsamt, 1910, **28**, 283—292.

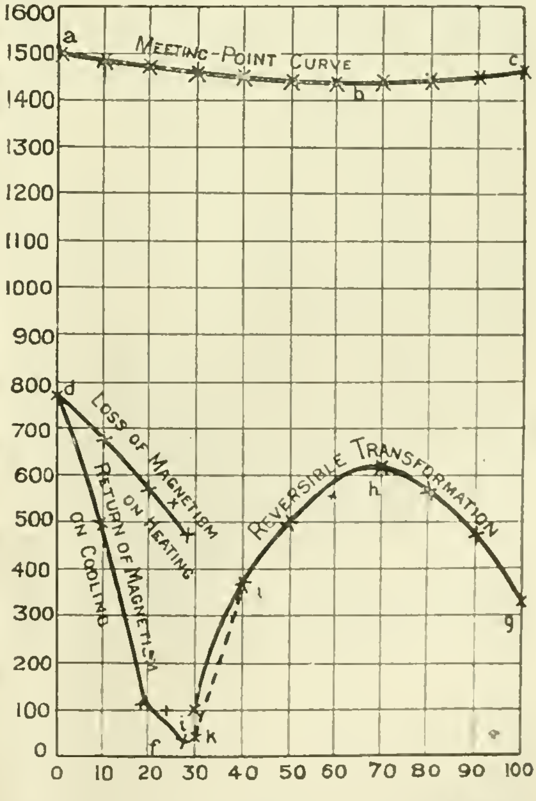
The author describes experiments made with 5 commercial samples of ferrosilicon manufactured in the electric furnace, and brings under review investigations made by other workers on the same material, with the view of establishing the cause of, and thereby devising means for preventing accidents arising from the poisonous and explosive gases which are given off by this material. In the experiments described, successive quantities of damp air were drawn over ferrosilicon broken down to the size of hazel nuts, and the phosphoretted hydrogen evolved was absorbed in potassium hypochlorite solution. In two cases, further quantities of phosphoretted hydrogen were obtained on allowing the samples, after the first treatment, to stand in a sealed vessel for some weeks. In this connection, Petrén and Grabe have shown (Teknisk Tidskrift, 1910, **7**, 283 and 289) that phosphoretted hydrogen is mechanically imprisoned in lumps of ferrosilicon. In none of the samples did the phosphoretted hydrogen obtained correspond with more than a small percentage of the total phosphorus present, nor were these amounts proportional. The silicon content seemed more the determining factor, the samples richer in silicon giving the smaller amounts of phosphoretted hydrogen. This gas is doubtless formed from calcium phosphide occurring as an impurity, and since a higher temperature is required for the production of the richer grades of ferrosilicon, we have, in the consequent decomposition at a high temperature of much of the calcium phosphide present, the probable explanation of the relation existing between the silicon content and the amount of phosphoretted hydrogen obtainable. None of the samples tested gave arseniuretted hydrogen. Lebeau (this J., 1910, 355) obtained hydrogen, phosphoretted hydrogen, and arseniuretted hydrogen by the action of steam on samples of ferrosilicon. He, also, found that the higher grades gave the smaller amounts of phosphoretted hydrogen and that none containing over 0 per cent. of silicon gave arseniuretted hydrogen. The author reviews the precautions recommended by various authorities, including the English Local Government Board (this J., 1910, 154). It is universally recognised that the most dangerous grades are those containing between 30 and 70 per cent. of silicon.—T. St.

Chrome-tungsten-steel ; Analysis of ——. F. W. Hinrichsen. Mitt. Kgl. Materialprüfungsamt, 1910, **28**, 229—246. (See also this J., 1909, 713.)

Tungsten should be precipitated quantitatively by benzidine hydrochloride, only in the absence of chromium. When this latter metal is present, precipitation with mercurous nitrate is much to be preferred. With regard to the determination of phosphorus, it was found that when this element was precipitated with ammonium molybdate from solutions containing tungsten, the precipitate always contained tungstic oxide. Attempts to precipitate phosphorus quantitatively as phosphotungstate were however not successful, either from neutral or acid solutions. Experiments were then made to devise a modification of Finkener's method so that tungsten would be kept entirely in solution when the phosphomolybdate precipitate was formed. It was found that the phosphorus precipitate obtained either by the use of magnesia mixture or ammonium molybdate, could be freed from tungstic oxide by dissolving in nitric acid or ammonia, as the case may be, and filtering. The filtrate is treated with the other reagent. The steel may be dissolved in dilute nitric acid and the bulk of the tungstic oxide removed in the well-known manner by taking the solution to dryness and baking, etc. The phosphorus is precipitated as phosphomolybdate in the way usual for steels, and then any contaminating tungstic oxide is got rid of by successive precipitations of the phosphorus with magnesia mixture and ammonium molybdate, the tungstic oxide being removed from the solutions by filtration.—T. St.

Iron-nickel system. R. Ruer and E. Schüz. Metallurgie, 1910, **7**, 415—420.

Alloys were prepared by melting iron containing 0·08 per cent. of carbon, 0·06 of manganese, 0·01 of silicon, phosphorus, and sulphur, and 0·03 of copper, with electrolytic nickel containing as the only impurity 0·19 per cent. of carbon in a magnesia lined crucible in a kryptol furnace. The minimum solidifying point occurred at 1435° C. corresponding to 70 per cent. of nickel. The relationship



of the magnetic permeability to temperature and concentration of the nickel was also determined (see Fig.). In the rich irreversible alloys (30 to 100 per cent. of nickel) the temperatures at which loss of magnetisation occurred and its return on cooling were identical, and showed a maximum at the 70 per cent. nickel concentration, $FeNi_2$. Among the low nickel, irreversible, alloys (0 to 30 per cent. of nickel) the point *d*, conversion of *a* into *β* iron, occurred at 773° C. with a lag of about 7° C. attributed to the experimental conditions; the curve *de* gives the temperature at which the alloy lost its magnetisation on heating, while the curve *df* shows the temperature of its return on cooling. The point *g* at 365° C. is the transformation of the *β* non-magnetic nickel into the *a* magnetic nickel, and the curve *gki*, from 100 to 40 per cent. of nickel, shows the temperatures at which the transformations on heating and cooling of the reversible iron-nickel alloys were identical. The dotted curve *ik* shows the slight difference, on heating and cooling, in the temperature of transformation of the alloys containing from 30 to 40 per cent. of nickel. An alloy containing 27·5 per cent. of nickel was irreversible, while that containing 30·0 per cent. of nickel was reversible. The specific resistance of alloys varying only by 5 per cent. of nickel content was also determined. This showed a sharp rise from 25 to 40 per cent. of nickel with a maximum at 35 per cent., falling sharply again to 45 per cent. of nickel, there being then no great variation up to pure nickel, the existence of $FeNi_2$ at a 68 per cent. concentration not being in any way well defined.—A. H. C.

The Nickel industry. Times Eng. Suppl., July 20, 1910.

The world's production of nickel, which showed a marked increase during the years subsequent to 1900, has for the last few years remained fairly constant. The demand has been steady, but there seems very little doubt that it would have been much greater had the metal been obtainable at a slightly lower price. The price has been high chiefly through the instrumentality of the International Nickel Company, which has controlled prices in America and has succeeded in influencing outside markets. The properties of nickel in itself are such that it will always command a wide sphere of utility. Its resistance to the attack of alkalis, the difficulty with which it is corroded by most acids, its durability, and the high polish it is capable of taking place it high amongst the commoner metals. It is these properties which have led to its adoption for such purposes as field and ship cooking utensils and for replacing copper as coinage, while it has long been used for electro-plating, and in this respect is little inferior to silver, while obtainable at a much smaller cost. Nickel will alloy with most of the useful metals. Amongst such alloys the so-called German silver, which consists essentially of nickel, copper, and zinc, is most widely known. The most valuable properties of German silver are its white colour, its brilliant lustre, hardness, tenacity, toughness, malleability, ductility, and power of resistance to many chemical influences. The presence of cobalt does not seem to interfere with these properties. A new alloy known as monel metal, which consists of one part copper and three parts nickel, with a small amount of incidental impurities, has many excellent properties, chief of which is its great resistance to the attack of acids. It is the combination known as nickel steel, however, which utilizes most of the nickel mined at the present day. Nickel steel is principally used for armour plates, but the toughness of this alloy or mixture renders it also applicable for other purposes. Recent tests have shown its utility for rails and for rivets, and it has been adopted for the barrels of small arms. The presence of nickel, up to 20 per cent., in steel increases the elastic limit and breaking stress, and steels rich in nickel are practically non-corrodible. Alloys have been made containing a high percentage of nickel, but it has been found that for general purposes, taking into account the relatively high price of the metal (at present about £160 a ton), the best result is obtained with the greatest economy when it is present to the extent of about 2 per cent.

Until quite recently the entire nickel supply of the world was obtained either from the Sudbury district of Ontario Canada, or from the ores of New Caledonia. The other sources are still insignificant compared to these, but there is a possibility of great developments in the near future About 60 per cent. of the world's nickel supply is mined at the present time in the Sudbury district. As early as 1770 Canada's deposits in Algoma, which borders on Sudbury, were worked as a source of copper; but the true nature of the deposits was not recognized till in recent times the officers of the Canadian Geological Survey pointed out that they would probably be workable. The Sudbury deposits first attracted notice in 1883, during the construction of the Canadian Pacific Railway, and in 1886 they were first exploited for nickel. The ore in this district is mined and treated by two companies—the Canadian Copper Company and the Mond Nicke Company. A new company, the Diamond Nickel Copper Company, has started operations in the Northern range The ore of the Canadian Copper Company is chiefly raised from the Creighton mine, which is rich in nickel, while the Mond Nickel Company obtain their supply principally from the Victoria mines. The ore is smelted into a matte by the Bessemer process, and this matte, which contains about 40 per cent. of nickel and about the same amount of copper, is then shipped for the production of pure nickel, by the former to Constable Hook, Nova Scotia and other places, and by the latter to South Wales. The ores from the Cobalt district, worked for their high silver content, give the only other supply from Canada, but in this case the metal is only a by-product, and the nicke content is not reckoned with in the sales. There are indications of workable deposits further north in Canada. Returns for the nickel industry of Ontario in 1908 give the following figures:—Ore raised, 409,551 short tons; ore smelted, 360,180 tons; Bessemer matte produced 21,197 tons; nickel contents, 9,572 tons; copper contents, 7,503 tons. The ore also contains considerable amounts of silver, palladium, platinum, and gold.

All the ore in New Caledonia is exported to France Great Britain, and Germany for smelting, although plans have often been discussed for treating the ore on the island In Great Britain the ore is treated by the Glasgow Nicke Company at Kirkintilloch. The approximate output of nickel ores from New Caledonia during the year 1909 was 120,000 tons.

There are now two other countries which produce nickel. In Norway it is worked in the valley of Sötersdalen, not far from Christiansand. The output in 1908 was only 81 tons, but has now probably much increased Nickel was produced in the United States for the first time from its own ores in 1908, by the North American Lead Company, but the production was small. The Orford Copper Company and the Balbach Refining Company refine nickel, but obtain their supply from the Bessemerized matte from Sudbury or from other sources. A deposit of ore somewhat resembling the Sudbury ore has been found in Nevada, but has not been worked. Particulars of a recent development at Webster, Jackson County, North Carolina, were given lately. Dr. Hennig has worked out a process for direct reduction in the electric furnace of a nickel silicate ore found there. A product consisting of silicides of nickel and iron with some chromium, aluminium magnesium, and a little carbon is obtained, which can be applied directly to the manufacture of nickel steel. The production of ferro-nickel, nickel alloys, and metallic nickel is also contemplated. For refining nickel, or obtaining the metal from a nickel-copper matte, various processes have been adopted. The preparation of nickel oxide and direct chemical reduction gives an impure product as a rule. Formerly commercial nickel only contained about 94 per cent. of the metal, but in the last few years the commercial metal has greatly risen in purity. An analysis of one of the best makes of nickel would give figures of the following order:—Nickel 99·1 per cent., cobalt 0·4 per cent., iron 0·3 per cent., carbon 0·05 per cent., manganese 0·05 per cent., silicon 0·10 per cent. These figures and the nature of the elements present as impurities, of course vary according to the nature of the ore and the methods adopted in refining it. In the United States since 1894, electrolytic methods have been largely employed. Copper is deposited apart from the nicke in the actual electrolysis. Nickel is almost invariably deposited from solutions which have been made alkaline by the addition of ammonia, copper having been eliminated in a previous operation. In Germany, at the Papenburg works of the Allgemeine Elektro-Metallurgische Gesellschaft, an electrolytic process known as the Hoepfner process has been adopted. In America the chief processes which have been tried or adopted are the Thum process at the Bolbach Company's works, Newark, the process of the Orford Copper Company at Bayonne, New Jersey, the Brown process at Cleveland, Ohio, by the Canadian Copper Company, and the Hybinette process at Sault Sainte Marie.

The carbon monoxide process adopted by the Mond Nickel Company at their Clydach works in South Wales gives nickel of a very high degree of purity, seldom less than 99·9 per cent., the small trace of foreign elements left being carbon and iron. Since no other element present under ordinary conditions, with the exception of iron to a very limited extent, forms a carbonyl, the nickel is free from other metals, and especially from cobalt, which is separated only with extreme difficulty in other methods of refining. The metal appears on the market in the form of pellets varying in size up to 5/16 in. in diameter. The works at present turn out about 1,800 tons of nickel a year, but are being much enlarged. The future production of nickel, at any rate in so far as it will be used for the manufacture of nickel steel, will, it seems, lie in the formation of ferronickel by direct reduction in the electric furnace, and with cheap electric power, and by working possibly some of the sources of nickel not yet tapped, it seems probable that the price may be considerably reduced. There are indications, however, that vanadium, or mixtures of vanadium and chromium, if the former can be obtained sufficiently cheaply, may replace the use of nickel; but, whether or not it is superseded as a toughening addition to steel, the fact remains that pure nickel, by reason of its excellent properties as a metal, must always find its uses, and the extent to which it is employed will depend on its cost.

Bismuth from lead; Separation of —— and the analysis of bismuth-lead alloys. H. F. V. Little and E. Cahen. Analyst, 1910, **35**, 301—306.

The authors find that the formate method described by Benkert and Smith (this J., 1897, 164) is reliable for the separation of bismuth from lead, provided that the double precipitation recommended is carried out. The bismuth may be determined by dissolving the precipitate of bismuth basic formate in hot dilute nitric acid, diluting the solution to a volume of 250 c.c., neutralising the excess of acid by the addition of sodium carbonate, and precipitating the bismuth as phosphate. The filtrates containing the lead are treated with hydrogen sulphide, the lead sulphide is collected on a filter, and converted into sulphate in the usual way. The method was also applied, with satisfactory results, to alloys containing bismuth, lead, tin, and cadmium. The tin was determined in one portion of the alloy, and the remaining constituents in another, except when the tin was estimated electrolytically. From 0·5 to 0·7 grm. of the alloy was dissolved in nitric acid, the metastannic acid was filtered off, washed with hot dilute nitric acid, and redissolved in warm ammonium hydrosulphide solution. After filtration, the insoluble sulphides (which were present in small quantities as oxides in the metastannic acid) were dissolved in hot nitric acid and the solution added to the first filtrate. The latter was then evaporated to a small volume to expel most of the nitric acid, the solution was diluted to 300 c.c. with cold water, and the bismuth separated twice as basic formate in the manner described previously. The cadmium remained in the filtrate from the lead sulphate and was determined electrolytically from a cyanide solution. The tin was either determined as oxide in the usual way or by electrolysing the ammonium hydrosulphide solution of the metastannic acid.—W. P. S.

Cyanide solutions; Protective alkalinity in ——. R. Bell. Eng. and Min. J., 1910, **90**, 3. (See this J., 1910, 761.)

When testing for protective alkalinity in cyanide solutions, by converting the potassium cyanide into double cyanide with standard silver nitrate in the presence of potassium iodide, and titrating the residual alkalinity with standard sulphuric acid, an error may occur through the formation of additional potassium cyanide by the interaction of the slight precipitate of silver cyanide with the potassium iodide. The author suggests determining the free cyanide by silver nitrate solution and the total alkalinity in a different portion, by titration with sulphuric acid, using Schuchardt's methyl orange as indicator, and estimating the protective alkalinity by difference.—F. R.

Cyanide solution; Precipitation of gold from —— by carbon in lime. E. H. Croghan. J. Chem., Met. and Min. Soc., S. Africa, 1910, **10**, 391—393.

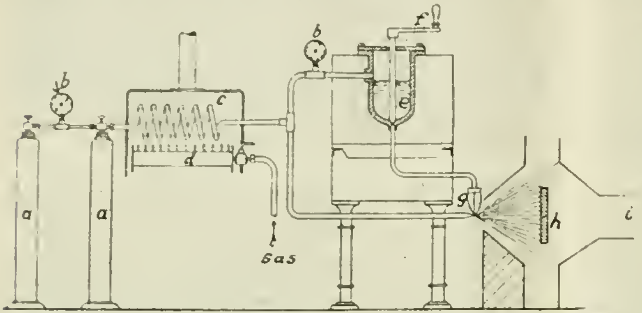
Experiments were made to ascertain to what extent the trace of carbonaceous matter, present in the lime used as protective alkali in the cyaniding of gold ores, is responsible for the precipitation of gold in the treatment tanks. (See also Caldecott, this J., 1909, 658.) Ten tests were made using 500 c.c. of a cyanide solution, containing 1 dwt. of gold per ton and the equivalent of 10 lb. of lime, containing from 0·45 to 0·01 per cent. of carbon respectively. The weight of gold obtained from those tests containing 0·1 per cent. of carbon or over, in the lime was only 0·01 The author however suggests that lime that contains 0·3 per cent. of carbon or over should not be accepted for cyanide work.—F. R.

Platinum-rhodium thermoelement; The ——, from 0° to 1755°. R. B. Sosman. Am. J. Sci., 1910, **30**, 1—15.

The author, with Day (this J., 1910, 282) has compared the platinum-rhodium element with the nitrogen thermometer between the melting points of zinc and palladium. In the present paper the comparison is continued downward, using the boiling-points of benzophenone, naphthalene, and water, and upward, by making a determination of the E.M.F. of the couple at the melting point of platinum. This temperature is taken as 1755° C., on the ground that all the published optical determinations, whilst they differ as to the absolute figure, agree that the difference between it and the melting point of palladium is 206°. Extrapolation of the curves of several thermo-elements with different percentages of rhodium confirms this figure very closely. The standard fixed points used are:—Ice, m. p., 0°; water, b. p., 100° + 0·037 (760 mm.); naphthalene, b. p., 217°·7 + 0·057 (760 mm.); benzophenone, b. p., 305°·4 + 0·063 (760 mm.); cadmium, m. p., 320°·2; zinc, m. p., 418°·2; antimony, m. p. (in carbon monoxide), 629°·2; silver, m. p. (in carbon monoxide), 960°·0; gold, m. p., 1062°·4; copper, m. p. (in carbon monoxide), 1082°·6; diopside, m. p., 1391°·2; nickel, m. p. (in nitrogen), 1452°·3; cobalt, m. p. (in nitrogen), 1489°·8; palladium, m. p., 1549°·2; platinum, m.p., 1755°. The method of interpolation used was to draw an arbitrary standard curve, approximately representing the relation between voltage and temperature, and to plot the deviations of each of the elements used from the standard curve. A complete table of figures for such a standard curve, for each 10° C., is given in the paper; the figures in microvolts for each of the fixed temperatures given above, beginning with naphthalene are:—1584, 2365, 2502, 3429, 5529, 9111, 10,296, 10,535, 14,231, 14,969, 15,423, 16,140, 18,613. The variation of E.M.F. with the percentage of rhodium in the alloy was also investigated, and found to be continuous within the limits of experimental error. The variation with temperature of thermo-electric power indicates the formation of solid solutions, but no compounds between 0 and 55 per cent. of rhodium.—J. T. D.

Metallic coatings; New process for production of ——. M. U. Schoop. Met. and Chem. Eng., 1910, **8**, 404—406. (See also this J., 1910, 700.)

The object to be coated is passed through a chamber, *i*, into which the molten metal from a crucible, *c*, is projected in a highly atomized condition. The spray is produced by forcing the metal from the crucible by an inert gas at a pressure of about 25 atmospheres into a very fine nozzle, *g*, where it meets a jet of gas previously heated in a coil, *c*, and passing at right-angles to the nozzle, *g*. By using an oxidizing gas at the jet a coating of oxide may be obtained in some cases, *e.g.*, lead peroxide may be



deposited in a firmly adhering film in this way. Alloys may be deposited by simultaneously spraying two different metals from separate jets. Among other applications the process may be applied, owing to the low temperature of the spray, to the coating of wood, paper, and glass, and it is suggested that balloons may be rendered gastight by the application of a very thin film of aluminium by this method. —H. H.

Cast-iron ; Enamels for ——. Grünwald. *See under* VIII.

PATENTS.

Precious-metal bearing materials ; Process of treating ——. P. W. Avery and E. C. Knowles, Deadwood, S.D. U.S. Pat. 963,111, July 5, 1910.

SULPHIDE ores, or products, containing precious metals are treated in the presence of a suitable oxidising agent, with a solution of caustic soda, or other basic substance capable of decomposing the sulphides present and liberating the precious metals, which latter are recovered in any convenient way, after the solution has been removed. —F. R.

[*Cyaniding.*] *Apparatus for dissolving metals and other substances.* S. Landau, London. From A. L. Landau, Tarkwa, Gold Coast, W. Africa. Eng. Pat. 16,546, July 15, 1909.

THE apparatus consists essentially of a self rotating feed pipe, for the introduction of cyanide solution, or other solvent, below the surface of ore pulp or slimes, whereby the latter are agitated and mixed. The end of the inflow pipe is fitted with a rotatable tube having an extension bent round at about right angles and having a tangential nozzle at its end. A series of inflow pipes, radiating from a common centre, may be furnished with rotatable ends, the whole being simultaneously lowered below the surface of the ore pulp.—F. R.

Furnaces for roasting, calcining, smelting, and treating ores, and for reheating billets, and heating metals generally. L. A. Smallwood, Birmingham. Eng. Pat. 14,812, June 24, 1909.

THE furnace consists of a single grate, or other source of heat, combined with a primary combustion chamber, the latter directly communicating, by means of dampers, alternately with one of a pair of heating chambers, the further ends of which are in communication with one another. The waste heat from the directly heated chamber passes back through the other on its way to the stack, and preheats a fresh charge of ore, which is subsequently directly heated by the reversal of the flow of the heated gases.—F. R.

Electric furnace for metallurgical purposes. H. F. D. Schwahn, Belleville, Ill. U.S. Pat. 962,532, June 28, 1910.

THE furnace consists of an annular chamber furnished with a number of electrodes and having an annular conical cover in register with it. The cover is provided with a centrally located hopper for charging, and outlets for gases and metallic vapours. An alternating current transformer is situated in the central space.—F. R.

Furnace ; Electric ——. J. H. Reid. Fr. Pat. 411,583, Jan. 15, 1910. Under Int. Conv., May 8, 1909.

THE furnace is provided with a fixed electrode, and with two inclined electrodes, which may be regulated, and which are opposed the one to the other, above and on each side of the first, thus forming a hopper for receiving the ore. A cooler is placed below to receive the metal and separate the lighter from the heavier elements. A perforated shaking plate is arranged with a slight inclination over which a current of water is ascending, so as to entrain the lighter elements and separate them from the metal which falls to the bottom of the cooler. Each of the movable electrodes is submitted to the action of an electric motor, in which the direction of rotation may be reversed by means of a galvanometer, when the voltage of the current passes a determined limit in one direction or the other, the separation of the electrodes being afterwards automatically regulated.—B. N.

Minerals or other finely divided materials ; Separation of ——. Huff Electrostatic Separator Co. Fr. Pat. 411,116, Dec. 3, 1909.

THE finely divided mineral, mixed with water, is subjected to the action of a halogen, or other suitable reagent, whereby the surfaces of the particles of the several components become differentiated as regards their aversion to, or attraction for, a given liquid such as water. Thus, the particles of certain components (such as zinc blende) become less susceptible to wetting, and consequently tend to float ; while other particles (such as those of iron pyrites) become more susceptible to wetting, and thus tend to subside. The process, as conducted in the apparatus described, is automatic and continuous, the chemical treatment and the separation by flotation and subsidence being effected simultaneously.—W. E. F. P.

Separation of ores and the like ; Process and apparatus for the ——. F. Wynne, Bagshot, Surrey, Eng. Pat. 12,266, May 25 and Nov. 24, 1909.

A MIXTURE of finely divided ore and water is mixed with oil, so that the metalliferous particles become coated with oil. The mixture is then concentrated on a constantly oiled endless travelling belt of plain or perforated sheet metal or metallic gauze, to which the oiled particles adhere. If required the adhering particles are removed by means of a revolving brush.—F. R.

Ore concentrating and separating apparatus. F. and H. Dallemagne, Passages, Spain. Eng. Pat. 4334, Feb. 21, 1910. Under Int. Conv., May 8, 1909. Addition to Eng. Pat. 11,684 of 1907.

AN improvement on the concentrating table described in the chief patent (see Fr. Pat. 378,895 of 1907, this J., 1907, 1203), consists in substituting an eccentric for the original device for modifying the surface movement of the table, the variations being obtained by altering the setting angle of the eccentric with regard to the operating lever.—F. R.

Metallurgical process. T. L. Willson and M. M. Haff, Ottawa, Canada. U.S. Pat. 963,345, July 5, 1910.

A MIXTURE of silicon, and at least one of the compounds of iron, aluminium or magnesium, is smelted with calcium carbide, with or without carbon, to reduce the metallic compounds to metal, with the production of calcium silicide.—F. R.

Briquettes ; Composition of ——. W. J. Shaw, Assignor to Int. Tool Steel Co., Ltd., Toronto, Canada. U.S. Pat. 963,400, July 5, 1910.

CLAIM is made for a briquette consisting of 100 lb. of magnetite sand, 10 to 20 lb. of powdered charcoal, 6 to 10 lb.

f sand and 10 to 20 lb. of caustic alkali or sodium caronate combined with starch from which glutinous material as been eliminated.—F. R.

leating or tempering metals; Electric furnace for ——, with indirect heating by means of a bath of fused metallic salts. Ateliers de Construction Oerlikon. Fr. Pat. 411,417, Jan. 8, 1910.

n the apparatus described, the containing vessel for the used salts is made of graphite or carbon, the current being upplied by metal, water-cooled terminals situated on ither side, or at the top and bottom, of the vessel according o its shape. The actual contact with the vessel is made y means of blocks of carbon, this arrangement (it is laimed) preventing action by the current upon the metal n the bath.—W. E. F. P.

ir for blast-furnaces, etc.; Process for drying ——, by calcium chloride, and apparatus therefor. F. A. Daubiné. Fr. Pat. 411,270, Jan. 4, 1910.

HE drying chamber is divided into compartments by a eries of hollow, water-cooled grates which support layers f calcium chloride. The latter is kept solid during its ydration by reason of the constant temperature at which is maintained on the cooled grates. When sufficiently ydrated—a point determined by calculation—the aterial is rendered anhydrous by the passage of hot aste gases through the chamber, the temperature of hich is allowed to rise gradually to a maximum of 235° C., hen, after cooling, the calcium chloride is again ready for se. It is claimed that, by the above procedure, the alcium chloride is continuously maintained in a solid and orous condition.—W. E. F. P.

teel; Manufacture of ——. A. Reynolds, London. U.S. Pat. 963,652, July 5, 1910.

OLTEN steel, containing oxygen in solution, together ith a portion of the required alloying materials, are introuced into a heated vessel, having a lining chemically ert to the charge. The vessel is closed, the atmosphere xcluded and the components of a slag, inert both to the harge of steel and the lining of the vessel, are introduced, ollowed by the remainder of the alloying materials.
—F. R.

Pickling"; Immersing coils of flat steel, wire or the like in acid. D. and A. Beever, Sheffield, and J. Beever, Rotherham. Eng. Pat. 24,048, Oct. 20, 1909.

HE coils of metal, to be pickled, are placed side by side pon a rotating rod, the lower portion of the coils being nmersed in the pickling solution. The rotation of the d causes the coils to slowly turn, while the lower portions the convolutions tend to separate from each other, abling the entire surface to be exposed to the action of the ickling solution. Separating bars are placed at right gles to the rotating rod to prevent the different coils ecoming entangled.—F. R.

luminium bronze. P. H. G. Durville. Fr. Pat. 411,193, Dec. 31, 1909.

LAIM is made for aluminium bronze containing from to 95 per cent. of copper, from 6 to 11 of aluminium, d from 0·05 to 5 of manganese, the latter metal serving a purifier, and, when present in the larger proportions, creasing the toughness and malleability of the alloys.
—W. E. F. P.

hromium-bronze, etc.] Alloy and a compound for the production thereof. W. Rübel, Berlin. U.S. Pat. 964,122, July 12, 1910.

COMPOUND is formed consisting of zinc and a chloride of a metal having a less affinity for chlorine than zinc at the fusing temperature of such chloride, such as chromium chloride. Alloys are then formed by melting such a zinc-metallic-chloride compound with another metal, such as copper.—F. R.

Zinc; Extraction of ——, as metal or oxide, from minerals poor in the metal. F. Ellershausen. Fr. Pat. 411,555, Jan. 14, 1910.

THE solution obtained by treating the oxidised ore with dilute sulphuric acid is precipitated with milk of lime; a proportion of coal dust is then added, and the gelatinous mixture is heated in a reverberatory furnace. The resulting hard, compact mass is then either distilled for metal or roasted in a current of air for the production of oxide fume. In the case of sulphide ores, the sulphur dioxide evolved during the initial roasting is utilised by passing the furnace gases, with steam, through a chamber containing a previously oxidised charge of ore.—W. E. F. P.

[Zinc.] Volatile metal; Apparatus for smelting ores yielding a ——. W. McA. Johnson, Assignor to The Continuous Zinc Furnace Co., Hartford, Conn. U.S. Pat. 964,268, July 12, 1910.

THE apparatus consists of an electric smelting furnace, having a gas outlet near the top directly communicating with a reduction chamber containing an electrically heated column of carbonaceous matter, through which the metallic fumes pass on their way to the condenser.—F. R.

Electrolytic apparatus for stripping small metallic objects for electro-plating. H. W. T. Schulte. Fr. Pat. 411,054, Dec. 28, 1909.

A DRUM, having transverse bars from which the objects are suspended, revolves in, but is not wholly submerged by, the electrolyte, which is contained in a rectangular vessel divided into two compartments by a vertical partition. The drum itself serving as the cathode, the actual stripping occurs in the first compartment which contains two anodes, one within and the other without the bars of the drum; the resulting sludge or slime does not reach the second compartment, which thus serves as a washer for the stripped articles. By automatically stopping the drum for a few minutes each time one of the transverse bars arrives between the anodes, time is afforded for the stripping to take place and for the removal of the finished objects from the upper bars.—W. E. F. P.

Alloy; Electrical resistance ——. J. T. H. Dempster, Schenectady, New York, Assignor to General Electric Co., New York. U.S. Pat. 963,123, July 5, 1910.

CLAIMS are made for alloys of iron, nickel, chromium, and manganese, (1) in which the iron constitutes more than 50 per cent. of the total, (2) in which the iron and nickel together constitute more than 80 per cent., (3) in which there is approximately 75 per cent. of iron and 20 per cent. of nickel, and also for alloys such as those containing at least 90 per cent. of iron and nickel.—F. R.

Pyrites residues, mattes or all residues of copper and other metals; Process for the treatment of —— with a view to their conversion into soluble salts. J. Parent. Fr. Pat. 411,863, Jan. 20, 1910.

AN ordinary pyrites burner is provided with a special sulphating hearth arranged at the top, or the uppermost hearth of the burner may be used as such, and on this hearth the copper or other metals in the residues are rendered soluble by the action of sulphur and its derivatives at a dull red heat. The residues are first finely crushed and intimately mixed with a certain amount of dilute sulphuric acid or very finely powdered pyrites, rich in sulphur, or sulphur itself, and are left in a heap for some hours; they are then introduced, through a suitable hopper, on to the sulphating hearth of the furnace where they are heated by the combustion gases passing up from the lower hearths, and, in one or two hours, the copper is rendered completely soluble.—F. Sodn.

(1) *Sulphuric acid; Method of making —— from "smelter" gases, and* (2) *method of smelting pyritic ores.* J. P. Channing and F. J. Falding, New York. U.S. Pats. 962,493 and 963,020, June 28, 1910.

(1). Furnace gases, from the pyritic smelting of sulphide ores, are utilised by keeping the percentage of carbonaceous material employed in the smelting sufficiently low, with reference to the percentage of sulphur in the ore (*e.g.*, in the proportion of about 1 per cent. of such material to about 4 per cent. of sulphur), to ensure such relative contents of sulphur dioxide and oxygen in the gases that they may be treated to produce sulphuric acid, claim being also made for the mixing of the gases from several furnaces in a common chamber, so that the proportion of sulphur dioxide may be maintained at about 5—8 per cent. (2). In the pyritic smelting of pyritic ores, air is supplied in sufficient quantity to almost completely oxidise the available sulphur and iron, and produce a matte and also a gas of such composition as will enable the contained sulphur dioxide to be oxidised to sulphur trioxide, for use in making sulphuric acid.
—F. Sodn.

Lead; Process for the reduction of —— from its compounds, especially oxides and sulphates, by means of sulphur or substances yielding sulphur, or of caustic alkalis. J. Asbeck. Ger. Pat. 223,667, May 22, 1909.

The lead compounds are heated with a mixture of caustic alkali and sulphur, or substances yielding sulphur, to 400°—500° C. It is stated that impurities present in lead compounds are not reduced by this method. Suitable mixtures are: (1), 3 parts of caustic soda and 1 of sulphur; (2), equal parts of caustic soda and sodium thiosulphate; (3), 3 parts of caustic soda and 1 of sodium sulphide or polysulphide.—A. S.

Lead; Process for the electrolytic refining of ——. Siemens und Halske Akt.-Ges. Ger. Pat. 223,668, Aug. 24, 1909.

An electrolyte consisting of a solution of lead perchlorate, and containing also some free perchloric acid, is used, and an organic colloid is added in order to obtain a dense compact deposit. (See also Mathers, this J., 1910, 824.)
—A. S.

Mercury from low-grade ores; Process for obtaining —— electrolytically. B. Szilard. Ger. Pat. 223,152, Aug. 14, 1909.

The finely-divided ore is treated with a lukewarm mixture of Leblanc alkali waste (containing calcium sulphide) and common salt solution, and after standing for about two days, warm air is forced through the mass from below. After settling, the solution, containing mercury in the form of mercury-sodium chloride, and also a portion of any silver present in the ore, is run off, and the mercury and silver are recovered electrolytically, either by passing a current from an external source or by placing plates of metal in the liquid.—A. S.

Electro-plating; Process of ——. T. A. Edison, Orange, N. J. U.S. Pat. 964,096, July 12, 1910.

A small quantity of a chlorinated solution of copper sulphate is added to the copper plating bath, and further additions made as the chlorine becomes exhausted by reacting with the hydrogen developed upon the surface of the cathode.—F. R.

Iron product and open-hearth process of manufacturing same. C. A. Allison, London. From International Metal Products Co., Newark, N.J., U.S.A. Eng. Pat. 27,201, Nov. 23, 1909.

See U.S. Pats. 940,784 and 940,785 of 1909; this J., 1910, 219.—T. F. B.

Cement from blast-furnace slag. Fr. Pat. 411,016. *See* IX.

Cleaning old tinned sheet-iron boxes and other tinned articles to render the same suitable for being detinned; Method of ——. K. Goldschmidt and J. Weber, Essen-on-Ruhr, Germany, Assignors to Goldschmidt Detinning Co., Jersey City, N.J. Reissue No. 13,123, June 28, 1910, of U.S. Pat. 836,028, Nov. 13, 1906.

See this J., 1907, 99.—T. F. B.

Metals and alloys; Process of refining ——. A. E. Greene, Chicago. Eng. Pat. 9508, April 21, 1909.

See Fr. Pat. 402,353 of 1909; this J., 1909, 1205.—T. F. B.

Electrical induction furnaces. C. Grünwald, Bredeney, Germany. Eng. Pat. 14,937, June 26, 1909. Under Int. Conv., Oct. 2, 1908. Addition to Eng. Pat. 3599 of 1909, dated May 7, 1908.

See Addition of July 15, 1909, to Fr. Pat. 400,864 of 1909; this J., 1910, 763.—T. F. B.

Zinc; Extraction of ——. C. S. Brand, Troon, Assignor to Brand's Pure Spelter Co., Ltd., Glasgow. U.S. Pat. 963,416, July 5, 1910.

See Eng. Pat. 9955 of 1909; this J., 1910, 701.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Patents.

Electrolytic apparatus with liquid anode. Schott und Gen. (*a*) First Addition and (*b*) Second Addition, dated Dec. 11, 1909, to Fr. Pat. 404,332, June 23, 1909. Under Int. Conv., March 30, 1909 (see this J., 1910, 222).

(*a*) The solid body, hindering the displacement of the liquid anode, is formed of an undulating member, or may be replaced by several bodies, so as to break up the anode into several parts, more or less separated. In an alternative form, the anode consists of several parts completely separated, each portion of anode liquid being furnished with a current terminal. (*b*) The solid body is sufficiently elevated, above the level of the liquid anode, to prevent any of the anode from being projected into the central conduit containing the cathode.—B. N.

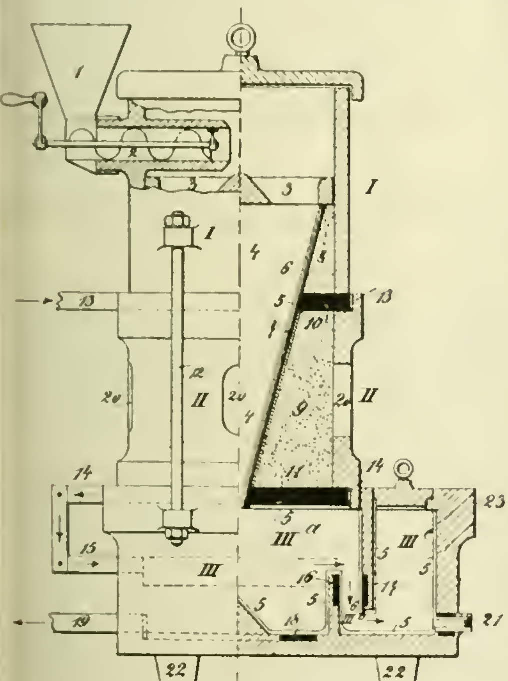
Electric arcs; Apparatus for the production of continuous long —— especially for gas reactions. Dynamit-Act.-Ges. vorm. A. Nobel und Co. Ger. Pat. 223,366, Sept. 18, 1908. Addition to Ger. Pat. 211,196, Feb. 2, 1908.

The furnace may be made in the form of a cylinder, surrounded by a wind-box. Around the wall of the cylinder, and throughout its length, air-supply nozzles are disposed n regular order, and through them air is blown against the re simultaneously on all sides. In another form of the urnace the air is supplied through annular slits instead of hrough nozzles.—A. S.

urnace ; Electric triphase ——. C. R. J. Louis. Fr. Pat. 411,075, Dec. 4, 1909.

wo electrodes are arranged in the upper part of the rnace and are movable for regulating the current, the hird electrode being fixed in the base of the furnace to revent it wearing away. —B. N.

urnace ; Electric —— for the fusion of quartzose materials. O. Vogel. Fr. Pat. 411,437, Jan. 10, 1910.



HE furnace comprises three parts, the charging compartent, 1, provided with a mechanical transporter, 2, which plies material to the furnace in proportion as the mass melted, the material remaining sufficiently long in this upartment to receive a preliminary heating ; a fusion umber, II, conical or funnel-shape in form, and provided h resistances between two poles, 10, and 11, so that the terial is rapidly heated to the temperature of fusion ; a, IIIb, IIIc, three separate compartments of a lector, through which the material continuously circus, and in which the heating resistances are particularly ense, so that the material is rendered thoroughly fluid and mitted to a perfect refining. The wall of the fusion mber is composed of three layers, the layer, 5, in cont with the mass having a high melting point, and being ttacked by the silicic acid. For this purpose rare ths are employed, either alone or as mixtures, notably mically pure oxides of scandium, yttrium, ytterbium, thanum, zirconium or thorium. The layer, 6, is a thin stance layer of graphite or carbon, and the third layer, consists of a protective layer of borates or silicates. base and the lateral walls of the collector are similarly covered with a layer of oxides, 5, the heating resistances, 18, 16, 17, and 21, being embedded in magnesia. The compartment, IIIa, is provided with a conical base, so that the material escaping from the fusion chamber is directed against the heating resistance, 18. The resistance, 16, is embedded in a partition forming an overflow into the second compartment, IIIb, in which the material is intensely heated by the resistances, 16 and 17. The third compartment, IIIc, is not heated, but the tap-hole, 21, is provided with heating resistances. Two or more furnaces may be combined so as to have a common collector, or a common third compartment of the collector.—B. N.

Nitrogen peroxide ; Process for the extraction of pure —— from mixtures of nitric oxide and air obtained electrolytically. Fr. Pat. 411,693. *See* VII.

Galvanic battery. S. Benkö, Assignor to Company Limited for Exploitation of Inventions by Stephan Benkö, Budapest. U.S. Pat. 963,852, July 12, 1910.

See Eng. Pat. 28,290 of 1908 ; this J., 1909, 1257.—T. F. B.

Electrolysis of metallic solutions. F. Lacroix, Paris. Eng. Pat. 845, Jan. 12, 1910.

See Fr. Pat. 400,262 of 1909 ; this J., 1909, 990.—T. F. B.

Electrolytic preparation of perborates and perboric acid ; Process for the ——. Pouzenc. Fr. Pat. 411,258. *See* VII.

Acetic acid from alcohol. Ger. Pat. 223.208. *See* VII.

Films prepared from acetylcellulose, specially destined for electrical insulation and for photography. Mijnssen. *See* XXI.

XII.—FATS ; OILS ; WAXES.

Oils [Edible] ; Coloration of —— with auramine. M. Frehse. Ann. Falsific., 1910, **3**, 293—294.

Auramine, with which edible oils are sometimes coloured, may be detected by means of the following test. One c.c. of the oil is boiled under a reflux condenser with 20 c.c. of alcoholic sodium hydroxide solution (8 per cent.) and a little zinc dust ; after cooling, the mixture is transferred to a separating funnel containing 20 c.c. of benzene. Fifty c.c. of water are then added, the whole is shaken, allowed to separate, the benzene layer is drawn off, filtered, and evaporated. On dissolving the residue in glacial acetic acid, a blue coloration is obtained if auramine be present. When the oil contains only traces of auramine it is advisable to treat a large volume of the oil with alcohol and to test the alcoholic extract as described above. Most oils, if coloured with auramine, yield a yellowish-brown coloration when shaken with hydrochloric acid, but in the case of sesamé oil, the hydrochloric acid is coloured green in the presence of auramine ; this green coloration, is not, however, characteristic of auramine, as other amines yield a similar colour.
—W. P. S.

Oils (lubricating) for automobiles ; their adulteration and its detection. P. Carles. Ann. Chim. Analyt., 1910, **15**, 263—265.

The following method, based on Sans's colour reaction for colophony (this J., 1909, 483) is recommended for the detection of rosin oil. 3—5 grms. of the oil and 5 times the quantity of 60 per cent. alcohol are heated together in a stoppered tube to 40°—50° C., and the mixture emulsified by vigorous shaking. The tube is then cooled in water and slowly turned round 3 or 4 times, when the oily particles will separate in a mass. The whole is then poured on a filter, and the clear filtrate obtained is evaporated in a capsule on a water bath until the alcohol is just driven off; it is essential that the water should be evaporated as little as possible. After cooling 2—3 c.c. of methyl sulphate are added in drops, a red coloration (which, however, does not change to violet) indicates rosin oil. No reaction is obtained if 90—95 per cent. alcohol is used. It is stated that less than 1 per cent. of rosin oil can thus be easily detected.—A. Sbld.

Conversion of saturated fatty acids ($R.CH_2.CH_2.COOH$) into ketones ($R.CO.CH_3$); General reaction for the ——. H. D. Dakin. Amer. Chem. J., 1910, **44**, 41—48.

The ammonium salts of fatty acids, when heated almost to boiling with a large excess of 3 per cent. hydrogen peroxide solution, in the presence of a little alkali, are oxidised, and, in the case of the higher acids, a ketone is always produced; the yields are, however, generally small. The following table shows the ketones and aldehydes obtained from the various acids.

Acid.	Product.
Acetic	Glyoxylic acid; formaldehyde
Propionic	Acetaldehyde
n-Butyric	Acetone
iso-Butyric	Acetone
n-Valeric	Ethylmethylketone
iso-Valeric	Acetone
n-Caproic	Propylmethylketone
Caprylic	Amylmethylketone
Nonylic	Hexylmethylketone
Capric	Heptylmethylketone
Lauric	Nonylmethylketone
Myristic	Undecylmethylketone
Palmitic	Tridecylmethylketone
Stearic.	Quindecylmethylketone
Phenylacetic..	Benzaldehyde
Phenylpropionic	Acetopheaone
Phenylbutyric	Benzylmethylketone (?)

The ketones were, as a rule, identified by conversion into corresponding *p*-nitrophenylhydrazones which were analysed.—F. Sodn.

Apeiba (burillo) oil. J. Lewkowitsch. Comptes rend. de l'Assoc. Franç. pour l'Avancement des Sci., Congrès de Lille, 1909, 356.

The seeds of *Apeiba Timbourbou*, a tree known in Nicaragua under the name "burillo," yield an oil which has a composition essentially different from that of any other known oil or fat. A sample of the oil having the acid value, 34·8, possessed the following characters:—Sp. gr. at 15·5° C., 0·9275; saponification value, 234·8; Reichert-Meissl value (soluble volatile fatty acids) 7·75, and insoluble volatile fatty acids, 27·21; iodine value, 77·9; unsaponifiable matter, 1·28 per cent.; insoluble fatty acids, 74·99 per cent. The insoluble fatty acids had the following characters:—Mean molecular weight, 220·9; solidifying point, 26·6°—37·8° C.; iodine value, 34·51. The oil contained 10·2 per cent. of insoluble volatile fatty acids having a mean molecular weight of 167·8, and 1·81 per cent. of soluble volatile fatty acids calculated for a mean molecular weight of 120. In its content of soluble and insoluble volatile acids, the oil resembles cocoanut oil, but it differs essentially from the latter in its high iodine value. In the distillation of the soluble volatile fatty acids, an odour resembling that of hydrocyanic acid or of nitrobenzene was observed, but the presence of hydrocyanic acid could not be proved.—A. S.

Watermelon seed; Chemical examination of ——. F. B. Power and A. H. Salway. J. Amer. Chem. Soc., 1910, **32**, 360—374. Reports from Wellcome Chemical Research Laboratories, No. 105.

The results of a complete chemical examination of the seeds of the watermelon (*Cucurbita citrullus*, Linné) are given in this paper. The seeds contain neither alkaloid nor glucoside. The kernels yielded 7·4 per cent. of oil by expression. The entire seed, when extracted by light petroleum, gave 10·9 per cent. of fatty oil. The expressed oil had the sp. gr. 0·9233 at 20°/20° C., acid value 3·9, saponification value 191·8, iodine value 121·1. It contained the following acids as glycerides: linolic, 45 per cent.: oleic, 25 per cent.; palmitic and stearic, together, 30 per cent. The oil also contained a small amount of a phytosterol, m. pt. 163°—164° C. The material left after expressing the kernels was extracted with hot alcohol. A further quantity of fatty oil was obtained together with soluble protein products, sugar, and resinous material. The resin was found to contain a phytosterol, m. pt. 158—159° C., and a new alcohol *curcurbitol*, $C_{24}H_{40}O_4$, m. pt. 260° C., homologous with *grindelol*, $C_{23}H_{38}O_4$, m. pt. 256°—257° C. (this J., 1907, 295), and *ipurganol*, $C_{21}H_{34}O_4$, m. pt. 222°—225° C. The shells amounting to 48·7 per cent. of the weight of the seeds were found to contain small amounts of arachidic acid, cucurbitol, and a phytosterol, m. pt. 138°—140° C., besides substances similar to those found in the kernels, and traces of copper. The resin from these seeds has no physiological activity.
—F. Shdn.

Rape oils; Detection of —— *in other oils.* D. Holde and J. Marcusson. Z. angew. Chem., 1910, **23**, 1260—1262.

A method of detecting rape and other crucifer oils is based upon the isolation of erucic acid. From 20 to 25 grms. of the fatty acids of the oil under examination are dissolved in twice their volume of 96 per cent. alcohol, and the solution stirred and cooled to −20° C. The precipitate is separated at −20° C. and washed with chilled alcohol, the filtrate and washings are evaporated, the residue taken up with 4 times its volume of 75 per cent. alcohol, and the solution again cooled to −20° C. In the presence of crucifer oils a crystalline deposit slowly appears in the course of about an hour. This is collected at −20° C., washed with chilled 75 per cent. alcohol, and dissolved off the filter with warm ether or benzene, the solution evaporated, and the molecular weight, m. pt. and iodine value of the residue (consisting in the main of erucic acid), determined. When the original material contained crucifer oils, the molecular weight will range from 310 to 320 (pure erucic acid, 338). The m. pt. will usually be below 30° C., whilst the iodine value will be about 60 (erucic acid = 75·1). When the original oil contained a notable amount of saturated fatty acids (*e.g.* in the case of marine animal oils) so copious a precipitate is obtained at −20° C. that filtration is difficult. In such cases it is advisable to cool the alcoholic solution first to 0° C., and to separate the bulk of the solid fatty acids at that temperature, and then to treat the filtrate as described above. Occasionally, in the absence of crucifer oils slight amounts of solid fatty acids may be deposited on cooling the alcoholic solution to −20° C., but these may readily be distinguished from erucic acid by their higher m.pt., and lower molecular weight. It is stated that thus it is possible to detect 20 per cent. of rape oil in linseed oil. In one sample of this composition the separated erucic acid (0·74 grm.) had the molecular weight 321·5 and melted at about 30° C. A sample of a lamp oil was found to consist of a mixture of mineral oil, marine animal oil, and rape oil, the latter being detected by yielding erucic acid with molecular weight 314 and iodine value 57. (See Tortelli and Fortini, this J., 1910, 887.)—C. A. M.

Function of methane in organic life. [*Fermentation of cellulose and of calcium-salts of fatty acids.*] Söhngen. *See* XXIV.

Oil and oil cake in Java. Oil, Paint and Drug Rep., July 18, 1910. [T.R.]

The British consul at Batavia reports that the only vegetable oil imported in quantity into Java is linseed oil, of which about 170,000 gallons were received in 1909. The only oil cake which has so far been imported to any considerable extent is ground nut cake, but it is understood that trials have been made with others, such as castor cake and sesamé cake. Oil cake for use as a fertilizer in Java should contain 6 to 7 per cent. of nitrogen, and should be free from adulteration.

Soap in the Congo State. Oil, Paint and Drug Rep., July 18, 1910. [T.R.]

The soap used in the Belgian Congo is principally of British manufacture, and the consumption is rapidly on the increase. Most of the soap imported is for domestic purposes, and there is a great demand for blue mottled, which is usually packed in boxes containing 26 lb. There is also a good sale for toilet soaps, coloured and strongly perfumed, made up in bars of from 15 to 100 grammes.

Patents.

Soaps ; Process for the preparation of mechanically acting ——. R. Reiss. Ger. Pat. 222,891, May 18, 1909.

Potassium or sodium soaps, or soap powders, are mixed with powdered "reserve-cellulose," *e.g.*, ivory nut meal. —A. S.

Lubricating oils having as basis castor oil and mineral oils ; Process for preparing ——. E. Boyer, L. Cavaillon, and N. Barishac, Marseilles, France. Eng. Pat. 15,497, July 2, 1909. Under Int. Conv., July 3, 1908.

See Fr. Pat. 391,992 of 1908 ; this J., 1909, 250.—T. F. B.

Oils and similar bodies ; Apparatus for the purification of ——. O. Brücke, Frankfort on Maine, Germany. U.S. Pat. 963,510, July 5, 1910.

See Fr. Pat. 392,986 of 1908 ; this J., 1909, 79.—T. F. B.

Mineral and vegetable oils ; Treatment of ——. J. J. Hood and A. G. Salamon, London, Assignors to The Oil Refining Improvements Co., Ltd., Glasgow. U.S. Pats. 962,840 and 962,841, June 28, 1910.

See Eng. Pats. 16,617 and 24,209 of 1908 ; this J., 1909, 1081.—T. F. B.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Turpentine oil, wood turpentine oil and rosin spirit ; Colour reactions of —— and their use in the analysis of varnishes. C. Grimaldi. Chem.-Zeit., 1910, 34, 721.

In applying Halphen's bromine phenol test (Chem.-Zeit, 1907, 1145) to products containing, in addition to conifer oils, substances such as benzene, petroleum derivatives, etc., only the fraction boiling below 170° C. must be used. In examining varnishes, from 25 to 30 grms. of the sample are mixed with 50 c.c. of water and distilled in a current of steam, and the distilled oil separated from the water, dried over calcium chloride, and again distilled in a small flask with a side tube, in which the first 2 or 3 c.c. (which must not boil above 170° C.) are collected. One drop of this fraction is now dissolved in 2 c.c. of the solution of 1 part of crystalline phenol in 2 parts of carbon tetrachloride in a white basin and brought into contact under a glass cover with the vapour from a solution of 1 part of bromine in 4 parts of carbon tetrachloride. A yellow coloration, changing to green on shaking the basin, indicates rosin spirit ; a carmine red colour changing to violet indicates wood turpentine oil ; whilst if the liquid remains colourless or, at most, becomes pale yellow, oil of turpentine is present.—C. A. M.

Patents.

Zinc white ; Process and apparatus for the manufacture of ——. A. C. Krüsemann and J. F. Pool. Fr. Pat. 411,672, Jan. 18, 1910.

Zinc is dissolved in an aqueous solution of caustic soda or potash in the presence of a pile of cupric oxide, with production of an electric current, and pure zinc oxide is obtained by boiling the solution so formed. The apparatus comprises an iron vessel, which constitutes the cathode, a block of zinc, which is out of contact with the iron vessel and rests upon a porous plate, constituting the anode. The space between the porous plate and the bottom of the iron vessel is packed with granulated cupric oxide, the zinc block is kept in contact with the porous plate by means of two vertical springs attached to a cover, which seals the vessel, and a delivery tube is provided in the cover for the escape of the gases produced during the reaction. The electromotive force of the apparatus is 0·7 volt and a sufficient number of elements may be arranged in series, so that the current produced may be used for lighting or other convenient purpose.—O. R.

Antimony compounds for use as pigments, etc. ; Process for the preparation of ——. E. Chatillon. Second Addition, dated Dec. 31, 1909, to Fr. Pat. 353,565, April 20, 1905 (this J., 1905, 1023).

Pure antimony sulphide, or pigments prepared as in the main patent with or without the addition of compounds rich in sulphur, are fused in a suitable vessel and steam is blown through the liquid. The issuing vapours are drawn into condensing chambers, which are kept damp, and are freed from powdered colouring matter by filtering through suitable tissues.—O. R.

Distemper ; Manufacture of ——. Strübin and Co. Fr. Pat. 411,374, Jan. 7, 1910.

Sixty parts of chalk are mixed with 5 parts of casein and 3 parts of slaked lime, the mixture is made into a thick paste with water, and diluted with water to the required extent before using. To obtain various tints, up to 10 per cent. of mineral colours may be added to the mixture. —O. R.

Paint and process of making the same. J. Meurant, Liege, Belgium. U.S. Pat. 963,917, July 12, 1910.

See Fr. Pat. 389,051 of 1908 ; this J., 1908, 988.—T. F. B.

Zinc white ; Process for producing ——. A. C. Krüsemann and J. F. Pool, Amsterdam. Eng. Pat. 1178, Jan. 17, 1910.

See Fr. Pat. 411,672 of 1910 ; preceding.—T. F. B.

Wood ; Baths for extracting products from ——. E. C. R. Marks, London. From Southern Manufacturing Co., Pittsburg, U.S.A. Eng. Pat. 19,109, Aug. 19, 1909.

See Fr. Pat. 406,080 of 1909 ; this J., 1910, 439.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

India-rubber and gutta percha imports into the United Kingdom for five years.
India-Rubber J., July 11, 1910. [T.R.]

Articles and Countries whence imported.	Quantities.					Value.				
	1905.	1906.	1907.	1908.	1909.	1905.	1906.	1907.	1908.	1909.
CAOUTCHOUC:	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	£	£	£	£	£
From Russia..	31,443	23,404	50,747	12,015	36,066	43,394	42,961	85,322	30,579	74,424
,, Germany	31,569	45,825	28,865	30,737	40,254	194,581	294,821	265,977	236,168	269,372
German West Africa	2,756	3,372	3,990	2,558	2,381	36,432	49,345	61,660	35,074	39,205
,, Netherlands	4,170	8,690	8,895	6,596	6,780	36,428	47,670	100,682	64,878	39,780
Dutch Guiana ..	2,056	300	1,092	416	4,793	21,695	3,340	14,425	5,590	61,435
,, Belgium	9,050	7,886	4,953	5,737	8,224	145,288	126,114	71,960	60,664	99,318
,, France..	17,688	38,858	32,201	27,279	35,823	133,889	407,808	266,872	181,970	204,361
French West Africa	41,633	37,960	35,871	29,136	30,686	658,121	603,338	552,505	343,522	493,983
French Somaliland	—	—	224	243	1,273	—	—	4,669	4,085	27,598
Madagascar ..	4,273	8,290	9,446	2,201	1,819	56,906	128,333	138,900	28,782	31,304
,, Portugal	4,306	11,199	7,642	378	4,080	55,127	162,535	138,282	12,349	50,490
Portuguese West Africa	3,300	3,057	4,043	1,616	4,593	48,383	50,062	48,447	17,111	53,852
Portuguese East Africa	1,930	1,821	3,280	2,362	4,000	31,687	29,652	49,492	32,669	72,020
,, Congo Free State ..	2,037	1,129	1,336	1,577	432	40,974	21,319	25,460	21,567	7,838
,, Liberia	582	583	1,166	1,140	1,418	8,023	7,603	13,668	13,886	14,717
,, United States of America	46,443	34,488	31,843	26,682	34,628	163,561	160,523	180,781	101,470	236,793
,, Mexico	51	197	32	2,432	1,829	960	2,368	359	17,044	34,885
,, Nicaragua	107	102	118	30	73	1,746	1,622	2,087	372	1,436
,, Columbia	2,393	3,307	3,676	2,147	1,102	34,504	52,424	61,616	29,640	21,748
,, Venezuela	1,439	309	2,417	658	1,179	20,589	5,390	36,648	9,251	14,843
,, Ecuador	466	57	172	430	667	7,277	1,017	3,041	5,269	13,621
,, Peru	26,621	19,134	29,323	29,572	30,518	563,778	401,984	674,117	517,610	731,408
,, Chile	1,393	661	660	735	451	24,786	14,393	15,331	15,239	11,203
,, Brazil	263,687	254,571	283,209	239,545	308,742	6,075,664	5,919,026	6,189,783	5,322,220	8,626,639
,, Uruguay	5,891	5,326	7,010	6,943	7,768	99,353	91,818	126,789	85,013	175,002
,, Bolivia	1,032	758	3,914	682	966	26,183	19,370	84,057	13,778	30,310
,, Argentine Republic ..	90	1,133	586	891	1,745	990	23,195	6,643	5,383	15,013
,, Other Foreign Countries	2,351	4,075	5,763	2,518	9,723	13,814	42,072	37,361	23,480	61,037
Total from Foreign Countries	508,747	516,492	562,474	499,856	582,013	8,544,133	8,711,103	9,256,934	7,234,673	11,513,641
From British West Africa:										
Gambia	600	102	824	160	221	10,404	1,684	9,601	1,469	3,379
Sierra Leone ..	4,639	2,736	1,434	1,117	866	66,568	44,158	20,491	15,038	13,607
Gold Coast ..	25,008	22,188	26,977	14,060	23,276	286,704	262,013	324,244	150,117	272,370
The Colony and Protectorate of Southern Nigeria	25,997	24,408	22,828	10,436	8,112	321,309	310,804	303,200	107,554	94,044
Protectorate of N. Nigeria				—	—				—	—
,, Natal	873	1,293	1,165	630	1,021	3,504	8,961	2,775	1,840	1,661
From British East Africa:										
Zanzibar and Pemba	563	764	2,710	519	725	10,275	13,539	46,210	8,196	12,845
East Africa Protectorate ..	674	1,672	1,315	925	1,733	13,008	33,452	25,623	13,833	47,065
,, British India	3,766	5,865	5,138	4,315	3,690	64,311	81,026	54,684	31,347	23,292
,, Straits Settlements and Dependencies, including Labuan	18,906	22,523	32,100	29,323	53,855	250,076	343,847	563,011	524,922	1,412,241
,, Federated Malay States	475	1,831	2,582	3,250	11,198	14,407	57,776	77,112	77,440	385,798
,, Ceylon and Dependencies	1,221	3,006	5,068	8,501	11,117	34,659	84,494	141,101	187,826	348,183
,, British Borneo ..	684	100	34	542	5	7,900	1,330	368	10,762	81
,, British West India Islands	415	60	129	50	37	6,134	1,010	2,372	682	603
,, Other British Possessions	899	4,037	2,516	1,382	2,193	10,561	11,423	7,030	5,206	9,454
Total from British Possessions	84,690	90,585	104,820	75,210	118,049	9,099,820	1,255,517	1,577,825	1,136,232	2,624,563
TOTAL	593,437	607,077	667,294	575,066	700,062	1,643,953	9,966,620	10,834,759	8,370,905	14,138,204
GUTTA PERCHA:	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	£	£	£	£	£
From Germany	1,078	1,754	2,229	2,161	2,111	6,823	15,884	19,661	13,010	25,949
,, Netherlands	1,364	2,643	1,576	32	1,221	15,574	30,364	12,053	338	9,779
Dutch Guiana ..	230	647	1	967	1,153	2,460	6,542	4	11,780	15,625
,, France	1,164	56	95	46	194	9,757	1,079	1,528	596	2,052
,, United States of America	109	41	164	882	—	1,570	552	1,947	9,194	—
,, Venezuela	14,966	11,539	12,021	10,179	20,277	130,608	108,391	127,457	99,921	212,937
,, Other Foreign Countries	251	457	753	822	879	1,821	5,666	10,721	6,706	13,437
Total from Foreign Countries	19,162	17,137	16,839	15,089	25,835	168,613	168,478	173,371	141,545	279,779

Patent.

Indiarubber; Manufacture of [spongy] —— for elastic tyres of vehicle-wheels. E. Poizot, Glos, Assignor to L. A. D. de Roussen, Condom, France. U.S. Pat. 963,806, July 12, 1910.

See Fr. Pat. 401,303 of 1908; this J., 1909, 1261.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tan liquors; Loss of acid in ——. L. Balderston. J. Amer. Leather Chem. Ass., July, 1910, 326—329.

If tan-liquors containing acid are allowed to stand exposed to the air and not in contact with hide, the acidity diminishes. The loss of acid is more rapid in warm weather and is accompanied by the growth of a film on the surface of the liquor. The film consists of yeast cells of various kinds. Ten 150 c.c. samples of liquor from an oak tannery were sterilized and nine of them inoculated with nine separate organisms isolated from tan-liquors. Four of these were yeasts which grew throughout the liquor and three of these four fermented glucose. The other five were organisms which grew at the surface, forming a film, and fermented glucose. The tenth sample was left uninoculated. The acidity of the liquor at first was 0·80 per cent. as acetic acid and at the end of two weeks the blank showed no change not due to inaccuracies of titration. After the same period of time the inoculated samples were examined and found to be pure cultures except the non-fermenting bottom-yeast which had failed to grow. The five samples inoculated with surface yeasts showed the following percentages of acid expressed as acetic acid:—0·34, 0·36, 0·30, 0·28, and 0·36. At the end of three weeks the same five showed: 0·28, 0·28, 0·26, 0·22 and 0·30 per cent. of acid. The samples in which the three fermenting yeasts had grown showed, after two weeks:—0·80, 0·82 and 0·78, and after three weeks:—0·82, 0·86 and 0·78. Thus, the surface yeasts in three weeks had destroyed 60 per cent. of the acid while the others had destroyed none. Experiments as to whether the loss of volatile and non-volatile acids was proportional to the amount present showed that this was so, except in one case, that of a new oak liquor which had not stood in a sample vessel. In this case, the lactic acid increased for eleven days so as to become greater than in the original sample, but decreased again after that time. Lactic acid decreases more rapidly in "sapped" liquors than in new and the growth of the yeast film is also more rapid in the "sapped" liquors.—D. J. L.

Gallotannic acid; Optical activity of ——. O. Rosenheim and P. Schidrowitz. Chem. Soc. Trans., 1898, **73**, 878—885.

Commercial so-called pure gallotannic acid contains varying quantities of gallic acid and mineral substances, to which the great differences in optical activity ($[\alpha]_D = +11°$ to $+74·2°$) are probably due. The authors have succeeded in preparing from all these commercial products, a gallotannic acid with an optical activity of about $[\alpha]_D = +75°$. The crude product was dissolved in acetone, and the solution treated with ether, and after filtering off the amorphous precipitate, which was produced in most cases, a little water was added. The ethereal layer was now removed, and the residual acetone solution shaken repeatedly with ether until most of the soluble impurities and colouring matters were extracted. On adding a little more water, three layers were formed, the bottom ayer consisting of a syrupy concentrated solution of gallotannic acid. This was separated, the ether driven off on the water-bath, and the syrupy residue dried *in vacuo* n the dark. By repeating the process of purification several times, products free from gallic acid and having a rotatory power of $[\alpha]_D = +75°$ to $+75·2°$ were obtained, the yield varying from 50 to 75 per cent., calculated on the aw material.—A. S.

Gelatin and tannin. H. Trunkel. Biochem. Zeits, 1910, **26**, 458—492.

The author has made numerous experiments on the interaction of solutions of gelatin and tannin, using solutions of from 0·18 to 0·6 per cent. concentration in the case of the gelatin and 1—5 per cent. in that of the tannin. The gelatin before purification contained 2·34 per cent. of ash, and after purification, from 0·20 to 0·28 per cent. The tannin had the rotatory power, $[\alpha]^{21}_D = +72·7°$, and after purification by Rosenheim and Schidrowitz's method (see preceding abstract), $[\alpha]^{20}_D = +72·5°$. It was found that under suitable conditions both the gelatin and the tannin are quantitatively precipitated, and the precipitate is then insoluble in and resistant to water. With an insufficient proportion of tannin the filtrate from the precipitate contains both gelatin and tannin, whilst with an excess of tannin, the filtrate contains tannin, but no gelatin. In all cases except where quantitative precipitation of both tannin and gelatin is obtained, small quantities of gallic acid can be detected in the solution. A given quantity of gelatin in a freshly prepared solution requires more tannin for complete precipitation than when the solution has been allowed to stand. In a freshly prepared solution 1 grm. of gelatin requires about 0·7 grm. of tannin, but after 24 hours only about 0·4 grm.; on more prolonged standing the effect gradually becomes less and less pronounced. If a gelatin solution which has stood for some time be warmed, it regains its original tannin-precipitating-power. With excess of tannin, the precipitate produced may contain up to 3 parts of tannin to 1 of gelatin, but it is no longer insoluble in and resistant to water, readily yielding tannin. Neither the stable nor the unstable precipitate can be completely resolved into its components. By repeated treatment with alcohol, 97 per cent. of the tannin can be extracted, but the remainder is obstinately retained, and from the residue only small quantities (up to 6 per cent.) of unaltered gelatin, capable of gelatinising, can be recovered. Both the stable and the unstable precipitate yield small quantities of gallic acid on prolonged treatment with water or alcohol. Although both the gelatin and tannin undergo chemical alteration to a slight extent, and the experimental data do not give very concordant results when calculated according to the exponential formula, on account of unavoidable experimental errors, the author states that the mutual precipitation of the gelatin and tannin is undoubtedly an adsorption process, this being shown most clearly by the behaviour of the gelatin-tannin precipitates towards alcohol.—A. S.

Gelatin; Optical rotatory power of ——. H. Trunkel. Biochem. Zeits., 1910, **26**, 493—513.

The lævo-rotatory power of gelatin solutions increases when the solutions are allowed to stand and decreases with rising temperature (to a minimum at about 35° C.); it is not proportional to the concentration of the solution, although weaker solutions have a lower rotatory power than stronger ones. When gelatin solutions which have been allowed to stand are warmed, they regain their original rotatory power. The rotatory power is lower the longer and the more strongly the gelatin solution has been heated before the determination. The rotatory power of β-gelatin (gelatin which has been subjected to prolonged heating at 100° C.) is considerably lower than that of α-gelatin. The change in rotatory power on keeping proceeds in a similar manner to the change in tannin-precipitating power (see preceding abstract), being rapid at first and then slower. The phenomenon appears to be a case of "hysteresis" such as has been known for a long time as characteristic of colloids, and to be due to a change in the degree of dispersion of the colloidal gelatin solution (compare Menz, Z. physik. Chem., 1909, **66**, 129).—A. S.

Patents.

Leather; Drying of ——. A. Turnbull, Liverpool. Eng. Pat. 30,173, Dec. 24, 1909.

A drying chamber for leather is described, provided with a double-floor and roof. Hot, dry air is passed into the space floor and roof. Hot, dry air is passed into the space between the roof and the false-roof and, passing downwards through the chamber and around the sheets of leather suspended therein, leaves the chamber by means of the space between the false-floor and the floor ; both the false-roof and false-floor have a number of openings provided with sliding covers so that the current of air may be regulated. The moist air leaving the chamber is conducted through pipes surrounded by cold water and is then passed through pipes heated by steam before being again delivered into the drying chamber ; a fan situated between the cooling and heating pipes causes the air to circulate through the different parts of the plant, a feature of the invention being that the same air is used over and over again.—W. P. S.

Casein ; Machinery for the manufacture of ——. W. E Browning and W. Golder, London. Eng. Pat. 15,028, June 28, 1909.

The milk from which the casein is to be prepared is delivered from tanks into a mixing pan where it is treated with suitable chemicals for the purpose of precipitating the casein. The mixture of casein and whey is then delivered to a separator consisting of a hollow drum which rotates on a stationary pipe ; in the curved surface of the drum a number of radial compartments, opening outwards, are provided, the open ends of the compartments being covered with wire gauze. The whey passing through these strainers is collected in a pan, whilst the casein is washed off the gauze by means of a water-sprinkler and conducted to washing tanks provided with stirrers and a constant water supply. The washed casein together with water is then transferred to a tank from which it is pumped to a draining device consisting of a number of slats hinged to a travelling endless band which delivers the drained casein into trucks. Each truck when loaded is run along a track to a hydraulic press where the mass of casein is pressed. The cake of casein thus obtained is passed through a disintegrator, then passed through a distributor on to travelling bands mounted in a drying chamber whence it is delivered as a dry powder, which is sifted into various grades of fineness. Should it be desired to produce an acid or alkaline casein, the washed casein is passed through an acid or alkali tank before being drained, pressed and dried.—W. P. S.

Casein ; Process for obtaining homogeneous —— *directly from milk.* F. Lebreil and R. Desgeorge. Fr. Pat. 410,994, Mar. 31, 1909.

Milk under a pressure of from 2 to 3 atmospheres is forced through a jet into a vessel which contains a mixture of 300 litres of water and 300 grms. of nitric acid ; the temperature of this mixture should not be less than 70° C. The oxidised casein thus separated from the milk floats on the surface of the liquid and is easily collected and removed. It is advisable to add fresh quantities of nitric acid to the vessel from time to time. (See this J., 1909, 153.)—W. P. S.

XVI.—SOILS ; FERTILISERS.

Phosphoric acid ; Active —— *and its relation to the needs of the soil for phosphoric acid in pot experiments.* G. S. Fraps. Texas Agric. Expt. Stations. Bull. No. 126, 1910, 65 pages.

The amount and nature of the plant food withdrawn from the soil by the plant depends on the form of combination of the plant food, its protection or non-protection by encrusting particles, the action of weathering agencies and the nature of the plant. The composition of the soil extract obtained with any solvent depends on the quantity of phosphate exposed, its solubility, the solubility of the protecting material and the ability of the soil to fix phosphoric acid from the solvent. $N/5$ nitric acid dissolves phosphates of lime completely but iron and aluminium phosphates only to a slight extent. This solvent is preferred to 1 per cent. citric acid and other solvents. Soils absorb phosphoric acid from solution in $N/5$ nitric acid and other solvents, the percentage absorbed by a soil increasing with its content of iron and aluminium oxides. The phosphoric acid absorbed by soils is not extracted by the first extraction with $N/5$ nitric acid but it is by the fourth, and sometimes the sixth, extraction. Soils containing little or no highly soluble phosphates give the same amount of phosphoric acid to successive extractions. Soils with a fixing power of 80 per cent. or less fix about half as much from $N/5$ nitric acid. Soils with a fixing power above 80 per cent. fix equally as much from $N/5$ nitric acid. (The fixing power is defined as the percentage of phosphoric acid absorbed from an aqueous solution containing 400 parts of the acid per million.) Calcium sulphate increases the amount of phosphoric acid extracted from soils rich in iron. Calcareous soils contain phosphates protected by the calcium carbonate from the plant roots but these are exposed by acid solvents and the quantity of acid consumed gives a measure of the amount of lime and magnesia dissolved. Citric acid dissolves less iron, lime and magnesia than $N/5$ nitric acid. In pot experiments it is impossible to maintain only one variable. Soils containing less than 20 parts per million of phosphoric acid are highly deficient in this acid in pot experiments. Soils with less than 100 parts per million are deficient ; soils with 100 to 200 parts per million are possibly deficient. The average possible corn (maize) crop increases regularly with the amount of active phosphoric acid extracted by $N/5$ nitric acid. Soils with less than 10 parts per million of phosphoric acid have an average possibility of 4·5 bushels of corn (maize) per acre. With 10—20 parts the possibility is 12·3 bushels ; with 30—100 parts the possibility is 19·7 to 26·3 bushels ; with 110—420 parts per million the possibility is 50—60 bushels per acre. Soil may provide sufficient phosphoric acid for large crops and yet respond to phosphoric fertilisation in pot experiments. Phosphoric acid taken up by the crop comes from other sources as well as the active phosphoric acid ; the amount removed by the crop decreases with the quantity of active phosphoric acid in the soil.—E. F. A.

Fertilizers ; Detection of inferior ammoniates in commercial ——. J. P. Street. J. Ind. Eng. Chem., 1910, 2, 311—313.

The use of an inert nitrogenous filler, such as peat, in compounding mixed fertilizers necesitates some means by which the inferior form of nitrogen may be differentiated from that of unquestionable value. The method proposed by the author for doing this is as follows :—A quantity of the fertilizer equivalent to 45 grms. of organic nitrogen is placed on a moistened filter, and washed with about 200 c.c. of water at room temperature. Both filter and contents are then digested in a water-bath with 125 c.c. of 1·6 per cent. neutral potassium permanganate solution, and stirred at intervals of 10 minutes with a glass rod. After 30 minutes, 100 c.c. of cold water are added and the liquid filtered, the filter being washed until washings and filtrate amount to 400 c.c. Finally the filter and contents are removed, and the nitrogen in them determined by the Kjeldahl process. The nitrogen obtained less the amount in the two filters used is the nitrogen not oxidised by the permanganate. A series of analytical results is given showing that by this method high grade ammoniates, such as blood, fish, and bone, may be readily differentiated from those of less value, such as garbage, tankage and peat, the last-named material giving the lowest results of all.—J. P. O.

Fertiliser industry of United States. Oil, Paint and Drug. Rep., July 18, 1910. [T.R.]

The Report of the National Fertiliser Association states that during the past year the production of fertilisers in the United States has increased 30 per cent., and that the demand has increased in the same proportion.

Soil constituents : Effect of lime upon the solubility of ——. E. W. Gaither. J. Ind. Eng. Chem., 1910, 2, 315—316.

It is shown that the addition of lime to a loam soil renders insoluble phosphates soluble by replacing the iron and alumina which is combined with the phosphorus, and that all three constituents are thus made more soluble in *N*/5 nitric acid. At the same time the silicates are partly broken up and rendered more soluble in *N*/5 nitric acid, but those silicates carrying potassium are not decomposed to any appreciable extent. It was also found that the addition of lime has the effect of diminishing the amount of potash assimilated by wheat grown on the soil. In view of this last result the hypothesis that the addition of lime to the soil increases the amount of available potash would appear to be erroneous. —J. P. O.

Soil nitrogen : Availability of —— in relation to the basicity of the soil and to the growth of legumes. T. L. Lyon and J. A. Bizzell. J. Ind. Eng. Chem., 1910, 2, 313—315.

A series of comparative experiments carried out by the authors confirms the opinion that a certain degree of basicity of the soil is favourable to nitrification, it being shown that the addition of lime to a soil deficient in this constituent produces a substantial increase in the nitrates for some years after its application. The growth of alfalfa, and possibly other legumes, on soil which is well supplied with lime further contributes to the nitrifying process. But whether the alfalfa acts in this way by increasing the quantity of easily decomposing matter through the production and decomposition of tubercles or small roots, or in some other way, was not established. —J. P. O.

Insecticide ; A new ——. H. Maxwell-Lefroy. Agr Jour. India, 1910, 5, 138—143.

The arsenical poisons used against caterpillars, grasshoppers, etc., are not suitable for use in India owing to the danger of cattle poisoning, and, in the case of lead arseniate, to the fact that decomposition occurs at the high temperatures giving soluble arsenic which poisons the plants. As a result of many tests on the poisoning effect of different compounds on caterpillars, lead chromate was found to be most suited to the requirements. It is easily made in paste form from lead nitrate and potassium bichromate, can readily be seen on the leaf, is extremely insoluble, not easily washed off, and does not injure the plant. It may be used at a strength of 1 lb. in 32 gallons.—H. H.

Lime-sulphur solution ; Further studies of the reactions of —— and alkali waters on lead arsenates. C. E. Bradley and H. V. Tartar. J. Ind. Eng. Chem., 1910, 2, 328—329. (See this J., 1910, 589, and 837.)

It has previously been shown by the authors that on mixing normal lead arsenate and commercial "lime-sulphur" solution together as a combined spray only a small amount of arsenic is rendered soluble. They now find that if in place of normal lead arsenate the acid compound be used, a considerable decomposition takes place, about eight times more arsenic then passing into solution. A study of the reactions thus involved indicated that there is a partial interchange of the bases resulting in the formation of calcium arsenate, and lead sulphide, free sulphur being deposited at the same time. The presence of soluble arsenic is attributed to the partial solution of the calcium arsenate. Further experiments showed that both the normal and acid lead arsenates are more soluble in saline than in pure water, this being very much more pronounced in the case of the acid compound. In conclusion it is pointed out that in mixing lead arsenate for spraying purposes it is necessary, so as to lessen the tendency to render the arsenic soluble, to employ the normal lead compound and to avoid using water containing a large amount of alkali carbonates.—J. P. O.

Report of Inspector of alkali works. See VII.

Patents.

Phosphoric acid soluble in citric acid ; Process for obtaining —— from crude phosphates. H. Förster. Ger. Pat. 221,077, Dec. 7, 1909.

The crude phosphate is heated in closed retorts at a high temperature, then the air in the retorts is displaced by carbon dioxide, and the heating is continued for some time under a pressure of carbon dioxide.—A. S.

Superphosphates : Manufacture of enriched ——. A. Ducco. Fr. Pat. 410,969, Mar. 25, 1909.

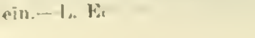
In the manufacture of superphosphates, a solution of phosphoric acid or its salts is added to the sulphuric acid employed in treating the mineral. For example, the superphosphate obtained with sulphuric acid (with or without phosphoric acid), in the usual way, is washed with water, and the washings are added to the sulphuric acid used in attacking a fresh quantity of mineral ; this facilitates the transformation into superphosphate and gives a richer product, besides reducing the proportion of sulphuric acid required.—F. Sodn.

Potash works ; Process for the utilisation of the final mother-liquors from ——. E. von Alten. Ger. Pat. 221,076, Feb. 21, 1909.

The liquors are treated with burnt lime so as to form a dry mass, which is ground and used as a fertiliser.—A. S.

XVII.—SUGARS ; STARCHES ; GUMS.

Carbohydrates ; Phosphoric acid esters of ——. *II. Sucrose-sulphuric acid, and the introduction of the phosphoryl group into protein.* C. Neuberg and H. Pollak. Ber., 1910, 43, 2060—2068 (see this J., 1910, 291). (See also Biochem. Zeits., 1910, 26, 514—534.)

The preparation of sucrose-phosphoric acid has already been described (*loc. cit.*) ; the following modified method for obtaining dextrose-phosphoric acid is now given :— A suspension of 500 grms. of precipitated calcium carbonate in a solution of 180 grms. of dextrose in 3—4 litres of water, was cooled in a freezing mixture. The cooled liquid holding the precipitate in suspension was treated with a solution of 154 grms. of phosphorus oxychloride in about 500 c.c. of chloroform. The whole was allowed to stand and then filtered, the residue being washed with cold water. The filtrate and washings were concentrated *in vacuo* at 35°—40° C., to about 1 litre, filtered again, and added, drop by drop to alcohol, the calcium salt of dextrose-phosphoric acid thus being precipitated. The calcium salt of dextrose-phosphoric acid, $C_6H_{11}O_9PCa + 2H_2O$, is a white powder, stable in air, and soluble in water. The acid is more readily hydrolysed than sucrose-phosphoric acid ; it is not fermentable, but yields fermentable sugar (dextrose) on hydrolysis. *Sucrose-sulphuric acid.*—A solution of 90 grms. of sucrose and 80 grms. of potassium hydroxide in 400 c.c. of water, was heated to 60°—70° C., and treated with 64 grms. of finely powdered potassium pyrosulphate. After standing the mixture was neutralised with acetic acid, all the sulphuric acid in inorganic combination being then precipitated with a concentrated solution of barium acetate. The precipitate was filtered off and washed, the filtrate and washings being concentrated *in vacuo*. On adding basic lead acetate and ammonia, an abundant precipitate formed ; this was filtered off, washed till neutral, mixed with water, and decomposed with sulphuretted hydrogen in presence of barium carbonate. The filtered solution was concentrated *in vacuo*, filtered, and added to alcohol, the precipitate thrown down being purified by repeated solution in water and precipitation with alcohol. The barium sucrosesulphate thus obtained is probably represented by the formula,  $\underbrace{C_{12}H_{20}O_{10}.O.SO_3}_{Ba}$; it is a white powder, stable in air, and easily soluble in water. The authors have also succeeded in introducing the phosphoryl group into protein.—L. E.

Sugar manufacture ; The efficiency of the "Hadi" process of ——. G. Clarke and S. C. Banerjee. Agric. J. India, 1910, 5, 29—41.

The "Hadi" process of sugar manufacture is much used in India amongst planters desiring to produce sugar directly from the juice in districts having a limited supply of cane. It consists essentially in clarifying the raw juice by the addition of small quantities of sodium carbonate solution and the juice of *Hibiscus esculentus*, the scum being removed by hand, and then boiling the treated juice to grain in a series of open pans. The resulting warm massecuite is stored in earthen vessels for 10 days, after which it is cured in a hand centrifugal and dried in the sun. The molasses is concentrated and treated in a similar way to the first product, a second sugar and a final molasses being thus obtained. On examining this method of manufacture with the object of reporting on its improvement, the authors found that 19·2 per cent. of the sucrose entering the factory in the form of juice was lost by inversion, and that 4·7 per cent. was removed with the scums. As means of effecting a better yield, the authors recommend neutralising the juice with finely ground calcium carbonate, passing the liquor through cloth to the evaporators, and removing the scums by suitable filtering apparatus. Large central factories are not feasible in the districts where the "Hadi" process is worked, the principal reason being the scattered distribution of the crop, but the authors see no reason why a small and efficient plant, employing vacuum evaporation and improved methods of clarification, should not be a success.—J. P. O.

Raffinose ; Occurrence of —— in raw sugar, and its determination. F. Strohmer. D. Zuckerind., 1910, 35, 543—514.

According to the author, the disturbing influence of cold on the process of assimilation in the living plant may account for the formation of raffinose in the sugar beet, although up to the present he has been unable to detect this sugar in syrups obtained from frozen roots. The average raffinose content of the sugar beet is 0·02 per cent., and the higher values which are reported from time to time may be generally assumed to be due to the presence of optically active bodies other than sugar. As Herzfeld has pointed out, these non-sugar substances exist as lævo-rotatory salts which on treatment with acid under the conditions of the Clerget determination become dextro-rotatory, and may thus vitiate the raffinose value to the extent of more than 2 per cent. In raw sugars manufactured by returning a very low after-product, the author has found a difference amounting to 0·92 per cent. between the direct polarization and the sugar by Clerget, and has noticed that such raw sugars always contain a greater amount of optically active non-sugar than do sugars obtained by normal working without return of after-product. On examining the possibility of the presence of raffinose in colonial sugars, as suggested by Pfeiffer and Pellet, a positive result was never obtained, but here, too, as with the beet products, it was found that optically active non-sugars influence the raffinose determination.—J. P. O.

Beet sugar factories ; Final molasses of Russion ——. J. B. Minz. Z. Ver. deutsch Zuckerind, 1910, 485—510.

The author gives the results of careful analyses of final molasses from a large number of Russian beet sugar factortories. These molasses were not true molasses (*i.e.*, solutions of non-sugars saturated with sucrose at a given temperature) but factory products, which in the large majority of cases were supersaturated and from which sugar crystallised out on long keeping. These results confirmed the view that the inorganic portion of the non-sugars is more active in retaining sucrose in solution than the organic portion. In Russian beet molasses of similar character the true purity (*i.e.*, the percentage of sucrose by Clerget) is greater the lower the organic coefficient (*i.e.*, the ratio of organic non-sugars to ash), but on the other hand, there is a greater tendency for sucrose to crystallise out from factory molasses the higher the organic coefficient, even with a lower true purity. The purity alone of a final molasses does not suffice to indicate the degree to which that molasses can be desaccharified; for this a determination of the organic coefficient is also necessary. In Russian final molasses produced as they usually are from beet juices purified by lime defecation, the non-sugars are mainly salts of organic acids, the organic matters other than sugar originally present having been mostly decomposed during defecation and subsequent concentration at comparatively high temperatures, into organic acids stable towards lime. A large number of experiments on further treating these molasses with lime showed very little further change in the organic coefficient, and did not raise the true purity more than about 1 per cent. The organic coefficient is an indication of the magnitude of the organic acid radicle and in general the greater this magnitude (and consequently the greater the organic coefficient) the less is its sucrose retaining power. The organic coefficient thus forms a valuable guide to the melassigenic effect of the non-sugars whilst the ash coefficient (*i.e.*, the ratio of sucrose to ash) is of little value as a guide to the composition of the molasses. The author strongly insists on the desirability of using phenolphthalein as the indicator in determining the acidity or alkalinity of molasses. All the molasses showed alkaline reaction to litmus whilst only about 30 per cent. were alkaline to phenolphthalein.
—L. E.

Sugar-beet ; Optically active non-sugars of the ——. W. H. Rees. J. Ind. Eng. Chem., 1910, 2, 323—325.

The high apparent loss of sugar that has been observed in beet sugar factories of recent years is generally attributed to the presence of an unidentified substance which, although indicated by direct polarisation, is either destroyed or eliminated during the manufacturing processes. The author has investigated the problem and claims to have obtained from the beet, from thick-juice, from molasses, and from the condensation water produced during the concentration of the osmose syrup a body which corresponds in every way to that hypothetically assumed to be present. It is dextro-rotatory, is readily soluble in water, is not precipitable by basic lead acetate, and is not destroyed when heated with acid under the conditions of the Clerget process. By heating with milk of lime it loses its optical activity entirely, but if slowly evaporated in alkaline solution its rotation is not changed, and it may be distilled in a current of steam. It is also stated that it is possible to extract the same dextro-rotatory substance by concentrating the vapours condensed from the first defecating pan; and it is suggested that this explains the reason of the difference between the polarisations of aqueous and alcoholic solutions of syrups, massecuites, and molasses that are not observable in the case of concentrated undefecated juices. Concluding, the author affirms that his investigations have convinced him that the observations of Kopecky (this J., 1909, 1215) and others who have found differences between the polarizations by the direct and inversion methods are correct, and that he has also been able to corroborate the statement of Herles (this J., 1908, 1168 and 1909, 32) that on heating raw juice with lime there is a reduction in the polarization due to the transformation or elimination of optically active non-sugar.
—J. P. O.

Maple syrup ; Influence of micro-organisms upon the quality of ——. H. A. Edson. J. Ind. Eng. Chem., 1910, 2, 323—327.

Those portions of the sugar maple sap that are first drawn off are clear and transparent, and possess a luscious sweet taste, but with the advance of the season as the days become warmer and the frost less severe, the sap is often obtained cloudy and develops an unpleasant flavour. Further, the syrup resulting from the concentration of this last run material is frequently dark in colour, and lacks flavour. It is also generally known that uncleanly methods result in yielding a poor syrup. Consideration of these facts suggested that micro-organisms might be the direct cause of this inferior syrup, and accordingly a bacteriological study of the maple sap was undertaken. It was found that the sap within the vascular bundles of the tree is quite free from micro-organisms, and that when drawn under conditions preventing their entrance, the sap remains in a perfect state of preservation. The principal organisms occurring in the faulty sap were isolated and examined in pure culture; first run sap was then inoculated, with the result that the characteristic cloudy appearance and inferior flavour were generally reproduced. As a final proof, comparative experiments were made with trees giving faulty sap; in some, clean buckets and spouts and fresh tap holes were used, whilst in others the ordinary utensils and old tap holes were retained. It was then found that, whereas the sap from the old holes was cloudy and sour, that from the fresh holes was perfectly clear and sweet and on concentration yielded a syrup quite equal to the first run material.—J. P. O.

Molasses; Decomposition products of glucose in cane sugar ——. H. C. Prinsen Geerligs. Intern. Sugar J., 1910, **12**, 293—305, 332—338.

On adding together those constituents of a cane molasses that can be determined analytically, *viz.*, sucrose, glucose, ash, and gums, and subtracting the sum from the total dry substance by desiccation, a considerable difference is invariably found, which difference is not the outcome of the errors involved in the several determinations, but is apparently due to the presence of a constituent which hitherto has not been identified. It was thought that a probable explanation of this might be found in the observation that during the course of manufacture from raw juice to massecuite the glucose ratio gradually falls, whilst the percentage of organic non-sugar increases, the supposition being that the decomposition of the glucose results in the formation of an unknown non-sugar substance. With the object of testing this experimentally, neutral invert sugar solutions containing organic and inorganic salts in the proportions occurring in cane juice were heated for 80 hours on a water-bath at 90°—100° C., a control experiment using neutral invert sugar solution without the addition of salts being also made. It was found that, whereas with the control test no appreciable decomposition had occurred, in the case of the invert sugar solution containing cane salts, the sp. gr., the ash, the cupric-reducing power, and the dry substance as found by desiccation each decreased. It was further shown that treatment with normal lead acetate of the invert sugar solution containing cane salts which had been heated for 80 hours to 99—100° C. caused a decrease of the cupric-reducing power. From these, and from a series of similar experiments which were carried out on raw cane juices and exhausted cane molasses, the general conclusion is drawn that under the conditions normally prevailing in cane sugar factories a portion of the invert sugar is broken up into bodies which are partly volatilized; the non-volatile portion of these decomposition products remaining in the syrups and molasses is optically active, has a slight cupric-reducing power, is precipitable by normal lead acetate, is of a dark brown colour, and is liable to further decomposition. Since these decomposition products are non-volatile, contain no ash, are not altered under the conditions of the Clerget determination, and are not soluble in acid-alcohol, they escape detection by the ordinary methods used in the analysis of molasses, and they are to be held accountable for the discrepancy always met with on comparing the sum of the sucrose, glucose, ash, and gums with the total dry substance found by desiccation.—J. P. O.

PATENTS.

Sugar factories and refineries; Treatment of the low products or poor syrups of ——. P. Lagrange. Fr. Pat. 411,341, Jan. 7, 1910. Under Int. Conv., Jan. 7, 1909.

By this process the low products or centrifugal syrups of sugar factories and refineries are treated so as to yield a fully exhausted molasses in a single operation. The syrups, which may be blended so as to show an average quotient of purity of 77—76, should possess after concentration an alkalinity of 0·7—1·0 grm. per litre in the case of beet products, or of 1·5—2·0 grms. per litre in the case of cane products. They are concentrated by boiling under pressure at a temperature accurately adjusted according to their degree of purity. The massecuite is then rapidly cooled to a temperature corresponding to the commencement of crystallisation, also depending on its purity. Subsequently it is cooled very slowly in a series of malaxeurs, fed continuously, and cooled by a current of water flowing in the opposite direction. The rate of cooling and the final temperature to be attained are specified, and depend on the quotient of purity. For massecuites of 80—76 degrees of purity the fall of temperature is adjusted at 3°—4° C. per hour, for those of 74—68 degrees of purity it is adjusted at 1° C. per hour during the whole cooling process. Before the separation of the sugar in centrifugals, the massecuite is re-heated to a temperature of 50° C. and is mixed with about 10 per cent. of molasses to serve as "clairce," or else the massecuite may be drained in vacuum filters.—J. F. B.

Sugar juices; Continuously working depositing vessel for solutions, particularly for —— provided with contrivances for compressing and washing the precipitates or deposits. F. Tiemann. First Addition, dated Dec. 23, 1909, to Fr. Pat. 395,752, Oct. 28, 1908 (this J., 1909, 537).

In the original form of the apparatus it was found that the quantity of the deposits, particularly of the sedimentary deposit, was not sufficient to permit of proper compression and elimination in continuous working, with the result that the juice became cold, owing to the delay thus occasioned, and much of it was lost together with the mud. In the present modification of the plant, arrangements are made by which the mud and juice, continuously removed from the conical bottom of the vessel, are pumped through an external heater and returned to the vessel at the point where the fresh juice is entering. This re-heating effects a coagulation in the form of large flakes, which greatly assist the clarification of the fresh juice. The elimination of the mud is now effected intermittently, when a sample taken from the external circulation pipe shows that it has attained a satisfactory consistence.
—J. F. B.

Concentrating and boiling of green syrups; Apparatus for the ——. Soc. Anon. Raffinerie Moderne Procédé Natta, Malpassé-Marseille, France. Eng. Pat. 16,845, July 19, 1909. Under Int. Conv., July 22, 1908.

See Fr. Pat. 392,541 of 1908; this J., 1909, 33.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Glycerin; New method of determining —— in wine. C. Beys. Comptes rend., 1910, **151**, 80—81.

Discordant results obtained in the determination of glycerin in wine by the usual methods are stated to be caused mainly by variations in the quantity of barium hydroxide used to render the sugar insoluble. The following process is recommended: 50 c.c. of the wine (or 25 c.c. if the density is below 5° B.) are neutralised with barium hydroxide, and evaporated to a syrupy consistency in a platinum capsule at a temperature not exceeding 70° C. Some sand is added and the mixture extracted with 40—50 c.c. of acetone at a temperature below 56° C., the liquid being filtered off, after cooling; the extraction is repeated with smaller quantities of acetone until at least 200 c.c. of filtrate are obtained. Two aliquot portions of the filtrate are evaporated (without boiling). In one of the residues the sugars are determined with Fehling's solution; the other is dissolved in 5 times its weight of water and a quantity of powdered barium hydroxide, equal to 4/5 of the weight of the inverted sugar contained, is added. The mixture is frequently shaken and after 30 min. some sand is added and the glycerin extracted by heating (below the boiling point) 4 times with 15 c.c. of acetone. The solution, after filtration, is evaporated at a temperature below 56° C., the residue dried at 60°—65° C. and weighed. The glycerin thus obtained contains about 5 mgrms. of impurities, which about compensates for loss in evaporation, etc. For wines containing less than 5 per cent. of sugar, the first extraction of the residue left on evaporation of the 50 c.c. of wine (after neutralisation with barium hydroxide) is unnecessary.—A. Sbld.

Brandy; The rate of distillation of volatile constituents in the manufacture of pure wine ——. J. Lewis. Cape of Good Hope Agricultural Journal, Feb., 1910.

Two experiments are recorded in each of which 127 gallons of liquid were distilled by live steam from a "Cognac still" of 150 gallons capacity. In the first experiment (A) the material was a spirit, containing 37·4 per cent. of alcohol, obtained from white wine distilled in the common type of farmer's still. Neither foreshots nor feints had been removed. The second experiment (B) was conducted on white wine of an alcoholic strength of 12·93 per cent. by volume. The distillation was carried out at the rate of about a litre a minute and samples were taken at intervals for analysis.

Fractions.		Volume. litres.	Alcohol. per cent.	Grms. per 100,000 absolute alcohol.					
				Volatile acid.	Aldehydes.	Furfural.	Ethers (Esters).	Higher alcohols.	Total secondary constituents.
A. Foreshots	1	10	77·08	11·2	28·7	0·11	1082	537	1659
	2	10	77·65	10·3	19·2	0·12	826	483	1339
	3	20	77·13	10·4	17·7	0·13	439	342	809
	4	20	76·99	12·2	7·0	0·14	391	207	618
	5	30	76·23	12·3	4·1	0·17	216	154	386
	6	40	74·76	13·2	1·5	0·19	91	123	229
	7	40	71·94	18·4	trace	0·26	53	101	172
	8	40	68·65	21·6	"	0·45	54	83	159
	9	40	63·15	28·9	"	0·58	64	72	166
	10	30	53·60	47·5	nil	0·74	87	49	184
	11	20	44·02	71·2	"	0·81	104	34	210
Feints ..	12	20	35·05	112·2	"	0·96	193	29	336
	13	20	25·39	165·3	"	1·24	281	—	447
	14	20	16·47	288·5	"	1·80	369	—	659
	15	20	9·29	571·5	"	2·37	582	—	1156
B.	1	5	63·00	57·3	84·9	nil	973	647	1762
	2	10	60·39	76·6	60·0	"	511	252	900
	3	10	58·87	79·5	36·7	"	300	194	611
	4	20	55·84	62·9	13·8	0·04	192	156	425
	5	20	52·95	73·1	4·7	0·06	136	117	331
	6	20	47·51	81·5	1·0	0·16	119	97	298
	7	20	41·98	97·4	nil	0·39	109	90	288
	8	20	34·60	130·0	"	0·81	92	58	281
	9	20	24·92	195·9	"	1·69	74	nil	271
	10	20	18·02	274·7	"	3·46	61	—	339
	11	20	11·65	460·9	"	3·49	45	—	510

The mixed brandy from fractions 3 to 11 of distillation A, and the whole of distillation B, had the following composition:—

	Alcohol per cent.	Per 100,000 absolute alcohol.					
		Volatile acid	Aldehydes.	Furfural.	Ethers (Esters).	Higher alcohols	Total.
A.	67·07	23·0	3·6	0·38	144	133	304
B.	40·23	109·1	15·4	0·62	202	151	478

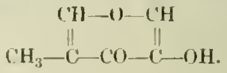
The residue in the still was partially analysed.

	Per 100,000 residue.				
	Alcohol.	Volatile acids.	Aldehydes.	Furfural.	Ethers (Esters).
A.	·53	65·9	nil	0·19	21·1
B.	·63	72·7	nil	0·14	—

—R. L. S.

Isomaltol. A. Backe. Comptes rend., 1910, **151**, 78—80.

The substance, resembling maltol, previously extracted by the author from certain kinds of bread, biscuits, etc. (this J., 1910, 447) is found to have the formula, $C_6H_6O_3$, and is regarded as isomaltol. It forms colourless crystasl which are easily soluble in alcohol, ether, benzene and hot water but much less soluble in cold water and petroleum ether; they melt at 98° C. (m. p. of maltol = 159° C.). It is volatile and easily separated from maltol by sublimation. Isomaltol reduces cold ammoniacal silver nitrate solution and Fehling's solution slowly on heating. On oxidation by permanganate, silver oxide or Fehling's solution, it gives off a characteristic caramel-like odour. With copper sulphate it gives beautiful green crystals of the formula, $Cu\,(C_6H_5O_3)_2 + H_2O$, which easily effloresce. The benzoic ester, $C_6H_5O_3.C_7H_5O$ is easily obtained in hard crystals, melting at 99°. The methyl derivative, $C_6H_5O_3(CH_3)$, crystallises from ether in hard tablets, soluble in alcohol and water, melting at 102° C. (the corresponding maltol compound is an oily liquid boiling at 114° C.), and on hydrolysis it yields formic acid but no acetic acid. Formic acid is formed when isomaltol is oxidised by a cold acid or alkaline permanganate solution. 1 kilo. of biscuit powder, on distillation with phosphoric acid, yields 0·07 grm. of isomaltol. The following constitutional formula is suggested:—



$$\begin{array}{c} CH—O—CH \\ \| \qquad\quad \| \\ CH_3—C—CO—C—OH. \end{array}$$

—A. Sbld.

Barley husk; Chemistry of ——. K. Geys. Z. ges. Brauw., 1910, **33**, 347—349.

Barley husk has long been known to contain bitter and harsh flavoured substances which may prejudicially affect the flavour of beer. In order to obviate this possibility Heymann (this J., 1908, 136, and 1909, 213) has devised a method of decorticating the corn. The author has examined the resulting husk. The proximate percentage composition of the husks was: water 7·4, protein 7·1, starch 8·2, fat 2·1, fibre 22·6, ash 10·0, pentosans 20·0, non-nitrogenous extractives 22·6. The ash consists chiefly of silica, 71 per cent., and contains 6 per cent. of phosphoric acid. An ether extract of husk yields a dark green fat with a harsh and burning flavour: by repeated fractionation from alcohol the fat was separated into a white wax nelting at 68° C. and a fat, obtained colourless after treatnent with animal charcoal, of the consistency of soft-soap. The melting point was 18 to 19° C., the iodine value 65 and saponification value 192. From the alcoholic xtract small quantities of a volatile pleasant smelling thereal oil were obtained but all attempts to isolate a annin were unsuccessful. From the aqueous or dilute ydrochloric acid extracts an organic phosphorus compound phytin was isolated. It contained phosphorus 17·7, calcium 20·5, magnesium 2·3, carbon 8·4 and hydrogen 1·86 per cent., and yielded inositol on hydrolysis with 30 per ent. hydrochloric acid.—R. L. S.

Tartaric acid in wine by-products; Determination of ——. C. Béis. Bull. Soc. Chim., 1910, 7, 697—699.

The method generally employed, viz., that of Goldemberg and Géromont, for the determination of tartaric acid in artars and wine lees does not always give reliable results, specially in the presence of much calcium tartrate, nalic acid, phosphates of aluminium or iron, or gummy natters. Better results are obtained by the following rocess. Between one and two grms. of the material to e analysed is heated for half-an-hour on the water bath vith an equal weight of sulphuric acid diluted with 20 imes its volume of water. When the liquid is cool, 5 imes its volume of alcohol and 10 times its volume of ther are added, and the liquid filtered. The residue is vashed with a mixture of one part of alcohol with two parts f ether. Some phenolphthalein is added to the filtrate, vhich is neutralised with potassium hydroxide dissolved n 90 per cent. alcohol. The amount of the latter is noted, nd 5—10 c.c. more are added. The whole is heated till he ether begins to boil off, when it is allowed to cool. The lear liquid is poured off and excess of glacial acetic acid dded. The crystals left behind are heated with 12—15 .c. of water and 5 c.c. of glacial acetic acid are added, ausing the precipitation of the greater portion of the otassium bitartrate. 30 c.c. of 96 per cent. alcohol are added, hich is about the quantity required to make the alcoholic trength of the mixture 65 per cent. After shaking for a ew minutes and standing for an hour the precipitate is iltered off, washed first with 15 c.c. of 65 per cent. alcohol, hen with 96 per cent. alcohol. The other precipitate roduced by the addition of acetic acid (see above) is ashed with 96 per cent. alcohol. Both precipitates are issolved in the same quantity of boiling water. The iquid is then titrated as described by Goldemberg and éromont (this J., 1908, 245), but using phenolphthalein s indicator.—F. Sodn.

lcetaldehyde; Oxidation of —— by low forms of vegetable life. Perrier. *See* XXIV.

Patents.

lcohol; Manufacture of —— and by-products and apparatus therefor. R. O. Chute. U.S. Pat. 963,275. July 5, 1910.

rain is fermented in the presence of returned "distillers' op" and the alcohol distilled from the fermented liquid. he slop from such distillation is divided into liquid and lid fractions, a portion of the liquid being mixed ith more grain and fermented. The other portion is aporated to a syrup, which is mixed with the solid portion the slop and the mixture dried, whilst the heat derived om a portion of the vapours generated during the pro- ss of evaporation is utilised for the distillation of the rmented grain and slop. The apparatus consists of the mbination, with a still arranged to distil off alcohol and rovided with a slop outlet, with a separating arrangement r removing solids from the still-slop so as to produce a ore attenuated liquid ("thin slop"), and with means r conveying still-slop from its outlet to the separator, (1) a fermenting vessel, (2) means for conveying a part the thin slop from the separating means to the ferment- g vessel, (3) means for conveying liquor from the fer- enting vessel to the still, (4) a vapour generator for ncentrating slop, (5) means for conveying a part of the in slop from the separator to the generator, (6) connec- ens between the generator and the still whereby vapour from the thin slop is conducted to the still, (7) a multiple effect evaporator and means for conveying to it, concentrated slop from the generator.—T. H. P.

Multiple distilling apparatus. O. Blaret. Fr. Pat. 411,594, Jan. 15, 1910.

The claim is for the combination of a distilling column having a serpentine preheater mounted above a rectifying column surmounted by a condenser and a tubular cooler, which acts also as an analyser and heater. The three parts of the apparatus are so connected together that they can be combined to work as a still to produce weak spirit, as an intermittent rectifying still, or as a continuous rectifying still with continuous removal of feints and ethers.—W. H. C.

Vinification yielding partly white and partly red wines; Rational process of ——. E. A. Barbet. Fr. Pat. 411,359, Apr. 10, 1909.

In taking off a portion of the juice from black grapes for fermentation apart from the skins, for preparation of white wines, the quality of the red wine obtained from the rest of the juice frequently suffers owing to the preponderance of marc over juice in fermentation. This disadvantage is avoided by the system of maceration of the pulp on the battery principle with sulphited juices. The maceration vats are provided with false bottoms, and a corner of the vats is divided off, forming a pipe by which percolation of the juice may be effected either upwards or downwards through the mass of marc. According to this process the grapes are crushed and thoroughly drained, but without pressing, with a view to obtaining, if possible, a yield of 60—65 per cent. of juice. This juice is sulphited and a quantity representing 50 per cent. of the grapes is taken for the preparation of white wine. The residual 15 per cent. of sulphited juice goes to the maceration vats for red wine. The drained marc, still containing about 20 per cent. of juice calculated on the original grapes, is freed from stalks and placed in a maceration vat, heavy hurdles being placed on the top, and flooded with juice from a previous vat of the battery. The portion of sulphited fresh juice, not taken for conversion into white wine, is mixed with juice expressed from the marc of a maceration vat which has been unloaded, and the mixture is passed into the battery, enabling an equal quantity of red-wine juice to be drawn off. Arrangements are made to maintain the degree of sulphitation, both of juice and marc, by introducing sulphur dioxide into the battery. The red-wine juice obtained is richer in grape constituents than an entire juice, and the process is admirably adapted for blending and enriching juices from poor grapes. The same battery system may be applied, without sulphitation, to a fermentation process, the maceration vats being used as fermentation vats.—J. F. B.

Malt; Process of and apparatus for treating ——, for mashing purposes. G. Porteous, Leeds. Eng. Pat. 15,278 June 30, 1909.

The whole malt is partially reduced by one pair of rolls, and the reduced malt is then subjected to two distinct combined rubbing and sifting processes, produced by beaters or detachers revolving within stationary cylindrical sieves, the first process having the effect of sifting out the flour, and the second process that of throwing off the husks and sifting out the grits; the latter are then passed alone through a second pair of rolls; after which the separated flour, the uncrushed husks and the reduced nibs are mixed together.—T. H. P.

Malt returns or drafts; Process and arrangement for treating —— to secure more complete utilisation of the malt. J. Krieger, Riedenburg, Bavaria. Eng. Pat. 15,740, July 6, 1909.

The sparge liquor is applied to the grains in five, approximately equal parts, each part being added after the previous part has run through and the goods have settled. A rake is drawn through the whole mash-tun immediately after each addition of sparge liquor so as to prevent the formation of channels. The taps are left open during the whole process. Claim is also made for a special rake, in which the lower portions of the prongs are bent backwards.—T. H. P.

Malt; Apparatus for steeping, germinating, and kiln-drying —— and for aerating and drying seeds, wheat and the like. G. C. Dymond, London. From J. A. Topt und Soehne, Erfurt, Germany. Eng. Pat. 17,206, July 23, 1909.

The apparatus consists of a horizontal perforated drum mounted on rollers and provided with means by which it may be rotated; an inner perforated drum is fitted concentrically in the first and the barley or malt to be treated is introduced into the space between the two. Pockets are provided on the periphery of the outer drum so that, as the drum rotates, the grain is carried upwards and then allowed to fall to the lower part of the drum; stirrers fitted on the inner drum also aid in mixing the grain. When it is desired to steep the grain in the drum, water is admitted through a central pipe. Air may also be admitted to the inner drum; this air may be saturated with moisture before it enters the drum by passing it through a chamber fitted with water sprayers, and a separator which removes superfluous moisture from the air is fitted between this chamber and the drum. Hot air may also be circulated through the drums when it is desired to dry the malt or grain.—W. P. S.

Brewing; Art of ——. W. P. F. Woeller, Newport News, Va. U.S. Pat. 963,458, July 5, 1910.

The main fermentation is effected in two communicating vessels. The exhausted yeast cells and other impurities are allowed to settle to the bottom of the first vessel, in which the liquid is fermenting under pressure of its own evolved gases. The first vessel is then connected with the second and the fermenting and purified liquid transferred to the latter, in which the fermentation is continued under the pressure of the gas evolved. The liquid is ultimately transferred to a third vessel through a finings-adding apparatus, the residual good yeast being left in the second vessel and the finished liquor delivered to the third.
—T. H. P.

Beer; Process for the de-alcoholisation of ——. O. G. C. L. J. Overbeck, Great Grimsby, Eng. Pat. 1195, Jan. 17, 1910.

Carbon dioxide or fermentation gas is forced through beer in such quantities and for such a period that the percentage of alcohol in the beer is reduced to the desired extent.—T. H. P.

Sodium salt of lactalbumin: Process of making a neutral ——. E. Fischer and P. Bergell, Berlin. U.S. Pat. 962,753, June 28, 1910.

See Eng. Pat. 6178 of 1908; this J., 1908, 1079.—T. F. B.

XIXa.—FOODS.

Flour; A new adulterant of ——. G. Curtel. Ann. Falsific., 1910, 3, 302—303.

Attention is drawn to a substance which, it is claimed, improves the quality of inferior flours when the latter are treated with about 1 per cent. of their weight of the substance. It consists essentially of a mixture of bi- and tricalcium phosphates and its presence in flour may be detected by shaking 5 grms. of the flour with 50 c.c. of carbon tetrachloride, separating the flour and solvent by centrifugal action, dissolving the sediment in nitric acid, and testing the solution with molybdic acid reagent. The small quantity of sediment obtained in the case of pure flours does not give an appreciable phosphate reaction. Bread requires to be dried, ground to a fine powder, and boiled for some time with the carbon tetrachloride so that it shall be thoroughly disintegrated, before the added mineral matter can be separated by centrifugal action.
—W. P. S.

Cotton seed meal as human food. G. S. Fraps. Texas Agric. Expt. Stations, Bull, No. 128, 1910, 15 pages.

Cottonseed meal is a newly proposed human food. The flour should be free from hulls, and have a bright yellow colour, a pleasant odour, and a sweetish taste. It contains protein 48 per cent., fat 12 per cent., sugar (mostly raffinose) 23 per cent., fibre 4 per cent., ash 5·5 per cent. It is richer in protein than meat and resembles meat more closely in composition than it does the cereals; accordingly it might be tried experimentally as a meat substitute or to reinforce a diet deficient in protein. Analyses are given of a number of bakery products; it is stated as advisable to mix one part of meal with four parts of flour. Experiments with animals show that the protein of cottonseed meal is as digestible as that of cereals. Mouldy or damaged or dark coloured meal should be avoided.—E. F. A.

Rice; Determination of extraneous mineral matter ["facing"] in ——. F. W. Richardson. Analyst, 1910, **35**, 293—294.

The following method is recommended for the determination of "facing" on rice grains:—Five grms. of the rice grains are treated in a platinum basin with 0·5 grm. of ammonium fluoride, 2 c.c. of water, and 2 c.c. of concentrated hydrochloric acid. After the lapse of 10 minutes, the rice is washed with water, and incinerated at a moderately low temperature. The difference between the amount of ash thus found and the total ash after recarbonation gives the quantity of extraneous mineral matter present.
—W. P. S.

Poppy seeds; Occurrence of henbane seeds in ——. A. von Degen. Z. Unters. Nahr. Genussm., 1910, **19**, 705—720.

One sample contained as much as 1·7 per cent. (by weight) of henbane seeds and many persons had been made ill by eating the seeds from the stock from which this sample was drawn. Inquiry showed that the poppy seeds containing henbane seeds came almost exclusively from Russia. Of 170 samples examined, only 59 were free from henbane seeds (hyoscyamus).—W. P. S.

Parsley; Liquid apiols of ——. L. Lutz and G. Oudin. Ann. Falsific., 1910, 3, 295—301.

There are three apiols of parsley on the market, *viz.*, the green, yellow, and white varieties; they are obtained by extracting parsley seeds with alcohol, removing the alcohol from the extract by distillation, and cooling the residual liquid in order to separate a quantity of fatty matter, etc. The apiols should be fluid, but never viscous, and should not yield any crystalline deposit when cooled to 5° C. They are completely soluble in 90 per cent. alcohol, ether, chloroform, acetone, benzene, and glacial acetic acid. The green essence may be converted into the yellow variety by treatment with animal charcoal or litharge. The apiols should have a sp. gr. of not less than 1·095. The commonest adulterants of parsley apiols are fatty oils, parsley butter, (the fatty substance separated during the preparation of the apiol), alcohol, hydrocarbons separated by rectification from the alcohol which has been distilled from the extract, etc.—W. P. S.

Oils [edible]; Coloration of —— with auramine. Frehse. *See* XII.

Patents.

Flour and yeast; Method of and apparatus for testing ——. G. Baine, Belfast. Eng. Pat. 14,770, June 24, 1909.

The apparatus consists of a number of graduated cylinders preferably constructed of glass; these cylinders are so graduated that each division or degree is equal to 1 fluid oz. of water at 60° F. Each cylinder is provided with a cover, through which passes a piston-rod, carrying at its lower end, a flat plate which fits the interior of the cylinder, and guide-rods, etc., are provided on the covers, so that the pistons shall move smoothly. In testing flours, a dough is prepared from each, using the same weights of flour, yeast, water, etc., respectively, and the doughs are placed in the cylinders, which are then inserted in a water-bath maintained at a suitable temperature. The pistons are lowered on the surface of the doughs, and the latter are allowed to "rise." The degree of expansion will vary with the nature of the flour, and the volume of the expansion is shown by the upward movement of the piston. A ratchet device on the piston-rod prevents the latter from descending after reaching its highest point. The apparatus may also be used for comparing the strengths of different yeasts, but in this case portions of the same flour are employed in each test.—W. P. S.

Flour ; Art of ageing and conditioning ——. F. H. Loring, London. Eng. Pat. 17,992, Aug. 4, 1909. Addition to Eng. Pat. 12,781, June 15, 1908 (this J., 1909, 740).

The apparatus described consists essentially of an atomiser or sprayer for applying liquids to flour, such liquids being employed as are mentioned in Eng. Pat. 12,781 of 1908 (*loc. cit.*). A horizontal air tube is fixed so that its end, which may be constricted, is just over the end of a vertical tube which extends into a tank containing the liquid. When a current of air is blown through the horizontal tube the liquid is drawn up the vertical tube and the spray produced is brought into contact with the flour under treatment. The vertical tube is provided with a wire which may be moved up and down the tube for cleaning the latter ; this wire may also be used to regulate the flow of the liquid. The level of the liquid in the tank is controlled by means of a ball-valve and an electro-magnetic valve, and the flow of liquid from the tank may also be regulated by closing the tank entirely and admitting air at definite intervals by means of a suitably operated valve.—W. P. S.

Amylaceous materials ; Process of treating —— to facilitate their disintegration, saccharification or cooking. A. Boidin. First Addition, dated Apr. 5, 1909, to Fr. Pat. 399,087, Apr. 8, 1908 (this J., 1909, 997).

In carrying out the process previously described it is not necessary to cultivate the liquefying bacteria separately in liquid media ; they may be cultivated on the materials themselves. The material is moistened with not less than 10 per cent. of water, infected with bacteria and incubated at a temperature of 30°—40° C., with periodical agitation. The growth of the bacteria penetrates the material, and may either be restricted to an extent sufficient to liquefy the contained starch on heating to 75°—85° C., or may be extended to the production of a diastatic material capable of liquefying the starch of untreated grain. In both cases, an excess of moisture is to be avoided, since the access of air favours the development of the bacteria. The subsequent cooking of the material may be curtailed by heating it with 2—3 times its weight of water for a short time at 85° C., then digesting under a pressure of 3—4 atmospheres and suddenly releasing the pressure. If the treated material be lightly crushed, it readily disintegrates and a modified starch may be extracted from it, whilst the soluble matters are utilised for fermentation.—J. F. B.

Tea free from theine ; Process for the preparation of ——. L. Seisser. Ger. Pat. 223,783, July 16, 1908.

The tea is first freed from the substances to which the aroma is due by extraction with a suitable volatile solvent, and the theine is then removed by treatment with another solvent, both operations being conducted in a centrifugal apparatus, preferably of the kind described in Ger. Pat. 120,597. After removal of the theine solution, the aroma-constituents, freed from most of the solvent, are added to the tea in the centrifugal apparatus, and the latter is again rotated until the tea is dry.—A. S.

Baking powder ; Manufacture and production of ——. J. Y. Johnson, London. From Chemische Fabrik vorm. Goldenberg Geromont und Co., Winkel, Germany. Eng. Pat. 27,775, Nov. 29, 1909.

The acid constituents of the baking powder are treated with a solution of a substance such as paraffin wax, fatty acids, beeswax, vegetable wax, spermaceti, or the like. The solvent is then allowed to evaporate, and the fat or wax forms a thin layer on the crystals treated. The sodium bicarbonate used in baking powders may be treated in the same manner.—W. P. S.

Cocoa powder ; Process of manufacturing ——. F. E. F. Neumann. Fr. Pat. 411,208, Dec. 31, 1909. Under Int. Conv., Mar. 15, 1909.

Raw cocoa beans, in their natural condition, or after treatment with alkalis, are heated to 50° C., and the temperature is then raised gradually to 120° C. ; the husk is next removed from the beans, and the latter are reduced to a granular or pasty mass. The cocoa mass, before or after excess of fat has been removed, is then submitted, at a temperature varying from 35° to 100° C., to a grinding or pounding process (in suitable mills) for a period of from 1 to 24 hours.—W. P. S.

XIXb.—WATER PURIFICATION ; SANITATION.

London waters ; Results of the chemical and bacteriological examination of the —— for the twelve months ended Mar. 31, 1910. A. C. Houston. Metr. Water Board. Fourth Annual Report, 1910.

Generally speaking, the filtered waters, as judged by the albuminoid nitrogen, permanganate and colour tests, were clearly affected by the unsatisfactory quality of the raw waters during the period under review ; the chemical results obtained in the cases of raw Thames, Lea and New River waters were decidedly worse than in the previous year. The raw waters also contained many more bacteria during 1909—10 as compared with 1908—09 ; the number of bacteria growing on agar and bile-salt agar at 37° C. increased, and the B. coli results were less satisfactory. As regards the filtered waters, the bacteriological examination indicated a slight decrease in purity, but having regard to the unfavourable meteorological conditions and unsatisfactory state of the raw waters, the results afford some ground for satisfaction. About 80 per cent. of the London water supply is derived from sewage polluted rivers ; whilst a marked improvement has taken place within recent years in the methods of purifying sewage so as to render the resulting effluents non-putrescible and chemically unobjectionable, no practical process, apart from sterilisation, has yet been found which turns out a "safe" effluent, bacteriologically. The striking new fact shown in this report is that London is not really drinking merely filtered raw river water, but raw river water which by storage processes has been purified bacteriologically antecedent to filtration to a remarkable extent (see also this J., 1909, 810). Dealing with the question of filtration, it would appear from the results obtained that it is probably safer to use a coarse sand and filter rapidly when treating adequately stored water, than to use a slow fine sand filter when dealing with raw river water. After five years' work on the London water question, the writer is convinced that to a progressively increasing extent, the "safety" of the Metropolis as regards water supply is being reasonably if not absolutely, assured ; the aim now is to abstract raw river water as judiciously as possible, to store it as long as possible, and to filter it as perfectly as is practicable. In conclusion, the opinion is expressed that the "quality policy" of the Metropolitan Water Board should be directed towards securing an "epidemiologically sterile" water (*i.e.*, a water containing none of the microbes associated with water-borne epidemic disease) antecedent to filtration by storage (sedimentation, devitalisation, and equalisation) aided, if needs be, by the occasional employment of supplementary processes of water purification.

The actual chemical and bacteriological results obtained in the examination of the various waters, the processes employed, and other data are given fully in the report. —W. P. S.

Typhoid bacillus, Gärtner's bacillus, fæcal streptococci, and Morgan's (No. 1) bacillus; Results of the examination of Thames, Lea, and New River waters for the presence of —— and the isolation of cholera vibrios from samples of raw river water artificially infected with only a few vibrios. A. C. Houston. Metr. Water Board. Fifth Report on Research Work, 1910.

The raw waters were found to contain, on the average, less than 1 streptococcus per c.c., and are therefore, on the basis of the streptococcus test, at least 100,000 times less impure than human fæces, the latter containing more than 100,000 streptococci per grm. As the *B. coli* results show that the processes of storage and filtration improve the raw water bacteriologically, at least, 1000 times, it may be concluded that the chances of any appreciable number of fæcal streptococci ever reaching the consumer of stored and filtered water are extremely remote. The results of the search for typhoid and Gärtner's bacilli show that the raw waters contained less than 1 typhoid bacillus per 6·5 c.c. of water and less than 1 Gärtner bacillus per 18 c.c. of water. Morgan's No. 1 bacillus was not found in 1 c.c. amounts of numerous samples of the different raw waters. Further experiments (see this J., 1909, 810) were carried out on the isolation of cholera vibrios from samples of raw river water artificially infected with only a few vibrios; although the number of vibrios added was in each case fewer than 1 per c.c., and notwithstanding the circumstance that the river water contained a large number of "water microbes," the cholera vibrio was successfully isolated in 7 out of 14 experiments.—W. P. S.

Bacteria filtration with Berkefeld filters. P. Schmidt. Z. Hyg. u. Infect.-Krankh., 1910, **65**, 423—434. Chem. Zentr., 1910, **2**, 100—101.

In the filtration of pure water through a Berkefeld filter, Poiseuille's law of the passage of liquids through capillary openings holds, the quantity of filtrate being proportional to the pressure. In the filtration of bacteria the phenomenon is not so much one of physical surface adsorption, as of direct stoppage of the passages, although at the beginning of filtration, in the larger pores, adsorption may predominate. The "active size of the pores" in Berkefeld filters (Liliput candles) is probably about 0·5 μ. The laws governing the passage of liquids through glass capillaries are not applicable to bacteria filtration with Berkefeld filters. The thin sections of a Berkefeld filter clogged with bacteria show that the clogging occurs wholly at the surface of the filter-candle, so that an almost perfect cleansing by a reverse flow of water is possible. The larger pores and cracks of about 2—100 μ diameter, visible in thin sections, are, for the most part, not real hollow spaces. *Staphylococci* and other *cocci* of similar size never pass through the filter; but with *Spirillum parvum*, up to 80 per cent. passed through a filter with a candle 2·5 cm. thick. The chief factors influencing the passage of a bacterium through the filter are its size and mobility. Filter-candles of 2·5 cm. thickness are most effective. Under suitable conditions, in tests extending for 2—4 hours, only in 10 per cent. of the cases, did *Bact. fluorescens liquefaciens* pass through the filter.—A. S.

Patents.

Water; Process for utilising barium carbonate for the purification [softening] of ——. H. Reisert. Soc. G. m. b. H. Fr. Pat. 411,532, Jan. 13, 1910.

The water to be softened is conducted into the lower part of a vessel where it is treated with a sufficient quantity of milk-of-lime to decompose the bicarbonates present; the water then rises in the vessel and enters the upper part which is separated from the lower by an inverted conical partition. An opening is provided at the apex of this cone and below the opening is placed a hemispherical cap. The upper chamber contains barium carbonate. Means are provided for conducting a portion of the sludge from the barium carbonate chamber to the lime chamber, and also for removing the sludge from the latter. The treatment with milk-of-lime may be omitted, the water being treated in the lower chamber of the vessel with the sludge produced in the upper or barium carbonate chamber.
—W. P. S.

Sea-water; Treatment of —— [removal of sulphates previous to extraction of other dissolved salts]. F. H. Eijdman, Ryswyk, Holland. Eng. Pat. 11,421, May 14, 1909.

Calcium oxide or chloride is added to the sea-water, or preferably to the brine resulting from the evaporation of the water, in order to convert the sulphates present into calcium sulphate, the latter being removed by filtration during the subsequent evaporation of the water and before the more soluble salts commence to crystallise out. The quantity of calcium chloride to be added is ascertained by previously determining the amount of sulphate present. The evaporating apparatus employed is that described in Eng. Pats. 11,388 of 1908 (this J., 1909, 691), and 11,422 of 1909, and the condensed water obtained may be rendered suitable for drinking purposes by the addition of salts and by aeration.—W. P. S.

Waste-waters; Apparatus for the purification of ——. H. Desrumaux. Fr. Pat. 411,428, Jan. 10, 1910.

The apparatus consists of a closed tank divided into four compartments; the waste-water or sewage is conducted into the first compartment and as fermentation proceeds the liquid portion is forced through a pipe into the upper portion of the second compartment. From the latter the liquid flows through an opening at the bottom of the dividing wall into the third compartment where further fermentation takes place. An opening at about one-half the height of the partition allows the liquid to pass into the fourth compartment whence it is discharged through a pipe extending to about one-half the depth of the compartment.—W. P. S.

Sewage, foul waters, and the like; Treatment of ——. T. Williams, Bargoed, Glamorganshire. Eng. Pat. 14,439, June 21, 1909.

The sewage is delivered into a receiving chamber which is divided into two compartments in order that one may be used whilst the other is being cleaned; from the receiving chamber the sewage flows through a channel, where it operates a water-wheel, into a main tank which is also divided into two parts by a longitudinal partition. Two sets of perforated plates divide each of the two divisions of the main tank into three compartments, and filtering material is packed between the perforated plates composing each set. The first compartment of either chamber acts as a settling tank; in the second compartment the sewage, after having passed the first filter-partition, is subjected to the action of a current of electricity, power for generating the current being obtained from the water-wheel before-mentioned. After passing through the second filter the liquid collects in the third compartment and flows thence through a turbine chamber before being discharged into a water course; the power derived from the turbine is also employed for generating electricity. Means are provided for diverting the current of sewage from the water-wheel channel should the wheel get out of order, and conduits supply clean water to the various portions of the tank for flushing purposes. A supply of clean water is also conducted to the turbine for the purpose of increasing the power of the latter and for diluting the effluent.—W. P. S.

Night-soil; Process of transforming, utilising or destroying —— in the form of combustible briquettes. O. Crochet. Fr. Pat. 411,266, Jan. 4, 1910.

The night-soil, previously freed from metallic substances, bones, etc., is dried in a suitable heated chamber and intimately mixed with a quantity of tar, the mixture being then introduced into a vessel surrounded by a superheated steam jacket and provided with a stirrer. Rosin, or a mixture of rosin and tar, is then added, and the paste obtained is compressed into the form of briquettes. The slag obtained when these briquettes are burned may be used in filter beds.—W. P. S.

isinfecting process. Chemische Fabrik Ladenburg, G. m. b. H., Ladenburg, Germany. Eng. Pat. 25,472, Nov. 4, 1909. Under Int. Conv., May 24, 1909.

ALOGENATED naphthols, such as di-, tri-, and tetrabromo-naphthols, or dichloro-β-naphthol, are employed either one in a free or combined form, or dissolved in an alco-olic soap solution. The addition of water to the latter olution produces a milky solution ; the halogenated aphthol may also be dissolved in sodium hydroxide soluon and then diluted for use in disinfection. The halo-enated naphthols used should not contain more than ur halogen atoms in their molecule.—W. P. S.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

ucoside (arbutin) ; Extraction of a ——, from the leaves of the pear tree. E. Bourquelot and A. Fichtenholz. Comptes rend., 1910, **151**, 81—84.

GLUCOSIDE is extracted by ethyl acetate from the leaves the pear tree, the variety known as *Carici*, with large id fruits which are used for perry, giving the largest eld (12—14 grms. per kilo. of fresh leaves, gathered in ne). Purified by crystallisation from ethyl acetate and ied in the air, it melts at 194°—195° C. (on the Maenne block), has a rotatory power of $a_D = -68°·38$, and ses 6·40 per cent. on heating at 110° C. A solution of 6008 grm. in 100 c.c. of water yielded on hydrolysis with 25 grms. of emulsin for 2 days, 1·306 grm. of a product ·687 grm. per 1° reduction in the rotatory power of the lution) which is soluble in ether and melts at 167°—168° ı. p. of hydroquinone = 166°·5). The glucoside is therere believed to be arbutin. (Compare this J., 1908, 468, 38 ; 1910, 295).—A. Sbld.

mphor monobromide ; Determination of the bromine in ——. André and Leulier. J. Pharm. Chim., 1910, **2**, 64—66.

IE amount of bromine in camphor monobromide can be termined by the following process. 0·50 grm. of the bstance is placed in a flask of 125 c.c. capacity with 10 c.c. toluene and about 1 grm. of metallic sodium. The ıole is heated for an hour with a reflux condenser. When ld, the excess of sodium is destroyed by adding 30 c.c. water. The liquid is acidified with nitric acid, and c.c. of N/10 silver nitrate are added. The excess of ver is titrated with N/10 thiocyanate solution using n alum as indicator.—F. Shdn.

vet. E. Charabot and A. Hébert. Bull. Soc. Chim. 1910, **7**, 687—691.

IE authors consider that a normal sample of civet ould leave less than 6 per cent. of insoluble residue when ated with alcohol and ether, it should contain more than per cent. of fatty acids obtainable by saponification, d the saponification value should be greater than 100. ıe figures for a number of samples are given below :—

amples.	M. pt.	Residue insoluble in alcohol and ether.	Ash.	Fatty acids.	M. pt. of fatty acids.	Saponification value.	Colour.
	C.	per cent.	per cent.	per cent.	°C.		
No. 20	36—37	3·60	0·80	55·0	39	—	Dirty yellowish brown.
No. 22	36—37	4·30	0·60	51·0	39	—	Dirty yellowish brown.
A	36—37	5·30	1·20	70·0	39	—	Dirty brown.
1	35—36	3·70	0·70	62·5	36—37	182	Dirty yellowish brown.
2	35—36	4·80	0·30	59·6	36—37	109·2	Dirty yellowish brown.
3	35—36	4·50	0·70	63·8	36—37	110	Dirty brown.
4	35—36	20·50	2·00	17·2	36—37	81·2	Brown and very dark

Of the above specimens No. 1 was good, No. 2 average ality, No. 3 was doubtful, whilst No. 4 was a bad uple.—F. Shdn.

Methylamines ; Determination of mixed —— in presence of a large excess of ammonia. J. Bertheaume. Comptes rend., 1910, **151**, 146—149.

BOTH monomethylamine and dimethylamine are capable of displacing ammonia from ammonium salts. To determine small amounts of methylamines in presence of a great excess of ammonia, the liquid is placed in the first of a series of four Durand washbottles (600—800 c.c. capacity) with a quantity of hydrochloric acid about six times that necessary to neutralise the estimated quantity of amines present. A similar quantity of hydrochloric acid, diluted to 50—100 c.c. with water, is placed in each of the other three washbottles. Two larger washbottles (1000 c.c.) containing 1 : 1 hydrochloric acid in quantity more than enough to neutralise the whole of the ammonia, complete the series, through which is now aspirated a rapid current of air till the contents of the first four washbottles are neutral. These four now contain (with ammonium chloride) the whole of the mono- and dimethylamines as hydrochlorides ; the united liquids are evaporated down to a few c.c., mixed with quartz sand, and treated by the author's method for the determination of the two amines. (This J., 1910, 717.) The other two washbottles contain the trimethylamine, and the whole of the ammonia save the small amount with the other amines ; the liquid is evaporated to 500 c.c., cooled to 0° C., excess of ammonium chloride separated, and the trimethylamine determined as periodide.—J. T. D.

Mercurous chloride ; Action of ammonia on ——. H. Saha and K. N. Choudhuri. Z. anorg. Chem., 1910, **67**, 357—360.

THE statement of C. Barfoed (J. pr. Chem., **39**, 201), that the black substance produced by the action of ammonia on mercurous chloride is a mixture of mercury and "infusible white precipitate," NH_2HgCl, is definitely confirmed. The composition of the substance cannot, however, be expressed by the formula, $Hg + NH_2HgCl$, as he suggests, since part of the latter constituent goes into solution ; for, "infusible white precipitate," when freshly prepared, is soluble in concentrated ammonia and can be obtained in the crystallised state by evaporating this solution *in vacuo* over sulphuric acid.—F. Sodn.

Savin oil. F. Elze. Chem.-Zeit., 1910, **34**, 767—768.

THE oil of savin contains about 45 per cent. of liquid, which is more soluble in dilute alcohol than the rest of the oil, and has a stronger odour. The constants of this portion are : sp. gr. at 15° C. 0·960 ; optical rotation, +68° in a 100 mm. tube ; 83 per cent. of ester reckoned as sabinyl acetate, $C_{10}H_{15}O.COCH_3$. This oil was hydrolysed with alcoholic potassium hydroxide and fractionated at 3 mm. pressure, when it nearly all distilled at 77°—78° C. The pure sabinol thus obtained has the sp. gr. 0·950 at 15° C., and an optical rotation of +6° in a 100 mm. tube. The acetate of sabinol boils at 81°—82° C. at 3 mm., has the sp. gr. 0·972 at 15° C., and an optical rotation of +79° in a 100 mm. tube. Evidently the original oil owes its high rotation to the presence of sabinyl acetate. *n*-Decylaldehyde (b. pt. 80°—81° C. at 6 mm., sp. gr. 0·836 at 15° C., semicarbazone m. pt. 102° C.), geraniol, and dihydrocumin alcohol were also found in small amounts in the oil.—F. Shdn.

Water-melon seed : Chemical examination of ——. Power and Salway. *See* XII.

The camphor supply. For. Off. Ann. Series. No. 4500. [T.R.]

The action which the Japanese Government proposes to take, during the next few years, against the savages in the interior of Formosa will probably result in large tracts of camphor trees being brought under control. The supply of trees in the settled districts is steadily diminishing, but plantations are being made in suitable localities. The Government Monopoly Bureau is stated to have restricted the output of camphor and camphor oil for 1910 to 6,670,000 and 7,330,000 lb. respectively. In his report on the trade of North Formosa for 1909, the British Consul says:—The shipments of camphor were as follows: Germany, 2,465,600 lb.; United States, 1,908,000 lb.; France, 1,344,900 lb.; United Kingdom, 759,000 lb.; other countries, 193,160 lb.—total, 6,670,660 lb. Owing to the lowering of the price of camphor, in order to drive Foochow and synthetic camphor from the market, profits from the monopoly were small. The output of camphor oil was 4,795,907 lb., all of which was shipped to Japan for manufacture into camphor; the yield of camphor being about 40 per cent. of the weight of the oil. The recent establishment of two celluloid factories in Japan will doubtlessly favourably affect the camphor industry in Formosa. The distillation of camphor from leaves is still in the experimental stage.

"Terpinolene" and terpinyl acetate in Sicily. Oil, Paint and Drug Rep., July 18, 1910. [T.R.]

The Board of Trade reports that a by-product, of the manufacture of terpineol, known under the name of "terpinolene," is being introduced into Catania and neighbouring districts for the adulteration of essence of lemon, orange and bergamot. Terpinolene is stated to be produced in considerable quantities at Marseilles and devoted exclusively to the adulteration of essential oils. It is entirely harmless, and cannot be detected unless the quantity used in blending exceeds 10 per cent. It is also stated that a firm (non-British) is trying to introduce another substance, called "terpinyl acetat," manufactured by them for the same purpose and particularly for the adulteration of bergamot oil.

Morocco gum. Oil, Paint and Drug Rep. July 11, 1910. [T.R.]

The U.S. Consul-General at Hamburg describes "Morocco gum" as gum euphorbium, a drug of limited use. It is derived from the Euphorbium resinefera, a cactus-like plant which grows in the Atlas Mountains. The cortex and pith of the plant contain long, laticiferous cells. When the stem is incised the latex exudes in milky drops, which harden on exposure to air and form resinous masses which are collected. It is yellowish-brown in colour, translucent and readily pulverized. Under the microscope it shows the presence of bone-like grains, which are the characteristics of the Euphorbiaceae.

In the dry state the crude drug has no odour, but if heated in large quantities it produces a smell not unlike that of incense. It is scarcely soluble in water, but it can be partially dissolved in alcohol, ether, and essential oils. It is very hot to the taste, is emetic and powerfully cathartic. On account of its violent action its use internally has been abandoned. Externally it acts as a vesicant, and as such it is used in veterinary practice. The gum is never used in its original state, but must be crushed, ordinarily in the open air, and to 100 grams of the raw material two sweet almonds may be added. Unless the crushing takes place in a closed apparatus it causes violent and long-continued fits of sneezing. It is marketed in bags containing from one-half to one pound.

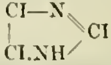
This gum is chiefly for veterinary purposes, being commonly mixed with cantharides or resin, after having been sprinkled with turpentine oil. Its free use in the drug trade is forbidden, and it can be obtained only upon physicians' prescriptions.

Tartaric acid in wine by-products; Determination of ——. Beis. *See* XVIII.

Patents.

Imidazoles containing iodine substituents in the nucleus; Process for preparing ——. H. Pauly and K. Gundermann. Ger. Pat. 223,303, Nov. 14, 1908.

Iodo-derivatives of imidazole or its derivatives containing free hydrogen atoms, are obtained by treating the imidazole with solutions of iodine, preferably in presence of substances which will combine with hydriodic acid. For example, tri-iodo-imidazole,



a colourless crystalline compound, melting at 191° C. with decomposition, is obtained by adding a quantity of N/10 iodine solution, corresponding to 6 atoms of iodine, to a solution containing 1 kilo. of imidazole and 2 to 2·5 kilos. of sodium hydroxide in 14 litres of water, and precipitating by means of acid.—T. F. B.

Chloramine derivative: Manufacture of a ——. C. F. Cross, London. Eng. Pat. 15,303, June 30, 1909.

A new crystalline substance, sparingly soluble in water, and containing the methylene group and "active" chlorine, is obtained by the action of chloramine on formaldehyde. For example, an aqueous solution of calcium hypochlorite, containing 2 per cent. of active chlorine, is cooled to 5° C.; to each litre of this solution is added a solution made by dissolving 40 grms. of ammonium chloride in 100 c.c. of water, adding 50 c.c. of 40 per cent. formaldehyde, and making up the volume to 1200 c.c. When the solutions have been thoroughly incorporated and allowed to stand a while, crystals of the new compound separate out, and are filtered off, washed, and pressed.—T. F. B.

Coumarin: Process for preparing ——. F. Raschig. Ger. Pat. 223,684, April 27, 1909.

Coumarin is prepared by heating esters of *o*-hydroxybenzylidene chloride (obtained by chlorination of the *o*-cresol ester at 160°—180° C.) with anhydrous sodium acetate at temperatures of 150°—200° C. for some hours. Such cresol esters as the phosphate, carbonate, or benzoate may be used.—T. F. B.

Aluminium formate soluble in water; Process for preparing crystalline ——. E. Jacoby. Ger. Pat. 224,074, Aug. 3, 1909.

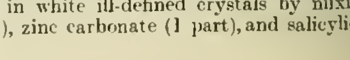
A crystalline aluminium formate, readily soluble in water and containing 16 per cent. of aluminium ($Al(O.CO.H)_3$ requires 16·63 per cent.) may be obtained by the careful evaporation of a solution of moist aluminium hydroxide in 95 per cent. formic acid, or by adding excess of formic acid to the commercial aluminium formate solution, evaporating until a film begins to form, and allowing to crystallise at 25°—30° C. The aqueous solutions of the formate are only stable in presence of formic acid. —T. F. B.

Carbonates [of phenols and alcohols]; Process for preparing mixed basic ——. A. Einhorn. Ger. Pat. 224,108, Jan. 15, 1909.

Chlorocarbonic esters of phenols react readily, in the cold or warm, with basic alcohols to form mixed basic carbonates, which form salts with acids, and which may be used as internal antiseptics. The phenolchlorocarbonates are prepared by the action of phosgene in benzene solution on the phenol in presence of quinoline, and are easily soluble in benzene, ether, and chloroform; seven of these are described in the specification.—T. F. B.

Zinc boro-diorthohydroxybenzoate; Production of ——. A. Foelsing. Fr. Pat. 411,614, Jan 17. 1910.

Zinc boro-diorthohydroxybenzoate,



$$\left(\begin{matrix} C_6H_4{\cdot}COO{\cdot}O{-} \\ C_6H_4{\cdot}COOH{\cdot}O \end{matrix}{>}B{\cdot}OH\right)_2 Zn,\ 10\ H_2O,$$

is obtained in white ill-defined crystals by mixing boric acid (1 part), zinc carbonate (1 part), and salicylic acid (3 parts, and adding the mixture, little by little, to ten times the weight of water at about 65° C.; this temperature is maintained and the mixture agitated, until carbon dioxide ceases to be evolved, and the filtered liquid is then allowed to crystallise. The substance is readily soluble in water and in methyl and ethyl alcohols, and it melts with decomposition at about 100° C., with liberation of phenol.—F. Sodn.

Tuberculosis; Process for producing a preparation for the diagnosis and treatment of ——. W. Schultz. Ger. Pat. 223,561, June 27, 1908.

Pure cultures of tubercle bacilli, which have been prepared in nutrient broth, are separated from the liquid medium and shaken with dilute aqueous solutions of phenol; the extract thus obtained is then treated with a solution of a suitable iron compound, *e.g.*, ferric oxychloride, and the precipitated mass is washed until free from chlorine and albumin, and finally dissolved in dilute sodium carbonate solution. If a preparation free from fat is required, the bacilli separated from the broth may be extracted with ether.—T. F. B.

Kawa resin; Process for separating an irritant oil, not possessing anæsthetic properties, from ——. J. D. Riedel A.-G. Ger. Pat. 223,516, Aug. 10, 1909.

The so-called *a*-resin of kawa copal contains about 20 per cent. of an oil which has an irritant action but no anæsthetic value. To remove this it is proposed to treat the resin with a petroleum distillate (especially the naphtha of b.pt. 120° C.) or to distil it with steam, or to combine the processes, the oil being more easily soluble and more volatile in steam than the active resin.—T. F. B.

Creosote; Process for preparing carbonic acid derivatives of ——. Verein. Chininfabr. Zimmer und Co. Ger. Pat. 224,072, July 16, 1908.

Creosote is converted into a solid compound, of slight odour and taste, when it is treated in the usual manner for converting phenols into their allophanic esters. For example, 1·5 kilos. of beech-wood creosote are added to a mixture of 2·5 kilos. of carbaminic acid chloride and 3 kilos. of chloroform, and after standing for a day, the chloroform is removed and the residue washed with water.—T. F. B.

Protocatechuic aldehyde from piperonal; Process for preparing ——. Schimmel und Co. Ger. Pat. 223,643, Nov. 14, 1908. Addition to Ger. Pat. 165,727, Oct. 18, 1904.

In preparing protocatechuic aldehyde according to the principal patent (Eng. Pat. 18,992 of 1905; this J., 1906, 89), the dichloropiperonal, formed by the action of sulphur chloride on piperonal, is always contaminated with sulphur, which is difficult to remove by a solution process, since it is soluble in most of the solvents of dichloropiperonal and protocatechuic aldehyde. It is now proposed to treat the mixture of dichloropiperonal and sulphur, in presence of a solvent, if desired, with chlorine in excess of the amount necessary to combine with the sulphur, after which the sulphur chloride is removed by distillation under reduced pressure and utilised for the first step of the process.—T. F. B.

Albuminoid compounds of guaiacol-sulphonates; Preparation of ——. A. Busch and J. A. von Wülfing, Brunswick, Germany. Eng. Pat. 29,787, Dec. 20, 1909.

Compounds of albuminates, casein, etc., with soluble basic salts of guaiacol-sulphonic acid, are obtained either by dissolving the albuminoid in aqueous solutions of the guaiacol sulphonate and evaporating to dryness, or by suspending the albuminoid in inactive organic liquids (*e.g.*, alcohol and ether) and then adding sufficient quantities of aqueous solutions of the guaiacol-sulphonate to dissolve it, and removing the liquid by filtration or evaporation. To obtain soluble products, it is necessary to use 5 to 7 parts of the basic sodium salts of the guaiacol-sulphonic acids to 100 parts of albuminoid. The products are white powders, odourless and tasteless, which swell in presence of cold water and dissolve in hot water to milky solutions.—T. F. B.

Opium alkaloids; Phenol-sulphonate of ——. G. L. Schaefer, Brooklyn, N.Y. U.S. Pat. 963,254, July 5, 1910.

Neutral salts of opium alkaloids can be made by using a phenol-sulphonic acid. Such salts are morphine guaiacol-sulphonate, codeine guaiacol-sulphonate, which melts at 164°—165° C., and codeine phenol-sulphonate. These substances are white, crystalline, and soluble in water. The base is liberated on treating them with alkalis.—F. Sodn.

Essential oils from limes, lemons, oranges, bergamots, etc.; Improved rotary machine for extracting ——. H. G. Rose and T. A. Siddall. Eng. Pat. 15,552, July 3, 1909.

The machine for the extraction of oils from fruits such as limes, etc., consists essentially of two cones, one within the other. The inner side of the upper cone and the outer surface of the lower cone are provided with teeth, or other projections. The lower cone can be rotated by means of a vertical spindle, and raised or lowered by a lever working on the spindle shaft. Means are provided for collecting the oil and ejecting the extracted fruit. Diagrams of the machine are given.—F. Sodn.

Arsenoarylglycollic acids. P. Ehrlich and E. Schmitz, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 963,126, July 5, 1910.

See Eng. Pat. 4246 of 1909; this J., 1909, 1167.—T. F. B.

Meta-cresol ortho-oxalic ester and process for the production of the same. J. Wetter, London. From Rütgerswerke Akt.-Ges., Berlin. Eng. Pat. 14,805, June 24, 1909.

See Fr. Pat. 403,863 of 1909; this J., 1910, 42.—T. F. B.

Beta-methyladipic acid; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,298, Oct. 22, 1909.

See Ger. Pat. 221,849 of 1908; this J., 1910, 719.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Development by continuation of papers giving a visible image of silver chloride. J. Desalme. Bull. Soc. Franç. Phot., 1910, 1, 207—214.

Developers containing an amino group are the most suitable for the physical development of printing-out and similar papers. Developers containing two or more hydroxyl groups are not nearly so active. *p*-Aminophenol is the most useful of all the developers tried, the diamino compounds being so energetic as to be beyond control. By neutralising the amino group, *e.g.*, with an organic acid, the action is retarded and the tone modified. Dimethyl-*p*-phenylenediamine is less rapid than *p*-phenylenediamine, whilst monoacetyl-*p*-phenylenediamine has no developing power. Methyl-*p*-aminophenol (metol) acts less energetically than *p*-aminophenol, but both form valuable physical developers when used in conjunction with tartaric, citric, or acetic acid.—T. F. B.

Patents.

Dot screens [for colour photography]; Process for producing ——. F. Fritz. Ger. Pat. 223,819, Feb. 6, 1908.

Dot-screens for colour photography have been prepared by the use of a number of coloured fibres of natural silk cemented together by a suitable agglutinant. It is now proposed to utilise artificial silk fibres for this purpose, in which case no agglutinant is necessary. A number of the fibres, suitably coloured, are twisted together into a rope, while still containing a certain proportion of solvent, and several of these ropes are laid side by side on a suitable support, and pressed into a flat film, with or without the aid of a softening liquid.—T. F. B.

Screen filter for the direct photography of colours; Three-colour glass forming a ——. A. Montagna and G. Ascoli. Fr. Pat. 411,247, Jan. 4, 1910. Under Int. Conv., Jan. 4, 1909.

A sheet of glass, containing traces of arsenious acid, is covered with a mixture, in suitable proportions, of grains of blue and purple (or violet and green) enamel, and of another yellow or orange substance which will burn without leaving a residue. The whole is then fired, and the enamelled side is coated with a silver chloride-collodion emulsion. The plate is exposed to light, through the enamel, and the unreduced silver removed, when the plate is again fired, in order to fix the reduced silver.—T. F. B.

Celluloid and other similar support films for photographic purposes; Machines or apparatus for forming ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,009, July 21, 1909.

A band of metal or other suitable material, somewhat broader than the film to be made, is formed into a circular ring, and guards are fixed at either edge of this ring, preferably made of bar-metal of I-section. These guards rest on two bearing rollers, one of which can be rotated. A feeding device is fixed inside the ring, at its lowest part, and a stripping roller and reel are provided to remove the film when a nearly complete revolution of the ring has been made. The upper part of the apparatus is enclosed in a suitable casing, provided with a heating coil or other drying device. The solution of celluloid is fed on to the inner surface of the ring, which is rotated at such a speed that the film is dry when it reaches the stripping roller. —T. F. B.

Cinematographic films or bands. H. Danzer, Paris. Eng. Pat. 3603, Feb. 14, 1910.

Cellulose films or bands are rendered impermeable to water or other liquids employed in the usual photographic operations, by coating them with a suitable varnish or by superficially nitrating or acetylating them. When thus prepared they may be used in place of celluloid cinematograph films.—T. F. B.

Films prepared from acetylcellulose, specially destined for electrical insulation and for photography. C. Mijnssen. Fr. Pat. 411,298, Jan. 5, 1910. Under Int. Conv., Jan. 9, 1909.

Films are made by successively depositing layers of acetylcellulose one upon another, or by having alternate layers composed of either some supple, ductile material such as gelatin, together with some softening agent, or of acetylcellulose itself which has been previously treated with phenol or with any other substance which can replace camphor in the preparation of celluloid.—P. F. C.

Dyestuff emulsions suitable for the bleaching-out process [of colour photography]; Process for preparing ——. J. H. Smith and N. Stafford. Ger. Pat. 223,195, Aug. 29, 1908.

Essential oils, *e.g.*, peppermint oil, are used as sensitisers for bleaching-out colours in gelatin or collodion films, but they are volatilised from the films comparatively readily. To remedy this it is advantageous to add some colourless, viscous oil, resin, or balsam, the action of which is purely mechanical. The following are specially claimed for the purpose:—Oleic acid, castor oil, linseed oil, walnut oil, hempseed oil, poppy-seed oil, sesamé oil, cottonseed oil, olive oil, rapeseed oil, neatsfoot oil, fish oils, oxidised oils, colophony, copal, dammar resin, sandarac, gum elemi, mastic, shellac, copaïba balsam, and Canada balsam. —T. F. B.

Amino-xylenol photographic developer. E. Merck. Ger. Pat. 223,690, May 10, 1908.

The use of amino-xylenol ($NH_2 : CH_3 : CH_4 : OH = 2 : 1 : 3 : 5$) as a photographic developer is claimed. It is stated to be more rapid in its action than *p*-aminophenol, to produce greater density, and to work without fogging. As an example of a developer containing this substance the following is given:—6·3 grms. of amino-xylenol, 22 c.c. of sodium carbonate solution (sp. gr. 1·3), 15 grms. of potassium metasulphite, and 50 c.c. of water: for use, this solution is diluted with ten to forty volumes of water. The mono-methyl derivative of this amino-xylenol, unlike that of *p*-aminophenol, possesses no developing power.—T. F. B.

Polychrome screens for colour photography; Manufacture of ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils, Lyon, France. Eng. Pats. 29,273, Dec. 14, 1909, 4912, Feb. 26, 1910, and 5377, March 3, 1910. Under Int. Conv., Feb. 6, Feb. 27, and March 10, 1909, respectively.

See Fr. Pat. 409,044 of 1909, and First and Second Additions thereto; this J., 1910, 720, 841.—T. F. B.

Photographic emulsion. Y. Schwartz, Hanover, Germany. U.S. Pat. 962,788, June 28, 1910.

See Fr. Pat. 378,305 of 1907; this J., 1907, 1109.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Cellulose nitrates; Products containing nitrogen formed by the alkaline hydrolysis of ——. E. Berl and A. Fodor. Z. ges. Schiess- und Sprengstoffw., 1910, 5, 254—256, 269—273.

Collodion cotton (50 grms.) was dissolved in ether-alcohol (650 c.c.) and mixed with an excess of a dilute solution of sodium carbonate. The viscous liquid was continuously agitated for seven weeks. The liquid had then become mobile, and on standing separated into two layers with a brown flocculent body in suspension. This compound contained about 9 per cent. of nitrogen of which some 8·5 per cent. existed as an ester of nitric acid. The yellow alkaline layer gave on acidification, distinct evidence of the evolution of hydrocyanic acid and a colourless precipitate was formed. In the ether-alcohol layer the unchanged collodion cotton was precipitated by the addition of water, and the filtrate, after being freed from ether and alcohol, was slightly acidified. A flocculent precipitate was formed, which, after purification by treatment with alcohol, contained 9·11 per cent. of nitrogen, of which 8·01 per cent. was combined as an ester of nitric acid. The viscosity, in a 2 per cent. acetone solution, of these two compounds, acetone being taken as unity, was only about 1·2, whilst the original collodion cotton had a viscosity of 13·5. Collodion cotton (445 grms.) containing 12·3 per cent. of nitrogen, was gelatinised with 3450 c.c. of ether-alcohol (3 to 1). The gelatinous mass was then treated with alcohol (720 c.c.) containing potassium hydroxide (36 grms.) in solution. This was carried out in small portions at a time, with constant stirring. The liquid separated into two layers, an alkaline red-brown liquid smelling of ethyl acetate, and a syrupy layer. On adding sulphuric acid to this latter portion a copious evolution of gas took place, and a white amorphous residue, insoluble in ether, remained which contained 8·46 per cent. of nitrogen. The other analytical data and molecular weight determinations agreed with the formula $C_{24}H_{33}O_{16}(NO_3)_5$. This compound was dissolved at 0° C. in sulphuric acid (80 per cent.). On addition of ice-cold water a gummy substance separated out. A second treatment in the same manner brought about complete hydrolysis. The solution, after removal of nitric acid by steam distillation strongly reduced Fehling's solution, and from its phenylhydrazine compound, glucosazone was shown to be present. The complete hydrolysis of cellulose nitrate, in alcoholic solution, with sulphuric acid was shown to produce, as an intermediate product, a cellulose nitrate soluble in ether. Cellulose nitrate, dissolved in absolute alcohol, when hydrolysed with ammonium sulphide produced the lactone of hexonic acid. Cellulose nitrate, dissolved in acetic acid, was heated for 2 hours with phenylhydrazine. Dilution with water produced a precipitate which was purified by treatment with benzene and alcohol. A determination of the nitrogen content showed it to be the phenylhydrazine derivative of a cellulose nitrate corresponding to the formula $C_{21}H_{33}O_{13}(NO_3)_3$. It was also found that *p*-bromphenylhydrazine formed a compound with cellulose nitrate of the formula given above.—G. W. McD.

Combinations of potassium chlorate and sulphur in India. Times, July 22, 1910. [T.R.]

The Eleventh Annual Report of the Chief Inspector of Explosives in India states that the Government of India contemplate the total prohibition of a sulphur-chlorate combination, largely used for fireworks, as it has been very considerably used as an exploding agent in bombs. This mixture is prohibited in England.

Patent.

Blasting-powder. C. Arnoudts, Guatemala. U.S. Pat. 964,365, July 12, 1910.

Claim is made for a blasting-powder composed of sugar, potassium chlorate, potassium permanganate, turpentine, and vegetable tar.—F. R.

XXIII.—ANALYTICAL PROCESSES.

Bomb calorimeter ; Friction in the ——. H. A. Roesler. Amer. Chem. J., 1910, **44**, 80—84.

The heating effect due to the friction of the stirrer in the bomb calorimeter is found to be considerable, amounting to 42·6 and 82·2 cals. for the whole combustion period with the two calorimeters examined, of which the water equivalents were 2944 grms. and 2767 grms. respectively. This source of heating is, however taken into account in the ordinary correction for radiation, and does not, therefore, affect the accuracy of a calorific determination, provided that the rate of rise in temperature, due to friction, is uniform, that is, provided the rate of stirring be absolutely constant throughout. The best motor to employ is considered to be an alternating current induction fan motor.—F. Sodn.

Methylene blue as an indicator in iodometric titrations ; Use of ——. F. S. Sinnatt. Analyst, 1910, **35**, 399—310.

A 0·005 per cent. solution of methylene blue may be used instead of a solution of starch in iodometric titrations; when a solution of iodine in potassium iodide is added to a solution containing methylene blue, an iodo compound of the colouring matter is precipitated, but in dilute solution this reaction is indicated by a change from blue to yellowish-green, and finally a yellowish-brown colour is developed. One c.c. of the above-mentioned solution is a suitable quantity to employ as an indicator in a titration, and this quantity requires only 0·2 c.c. of $N/1000$ solution of iodine to effect the colour change.—W. P. S.

Sulphur ; Detection of —— in inorganic and organic compounds. E. Deussen. Z. angew. Chem., 1910, **23**, 1258—1260.

The method devised for the detection and estimation of sulphuric acid in the presence of fluorides (Z. anal. Chem., 1907, **46**, 320) affords a sensitive test for sulphur in the absence of fluorides. If in solid form, the substance is mixed with 0·1 grm. of sodium carbonate (free from sulphur) and the necessary amount of filter paper cut in fragments, and the whole evaporated to dryness over a spirit lamp, and triturated with 0·2 grm. of anhydrous sodium carbonate. The mixture is next rolled up in filter paper about 5 cm. in length, fixed in a piece of platinum wire, and ignited in the reducing flame of a blowpipe lamp in which is burned the so-called "molecular" benzene of Kahlbaum, which was found to contain no sulphur. After 7 to 8 minutes' heating the fused mass, containing but few particles of carbon, is cooled, and dissolved in water, and the solution tested with lead acetate solution, prepared by mixing 10 drops of $N/1$-lead acetate solution, 70 c.c. of water and 30 c.c. of $2N$-sodium hydroxide solution. The sensitiveness of the method is shown by the fact that a perceptible yellow coloration was obtained with a sodium carbonate mixture containing 0·00000303 grm. of sulphur. It is suggested that this reduction method may be found useful in testing different kinds of paper, *e.g.*, in forensic cases. —C. A. M.

Total sulphur in organic matter ; Determination of ——. H. Schreiber. U.S. Dept. Agr., Bureau of Chemistry, Circular No. 56, June 15, 1910.

The following method was adopted in preference to the peroxide method as more nearly fulfilling the requirements that (1) moderate amounts of reagents should be used and only such as do not interfere with the precipitation of the barium sulphate, (2) all organic matter must be destroyed and all the sulphur fixed as sulphate, and (3) the method must be rapid and easy. To 1 grm. of the material contained in a nickel crucible of 100 c.c. capacity are added 10 c.c. of a solution made by dissolving 100 grms. of sodium nitrate and 150 grms. of sodium hydroxide in 500 c.c. of water, and 5 grms. of crystallised magnesium nitrate. The crucible is heated for 1 hour on a hot plate at 130° C. and subsequently at 150° to 160° C., till the mass is dry. The temperature is then raised to 180 to 200° C., and finally the material is fused over a direct Bunsen flame for half an hour. The mass is then treated with dilute hydrochloric acid, filtered, and the sulphate precipitated with barium chloride in the usual way. The crucible loses from 0·3 to 1·3 grms. in weight for each determination.—H. H.

Gravimetric determination of phenol. Olivier. *See* III.

Selenium in pyrites ; Determination of ——. Grabe and Petrén. *See* VII.

Sulphur (combustible) ; Determining —— in graphite. Cibulka. *See* VII.

[Analysis of ammoniacal liquor]. Report of Inspector of alkali works. *See* VII.

Ferrocyanides ; Analysis of —— Colman. *See* VII.

Potassium ferro- and ferricyanide ; Iodometric determination of ——. Mecklenburg. *See* VII.

Nitrates ; Comparison of Pozzi-Escot's and Devarda's methods for the determination of ——. Cahen. *See* VII.

Valuation of ammonium bifluoride. Deussen. *See* VII.

Cyanide solutions ; Protective alkalinity in ——. Bell. *See* X.

The lead coulombmeter [and method for the determination of tin and antimony in presence of each other]. Fischer Thiele and Maxted. *See* X.

Analysis of chrome-tungsten-steel. Hinrichsen. *See* X.

Bismuth from lead ; Separation of —— and the analysis of bismuth-lead alloys. Little and Cahen. *See* X.

Oils (lubricating) for automobiles ; their adulteration and its detection. Carles. *See* XII.

Detection of crucifer oils in other oils ——. Holde and Marcusson. *See* XII.

Detection of inferior ammoniates in commercial fertilizers. Street. *See* XVI.

Rice; Determination of extraneous mineral matter ("facing") in —— Richardson. *See* XIXa.

Methylamines; Determination of mixed —— in presence of a large excess of ammonia. Bertheaume. *See* XX.

Camphor monobromide; Determination of the bromine in —— André and Leulier. *See* XX.

Tartaric acid in wine by-products; Determination of ——. Béis. *See* XX.

Determination of raffinose in raw sugar, and its occurrence there. Strohmer. *See* XVII.

Glycerin; New method of determining —— in wine. Beys. *See* XVIII.

Patents.

Photometer; Société Chauvin et Arnoux. Fr. Pat. 411,669, April 15, 1909.

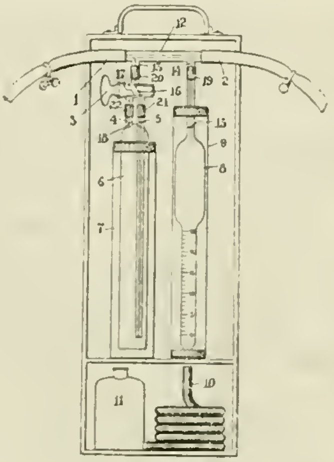
A screen or mirror is placed between the sources of light to be compared at an angle of 45° to the line joining them. Another screen or mirror is fixed to the back of, and at right angles to, the first, which is provided with a central opening so that each screen is illuminated only by one of the sources of light. The screens are mounted in a fitting capable of rotation through 180° to give two readings, and eliminate errors of construction. The lights to be compared are carried on small bases separated by graduated rods upon which the support for the screens slide. At the corners vertical rollers are provided to carry a continuous band of black cloth with an aperture for viewing the screens and making it possible to use the apparatus in daylight.—J. W. H.

Generating gas; Means for ——. T. James. Cardiff. Eng. Pat. 15,506, July 3, 1909.

A gas generator is claimed which is made entirely of glass and consists of a cylinder to receive a solid or liquid reagent provided at the top with a delivery tube and cock for the gas, and at the bottom with a tube leading to an acid bulb at a higher level, also provided with a regulating cock. The whole is supported in a glass cylinder.—J. W. H.

Gas analysis; Apparatus for ——. G. M. S. Tait, Montclair, N.Y., Assignor to Gas Power Co., New York. U.S. Pat. 963,484, July 5, 1910.

The laboratory vessel consists of a tube, 6, open below and closed above, which is immersed in the absorbing liquid contained in the outer vessel, 7. The gas enters the laboratory vessel, 6, through the three-way tap, 16, passing through the tube, 5, which reaches nearly to the bottom of the vessel, 6. The gas is consequently obliged to bubble up through the liquid in the vessel, 6. The gas is returned to the measuring burette through the short tube, 4.—W. H. C.



XXIV.—MISCELLANEOUS ABSTRACTS.

Green leaves; Toxicity of certain salts with regard to ——. L. Maquenne and E. Demoussy. Comptes rend., 1910, **151**, 178—182.

Green leaves were immersed in solutions of various salts, and the time required to blacken the leaves completely was observed. The blackening always started from the edges of the leaves; and it was very much more rapid with leaves the edges of which had been trimmed off with scissors, than with complete leaves. Copper salts were found to be very strongly toxic; blackening began after 24 hours in a solution of sulphate containing 1 part of copper in five millions. The copper from any small quantity of such a solution was quickly absorbed, and the black rim ceased to increase in breadth; but immersion of the leaf in a fresh quantity of solution caused the action to proceed again. Salts of the alkalis and alkaline-earths were examined, in 1 per cent. solutions. Ammonium salts were found to be much more rapidly injurious than potassium or sodium salts, and whilst in general there was not much difference in the behaviour of chloride, sulphate, and nitrate of the same metal, yet sodium chloride was much less harmful than other salts either of sodium or of potassium. Calcium chloride was still more nearly inert than sodium chloride. Salts of mono-methylamine were less toxic than those of ammonium, and those of trimethylamine still less so; hence the inferiority as manures of the salts of these amines to ammonium salts is not due to the poisonous character of the amine salts, but must be due to their greater resistance to the ferments in the soil. In general, a sudden change in the tonicity of the liquid in which a leaf is immersed is harmful to it; for example, leaves immersed for two days in 10 per cent. sodium chloride solution and still quite green, began to blacken immediately on immersion in distilled water, and were completely blackened in a few hours, whilst those which had remained in the salt solution showed no change till long afterwards.—J. T. D.

Acetaldehyde; Oxidation of —— by low forms of vegetable life. A. Perrier. Compt. rend., 1910, **151**, 163—165.

Certain micro-organisms, similar to *Torula*, can live in a medium containing as its only organic constituent, acetaldehyde. Tap-water, to which were added 1 grm. of ammonium phosphate, 0·5 grm. of potassium phosphate, 0·025 grm. of magnesium sulphate, and 4·3 grms. of acetaldehyde per litre, and sown with the organisms, lost aldehyde at the rate of about 1·3 grms. per day at first, and the whole disappeared in 12 days, whilst in a parallel experiment without the organism, the loss through volatilisation was only 0·38 grm. per litre in 12 days. Products of the incomplete oxidation of the aldehyde were found in the liquid containing the organisms. These results favour the view that alcohol and acetaldehyde form two stages in the digestion of sugars by certain vegetable cells.—J. T. D.

Methane in organic life; The function of —— [Fermentation of cellulose and of calcium salts of fatty acids]. N. L. Söhngen. Rec. Trav. Chim. Pays-Bas, 1910, **29**, 238—273.

The biological production of methane by the fermentation of cellulose and of the calcium salts of fatty acids has been studied by Hoppe-Seyler and later by Omelianski (this J., 1902, 418). The bacteria occur in river-mud, dung, etc., and two types of fermentation are distinguished, one with production of methane and the other with that of hydrogen. The organisms are morphologically very similar; in mixed sowings the methane bacillus proved the more powerful, but a separation could be effected by pasteurisation at

75 C., the hydrogen bacillus surviving owing to its more pronounced sporulating properties. The author has confirmed all Omelianski's observations with regard to the fermentation of cellulose; he has also studied the fermentation of the calcium salts of fatty acids by the organisms of mud and sewage. Cultures were made in mineral nutrients (potassium phosphate and ammonium chloride) in 2 per cent. solutions of the calcium salts at a temperature of 35° C. Fermentation may be continued for years with the periodical renewal of the liquid. The organisms all collect in the sediment, the liquid being incapable of transferring infection; the sediment, at first black, gradually becomes white owing to the deposition of calcium carbonate. Positive results were obtained with calcium formate, acetate, butyrate, caproate, caprylate and caprate. With the exception of the formate the salts of none of the acids with an odd number of carbon atoms were susceptible to this type of anäerobic fermentation. The products are methane, carbon dioxide and calcium carbonate. The fermentation of the acetate is expressed by the equation: $C_4H_6O_4Ca+H_2O=2CH_4+CO_2+CaCO_3$. The salts of the various acids are interchangeable in relation to the same culture. the sediment from the fermentation of one fatty acid being capable of fermenting the calcium salt of another. The organisms may be observed after dissolving the calcium carbonate by which they are enveloped: generally a rodlet bacterium was predominant but in some cases, particularly with the acetate. a sarcina preponderated. The sarcina survives drying at 40° C., whilst the bacterium succumbs. The author has studied the absorption of elementary hydrogen in the course of these fermentations. He has observed that hydrogen is absorbed in the methane fermentation of cellulose, also in the fermentation of the salts of the fatty acids, *e.g.*, calcium formate and butyrate, with the production of methane. This was proved by the production of methane by the action of a culture of the same bacteria in purely mineralised media on a mixture of hydrogen and carbon dioxide. Combination takes place according to the equation: $CO_2+4H_2=CH_4+2H_2O$. This accounts for the absence of hydrogen from marsh gas, firedamp and natural gases produced by the agency of methane fermentations. The author has also proved the presence of bacteria in mud, which, acting under aerobic conditions, are capable of causing the disappearance of methane, which undergoes oxidation to carbon dioxide. The methane is absorbed under conditions where it constitutes the sole source of carbonaceous nutrient for the bacteria which develop, and to which the author has given the name of *B. methanicus*.—J. F. B.

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PHYSICAL CHEMISTRY; ITS BEARING ON BIOLOGY AND MEDICINE. By JAMES C. PHILIP, M.A., Ph.D., D.Sc. Imperial College of Science and Technology, London. Edward Arnold, 41 and 43, Maddox Street, London, W. 1910. Price 7s. 6d.

SMALL 8vo volume. containing 306 pages of subject matter, with 23 illustrations, and indexes of subjects and names. The text is subdivided as follows:—I. Gases. Diffusion phenomena. II. Absorption of gases by liquids. III. Osmotic pressure. IV. Comparison of osmotic pressures. Isotonic solutions. V. Permeability and impermeability of membranes. VI. Vapour pressure. Boiling point and freezing point of solutions. VII. Behaviour of salts, acids, and bases in aqueous solution. VIII. Electrolytic dissociation; physical and biological applications. IX. Colloidal solutions. X. Separation of colloids from their solations. XI. Adsorption. XII. Chemical equilibrium and the law of mass action. XIII. Velocity of chemical reaction.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works and dissertations in the preceding lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

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17,696. Fowler and Medley. Apparatus for subjecting gases or vapours to the action of liquids. July 26.

17,899. Madeley (Richards). Apparatus for separating solids from liquids.* July 27.

17,996. Pawlikowski. Producing chemical combinations in mixtures of gases by compressors.* July 28.

18,031. Fowler and Medley. Apparatus for subjecting gases or vapours to the action of liquids. July 29.

Complete Specifications Accepted.

8841 (1909). Cowper-Coles. Furnaces. July 20.

12,927 (1909). Harries. Revolving muffled calcining and smelting furnace. August 4.

14,024 (1909). Michaelis. Centrifugal separators. July 27.

20,462 (1909). Suzuki. Evaporators. July 20.

23,618 (1909). Burstinghaus and Schweder. Compound for preventing scale, corrosion, &c., in steam generators. July 27.

23,978 (1909). Texier. Filters for liquids. July 27.

25,809 (1909). Swan. Separation of liquids from finely-divided material such as gold ore slime. August 4.

8713 (1910). Marks (Badische Maschinenfabr. u. Eisengiesserei). Separating and pulverising materials. July 27.

9628 (1910). Grümer und Grimberg. Apparatus for storing and delivering inflammable liquids. July 27.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION: HEATING; LIGHTING.

Applications.

16,596. Burstall. Apparatus for removing tar and other suspended matter from gases. July 12.

16,630. Woodall and Duckham. Vertical retorts for carbonising coal, etc. July 12.

16,631. Duckham. Delivery of products from gas retorts, coke ovens, etc. July 12.

16,981. Dixon. Apparatus for treating bituminous coal and other carbonaceous materials. July 16.

16,984. Dunlop. Gas producers. July 16.

19,043. Lewis and True. Gas manufacture. July 18.

17,048. Jones. Gas producers. July 18.

17,162. Leach. Manufacture of artificial coal.* July 19.

17,246. Coales. Manufacture of artificial fuel from refuse. July 20.

17,278. British Thomson-Houston Co. (General Electric Co.). Electrodes for arc lighting.* July 20.

17.281. Masters. Gas purifying apparatus.* July 20.

17.359. Burkheiser. *See under* VII.

17.469. Eisner. Manufacture of filaments for incandescing electric lamps.* July 22.

17.547. Otto-Hilgenstock Coke-Oven Co. (Otto und Co.). Regenerative coke-oven installations.* July 23.

17.548. Otto-Hilgenstock Coke-Oven Co. (Otto und Co.). Separating tar from gases.* July 23.

17.639. Bartel. Production of oils containing a high percentage of bitumen. [Ger. Appl., July 27, 1909.]* July 25.

17.766 and 17,767. Southey. Generation of gaseous fuel. July 26.

17,949. Bolz. Distilling ovens with upright retorts.* July 28.

18.016. Berlin-Anhalt. Maschinenbau A.-G. Gas purifiers. [Ger. Appl., April 20, 1910.]* July 28.

18.084. Bagrachow. Impregnating the filaments and mantles used in incandescent gas lighting.* July 29.

18,143. Whitfield. Gas producers. July 30.

18,148. Burstall. Treatment of carbonaceous substances.* July 30.

18,176. Wilton. Treatment of gas obtained by distilling or carbonising coal, etc. July 30.

Complete Specifications Accepted.

16.355 (1909). Wilton. Treatment of gas obtained in the distillation of carbonaceous materials. July 27.

16,925 (1909). Gibbons and Masters. Vertical gas retorts. July 27.

17.030 (1909). De Fazi. Treatment of shale oil to obtain a product suitable for working internal-combustion engines. July 20.

17.112 (1909). Gibbons and Masters. Vertical gas retorts. August 4.

17,139 (1909). Roux. Conversion of peat into charcoal. August 4.

17.420 (1909). Hiby. Treatment of gases produced by destructive distillation of coal, etc. August 4.

17.862 (1909). Kreidl and Heller. Manufacture of incandescent gas mantles. August 4.

4372 (1910) Duff and others. *See under* VII.

III.—TAR AND TAR PRODUCTS.

Application.

17.100. Fendler and Frank. Treatment of hydrocarbons or halogen-hydrocarbons to render them soluble in dilute soap solutions. [Gér. Appl., July 19, 1909.]* July 18.

IV.—COLOURING MATTERS AND DYES.

Applications.

16,517. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of thioindigo and its derivatives. July 11.

16,668. Green. Production of acid and mordant dyestuffs of the triphenylmethane class. July 13.

17,000. Johnson (Kalle und Co.). Manufacture of a blue vat dyestuff. July 16.

17,087. Meister, Lucius, und Brüning. Manufacture of dyestuffs of the triphenylmethane series. [Addition to No. 12,130 of 1910. Ger. Appl., Sept. 7, 1909.]* July 18.

17.088. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of substantive disazo dyestuffs.* July 18.

17.105. Newton (Bayer und Co.). Manufacture of azo dyestuffs. [Addition to No. 933 of 1910.] July 18.

17,143. Consortium f. Elektrochem. Industrie. Production of indoxyl, its derivatives or homologues. [Ger. Appl., July 30, 1909.]* July 19.

17,355. Newton (Bayer und Co.). Manufacture of azo dyestuffs. [Addition to No. 4767 of 1909.] July 21.

17,614. Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of a disazo dyestuff.* July 25.

17.615. Meister, Lucius, und Brüning. *See under* XIII.

17,970. Newton (Bayer und Co.). Manufacture of azo dyestuffs. July 28.

17.971. Bayer und Co. Manufacture of azo dyestuffs. [Addition to No. 4768 of 1909. Ger. Appl., July 30, 1909.]* July 28.

18,099. Anilinfarben- und Extract-Fabr. vorm. J. R. Geigy. Manufacture of monoazo colouring matters. [Ger. Appl., Oct. 1, 1909.]* July 29.

Complete Specifications Accepted.

20,029 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of dyestuffs of the safranine series. July 27.

28,717 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. July 27.

29,458 (1909). Newton (Bayer und Co.). Manufacture of an azo dyestuff. July 27.

29,674 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a yellow monoazo dyestuff for wool. August 4.

30,197 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable indigo-white preparations. July 27.

8127 (1910). Kalle und Co. Manufacture of azo dyes. July 27.

9497 (1910). Meister, Lucius, und Brüning. Manufacture of a monoazo dyestuff. July 27.

12,426 ((1910). Meister, Lucius, und Brüning. Manufacture of a red monoazo dyestuff and colour lakes therefrom. July 20.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

16,932. Bayer und Co. Production of solutions of cellulose esters. [Ger. Appl., July 22, 1909.]* July 15.

16,949. Elsaesser. Treatment of wool, etc.* July 16.

17,263. Seignol. Destroying hairs, horsehair, and horny or gelatinous substances in floss and waste silk. [Fr. Appl., July 28, 1909.]* July 20.

17,898. Schewelin. Treatment of flax, hemp, and similar fibre and materials formed therefrom.* July 27.

18,076. Eichengrün. Production of coatings from acetylcellulose. [Addition to No. 1441 of 1910. Ger. Appl., April 15, 1909. Comprised in No. 4959 of 1910.]* July 29.

Complete Specifications Accepted.

17,036 (1909). Von Kapff, and Nitritfabrik. Production of cellulose formate. July 20.

17,952 (1909). Temperley, Wild, and Wild. Engines for breaking and bleaching paper-making materials. August 4.

22,413 (1909). Ellis (Le Crinoid Soc. Anon.). Alkaline precipitating baths for cellulose threads. August 4.

1441 (1910). Eichengrün. Manufacture of solutions and objects of cellulose acetate. July 20.

3559 (1910). Knoll und Co. Manufacture of films from acetylcellulose. August 4.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

16,751. Antill. Preparation for waterproofing fabrics and the like. July 13.

16,785. Cook. Dye-vat and arrangements for dyeing hank yarns. July 14.

16,960. Roberts and Turner. Scouring, boiling, washing, etc., textile fabrics. July 16.

17,331. Brierley and Melling. Machines for bleaching, washing, or treating textile fabrics. July 21.

17,401. Giesler. Apparatus for dyeing, scouring, etc., fibrous substances. July 22.

Complete Specifications Accepted.

17,018 (1909). Faller. *See under* IX.

17,449 (1909). Douqué. Manufacture of waterproof washable linen. July 20.

19,217 (1909). Bontemps. Machine for printing webs of textile fabric. August 4.

29,827 (1909). Sanderson. Fabric-printing machines. July 20.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

16,497. Hargreaves. Manufacture of soda and ammoniacal salts. July 11.

16,518. Saccharinfabrik A.-G. vorm. Fahlberg, List, und Co. Manufacture of chlorosulphonic acid. [Ger. Appl., Sept. 4, 1909.]* July 11.

16,540. Chem. Fabr. von Heyden. Manufacture of anhydrous alkali hydrosulphites. [Ger. Appl., June 16, 1910.]* July 11.

16,615. Heylandt-Ges. Method of liquefying hydrogen. [Ger. Appl., July 12, 1909.]* July 12.

16,755. Ashcroft. Electrolysing alkali amides and manufacture of alkali metals, alkali amides, cyanamides, cyanides, etc. July 13.

16,764. Ashcroft. Electrolytic treatment of alkali-halogen salts to produce the metals or their derivatives and halogens. July 13.

16,765. Ashcroft. Production of cyanamides and cyanides of the alkali metals. July 13.

16,972. Pope. Manufacture and purification of certain oxides of lead. July 16.

17,283. Moeller. Manufacture of sulphuric acid. July 20.

17,285. Moeller. Treating materials with ozone. July 20.

17,359. Burkheiser. Producing ammonium sulphate in the manufacture of gas. [Addition to Nos. 20,920 and 21,763 of 1908. Ger. Appl., July 22, 1909.]* July 21.

17,628. Harger. Manufacture of oxygen. July 25.

17,809. Zeiss. Mixtures disengaging oxygen when heated. [Ger. Appl., July 29, 1909.]* July 27.

17,997. Dior. Manufacture of sulphuric acid.* July 28.

17,998. Dior. Manufacture of alkaline carbonates.* July 28.

Complete Specifications Accepted.

11,526, 24,768, and 25,203 (1909). Pope. Manufacture of lead oxide. July 27.

17,591 (1909). Lane. Hydrogen-producing apparatus. July 20.

17,951 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. July 4.

20,893 (1909). Imray (Meister, Lucius, und Brüning). Manufacture of concentrated formic acid from formates. August 4.

26,452 (1909). Falding. Apparatus for making sulphuric acid. July 20.

3083 (1910). Chem. Fabr. von Heyden. Manufacture of a new class of chemical compounds. August 4.

4372 (1910). Duff, and Gas Power and By-Products Co. Recovery of ammonia from producer gas. July 20.

7175 (1910). L'Air Liquide. Separation of nitrogen from the air. July 20.

VIII.—GLASS; CERAMICS.

Applications.

17,242. Benedictus. Manufacture of strengthened glass. [Addition to No. 1790 of 1910.]* July 20.

17,984. Exploration Co., Ltd., and Salamon. Preparation of china clay. July 28.

Complete Specifications Accepted.

16,935 (1909). Martin. Treatment of clays for the manufacture of pottery, etc. July 27.

IX.—BUILDING MATERIALS.

Applications.

16,691. Smart. Manufacture of bricks. July 13.

17,093. Owen. Utilising slate refuse and making artificial slates or tiles. July 18.

17,109. Grau. Utilising blast furnace slag to make stones or bricks.* July 18.

17,640. Bartel. Preservative treatment of wood, stone, etc. [Ger. Appl., July 27, 1909.]* July 25.

Complete Specifications Accepted.

17,018 (1909). Faller. Process of dyeing wood. August 4.

17,381 (1909). Lake (Pine Street Patents Co.). Manufacture of cement. August 4.

29,753 (1909). Poths. Rotary kilns for burning cement. July 20.

3960 (1910). Berner. Manufacture of artificial stone. July 20.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

16,516. Hopkins. Apparatus for smelting zinc ores, zinc lead ores, galvanisers' dross, etc. July 11.

16,555. Clador Synd., Ltd., and Lockwood. Extraction of precious metals. July 11.

16,577. Whitfield. Manufacture of antimony from antimony ores. July 12.

16,862 and 16,863. Ashcroft. Treatment of sulphide ores or products. July 14.

17,238. Buess. Crucible furnaces, etc.* July 20.

17,284. Moeller. Extraction of metals from ores. July 20.

17,587. Beauchamp. Extraction of zinc from ore and tailings. July 25.

17,609. Du Pont. Gravity liquid separation of iron ores.* July 25.

17,632. Sinding-Larsen. Treatment of titaniferous iron ores. [Appl. in Norway, July 23, 1909.]* July 25.

17,647. Heskett. Manufacture of steel.* July 25.

17,785. Dick. Treatment of siliceous zinc ores. July 26.

18,010. Cinille. Direct manufacture of hard steels and other metals.* July 28.

Complete Specifications Accepted.

9163, 10,790 and 25,152 (1909). Simpson and Oviatt. Direct production of iron and steel from oxide iron ores. July 27.

9958 (1909). Wildbore (Haggenmiller). Smelting pyritic and other sulphide ores. August 4.

12,927 (1909). Harries. *See under* I.

15,989 (1909). Reynolds. Manufacture of crucible steel. July 20.

16,936 (1909). Holman and Coad. Apparatus for treating metalliferous slimes. July 27.

16,956 (1909). Buchel. Obtaining soluble slag in the alumino-thermic process for producing metals. July 27.

17,474 (1909). Bailey. Recovery of tin from tin scruff. August 4.

17,718 (1909). Stoker. Treatment of metals and alloys. August 4.

19,386 (1909). Macivor, Hommel, and Metals Extraction Corporation, Ltd. Manufacture of oxide of zinc for smelting. August 4.

25,809 (1909). Swan. *See under* I.

25,979 (1909). Lindblad and Stalhane. Reduction of zinc. August 4.

28,487 (1909). Imbert Process Co. Extraction of zinc from zinc sulphide ores. July 20.

484 (1910). Rodman. Mixture for case-hardening purposes. August 4.

2002 (1910). Corey. Electrodeposition of metals. July 20.

3981 (1910). British Thomson-Houston Co. (General Electric Co.). Treatment of metals of the chromium group. July 27.

XI.—ELECTRO-CHEMISTRY.

Applications.

16,522. Serpek. Electric resistance furnaces. [Addition to No. 12,601 of 1910.]* July 11.

16,755 and 16,764. Ashcroft. *See under* VII.

17,650. Helfenstein. Electric furnace. [Austrian Appl., July 27, 1909.]* July 25.

Complete Specifications Accepted.

15,960 (1909). Flood. Electrolytic cell. July 20.

23,225 (1909). British Thomson-Houston Co. (General Electric Co.). Manufacture of insulating compounds. July 20.

24,498 (1909). Helfenstein. Utilising the gases from reduction operations in electric furnaces. August 4.

26,649 (1909). New Ignition Synd., and Sandy. Electrolyte for electric batteries. August 4.

27,976 (1909). De Laminière. Accumulator plates. August 4.

2032 (1910). Crocker. Electrolytic cells. July 20.

3733 (1910). Marseille and Gouin. Manufacture of alkaline accumulator electrodes. July 20.

XII.—FATS; OILS; WAXES.

Applications.

17,076. Winterstein and Nitsch. Separation of the liquid from the solid constituents of fats or fatty substances.* July 18.

17,593. Bartelt. Soap substitute for use in laundries. July 25.

17,817. Knecht and Petraczek. Bleaching fats, oils, and fatty acids. July 27.

Complete Specifications Accepted.

18,236 (1909). Tuckfield and Garland. Bleaching and purifying fats and oils. July 20.

23,013 (1909). Böhme and Wolf. Production of a solid hydrocarbon soap. July 20.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

16,972. Pope. *See under* VII.

17,615. Meister, Lucius, und Brüning. Manufacture of bluish-green colour lakes. [Ger. Appl., July 27, 1909.]* July 25.

17,796. Cline. Manufacture of non-oxidising paints.* July 26.

Complete Specifications Accepted.

11,526, 24,768 and 25,203 (1909). Pope. *See under* VII.

12,426 (1910). Meister, Lucius, und Brüning. *See under* IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

16,758. Van der Burg. Substitute for rubber.* July 13.

17,306. Adshead. Manufacture of indiarubber, gutta-percha, and substitutes therefor. July 20.

17,645. Allsebrook and Docherty. Treatment of waste rubber for reforming the same or for producing vulcanite, ebonite, etc.* July 25.

17,734. Bayer und Co. Production of a caoutchouc substance. [Ger. Appl., Sept. 11, 1909.]* July 26.

Complete Specifications Accepted.

22,222 (1909). Van Oosterzee. Regeneration of old rubber. July 27.

27,130 (1909). Dreyfus, Friedl, Bentley, and Clayton Aniline Co. Manufacture or purification of india-rubber, etc., and obtaining by-products. August 4.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

17,106. Newton (Hesse). Manufacture of artificial leather.* July 18.

17,596. Browne. Compound for treating hides, skins, or leather.* July 25.

Complete Specification Accepted.

7819 (1910). Evans and Innes-Baillie. Tanning hides and skins. July 27.

XVI.—SOILS; FERTILIZERS.

Application.

17,747. Mordey and Hansard. Manufacture of fertilising material. July 26.

XVII.—SUGARS; STARCHES; GUMS.

Complete Specifications Accepted.

16,824 (1909). Soc. Anon. Raffinerie Moderne. Apparatus for concentrating the juices of refinery syrups. July 27.

28,742 (1909). Wolf. Production of artificial honey or invert sugar syrup and white sugar from raw or crude sugar. July 20.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

16,744. Wooldridge. Brewing. July 13.

16,857. Zwergel. Manufacture of concentrated non-alcohol in extracts for use in making liqueurs.* July 14.

16,966. Westergaard. Treatment of grain for brewing and distilling purposes. July 16.

17,025. Harrison. Combined mash tun and wort back for use in brewing. July 18.

17,493. Westergaard. Treatment of the residue from the mashing process in breweries and distilleries. July 23.

Complete Specification Accepted.

7398 (1910). Adlam. Apparatus for sparging brewers' wort. July 27.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

16,508. Comnin. Treatment of sewage.* July 11.

16,707. Wagner and Wagner. Manufacture of alcohol-free drinks. [Ger. Appl., July 13, 1909.]* July 13.

16,953. Grossmann. *See under* I.

17,417. Stahl. Production of bread poor in carbohydrates.* July 22.

17,445. Browne. *See under* I.

17,787. Siemens Bros. and Co. (Siemens und Halske A.-G.). Apparatus for purifying water by ozonised air.* July 26.

Complete Specifications Accepted.

13,702, 16,874, 21,135 and 27,155 (1909). Rapid preparation of potable water. July 20.

17,003 (1909). Charonnat. Food products from germs of wheat, etc. August 4.

17,279 (1909). Thomson. Treatment of waste liquors. July 27.

19,734 (1909). Farrer. Bacterial filter beds. August 4.

20,558 (1909). Dickson. Treatment of sewage. August 4.

23,434 (1909). Chitty and Jago. Treatment of wheat for flour-milling purposes. August 4.

23,839 (1909) and 8948 (1910). Chitty and Jago. Treatment of wheaten stock and flour, and of wheat for flour-milling purposes. August 4.

1328 (1910). Hübner. Extraction of caffeine from coffee. August 4.

1743 (1910). Witte. Process of making butter. August 4.

3673 (1910). Levin. Manufacture or treatment of flour. August 4.

8203 (1910). Erste Triester Reisschäl-Fabriks. Rendering gluten or substances containing gluten soluble. August 4.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

16,632. Meister, Lucius, und Brüning. Manufacture of a remedy for tuberculosis. [Ger. Appl., July 22, 1909.]* July 12.

16,979. Ruzicka. Manufacture of ethers, volatile alcoholic extracts, and oils. July 16.

17,099. Johnson (Badische Anilin und Soda Fabrik). Manufacture of aromatic ammonium compounds. July 18.

17,356. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. July 21.

17,360. Imray (Meister, Lucius, und Brüning). Manufacture of derivatives of oxyarylarsinic acids. July 21.

Complete Specifications Accepted.

16,721 (1909). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of acetyl derivatives of alkylated iminopyrimidines and of the alkylbarbituric acids derived therefrom. July 27.

17,830 (1909). Knoll und Co. Manufacture of purified extracts from aperient drugs. August 4.

21,174 (1909). Löloff. Enriching bacteria and like cultures. August 4.

28,361 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-aminophenylarsinic acid. July 20.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

17,880. Forbes. Colour photography. July 27.

18,021. Woodiwiss. Colour photography. July 29.

18,209. Dawson and Findlay. Colour photography. July 30.

Complete Specifications Accepted.

14,950 (1909). James (Cie. Gén. de Phonographes Cinématographes, et Appareils de Précision). Re-utilising the band supports of cinematograph films. August 4.

16,313 (1909). Palmer. Photographic screen-plates for natural colour photography. July 20.

XXII.—EXPLOSIVES; MATCHES.

Application.

17,194. Bichel. Increasing the density of fusible explosive nitro bodies. [Addition to No. 19,215 of 1906.]* July 19.

Complete Specification Accepted.

11,365 (1910). Claessen. Manufacture of smokeless gunpowder. August 4.

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Erratum.—This Journal, July 30, 1910, page 908, col. 2, line 11 from bottom, for XXII. read XXIII.

Journal of the Society of Chemical Industry.

No. 16, Vol. XXIX. AUGUST 31, 1910. No. 16, Vol. XXIX.

Official Notice.

THE FIRE AT THE BRUSSELS EXHIBITION.

On Sunday, August 14th last, the British Section of the Brussels Exhibition and all its contents, with the important exception of machinery, was totally destroyed by fire. With it perished the Chemical Industry exhibits. On Saturday, August 20th, the Royal Commission met and resolved to reconstitute the Section in the Salle des Fêtes.

As members of the Society form no inconsiderable portion of the Commission, Exhibitors, and Jury, it is hoped that they will respond without delay to the official invitation to form a fresh Exhibit of the British Chemical Industries. The offices of the British Commission are at Queen Anne's Chambers, Westminster.

Liverpool Section.

Meeting held at the University, on Wednesday, January 12th, 1910.

DR. JAMES CONROY IN THE CHAIR.

THE SOLUBILITY OF OXYGEN IN MOLTEN SILVER.

BY F. G. DONNAN AND T. W. A. SHAW, M.SC.

(From the Muspratt Laboratory of Physical and Electro-Chemistry, University of Liverpool.)

In 1820 Chevillot (Annales de Chimie, **13**, 299, 1820) found that 8 grms. of melted silver saturated with air gave up 7·8 c.c. of oxygen on solidifying. Gay Lussac in 1830 found that 1 volume of silver evolves 22 volumes of oxygen on solidification. A careful determination with modern methods of the solubility of oxygen in melted silver possesses both a technical and a scientific interest. For the silver smelter and refiner is troubled with the "spitting," *i.e.* foaming over, of the silver in the moulds during a pour, and with the liability of the ingot to "blister" on rolling, due to still entangled oxygen; whilst the molecular condition of the oxygen dissolved in the molten metal presents an interesting scientific problem.

A knowledge of the amount of oxygen dissolved in a given mass of molten silver at a given temperature might prove useful to the refiner, in giving him some guide to the amount of oxidisable metal (aluminium, copper) required to be added to the melt in order to deoxidise it.

Of course the technical difficulty could be overcome by working in an atmosphere of some gas which is not appreciably dissolved by melted silver, but this procedure might offer certain inconveniences in practice.

As regards the scientific interest of the problem, the dissolved oxygen may exist either in a state of "physical" solution, or in combination as dissolved oxide, Ag_2O. In the former case the oxygen may be dissolved either as molecules, O_2, or as atoms, O.

Let us consider the case of physical solution first. From Henry's law, the concentration of the dissolved oxygen will be proportional to the pressure (or partial pressure) of the oxygen if the molecular condition of the oxygen dissolved in the silver is the same as in the gaseous state, *i.e.* if the oxygen exists in both cases as diatomic molecules. We may express that by the equation $P_{O_2}=kC_{O_2}$. Supposes however, that the oxygen dissolved in the silver consist, mainly of atoms and only to a very small extent as molecules. We shall then have an equilibrium between the molecular and atomic oxygen in the silver, expressed by the law of mass action $C_{O_2}=k_1C_O^2$, since the chemical equilibrium is $O_2\rightleftarrows 2O$.

As Henry's law still holds for the dissolved *molecular* oxygen, we have still $P_{O_2}=kC_{O_2}$, so that $P_{O_2}=kk_1C_O^2$ or $C_O=\text{const.}\times\sqrt{P_{O_2}}$.

But according to our supposition we may regard C_O as practically equal to the total concentration of dissolved oxygen, so that in this case the concentration of the dissolved oxygen will be proportional to the *square root* of the oxygen-pressure.

Consider now the case where the oxygen contained in the molten metal exists mainly as Ag_2O, and to only a very slight extent as O_2 and O ("chemical" solution). As before, the laws of mass-action and distribution lead to the equations

$$Ag_2O\rightleftarrows 2Ag+O \quad ; \quad C_{Ag_2O}=k_2C_O$$

$$O_2\rightleftarrows 2O \quad ; \quad C_{O_2}=k_1C_O^2$$

$$P_{O_2}=kC_{O_2}.$$

$$\text{Hence } P_{O_2}=kk_1C_O^2=\frac{kk_1}{k_2^2}C_{Ag_2O}^2 \text{ or}$$

$$C_{Ag_2O}=\text{const.}\times\sqrt{P_{O_2}}.$$

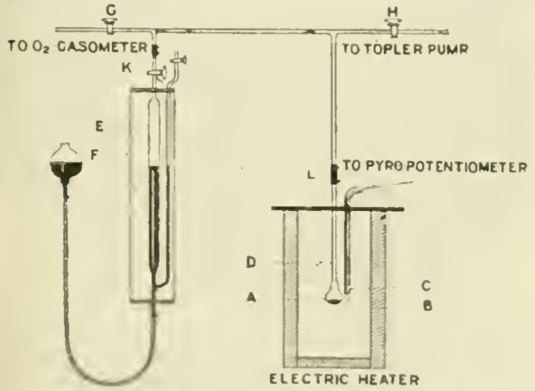
As by our assumption the oxygen of the Ag_2O constitutes the main bulk of the oxygen contained in the molten metal, the last equation shows us that the concentration of the dissolved oxygen will be proportional to the square root of the oxygen-pressure.

We cannot therefore distinguish in this way between oxygen "physically" dissolved in the atomic condition and oxygen "chemically" dissolved, *i.e.* contained in Ag_2O dissolved in the melted silver.

It is clear, however, that measurements of the solubility of oxygen in melted silver at different pressures and constant temperature will throw much light on the molecular condition of the solution.

With this object in view, and also in order to obtain data bearing on the technical question, the following apparatus was designed for the purpose of carrying out preliminary measurements. It was intended later to employ a more elaborate apparatus provided with compensating bulb and compensating leads, but the excellent work of *Sieverts* (see later), which was published after our first measurements had been made, appeared to us to render further work on this question unnecessary.

It will be evident from the following description and diagram that our preliminary apparatus was designed to measure the solubility at pressures equal to and below atmospheric pressure.



(A) is a small bulb of clear fused silica, provided with a long narrow stem (D). The silver is introduced into this bulb in the form of thin wire. The bulb is heated by the electric heater (B), which is wound with platinum wire and well insulated. The temperature is indicated by a Pt.-Pt. Rh. thermo-junction (shown at (C)), connected up with a suitable potentiometer. The stem of the silica tube is connected by means of the rubber joint (L) with the narrow tubing shown in the figure, which leads through the necessary taps to the Töpler pump, oxygen generator, and gas-burette (E) with water-jacket (F). The oxygen was produced by heating potassium permanganate and was purified from carbon dioxide and dried by passing through layers of soda-lime and phosphorus pentoxide respectively.

The silver employed was obtained as specially pure silver from Messrs. Sandars and Lees, Birmingham, and was not analysed.*

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* The silver was not of course gas-free. The dissolved or entangled gases were removed as explained later.

The determination is carried out in the following way. The tap (K) being shut (or the rubber connecting tube of the burette being compressed by a screw-clip), the apparatus (containing no silver in the silica bulb) is pumped out and then filled with pure oxygen to about atmospheric pressure. The taps (G) and (H) being closed and (K) open, the mercury levels are adjusted so that the gas is at the desired pressure (in our experiments, atmospheric pressure). Electric current is then passed through the coils of the heater (a controlling resistance and ammeter being in circuit) and the temperature gradually raised to the desired value. During the heating the pressure is maintained constant by lowering the mercury reservoir attached to the burette. When the temperature has become steady and no further increase in volume occurs, the burette-reading is taken and the atmospheric pressure and the air-temperature at various parts of the connecting tubing noted.

The apparatus is now allowed to cool down, the silica tube disconnected at (L), and a known weight of silver introduced into it. Connection is again made securely at (L), the tap (K) closed, and the apparatus evacuated. The silver is then melted by heating up to about 1000° C., and the Töpler pump kept in action until all the dissolved gases are pumped out. The silver is then allowed to cool and solidify *in vacuo*. When the apparatus has again attained room temperature, it is filled with oxygen by heating the permanganate, the tap (G) is closed, and the pressure adjusted to atmospheric as before. The silver is then heated up in the atmosphere of oxygen to the same temperature as in the initial blank experiment, the pressure being kept constant by adjustment of the mercury-reservoir. When the volume ceases to alter, indicating that the silver has become saturated with oxygen, the burette reading is taken, and the air-temperature at different parts of the apparatus noted as before.

It is very necessary that the varying temperatures at different parts of the "dead" connecting tubing should be the same in the absorption as in the blank experiment. In particular it is necessary that the distribution of temperature along the upper portions of the stem of the silica tubes should be practically the same in the two experiments.

The tap (K) is now closed, and the apparatus entirely evacuated, after which the silver is allowed to cool and solidify *in vacuo* as before. It was found by experience that if melted silver containing dissolved oxygen was allowed to cool and solidify in the silica tube the latter invariably cracked. The solidified silver appeared to adhere strongly to the silica, the fracture being due to the very unequal contraction on cooling. If, however, the silver had been previously pumped free from gases when in the molten state and was allowed to cool *in vacuo*, it did not adhere to the silica, and no fracture ensued.

The results obtained are as follows :—

I.—(*a*) *Blank experiment* (no silver in tube):
Initial reading of gas-burette = 20·7.
Final reading of gas-burette = 37·2.
∴ Total expansion = 16·5 c.c.
Barometer = 766 mm.
Temperature of water in jacket of burette = 18° C.
Expansion reduced to 0° and 760 mm. = 15·6 c.c.
Temperature of furnace = 1020° C.

(*b*) *Absorption experiment* (15·07 grms. silver in silica tube):
Initial reading of gas-burette = 19·8.
Final reading of gas-burette = 1·9.
∴ Total contraction = 17·9 c.c.
Barometer = 751 mm.
Temperature of water in jacket = 16° C.
Contraction of volume reduced to 0° and 760 mm. = 16·4 c.c.
Temperature of furnace = 1020° C.

In order to calculate the results of this experiment, we have to correct for the volume occupied by the silver in the absorption experiment. This is done as follows :— Let v = volume occupied by the silver. A volume v of oxygen at pressure p and temperature 291° (absolute) would contain $\frac{vp}{291R}$ mols. (where R is the gas-constant). At a temperature of 1293° (absolute) the volume v would contain $\frac{vp}{1293R}$ mols. Hence the corresponding increase of oxygen in the gas-burette is equal to $\frac{vp}{291R} - \frac{vp}{1293R}$ mols. But 1 mol of oxygen at pressure p and temperature 291° (absolute) occupies a volume $\frac{291R}{p}$. Hence the increase of volume in the gas-burette is equal to $v - \frac{v.291}{1293}$. For v we have to put the volume of 15·07 grams of melted silver. Taking the density of melted silver as 9·5 (Roberts and Wrightson, 1881), v = 1·58 c.c. Hence the increase of volume is 1·22 c.c. This is the expansion observed in the blank experiment corresponding to that volume of oxygen in the silica bulb which is occupied by silver in the actual absorption experiment. Reduced to 0° C., it becomes 1·15 c.c. The corrected (reduced) expansion is therefore 15·6—1·15 = 14·45 c.c.

The *total* absorption of oxygen is therefore 16·4 + 14·45 = 30·85 c.c. This is for 15·07 grams of silver. The volume of oxygen (measured at 0° and 760 mm.) absorbed by 10 grms. of melted silver at 1020° C. and 751 mm. pressure is therefore $\frac{30 \cdot 85}{15 \cdot 07} \times 10 = 20 \cdot 5$ c.c.

Sieverts and *Hagenacker* (Zeitschr.-physikal. Chemie, **68**, 115, 1909) give 20·56 c.c. as the volume of oxygen absorbed per 10 grms. of silver at 1024° and 760 mm.

II.—(*a*) *Blank Experiment* (new silica bulb):
Initial reading of gas-burette = 11·9.
Final reading of gas-burette = 29·1.
∴ Total expansion = 17·2 c.c.
Barometer = 753 mm.
Temperature of water in jacket = 16°.
Expansion reduced to 0° and 760 mm. = 16·04 c.c.
Temperature of furnace = 1020° C.

(*b*) *Absorption Experiment :*
Initial reading of gas-burette = 24·8.
Final reading of gas-burette = 5·5.
∴ Total contraction = 19·3 c.c.
Barometer = 753 mm.
Temperature of water in jacket = 17° C.
Contraction of volume reduced to 0° and 760 mm. = 18·05 c.c.
Temperature of furnace = 1020° C.

Correction :—Volume of 16·25 grms. of melted silver = 1·71 c.c. Amount of expansion which would correspond to that due to the volume of 1·71 c.c. of the silica bulb = 1·71 — 0·38 = 1·33 c.c. at 17° C. and 753°. Reduced correction = 1·25 c.c. Hence absorption = 18·05 + 16·04 — 1·25 = 32·84 c.c. Hence volume of oxygen (measured at 0° and 760 mm.) absorbed by 10 grms. of melted silver at 1020° C. and 753 mm. pressure = $\frac{32 \cdot 84}{16 \cdot 25} \times 10 = 20 \cdot 2$ c.c. This result agrees very satisfactorily with the previous one. These preliminary results having been obtained, it was intended, as stated above, to proceed to more exhaustive experiments with an apparatus provided with a compensating bulb and compensating leads, the correction for the volume of the silver being eliminated if necessary by adding an equal volume of silica rod to the compensator.

In order to show the nature of the results obtained, we reproduce here a table from the paper referred to.

Solubility of oxygen in molten silver at 1075° *C.*

Oxygen pressure in mm. Hg. (P).	c.c.O_2 (reduced to NTP) absorbed by 10·87 gms. Ag (m).	$\frac{P}{m}$	$\frac{\sqrt{P}}{m}$.
1203	26·91	44·7	1·29
760	21.01		1·31
488	17·02		1·30
346	14·53	23·8	1·28
209	11·75		1·23
150	10·09		1·21
128	8·87		1·28
39	4·75	8·2	1·31

It will be evident that the concentration of the oxygen in the molten metal is proportional to *the square root* of the oxygen-pressure over a very wide range of pressure. From this we can conclude, as shown previously, that the oxygen is either "physically" dissolved as atomic oxygen or exists in the form of dissolved silver monoxide. It cannot be physically dissolved as ordinary diatomic molecules corresponding to those which exist in the gaseous state.

The assumption that the oxygen exists in the silver as dissolved silver monoxide cannot be disproved by the fact that solid silver monoxide would exert an enormous oxygen dissociation-pressure at temperatures near 1000° C., for it must be remembered that in the present case the silver monoxide exists in the form of a *dilute* solution. From this point of view the "spitting" of silver would be due to the fact that on solidification of the silver the silver oxide (not being soluble to any extent in the solid silver) is thrown out of solution and hence explosively dissociates.

Possibly the "keying" of the solidified silver (saturated previously with oxygen) to the silica bulbs, noticed in some of our earliest experiments, may be explained by the presence of dissolved oxide of silver reacting with the silica to form a silicate of silver.

Returning now to the technical question, we see from the results of Sieverts and Hagenacker quoted above, that at 1075° and 150 mm. pressure, 10·87 grms. of silver absorb 10·09 c.c. oxygen. This is then the amount of oxygen which would be absorbed by this weight of silver *saturated with air* (since nitrogen is not appreciably soluble in melted silver). At the melting point of silver the amount of oxygen dissolved would be somewhat greater, about 11 c.c. (reckoned at 0° C. and 760 mm. pressure).

We shall be well within the mark if we allow 11 cc. of oxygen per 10 grms. silver. Now 11 c.c. of oxygen would weigh 11 × 0·00143 grms. To combine with this we should therefore require of, say, aluminium

$$\frac{11 \times 0{\cdot}0043 \times 102}{48} = 0{\cdot}4 \text{ grm.}$$

A kilogram of silver, therefore, would be deoxidised by 10 grms. of aluminium.

Another method would be to blow out the dissolved oxygen by a current of steam, or to use this to remove any excess of aluminium remaining dissolved in the silver. These operations would have to be carried out immediately before and during the pouring of the melted silver into the moulds, as the absorption of oxygen is very rapid.

As we know from the work of Sieverts and Hagenacker (*loc. cit.*) that the oxygen is contained in the molten silver in an atomic condition (whether as "free" atoms or in the form of Ag_2O), we can now attempt to calculate the initial freezing point of molten silver saturated with air at atmospheric pressure. To do this we have to employ the well-known van't Hoff equation, $\Delta t = \frac{RT^2}{\lambda} \cdot \frac{n}{M}$.

Where Δt = lowering of freezing point. R = gas-constant (in calories per degree centigrade per mol.).

λ = latent heat of melting of silver in calories per gram.
T = absolute temperature of melting point.
n = number of g-atoms oxygen dissolved.
M = mass of silver in grams.
We have T = 962 + 273 = 1235
λ = 24·7 (Pionchon, *Comptes Rendus*, 1887).
R = 1·985.

According to Sieverts and Hagenacker, 10 grms. silver absorb at 973° C. and 760 mm. oxygen-pressure, 21·35 c.c. of oxygen (measured at 0° C. and 760 mm.). We have, therefore, approximately

$$n = \frac{21{\cdot}35 \times 0{\cdot}001429}{16 \times \sqrt{5}}$$

$$M = 10$$

and hence

$$\Delta t = \frac{1{\cdot}985 \times (1235)^2}{24{\cdot}7} \times \frac{21{\cdot}35 \times 0{\cdot}001429}{16 \times 10 \times \sqrt{5}} = 10{\cdot}4^\circ.$$

The freezing-point of silver saturated with air is stated to be 955°, so that the observed value of Δt is 962 − 955 = 7°. The agreement is perhaps as good as could be expected, considering the uncertainty of several of the data available. The value of λ is not known with any degree of certainty, whilst it is doubtful if the *initial* freezing-point of silver in equilibrium with the atmosphere has been determined very exactly. The agreement between calculation and experiment is not, however, good enough (with the data at present available) to afford independent confirmation of the atomic condition of the dissolved oxygen.

It is interesting to compare the solubilities of oxygen in molten copper, silver, and gold. In the case of copper the solid oxide Cu_2O can separate from the solution, since the dissociation-pressure of Cu_2O at the melting-point of copper is quite low. In the case of silver the solid phase Ag_2O cannot separate owing to its very great oxygen dissociation-pressure, although Ag_2O can probably exist in dilute solution in molten silver. Finally, in the case of gold the affinity between this metal and oxygen has become so low that even a very dilute solution of oxide of gold in molten gold would correspond to an oxygen-pressure many times greater than that of the atmosphere. This comparison may perhaps lend some support to the view that the oxygen present in molten silver exists as dissolved silver monoxide.

In conclusion, we wish to express our best thanks to the Council of the University of Liverpool for a special Treasury grant, which enabled us to defray the considerable expenses of this investigation.

December, 1909.

Discussion.

Dr. J. T. Conroy said it was satisfactory that the figures of the several experimenters so closely agreed.

Mr. H. J. Watson said that in the refining of silver industrially, silver absorbed oxygen very quickly, and there was considerable difficulty in ladling the silver in consequence. He had tried copper and found it to answer very well; the copper absorbed the oxygen which the silver had dissolved; but when they commenced to ladle the silver, while the surface was fairly free from slag, the first few bars did not spit upon cooling, but the later ones did, showing that oxygen was absorbed very rapidly, and unless the ladling operation was carried out very quickly, the later bars had in some cases to be returned to the furnace. He might add that their difficulties arose through having to remove tellurium; it was then that the silver began absorbing oxygen. Before that they had had no trouble. They blew the silver with steam.

Professor F. G. Donnan, in reply to questions, stated that no experiments had been made on the deoxidising action of aluminium. There was no appreciable dissociation of oxygen gas at the temperatures in question.

He was very interested in the remarks made by Mr. Watson, who had a practical acquaintance with the subject from the refiner's point of view. It was clear from what he had said that copper was fairly efficient as a deoxidiser during the earlier stages of the pour, but that owing to the using up of the copper, spitting and foaming occurred in the moulds during the later stages. He would be much interested to know whether Mr. Watson could get better results by keeping a current of dry steam continuously passing through the molten silver. He would point out to Mr. Hill, who had enquired whether the steam would not have an oxidising action, that at the temperatures in question the dissociation of steam was far too small for that to occur. Dr. Bassett had suggested that as cuprous oxide did not dissolve in molten silver, it was improbable silver oxide would do so. The analogy was not a very good one. Silver oxide stood in somewhat the same relation to molten silver as a hydrated compound did to water.

Mr. H. J. Watson said that steam was used to oxidise the impurities in the silver. Steam did oxidise them, but not the silver. They did not blow the steam through during the ladling operation; they blew the steam on to the surface of the silver.

New York Section.

Meeting held at the Chemists' Club on Friday, April 22, 1910.

MR. MAXIMILIAN TOCH IN THE CHAIR.

THE DURABILITY OF PAINTS; INVESTIGATIONS BY THE U.S. PAINT MANUFACTURERS' ASSOCIATION.

BY HENRY A. GARDNER.

Abstract.

The maker of paints desires knowledge regarding the wearing properties of pigments, in order to prepare paint coatings proper for different purposes. Knowledge of this nature may be obtained only from practical field tests, and the following is a description of some of these tests.

In December, 1907, the U.S. Paint Manufacturers' Association erected at Atlantic City, N.J., a long wooden test fence upon which were placed 560 panels of wood—of three grades, white pine, yellow pine, and cypress. Upon the panels were painted a series of 47 paints, made from both single and mixed pigments. Most of them were applied in three colours—white, yellow, and grey. The fence was under the direction of the Scientific Section of the above mentioned Association, while the Master Painters' Association of Philadelphia had control of the actual painting work. Sub-Committee "E," on Protective Coatings, of the American Society for Testing Materials, agreed to inspect this fence, and their inspector was present throughout the work. A year after placing the painted panels upon the fence, an inspection was made by the various committees represented in the test.

At the same time a similar test fence was erected at Pittsburg in the grounds of the Carnegie Technical Schools. This fence was under the same direction, and the Master Painters of Pittsburg did the work. The Carnegie Technical Schools' Fence Committee supervised the work and assisted in preparing the report after the painted fence had been exposed for a year.

Several test fences were also erected at Fargo, in the grounds of the North Dakota Agricultural College. These tests were under the supervision of Dr. E. F. Ladd, State Food Commissioner, and his reports contain the results.

The following are extracts from the reports of the committees represented in the Atlantic City tests :—

"The panels painted with pure white lead chalked considerably and in this respect were in worse condition than many of the composition paints."

"A mixture of more than one prime white pigment, when used alone or in combination with a small percentage of inert pigments, makes a paint far superior to that manufactured from one pigment alone. The general failure of basic carbonate-white lead when used alone is so marked, as to be a conclusive demonstration of its unfitness for use along the coast. A large percentage of white lead in a paint, however, so far shows excellent results when the pigments combined therewith are selected with regard to a proper balance of qualities and a proper compensation for defects."

"Gypsum must be used with discretion in the paint coating, because of its solubility and liability to leach through the coating of linoxyn."

"Calcium carbonate, blanc fixe, and barytes seem to be useful when the percentage used is well subordinated to the percentages of prime white pigments. The use of mixtures of blanc fixe and barytes, which are physically different, though chemically the same, permits advantage to be taken of their different sized particles."

"Magnesium silicate (asbestine) and silica seem to be useful when used in small proportions."

"The complete failure of paints containing large percentages of lithopone demonstrate its unsuitability for outside work. The paints containing this pigment, which lasted the best, were those mixed with some zinc oxide and calcium carbonate. A large percentage of the latter together with less lithopone might give a combination of value for outdoor use. The softness of this pigment seems to require for outdoor use the addition of such hardening agents as zinc oxide, and in the tests outlined for the future such combinations will be tried."

"The blues, which had the greater permanence, were applied to panels with sublimed white lead (basic sulphate-white lead) and zinc oxide.

"The basic carbonate white leads, which were tinted with blues, showed marked failure, and in some cases the original blue panels could not be distinguished from the panels of untinted basic carbonate-white lead because of the fading.

"The chrome green tested was in excellent condition. It did not fade and was practically free from any mildewed appearance. The bronze green, however, had lightened somewhat and had whitened in some places ; a mildewed appearance was shown in spots. This appearance is possibly due to segregation of carbon."

The following observations are taken from the report of the joint inspection committee on the Pittsburg Test Fence :—

"A mixture of more than one prime white pigment, whether this mixture be alone or in combination with a small percentage of inert pigment, produces a paint far superior to a paint manufactured from single pigments, such as lithopone, white lead, and zinc oxide. The committee do not say that all composite paints are of equal value or are to be recommended, but the higher types, as evidenced by the appearance of the panels, are superior to the single pigment paints."

At North Dakota the report of the Committee gave results similar to those obtained at Pittsburg and Atlantic City. Their report states :—"The wearing of the paints made from white lead and zinc oxide seemed to indicate that a percentage of an inert pigment would have been beneficial. The high type mixtures of pigments containing lead and zinc, with moderate percentages of inert pigments, on good wood, were in excellent general condition ; in fact, much superior to the single pigment paints. Their surface exhibited only minor checking and moderate chalking with good maintenance of colour, and well adapted to repainting." All this information goes to show that the only paint which will satisfactorily meet all-round conditions for the painting of wood, in the districts where these tests were made, is one that is manufactured of two or more prime white pigments, properly ground in pure linseed oil, and, in some cases, containing a percentage of inert pigment.

Searches into the nature of the paints used for iron and steel have been recently made, which have enabled certain rules to be formulated, as the value of pigments for this purpose. The tests were made upon 50 pigments largely used in the production of paints, in order to determine which possess stimulative, which inert, and which inhibitive characteristics when in contact with steel in the presence of water, and the results appear in a report* by Dr. Allerton Cushman, recently issued by the United States Department of Agriculture.

In order to make a practical field test of the value of the various pigments, the Paint Manufacturers' Association erected a series of steel test plates at Atlantic City, upon which to paint in oil all those pigments which previously had been tested in water colour by so many investigators.

It was too early to make a report upon the value of the various pigments in the fall of 1909, but a few observations recently made, may not be out of place at this time :—The white leads (corroded and sublimed) and zinc oxide pigments appear to have well protected the steel and iron. The pure white leads have shown a tendency to early and heavy chalking, but the steel beneath seems in good condition. The zinc oxide has shown a tendency toward checking and cracking, possibly because insufficient oil was used in its grinding. Zinc oxide mixed with silica or white lead is giving efficient protection. The red iron oxides applied to the steel plates seemed to have done well, with the exception of Venetian red, on which there seems to be a slight exudation of the calcium sulphate contained in it.

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*The Preservation of Iron and Steel. Office of Public Roads. Bulletin No. 35, U.S. Dept. of Agriculture.

It is too early to report on the value of the graphite, lampblack and carbon-black films. They are still intact and the colour prevents close examination of the underlying surface. However, it was observed that wherever the plates, which were painted with these pigments, had been abraded to the least degree, very active corrosion had started, and appeared to be spreading underneath the paint coating.

The plates painted with red lead were in excellent condition, as were also those painted with zinc chromate and zinc and barium chromate. In the case of the plates painted with zinc chromate, several abrasions made at the time of erecting the fence disclosed the clean steel plate which had suffered practically no corrosion. This, presumably, was due to the fact that zinc chromate being slightly soluble had kept the abraded places in a passive state. The plates, which were primed with various inhibitive pigments and topped with the same second-coat, show that either red lead or zinc chromate are the safest pigments to use for this purpose.

The plates which were coated with red lead and second-coated with bitumen and coal tar paints, disclosed a marked cracking of the top coats, through which the red lead used as a prime coater could be distinctly seen. Unequal expansion of the two coats is partly responsible for this fault, as well as the action of light upon coal tar paints.

The appearance ot the plates painted with Prussian blue was perfect. The paint was in most excellent condition and possessed a very high gloss, thus demonstrating the value of ferrocyanides as excluders of moisture and retarders of oxidation.

Those plates painted with calcium sulphate (gypsum) showed the most marked corrosion, the plates showing brown oxide of iron working itself completely under the coating.

Calcium carbonate and barium sulphate when used alone were in very bad condition, early chalking and destruction of the film having taken place.

The samples of steel which were exposed unpainted after having been pickled showed varied degrees of corrosion, those containing manganese and other impurities either in small quantity or evenly distributed, being corroded evenly and without any marked pitting. However, those plates which were exposed unpainted, but having the mill scale, showed more rapid corrosion and more pitting than those plates not having the mill scale; in fact, some of these plates having the mill scale corroded in certain spots in an extremely rapid way, leaving certain areas with the mill scale unacted upon. The mill scale in this case would act as a surface upon which the hydrogen evolved during the electrolytic action which accompanies corrosion could be catalyzed to form water, thus allowing the corrosion to proceed very rapidly. This bears out the statement of Walker,* regarding the function of oxygen in the corrosion of iron and the action of mill scale as a depolarising surface.

Wherever an abrasion appeared upon the paint coatings of the various panels, different results were noted. In the case of panels which were painted with certain stimulative materials, abrasions showed progressive corrosion had proceeded and pitting was evident, while in the case of panels painted with high power inhibitive materials, the steel was in very good condition.

One of the most striking results of the tests is the effect on the life of a paint, of the addition of a very small percentage of colour (lampblack, chrome yellow, iron oxide, etc.). The North Dakota paint tests showed a marked improvement in the wearing of white leads, tinted yellow or grey, over that of untinted leads. The results of the tests at Atlantic City and Pittsburg confirmed this in the case of whites composed of lead and zinc. The only whites approaching the wearing value of the tinted whites were certain mixtures of lead and zinc, generally with a small percentage of inert pigment added. Thus the wearing value of a paint appears to be dependent upon its containing more than one pigment.

An addition of siliceous pigments appears to be valuable in increasing the wearing properties of paints. The statement of Toch that an addition of silica to white lead considerably prolonged the life of the paint confirms this experience. It is well known that corroded white lead acts upon linseed oil, but such paints may be made comparatively inactive toward the linseed oil by grinding with them some inert pigment. This explains to some extent the action of ochre, silica, barytes, lampblack, and chrome yellow.

The ability of certain pigments to absorb and of other pigments to prevent the passage of ultra-violet rays no doubt has some bearing upon their action in a paint. The reflection of light by white paints might tend to preserve any delicate colours underneath them, while black paints have the contrary effect. Black pigments, such as lampblack and carbon black, are very slow driers, and tend to form films with linseed oil, which are for some period excellent excluders, remaining quite elastic and durable. The chemical and heat rays of the sun, absorbed according to the selective action of the pigment, undoubtedly have some effect upon the drying and longevity of the oil.

Delicate pigments, such as Para red and others, need care in selection of foundations. Canadian and British painters often add red lead to the white lead used in the priming of wood, as a better base than white lead alone. Results obtained in the United States indicate that a combination of lead and zinc with a small percentage of suitable mineral pigment gives the best results.

The French Government, with its laws prohibiting the use of white lead, appears to be ultra-conservative in condemning so valuable a pigment. The use of zinc oxide alone, which is the present practice in France, cannot be recommended for all purposes, any more than the use of white lead alone for all purposes. J. Cruickshank Smith says:—"The question of admixtures of pigments is one which the paint grinder cannot evade. The keenest supporter of oxide of zinc will find frequent occasion to recommend white lead for some specific purpose, and the champion of so-called 'pure paints' will not readily spurn the aid of barytes or gypsum or whiting or asbestine. Each possesses merits and demerits, both have their value for specific purposes, and each should be used with due regard to its inherent limitations."

DISCUSSION.

Mr. G. THOMPSON said that the Paint Manufacturers' Association decided on a series of tests at Atlantic City on the lines of tests made by Professor Ladd in North Dakota, and asked Committee "E" of the American Society for Testing Materials to act as an inspection committee. There was some opposition, on the ground that Committee "E" would have no control over the tests, but the majority agreed to act as an inspection committee, although it was admitted that the scheme of tests was crude and unsystematic. It was agreed that the details of this painting should be submitted to a sub-committee of Committee "E," but no details were furnished. In painting, the priming coat was the key to the whole, and unless the priming coat penetrated the wood, and became sufficiently hard before the second coat was applied, "checking" and early destruction of the paint was inevitable. These tests were conducted in the winter time in sheds when the temperature was down to zero C. Under these conditions no paint could penetrate wood. After one year a report was made to Committee "E," which stated that the white lead paints chalked considerably, and in this respect were considerably less efficient than many combination paints. The paint on the fence at the present time was in very bad condition, and after two years none of the paints was worth anything.

Tests of this kind were not scientific. Eighteen years ago he undertook a series of 800 panel tests, solely for the purpose of finding the effect of variation of priming on the durability of paint, and found that a soft priming coat, no matter how produced, resulted in "checking." He then made over two hundred panel tests to determine, on an exterior paint—all boards being painted alike—what was the effect of variation in the percentage of pigment? One set of tests used 100 lb. of paste paint to four gallons of oil; another 90 lb. of paste to four gallons of oil; and another, 110 lb. of paste to four gallons of oil. The result was that the 110 lb. formula checked less than the 90 and 100. The proportion of pigment present thus largely determined "chalking." All the work the Paint Manufacturers' Association had done would have to be done over again.

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*Trans. Amer. Electrochem. Soc., Vol. XIV., 1908.

The addition of lamp-black undoubtedly increased the durability of all paint, and the addition of zinc, other things being equal, did this to white lead. This he believed was because most coloured pigments were very much finer than ordinary paste paints. Yellow ochre contained silica, and so did silex, but silex was coarse, while yellow ochre was very fine. They were told by Mr. Gardner that white lead contained 50 per cent. of coarse particles. This was not the case. Photomicrographs of classified portions of white lead, which showed only 2 per cent. of coarse particles, had been shown by himself at a meeting of the Section, and he said at the time that these ought to be taken out. Pure old Dutch process white lead—if further pulverized—would, at times, increase in durability. The addition of sublimed white lead under some circumstances would improve paint. This did not take from the fact that, of all the white paints used in the United States, fully one-half was straight white lead paint used by competent painters who knew how to apply it.

Mr. A. H. **Sabin** protested against the statement that Committee "E," or any sub-committee of it, had the supervision of this Atlantic City fence. They did inspect it; he was on that committee of inspection, and his conclusion was substantially the same as that of Mr. Thompson. The panels on the fence were in very bad condition; the best of them were not good.

While "chalking" was not a desirable thing, it was better than peeling, and the panels which chalked most were those which had a considerable body of paint on them. "Chalking" implied that the face of the pigment had lost most of its binder, but still adhered; it possessed a certain amount of toughness. Hard, brittle paints, when the oil deteriorated, washed off with rain, and did not chalk because the outer layer which would show it had gone; the paints which did not chalk were either in that condition, or had peeled and left the wood entirely. The worst thing that paint could do was to come off; and a paint might chalk considerably and still have a substantial body beneath.

A few weeks since a letter of complaint was sent to the National Lead Co. by a customer at Camden, S.C., who said he painted his house with two coats of Atlantic white lead and linseed oil nine years ago, and that the paint ought to have lasted longer. With the letter he sent up some specimen pieces of the lattice, which were painted only on the front side. Here was one of the samples. There was not a crack or defect in it.

Reference had been made to a French law against the use of white lead. There was no law in France which prohibited or limited the use of white lead at the present time but a law was passed recently to the effect that in five years' time white lead should be prohibited as a paint in France. There had been a law in Austria limiting or restricting the use of white lead, but it had been repealed within the last year. There had been an inquiry in Germany, but the German public officials found that there was practically no lead poisoning and that no legislation was needed, so none was enacted. The French Minister of Commerce at the time when the law above mentioned was proposed, received reports from 156 hospitals, all of which stated that they had not had a death from lead poisoning in twelve years.

He did not say that white lead was the best paint by itself, or that it might not be improved by mixing with others, but he did say that white lead was a good paint, and that comparatively little was known at the present time in regard to the effects of mixing of it with so-called "inert pigments." Experiments should be carried on, not only by private associations, but by societies like the American Society for Testing Materials, and all their reports should be published; but it was in the highest degree unwise to make a report after a year, or two years, saying that the experiments conclusively showed certain results. A paint test was never done until the time came to repaint; it was essential to know the condition of the surface at the end of that time, no matter whether it was iron or wood.

The iron fences at Atlantic City were more satisfactory than the wooden one; they were better prepared, and showed progress since the wooden fence was built. As the author had said, the zinc chromate and the "inhibitive" prussian blue were in good condition; the "stimulative" prussian blue was perhaps a trifle better than the other, and, in general, all the "stimulative" paints were in excellent condition, while nearly all the "inhibitive" paints had perished or greatly deteriorated. A dark coloured paint, other things being equal, was likely to stand weather better than white paint, because it did not allow the penetration of the actinic rays to which a great deal of destruction was due. In these experiments the dark coloured paints had shown up better than the light ones made out of practically the same materials.

Mr. H. A. **Gardner** understood Dr. Sabin to say that linseed oil films were not permeable to moisture, and that the theory of water forming a semi-solid solution with dried linseed oil, by which the passage of water through paint films was explained, was faulty. It had, however, been proved in their laboratory, by sealing dried oil films over the mouths of bottles containing weighed amounts of sulphuric acid, that moisture passed through these films and was absorbed by the acid. The bottles were exposed to a saturated atmosphere, and weighed carefully every few days. The increase in weight was enormous in some cases, and showed that the moisture absorbed by the acid went through the paint film, either because of the porosity of the film or because it formed a semi-solid solution with the film.

Dr. Sabin also said that coarse particles in paint were objectionable, and gave an uneven film which was apt to split at the rougher places. If this were true, why should corroded white lead be used as a paint? Certain varieties of it contained from 30 to 50 per cent. of large, coarse particles, and would, according to Dr. Sabin's statement, make a very uneven film. He further understood Dr. Sabin to say that the best pigment for making a paint should be extremely fine; in fact, that the finer the pigment, the better the paint. But zinc oxide was an extremely fine pigment, much finer than white lead, and, according to this line of argument, it would form the best paint. As a result of experiment, zinc oxide properly mixed with white lead formed the best base for paint. The Scientific Section, in making these exposure tests at Atlantic City and Pittsburg, were endeavouring to find out just what pigment should be used in different places. Such honest effort should not be ridiculed.

Dr. Thompson said that the silica in ochre was not the same as the silica which is found as pure silex. But the ochres on the market all contained free silica. If, therefore, free silica alone was used in a white paint, it would give the same reinforcement as ochre did in a tinted paint.

Regarding the supervision of the various fences: the Atlantic City wooden fence was under the inspection of Committee "E." The Atlantic City steel fence was under the direct supervision and inspection of a special body formed from Committees "E" on Preservative Coatings and "U" on the Corrosion of Iron. Of this body, Dr. Allerton S. Cushman, of the Office of Public Roads, U.S. Dept. of Agriculture, was chairman.

Regarding the excluding and rust inhibiting properties of paints for iron and steel, it was desirable to secure both these properties in such a paint. After the pigment had been carefully chosen for its inhibitive value, the vehicle should be selected with care. Combinations of linseed oil with various gums, such as kauri and copal, tended to form when spread out, films which were good excluders of moisture. After continued exposure all films broke down, and the importance of having a pigment of the inhibitive type was shown precisely at this point. If the pigment were of an inhibitive type, moisture which went through would have little effect upon the corrosion of the steel beneath; if the pigment were of a stimulative type, galvanic currents were apt to be set up, and corrosion would rapidly follow.

Dr. Sabin stated that zinc oxide, which in a water test proved a good inhibitor, was found on the test panels to be a very bad stimulator. Now, as a matter of fact, one of the paints giving the greatest amount of protection to the steel beneath was a mixture of zinc oxide, white lead and silica. Whenever zinc oxide was used on iron and steel, it gave good results if it had sufficient oil to prevent cracking. In his opinion, some of the best inhibitors on the steel plates were white lead, zinc oxide, zinc chromate, basic chromate of lead, prussian blue, zinc-and-barium chromate, and mixtures of these pigments.

Mr. N. J. **Lane** said that he went with four others in March, 1909, and spent two whole days and one half day inspecting one side of the fence. He had inspected the Atlantic City test fence nine times since Christmas, watching particular panels to note the progress, and to anticipate, if possible, by the use of high power glasses, what would occur in the next thirty days. It struck him as being most interesting.

When some committees inspected a fence, they went out in a motor car, provided with charts, etc. The fence received, perhaps, thirty minutes of concentrated attention. How, after such a short inspection, did they arrive at all this knowledge? No committee of any society under such conditions was competent to arrive at a decision off-hand how they were to make paint.

THE DURABILITY OF PAINTS; SOME FALLACIOUS THEORIES.

BY PROF. A. H. SABIN.

Abstract.

Recently the theory has been proposed that paint is similar to concrete in structure. In concrete, however, the spaces between the inactive materials are occupied by cement, and the pieces of stone rest one upon another in partial but actual contact; in paint, the so-called voids are occupied by linseed oil, and the particles float about, suspended in this liquid. Let us take a particular case, where the facts are known with some degree of accuracy; if we have a gallon of white lead putty, in which less than two-thirds the bulk is actual pigment, and the rest oil, we may assume that the oil at least fills what would otherwise be the voids of the pigment. To make a paint of this gallon of putty we must add about two and three-quarters gallons of oil—nearly three times as much as of the putty. Therefore in the paint the solid particles comprise less than one-fourth the whole volume; and if they are uniformly distributed, each particle is separated from those nearest in every direction by six-tenths of its own diameter. If the oil contracts 20 per cent. in drying, the particles are separated by half their diameter in the dry film. These conditions are radically different from those of concrete, and any talk of the particles mutually supporting one another, as the fragments do in concrete, is obviously irrational. Such a theory would not deserve serious consideration if it were not for the fact that the scientific section of the Paint Manufacturers' Association of the United States is spending thousands of dollars in circulating statements that this is a great scientific discovery.

It has, moreover, been shown by Mr. Robert Job, who made a long series of careful tests as chemist for the Reading railroad, that the value of a given pigment increases as it is more finely ground; and this agrees with the practically universal experience of paint manufacturers, who require their pigments to be as fine and uniform as possible. We should never let our interest in discussing a new hypothesis prevent our appreciation of the basic and fundamental facts, among which are, that beside its decorative effect, a pigment adds value to oil by increasing the hardness and thickness of the film.

As to the use of a pigment for making the film harder to better resist abrasion, it has been said that particles coarse enough to reach through the film give more support to the film than many fine ones. It is not fair to compare a paint film with a macadam pavement, yet the latter may suggest some thoughts. In such a pavement coarse pieces are used for foundation, smaller ones over these, still smaller for the top, and very minute ones to fill the voids in the latter; if carelessly done some of the large pieces may reach the surface and there the pavement quickly breaks down. Certainly small pieces stand that sort of abrasion better than large ones.

It seems inevitable that a fine pigment will make a more elastic film than one whose particles are coarse. For if we consider one of these particles which extends through the film, and then suppose it to be broken into pieces and the cracks between the pieces filled with dried oil, the latter would be more elastic; and in general, elasticity is a good quality in a film.

It is, however, by no means sure that a pigment consisting of particles of uniform fineness makes the best film, but it may be regarded as highly probable that any decidedly coarse portion is objectionable. The thickness of the film is directly related to the fineness of the pigment. A coarsely ground paint will run or slide off if applied in a heavy coat.

Other things being equal, the smoother a paint surface is, the better for wear; but a following coat of paint does not hold well on a very smooth under-coat, and in that case a pigment with somewhat coarse particles, which make a rough surface, is desirable. This whole matter of the most desirable degree of fineness of pigments for various uses has not yet been settled, and will require a great deal of careful work, though some things are definitely known.

It is well known that iron practically does not rust except in the presence of water, and rusting which takes place under paint is due to the porosity of the film which admits water. It is assumed that the protective action of the pigment is related to its action in the presence of water, and it is further assumed (contrary to fact) that the oil may be considered as only a binder, to keep the pigment in place. If these assumptions were correct, it is obvious that these experiments would seem to indicate how the pigment really acts. These experiments were first suggested by G. W. Thompson, who found that they did not lead to conclusive results, and discontinued them; they were then taken up by others, notably by A. S. Cushman, whose writings and lectures on the subject have caused his name to be most conspicuously connected with the matter. He, and others co-operating with him, have in this way arrived at a tentative classification of pigments as stimulators and inhibitors of corrosion, and indeterminates.

In this classification the second best inhibitor is zinc oxide, and in this division are also Prussian and ultramarine blue; the very worst stimulator is lampblack, and among these are carbon black and graphite; among the indeterminates are calcium carbonate and sulphate, china clay, red lead, and orange lead.

There is no relation between the classification of pigments based on this system of tests and that based on actual service in oil or varnish paints. This is not an opinion; it is a fact known to every one practically connected with the business. Any system of tests which proves that lampblack and graphite are worse paints for iron than whiting or calcium sulphate, or that these latter are about equal to red lead, and that ultramarine is good for this use, and the best of all is white zinc, simply breaks down on inspection. White zinc is a valuable pigment, unequalled for some particular work; but it is worthless as a paint on iron. Whiting is a damage to any oil paint which contains it; and calcium sulphate will rust iron every time.

The Scientific Section of the Paint Manufacturers' Association put out, in November, 1908, some steel panels on a special fence at Atlantic City, which were expected to show the value of this system of testing; photographs made a year later show that the white zinc and whiting paints on these panels have perished, while the lampblack and graphite are as good as new. These tests were not needed, as experience for fifty years or more has invariably shown the same thing.

The obvious fact is that pigments are not suspended in water but in oil, and linseed oil is one of the best insulators known; electrical apparatus of excessively high voltage (Tesla coils) is often submerged in linseed oil, to insulate it; and while a dried film may, because of its porosity, leak electricity, there is no reason to suppose that linoxyn is not an insulator of great efficiency, nor to doubt that the particles of pigment are surrounded by an insulating film. It is not reasonable to suppose that pigments imbedded in a solid insulating compound will act as they do in liquid water; and whether it is reasonable or not, it is certain that they do not. When Dr. Cushman says, "the fact has been brought out that some pigments which have been supposed to be excellent for protecting steel should never be used," no one doubts his good faith, ability, or accuracy; but he and his collaborators have been so carried away by the interest and ease of carrying on these experiments, that they seem to have lost sight of the fundamental thing, which is that we wish to investigate linseed oil paints, and that facts known by the common experience of half a century are not changed by a week's experiments with kalsomine.

These tests may prove something, but we do not yet know what it is. The value of an observation lies in the application of it, and there is no application. A test which appears to prove something which everyone knows is not so, is of no value; it involves a waste of time.

Certain basic pigments, such as red lead, may sometimes act chemically to inhibit corrosion, and soluble sulphates may stimulate it; but most of this talk about "inhibitors" and "stimulators," like the similar talk about the "law of minimum voids," may help to sell goods, but is of no use in making or using them.

THE DURABILITY OF PAINTS; THE ATLANTIC CITY AND NORTH DAKOTA TEST FENCES.

BY S. M. EVANS AND L. F. HUGHES.

The results recorded in the detailed report of the inspection of the Atlantic City test fence may be regarded as confirmed by those of the Pittsburgh fence, but the less drastic exposure of the latter fence has not yet caused sufficient paint decay to warrant a detailed report.

Inasmuch as the paints containing lithopone have been condemned by the inspection committees, it was deemed advisable to ignore them. Dividing the remaining paints into classes of seven single pigment paints, three are in bad condition, two in good condition, one fair, and one not described. Of eight paints carrying two pigments, six are in good and two in fair condition, the latter both containing no opaque body but zinc oxide. Of five paints containing three pigments each, three are in good condition and two in fair. Of seven paints made from four pigments, six are reported as "good," and the other is not described. Only two examples of five pigment mixtures are found—one good and one bad. It is unfortunate that there are so few of these because the single failure is clearly attributable to the large amount of gypsum used in it (formula 14). The two paints carrying six ingredients are both stated to be in good condition.

These data are fairly indicative of the correctness of the contention that neither chemical nor physical homogeneity in the pigment portion of a paint is desirable; for of the available opaque pigments we find the record of their use by themselves to be:—

Basic lead carbonate, "type A" ..	Bad condition.
,, ,, ,, "type B" ..	Bad condition.
,, ,, ,, "type C"	Bad condition.
Zinc oxide	Fair condition.
Zinc oxide (another test)	Not stated.
Sublimed or basic sulphate white lead ..	Good condition.
Zinc lead	Good condition.

Or a percentage of successful exposures of only 28·6 per cent.

Two pigment mixtures show 75 per cent. good and none bad; three pigment paints are 60 per cent. good, none bad; mixtures of four pigments are 85·7 per cent. good with the other not stated; 50 per cent. good is the record of five pigment mixtures, with a specific cause assignable for the single failure, as mentioned above; and six pigments in the mix make the best record for any class, 100 per cent. good.

Again classifying the data of the detailed report from the standpoint of pigment character instead of from that of the number of pigments, another interesting series of percentages is obtained.

Tabulating the fault of checking, for instance, a progressive improvement is noticeable, as they get further away from the unmixed pigments:—

Seven tests of the unmixed pigments show checking 85·7 per cent.; mixtures of two opaque pigments only 66·6 per cent.; or an average of checked surfaces for the "strictly pure" paints, of 77 per cent. The seventeen paints containing mineral pigments show checking in eight cases, or 47 per cent.; but four of these contain over 25 per cent. of reinforcing minerals, and may be therefore considered as overloaded. Excluding these we find that those paints containing reasonable amounts of mineral pigments show checking 30·7 per cent.

An interesting feature of those paints containing magnesium silicate deserves to be mentioned at this point: five mixtures contain this body, and none has checked.

From the fact that all paints containing over 25 per cent. of natural mineral pigments showed checking, it would appear reasonable to establish that proportion tentatively as a maximum. Probably the real limit of their efficiency is appreciably lower. In the case of paints containing lead carbonate, of eight mixtures containing 50 per cent. or upwards of this pigment, 85·7 per cent. show checking, while out of 13 mixes containing less than 50 per cent. of lead carbonate only 38·4 per cent. checked. An approximate limit for the general use of carbonates of lead is at least indicated.

Limits for the employment of zinc oxide are hardly deducible from the fence record so far, although the consistent exhibition of excessive hardness by mixtures containing high percentages of zinc oxide so far confirms previous experience.

Sublimed or basic sulphate white lead is reported as in good condition in the three mixtures of which it constitutes the major pigment: being used in the amount of 60 per cent., 75 per cent., and 100 per cent. The last two proportions show a hardness of only "2" which is below normal, so if a limit is to be established from the rather small number of examples it would fall between 60 per cent. and 75. As the 60 per cent. mixture exhibits no evidence of checking it can hardly be considered as a maximum.

The purpose of this brief memorandum is merely to call attention to the concordance in the behaviour of paints of corresponding formulæ, and to show that the characteristics of a pigment may be traced and recognised throughout a series of mixtures into which it enters, together with the modification of its salient characteristics by specific admixtures.

The feasibility of *a priori* correction of any weakness in a paint formula is plainly indicated. Such a control would be proof of the long-sought creation of a science of paint making; and with all due respect to those advocates of rule of thumb methods who have ridiculed the idea of anything "scientific" in connection with paint making, it must be said that the identification and systematization of the pertinent facts of paint making bid fair to render the craft a fairly exact science.

APPENDIX.

Mixtures classified in the above paper will be found in bulletin number 16 issued by the Scientific Section of the Paint Manufacturers' Association. The words "white lead," when used alone, mean "basic carbonate white lead." The mixtures used are as follows:—

Paints containing two pigments :—

No.	Page.	Constituents.	Per cent.	State.
1.	28	White lead	34·0	
		Zinc oxide	66·0	Good.
2.	28	White lead	50·4	
		Zinc oxide	49·6	Good.
6.	28	Zinc oxide	62·9	
		Barytes	37·1	Fair.
7.	29	White lead	45·0	
		Zinc oxide	55·0	Good.
11.	29	White lead	49·0	
		Zinc oxide	51·0	Good.
18.	30	White lead	79·10	
		Zinc oxide	20·90	Good.
19.	30	Basic lead sulphate	65·9	
		Zinc oxide	34·1	Good.
46.	34	Zinc oxide	62·75	
		Barium sulphate	37·25	Fair.

Note.—There is a discrepancy between the constituents given n pages 33 and 61 as representative of mixture 45. This was herefore excluded from consideration.

Paints containing three pigments :—

No.	Page.	Constituents.	Per cent.	State.
4.	28	White lead	48·5	
		Zinc oxide	48·3	
		Calcium carbonate	3·2	Good.
8.*	53	White lead	38·0	
		Zinc oxide	48·0	
		Silica	14·0	Good.
9.	29	Zinc oxide	74·5	
		Silica	22·4	
		Calcium carbonate	3·1	Fair.
12.	29	White lead	61·1	
		Zinc oxide	34·1	
		Inert pigment	4·8	Good.
6.	30	White lead	34·23	
		Zinc oxide	34·77	
		Barium sulphate	31·10	Fair.

* *Note.*—Omitted from the condensed table beginning on page 28.

Paints containing four pigments :—

No.	Page.	Constituents.	Per cent.	State.
3.	28	Sublimed white lead	29·56	
		White lead	16·04	
		Calcium carbonate	9·74	
		Zinc oxide	44·66	Good.
0	29	White lead	43·2	
		Zinc oxide	43·4	
		Calcium carbonate	7·4	
		Magnesium silicate	6·0	Good.
3.	30	Basic lead sulphate	57·04	
		Zinc oxide	30·74	
		Magnesium silicate	8·26	
		Calcium carbonate	3·96	Good.
5.*	67	Zinc lead white..	30·0	
		Zinc oxide	40·0	
		White lead	20·0	
		Calcium carbonate	10	Good.
7.	30	White lead	36·72	
		Zinc oxide	42·84	
		Barium sulphate	17·18	
		Asbestine	3·26	Good.
.	31	White lead	66·3	
		Zinc oxide	19·2	
		Asbestine	4·7	
		Calcium carbonate	9·8	Good
4.	32	Zinc oxide	32·94	
		Silica	29·77	
		White lead	17·29	
		Basic lead sulphate	20·00	Not described.

* Omitted from the condensed table beginning on page 28.

Paints containing five pigments :—

No.	Page.	Constituents.	Per cent.	State.
5.	28	White lead	41·4	
		Zinc oxide	49·3	
		Calcium carbonate	3·5	
		Magnesium carbonate	1.4	
		Aluminium and magnesium silicates	24·4	Good.
14.	30	Magnesium carbonate	·89	
		Calcium carbonate	2·86	
		Sublimed white lead	15·96	
		Zinc oxide	26·79	
		White lead	25·55	
		Calcium sulphate ; hydrated..	27·95	Bad.

Paints containing six pigments :—

No.	Page.	Constituents.	Per cent.	State.
34.	32	White lead	35·9	
		Lead sulphate	7·3	
		Zinc oxide	35·7	
		Calcium carbonate	18·3	
		Barytes and silica	2·8	Good.
35.	33	Lead sulphate	4·43	
		White lead	38·14	
		Zinc oxide	27·14	
		Calcium carbonate	20·26	
		Barytes and silica	10·03	Good.

Obituary.

OSCAR GUTTMANN.

Oscar Guttmann was born February 24th, 1855, at Nagy-Becskerek, in Hungary. At the comparatively early age of 23 years he already showed remarkable capability for literary work of a technical kind, for in the year 1878 he took over the editorship of "Der Bergmann," a technical journal devoted to mining, metallurgy, and engineering, and in connection therewith also edited the Austro-Hungarian Berg- und Hüttenkalender till 1888. In 1878, Guttmann obtained an appointment in the St. Lambrecht Dynamite Works in Austria, where dynamite was produced by mixing nitroglycerin with wood meal. In 1881 he was called upon to erect a guncotton factory at Buda-Pest, and three years later the Nobel Dynamite Company entrusted him with the management of the Isleten Dynamite Works, where the blasting material for the construction of the St. Gothard Tunnel was manufactured. In 1886, he was commissioned to reconstruct the Dynamite Works of Avigliana, in Italy.

Three years before, Guttmann had undertaken a journey of instruction and investigation to England, and aided by influential introductions he was permitted to visit a large number of Explosives Works in this country. The impressions of this journey have been laid down in a special report published in Dingler's Polyt. Journal. No doubt, he must have returned favourably impressed with the opportunities this country offered, for in 1887 he settled down in London as a consulting engineer and chemical adviser, especially for the manufacture of explosives, and for the subsidiary industries such as the manufacture of nitric acid, sulphuric acid, etc.

One of his first important undertakings in this country was the erection of the National Explosives Works at Hayle, in Cornwall, which he subsequently managed for several years. Later on he erected acetone plants at Waltham Abbey, Woolwich, Clapton, and Manchester. Special mention must also be made of the fact that he was commissioned to erect the testing station for explosives in Reichenstein, Germany.

He took out patents for his well-known apparatus for the manufacture of nitric acid, for a method for the concentration of sulphuric acid, and for the construction of condensing towers (Guttmann's Reaction Tower) filled with stoneware balls of various forms. As a logical outcome thereof there followed several other patents, having for their object the acceleration of the reaction of gases and liquids by means of contact substances and "Improvements in Heat Exchanging Apparatus."

In the year 1892 Guttmann published "Blasting," a handbook for the use of engineers, a second edition of which appeared in 1906. The same work was published in German under the title, "Handbuch der Sprengarbeit." In this work he described his apparatus for measuring the relative force exerted by different explosives on explosion. In 1895 appeared his "magnum opus," "The Manufacture of Explosives" in two volumes, the same work being also published in German. Thus Guttmann came to be recognised as one of the foremost authorities on all matters connected with explosives, and it is therefore not to be wondered at that he was asked in 1900 to write the article :—"Schiess- und Sprengstoffe" for "Muspratt's Chemie," which appeared under the same title as a separate work in German. A series of four Cantor lectures, delivered before the Royal Society of Arts in 1908, in which he summarised the progress made in the manufacture of explosives during the last twenty years, has been published as a separate book, richly illustrated, both in English and German, and has been selected by the Smithsonian Institution for publication in its "Contributions to Knowledge." He also wrote the articles on "Explosives" for the several editions of the "Chemisch - Technische Untersuchungs - Methoden." Not many months ago he revised and brought up to date the MS. of his article for the sixth edition of that work. About this time Guttmann also published a large number of papers in this Journal, in the Proceedings of the Institution of Civil Engineers, Chemiker-Zeitung, Zeitschrift für angewandte Chemie, Chemische Zeitschrift, and Zeit. f. das gesam. Schiess- u. Sprengstoffwesen. He devoted attention to the construction of safety buildings for Explosives Works, on which he read a paper before this Society last year; a continuation of this paper appeared in the last issue of the Journal. He patented this form of construction but placed no restriction whatever on the free use of his patent.

Guttmann devoted a large amount of such spare time as his practice left him to historical researches in the Explosives Industry. Not only did he collect the most representative documents and works, but he frequently visited home and foreign libraries, in order to examine and study old documents. The fruits of these special researches are embodied in a finely illustrated work, "Monumenta Pulveris Pyrii," which appeared in 1906 printed as an "édition de luxe," for a limited number of subscribers. The idea for the handsome volume published by the Explosives Section of the Seventh International Congress of Applied Chemistry, entitled "The Rise and Progress of the British Explosives Industry," originated with him. He collaborated with all his zeal in the production of this work.

He contributed largely to the Proceedings of this Society, and was no less active at the meetings of the London Section. He threw himself with enthusiasm into the movement to improve the technical education of chemists and chemical engineers. Thus he delivered a series of four lectures on Explosives in the Technical College at Glasgow and later at University College, London, and took a considerable part in promoting the scheme of technical examinations inaugurated by the Institute of Chemistry. He also read a paper on this subject before this Society entitled, "The Works Chemist as Engineer."

He became a naturalised British subject in 1894. He was twice a member of the Council of the Society of Chemical Industry; a vice-president of the Institute of Chemistry, a member of the Institution of Civil Engineers and of many home and foreign scientific and technical societies. His services to technical progress were frequently recognised by foreign societies. On August 2nd, whilst actively engaged as a Juror of the Brussels Exhibition, he met with that accident, in a motor cab collision, which put a sudden end to a life, active, still in its prime, and full of promise.

He was buried on August 9th, in Hampstead Cemetery. His remains were followed by a large concourse of friends, members of the Society of Chemical Industry, the Institute of Chemistry, and the Society of Public Analysts, and by many Freemasons, he having been a prominent member of the Craft.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—

English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.).

German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Coatings and coverings for the prevention of soil and electrolytic corrosion of iron pipe. Harper. *See* X.

Patents.

Furnaces. W. B. Bary, St. Petersburg, Russia. Eng. Pat. 18,452, Aug. 10, 1909.

The claim is for an annular, double-walled, dome-roofed furnace having the chimney shaft in the space enclosed by the annulus. An annular platform forming the sole is supported by conical rollers on ball bearings and is rotated within the furnace chamber, serving to support the materials to be heated. The furnace is heated by liquid or gaseous fuel, the latter being preheated by being caused to enter the combustion chamber through an annular passage in the furnace wall. The whole is enclosed within an outer wall and roof, spaced away from the furnace proper, to prevent loss of heat by radiation.—W. H. C.

Boiler furnaces. T. F. F. Lee. Fr. Pat. 412,350. Feb. 5, 1910. Under Int. Conv., Feb. 19, 1909.

In order to obtain a large amount of heating surface, three horizontal cylinders forming together one boiler unit are arranged in the form of a triangle leaving a space between the two lower cylinders to act as a combustion chamber. Fuel is supplied to the combustion chamber through inclined curved shoots one on each side of the boiler. These inclined shoots are provided with oscillating bars to assist the feeding of the fuel. A smoke-collecting chamber connected to a stack or chimney is provided at the end of the boiler remote from the furnace door.
—W. H. C.

mulsifying, pulverising and homogenising liquids. M. J. Talansier, Paris. Eng. Pat. 19,626, Aug. 26, 1909.

s order to avoid rapid deterioration due to wear and ear, a number of perforated discs of hard stones such as apphires, hard glass bodies and the like are tightly hreaded on a central hollow shaft provided with perorations or orifices corresponding to the perforations in he discs. The compound rod so formed is enclosed ithin an outer tube into which the material to be treated s forced under pressure. It passes through the perforaions in the stones into the inner tube from which it issues the desired emulsified condition. W. H. C.

acuum-pan apparatus. J. A. Groshon, New York, Assignor to E. J. Météríé, East Orange, N.J. U.S. Pat. 963,759, July 12, 1910.

he claim is for the combination of a vacuum-pan, a conenser and a rotary pump. The latter is connected to the utlet from the condenser and is provided on the delivery de with a pipe for the discharge of the condensed water, e end of the pipe being sealed in water.—W. H. C.

vaporating apparatus. C. W. Zastrow, Arundel Cove, Md. U.S. Pat. 964,359, July 12, 1910.

s upright cylinder having liquid and vapour spaces has steam inlet pipe which passes through a stuffing-box in e top and a similar corresponding outlet pipe passing rough the bottom of the cylinder. The inlet pipe is onnected within the cylinder to a horizontal steam ring d the outlet pipe to a similar ring immediately below e former. Between the two rings are a number of eam coils spaced round the ring. Steam is passed rough the coils and they are rotated in a horizontal plane y rotating the inlet and outlet pipes which act as a aft. W. H. C.

rying apparatus. P. M. Velilla, Medellin, Colombia. U.S. Pat. 964,342, July 12, 1910.

he materials to be dried are placed in a vertical, perrated cylinder with a non-perforated conical bottom. ot air is forced through a central, perforated, vertical pe surrounded by a concentric, perforated cylinder, to the materials. The air passes through the materials hich are agitated by a screw propeller arranged around e central pipe.—W. H. C.

rying wet materials by means of hot air. W. Bratkowski. Fr. Pat. 412,040, Jan. 29, 1910. Under Int. Conv., Feb. 2, 1909.

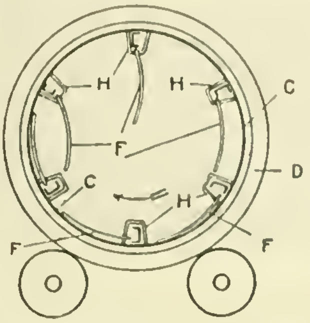
he claim is for the employment of two separate and stinct currents of air, one of which is heated directly by y suitable means, whilst the other is heated in heatterchanging apparatus by the waste heat of the directly ated current after it has passed over the material. The rectly heated air may be used for the final and the directly heated air for the preliminary drying or *vice rsa*, or the directly heated air may be used to complete e drying of part of the material and the indirectly heated partly for the preliminary and partly for the final ying.—W. H. C.

Dryer. L. Berger. Fr. Pat. 412,321, Feb. 5, 1910.

he drying chamber consists of an angle-iron frame ving a series of horizontal grooves or guides and proctions to support the trays containing the material to dried. The back and sides of the chamber are fixed d are formed of sheet iron, and the front is constructed narrow horizontal, easily removable shutters fitted one ove the other and provided with sliding bolts to make em tight.—W. H. C.

siccating drum or stove. Maschinenbau-Anstalt Humboldt. Fr. Pat. 412,569, Feb. 12, 1910. Under Int. Conv., April 24, 1909.

e rotary drying drum, c, is provided with a loose gmental and sectional lining of curved plates, *f*, supported by loops, *h*, so that as the drum rotates, the curved plates alternately rest upon and hang away from the drum.



The object is to prevent the formation of a crust upon the interior surface of the drum. W. H. C.

Treating solids with gases; Apparatus for ——. W. Mathesius. Fr. Pat. 411,969, Jan. 27, 1910.

The solids to be treated are fed into the upper part of a vertical, cylindrical furnace which is rotated in a horizontal plane. The interior of the furnace has the form of a series of superposed circular inclined planes or inverted truncated cones down which the solid material slides. A vertical, central, fixed shaft serves to convey the treating gas into the furnace and is provided with one or more superposed cones which correspond to the conical surfaces of the shell and serve to change the direction of the falling solid bodies and to cause them to slide down over each conical surface in succession. The rotating motion combined with the form and arrangement of the conical surfaces causes the solid bodies passing through the furnace to continually expose fresh surfaces to the action of the gas which passes upwards. The furnace is provided with a water-sealed or sand-luted cover. W. H. C.

Freezing machine utilising the absorption of sulphurous anhydride by camphor. C. C. Répin. Fr. Pat. 412,134, Jan. 8, 1910.

The cold is produced by the evaporation of liquid sulphur dioxide in the coils of the freezing machine. The gaseous sulphur dioxide is then absorbed by camphor preferably maintained in a liquid state by the addition of other bodies such as naphthols, naphthalene, etc. The sulphur dioxide is again driven off by heat and is again compressed and expanded. W. H. C.

Concentrating solutions without heating them: Process for ——. A Faragó, Budapest, Hungary. Eng. Pat. 20,380, Sept. 6, 1909.

See Fr. Pat. 406,843 of 1909; this J., 1910, 546.—T. F. B.

Evaporators. T. Suzuki, Sunamura, Japan. Eng. Pat. 20,462, Sept. 7, 1909.

See U.S. Pat. 937,114 of 1909; this J., 1909, 1185.—T. F. B.

Filtering and purifying liquids: Apparatus for ——. E. Abresch, Neustadt on Haardt, Bavaria. Eng. Pat. 28,360, Dec. 4, 1909.

See Fr. Pat. 409,526 of 1909; this J., 1910, 779.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Balloon-gas. W. v. Oechelhaeuser. J. Gasbeleucht., 1910, 53, 693–697. (Compare this J., 1910, 805.)

Experiments carried out at the Dessau gas-works on the preparation of a light gas suitable for filling balloons, by passing purified lighting-gas through highly heated retorts packed with charcoal or coke, showed that a suitable lighting gas for this process could be obtained equally well either from the old horizontal retorts, or from the newer vertical ones. With precautions to prevent leakage through the retort walls, an increase in volume of 20 per cent. was obtained. The process can be carried out either in vertical retorts or in horizontal retorts. With the latter, only those retorts which can be heated to 1200° C. can be used. The gas is drawn from the retorts at a very slightly reduced pressure and is passed through an air-cooler, a dust-filter to remove the carbon which separates out, and through an oxide purifier, and is delivered into a holder from which the balloon can be rapidly filled when required. The gas does not change in composition if kept in the holder. The average composition of the lighting gas used and of the balloon-gas obtained was as follows :—

	Lighting gas.	Balloon gas.
Heavy hydrocarbons	2·6	—
Carbon dioxide	1·3	—
Oxygen	0·2	—
Nitrogen	6·3	5·1
Carbon monoxide	5·3	7·3
Methane	24·7	6·9
Hydrogen	59·6	80·7
Specific gravity (air = 1)	0·41	0·225–0·30

The cost of transforming the lighting-gas into balloon-gas is about 3 pfennig per cb. m. (10d. per 1000 cb. ft.), or about equal to the cost of distribution of the lighting-gas, so that the balloon-gas can be sold at the gas-works at the same price as lighting-gas to the consumer.—A. T. L.

Sulphuretted hydrogen ; Removal of —— from lighting-gas by Feld's process. D. Stavorinus. J. Gasbeleucht., 1910, **53**, 705—706.

FELD'S process consists, in its simplest form, in passing the gas through a solution of zinc thiosulphate, so as to form zinc sulphide and free sulphur :—

$$ZnS_2O_3+H_2S=ZnS+H_2S_2O_3$$
$$H_2S_2O_3+2H_2S=3H_2O+4S,$$

the liquor from the washer being then treated with sulphur dioxide to convert the zinc sulphide into thiosulphate. The free sulphur remains in suspension and the processes are repeated until the liquor contains 15 per cent. of free sulphur. The sulphur is then removed by filtration. The original solution of zinc thiosulphate is obtained by passing sulphur dioxide through a mixture of commercial zinc oxide with water, and using the zinc sulphite so formed for a preliminary washing of the gas. When ammonia as well as sulphuretted hydrogen is to be separated from the gas, a solution of zinc or iron sulphate is used, the liquor being regenerated by passing sulphur dioxide and air through the warm liquor :—

$$2FeSO_4+4NH_3+2H_2S=2FeS+2(NH_4)_2SO_4.$$
$$2FeS+3SO_2=2FeS_2O_3+S.$$
$$2FeS_2O_3+4NH_3+2H_2S=2FeS+2(NH_4)_2S_2O_3.$$

In the process of regenerating the liquor, sulphate and tetrathionate are formed as well as thiosulphate. When the liquor contains 35—40 per cent. of ammonium salts, the process is stopped and the boiling liquor is treated with sulphur dioxide and hot air :—

$$2FeS+2(NH_4)_2S_2O_3+3SO_2+2O_2=2(NH_4)_2SO_4+2FeSO_4+5S.$$

The sulphur is separated by filtration, and the liquor is used for washing the gas until the iron sulphate is just converted to iron sulphide and ammonium sulphate. After filtration, the ammonium sulphate is obtained by evaporating the liquor. The process has been used for some time with satisfactory results at East Hull.—A. T. L.

PATENTS.

Coke-oven ; Regenerative —— without reversal of current within the oven. J. G. Kros. First Addition, dated Jan. 27, 1910, to Fr. Pat. 391,228, June 15, 1908. (This J., 1908, 1103.)

INSTEAD of two regenerative chambers being constructed beneath each oven as described in the chief patent, each chamber is made to serve as a regenerator for tw ovens, the total numbers of regenerators and ovens being equal.—H. H.

Coke-oven ; Horizontal —— with recovery of by-products T. von Bauer. Fr. Pat. 412,843, Feb. 18, 1910.

To prevent the decomposition of the distillation gases i the upper portions of the ovens, the latter are heated i such a manner that the temperature is least at the top o the ovens and increases regularly to the bottom. Th ovens are heated by gas fuel burning in long horizonta combustion chambers formed in the walls dividing th ovens, the products of combustion from the top chambe passing downwards in a serpentine course through th lower chambers into which fresh gas and air, which hav first been heated by passing them through narrow passage formed in the baffles separating the combustion chambers, are admitted. The combustion in the upper chamber serves increasingly to raise the temperature of the gase entering into combustion in the lower chambers.—H. H.

Gas-producer. R. P. Conkling, San Luis Potosi, Mexico U.S. Pat. 965,086, July 19, 1910.

A DOWN-DRAUGHT gas-producer is provided with an axia gas-outlet conduit extending through the whole height o the producer. The lower end of this conduit is flare outwardly, and is sealed in a water trough at the base o the producer. The hot gases pass through the wate seal into the outlet conduit, the heated walls of this condui serving to decompose the tarry constituents of the gas. —A. T. L.

Gas-producers. Compagnie de Fives-Lille, Seine. Fr. Pat 412,215, Feb. 1, 1910.

A GAS-PRODUCER of the type in which the gas is continuous drawn through the apparatus by means of an exhauster is fitted with an open grate so that the ashes may b removed during working without affecting the quality o the gas. The lower section of the body of the producer i formed of a conical piece of cast-iron or steel, having a deep outwardly-turned lip into which the water fo humidifying the air supply is led.—H. H.

Gases ; Process of treating combustible ——. H. L Doherty, New York. U.S. Pat. 964,901, July 19, 1910.

IN order to enrich a combustible gas containing a substantial amount of carbon dioxide, the gas is first cooled sufficiently to condense water vapour, then passed through a superheater which is heated by burning a portion of th gas, and finally the superheated gas is passed downward through a bed of incandescent fuel in a down-draught producer. A sufficient quantity of air is mixed with th gas entering the producer to maintain the temperature o the fuel bed.—A. T. L.

Air gas ; Composition for purifying ——. W. G. Moores, Bournemouth. Eng. Pat. 28,054, Dec. 1, 1909.

A COMPOSITION consisting of asphalt 1 part, bitumen 1 part pitch 1 part, ammonium chloride 1/16 part, and chloride of lime 1/3 part, is moulded while hot into blocks, having holes passing through them. These blocks are placed in the gas-making chamber or in a separate chamber through which the air-gas is passed.—H. H.

Producer gas ; Process and apparatus for recovery of ammonia from ——. A. B. Duff, Pittsburg, U.S.A., and The Gas Power and By-Products Co., Glasgow. Eng. Pat. 4372, Feb. 22, 1910.

THE sensible heat of the gases from the producer, before they pass to the ammonia recovery tower, is used fo boiling down the weak liquor produced, for raising th greater part of the steam required for the producer and for heating the air supply. For this purpose the hot gase from the producer are first passed through a casing surrounding an evaporating pan which is fed with weak liquor from the acid tower. The gases then pass upward through a washing tower; and the hot water from th tower is pumped to the top of an air heating and saturating tower which may be superposed upon the first tower. The saturated air may be passed through a superheating chamber on the producer. The water from the saturating tower is again used in the washing tower.—A. T. L.

Gases ; Extraction of tar and tar constituents from ——. W. Feld, Hönningen-on-the-Rhine, Germany. U.S. Pat. 965,147, July 19, 1910.

Gases containing aqueous vapour are heated above the saturation temperature and are treated with a washing liquid heated to a temperature sufficient to keep the gases above the saturation temperature. The gases are then cooled, and again heated above the saturation temperature and treated with a washing liquid for the extraction of naphthalene.—A. T. L.

Residues from purification of illuminating gas ; Treatment of ——. H. Simonin. Fr. Pat. 412,305, April 29, 1909.

The ammoniacal residues obtained in the purification of illuminating gas are treated with dilute sulphuric acid or a mixture of dilute sulphuric and nitric acids, and the acid liquors concentrated and absorbed in peat for use as a manure, or they may be evaporated with calcium phosphate. The sulphur in the insoluble residue is recovered by drying the residue and heating it to 400° to 500° C., when the sulphur is sublimed, or the sulphur may be dissolved out from the residue by a solvent under pressure.—H. H.

Illuminating gas ; Process for removing hydrogen sulphide and carbon dioxide from ——. H. Hirzel Ges.m.b.H. Ger. Pat. 223,468, March 17, 1909.

In the removal of hydrogen sulphide and carbon dioxide from illuminating gas by washing it with ammoniacal liquor, in order to avoid loss of ammonia, only the liquor which is produced from the gas by condensation (so-called weak liquor), and which contains most of the hydrogen sulphide and carbon dioxide removed from the gas, is treated in a column apparatus for the expulsion of these impurities. In order further to reduce the loss of ammonia, the upper part of the column apparatus, where the gas-liquor is introduced and cooled, is made deeper than usual. The higher hydrostatic pressure thus produced leads to a better exchange of heat, and also increases the boiling point of the liquor in the lower part of the column, thus facilitating the expulsion of the hydrogen sulphide and carbon dioxide. The same cooling water is used for cooling the freshly introduced gas liquor in the upper part of the column and then for preheating the liquor in the middle portion, before it passes to the lower heating compartment of the column, and thus economy of fuel is effected. An automatic temperature regulator is fixed on the inlet pipe for the heating steam, so that the temperature of the gas liquor in the heating compartment can be kept constant some degrees below the boiling point. The heating tubes in the lowest compartment of the column are made separate and interchangeable, so that they can be easily replaced by fresh ones.—A. S.

Oil and other volatile substances ; Vaporisation of ——. H. A. Kittle, London. Eng. Pat. 8336, April 6, 1909.

Oil is vaporised without fractionation by passing it at a constant rate through an apparatus in which the oil is subjected to a constant temperature sufficiently high to vaporise the constituent having the highest boiling point, the velocity of flow of the oil being not less than the velocity at which the same oil would spread if brought into contact with the hot vaporising surface. According to one method of carrying the invention into effect, as applied to gas-oil of sp. gr. 0·86 the oil is forced by air at a pressure of 100 lb. per sq. in. through a 20-ft. coil of $\frac{3}{16}$ in. pipe immersed in molten metal at a temperature of 700° C., the rate of supply of oil being 60 lb. per hour. The non-volatile constituents are collected in a trap immersed in the molten metal, while the vapour is led away either to be used for power purposes, etc., direct or to be condensed. —H. H.

Shale oil ; Treatment of ——, for the obtainment of a product more especially intended for use in working internal combustion engines. R. de Fazi, London. Eng. Pat. 17,030, July 21, 1909.

Shale oil is treated with sulphuric acid, then with charcoal, and with reagents for the generation of hydrogen, and finally with lead oxide. As an example of the process, 100 parts by weight of oil are shaken with 3 parts of commercial sulphuric acid of 66° B., allowed to stand for 24 hours and the oil run off. The oil is then shaken with 3 parts of wood-charcoal, allowed to stand for half an hour, and then run off. 4 parts of zinc powder and 3 parts of hydrochloric acid are added, and after the reaction is complete the oil is poured off, shaken with 1 part of lead oxide, and filtered. The product is used alone, or with the addition of about 5 per cent. of petrol.—A. T. L.

Acid tar produced in the refining of mineral oils with sulphuric acid ; Process for obtaining sulphur dioxide, liquid hydrocarbons, and coke from the ——. Steaua Romana, Petroleum-Ges.m.b.H. Ger. Pat. 224,566, March 18, 1909.

The acid tar is run continuously, in a thin stream, into a retort heated to 250°—350° C., into which is also introduced a current of air previously heated to the same temperature. The reaction products consist of hydrocarbons, sulphur dioxide, and a porous and friable coke. The coke is removed continuously from the retort by a suitable mechanical device. The gases and vapours from the retort are led first through a condenser to separate the liquid hydrocarbons, and next through washers containing respectively heavy mineral oil and concentrated sulphuric acid to remove gaseous hydrocarbons. They can then be used either directly or, after dilution with air, for the manufacture of sulphuric acid.—A. S.

Coke retort-oven. V. D. F. Fieschi, Douai, France. U.S. Pat. 964,635, July 19, 1910.

See Fr. Pat. 385,355 of 1907 ; this J., 1908, 553.—T. F. B.

Gas ; Generation of —— in gas producers. W. H. Cone, Detroit, U.S.A. Eng. Pat. 15,569, July 3, 1909. Under Int. Conv., July 3, 1908.

See U.S. Pat. 922,857 of 1909 ; this J., 1909, 647.—T. F. B.

Gas purifier. C. Wegescheidt, Cologne-Bayenthal, Germany. U.S. Pat. 964,719, July 19, 1910.

See Eng. Pat. 16,243 of 1909 ; this J., 1910, 746.—T. F. B.

Petroleum oils ; Impts. in ——. H. W. Knottenbelt, Brussels. Eng. Pat. 12,001, May 21, 1909.

See Fr. Pat. 411,780 of 1910 ; this J., 1910, 933.—T. F. B.

Petroleum and other hydrocarbon oils. H. W. Knottenbelt, Brussels. Eng. Pat. 9892 of 1910. Date of Appl., May 21, 1909.

See Fr. Pat. 411,780 of 1910 ; this J., 1910, 933.—T. F. B.

Recording gas calorimeter. Eng. Pat. 16,647. *See* XXIII.

Erratum.

This J. 1910, 480, col. 1, line 22 from bottom, *for* "951,271," *read* "951,272."

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Metal-filament lamps. Times Eng. Suppl., Aug. 10, 1910.

In a paper on "Metal-Filament Lamps" before the American Institute of Electrical Engineers, J. W. Howell stated that the first commercial metal-filament lamp was the osmium lamp. These lamps had a good commercial life using 1·5 watts per c.p., and were used in considerable numbers in Vienna and Berlin, where they were made. They were not shipped to distant points, as the filaments were very fragile, and the value of the metal osmium made it desirable to recover the lamps after they had burned out. The tantalum lamp appeared on the market in Germany in 1905, and in the United States in 1906. The filament had a tensile strength greater than steel, a very high melting point, about 2800° C., according to Waidner and Burgess, and it had radiating characteristics which made it an efficient light-giving body. The strength and flexibility of the filament prevented breakage in shipment, and made the lamps suitable for use wherever they were subject to handling or rough usage of any kind, a quality which had enabled the tantalum lamp to increase rapidly in use while in direct competition with others which operated at a much higher efficiency. Tungsten lamps were first placed on the market in the United States about the beginning of 1907, and were sold in Europe in September, 1906. The development and production of these lamps since that time had been very rapid, and in 1909 about 10,000,000 lamps were sold in the United States. The first tungsten lamps sold in the United States were high candle-power, thick filament lamps. The reasons for this were that the thick filaments were more easily made than the thinner ones, and the field of high candle-power lamps had been very imperfectly filled by carbon lamps. These early lamps consumed 100 watts and gave 80 c.p.; since that time both higher and lower candle-power lamps had been developed, and the adaptability of tungsten to the making of all sizes of filaments had been fully demonstrated. Lamps were now on the market which used currents as low as 0·15 ampère and as high as 10 ampères in a single filament. Lamps consuming 500 watts and giving 400 c.p. were used in large numbers, and some 1000 c.p. lamps had been made. Tungsten was one of the heaviest metals known. The melting point was over 3000° C., according to Waidner and Burgess; the metal, however, softened at a much lower temperature, and thus filaments which were easily broken when cold could be bent permanently into any desired shape with ease. The specific resistance of cold carbon was 800 times that of tungsten, and at normal working temperature it was 33 times that of tungsten. The low specific resistance of tungsten was a disadvantage in making high voltage lamps, and made it necessary to use very long and thin filaments; the length of filaments for 120-volt lamps ranged from 450 mm. for 20-watt lamps to 1400 mm. for 500-watt lamps, and the disposal of such long filaments within the proper sizes of bulbs necessited a great advance in the art and science of lamp making. This was however accomplished, and lamps of standard voltage now ranged from 20 watts and 16 c.p. to 500 watts and 400 c.p. This low specific resistance was an advantage for low-voltage lamps. It had caused a considerable increase in the use of low-voltage lamps for many purposes in connection with storage batteries, and it had led to the introduction of residence lighting systems where 27 and 60 volt lamps were used. Tungsten filaments as made to-day generally consisted of an agglomeration of fine particles of metallic tungsten, these particles being sintered or welded together by raising the filaments to a very high temperature in a reducing atmosphere, and the filaments were still more fragile than carbon filaments. This fragility had been the greatest obstacle met with in the introduction of tungsten lamps. The latest development which had been publicly announced was the drawn tungsten wire filament (see this J., 1910, 825). This wire had very great tensile strength, greater than steal, and could be drawn to any desired size. The filaments were very strong and were not injured by rough handling. In life and efficiency they were fully equal to pressed filaments. Tungsten filaments when burning were quite soft and plastic, and must be supported at points sufficiently near together to prevent the filaments from sagging and touching each other or the glass. Spring supports were used in many lamps. From the results of experiments made over 20 years ago it was deduced that the lives of lamps at different candle-powers varied inversely as the 3·65 power of the candle-power. These experiments were made on lamps with untreated bamboo filaments, and when carbon filaments came into use a great many experiments were made to determine whether or not this same exponent was true for them also. The conclusion was that the same exponent should be used for both types. When metal-filament lamps became established the same question arose, and comparisons had been made upon large numbers of lamps at different candle-powers, each comparison being made between lamps of the same type. The result of these comparisons indicated that the same exponent which was used for carbon filament lamps was also the proper one for lamps with metal filaments. From this relation between life and candle-power could be determined the relation between life and voltage, current, watts, or watts per candle-power. The relation between life and voltage or current depended upon the resistance characteristic of the filament, and as different types of lamps had very different resistance characteristics, a different relation would be found for each type. The relation between life and watts or watts per candle-power was very nearly the same for all different types of lamps, because the relation of candle-power and watts per candle-power was nearly the same for all types. With regard to the effect of metallic filament lamps on the electric power industry the fears of the suppliers of current that their income would be reduced by the introduction of tungsten lamps had not been realized; on the contrary, their income had been increased by the rapid extension of their business into new fields which were opened by the superiority of the new lamps, and by the availability of the larger sizes of lamps which, with carbon filaments, were not successful.

PATENTS.

Coal; Apparatus for continuous distillation of —— i vertical retorts. S. Glover and J. West. Fr. Pat 412,194, Dec. 7, 1909.

WATER is admitted together with the coal (and in amount sufficient to moisten it), at the top of the retorts, which are heated by producer gas burnt in separate and distinct combustion chambers surrounding the retorts. The air for the combustion chambers is passed round the lower ends of the retorts so as to cool the coke contained therein, which is removed by means of vertical helices working in closed chambers having doors at the bottom provided with water seals. It is stated that the humidification of the coal aids the descent of the charge in the retort, improves the quality of the coke, and prevents the deposit of tar, etc., in the outlet pipes.—H. H.

Incandescent filaments and their leading in wires; Process for the production of a metallic connection between —— Pope's Electric Lamp Co., Ltd., London. From C. Trenzen. Münster-am-Stein, Germany. Eng. Pat 16,076, July 9, 1909.

A PASTE is made by mixing about 20 c.c. of 29 per cent ammonia solution with 200 grms. of finely divided metallic tungsten and is used to cement the filament to the leading in wire by means of simple pressure. The knob of cement is then melted electrically in an inert gas. About 2 per cent. of gelatinous silicic acid may be added to the paste; the tungsten silicide produced by reduction melts with comparative ease and forms a very good connection.
—E. F.

Metallic filaments of electric lamps; Method of preventing the volatilisation of ——. Bergmann-Elektricitäts Werke Aktges. First Addition, dated Jan. 24, 1910, to Fr. Pat. 394,823, of Oct. 1, 1908 (this J., 1909, 302).

THE original patent referred to the production of a rarefied atmosphere of hydrogen phosphide within the lamp by painting surfaces within the same, such as the centra support, with substances which disengage that gas. According to the present addition an especially steady current of hydrogen phosphide is obtained by using mixtures of substances which disengage that gas, such as the yellow hydrogen phosphide, with inert substances which do not react with the gas which is formed. It is claimed that the extremely fine state of division of the active substance which is so produced is beneficial.—E. F.

Soldering of easily oxidisable metallic filaments; Method of ——. Bergmann-Elektricitäts-Werke Aktges. Fr. Pat. 411,910, Jan. 21, 1910.

The filaments are placed in a receiver through which is passed a current of a reducing gas, such as coal-gas or hydrogen. Air or oxygen is introduced through a jet into the receiver and a flame started at the jet by means of an electric spark, which consumes all the oxygen which is admitted; the necessary soldering is performed in this flame, and as the joints are withdrawn into the atmosphere of reducing gas and there cooled, all oxidation is said to be avoided.—E. F.

Metallic filaments for electric incandescent lamps; Method of decarbonisation of ——. The Westinghouse Metal Filament Lamp Co., Ltd. Fr. Pat. 412,443, Feb. 9, 1910.

The filaments, consisting of powdered metal and a binding material, either previously carbonised or not, are placed in suitable receivers, exposed to a high vacuum, and simultaneously to a high temperature, by heating the vessel externally. In this way the carbon is said to be practically eliminated, probably by electrical disintegration. The vacuum must be very high as it was found that at pressures of 0·2 to 0·5 mm. of mercury the carbon was not eliminated from filaments containing tungsten and carbon even at 1500° C. As an example, tungsten filaments containing 1·5 per cent. of carbon were heated in a high vacuum for 1 hour at 800° C. This reduced the carbon to 1·23 per cent. After heating for a further hour at 900° C. only 0·57 per cent. of carbon remained; after a further 1¼ hours at 1000° C. there remained 0·35 per cent. of carbon, after another hour at 1100° C. 0·06 per cent. and after finally heating for a further hour at 1200° C. only 0·04 per cent. of carbon remained, or possibly even less than this. The vacuum employed was 0·056 mm. of mercury whilst cold, but dropped to 0·2 mm. of mercury whilst heating, rising again to the former value on cooling. —E. F.

Electrodes for arc lamps. The British Thomson-Houston Co., Ltd., London. From The General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 18,965, Aug. 17, 1909.

Electrodes for arc lamps largely or wholly composed of titanium carbide are mixed with from 1 to 6 per cent. of sulphur, or other element of the sulphur group, in order to avoid projection from the arcing end of fused particles of carbide which adhere to the glass of the enclosing globe; with the admixture described in this patent such spitting of the electrode is diminished, whilst the particles which are still thrown off do not fuse or adhere to the glass of the globe, but roll off the same to the bottom, where they collect or drop out. The best results have been obtained with an admixture of 4·5 per cent. of sulphur. —E. F.

Incandescent mantles; Process for the manufacture of ——. J. Visseaux, Lyons, France. Eng. Pat. 23,434, Oct. 13, 1909.

See Fr. Pat. 408,807 of 1909; this J., 1910, 618.—T. F. B.

Incandescent mantles; Manufacture of ——. A. G. Adamson, Assignor to D. M. Still and Sons, Ltd., London. U.S. Pat. 965,057, July 19, 1910.

See Eng. Pat. 25,549 of 1908; this J., 1910, 480.—T. F. B.

Metal filaments for electric incandescence lamps; Process for decarburising ——. Westinghouse Metal Filament Lamp Co., Ltd. Fr. Pat. 412,048, Jan. 29, 1910.

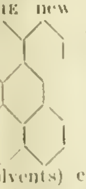
See Eng. Pat. 6936 of 1909; this J., 1910, 340.—T. F. B.

Tungsten; Process of making ——, specially applicable to the manufacture of incandescence lamps. Fr. Pat. 373,923. See X.

III.—TAR AND TAR PRODUCTS.

Perylene, a highly condensed aromatic hydrocarbon, $C_{20}H_{12}$. R. Scholl, C. Seer, and R. Weitzenböck. Ber., 1910, **43**, 2202—2209.

The new hydrocarbon has the constitution



and may be regarded as *peri*-dinaphthylene, from which the authors derive the name perylene. It is obtained by heating either naphthalene or 1:1′-dinaphthyl with aluminium chloride or by heating 1:8-di-iodonaphthalene with copper powder. Perylene forms glistening yellow (by sublimation) or bronze-coloured (from solvents) crystalline leaflets, melting at 264—265° C. It forms yellow to reddish yellow solutions possessing a beautiful blue fluorescence. A dibenzoyl derivative was also prepared.—J. C. C.

Amines with phenols; Additive compounds of certain aromatic ——. J. Dollinger. Monatsh. f. Chem., 1910, **31**, 643—656.

The author has prepared additive compounds of benzidine with quinol (I.) and β-naphthol (II.), of o-tolidine with quinol (III.), α-naphthol (IV.) and β-naphthol (V.), of dianisidine with quinol (VI.) and β-naphthol (VII.), of α-naphthylamine with α-naphthol (VIII.) and β-naphthol (IX.) and of β-naphthylamine with β-naphthol (X.) by mixing hot saturated aqueous solutions of the components. The compounds are all very sparingly soluble in water from which solvent they crystallise on cooling. They are all decomposed into their constituents by boiling with dilute acids or alkalis. They contain equal numbers of amino- and hydroxy-groups with the exception of IV. (above), which contains two amino-groups to one hydroxy-group. Nos. I. and II. are distinctly basic, No. X. is acidic, and Nos. III., IV., V., and IX. possess an amphoteric character. The nature of Nos. VII. and VIII. could not be accurately ascertained, as by the test applied (addition of the dye-acids of Crystal Violet and Crystal Ponceau) they were decomposed into their constituents. With ferric chloride characteristic colorations are produced which are generally different from those given by the constituents alone.—J. C. C.

Patent.

4-Chloro-1-hydroxynaphthoyl-o-benzoic acid; Process for preparing ——. Anilinfarben- u. Extract- Fabr. vorm. J. R. Geigy. Ger. Pat. 224,538, Aug. 7, 1909.

When 1-hydroxynaphthoyl-o-benzoic acid is treated, in suspension or solution, with not more than the theoretically necessary quantity of sulphuryl chloride, in the cold, chlorine is introduced into the naphthalene nucleus in the p-position to the hydroxy group. The new derivative melts at 211° C., is soluble in alcohol, acetone, ether, and chloroform, and may be used for the preparation of naphthacene-quinone derivatives.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Indigo trade in the Netherlands in 1909. Z. angew. Chem., 1910, 23, 1113—1414.

The tone of the Dutch market for Java indigo remained dull at the beginning of 1909, and the stocks (179 chests) left from the preceding year could only be slowly disposed of at falling prices. Imports of the new crop remained small and there was soon a deficit in the case of the best red indigo, for which a vigorous demand persisted throughout the year. After July the price rose by 10 cents (2d.), and in November, owing to increasing demands, by a further 20 cents (4d.). The prices for the different qualities were as follow :—

	End of 1909.	End of 1908.
Superfine red indigo. .	5s. 3d.—5s. 4d.	4s. 8d.—4s. 9d.
Superfine violet indigo	4s. 11d.—5s. 0d.	4s. 6d.—4s. 7d.
Fine medium to fine indigo	4s. 5d.—4s. 9d.	4s. 4d.—4s. 5d.
Ordinary medium indigo	3s. 10d.—4s. 2d.	3s. 7d.—3s 10d..
Ordinary and good ordinary indigo . .	3s. 4d.—3s. 8d.	3s. 2d.—3s. 6d.

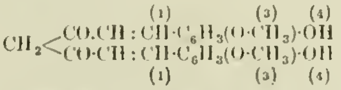
The imports, sales, and stocks of Java indigo were as follow :—

	Imports.	Sales and re-exports.	Stocks on Dec. 31.
	Chests.	Chests.	Chests.
Amsterdam : 1909......	326	405	—
1908......	379	437	79
Rotterdam : 1909......	370	470	—
1908......	945	986	100

—A. S.

Curcumin. J. Mitobedzka. S. v. Kostanecki and V. Lampe. Ber., 1910, **43**, 2163—2170.

The resemblance between Curcumin and the hydroxychalkones suggests that the former may contain the chromophore ·CO·C : C· and this is supported by the fact that the following chalkone derivatives, prepared by the authors, are similar in properties to Curcumin except that they do not dye unmordanted cotton. 4′ : 3- Dimethoxy- 2′ : 4-dihydroxychalkone, $OH{\cdot}C_6H_3(O{\cdot}CH_3){\cdot}CO{\cdot}CH{:}CH{\cdot}C_6H_3{\cdot}(O{\cdot}CH_3){\cdot}OH$, prepared by boiling an alcoholic solution of paeonol and vanillin with sodium hydroxide, forms yellow needles, m. pt., 142°—143° C., and forms lakes with zirconium, glucinum, uranium and copper salts. The condensation of vanillin and quinacetophenone monomethyl ether furnishes 5′ : 3-dimethoxy -2′ : 4-dihydroxychalkone which forms orange red leaflets, m. pt. 122°—123° C., and gives lakes as the preceding compound, the colours being slightly different. Aceto-*a*-naphthol and vanillin, when condensed together, furnish 3′-methoxy-4′-hydroxy-2-benzylideneaceto -*a*-naphthol, $OH{\cdot}C_{10}H_6{\cdot}CO{\cdot}CH : CH{\cdot}C_6H_3(O{\cdot}CH_3){\cdot}OH$, red needles, m. pt. 190°—191° C., which similarly forms lakes. Confirmation of the idea of the presence of the group ·CO·C : C· in Curcumin was afforded by the discovery that ferulic acid, $OH{\cdot}C_6H_3(O{\cdot}CH_3){\cdot}CH : CH{\cdot}CO_2H$, is obtained (along with vanillic acid) when Curcumin is boiled with potassium hydroxide solution. From this the authors are led to the conclusion that the constitution of Curcumin may be



$$CH_2\begin{cases} CO.CH : CH{\cdot}\overset{(1)}{C_6}H_3(\overset{(3)}{O{\cdot}CH_3}){\cdot}\overset{(4)}{OH} \\ CO{\cdot}CH : CH{\cdot}\underset{(1)}{C_6}H_3(\underset{(3)}{O{\cdot}CH_3}){\cdot}\underset{(4)}{OH} \end{cases}$$

and the preparation of well crystallised derivatives (dicarbomethoxy- and dicarboethoxy-curcumin) confirms this formula (Ciamician and Silber, $C_{21}H_{20}O_6$) rather than that of Latham and Jackson ($C_{14}H_{14}O_4$). Further confirmation is adduced in the fact that Curcumin, like β-diketones, gives an *iso*-oxazole derivative when treated with hydroxylamine.—J. C. C.

Patents.

Monoazo dyestuff and colour lakes therefrom ; Manufacture of a red ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/M., Germany. Eng. Pat. 12,426, May 21, 1910. Under Int. Conv., May 25, 1909.

By combining diazotised 5-amino-2-chloro-1-toluene-4-sulphonic acid with β-naphthol, a dyestuff is obtained which yields colour lakes of a yellowish red shade and which are very fast to light. It is now found that by combining with β-hydroxynaphthoic acid (m. pt. 216°) in place of β-naphthol, a dyestuff which yields lakes of a bluer and brighter shade (and even faster to light) is obtained. The dyestuff may be prepared for itself ; or the preparation may be combined with the production of the colour lake in one operation, by adding to the solutions before mixing, barium or strontium chlorides or any suitable substratum. —F. M.

Dyestuffs of the anthraquinone series ; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Second Addition, dated Jan. 29, 1910 (Under Int. Conv., Feb. 16, 25 and 27, and Mar. 15, 1909) to Fr. Pat. 410,842, Oct. 27, 1909.

Dyestuffs similar to those described in the chief patent (this J., 1910, 750) are obtained from heteronuclear $\beta\beta$-diaminoanthraquinones by heating the carbamyl chlorides produced from 2 : 6- or 2 : 7-diaminoanthraquinone and an excess of carbonyl chloride in the presence of nitrobenzene, or by heating the diurethanes produced from 2 : 6- or 2 : 7-diaminoanthraquinone and a chlorocarbonic ester, with amino- or diamino-anthraquinones. The urea derivative of a $\beta\beta$-diaminoanthraquinone itself can be obtained in one operation by passing carbonyl chloride into a cold suspension of the diaminoanthraquinone in question. The vat dyestuffs obtained in this way give yellow to orange yellow shades.—J. C. C.

Indigo ; New dyestuffs derived from —— *and their production.* M. Wyler and Levinstein, Ltd., Manchester. Eng. Pat. 17,818, July 31, 1909.

The dyestuffs claimed are prepared by treating, in the presence of sulphuric acid, Indigo white, indoxyl or Indigo with nitrosophenol or its homologues and then treating the products with bromine and subsequently heating the mixture. *Example ;* 6·1 kilos. of nitrosophenol are added, at 5—10° C., to a suspension of 13·3 kilos. of Indigo white in 100 kilos. of 80 per cent. sulphuric acid. When nitrosophenol is no longer present the mass is diluted with ice water, filtered, washed and dried. The dry product is powdered, stirred with 70 kilos. of nitrobenzene and a solution of 24 kilos. of bromine in 30 kilos. of nitrobenzene added. After being stirred for 12 hours the mass is heated to 120° C. for three hours and finally to 200° C. until the evolution of hydrogen bromide has ceased. After cooling the product is filtered, washed with alcohol and dried. It dyes cotton from a hydrosulphite vat in bright reddish blue shades.—J. C. C.

Sulphurised [*sulphide*] *dyestuffs ; Manufacture of new* ——. A. G. Bloxam, London. From Akt. Ges. f. Anilinfabr., Berlin, Germany. Eng. Pat. 24,703, Oct. 27, 1909.

Brown sulphide dyestuffs are obtained by heating *m*-tolylenediamine with an acyl-*o*-aminophenol in the presence of sulphur. *Example :* 12·2 parts of *m*-tolylenediamine, 6·5 parts of acetyl-*o*-aminophenol and 45 parts of sulphur are heated together to 250° C. The resulting mass is pulverised and treated with about three times its weight of aqueous sodium hydroxide (40° B.) at 120°—130° C. The solution is then diluted and the dyestuff precipitated either by adding acid or by means of a current of air. It dyes cotton in fast brown shades resembling those obtained by means of catechu.—J. C. C.

Dyestuff ; Azo ——. M. Kahn and A. Ossenbeck, Assignors to Farbenfabriken vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 964,786, July 19, 1910.

By combining diazotised amino-benzoic acids with 1-acidylamino-8-naphtholsulphonic acids, dyestuffs are obtained which are red powders in the form of their alkali salts, and upon chromed cotton, or printed upon cotton together with chromium acetate, yield pure red shades similar to that of Alizarin Red.—F. M.

Lakes ; Preparation of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 411,938, Jan. 25, 1910. Under Int. Conv., Aug. 24, 1909.

Bordeaux lakes, fast to light and insoluble in oil are obtained, for example, by combining diazotised *a*-naphthylamine with *a*-naphthol-5-sulphonic acid in the presence of barium chloride.—J. C. C.

Indigo; Halogen derivatives of ——. Badische Anilin und Soda Fabrik. First Addition, dated Feb. 4, 1910 (under Int. Conv., Nov. 15, 1909), to Fr. Pat. 409,618, Nov. 25, 1909.

Penta- or hexa-halogenated derivatives of Indigo may be obtained from 4 : 4′-dihalogen derivatives of Indigo, Indigo white or dehydroindigo by treating them with halogens in one or in two stages (in the latter one or two atoms of a halogen may first be introduced and the resulting tri- or tetra-halogen derivative further treated with halogen). The operation is most conveniently effected in the presence of solvents or diluents such as sulphuric or chlorosulphonic acids, sulphuryl chloride, nitrobenzene, trichlorobenzene, glacial acetic acid, etc. Examples are given illustrating the preparation of dichlorotetrabromoindigo (by boiling 4 : 4′- dichloroindigo with bromine in nitrobenzene solution) and pentachloroindigo (by treating a solution of 4 : 4′-dichloroindigo in glacial acetic acid with chlorine at 25°—30°C.). The penta- and hexa-halogenated Indigos furnish pure, greenish blue shades. —J. C. C.

Indigo series; Production of halogenated derivatives of the ——. Badische Anilin und Soda Fabrik. Fr. Pat. 412,642, Jan. 31, 1910. Under Int. Conv., Aug. 5, and Oct. 23, 1909.

Salts of halogenated dehydroindigos are obtained by treating salts of dehydroindigo, its homologues or substitution products, with halogens in the presence or absence of salts capable of fixing the hydrogen halide which is produced and with or without the addition of the acid identical with that forming a salt with the dehydroindigo. In this process the salts of dehydroindigos may be replaced by the corresponding Indigos which are halogenated in the presence of a salt capable of fixing he hydrogen halide and of an organic acid able to form a salt with the dehydroindigo formed; the latter addition s not necessary if the salt added is a compound of such an acid. The halogenation is continued until the mass becomes yellow or brownish yellow. Indigoid dyestuffs containing an indoxyl nucleus, or their dehydro-derivatives may also be treated in the same way.—J. C. C.

Dyestuffs insoluble in water; Process for reducing —— to a state of fine subdivision. Badische Anilin und Soda Fabrik. Ger. Pat. 222,191, March 5, 1909.

By adding sulphite-cellulose waste lyes, or similar mixtures of substances, to insoluble dyestuffs or to solutions or uspensions of substances or leuco-compounds easily onverted into the dyestuffs, these are at once brought nto a state of very fine subdivision, colloidal products being obtained in some cases.—T. F. B.

Azo dyestuffs for cotton, derived from sulpho-m-diaminedicarbonyldihydroxydinaphthylaminedisulphonic acids; Preparation of ——. Carl Jäger, G. m. b. H. Fr. Pat. 412,138, Jan. 10, 1910. Under Int. Conv., June 17, 1909.

A current of carbonyl chloride is passed into a cold solution of 24 kilos. of 2 : 5-aminonaphthol-7-sulphonic cid, 10 kilos. of tolylenediaminesulphonic acid ($CH_3 : NH_2 : NH_2 : SO_3H = 1 : 2 : 6 : 4$) and 40 kilos. of sodium arbonate in 200—250 litres of water until no more is bsorbed. The precipitate which is formed has the onstitution:

$$O_3H\cdot C_{10}H_5(OH)\cdot NH\cdot CO\cdot NH\cdot C_6H_2(CH_3)(SO_3H)\cdot NH\cdot CO\cdot NH\cdot C_{10}H_5(OH)\cdot SO_3H.$$

he azo-dyestuff produced by the action of 2 mols. of iazotised o-toluidine on this compound dyes cotton in right orange red shades and that obtained by the use of iazotised β-naphthylamine gives bluish red shades. —J. C. C.

rominated colouring matters of the thioindigo group: Manufacture of ——. G. W. Johnson, London. From Kalle und Co., Biebrich on Rhine, Germany. Eng. Pat. 21,581, Sept. 21, 1909.

SEE Fr. Pat. 407,228 of 1909; this J., 1910, 482.—T. F. B.

Acid wool [azo] dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,487, Oct. 25, 1909.

See Fr. Pat. 408,225 of 1909; this J., 1910, 686.—T. F. B.

Disazo dyes. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pats. 964,918 and 964,920, July 19, 1910.

See Eng. Pat. 9173 of 1910; this J., 1910, 939.—T. F. B.

Azo dye; Brown mordant ——. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 964,919, July 19, 1910.

See Eng. Pat. 8722 of 1910; this J., 1910, 938.—T. F. B.

Dyestuffs [from carbazole] for vegetable fibres; Process for producing ——. L. Cassella und Co. Fr. Pat. 412,012, April 22, 1909.

See Eng. Pat. 9689 of 1909; this J., 1910, 481.—T. F. B.

Polyazo dyestuffs; Production of substantive ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 412,084, April 24, 1909.

See Eng. Pat. 10,936 of 1909; this J., 1909, 1190.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Bagasse as a papermaking material. W. Raitt. Tropical Agriculturist, 1910, **34**, [1], 11—12.

The author points out that papers may be divided into three classes: the finest writing papers, made almost exclusively of rags, fine and medium writings and printings, and coarse unbleached papers, wrappings, etc. The raw material of the second of these groups is mainly wood, and this group represents 75 per cent. of the whole of the paper consumed, or about 6 million tons yearly. It is only in class 2 that any serious shortage of raw material is threatened; the materials for class 3 are cheap and abundant. Sugar cane bagasse contains about 50 per cent. of available cellulose, and a yield of 45 per cent. of air-dried unbleached pulp might be expected on an industrial scale, but it cannot be regarded as a good material for the manufacture of papers of group 2. In most plants, the period of development at which the fibres are in their best condition is that which immediately precedes the maturing of the fruits or seeds. The sugar cane, being harvested for its juice, has not reached this stage of full development, and the fibres are irregular. Whilst the fibres near the surface of the stem are long and strong, those in the interior are short and weak. The chemical treatment of the bagasse must then either be sufficiently severe to isolate and purify the outer fibres, in which case the interior fibres are largely destroyed, or else it must be modified to conserve the latter, in which case the strong outer fibres are not properly isolated. In the first case, the pulp is difficult to bleach on account of the decomposition products of the weaker fibres, and in the second case on account of the incrusting matters left in the stronger fibres. The author pronounces in favour of the milder type of chemical treatment, which, whilst eliminating bagasse from the possible substitutes for wood pulp in fine European papers, gives it an advantage for coarser papers for local consumption. The author estimates the value of bagasse as a raw material for papermaking at the sugar factory as 40s. per ton, whilst its value as a fuel is only about 7s. 6d. per ton. —J. F. B.

Cellulose; New method for the determination of —— and its application to wood and to materials used in papermaking. R. Dmochowski and B. Tollens. J. f. Landw., 1910, **58**, 1—26. Chem. Zentr., 1910, **2**, 246—247.

The authors separate the "crude fibre" according to the Henneberg-Weender process, and then treat it with nitric acid. The residue insoluble in sulphuric acid, potassium hydroxide, and water is placed in a Gooch crucible with asbestos, the water drained off by means of the pump, and the contents of the crucible then transferred to a beaker and treated with 25—40 c.c. of nitric acid of sp. gr. 1·15. The mixture is warmed and stirred for 1 hour on the water-bath at 80° C., and after removing the liquid, the residue is boiled with water until the yellow colour nearly or completely disappears. In the case of substances rich in lignin, the residue is further heated with 2 per cent. ammonia for half an hour on the water-bath, drained, and boiled twice with water. The residue is finally collected in a Gooch crucible, treated successively for ¼—½ hour with alcohol and ether, and the cellulose then weighed. Since in the process the cellulose is attacked slightly, 1·1 is added to the result. The method gives approximately correct results with sulphate-cellulose, wood pulp, etc., the figures agreeing fairly well with those obtained by Cross and Bevan's chlorination method. (Compare also Renker, this J., 1909, 1269.)—A. S.

Wood pulp and cellulose industry of Finland. Board of Trade J., Aug. 4, 1910. [T.R.]

THE following particulars are extracted from a Government report by H.M. Consul at Helsingfors :—

The development of the pulp and cellulose industry, as well as of the paper manufacture, is shown by the following figures :—

Year.	Pulp Mills.		Cellulose Mills.		Paper Mills.			Quantity Manufactured.			Value.
	Number of Mills.	Number of Workmen.	Number of Mills.	Number of Workmen.	Number of Mills.	Number of Workmen.	Mechanical Power.	Wood Pulp.	Cellulose.	Paper.	
							H.P.	Metric tons.	Metric tons.	Metric tons.	£
1885..	11	554	1	96	8	1,483	6,980	16,458	383	16,201	361,000
1890..	16	1,085	6	269	9	1,740	14,206	23,808	5,335	15,272	494,000
1895..	18	1,515	7	492	11	2,209	20,092	40,754	9,527	23,862	665,000
1900..	24	2,101	9	684	16	3,519	34,188	50,963	18,422	48,547	1,109,000
1905..	36	2,779	10	897	16	5,412	52,015	113,816	29,599	70,484	1,677,000
1906..	40	2,930	11	869	17	6,080	58,296	101,453	57,306	79,077	1,684,000
1907..	42	3,028	13	1,552	22	8,512	73,181	146,181	63,560	101,956	2,055,000
1908..	42	2,594	13	1,480	22	7,009	75,428	119,488	66,107	98,243	1,821,000

The exports of wood pulp and cardboard, as well as of cellulose and paper, are shown by the following table :—

Year.	Quantity exported.			Value.	Percentage of Total Exports from Finland.
	Wood Pulp and Cardboard.	Cellulose	Paper.		
	Tons.	Tons.	Tons.	£	
1885	5,748	—	13,899	318,000	8·7
1890	22,220	1,824	10,504	342,000	9·2
1895	33,124	2,051	17,732	512,000	9·0
1900	48,203	4,694	35,455	700,000	8·9
1905	89,526	8,876	54,876	1,352,000	13·7
1906	83,367	13,407	60,132	1,513,000	13·5
1907	67,860	30,259	75,934	1,704,000	16·1
1908	69,510	34,110	79,046	1,672,000	17·2

Cloth from banana fibre in China. Board of Trade J., July 28, 1910. [T.R.]

H.M. CONSUL at Chungking reports that an exhibit was made at the Chungking Fair of banana cloth. The process of manufacture is as follows :—The stalk of the banana, when about one year old, is unrolled and steamed over cauldrons of water until it becomes soft ; the green outer skin is then easily removed by passing strips of the stalk through an instrument provided with two blunt blades, which act as scrapers. The residue contains the fibre ; it is enclosed in a cloth and pounded in order to drive out the moisture. The fibre is then shredded and twisted into thread for weaving. After the steaming, the method employed to extract the fibre is similar to that adopted locally in the case of ramie fibre. Up to the present only a few pieces of the cloth have been made experimentally, for which reason the price is high, viz., £1 3s. 6d. per roll 15 ft. in length by 3 ft. in breadth. It is claimed that the cloth is extremely durable, and it is hoped that, with a lower price rendered possible by manufacture on a larger scale, it may, in time, be used for summer wear.

Samples of the fibre and of the cloth made therefrom may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

PATENTS.

Artificial silk ; Means for collecting the vapours of the volatile solvents used in the manufacture of ——. Fab. de Soie artificielle de Tubize, Tubize, Belgium. Eng. Pat. 11,729, May 11, 1910. Under Int. Conv., May 12, 1909.

THE invention relates to the arrangement of the walls of the cabinet which completely encloses the filament-producing apparatus. The front of the cabinet is composed of two superposed counterbalanced frames, dividing the wall into an upper and a lower accessible zone, corresponding with the position of the essential parts of the apparatus, *i.e.* the capillaries below and the winding drums above.—J. F. B.

Fibrous materials : Process and machine for washing and otherwise treating ——. T. J. Hutchinson. Fr. Pat. 412,129, Jan. 4, 1910.

THE apparatus is designed for washing fibrous materials (particularly bagasse) after digestion for the removal of incrusting impurities. It consists of a series of tanks containing water or other liquid and provided with suitable beating arms. The digested material, after draining, is transported by a conveyer to a pair of grooved rollers between which it is squeezed and fed into the first tank of the series. At the entrance of each tank is fitted a vertical baffle-plate, reaching not quite to the bottom of the tank, and the material fed into the tank has to travel under this plate before being caught and broken up by the beating arms. At the exit end of each tank is fitted a horizontal board slightly below the surface of the liquid. This board distributes the material, which is displaced by that entering the tank, in a thin layer and feeds it between a pair of grooved rollers placed between every two tanks of the series. The last pair of rollers delivers the material as a sheet to the drying apparatus.—J. F. B.

Paper ; Apparatus for saving pulp in the manufacture of —— *also applicable for concentrating pulp.* R. J. Marx, London. Eng. Pat. 16,220, July 12, 1909.

To recover the fibres which would otherwise pass away with the effluent, the waste water from the wires, etc., s led under pressure into a cylinder, within which is a evolving drum (of polygonal cross-section) built up of ars, perforated metal, or wire, and covered with felt. he water passes into the interior of this drum and flows way, and means are mentioned whereby the fibres collecting upon the outer surface of the drum may be periodically emoved. The machine may also be used for delivering ulp of any required degree of concentration.—F M.

iscose ; Process for coating or printing with ——. L. Lilienfeld, Vienna. Eng. Pat. 15,306, June 30, 1909.

ITHERTO the difficulties connected with coating or printing ith viscose, whether crude, neutralised or purified, have een due to the presence of salts, which have contaminated he finished products. The zinc compound of viscose is soluble in water and may be washed free from salts, but itherto it has always been necessary to use an excess of lkali to bring it into solution again, with the result that he same difficulty has presented itself again. According o the present invention, the compound of cellulose anthogenate with zinc or other metal of the magnesium roup, after washing, is very finely pulverised. In this ondition it is possible to dissolve the compound merely ith the aid of a quantity of alkali exactly equivalent to he zinc or other metal present. The solution so obtained neutral and contains no excess of saline impurities, so hat the coatings or other films or designs produced may e finished by drying alone. These films are apt to be rittle, but are made elastic by the use of soaps or of lpholeic or other sulphonated fatty acids or their salts, conjunction with the coating medium, in quantities not ss than 20 per cent. of the cellulose present.—J. F. B.

ellulose acetate ; Preparation of solutions of —— and of masses similar to celluloid from these solutions. A. Eichengrün. Fr. Pat. 412,797, Jan. 20, 1910. Under Int. Conv., Jan. 25, 1909.

ERTAIN types of cellulose acetate, notably those which re soluble in acetone, are soluble, on heating, in mixtures f liquids, *e.g.* methyl alcohol and benzene, neither of hich have any solvent action alone. On cooling these lutions, the ester may either remain in solution or parate out in the form of long felted filaments. The paration may be prevented by adding to the solution y of the ordinary solvents of cellulose acetate, in which is soluble in the cold, *e.g.* glacial acetic acid, acetone, etc., which case the solution remains liquid or becomes rupy on cooling. Or else there may be added a substance ving an influence analogous to that of camphor on nitrollulose, in which case the solution sets to a continuous ass on cooling. Suitable bodies are methylacetanilide, hyl toluenesulphonate, trichloraniline, etc. If a very ncentrated mass be desired, the cellulose acetate may be issolved in alcohol and benzene, freed from impurities filtration and allowed to deposit by cooling ; the liquid then poured off and the precipitated cellulose acetate is orked up with a camphor-substitute. One of the umerous examples of the process runs as follows : 1 kilo. cellulose acetate is dissolved in 2 kilos. of methyl alcohol d 1 kilo. of toluene at 80° C. ; 150 grms. of methylctanilide are added to the solution and 100 grms. of ichlorhydrin. The liquid is filtered hot, and on cooling ts to a solid mass, which may be sliced, moulded or essed through orifices. In various ways plastic masses ving all the technical properties of celluloid may be epared.—J. F. B.

aweed ; Treatment of ——. C. Petit. Fr. Pat. 412,590, May 4, 1909.

AWEED (varech) is subjected to a bleaching process by eeping in a solution composed of bleaching powder, kilos., sodium hydroxide, 10 kilos., and water, 90 litres, luted to a density of 6° B. After 5 hours' immersion e material is drained and soured with dilute sulphuric id at a density of 1° B. The product is suitable for cking purposes as a substitute for wood-wool, paper avings, etc. and for other uses.—J. F. B.

Packing material [Seaweed] ; Manufacture of a non-putrescible and non-inflammable ——. Soc. anon. "La Parisette." Fr. Pat. 412,845, Feb. 18, 1910.

THE material is prepared from seaweed which is first treated for a very short time in a bath of "chlorine" at 2·5° B. in which its brown colour is changed to yellow, and subsequently in a bath of sodium hypochlorite at 1° B., which is prepared hot, and which should not be allowed to act for a longer time than is sufficient to produce the required amount of decolorisation (about 20 minutes). The material is then rinsed to remove not only the chemical residues but also the *débris* present in the seaweed. The water used may be slightly alkaline or may be treated with traces of alum. Lastly the bleached seaweed is treated with a solution of sodium thiosulphate slightly acidified with a few drops of sulphuric acid, and dried. This last treatment imparts to the product the quality of non-inflammability.—J. F. B.

Waterproofing fibrous materials ; Art of ——. A. O. Tate, Toronto. Eng. Pat. 19,213, Aug. 20, 1909.

SEE U.S. Pat. 933,861 of 1909 ; this J., 1909, 1085.—T. F. B.

Paper, card, or other materials ; Process for glazing ——. Armitage and Ibbetson, Ltd. Fr. Pat. 412,505, Feb. 11, 1910. Under Int. Conv., Feb. 17, 1909.

SEE Eng. Pat. 3883 of 1909 ; this J., 1909, 1061.—T. F. B.

Cellulose formate ; Process for producing ——. S. von Kapff, Aachen, and Nitritfabrik A.-G., Copenick, Germany. Eng. Pat. 17,036, July 21, 1909.

SEE Fr. Pat. 405,293 of 1909 ; this J., 1910, 417.—T. F. B.

Cellulose acetate ; Manufacture of solutions and objects of ——. A. Eichengrün, Berlin. Eng. Pat. 1441, Jan. 19, 1910. Under Int. Conv., Jan. 25, 1909.

SEE Fr. Pat. 412,797 of 1910 ; preceding.—T. F. B.

Celluloid or the like ; Manufacture of ——. T. Bolas, Chiswick, and Self-Developing Plate Co., Ltd., London. U.S. Pat. 964,483, July 19, 1910.

SEE Eng. Pat. 21,880 of 1907 ; this J., 1908, 1081.—T. F. B.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Dyeing : Theory of ——. *I. Dyeing of Glanzstoff artificial silk with Crystal Violet.* W. J. Müller and W. Slassarski. Chem.-Zeit., 1910, **34**, 805—807.

UNBLEACHED Glanzstoff artificial silks made by the alkaline and acid precipitation processes respectively, were dyed at the ordinary temperature for 3 days in aqueous solutions of Crystal Violet. Both kinds absorbed practically the same weight of dyestuff, which, however, was practically completely removed by washing with cold water (a reversible adsorption). After bleaching, by steeping in a 0·1 per cent. bleaching powder solution for 10 min. and washing with cold water until the washings no longer gave any reaction, the fibres were found to absorb decidedly more colour, the silk prepared with alkali absorbing 49·0 per cent., and the product prepared with acid 16·8 per cent. more than the corresponding unbleached samples ; treatment of the latter silk with 0·3 per cent. bleaching powder solution only increased the absorbing power to 22·5 per cent. After bleaching with $N/10$ permanganate and dilute bisulphite solution and subsequent thorough washing, the increases in the amounts of dyestuff absorbed were 13·1 and 18·8 per cent. respectively, and after similar treatment with $N/5$ permanganate, 32·0 and 21·8 per cent. respectively. Mercerising the unbleached (alkali-prepared) silk with a 10 per cent. sodium hydroxide solution, caused a reduction of 15 per cent. in the dye absorbed. The marked influence of chemical treatment of the fibre on its relation to the colour is opposed to the conclusions of

Freundlich and Losev (this J., 1907, 682) that the adsorption of the dyestuff is independent of the nature of the adsorbent. The electrical theory of dyeing (this J., 1910, 484), according to which dyeing with basic dyestuffs is stated to be due to the adsorption of the dyestuff cations by the negatively charged fibre also does not explain why oxycellulose is dyed so much more strongly than cellulose ; with a specific contact electrical potential for each substance this theory appears to the authors to offer hardly any advantage over a purely chemical theory of "salt" formation. Glanzstoff artificial silk was selected for the investigation on account of its definite composition (the products used contained 10—11 per cent. of moisture and left 0·41 per cent. of ash on incineration). Crystal Violet was chosen as a representative basic colour easily obtainable in a pure state ; analysis of the dyestuff by Knecht's titanium chloride process (this J., 1905, 154, 1192), gave 92·01 per cent. of pure colour, and the moisture was found to be 8·2 per cent. The relation of Glanzstoff artificial silk to the direct dyeing dyestuffs is being investigated. (Compare also this J., 1910, 937.)—A. Seld.

Dyed fabrics ; Chemical action of sunlight on ——. D. Brownlie. J. Soc. Dyers and Col., 1910, **26**, 191—195.

The author gives a resumé of the theories which have been advanced to account for the fading of dyestuffs under the influence of sunlight, and also of his own work upon the subject with reference to the group of benzidine colouring matters. He noted that there was little difference in the fastness of the dyestuffs prepared from benzidine, tolidine, dianisidine, or other benzidine derivatives. Combinations with phenol or its homologues, or their sulphonic or carboxylic acids are fast to light ; those with hydroxybenzenes containing more than one hydroxyl group are fugitive to light. Among the dyestuffs which were found to be fugitive to light were those derived from amines of the benzene series and their sulphonic and carboxylic acids ; also, those derived from *a*- and *β*-naphthylamine and their sulphonic and carboxylic acids, and from *a*- and *β*-naphthol and their sulphonic acids. Dyestuffs derived from amino-naphthols and their sulphonic acids vary ; those derived from 2 : 6 : 8-monosulphonic acid and 2 : 3 : 6 : 8-disulphonic acid are fast, whilst those derived from 1 : 8 : 3 : 6- and 1 : 8 : 2 : 4-disulphonic acids are fugitive. The behaviour of the dihydroxynaphthalenes and their derivatives agrees closely with that of the corresponding amino-naphthols. The replacement of the amino group by hydroxyl results in general, if there is any difference, in increased fastness. The salt forming groups (carboxylic and sulphonic acid groups) exert but little influence on the behaviour of a dyestuff towards light, but the effect of the auxochromic groups (amino and hydroxy groups) is pronounced. This question of the effect of the constitution of a dyestuff upon its fastness to light has been discussed by Gebhard, who states that : (1) Dyestuffs which contain characteristic accelerating groups in the molecule are fugitive to light. (2) Those which contain retarding groups are but little affected. (3) Dyestuffs which, from the presence of accelerating groups in the molecule, are fugitive to light become faster by the introduction of retarding groups. (See this J., 1909, 304, 1084 ; 1910, 84, 691, 876.)—F. M.

Patents.

Bleaching of fabrics, yarns and textile fibres ; Process for the rapid ——. A. Delebecque. Fr. Pat. 412,010, April 22, 1909.

The material is successively worked in the following baths :—(1) 2 kilos. of sodium hydroxide and 2 kilos. of sodium carbonate (anhydrous) to 1000 litres of water. Time of immersion ½—2 hours. (2) A 0·5 per cent. solution of sulphuric acid, the time of immersion being about 10 minutes. (3) A 3 per cent. solution of potassium permanganate ; time of immersion 3—5 minutes. (4) 3 kilos. of barium peroxide and 10 kilos. of hydrochloric acid to 100 litres of water ; time of immersion 15—20 minutes. (5) 200 litres of hydrogen peroxide (10—12 vols.), 4 kilos. of borax and 10 kilos. of white soap to 800 litres of water ; time of immersion ½—1½ hours. Baths (1) and (5) are worked up to a maximum temperature of 80° C. whilst operations (3) and (4) may be repeated several times if necessary.—P. F. C.

Bleaching fabrics, yarns and textile fibres ; Process for ——. H. Cormimbœuf. Fr. Pat. 412,520, May 3, 1909.

In order to prepare the material it is worked for about an hour in a bath containing 2 per cent. of sodium hydroxide and 2 per cent. of anhydrous sodium carbonate, the operation being carried out in the cold for cotton and at a maximum temperature of 80° C. for linen and hemp. The material is next washed, then immersed in a 0·2 per cent. solution of sulphuric acid (66° B.) and is afterwards washed again. For heavy fabrics of linen and hemp the bleaching process proper is effected by working the material for 15—30 minutes in a bath containing 5 kilos. of calcium hypochlorite or 15—20 kilos. of sodium hypochlorite (36°) to 100 litres of water. Finer materials are treated for 2—3 minutes in a 2 per cent. solution of potassium permanganate with or without the addition of 1 per cent. of potassium bichromate. The excess of liquor is then expressed and the material is immersed for 15 minutes in a bath containing 5 kilos. of powdered barium peroxide and 10 kilos. of hydrochloric acid (22° B.) to 100 litres of water. It is afterwards washed and entered into a bath containing 30—35 kilos. of hydrogen peroxide (12 vols.), 250 grms. of borax or sodium carbonate, 1 kilo. of white Marseilles soap and 65—70 litres of water. The temperature of the bath is then raised in 1—2 hours to 80° C., and the material is finally washed and dried.—P. F. C.

Half-woollen goods ; Process of dyeing ——. M. Becke and A. Beil, Hoechst a/M., Germany. Eng. Pat. 25,999, Nov. 10, 1909. Under Int. Conv., April 8, 1909.

The wool in the union material is first dyed with acid dyestuffs in an acid bath. The dyebath also contains tannic acid which, after fixing with metallic salts, prevents the wool from absorbing further quantities of dyestuff during the subsequent dyeing of the cotton with direct cotton colours, in a hot dyebath containing Glauber's salt. Special claim is made for the treatment by the process of union fabrics containing wool which, before being woven, has been treated by the process described in Eng. Pat. 19,668 of 1900 (this J., 1901, 1110).—F. M.

Dyeing warps in shades varying along their length ; Machine for automatically ——. Soc. Farrat et Degasches. Fr. Pat. 412,286, Feb. 3, 1910.

The warps are unrolled from bobbins mounted on a framework and are separately led over a dyeing device consisting of a roller revolving in a colour reservoir, which is suspended over pulleys by cords. A felted roller is also similarly suspended above the warps and by means of a system of levers (which are automatically set in motion at intervals by projections arranged along a travelling band) the colour trough and its roller are at intervals made to rise and the felted roller to lower so as to form a nip which takes hold of the warps and transfers colour to them. The warps are next led over heated drying rollers, which are separated from the warps by a cloth band, and are finally wound round a drum. The machine is also provided with an electrical device for giving warning when a warp is broken.—P. F. C.

Fabric printing machines. J. G. Sanderson, Salford. Eng. Pat. 29,827, Dec. 21, 1909.

The machine is intended for the printing of fabrics such as scarves, sarees and the like. The printing rollers are removed from and brought into contact with the material at the exact intervals required and the printing intervals may be quickly and correctly altered whilst the machine is working. The construction of the machine and the method of working are fully described, with reference to figured drawings.—F. M.

Discharge effects on coloured grounds ; Producing ——. Ges. für Chem. Ind. in Basle, Basle, Switzerland. Eng. Pat. 7094, Mar. 21, 1910. Under Int. Conv., Feb. 14, 1910.

It has been found that quaternary organic ammonium compounds, in presence of alkali, are capable of decomposing the majority of organic dyestuffs. A white discharge is obtained by printing with a mixture of dimethylphenylbenzyl-ammonium chloride and alkali, and steaming.

Quaternary ammonium compounds which are themselves dyestuffs (Brilliant Phosphine 5G, Methyl Green, etc.) may also be employed, and for coloured discharges suitable dyestuffs (Alizarin Yellow 5G, Cibanone Yellow R, Printing Chrome Red B) may be mixed with the discharge paste.—F. M.

Silk; Process of preserving tin-weighted ——. O. Berg and M. Imhoff, Paterson, N.J., U.S.A. Eng. Pat. 6538, Mar. 15, 1910.

The treatment consists in impregnating the material, after dyeing and weighting, with a dilute solution of a hydroxylamine derivative, and drying.—F. M.

Drying fabrics; Apparatus for ——. C. T. Gilmore, Chicago, U.S.A. Eng. Pat. 22,604, Oct. 4, 1909. Under Int. Conv., Oct. 5, 1908.

The articles to be dried are placed in a rotatable perforated drum, through which heated air is driven by means of a fan. The machine is enclosed in a casing, in the base of which the heating apparatus is arranged, and the direction of the air current is controlled by means of partitions.
—F. M.

Dyeing; Process of —— *and product thereof.* R. E. Schmidt, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 964,816, July 19, 1910.

See Eng. Pat. 3055 of 1909; this J., 1910, 209.—T. F. B.

Wood; Process for colouring ——. International Timber Inoculation Co. Fr. Pat. 412,809, Jan. 27, 1910.

See U.S. Pat. 952,245 of 1910; this J., 1910, 492.—T. F. B.

Linen; Manufacture of waterproof washable ——. A. Douqué, St. Petersburg. Eng. Pat. 17,449, July 27, 1909.

See Fr. Pat. 403,761 of 1909; this J., 1910, 19.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Fuming sulphuric acid; Determination of the sulphur trioxide in ——. R. H. Vernon. Chem.-Zeit., 1910, **34**, 792.

In the analysis of fuming sulphuric acid of high percentage with Finch's apparatus (this J., 1910, 625) it was found that the energetic reaction between the first few drops of water and the acid, sometimes resulted in water being driven out of the U-tube. The author, therefore, replaces this tube by a narrow side tube from the same opening to the upper extremity of the pipette or funnel, which is also fitted with a ground hollow glass stopper. A hole in the side of the stopper enables a connection to be made between the upper and lower parts of the apparatus, by which the pressure can be equalised. It is further claimed that the acid is more easily washed out at the end of the reaction.
—A. Seld.

Sulphuric acid; Gravimetric determination of —— *in the presence of alkali metals.* Y. Kato and I. Noda. Mem. Coll. Sci. and Eng., Imp. Univ. of Kyoto, 1910, **2**, 217—228.

Experiments on the gravimetric determination of sulphuric acid, at different concentrations, by means of barium chloride in pure solutions and in presence of the chlorides of potassium, sodium, ammonium, and magnesium were made. In the case of potassium chloride the results indicate that the different results obtained in presence of this salt and in pure solutions are probably due to adsorption of potassium sulphate by the precipitated barium sulphate. Dilution of the solution in which precipitation is effected is not an adequate remedy. The author recommends that the concentration of a standard sulphuric acid be determined in presence of various salts in different proportions, and that the actual determination be performed in a concentration approximately equal to that of the standard acid, and the result corrected in accord with the experimental data.—A. S.

Colloidal barium sulphate; Studies on ——. Y. Kato. Mem. Coll. Sci. and Eng., Imp. Univ. of Kyoto, 1910, **2**, 187—215.

A solution of barium acetate was prepared by diluting a grm.-molecular aqueous solution with six times its volume of alcohol, and to this was added, with constant stirring, an alcoholic solution of sulphuric acid prepared by diluting a molecular aqueous solution with twice its volume of alcohol. The milky solution and jelly-like precipitate thus obtained were evaporated to dryness, under reduced pressure, at a temperature below 40° C. Colloidal barium sulphate was obtained in this way as a translucent, casein-like mass, readily soluble in water, giving a fluorescent solution. It could be kept for some months without apparent change, except that it became less easily soluble in water. Experiments with the solution of the colloidal sulphate showed that it is, in general, coagulated by electrolytes. The coagulating power of different anions increases with their valency in accord with Hardy's law, and highly dissociating electrolytes have a higher coagulating power. Cations of high valency interfere with the coagulating action of anions. Colloidal barium sulphate is not coagulated by barium chloride and nitrate except when these are used in highly concentrated solutions, and coagulation by potassium chloride is hindered by the presence of barium ions. Some electrolytes which may contain or readily form colloids appear to have abnormal coagulating power: when the colloid produced or present is negative, the compound (*e.g.*, sodium thiosulphate) has a strong coagulating power, whilst when a positive colloid is formed, the compound (*e.g.*, ferric sulphate) has a weak coagulating power. The amount of adsorption by barium sulphate gel suspended in solutions of potassium nitrate, potassium sulphate, and barium chloride, was small, but agreed roughly with the characteristic adsorption formula.—A. S.

Nitrous oxide. I. A. Stavenhagen and E. Schuchard. Ber., 1910, **43**, 2171—2174.

The authors find that when sulphur (the best form is sulphur crystallised from carbon bisulphide) is burnt in an atmosphere of nitrous oxide, the latter forms higher oxides of nitrogen, and nitrosulphonic anhydride, $NO_2{\cdot}SO_2{\cdot}O{\cdot}SO_2{\cdot}NO_2$, is produced, which on the addition of water, is decomposed into sulphuric and nitric acids and nitric oxide. When water is present during the combustion, nitrosylsulphuric acid, $NO_2{\cdot}SO_2{\cdot}OH$, is formed.
—J. C. C.

Hydroferrocyanic and hydroferricyanic acids; Volumetric determination of ——. E. Müller and O. Diefenthaler. Z. anorg. Chem., 1910, **67**, 418—436.

The titration of hydroferrocyanic acid with permanganate by de Haen's method is found to give accurate results when carried out as follows:—20 c.c. of sulphuric acid (1 mol. of acid to 4 mols. of water) are added to 150—200 c.c. of the solution (containing about 1 grm. of ferrocyanide), and the mixture is titrated with *N*/20 permanganate, until the colour changes from yellowish-green to yellowish-red. Hydroferricyanic acid also may be determined by permanganate, after reduction with ferrous sulphate; but this acid is preferably estimated by Mohr's method, which is accurate when carried out in the following manner:—0·7 grm. of ferricyanide is dissolved in about 50 c.c. of water, and to the neutral solution are added 3 grms. of potassium iodide and 1·5 grms. of zinc sulphate (free from iron); the solution is then shaken and titrated with *N*/20 thiosulphate. The determination of hydroferrocyanic acid by oxidation with iodine and titration with thiosulphate, in the presence of alkali bicarbonate (Rupp and Schiedt; this J., 1902, 1099), is found to be inaccurate. Small quantities of ferricyanide were detected in all the samples of potassium ferrocyanide examined.
—F. Sodn.

Cyanogen [cyanides, thiocyanates, etc.]; Detection of small quantities of —— in mixtures. G. Lockemann. Ber., 1910, **43**, 2127—2128.

THE substance, solid or liquid, is placed in a test-tube, and to it dilute sulphuric acid is added. When carbonates are present sufficient acid is first of all added to decompose them, and then a few c.c. are added in excess. A piece of filter-paper 10 cm. square is folded into a strip 2·5 cm. broad. A spot in the middle of the strip is moistened with a few drops of caustic soda or potash solution, the moistened patch is placed over the mouth of the tube, the ends of the strip are folded downwards, and the test-tube is heated over a flame, or, in the case of explosive mixtures, in a water-bath. The hydrocyanic acid evolved is taken up by the alkali on the filter-paper. Its presence is detected by adding a few drops of very dilute ferrous sulphate solution ($\frac{1}{4}$ to $\frac{1}{2}$ per cent.), oxidising the greenish ferrous hydroxide formed to the brown ferric hydroxide by a few minutes' exposure to the air, again exposing the strip to the action of the steam from the test-tube for a short time, and finally adding a few drops of concentrated hydrochloric acid diluted with its own volume of water. In the presence of cyanide a Prussian blue stain is produced on the filter-paper. The test may also be carried out as a thiocyanate reaction. In this case a few drops of yellow ammonium sulphide are added to the filter-paper strip after the alkali, the moist patch is exposed to the vapour from the test-tube as before, and then acidified with hydrochloric acid. In the presence of cyanides the addition of ferric chloride to the moist patch produces the characteristic blood-red coloration. In the case of potassium cyanide the reaction will indicate 0·03—0·04 mgrm. of cyanogen; in the case of the ferrocyanide, 0·2—0·3 mgrm. of cyanogen.—E. W. L.

Percarbonates. S. Tanatar. Ber., 1910, **43**, 2149—2151.

THE author has repeated the experiments made by Riesenfeld (this J., 1910, 421) and confirms his observations. In solutions of the same alkalinity more iodine is liberated from potassium iodide by potassium percarbonate than by sodium percarbonate. The author remains, however, of the opinion that the reaction cannot legitimately be employed for settling the question of the constitution of the known percarbonates and other similar compounds. Five minutes after potassium percarbonate has been dissolved at 18° C., it behaves like the sodium salt, liberating iodine equivalent to only 0·7—1·1 c.c. of $N/10$ thiosulphate for every 1 millimol. of sodium carbonate + 1 millimol. of potassium percarbonate, whereas the freshly dissolved salt behaves like the solid substance, liberating considerable iodine. The hydrolysis of potassium percarbonate, to bicarbonate and hydrogen peroxide is therefore not instantaneous, since when hydrogen peroxide is present in the solution the latter is immediately decolorised. 1 millimol. of sodium carbonate + 1 millimol. of potassium percarbonate liberate iodine equivalent to 12·1 c.c. of $N/10$ thiosulphate. On adding $\frac{1}{2}$ millimol. of hydrogen peroxide (or a solution of $\frac{1}{2}$ millimol. potassium percarbonate) the solution is almost completely decolorised (leaving iodine equivalent to 0·7 c.c. of thiosulphate). Hence assuming that potassium percarbonate has the same constitution as the sodium compound, their difference in behaviour towards potassium iodide may be explained by the difference in their rates of hydrolysis, this being greater, in the case of the sodium salt, than the speed of the reaction with iodide, whereas in the case of the potassium salt the reverse is the case. Sodium perborate behaves like sodium percarbonate probably for a similar reason. Again when one molecule of sodium percarbonate ($Na_2CO_3 + \frac{1}{2}H_2O_2$) is introduced into a solution, half a molecule of hydrogen peroxide is introduced with it, and that this is sufficient to inhibit iodine separation is shown by the fact that when 1 millimol. of sodium carbonate, 1 millimol. of solid potassium percarbonate and $\frac{1}{2}$ millimol. of hydrogen peroxide are added to potassium iodide, only a slight separation of iodine occurs (equivalent to 0·9 c.c. of thiosulphate instead of 12·1 c.c. that is practically the same amount as in the case of sodium percarbonate alone.)—E. W. L.

Alkali sulphates; Solubility of the —— in solutions containing alkali, at 25° C., and [the behaviour of] calcium sulphate in these solutions. J. D'Ans and O. Schreiner. Z. anorg. Chem., 1910, **67**, 437—441.

IN continuation of former work (see this J., 1910, 150) an examination has been made of the solubility isotherm, at 25° C., of the system, alkali-sulphuric acid, in solutions containing an excess of alkali. The solubilities of sodium and potassium sulphates are continuously diminished by the presence, in increasing quantities, of sodium and potassium hydroxides respectively, becoming zero in saturated solutions of these alkalis, and the solubility of ammonium sulphate is similarly affected by ammonia; no basic salts are formed. The regions of stability of calcium sulphate and its double sulphates in solutions of alkali sulphates containing free alkali was also determined (see also this J., 1909, 521), and in contact with solutions containing much alkali (except ammonia) calcium sulphate was found to be unstable, calcium hydroxide being stable; the formation of basic sulphates here also was not observed. —F. SODN.

Nitrate deposits of Southern California. F. W. Graeff. Eng. and Min. J., 1910, **90**, 173.

THE author describes the appearance of the nitrate deposits in the Chemehuvis valley, 33 miles south of Needles, Cal., U.S.A., and compares them with those in Chile. The area is covered with clay overlaid with gravel, except where the clay has become exposed on the hills, which latter vary from 100 to 300 ft. in height. The nitrate is mainly contained in the clay strata, the analyses of four surface samples of which gave from 7 to 22 per cent. of sodium nitrate, associated with common salt, Glauber's salt and gypsum. The overburden is soft and the deposit can be worked without blasting. The river Colorado, which borders the nitrate deposits on the east, provides the necessary water for extracting the nitrate.—F. R.

Double bromides of manganese, and some double chlorides and iodides of zinc. F. Ephraim and S. Model. Z. anorg. Chem., 1910, **67**, 376—378 and 379—386.

MANGANOUS bromide shows very little tendency to form double salts with other bromides. The slightly hygroscopic salt, $CaMnBr_4.4H_2O$, has been obtained by evaporating the mixed solutions of the corresponding bromides over sulphuric acid, but it is readily decomposed into its constituents. With ammonium and sodium bromides respectively, what are believed to be mixed crystals of these salts and double bromides are obtained. The following new double chlorides and iodides have been prepared by evaporating mixed solutions of the corresponding salts:—Calcium zinc chlorides, $CaZnCl_4.5{\cdot}5(?)H_2O$ and $Ca_2ZnCl_6.6H_2O$, strontium zinc chloride, $SrZnCl_4.4H_2O$, barium zinc chlorides, $BaZnCl_4.2{\cdot}5H_2O$ and $BaZnCl_4.4H_2O$, potassium zinc iodide, $K_2ZnI_4.2H_2O$, sodium zinc iodide, $NaZnI_3.2H_2O$, ammonium zinc iodide, $NH_4.ZnI_3 4{\cdot}5(?)H_2O$, calcium zinc iodide, $CaZnI_4.8H_2O$, strontium zinc iodide, $SrZnI_4.9H_2O$, and barium zinc iodide, $BaZnI_4.4(?)H_2O$. All are crystalline and very hygroscopic.—F. SODN.

Aluminium nitride. D. Wolk. Comptes rend., 1910, 151, 318—319.

THE author draws attention to previous publications in which he has shown that the temperature of formation of nitride when aluminium powder is heated in the products of decomposition of gaseous ammonia is 820°—850° C. The production of nitride is very rapid at 1000°; above 1100°, the product crumbles and begins to dissociate. The nitride contains 33·6 per cent. of aluminium (Al_2N_2 requires 34·06), and forms a gray mass, the more readily decomposable by water the lower its temperature of formation. No intermediate amide appears to be formed.—J. T. D.

Scandium [and methods of separating scandium and thorium]. R. J. Meyer, H. Winter, and M. Speter. Z. anorg. Chem., 1910, **67**, 398—417.

EXPERIMENTS on the purification of scandium oxide prepared by precipitation with sodium silicofluoride and with sodium thiosulphate, as previously described (Z. anorg. Chem., 1908, **60**, 134), show that thorium, which is the only impurity, in the presence of much scandium, does not exhibit quite normal properties (*e.g.*, it is not precipitated by hydrogen peroxide); it may be detected, however, by the action of iodic acid in strongly acid solution, the solution, containing sulphuric or nitric acid, being mixed with excess of iodic acid in nitric acid; thorium iodate remains insoluble, even in a large excess of acid, whereas scandium iodate is soluble. Small quantities of thorium may also be detected in the presence of scandium, by largely diluting the neutral solution of the chlorides, when a turbidity due to thorium oxychloride becomes apparent after a time. A technical method of separating thorium from scandium is based on the fact that the latter is precipitated as the double carbonate, $Sc_2(CO_3)_3, 4Na_2CO_3, 6H_2O$, on boiling a mixture of an approximately neutral solution of scandium chloride and a 20 per cent. solution of sodium carbonate, whereas the corresponding thorium double salt is soluble. The separation is effected as follows:—The chloride solution is evaporated to dryness on the water-bath, the residue is dissolved in a little water, and the concentrated solution is poured into a solution of pure sodium carbonate (containing 20 per cent. of the anhydrous salt), 1 litre being used for every 10 grms. of scandium oxide, and the mixture is stirred and gently warmed, until a clear solution is obtained. This is boiled vigorously for half-an-hour, keeping the volume approximately constant by adding water as required, and the liquor is then poured off from the separated double carbonate, which is boiled three times for 15 minutes with 20 per cent. sodium carbonate solution; the thorium is thus completely or almost completely removed in the solution by one treatment, and the scandium double carbonate may be dissolved in water and precipitated as hydroxide, to be finally converted into oxalate and oxide. Scandium also readily forms, in quantitative yield, a stable well-crystallised acetylacetonate (see this J., 1904, 341), which is obtained by adding acetylacetone to a neutral solution of a scandium salt and neutralising the liberated acid with ammonia, the precipitated salt being crystallised from alcohol. This compound melts at 187°—190° C. and is easily sublimed; it is readily soluble in alcohol, ether, and chloroform, but is insoluble in water. Scandium purified by this method was found to give the same atomic weight as that purified by the sodium carbonate method, *viz.* 45·0; but further work on the atomic weight determination is in progress. Anhydrous scandium chloride, $ScCl_3$, is readily prepared by the method of Matignon and Bourion (this J., 1904, 370); it sublimes as glittering transparent leaflets which are very hygroscopic; on heating it gives an insoluble oxychloride. Pure scandium oxide is not radio-active.—F. Sody.

Ozone; Action of —— on various solvents. C. Harries. Annalen, 1910, **374**, 307—309.

Of the various solvents that have been used in the preparation of ozone derivatives of organic bodies many are unsuitable owing to their being attacked by the gas. This is notably the case with carbon tetrachloride and chloroform, the latter being attacked to such an extent as to be unusable for this purpose. Ethyl chloride and methyl chloride are but little affected by ozone, but their high price prevents their being generally used. Glacial acetic acid is not attacked to any appreciable extent, but has the drawback that most ozonides are too soluble therein, and that it is not easily evaporated *in vacuo*. Acetone is not much attacked, whereas methylacetone is strongly attacked by ozone. Hexane, which at one time was widely used, is now regarded as a less suitable solvent, since the commercial substance absorbs bromine. Apart from this, hexane free from this defect, is unstable in the presence of concentrated ozone, and is decomposed with the formation of aldehydes (*e.g.*, valeric aldehyde), monocarboxylic acids, peroxide compounds, and adipic acid. Hence cyclohexane is probably present in hexane. Benzene, which is recommended by Semmler, is unsuitable owing to its being readily converted into the dangerously explosive ozo-benzene.—C. A. M.

Charcoal; Absorptive power for air of some varieties of vegetable ——. A. Piutti and G. Magli. Gazz. chim. ital., 1910, **40**, I., 569—577.

About 5 grms. of the freshly-ignited charcoal, in pieces of about 0·25 cm. size, were placed in a glass tube immersed in liquid air, which was then exhausted, and air, purified by means of sulphuric acid and potassium hydroxide, was passed in for 15 mins. The tube was then removed from the liquid air and its temperature allowed to rise gradually to that of the atmosphere, after which the tube was heated until a temperature of 550° C. was attained. The results obtained are shown in the following table.

Charcoal from:	Volume of 1 grm. of charcoal in c.c.	Volume of gas in c.c., from 1 c.c. of charcoal from −190° to + 550 C.
Cherry (*Prunus cerasus*), shells of kernels	0·6100	280·1
Cocoanut (*Cocus nucifera*), shells	0·6898	251·8
Phillyrea media, branches	0·6680	222·4
Silk oak (*Grevillea robusta*), branches	0·6951	212·7
Fir (*Abies alba*), trunk	0·8403	199·5
Chestnut (*Castanea vesca*), trunk	0·7690	186·3
Box (*Buxus sempervirens*), trunk	0·7046	138·5
Chinese date plum (*Diospyros Kaki*), branches	0·7464	134·5
Poplar (*Populus nigra*), trunk	0·7733	134·1
Plum (*Prunus virginiana*), branches	0·8091	133
Carob (*Ceratonia Siliqua*), seeds	0·6145	131·5
Apricot (*Prunus Armeniaca*), shells of kernels	0·7146	129·5
Walnut (*Juglans regia*), trunk	0·7615	118·6
Pine (*Pinus rigida*), trunk	0·7626	111·1
False acacia (*Robinia pseudoAcacia*), branches	0·8184	99·9
Box, twigs	0·8512	92·4

The three samples which gave the best results were then heated in a current of chlorine for 1 hour, and again examined, when it was found that their absorptive power had been considerably increased, the quantity of gas from 1 c.c. under the same conditions as before being:—cocoanut, 334·2; cherry, 312·2; *Phillyrea media*, 260·0 c.c. —A. S.

Ozonisation and concentration of ozone. C. Harries. Annalen, 1910, **374**, 309—315.

In order to obtain a greater supply of ozone the author has introduced a second transformer and ozoniser into the circuit, and has replaced the ¾ h.p. alternating current motor used with his former apparatus (this J., 1906, 1155, 1156) by a 2 h.p. motor. The arrangement of the Berthelot tubes in one of the ozonisers has been altered as shown in the diagrams, which represent the method of grouping them in the wooden box and the mode in which they are connected with one another. The apparatus is used in the same manner as previously described, and on the average a gas containing 15·5 per cent. of ozone is obtained as compared with 14·5 per cent. with an apparatus containing parallel tubes. The yield of ozone with the

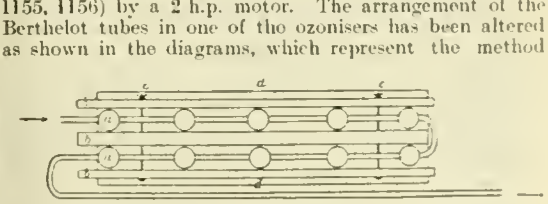


Fig. 1

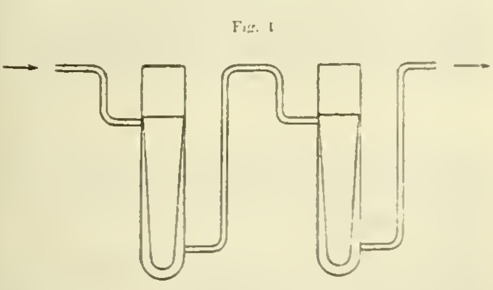


Fig. 2.

later form of apparatus has risen considerably since the apparatus was first tried. This is attributed to alterations in the glass of the Berthelot tubes under the long-continued influence of the stronger current. For many purposes the ozone thus obtained is too concentrated. Thus in the case of compounds of the aromatic series the benzene nucleus may be attacked. In order to reduce the concentration when desired, the gas may be passed through flasks containing sodium hydroxide solution and concentrated sulphuric acid, both of which decompose ozone. By regulating the speed of the passage of the gas a greater or less degree of decomposition is effected. After leaving the sulphuric acid the gas will not be quite dry and this must be taken into account in the preparation of unstable ozonides.—C. A. M.

Sodium carbonate as an oxidiser [*metals*]; *Use of* ——. Deiss. *See* X.

Patents.

Nitric acid; Process for the preparation of —— from ammonia by the contact process. A. Frank and N. Caro. Ger. Pat. 224,329, May 2, 1907.

By using thorium oxide or mixtures of thorium oxide with other rare earth oxides, as contact substance, at 150°—200° C., it is stated that ammonia can be oxidised by air to nitrous or nitric acid to the extent of up to 90 per cent. The favourable results obtained with thorium oxide are due to the fact that thorium nitrate, which is formed as intermediate product, yields a loose porous form of the oxide on heating.—A. S.

Lactic acid; Preparation of pure —— by distilling technical lactic acid. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 224,664, Dec. 8, 1907. Addition to Ger. Pat. 221,786, Dec. 2, 1906.

In the preparation of pure lactic acid by distillation as described in the principal patent (see Eng. Pat. 26,415 of 1907; this J., 1908, 246), it is advisable not to heat the crude lactic acid directly, as this causes a certain amount of decomposition. It is therefore proposed to heat the air or gas, which is to be passed through the acid during distillation, to temperatures not exceeding 120° or 130° C., and also to remove solid impurities and moisture from it.—T. F. B.

Cell; Electrolytic —— principally applicable to the electrolysis of sodium chloride and the recovery of caustic soda. J. R. Crocker. Fr. Pat. 412,054, Jan. 29, 1910.

The cell comprises an inclined anode, the lower faces of which co-operate with an inclined cathode which also acts as a diaphragm. The cathode consists of a metallic support pierced with holes, and an asbestos tissue impregnated with a stable metallic oxide and a silicate. The diaphragm is adjacent to a cathode chamber in which the caustic liquid is received and in the lower part of which it is concentrated. This is accomplished by blowing steam into a pocket in the chamber at the lower part of the diaphragm, and the vapour simultaneously assists in removing the electrolysed fluid from the surface of the diaphragm. —B. N.

Calcium cyanamide; Converting —— into nitrate of lime. D. E. Collett and M. Eckardt, Christiania, Norway. Eng. Pat. 10,815, May 2, 1910. Under Int. Conv., May 3, 1909.

Calcium cyanamide is heated with aqueous nitrate of lime whereby ammonia is formed. The ammonia is then converted into nitrogen oxides or nitric acid in any known manner and the resulting nitric acid is used to dissolve the residue of lime from the first operation. The solution of nitrate of lime obtained is treated in any known manner to obtain solid nitrate of lime. —W. H. C.

Cyanogen compounds; Process of utilising the products of decomposition of certain ——. E. Collett and M. Eckardt. Fr. Pat. 412,768, Feb. 18, 1910. Under Int. Conv., Feb. 20, 1909.

Calcium cyanamide is heated to a moderate temperature with calcium nitrate and water, or steam, with production of ammonia, the residue being preferably converted into calcium nitrate by means of dilute nitric acid.—O. R.

Sodium hydrosulphite; Manufacture of anhydrous ——. L. Cassella und Co., Ges. m. b. H., Frankfort-on-Maine, Germany. Eng. Pat. 11,906, May 13, 1910. Under Int. Conv., May 15, 1909.

Concentrated aqueous solutions of formaldehyde-sodium sulphoxylate, sodium bisulphite, and sodium chloride are mixed together at a temperature of about 65° C., and the anhydrous sodium hydrosulphite, which is precipitated, is filtered off and dried with the necessary precautions.—O. R.

"*Haloids*" [*Halides*]; *Method of making*——. J. C. Graves, Midland, Mich., and J. P. Simons, Cleveland, Ohio, Assignors to The Dow Chem. Co., Midland, Mich. U.S. Pat. 964,156, July 12, 1910.

An alkali chlorate in aqueous solution is reduced to the corresponding chloride by means of finely divided cast iron. —O. R.

Nitrogen oxides; Manufacture of ——. D. Timar. Fr. Pat. 412,227, Feb. 2, 1910. Under Int. Conv., June 1, 1909.

A mixture of nitrogen and oxygen is passed through a hollow tube of refractory material, such as magnesia or the like, which is maintained at a high temperature by the passage through it of a suitable electric current. The tube is provided with a number of small openings, through which the resulting oxides of nitrogen pass in the form of jets under pressure. The space which surrounds the tube is maintained under diminished pressure, so that the issuing gases are subjected to sudden expansion, and consequent sudden cooling through about 500° C. The tube is so constructed as to offer the maximum electrical resistance, and therefore to possess the highest temperature, nearest to the exits of the gaseous jets. The oxides of nitrogen consequently leave the region of synthesis at their highest temperature, and being immediately cooled on emerging from the apparatus, suffer the minimum amount of dissociation.—O. R.

Nitrous gases; Process of absorbing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 412,788, Jan. 11, 1910. Under Int. Conv., Jan. 23 and Feb. 9, 1909.

An alkaline-earth oxide, hydroxide, or carbonate, suspended in water, is reduced to a fine state of division in the presence of the gases to be absorbed.—O. R.

Sulphuric acid; Apparatus for making ——. F. J. Falding, New York. Eng. Pat. 26,452, Nov. 15, 1909. Under Int. Conv., Dec. 31, 1908.

See U.S. Pat. 932,771 of 1909; this J., 1909, 1086.—T.F.B.

Electrolytic cells. J. R. Crocker, New York. Eng. Pat. 2032, Jan. 26, 1910.

See Fr. Pat. 412,054 of 1910; preceding.—T. F. B.

Sodium; Electrolytic apparatus for preparing ——. Soc. d'Electro-Chimie, and P. L. Hulin. Fr. Pat. 412,631, May 6, 1909.

See Eng. Pat. 6063 of 1910; this J., 1910, 885.—T. F. B.

Oxides; Conversion of difficultly fusible —— into other compounds [*Preparation of aluminium nitride*]. O. Serpek. Fr. Pat. 411,947, Jan. 26, 1910.

See Eng. Pat. 15,995 of 1909; this J., 1910, 25.—T. F. B.

Hydrocyanic acid and cyanides; Process for making ——. C. Beindl. Fr. Pat. 412,541, Feb. 11, 1910.

See Ger. Pat. 216,264 of 1908; this J., 1909, 1314.—T.F.B.

Nitrogen; Separation of —— from the air. Soc. l'Air Liquide, Paris. Eng. Pat. 7175, March 22, 1910. Under Int. Conv., March 23, 1909.

See Fr. Pat. 410,933 of 1909; this J., 1910, 817.—T. F. B.

Obtaining sulphur dioxide, liquid hydrocarbons, and coke from the acid tar produced in the refining of mineral oils with sulphuric acid. Ger. Pat. 224,566. *See* IIa.

VIII.—GLASS; CERAMICS.

Ceramic industry; Progress in the ——. W. Pukall. Ber., 1910, 43, 2078—2106.

After a brief account of the modern development and present condition of the ceramic industry and of scientific work in connection therewith, especially that of Seger, the author refers to some of his own experiments on the chemistry of silicates. Pure sodium metasilicate was prepared by heating together the requisite quantities of sodium bicarbonate and pure powdered quartz sand in a platinum vessel until the sand completely dissolved (up to the melting point of gold). The crystalline product was coarsely powdered and again fused at the same temperature as before, in order to ensure the completion of the reaction. On pulverising the sodium silicate thus prepared, long pointed silky crystals were observed. The compound dissolved in water to a turbid solution, which could be cleared by allowing to stand for about 24 hours or by filtering through an earthenware filter. Different metallic silicates (calcium, barium, strontium, magnesium, zinc, cadmium, ferrous, ferric, aluminium, nickel, cobalt, copper, and lead) were prepared from the alkali silicate and metallic salts by double decomposition in very dilute aqueous solution. In the case of lead the snow-white precipitate, soon after its formation, consisted of fine glistening leaflets. The bluish-green ferrous silicate gradually oxidised in the air, becoming brown; in an analogous manner the colour of the manganese precipitate changed from pink to brownish-black. Most of the precipitated silicates became crystalline on ignition, but the lead compound fused at incipient red heat. The aluminium compound (from sodium metasilicate and ammonium alum) had a composition corresponding to the formula, $3SiO_2, 2Al_2O_3, 6H_2O$. Both this compound and the product, containing sodium, obtained by the interaction of 2 mols. of sodium metasilicate with 1 or 1½ mols. of sodium aluminate, were soluble in excess of sodium hydroxide (or potassium hydroxide), and from the solution, on heating on the water-bath, a white crystalline compound separated having the composition, $2SiO_2.Al_2O_3, Na_2O, 2H_2O$. The same compound was obtained by fusing together: (1) kaolin, sodium hydroxide and a small quantity of water; (2) felspar, sodium hydroxide, water, and aluminium hydroxide; and (3) quartz sand, aluminium hydroxide, sodium hydroxide, and water. It could also be obtained by using sodium carbonate in place of sodium hydroxide, but in this case it was necessary to ignite the mixture strongly. It forms white microscopic crystals which, under the microscope, are seen to be arranged in a similar manner to the beads in a necklace. It melts above 1270° C., *i.e.*, at about the same temperature as that at which the so-called salt glaze forms on stoneware. It is slowly acted upon by boiling water, alkali being removed; in dilute acids it dissolves to a clear solution. On ignition it loses two mols. of water; the residue is easily soluble in dilute hydrochloric acid. Zettlitz kaolin or English china clay when fused with ten times its weight of sodium chloride gives a crystalline product of approximately the composition, $2SiO_2. Al_2O_3, Na_2O$. The author regards the sodium compound with 2 mols. of water, as the sodium salt of a so-called kaolinic acid, $NaO.(OH)Al.O.SiO(OH) : (HO)SiO.O.Al(OH).ONa$. By treating 30 grms. of this sodium salt with 100 c.c. of water and 80 c.c. of dilute hydrochloric acid, and, after diluting to three litres, precipitating with a slight excess of ammonia, a product was obtained containing small quantities of sodium and ammonia, but in which the relation between the silica, alumina, and water corresponded with the formula, $(HO)_2Al.O.SiO(OH) : (HO)SiO.O.Al(OH)_2$ or $2SiO_2,Al_2O_3,3H_2O$, of the free kaolinic acid. This substance is amorphous, pure white, and infusible in the blowpipe flame. When freshly precipitated it dissolves easily in dilute acids and is reprecipitated by ammonia; it is decomposed by boiling acids. When fused with sodium chloride it behaves like kaolin, thus differing from a mechanical mixture of silicic acid and aluminium hydroxide. It loses more than half of its three molecules of water at temperatures up to 350° C., but the remainder only on ignition. When used in place of kaolin in a porcelain mass of the composition: clay substance, 50; quartz, 25; and felspar, 25 parts, it yielded a plastic mass, which when burnt at about 1370° C. (cone 12), gave a fine, white transparent porcelain, again differing from a mixture of silicic acid and aluminium hydroxide. The author regards kaolin as the anhydride of this kaolinic acid,

$$\left.\begin{array}{l}HO.Si.O.O.Al(OH)\\HO.\ddot{Si}.O.O.Al(OH)\end{array}\right>O$$

(Compare Zulkowski, this J., 1899, 760).—A. S.

Patents.

Glass-plates; Apparatus for silvering ——. H. Birkbeck, London. From American Looking-Glass Co., New York. Eng. Pat. 6206, Mar. 12, 1910.

Instead of silvering glass plates singly by placing them in a horizontal position in the silvering tank, a removable frame-box fitted with vertical grooves in the side walls is used, so that a number of glass plates may be submerged in an upright position in the silvering solution and be removed together after the silver layer is deposited. —H. H. S.

Glass; Method of and apparatus for drawing ——. R. L. Frink, Cleveland, Ohio. U.S. Pat. 963,888, July 12, 1910.

Hollow glass articles are produced by drawing a cylinder from a bath of molten glass, a body of air being maintained therein at a predetermined degree of humidity.—O. R.

Rolled glass; Mechanical process for manufacture of ——. E. Sigward. Fr. Pat. 412, 749, Feb. 17, 1910.

The usual process of plunging a block into molten glass and then passing the adhering metal between rollers leads to a non-homogeneous body of uneven appearance. The block is therefore replaced by a "punter" tapering towards both ends, while blasts of heated air keep the molten metal at a suitable temperature, and an endless chain elevator passes it between the rollers.—H. H. S.

Earthenware articles; The placing of —— in kilns, muffles and the like during the firing process. W. E. and C. D. Maddock, Stoke-on-Trent. Eng. Pat. 18,879, Aug. 17, 1909.

Earthenware and like glazed articles are arranged in a vertical position in open "cranks" or stands which are placed in the kiln to be fired. The stands consist of a base and one or more vertical portions against which one piece of the ware to be fired can rest, the other pieces of the ware being separated from each other and retained in a vertical position by means of stilts, nibs or the like arranged on the base of the stand and between the pieces of the ware. The open stands may also be provided with sides arranged to support a number of nibs or stilts which engage with the bottom, edges, and backs of the ware. The open stands may also consist of a base and horizontal portions or rails supported by vertical portions from the base, the horizontal rails and the base serving to support stilts, nibs, etc., which engage with the ware.—W. C. H.

Acid-resisting and refractory ware; Manufacture of pressed ——. Gebrüder Siemens und Co. Fr. Pat., 412,208, Jan. 31, 1910.

Crystallised boric acid and liquid phosphoric acid are added to the usual silicious materials in order to form phosphoboric acid, BPO_4, which is alleged to make the mass sufficiently plastic to be pressed and to render it resistant to fire and acid. The resulting ware is said to be suitable for diaphragms or filters.—H. H. S.

Ceramic body with alumina as base. A.-A. Riasse. Fr. Pat., 412,366, Feb. 7, 1910.

Felspar, kaolin, alumina and bauxite are mixed so as to form a mass of the composition—Al_2O_3 52, SiO_2 38, K_2O, Na_2O and CaO 3·5, and loss on ignition, 6·5 per cent. Dextrin may be added for binding and the whole is then fired at 1300° C. Building materials made in this manner are said to be durable and non-porous.—H. H. S.

Masses which can be cast; Process for the preparation of —— from non-plastic substances without any addition of a clayey binding material. E. Weber. Ger. Pat. 224,098, June 24, 1909.

The preparation of pottery slips which can be cast, from clays and kaolin, by the addition of small quantities of alkali is known (see this J., 1909, 835). It has now been found that the same method can be applied to non-plastic substances such as quartz, corundum, magnesite, zinc oxide, burnt clay, glass, sulphur, graphite, metals, etc. The substance, in a finely-divided condition, is mixed with a small quantity of water, and a small quantity (0·5—1 per cent.) of alkali added, whereupon a paste is obtained, which can be cast in water-absorbent moulds. Mixtures of different substances or of the same substance in different degrees of fineness may be used. The fluidity of the paste can be increased by addition of small quantities of humous or carbonaceous substances (peat, lignite, etc.), or in some cases, of solutions of barium or lead salts, which precipitate soluble sulphates or carbonates capable of counteracting the effect of the alkali. If necessary the "liquefied" paste can be rendered stiffer by addition of acids or salts.—A. S.

IX.—BUILDING MATERIALS.

Patents.

Stone; Manufacture of artificial ——. R. Berner, Baden, Austria. Eng. Pat. 3960, Feb. 17, 1910.

Artificial stone has been previously made of a mixture of screened sand, pit coal cinders, Portland cement, milk of lime, and calcium chloride solution, and the present invention provides for the replacement of the whole or part of the pit coal cinders in such a mixture by blast-furnace, converter and like slags, and for the replacement of a part of the Portland cement by Roman cement, puzzuolana or slag cement.—W. C. H.

Wood; Art of transforming [colouring] ——. W. A. Hall, New York, Assignor to American Mahogany Co., Maine. U.S. Pat. 964,017, July 12, 1910.

Dried or seasoned wood is subjected to the action of a vacuum in a closed tank, and a solution of an iron salt is then forced into the wood under pressure. A dark-coloured, insoluble compound is formed by the interaction of the iron salt and the tannin contained in the wood, and as the tannin predominates in the grain, the latter is prominently developed, whilst the body of the wood also becomes coloured, but a lighter shade than the grain.—O. R.

Cement; Rotary kilns for burning ——. F. J. Poths, Hamburg. Eng. Pat. 29,753, Dec. 20, 1909. Addition to Eng. Pat. 13,440, June 24, 1908.

The whole or a part of the plain surfaces in the interior of the kiln described in the chief patent (this J., 1908, 1154) is arranged in the form of a helix, in order to increase the length of the transport surface.—W. C. H.

Wood; Agent for preserving —— which does not attack metals. A. Möllers Söhne, and I. Krauschner. Fr. Pat. 412,253, Feb. 2, 1910. Under Int. Conv., Feb. 4, 1909.

See Ger. Pats. 219,893 and 219,942 of 1909; this J., 1910, 631.—T. F. B.

Cement; Process and apparatus for burning ——. H. L. Doherty. Fr. Pat. 412,168, Jan. 22, 1910.

See U.S. Pats. 945,307 and 945,498 of 1910; this J., 1910, 153.—T. F. B.

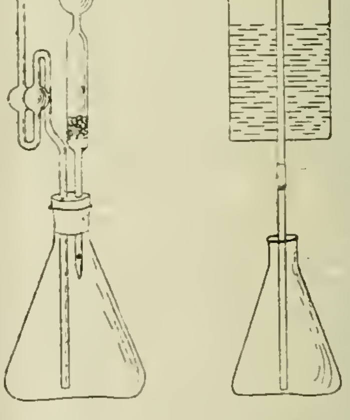
Cement [from slag]; Apparatus for producing ——. H. Passow, Blankanese, Germany, Assignor to The Atlas Portland Cement Co., New York. U.S. Pat. 964,805, July 19, 1910.

See Fr. Pat. 328,533 of 1903; this J., 1903, 999.—A. S.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Sulphur in pyrites, burnt pyrites, and sulphates; Determination of ——. A. Zehetmayr. Z. angew. Chem., 1910, 23, 1359—1360.

0·5 grm. of the finely powdered sample is placed in a glass tube, 60—70 mm. long and 7—8 mm. wide, closed at one end, where it is intimately mixed with reduced iron, free from sulphur. The amount of iron used should be from about an equal amount up to twice the amount of the sample, and the mixing may be carried out by means of a platinum wire, bent into the form of a hook at the end, which is rapidly rotated in the mixture. A layer of reduced iron is placed in the tube above the mixture, a small channel is made between the side of the tube and its contents, and the tube then heated for a short time to a dull red heat. While still hot it is dropped into a 200 c.c. flask containing 20—30 c.c. of water, the flask being fitted with a thistle funnel and delivery tube provided with an arrangement for holding back the spray, as shown in the sketch.



The delivery tube passes through a cooling jacket (shown diagrammatically), into a flask containing dilute potassium hydroxide. 20 c.c. of strong hydrochloric acid are poured into the flask through the thistle funnel, and when the reaction slackens, the flask is warmed until the whole of the sulphuretted hydrogen is driven off. This may be ascertained by testing with lead paper at the joint in the delivery tube. The distillate is washed into a flask together with excess of $N/10$ iodine acidified with acetic acid, and titrated with $N/10$ thiosulphate. 1 c.c. of iodine corresponds to 0·0016 grm. of sulphur. The method is a rapid one, and gives accurate results.—E. W. L.

Steel ingots; Influence of ingot-size on the degree of segregation in ——. H. M. Howe. Trans. Amer. Inst. Min. Eng., 1909, 40, 644—647.

The degree of segregation is greater, in general, the larger the size of the ingot, but in small ingots the effect of increase of size may be masked by other factors. Experiments with 49 different ingots, divided into groups according to their size, showed that the effect of increase of size on segregation is relatively slight until the thickness of the ingot is about 20 ins.; with further increase of size, the degree of segregation rises more rapidly. The segregation of sulphur is greater than that of phosphorus, and that of phosphorus greater than that of carbon. Marked segregation may take place even in very small ingots. A small ingot (about 5 in. long and $\frac{13}{16}$ in. wide at its widest part) of acid open-hearth steel was quenched in water from a moderate red heat. The outer portion of the ingot contained 1·08 per cent. of carbon, but microphotographs of the metal around a small cavity in the upper part of the axis of the ingot showed that some of the metal had been converted into white cast-iron (about 3 per cent. of carbon), whilst the eutectic areas must have contained more than 4·3 per cent. of carbon.—A. S.

Steel; "Strain disease" in ——. G. Charpy. Comptes rend., 1910, **151**, 389—392.

The author has observed certain phenomena in the case of steel resembling those described by Cohen as the effect of "strain disease" or "forcing disease" on tin (this J., 1909, 1139; 1910, 94; see also this J., 1910, 281). Stead has shown (see this J., 1898, 927) that the growth of the grains of ferrite in soft steel proceeds most rapidly between 650° and 800° C. The author has found that previous mechanical working of the metal causes a considerable increase in the rate of growth of the ferrite grains on subsequent annealing. For example in the case of two test pieces of a bar of soft steel of which one had been worked by means of a screw-plate, the difference in the growth of the ferrite grains on annealing for a certain time between 650° and 800° C. was so marked as to be visible to the naked eye on breaking the pieces of metal. In a given bar in which the mechanical working had been only superficial, the grains at the periphery were larger than those at the centre. It is stated that if the annealing be prolonged sufficiently, the growth proceeds until in a piece of metal there is only a single large crystal of ferrite. This growth of the grains of ferrite does not notably affect the tensile strength of the steel, but renders the metal brittle. In some cases observed by the author, bars of steel which had been worked in a screw-plate gave good results in the bending test, but after annealing at about 650° C., became so brittle that they broke on falling to the ground. Similar results are obtained with steel that has been worked in other ways, *e.g.*, by drawing, cold-rolled plates, cold-forged or stamped steel, etc., and it is probable that many so-called abnormal failures of metallurgical products are due to effects such as those described.
—A. S.

Cementation in a vacuum, by the use of pure carbon. F. Weyl. Metallurgie, 1910, **7**, 440—456.

A historical survey of the literature of the subject and of the methods employed by various authors is given, together with a description of some experiments by the author. Sugar charcoal, Ceylon graphite, graphite from cast-iron, and diamond were used, and the method employed for their careful purification is detailed. Electro-iron containing 0·09 per cent. of carbon, and 0·30 of manganese was used for cementation, and a specially designed apparatus is described in which the cementation was carried out at high temperatures in a vacuum of about 0·05 mm. pressure and in some cases of 0·001 mm. pressure only. The iron and the cementing material were previously separately heated for three to five hours in a vacuum to remove all the gases contained in them, and in all the experiments cementation was produced when at a sufficiently high temperature the material was in intimate contact with the iron. The details of seventeen experiments are given, with thirty-two microphotographs, and although the author agrees with Charpy's view that the gaseous carriers in the cementation box play a most important part in cementation, yet carbon of itself when in really intimate contact with iron produces cementation although small in amount.—A. H. C.

Corrosion of iron pipe; The comparative values of various coatings and coverings for the prevention of soil and electrolytic ——. R. B. Harper. Amer. Gas Light J., 1909, **91**, 428—431, 475—479, 528—534, 575—579, 625—629, 667—675.

The general conclusions drawn from tests made with a large number of different coatings are as follow:—Paints as a rule do not prevent corrosion by electrolysis, but some paints reduce soil corrosion. The permeability to water of a coating of paint cannot be judged from its appearance, and corrosion of the underlying metal may occur without altering the appearance of the coating. Dips, applied hot, are more effective than paints. Ingredients such as rubber, tallow, lime, etc., decrease the effectiveness of a coating of coal-tar pitch. Concrete does not of itself protect iron from electrolytic action. No coating is effective unless the surface of the metal is originally smooth and free from rust, moisture, loose scale and foreign matter. The most practical and effective coating is one of clean coal-tar pitch which must be free from water, acids and soluble mineral substances. The pitch should be as hard as possible without cracking when struck a smart blow. The pipe should be dipped in a bath of melted pitch until bath and pipe are at the same temperature. The coating should be $\frac{1}{32}$ in. thick.
—A. T. L.

Corrosion of iron and steel; and its prevention. G. W. Thompson. Amer. Inst. Chem. Eng., June 22, 1910. Oil, Paint and Drug Reporter, July 4, 1910, 25—26.

The author's remarks are mainly directed to the prevention of corrosion, which, he considers, is best effected by the application of successive coatings of paint to the clean metal surface. Moisture and oxygen being the chief corroding agents, the pigments employed should contain no hygroscopic or water-soluble matter, or substances capable (by reduction) of acting as depolarisers; so far as possible, they should be non-conductors of electricity and inhibitors of corrosion. Since protective coatings should be as impermeable as possible, each coat should have a reasonable thickness; and in order to facilitate control of the work and proper inspection during its progress, each coat should also be distinctive in colour. The use of linseed oil as a priming coat is condemned, the author considering that all under-coats should be as hard as possible, and that the separation of the paint from the metal surface, by the film of oil, tends to nullify such anti-corrosive properties as the paint may possess. The importance of thoroughly cleaning the metal before the application of paint is emphasised, the methods in general use being briefly considered.—W. E. F. P.

Copper refining: Simplification of ——, and other concentration processes by electric smelting. W. Borchers. Metallurgie, 1910, **7**, 435—440.

The views of various authors upon the chemical mechanism of the refining of copper and the general concentration of the copper in the matte are discussed. The author considers that the oxides of copper and iron formed by the action of the blast coming into close contact with the metal where the slag is blown away, are the real oxidising and refining substances, and shows how the electric furnace both simplifies and hastens the refining of the copper. (This J., 1910, 35.) In the electric furnace, ore dust and the finest calcined ore can be smelted without previously being made into briquettes. The ore either in the solid or liquid state can be used as a resistance material and placed directly in the path of the current either in a deep pan or on a long hearth, where the reactions between sulphides and oxides and the formation of slag can be completed without the disturbing influence of large quantities of combustion gases. The reactions complete themselves in the melted mass and only the gaseous products of the reactions escape, these gases being small in amount as compared with those of the reverberatory furnace. The loss by volatilisation and dusting is so minimised that the dust question is much simplified. The slag is so free from copper that it may be thrown away, and where the composition of the gangue favours the presence of copper in the slag, this may be washed out by a separate addition of a little sulphide and collected in a small quantity of matte. The electric furnace also greatly simplifies the working up of complex ores.—A. H. C.

Tin anodes; Behaviour of —— in caustic soda. F. Foerster. Z. Elektrochem., 1910, **16**, 599—606.

The fact that alkaline stannous solutions deposit tin and pass spontaneously into stannate, is apparently at variance with the fact that no stannic tin is observed in the anodic polarisation of tin in alkali solution. Carefully repeated experiments have convinced the authors that solutions containing up to 0·8 grm.-atom of tin per litre, all in the stannous state, may be obtained in this way, if air is carefully excluded. The end of polarisation is always caused by the tin becoming passive, and the evolution of oxygen, some of which begins to oxidise the stannous salt in solution. Solutions prepared in this way slowly deposit metallic tin after electrolysis, the equation, $2\,Sn^{\cdot\cdot} \rightleftarrows Sn - Sn^{\cdot\cdot\cdot\cdot}$ being apparently reversible, though the process is very slow, and at ordinary temperatures it is only possible to attain equilibrium when the alkali concentration is at least $3N$. If the process of tin separation is analogous to that of copper from cuprous solutions where the cuprous ion at high concentration has a greater free energy than the system copper-cupric ion, then we should expect to find that a concentrated stannous solution would have a lower potential against platinum (where only the free energy of the stannous ion is measured) than against tin. Experiment does not show this to be the case. Although the solutions containing stannous and stannic tin in various proportions give values for the $Sn^{\cdot\cdot}/Sn^{\cdot\cdot\cdot\cdot}$ potential which gradually decrease, they do not sink below the corresponding $Sn/Sn^{\cdot\cdot}$ potentials. The explanation is that the stannic tin is gradually removed from the reaction by hydrolysis of the stannate, and separation of colloidal or insoluble metastannic acid. If conditions are favourable, this continues so that the potential $Sn^{\cdot\cdot}/Sn^{\cdot\cdot\cdot\cdot}$ falls slowly and when it reaches the value of the potential $Sn/Sn^{\cdot\cdot}$, the separation of tin is possible though it can only take place with extreme slowness, since it regenerates the stannic ion which must again be disposed of. The analogy with cuprous and aurous salts is therefore incomplete, the important factor being the gradual fall in the concentration of the stannic ion rather than the high concentration of stannous ion. The technical recovery of tin from tin-plate however gives results from which it would appear that the tin dissolves and separates in the stannic state. The experiments show that this only occurs when a layer of anode mud has been formed from the impurities in the plate, which prevents the free diffusion of the stannous tin into the electrolyte. If this layer be broken, the stannous tin continues to be formed, but if it be allowed to persist, a very high local concentration of stannous ion is obtained which is capable of anodic oxidation to the stannic state. Such a layer is not formed when pure tin is used as anode and the metal always becomes passive when the concentration and potential necessary for the oxidation are reached. This passivity is accompanied by the evolution of oxygen and the formation of a thin iridescent coating on the metal. It is probably the protective action of this diaphragm which prevents further electrolytic oxidation. The diaphragm is not likely to consist of metastannic acid which could not be formed so rapidly from a solution containing (as yet) so little stannate. It is more probably the colloidal intermediate oxide which produces the yellow colour when stannite and stannate solutions are mixed. This is known to pass to the anode in alkaline solutions and to adhere to it very closely. The same diaphragm and the same passivity may be observed at a tin-plate anode, though naturally owing to the interference of the layer of mud, the phenomenon is observed much later in the electrolysis after a considerable quantity of tin has been electrolytically oxidised.—W. H. P.

Alumina; The thermal reduction of ——. A. Askenasy and A. Lebedeff. Z. Elektrochem., 1910, **16**, 559—566.

The literature of the reaction between alumina and carbon which the authors epitomise in the introduction to their paper, contains many discrepancies, and leaves undecided the question as to whether it is possible to prepare pure aluminium by the thermal reduction of its oxide. The experiments described in the present paper which were carried out by heating a mixture of alumina with excess of wood charcoal in an arc furnace (500—600 amp., 30—50 volts) resulted in the formation of a fused mass which obviously contained aluminium and aluminium carbide as well as the oxide, carbon being practically absent. Under favourable conditions as much as 60 per cent. of metal was found in the mass with about 30 per cent. of carbide. An experiment with an alternating current furnace showed 65 per cent. of metal and 18 per cent. of carbide. Petroleum coke did not reduce the oxide nearly so well (4·5 per cent. of metal, 8·6 per cent. of carbide). The best yields were obtained when the arc was stopped at the first appearance of the flame of burning aluminium. Experiments in a graphite resistance furnace in a current of hydrogen showed that the formation of aluminium carbide was appreciable after heating alumina and carbon for about 15 minutes in the neighbourhood of the sintering point. No metal was observed till the mass fused. It was also shown that the carbide is undecomposed up to at least 1400° C. The formation of carbide is represented by the equation: $2Al_2O_3+9C=Al_4C_3+6CO$, which may be looked on as the sum of (1), $Al_2O_3+3C=2Al+3CO$ (endothermic), and (2), $4Al+3C=Al_4C_3$ (exothermic). Hence within the range of stability of aluminium carbide no free metal is found, while at higher temperatures the metal is produced by equation (1) and the reverse of (2). According to this explanation the existence side by side in the fusion of metal, carbide, and carbon, should not be possible, since at temperatures at which the carbide is stable, there would only be carbide and excess of carbon, while at higher temperatures there would be metal and carbon or carbon alone. The temperature of appreciable decomposition of the carbide is above the boiling point of the pure metal. The co existence of the three phases is occasionally observed, and this can only be explained by assuming that the carbide can dissolve the metal at high temperatures (so that, although above its boiling point, it does not distil) giving it up again on cooling. The pure metal may be obtained from the authors' reaction products by heating just above the melting point of the metal, if the mass is not previously powdered. The failure of other observers to isolate the metal has been due to (1) prolonged application of very high temperatures resulting in the distillation and loss of metal, and (2) omission to test by treatment with acid when the metal was not visible to the eye.—W. H. P.

Gold-magnesium alloys; Equilibrium diagram of the ——. G. G. Urasow and R. Vogel. Z. anorg. Chem., 1910, **67**, 442—447.

Certain minor points of difference between the results obtained by the authors, working singly (this J., 1909, 1041; Z. anorg. Chem., 1909, **64**, 375), are discussed in the light of further experiments. It has been ascertained that at 796° C. the compound, $AuMg_3$, reacts with the melt to form another compound, Au_2Mg_5, and that this compound at a lower temperature (716° C.) breaks up, in the solid state, to give a mixture of the compounds, $AuMg_2$ and $AuMg_3$; the new compound has, therefore, but a small range of stability.—F. Sodn.

Flue dust and fume in smeltery gases. L. T. Wright. Eng and Min. J., 1910, **90**, 111—112.

The paper deals with the collection of the fume and flue dust carried by the flue gases from copper smelters, and the factors which govern their respective depositions are considered.—F. R.

Sodium carbonate as an oxidiser; Use of ——. E. Deiss. Chem.-Zeit., 1910, 34, 781—782.

When finely divided silicon, tungsten, molybdenum, titanium, or such alloys as ferrotitanium, ferrosilicon, phosphor-iron, etc., are strongly heated with sodium carbonate, the metal becomes oxidised and carbon monoxide is evolved, and this is found to offer a convenient method of attacking many metals and alloys which are dissolved with difficulty by acids. The addition of magnesia to the sodium carbonate renders it more effective (chromium and its alloys being, for instance, attacked by this means) and prevents actual fusion of the mass; the carbon monoxide is allowed to burn, as evolved, in order to avoid the possibility of reverse action.—F. Sodn.

Pig-iron production in United States. Times Eng. Suppl. Aug. 10, 1910.

The American Iron and Steel Association has just published some statistics representing the returns from all the manufacturers of pig-iron in the United States, which show that the production for the first half of 1910 was 15,012,392 gross tons, as compared with the previous six months' output of 14,773,125 tons and 11,022,346 tons for the corresponding period of 1909. The increase in production in the first half of 1910 as compared with the second half of 1909 was 239,267 tons, and as compared with the first half of 1909 it was 3,990,046 tons. The contrast afforded by a comparison of the figures for the six months just ended with those for the entire year of 1900, when the output was 13,789,242 tons, gives some idea of the development of this industry in the past ten years.

The production for this year is divided as follows:—Bessemer and low phosphorus pig, 6,323,883 tons; basic pig (exclusive of basic charcoal pig), 4,953,810 tons; charcoal pig iron, 219,653 tons; bituminous coal and coke pig, 14,416,000 tons; anthracite and coke mixed, 371,957 tons; spiegeleisen and ferro-manganese, 129,978 tons; and anthracite alone, 4,782 tons, the last three grades showing slight decreases from the tonnage of the previous half-year. The number of furnaces in blast on June 30 was 293, whilst the number of furnaces actually in blast during part or the entire six months previous was 374.

Patents.

Crucible steel; Manufacture of ——. A. Reynolds, London. Eng. Pat. 15,989, July 8, 1909.

In order to reduce the wear and tear of crucibles, and to minimise the loss by oxidation, of alloying substances, such as tungsten, during the melting period, the steel is charged into the crucible in a single block, substantially fitting the interior, the alloying substance being placed in a cavity formed in the under side of the block, the cavity being subsequently plugged or closed with a steel plate. During heating, the surface of the steel should be protected by a covering of slag.—F. R.

(1). *Metallic oxides; Method of reducing* ——. (2). *Manufacture of steel.* (3). *Treatment of* [*tungsten*] *ores.* (4). *Furnace for reducing metallic oxides.* C. M. Johnson, Avalon, Pa., Assignor to Crucible Steel Co. of America, New Jersey. U.S. Pats. 964,868—964,871, July 19, 1910.

(1). Oxides of tungsten, vanadium, molybdenum, or chromium, together with a separate body of carbon-containing material are heated in a reducing chamber, to such a temperature that the carbon will unite with the oxygen of the oxide, the temperature being maintained until the reaction is complete. (2). Tungsten or like metal, from which the silica from the native rock has not been removed, is charged, as required, into the steel-making furnace and the silica slagged off. (3). Ores of tungsten or like metals, combined with a silicious gangue are treated with hydrochloric acid in the presence of a material producing chlorine, and the residue treated in a reduction furnace without previous removal of the silica. (4). The furnace consists of a cylindrical reducing chamber enclosed in an outer furnace body. The charge is contained in a semi-cylindrical receptacle closed at the ends and open along its length, which is inserted with the contained charge into the reducing chamber.—F. R.

[*Aluminium-nickel-magnesium*] *Alloys.* R. D. Mackintosh, Mortlake, Surrey. Eng. Pat. 15,384, July 1, 1909.

Alloys, combining strength, malleability, lightness, durability, resistance to the action of the weather and most dilute acid and alkaline solutions, and capability of taking a high polish, are prepared by melting aluminium in a magnesia-lined crucible, allowing it to cool, adding an oxide of nickel mixed with a reducing agent, such as charcoal, excluding the air with a cover of powdered magnesia, heating to 1600° C. and then adding metallic magnesium. The proportions suggested are 90 parts of aluminium, 10 of nickel monoxide or sesquioxide, or 75 of aluminium, 20 of nickel monoxide, both with from 1 to 5 parts of magnesium; or 90 of aluminium, 5 of nickel sesquioxide and 5 of magnesium.—F. R.

[*Aluminium*]. *Coating metallic surfaces, such for instance, as of metal sheets, plates, bars, cisterns, tanks, bowls, cooking utensils, and the like.* J. Summerhill, Wolverhampton. Eng. Pat. 16,574, July 16, 1909.

Sheets, plates, or other articles of iron, steel, or copper are coated with aluminium, by immersing them in a bath of just molten aluminium, or the aluminium may be applied in any other convenient manner. The surface of the articles does not require to be previously specially treated, other than by the ordinary pickling bath.
—F. R.

Aluminium and its alloys; Manufacture of ——. H. F. D. Schwahn, Belleville, Ill. U.S. Pat. 964,566, July 19, 1910.

An electric resistance conductor is produced by heating dehydrated aluminium sulphate with carbon-containing substances, such as pitch, to a temperature of about 900° C., and the conductor is subsequently reduced by heating electrically in a chamber, in which a reducing atmosphere is maintained, a fluorine-containing gas being added for a flux.—F. R.

Tin and like metals capable of oxidation; Extraction of —— *from ores and slags; and furnaces therefor.* A. M. S. Robertson, Aberdeen. From J. H. Robertson, Penang, Straits Settlements. Eng. Pat. 22,140, Sept. 29, 1909.

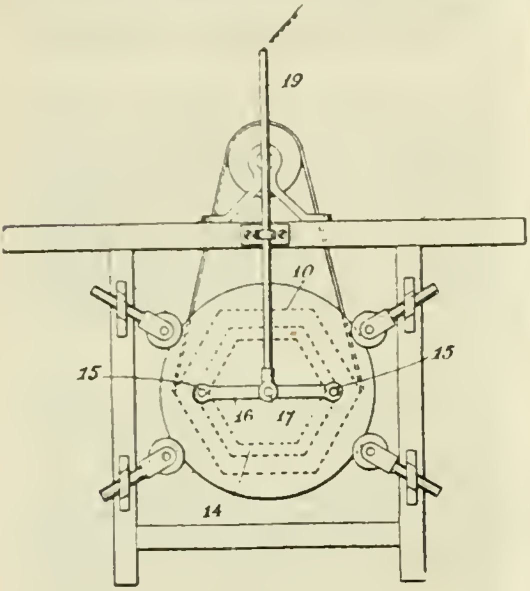
The invention consists essentially of a laterally rocking furnace, having a slightly convex bed, across which the molten material constantly flows from side to side in a thin layer, exposing a large area to the action of the oxidising flame, whereby the contained metals are rapidly volatilised.—F. R.

Electro-deposition of metals. J. A. Corey, Datchet. Eng. Pat. 2002, Jan. 26, 1910.

The apparatus is employed more particularly for the production of printers' electrotypes, with the economical use of high current densities. A ring carrier is provided for the negative electrode, and is carried by arms upon a vertical hollow spindle, which may be driven through variable speed gear. From the electrode, the current passes by means of brushes to a stationary slip ring connected with the negative cables or leads. Both the negative and positive electrode carriers are provided with ridges, each ridge being in wedge form, with two inclined faces adapted to carry mould or plate holders, the latter having ridge contact surfaces in V-form, so as always to ensure good contact over a large contact area with the electrode. Air is injected under pressure through a nozzle in the vat, so as to force the electrolyte into an outlet pipe leading to a continuous filtering and concentrating apparatus, thus ensuring the maintenance of the strength of the electrolyte without interruption of the working of the apparatus.—B. N.

Electro-deposition apparatus. A. F. Harris, Walsall, Staffs. Eng. Pat. 24,735, Oct. 28, 1909.

The revolving barrel, 10, is provided with wooden ends, into each of which is sunk a metallic ring or tape, 14, and metallic cathode studs project from the interior of the barrel and are screwed into the ring, 14. Studs, 15, are similarly connected to the ring, 14, and to the bridge piece, 16. The bridge piece is provided with a bearing pivot, 17, and a rod, 19, the latter being connected with the cathode terminal. The barrel is thus free to rotate, the cathode studs making contact with the articles to be plated.—B. N.



Separating metallic compounds from complex ores, mattes, residues and metalliferous substances; Methods or processes of ——. A. McKechnie, Birmingham, and F. G. Beasley, Smethwick. Eng. Pat. 29,286, Dec. 14, 1909.

Ores containing iron, together with a more valuable metal, are treated with just sufficient sulphuric, hydrochloric, or similar acid, to dissolve the non-ferrous metal, in the presence of air and steam under high pressure. Under these conditions the acid has a definite selective solvent action, the iron remaining undissolved. The solution containing the desired metal is subsequently separated, and the metal recovered by precipitation.—F. R.

Metallic oxides; Reduction of ——. W. Mathesius. Fr. Pat. 411,965, Jan. 27, 1910.

In the reduction of ferric oxide by means of carbon monoxide, no heat-change takes place and it is possible to complete the reduction to metallic iron without any fusion of the materials. The ore, heated to 700°—900° C. by means of a rotary kiln, is charged into a furnace where it is treated with producer gas at about 900° C. for some hours, by which all the iron is reduced to the metallic state. The reduced ore is cooled to 150° C. (at which temperature no re-oxidation of iron takes place) by contact with cold surfaces or otherwise. The reduced metal is separated by mechanical or magnetic methods. The process is stated to be also applicable to other metals, such as cobalt, nickel, copper, tin, etc.—J. W. H.

Filter; Continuous slimes vacuum ——. A. E. Drucker, Taracol, Korea. Eng. Pat. 29,445, Dec. 16, 1909.

The filter consists of a number of filter leaves arranged tangentially on the periphery of a wheel, with their outer ends directed forward in the direction of revolution. The wheel is partly submerged in the slimes vat and portions of the slimes are continuously being carried up in the pockets formed between adjacent filter leaves. Means are provided for maintaining a vacuum within the leaves for the greater portion of a revolution of the wheel, but outward pressure, for discharging the filter cakes, is automatically substituted near the completion of each revolution.—F. R.

Metals; Extraction of volatile ——, and the preparation of zinc white. A. Seytre. Fr. Pat. 412,214, Feb. 1, 1910.

The ore is treated with coke and fluxes (lime, iron oxide) in a converter for the production of a matte and a slag. Gas, from a gas producer, is then forced through the mass in the converter, driving off the reduced volatile metals which are condensed in condensers or allowed to oxidise and collected as zinc white, etc. The blowing engine is connected to the converter by alternate paths; one, by direct pipework provided with an escape valve and the other through a gas producer and gas-holder. During the first period, gas is being made and stored in the gas-holder ready for use during the second period of the operation.—J. W. H.

Metals [vanadium, molybdenum, tungsten]; Extraction of those —— the highest oxides of which are soluble in fused alkalis or alkali carbonates. A. H. Perret. Fr. Pat. 412,641, Jan. 26, 1910.

The process is applicable to all metals the higher oxides of which are readily soluble in fused alkalis or alkali carbonates. In the treatment of slags containing such metals, oxidising conditions are maintained after the addition of a suitable amount of sodium carbonate, and oxidising agents, such as nitre, may be projected on the bath to ensure the formation of the highest oxide, which is readily soluble. The fused mass obtained is run into a tank of cold water and lixiviated thoroughly. The solutions obtained will contain, amongst other bodies, vanadate, silicate, and aluminate of sodium. Alternative methods for separating the vanadium from the solutions are given. The usual process in which ammonium vanadate is precipitated by the addition of ammonium chloride may be used or sulphuric acid may be added to precipitate directly vanadic acid. By the latter method the solution is concentrated and the silica precipitated by nearly neutralising the solution with sulphuric acid, the last traces of silica being deposited by immersing solid vanadic acid in a basket in the solution at 80° C. Finally the vanadic acid is precipitated by the addition of more sulphuric acid. Other modifications of the process are given.—J. W. H.

Copper; Extraction of —— from poor ores [by wet method]. P. J. Petiot and G. Chardet. Fr. Pat. 412,724, Feb. 17, 1910.

To every 1000 kilos. of ore, reduced to the finest powder, is added an equal volume of water containing 100 litres of a saturated solution of calcium bisulphite and 120 kilos. of calcium chloride. The mixture is raised to the boiling point and maintained near that temperature for at least one hour with constant agitation. After standing, the solution of cuprous chloride formed is decanted and the residue washed twice. The solution and washings are treated with milk of lime to precipitate the copper as hydroxide.—J. W. H.

Pulverulent ores; Process for the briquetting of —— with simultaneous production of chlorine compounds. C. A. Brackelsberg. Ger. Pat. 224,309, Sept. 23, 1908.

The fine ore if dry, is mixed with magnesium chloride solution, or if wet, with solid magnesium chloride, then formed into briquettes, and dried. The briquettes are then heated, whereby the magnesium chloride is decomposed, yielding magnesia and hydrochloric acid, the latter being either evolved as such, or reacting with substances present in the briquettes to form chlorine compounds, which may be recovered.—A. S.

Iron and similar substances ; Process for the protection of —— against atmospheric influences. E. Wasserfuhr, Bonn, Germany. Eng. Pat. 15,913, July 7, 1909.

SEE Fr. Pat. 404,847 of 1909 ; this J., 1910, 361. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 17,118 of 1896.—T. F. B.

Steel ; Treatment of —— for desulphurising and deoxidising purposes. R. H. Wolff, New York. Eng. Pat. 18,962, Aug. 17, 1909.

SEE U.S. Pat. 946,302 of 1910 ; this J., 1910, 219.—T.F.B.

Zinc ; Extraction of —— from zinc sulphide ores. Imbert Process Co., New York. Eng. Pat. 28,487, Dec. 6, 1909. Under Int. Conv., Dec. 24, 1908.

SEE Fr. Pat. 407,305 of 1908 ; this J., 1910, 496.—T. F. B.

Zinc ; Extraction of ——. Brand's Pure Spelter Co., Ltd. Fr. Pat. 412,842, Feb. 18, 1910. Under Int. Conv., April 27, 1909.

SEE Eng. Pat. 9955 of 1909 ; this J., 1910, 701.—T. F. B.

Objects to be galvanised : Apparatus for electrolytically removing the grease from ——. H. W. T. Schulte, Bielefeld, Germany. Eng. Pat. 30,463, Dec. 30, 1909.

SEE Fr. Pat. 411,054 of 1909 ; this J., 1910, 959.—T. F. B.

Ores ; Process of treating ——. E. B. Parnell, Carshalton. U.S. Pat. 962,383, June 21, 1910.

SEE Eng. Pat. 14,372 of 1909 ; this J., 1910, 884.—T.F.B.

Tungsten ; Process of making —— specially applicable to the manufacture of incandescence lamps. Cie. Franç. pour l'Exploitation des Proc. Thomson-Houston. First Addition, dated Jan. 21, 1910, to Fr. Pat. 373,923, Jan. 26, 1907.

SEE Eng. Pat. 3951 of 1909 ; this J., 1909, 647.—T. F. B.

Copper and other metals ; Method of separating —— from liquors containing them, obtained in wet metallurgical processes. J. H. Thwaites and S. J. Ralph. Fr. Pat. 412,411, Feb. 8, 1910. Under Int. Conv., Feb. 20, 1909.

SEE Eng. Pat. 4167 of 1909 ; this J., 1910, 432.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Oxygen electrode ; Theory of the ——. Electromotive behaviour of the oxides of platinum. G. Grube. Z. Elektrochem., 1910, **16**, 621—632.

THE discrepancy between the free energy of the formation of water from its elements, and the E.M.F. of the electrolytic gas cell measured at a platinised platinum electrode, has led to the opinion that the latter is modified by the formation and decomposition of some oxide of platinum. The author has studied the behaviour of the oxides of platinum and their hydrates in 2*N*-sulphuric acid with a view to deciding the actual course of the reaction. He finds that the equilibrium potential of platinic oxide increases with time, reaching +1·06 volt for $PtO_2,4H_2O$ and passing through a maximum of +1·04 volt for $PtO_2,2H_2O$. The potential of platinous oxide is not capable of accurate determination but is probably about +0·9 volt. The potential of freshly prepared platinum trioxide, PtO_3, is in the neighbourhood of +1·5 volt. An electrode coated with the trioxide shows a gradual fall of potential with evolution of oxygen, a similar fall being shown by an electrode of platinic oxide which has been anodically polarised in 2*N*-sulphuric acid. After anodic polarisation of platinous oxide, a potential value higher than that of the dioxide is obtained, which then falls gradually without showing any discontinuity at the potential of the pure dioxide. If an electrode of platinised platinum be anodically polarised, its self-discharge potential falls continuously from +1·5 volt to +1·05 volt without any break at either 1·23, 1·15 or 1·08. These results lead to the conclusion that platinum trioxide, PtO_3, is the cause of the high positive potential of a polarised platinised platinum electrode. The oxygen evolution taking place below 1·6 volts may be attributed to formation and decomposition of the trioxide, while the continuous fall of potential is probably due to the formation of solid solutions of the trioxide in the dioxide and of the dioxide in the monoxide. Electrodes of platinum trioxide and of dioxide are discharged by hydrogen peroxide, the rapidity and extent of discharge depending on the concentration of the peroxide. The oxygen evolution taking place with these electrodes at upwards of +1·6 volts is probable evidence of a still higher oxide of platinum, probably PtO_4.

—W. H. P.

Silent electric discharge ; Chemical action of the ——. A. Moser and N. Isgarischew. Z. Elektrochem., 1910, **16**, 613—620.

THE authors have devised apparatus for the study of the conditions of equilibrium of certain reactions in a Siemens' ozoniser. In the case of the reaction $CO_2 \rightleftarrows CO + \frac{1}{2}O_2$, it is found that, starting with pure carbon dioxide, only the very slightest quantities of ozone can be detected in the products. By the action of the silent discharge on carbon dioxide or on a mixture of carbon monoxide and oxygen (2 : 1) an equilibrium point may be reached from either side which depends on the discharge potential, on the temperature, and on the distance between the electrodes. If oxygen is in excess the reaction is complicated by ozonisation, while with excess of carbon monoxide a solid brown body is formed similar to the body obtained on passing the discharge through pure carbon monoxide. Apparently only from 1—6 per cent. of the electrical energy is consumed in chemical action. Small quantities of chlorine, which acts powerfully as catalyst in photochemical reactions, delay the reaction in either direction although the position of equilibrium is unaltered. In the case of the reaction $2HCl \rightleftarrows H_2 + Cl_2$ about 1 per cent. of the hydrogen chloride is decomposed at 14,000 volts and 20° C. The union of sulphur dioxide and oxygen, unlike the photochemical reaction between these gases, proceeds irreversibly. So long as both sulphur dioxide and oxygen are present the formation of trioxide takes place quite smoothly. When one of them is exhausted, a peroxide, probably S_2O_7, begins to form as a result of one or other of the following processes : (1) The condensation of the trioxide with the separation of sulphur. (2) The further oxidation of the trioxide when excess of oxygen is present, $2SO_3 + \frac{1}{2}O_2 = S_2O_7$ or (3) Condensation of excess of sulphur dioxide to form trioxide and finally peroxide with separation of sulphur at each stage. The yield of sulphur trioxide per kilowatt-hour varies with the conditions of experiment, reaching 14·5 grms. in the most favourable circumstances. A mixture of hydrogen chloride and oxygen reacts as in Deacon's process under the influence of the discharge, about 95 per cent. of the original hydrogen chloride being oxidised at 6000—12,000 volts. The yield of chlorine per kilowatt-hour is from 10—13 grms.

—W. H. P.

Silent electric discharge ; Action of the —— on some mixtures of gases and vapours. E. Comanducci. Gaz. chim. ital., 1910, **40**, I., 600—602.

IF a mixture of oxygen and hydrogen be passed through a Siemens' ozoniser, water is produced ; if the oxygen be in excess, water and ozone are formed, but no hydrogen peroxide. Chlorine and hydrochloric acid when mixed with oxygen and passed through the ozoniser, yield hypochlorous anhydride and hypochlorous acid respectively. 10·95 grms. of hydrochloric acid mixed with 40 litres of oxygen yielded 0·722 grm. of hypochlorous acid in 70 mins. Under analogous conditions methyl and ethyl alcohol are oxidised to the corresponding aldehydes, acetaldehyde and paraldehyde yield acetic acid, and formaldehyde yields formic acid. The hydrogenising action of hydrogen is increased under the influence of the silent electric discharge: chlorine is converted into hydrochloric acid (with good yield) and acetaldehyde into the corresponding alcohol.—A. S.

Selenium cells of great sensitiveness. F. C. Brown. Physikal. Zeits., 1910, **11**, 481—482. Chem. Zentr., 1910, **2**, 279.

Selenium cells of great sensitiveness can be prepared by using a mixture of two modifications of selenium, *viz.*, the amorphous variety obtained by dissolving vitreous selenium in potassium cyanide and precipitating with hydrochloric acid, and the red crystalline product prepared from the former by dissolving in carbon bisulphide and exposing the solution to direct sunlight. A mixture of 10 parts of the amorphous and 1 part of the crystalline selenium is rubbed to a paste with ether, pressed in a mould around wires of German silver, heated for 5 hours at 170° C., and then slowly cooled. The resistance of the product shows great variations (5×10^7 to 1×10^{10} ohms in the dark). The ratio of the conductivity in the light to that in the dark, *i.e.*, the sensitiveness, ranges from 30 : 1 to 300 : 1; it varies considerably with the temperature, *e.g.*, from 80 : 1 at 39° C. to 300 : 1 at 3° C. A. S.

Errata.

This J. 1910, 866, col. 1, line 30 from top, *for* "(process I)" *read* "(process II)"; and *ibid.* line 35 from top, *for* "ferous," *read* "ferrous."

Patents.

Insulation of electric conductor windings or coils made of aluminium or aluminium alloys. E. W. Küttner, Berlin. Eng. Pat. 15,896, July 7, 1909.

The coils are immersed in a hot solution, such as caustic soda or sodium carbonate, and the air in the chamber is rarefied, the liquid being afterwards subjected to increased pressure. The penetration of the liquid may be facilitated by heating the coils, *e.g.*, by means of an electric current. When the cross-section of the total number of windings does not exceed 200 times the cross-section of a single wire, the coils may be simply immersed for an appropriate length of time, extending to several hours, in a hot or cold solution and subsequently dried.—B. N.

Insulating compounds and processes of making the same. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, New York. Eng. Pat. 23,225, Oct. 11, 1909.

The insulating material is composed of a mixture of 237 parts of dry kaolin, 37 parts of powdered glass, 90 parts of powdered slate ("green silko") and 156 parts of "asbestos stable." Lime and "red silko" may also be added. The mixture is formed into sheets, which are treated with sodium silicate, subjected to pressure and fired at a high temperature. The material may be used for separating parts of electrical apparatus of different potential.—B. N.

Cell; Electrolytic ——. J. F. Flood, London. Eng. Pat. 15,960, July 8, 1909.

A cathode spray or jet is projected over the wall of the electrolytic compartment, which itself remains fixed, and the liquid is received in an adjoining vessel.—B. N.

Electrodes; Manufacture of alkaline ——, *for preventing the dropping of active material therefrom.* L. Marseille and P. Gouin. Eng. Pat. 3733, Feb. 15, 1910. Under Int. Conv., March 8, 1909. Addition to Eng. Pat. 15,373 of 1909, dated July 4, 1908.

The electrodes are made in tubular form from a sheet of nickel or other metal perforated over its full height with a large number of holes, the tubes being afterwards wound with wire in closely adjacent coils. The electrode is finally subjected to oxidation, as detailed in the main patent (see Fr. Pat. 392,024 of 1908; this J., 1908, 1211) so as to form an adherent deposit of nickel sesquioxide. —B. N.

Furnace; Process and electric —— *for the calcination and graphitisation of carbonaceous materials.* G. Rose. Fr. Pat. 412,197, Dec. 11, 1909. Under Int. Conv., Dec. 12, 1908.

The furnace utilises triphase current by means of three electrodes, disposed symmetrically so that the three normals meet in a horizontal section at angles of 120°. The horizontal section of the furnace may be circular or polygonal, but preferably hexagonal, the three electrodes forming alternate sides, with refractory masonry forming the other three sides. At the bottom of the furnace the material is discharged into cooling waggons, by means of a movable base working on a hinge. The furnace is employed for the conversion of anthracite, etc., into artificial graphite, suitable for the manufacture of electrodes for electric furnaces.—B. N.

Metallisation of wood and other bad conductors; Electrolytic process for the ——. L. E. Waltispurger. Fr. Pat. 412,629, May 6, 1909.

Fibrous materials may be metallised by first soaking the objects in a mixture of stearine and "carbolyneum," then in a bath of ligroin (petroleum spirit), and afterwards covering the surface with a layer of "Bonchou" glue. The material is then put into an electrolytic bath containing a suitable solution, the nature of which depends on the metallic envelope required.—B. N.

Electrolytic apparatus having a liquid annular anode. Schott und Gen., Jena, Germany. Eng. Pat. 6596, March 16, 1910. Under Int. Conv., March 30, 1909. Addition to Eng. Pat. 14,288 of 1909, dated June 26, 1908.

See Addition of Dec. 11, 1909, to Fr. Pat. 404,332 of 1909; this J., 1910, 960.—T. F. B.

Wood; Treatment of —— *to render it suitable for use in accumulators.* P. Marino. Fr. Pat. 412,113, Feb. 1, 1910. Under Int. Conv., Feb. 3, 1909.

See Eng. Pat. 2641 of 1909; this J., 1910, 97.—T. F. B.

Accumulators. P. Marino. Fr. Pat. 412,114, Feb. 1, 1910. Under Int. Conv., Feb. 4, 1909.

See Eng. Pat. 2683 of 1909; this J., 1910, 97.—T. F. B.

Accumulators with alkaline electrolyte; Positive electrode for ——. Nya Ackumulator Aktiebolaget Jungner. Fr. Pat. 412,486, Feb. 10, 1910. Under Int. Conv., Feb. 22, 1909.

See Eng. Pat. 8195 of 1909; this J., 1910, 286.—T. F. B.

Electric arcs; Process for producing and maintaining luminous —— *for reactions in gases.* Chem. Fabr. Griesheim-Elektron. Fr. Pat. 412,262, Feb. 2, 1910.

See Eng. Pat. 11,060 of 1909; this J., 1910, 575.—T. F. B.

Electrolytic cell for the electrolysis of sodium chloride. Fr. Pat. 412,054. *See* VII.

Bleaching and ageing cereals. U.S. Pat. 963,970. *See* XIXa.

Apparatus for electrolytic purification of liquids. Fr. Pat. 412,584. *See* XIXb.

XII.—FATS; OILS; WAXES.

Olive oil; Alteration of a sample of —— *kept for over two hundred years.* A. Agrestini. Staz. sperim. agrar. ital., 1910, **43**, 283—296. Chem. Zentr., 1910, **2**, 174.

The oil, which had been preserved in an earthenware vessel, consisted of a viscous, fluorescent, rancid mass, in which a whitish solid fat was present. The liquid portion was easily soluble in alcohol and acetic acid and had the following characters: Sp. gr., 0·9554; acid value, 119·6; saponif. value, 252·5; iodine value 51·2; Reichert value, 1·95; acid acetyl value, 170·4; acetyl value, 77·7; Hehner value, 81·4; hydroxy-acids, 31·4 per cent.; liquid fatty acids, 76·8; semi-liquid fatty acids, 8·55 per cent. It gave no reaction in the Halphen, Milliau (Tortelli and Ruggeri's modification), and Villavecchia-Fabris tests. The solid portion was a pale yellowish mass and after melting had a wax-like appearance. It was soluble in alcohol and acetic acid and had the following characters: M. pt., 49·5°—50·5° C.; solidif. pt., 46°—45° C.; acid value, 156·7; saponif. value, 204; iodine value, 30·6; m. pt. of fatty acids, 66°—68° C.; solidif. pt. of fatty acids, 51°—50° C.; Valenta test, 26° C.; hydroxy-acids, 17·6 per cent. The small content of volatile acids, indicated by the Reichert value, is probably due to the oil having been protected from the light during preservation. A specimen of the oil preserved in a bottle for a further period of 1 year had a Reichert value of 3·8.—A. S.

Grape seed oil. S. Fachini and G. Dorta. L'Ind. Chimica, 1910, **10**, 183—184.

The authors have examined five samples of grape seed oil:—I., obtained by hot pressing from seeds of Puglia grapes; II., from the same seeds by cold-pressing in the laboratory; III., by cold-pressing in the laboratory, from seeds of a black and white grape, which had not been subjected to distillation; IV., the same as III., but from seeds which had been subjected to distillation; V., from seeds of a black and white grape from S. Daniele del Friuli, by cold-pressing in the laboratory. The results obtained are shown in the following table:—

	Sp. gr. at 15° C.	Acid value.	Saponif. value.	Iodine value.		Hehner value.	Reichert-Meissl value.	Acetyl value.	Thermo sulphuric value. (Tortelli).	Refractive index.
				Hübl.	Wijs.					
I.	0·9262	7·9	189·7–189·9	129·4–129·8	130·4	92·6	0·4	24·7–25·0	81·5	1·4769
II.	0·9260	3·3	195·5	—	130·4–130·7	—	—	24·2–24·5	—	1·4772
III.	—	4·3	193·3–194·9	—	140·1–140·7	137·2	0·35	23·2–23·6	—	1·4759
IV.	—	4·2	193·4	—	140·4	—	—	23·0–24·1	—	1·4760
V.	0·9258	3·9	192·9	136·5	139·4	93·7	—	—	—	—

—A. S.

Oils and fats from certain rare fruits. C. Grimme. Chem. Rev. Fett- u. Harz-Ind., 1910, **17**, 156—158; 178—183.

(A). *Acrocomia totai* (Mort.), a large tree belonging to the palm family, is found throughout S. America. The kernels contained in the stones of the fruit are white beneath a thin black epidermis, and have a taste recalling that of copra. On extraction with ether, a sample of the kernels yielded 58·9 per cent. of a light yellow, odourless, non drying oil, having a pleasant taste. The residue from the extraction contained 25·54 per cent. of proteins.

(B). *Ximenia americana* (Linn.) is a small tree indigenous to America, but now also found in tropical parts of Africa and Asia. The fruit resembles the olive in size and appearance, and is very aromatic. The kernels of the seeds of the fruit have a nutty flavour and are very widely eaten by the natives. The specimen examined yielded 63·82 per cent. of a yellow non-drying viscous oil (=39·25 per cent. calculated upon the whole seeds). The residue contained 46·54 per cent. of proteins.

(C). *Moquilia tomentosa* (Benth.), a tree belonging to the *Rosaceæ*, is indigenous to the Brazils. It produces edible egg-shaped fruit of a yellow colour, containing seeds 3 to 4 cm. in length and 1·5 to 2 cm. thick. The yellow kernels examined yielded on extraction with ether 48·26 per cent. of a dark brown, very viscous oil with slight drying properties. The residue contained 19·34 per cent. of proteins.

(D). *Pentaclethra macrophylla* (Benth.) is a huge tree, belonging to the *Leguminosæ*, which occurs in all parts of the West Coast of Africa. The fruit produces from 6 to 7 oval brown seeds from 7 to 8 cm. in length and 5 cm. in breadth. The endosperms (78·6 per cent. of the seed) yielded, on extraction with ether, 36·5 per cent. of a light yellow, viscous non-drying oil with a penetrating odour. The residue from the extraction contained 52·21 per cent. of proteins.

(E). *Oil-fruit from Guatemala*:—This fruit, termed *tariri* by the Indians, is probably the product of *Picramnia Carpinteræ* Pollack. It has the size and appearance of a dried wild cherry, and contains one or two soft seeds resembling a coffee bean in appearance. The kernels yielded 75·98 per cent. of a solid white crystalline fat. The residue contained 35·23 per cent. of proteins.

(F). *Canarium oleosum* (Lam.):—This is a balsam-producing tree which is found in the tropics and especially in tropical Asia. The kernels of the seeds yielded 68·63 per cent. of a light yellow non-drying oil, which on standing gave a deposit of stearine. The shells of the seeds yielded, on extraction with ether, 34·53 per cent. of a yellowish white fat of the consistence of butter. The residue from the extraction of the kernels contained 57·68 per cent. of proteins.

(G). *Carapa procera*, D. C.:—The kernel of the seeds contained 30·29 per cent. of water and yielded on extraction 31·54 per cent. of a yellow oil (the whole seed yielding 22·84 per cent.) The higher yield obtained by Lewkowitsch (this J., 1909, 150) is to be attributed either to the seeds not being fresh, or to their being derived from a different species of plant. The residue from the extraction contained 21·16 per cent. of proteins.

(H). *Oil-fruit from Mexico*:—The fruit, derived from a species of *Trichilia*, was in the form of yellow balls 0·8 cm. in diameter. It contained 49·10 per cent. of oil. The kernels yielded 61·44 per cent. of a yellow oil, whilst the shells yielded 12·11 per cent. of a semi-solid fat, and the fruit pulp gave 59·68 per cent. of a reddish-brown oil.

(I). *Sterculia appendiculata*:—This tree grows to a height of 60 to 90 metres in Usambaras, Ger. East Africa, where it is termed "Nfune" by the natives. It produces brown seeds 2 cm. in length and 1 cm. broad. A sample of these contained 55 per cent. of kernels, which yielded 28·76 per cent. of a yellow oil, whilst the husks yielded 15·82 per cent. of oil. The residue from the extraction contained 24·53 per cent. of proteins.

(J). *Mesua ferrea* (Linn.):—This is an evergreen tree indigenous to India and the East Indies. It is greatly prized for its hard timber (iron wood), and also yields a good balsam, which has frequently been recommended as a substitute for Canada balsam. The seeds resemble chestnuts in colour and form. The kernels of the sample examined yielded 79·48 per cent. of a brown non-drying oil, which was partially soluble in alcohol and gave an orange coloration with a mixture of sulphuric and nitric acids. The residue contained 24·14 per cent. of proteins.

(K). *Terminalia catappa* (Linn.), a tall tree belonging to the *Combretaceæ*, is found on the coast of Madagascar, the Malay Islands, etc., and is largely cultivated in the tropical parts of the old and new world. Of late, the seeds have been exported from Togo as a commercial product. The oil is known under various synonyms, such as Indian almond oil, Jougli almond oil, and catappa oil. The seeds are 2 to 3 cm. in length and 0·5 cm. in diameter, and resemble the true almond in flavour. The shells, however, cannot be separated from the kernels, and hence the latter cannot be used for confectionery purposes. The brown colouring matter of the thin shell is not soluble in ether, and therefore does not interfere with the production of the oil. The seeds examined yielded 63·43 per cent. of oil, which in odour, taste and colour closely resembled true almond oil. The oil did not readily become rancid, but had the drawback of becoming thick on standing, and of yielding an abundant deposit of stearine. The residue from the extraction contained 59·38 per cent. of proteins. (See also Hooper, this J., 1908, 906.)

(L). *Acanthosicyus horrida*, which belongs to the *Cucurbitaceæ*, is indigenous to the district of Walfisch Bay. It is leafless, covered with thorns, and produces fruits weighing about 1·5 kilos. and resembling oranges in appearance. The nearly liquid acid pulp is of a creamy colour and contains numerous seeds. The fruit is termed "Narras" by the natives and throughout the year is their only food in addition to fish (see this J., 1910, 777). For winter use it is dried on sand. The kernels are separated from the boiled pulp by means of roughly-woven sieves, and are sent in large quantities to Kapstadt where they are sold under the name of "butter pits." The raw kernels, which are very difficult to obtain, are yellowish white, about 1 to 1·5 cm. in length, and 0·5 to 1 cm. in breadth. The raw kernels yielded 47·8 per cent. of oil, whilst the boiled kernels yielded 46·3 per cent. The oil had a good flavour and slight acidity and could be used as a substitute for almond oil provided that sufficient kernels could be obtained. This would hardly be possible without making special plantations. There was little difference between the values obtained with the oils from the raw or boiled seeds.

(M). *Citrullus naudinianus* (Hook)., which is termed "Tschama melon" by Europeans, grows on the steppes of German South West Africa. It reaches a height of about 5 metres, and produces fruits about the size of a goose's egg. The pulp, which can be readily separated from its bitter skin, is acid and very liquid, and contains hard seeds about 1 cm. long by 0·5 cm. in breadth. These are covered with a thin grayish-white husk which cannot be separated from the kernel. On extraction with ether a sample of the seeds yielded 15·33 of a yellow, fluid non-drying oil. The residue contained 19·96 per cent. of proteins.

The characters of the above-described oils and fats, and of the fatty acids therefrom are shown in the following table :—

	Oil or Fat.						Fatty Acids.								
	Sp. gr.	M. pt.	Solidif. pt.	n_D	Acid value.	Sapon. value.	Iodine value.	Insol. acids + unsap.	Unsapon	M.pt.	Solidif. pt.	n_D	Neutralisation value.	Iodine value.	Mean mol. wt.
		°C.	°C.	at C.					per cent.	°C.	°C.				
(A)	—	—	+8	1·4580 (25)	15·1	188·3	26·9	92·85	1·43	—	28—30	1·4460 (30°)	191·4	29·3	293·4
(B)	0·9248 (15°)	—	+2	1·4737 (20)	1·2	183·1	84·0	92·85	2·91	51–52	—	1·4596 (60°)	172·3	78·2	326·0
(C)	—	—	+14·5	1·4921 (30)	18·3	196·5	81·5	88·91	8·23	64–67	—	1·4857 (70°)	183·9	102·4	305·4
(D)	0·9259 (15°)	—	semi-solid at 20 solid at 5–7	1·4728 (30)	9·2	203·0	85·7	91·85	3·17	58–59	—	1·4647 (70°)	192·7	92·6	291·5
(E)	—	50–52	—	1·4624 (50)	3·6	156·2	63·9	96·31	1·74	56–57	—	1·4538 (70°)	192·0	87·0	292·5
(F) kernels ..	—	—	+12·5	1·4644 (20)	3·9	197·0	63·0	94·76	0·97	44–46	—	1.4505 (50°)	195·2	63·7	287·7
shells ..	—	—	16·5	1·4584 (20)	3·1	183·5	78·2	89·93	4·88	—	—	—	—	—	—
(G)	0·9238 (15°)	—	8—9	1·4686 (20)	5·3	201·2	56·8	94·24	0·97	43–45	—	1·4536 (50°)	181·4	60·9	310·0
(H) : kernels ..	—	—	+2·5	1·4731 (30)	3·8	198·8	90·7	92·14	4·75	40–41	—	1·4586 (50°)	181·3	88·0	309·8
shells ..	—	—	14	1·4706 (40)	31·6	189·5	52·2	—	6·85	—	—		—	—	—
fruit pulp	—	—	9	1·4736 (30)	2·4	194·3	78·9	—	3·62	—	—	—	—	—	—
(I) : kernels ..	—	—	−2	1·4729 (20)	28·4	185·0	82·4	91·12	6·39	34–35	—	1·4630 (40°)	175·2	86·7	320·6
(J) :	0·9285 (20°)	—	+ 5·5	1·4786 (20)	21·6	192·5	82·2	93·15	2·51	33–34	—	1·4679 (40°)	165·3	88·0	339·7
(K)............	0·9195 (15°)	—	+7	1·4682 (20)	4·1	185·7	77·0	93·95	1·87	48–49	—	1·4492 (50°)	198·6	73·5	282·8
(L) : raw kernels	—	—	−4 to −5	1·4766 (20)	0·6	180·9	115·8	93·9	1·42	31–32	—	1·4581 (40°)	179·8	122·0	312·3
(M)............	—	—	−7	1·4747 (20)	2·3	203·1	120·3	91·39	4·37	32–34	—	1·4647 (40°)	182·2	104·0	308·3

—C. A. M.

Carap oil. C. H. Wright. Bull. Dept. Agriculture, Trinidad, 1910, 9, No. 65, 1—5.

The Carap tree, *C. guianensis*, is now being planted to a considerable extent in Trinidad for the sake of its wood, but the seeds are not yet collected for export. The oils from all the species of carapa are bitter. They closely resemble each other in chemical characteristics, the chief difference apparently being that the iodine value of the oil from the seeds of *C. guianensis* is lower than those of oils from *C. grandiflora* and *C. procera*. Two samples of carap oil, presumably from *C. guianensis*, examined by the author gave the following results :—Sp. gr. at 40°/40° C. 0·9149 (one sample) ; sp. gr. at 15·5°/15·5° C., 0·9249 and 0·9211 ; acid value, 27·5 and 19·4 ; saponification value, 197·2 and 196·1 ; iodine value, 67·7 and 58·5 ; Reichert-Meissl value, 3·8 and 3·6 ; and unsaponifiable matter (one sample) 1·16 per cent. (see also this J., 1908, 578 ; 1909, 150).—C. A. M.

Oleic acid ; Ozone derivatives of —— and their decomposition products. W. Franck. Annalen, 1910, 374, 356—368.

The normal ozonide of oleic acid is obtained by ozonising the acid with the exact amount of ozone required (this J., 1906, 1158), and it is immaterial whether oxygen containing 0·5 or 18 per cent. of ozone be used. As soon as the saturation limit is exceeded the perozonide is formed. A specimen of the latter had the molecular weight of 347·6 (calculated 346·26) ; sp. gr. at 22·5°/22·5° C., 1·049 ; and refractive index, $n_D^{22·5°}$=1·47113. After very long-continued treatment (about 3 hours) of oleic acid with oxygen containing 10 per cent. of ozone, yet a third ozonide is obtained, which resembles the ozonides already described in its chemical properties, but has different physical characteristics. By the use of more concentrated ozone it may be obtained in a shorter time. This super-perozonide of oleic acid had the composition $C_{18}H_{34}O_7$; sp. gr. at 22° C., 1·079 ; and refractive index, $n_D^{22°}$= 1·46817. The normal ozonide of elaidic acid was also prepared. It was a colourless liquid which showed no signs of difference from the normal ozonide of oleic acid. Its composition was, $C_{18}H_{34}O_6$; sp. gr. at 20°/20° C., 1·027 ; and refractive index, $n_D^{20°}$= 1·46171. Decomposition of oleic acid ozonide with glacial acetic acid yields considerably more peroxides than decomposition with water. Further details are also given of some of the products of the decomposition of the several ozonides (see this J., 1906, 1055, 1158; 1909, 250). Molinari and Soncini (this J., 1906, 1055) were unable to obtain any salts of oleic acid ozonide. The author, however, finds that by exclusion of all moisture and by preventing a rise of temperature, such salts can be prepared. Thus by passing dry ammonia gas into a chilled ethereal solution of oleic acid ozonide, a white gelatinous mass ($C_{18}H_{37}O_5N$) is deposited, which on drying in a desiccator gradually turns yellow and begins to decompose. It is decomposed by water immediately. The sodium salt, $C_{18}H_{33}O_5Na$ is readily soluble in methyl alcohol, but is immediately decomposed by water, whilst the copper salt, prepared by adding a solution of copper acetate in methyl alcohol to a solution of the sodium salt in the same solvent, is a viscid mass which becomes friable on drying. It has the composition, $(C_{18}H_{35}O_5)_2Cu$, and is gradually decomposed on treatment with acidulated water, with the formation of the derivatives normally yielded by the ozonide of oleic acid.—C. A. M.

Emulsion of fatty matters. L. Meunier and Maury. Collegium, 1910, 277—284, 285—287.

Other conditions being equal, the rate at which an oil forms an emulsion, and the stability of the emulsion increase with the decrease in the surface tension of the neutral oil. For comparative determinations of the surface tension of different oils the method of Tate gives sufficiently accurate results. This is based upon the fact that there exists a relationship ($P=2\pi\rho a$) between the weight P, of a drop falling from a vertical capillary tube of radius, ρ, and the surface tension, a. Instead of weighing the drops it is more convenient to count the number of drops escaping from the capillary, when the weight of oil, the height of the liquid within the capillary, and the duration of the immersion within the medium representing the interglobular liquid are kept constant. Under these conditions the number of drops is inversely proportional to the surface tension. A Mohr's burette with its lower part finely drawn out and turned upwards was used in the author's experiments. The following results were obtained at 21° C. with 1 grm. of the different oils and with water as the interglobular liquid:—Neat's foot oil, 18; olive oil, 20; castor oil, 9; linseed oil, 18; and mineral oil (sp. gr., 0·934), 9 drops. Contrary to anticipation, the temperature had no pronounced influence on the surface tension. Thus with 1 grm. of neat's foot oil the following surface tensions were observed (in air) at different temperatures:—At 20° C., 48; at 40° C., 48; and at 60° C., 44 drops. With a finer capillary tube the results were:—At 20° C., 256; at 40° C., 155; at 50° C., 149; and at 60° C., 142 drops. Mineral salts, which have a restrictive influence on the formation of emulsions by certain colloids such as soap, promote the formation of emulsions when the interglobular liquid consists of pure water, owing to the fact that they diminish the surface tension of contact. Thus 1 grm. of neat's foot oil at 21 C. gave the following results:—In pure water, 18; in 1 per cent. salt solution, 19; in 5 per cent. salt solution, 24; and in 10 per cent. salt solution, 31 drops. Aqueous solutions of alkali sulphoricinoleates have also a very pronounced effect upon the surface tension of contact of oils. Thus 1 grm. of neat's foot oil falling into solutions of neutral sodium sulphoricinoleate gave the following numbers of drops:—With a 5 per cent. solution, 44; with a 10 per cent. solution, 67; 15 per cent. solution, 85; and 20 per cent. solution, 104; whilst with a 25 per cent. solution the oil flowed from the capillary in an uninterrupted stream. These variations in the surface tension of contact are much more marked in the case of alkaline sulphoricinoleates than when free sulphuric acid is present, or than with other sulphonated (aromatic) derivatives. Hence, in addition to the colloidal character of sulphoricinoleates, their hydrolytic action is also a factor. In the authors' opinion it is owing to a slow process of hydrolysis promoted by a progressive state of division of the fat, that it is possible to prepare stable emulsions of oils by a sufficiently prolonged agitation with pure water. The influence of colloids upon oil emulsions is due to their forming a protective layer over each particle of oil which is thus prevented from re-uniting with other particles, and also to their imparting viscosity to the interglobular liquid. Fatty acids have an emulsifying power greatly superior to that of neutral fats, and in the case of mixtures of free fatty acids and neutral fats, the stable emulsions that can be formed are mainly due to the influence of the former. The following results show that the surface tension of contact with water of an acid oil is inferior to that of a neutral oil:—Neutral neat's foot oil, 30; neat's foot oil with 33 per cent. of fatty acids, 40; with 50 per cent. of fatty acids, 44; with 66 per cent. of fatty acids, 60; and pure fatty acids 62 drops. Further results given in detail show that if an alkaline liquid is substituted for water as the interglobular liquid the surface tension of contact is still further diminished. Every solid or liquid substance capable of being precipitated or emulsified in the form of fine particles may act as an emulsifying agent, especially if its surface tension of contact with the interglobular liquid is inferior to that of the oil to be emulsified. By the simultaneous use of colloids and of finely divided emulsions a very effective emulsification of oils may be obtained. The emulsifying properties of egg-yolk and of milk are due to these substances fulfilling both requirements. With regard to emulsions formed in soap solutions the authors' experiments have shown that the proportion of alkali giving the maximum emulsifying capacity varies with the dilution of the emulsion, and that it increases with the amount of water. For emulsions in which an excess of alkali would be objectionable it is essential to dissolve the soap in the smallest possible quantity of water, and then to add the oil to be emulsified. Soaps containing free fatty acids are particularly suitable. If to a soap emulsion a substance (*e.g.* salt) capable of coagulating the colloid is added, the emulsion is immediately destroyed. Hence the use of salted egg-yolks in the preparation of emulsions for greasing chromed leathers is irrational, and it is better to use fresh yolks when the price permits. Potassium soaps have better emulsifying properties than sodium soaps. If a substance insoluble in water be dissolved in a solvent miscible with water, the solution usually forms a very stable emulsion with water. Thus excellent results may be obtained by the use of the commercial products soluble in water prepared by dissolving carbon tetrachloride in sulphonated derivatives of castor oil. Since the emulsifying properties of oils stand in relationship to the acidity, all factors that develop the acidity should also promote emulsification. This would explain the influence of lipolytic enzymes in the formation of emulsions.—C. A. M.

Mexican candelilla wax. Chem. and Drug. Aug. 6. 1910. [T.R.]

According to the American Consul at Hamburg, manufacturers in that city do not consider that Mexican candelilla wax is equal to carnauba wax for industrial purposes other than the manufacture of boot-polish. Candelilla wax is known in Hamburg, and one or two sales have been made at 155m. per 100 kilos., but carnauba wax is preferred. Candle manufacturers object to candelilla wax, for the reason that it melts at 65 C., whereas carnauba wax melts at 83° to 91° C. For the manufacture of boot-polish the low melting-point of candelilla wax is an advantage, if only exporters could offer it at prices lower than carnauba wax.

Utilisation of the residues obtained in the working up of tomatoes. Perciabosco and Semeraro. *See* XIXa.

Patents.

Fats and oils; Means for bleaching and purifying ——. C. Tuckfield and W. G. de Forgés Garland, East Molesey. Eng. Pat. 18,236, Aug. 7, 1909.

The oil is fed into a vessel placed at a level above a tank, at the top of which is a filtering medium preferably of animal charcoal. Through the lower part of this oil tank passes a coil supplied with steam superheated at a low pressure and the outlet of this terminates in a nozzle dipping into the oil which has passed upwards through the filter. The fine spray of oil thus produced is subjected to the action of natural or artificial light. If desired, a second ejector nozzle may be fitted on to the steam pipes so that the oil can be treated with chemical agents. —C. A. M.

Soap; Production of a solid hydrocarbon ——. C. Böhme and E. B. Wolf, Chemnitz, Germany. Eng. Pat. 23,013, Oct. 8, 1909. Under Int. Conv., May 13, 1909.

Fats readily saponifiable in the cold (*e.g.* cocoanut or palm oils) are mixed with the required proportion of hydrocarbon (*e.g.*, 30 to 35 kilos. of benzine or turpentine oil to 130 kilos. of fatty oil), and the mixture is saponified with an alkali solution of such concentration that the proportion of water in the finished soap does not exceed 25 per cent. Under these conditions a hard soap containing 10 to 20 per cent. of hydrocarbon is obtained.—C. A. M.

Oil; Process of extracting —— from oleaginous substances. E. Sagols. Fr. Pat. 411,943, Jan. 26, 1910.

The oleaginous substance (*e.g.* olives) is crushed and mechanically agitated with water (with or without the addition of salt) at the desired temperature (not lower than 20° C.), and the mixture conducted into an extractor, separator or turbine and subjected to centrifugal action so as to separate water and impurities; the oil is then allowed to stand when further impurities deposit.—C. A. M.

Fats; Process and apparatus for separating —— from waste waters. R. Schilling. Fr. Pat. 412,183, Jan. 26, 1910.

The pipe which conducts away waste water has a branch pipe the opening into which can be partly closed by means of a shutter to which is attached a deflector at a higher level. The shutter and deflector are controlled from above by a common rod, the raising or lowering of which alters the level at which the grease floating on the water escapes into the branch pipe.—C. A. M.

Effluents; Apparatus for removing fat from ——. R. Schilling, Daklem, Germany. Eng. Pat. 2073, Jan. 27, 1910.

See Fr. Pat. 412,183 of 1910; preceding.—T. F. B.

Greases and other fats; Process for obtaining and refining ——. A. J. B. M. Colletas. Fr. Pat. 412,500, Feb. 11, 1910.

The material (especially the waste grease from the manufacture of leather) is extracted with a suitable solvent in a steam-heated vessel, the solution filtered while hot through a decolorising agent, and the solvent distilled from the filtrate. The residual fat is then heated to 100° C., and added to an equal volume of an oxidising agent (*e.g.* alkaline permanganate, nitric acid, hydrogen peroxide), and the mixture mechanically agitated so as to emulsify the fat and oxidise the impurities.—C. A. M.

Stearin; Manufacture of —— with simultaneous sulphonation of oleic acid. H. Dubovitz. Fr. Pat. 412,546, Feb. 12, 1910.

After saponification of the fat in an autoclave in the usual manner, the mass is transferred to another vessel and treated with a quantity of sulphuric acid sufficient not only to liberate the combined acids, but also to sulphonate the oleic acid, the temperature being meanwhile maintained at about 100° C. The advantages claimed for this process are economy of time, steam and materials and obviating the use of leaden vessels.—C. A. M.

Fats; Filtering material for edible and industrial ——. Soc. Française des Matières filtrantes (G. Trusson et Cie). Fr. Pat. 412,677, Feb. 16, 1910.

The oil or melted fat is mechanically stirred into a paste with wool flocks (obtained *e.g.* from clean woollen rags) mixed with 20 to 50 per cent. of cleaned vegetable fibres, and the mass subjected to uniform pressure. The use of wool previously dyed is advantageous, the dyestuff having an affinity for certain impurities which would otherwise pass through the filter medium. By this process a clear oil is stated to be obtained by a single filtration without the necessity of subsequent standing.—C. A. M.

Soaps and other saponaceous compounds, detergents, bleaching compounds and the like. The Patent Borax Co., Ltd., and L. Bradford, Birmingham. Eng. Pat. 3591, Feb. 14, 1910.

A suitable proportion (say 2 to 10 per cent.) of alkaline borosilicate of sodium is incorporated with the other ingredients of the soap, etc., with the object of increasing the antiseptic, detergent, water-softening and lathering properties of the preparation.—C. A. M.

Fatty compounds for use as Turkey-red oils; Process of making ——. A. Schmitz, Heerdt, Germany. U.S. Pat. 964,565, July 19, 1910.

See Eng. Pat. 11,903 of 1907; this J., 1907, 964.—T. F. B.

Sodium peroxide compositions for washing and bleaching purposes; Process for producing ——. P. Roser, Esslingen, Germany. U.S. Pat. 965,016, July 19, 1910.

See Eng. Pat. 1150 of 1909; this J., 1909, 663.—T. F. B.

Filter for the purification of water, oil, etc. Fr. Pat. 412,045. *See* XIXb.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead; Constitution of normal ——. H. Hof. Chem.-Zeit., 1910, **34**, 784—785.

White lead dissolves in a solution of magnesium chloride of sp. gr. 1·16, and the solution, when diluted, gives a red colour with phenolphthalein. It is considered, therefore, that white lead must contain basic hydroxyl groups, and the usually accepted formula, $OH.Pb.CO_3.Pb.CO_3.Pb.OH$, as opposed to Falk's formula (this J., 1910, 769), is regarded as confirmed. When shaken with magnesium chloride solution of sp. gr. 1·3, white lead is converted into lead chloride, and carbon dioxide is evolved; a basic magnesium carbonate also is precipitated. —F. Sodn.

Linoleum: Fireproof ——. F. Fritz. Chem. Rev. Fett- u. Harz-Ind., 1910, **17**, 187.

Attempts to render linoleum fireproof by substituting asbestos, kieselguhr, etc., for the cork powder have not met with any appreciable success. Good results, however, have been attained by adding to the ingredients of the linoleum substances which when heated emit gases that would extinguish a flame. Suitable proportions are: 20 kilos. of cork powder, 17 kilos. of linoleum cement, 8 kilos. of sodium bicarbonate, and 4 kilos. of ochre. The addition of the bicarbonate does not have any apparent injurious effect upon the finished linoleum, and the temperature at which it decomposes is far above that of the kneading process. It is unnecessary to impregnate the jute basis with the salt, though in certain cases the fabric may with advantage be soaked in a weak solution thereof, and then dried.—C. A. M.

Corrosion of iron and steel and its prevention. Thompson. *See* X.

Patents.

Pigment; Red ——. E. Morin and J. Janet. Fr. Pat. 412,265, Feb. 3, 1910. Under Int. Conv., Feb. 17, 1909.

Cadmium sulphide, finely powdered, is triturated with 10 per cent. of sulphur, and then with powdered selenium in quantity varying from 5 to 7 per cent. according to the tone of colour desired. Orange tones are given by the lower proportions of selenium, bright red tones by the higher proportions. The powdered mixture is heated in an open vessel at 200° to 250° C. until fumes cease to be given off, when the temperature is gradually raised to about 600° C. Samples are taken from time to time and allowed to cool, in order to ascertain the tone of colour that has been attained.—E. W. L.

Colouring matters [pigments]; Preparation of ——with the aid of titaniferous iron ores. P. Farup. Fr. Pat. 412,563, Feb. 12, 1910. Under Int. Conv., Feb. 15, 1909.

A titaniferous iron ore, such as ilmenite, is gently roasted so as to obtain a product which is free from concretions, and which has not undergone incipient fusion. The roasted mass is crushed in water, and under this treatment an extremely finely divided product is obtained. In certain cases it is found that the finely divided powder does not become suspended in the water. This is due to the presence of soluble substances in the product of roasting, and the difficulty is overcome by changing the water once or twice. The suspended powder is finally caused to deposit by the addition of some soluble substance to the water. The tone of colour—which may vary from red to yellow—can be modified by varying the temperature and duration of the roasting, by adding other substances to the original ore, such as sodium chloride, barium oxide, etc., or by heating the final product in contact with air or otherwise, and with or without the addition of other substances such as sodium chloride, barium oxide, etc.—E. W. L.

Metal or coloured foil; Process for preparing weather resistant ——. Genthiner Kartonpapierfabrik, Ges. m. b. H. Ger. Pat. 223,031, June 5, 1909.

The powdered metal or colour is spread over a thin film of an inert varnish (*e.g.*, a 2 per cent. acid-free solution of nitrocellulose) on a flat surface, any excess of the powder is removed, and then another thin layer of the varnish is applied.—A. S.

Lampblack; Process for the preparation of —— by the decomposition of hydrocarbons under pressure. A. Wegelin, Akt.-Ges. f. Russfabrikation und Chem. Ind. Ger. Pat. 223,416, April 24, 1909.

The hydrocarbons are forced, under pressure, continuously into the closed decomposing chamber, which is provided with a safety-valve, and in which the pressure necessary for the decomposition of the hydrocarbons, is maintained constant. On starting, the hydrocarbons are fired by means of an electric spark or the like, but subsequently the operation proceeds continuously, successive charges of hydrocarbons being ignited by means of a metal wire which is kept in an incandescent condition by the heat of the reaction.—A. S.

Turpentine and rosin; Apparatus for extracting —— from resinous woods. H. T. Yaryan, Toledo, Ohio. U.S. Pat. 964,728, July 19, 1910.

The wood is treated with a solvent in a vessel connected with the solvent reservoir by means of a pipe in which are two valves with an intermediate outlet, so that a pressure may be produced within the pipe different from that within the extraction vessel. The outlet between the valves may be opened or closed at will, and may be connected with a pump.—C. A. M.

Turpentine, oils, and other products from wood; Processes of extracting ——. E. C. R. Marks, London. From Southern Manufacturing Co., Pittsburgh, U.S.A. Eng. Pat. 29,886, Dec. 21, 1909.

See Fr. Pat. 410,753 of 1909; this J., 1910, 831.—T. F. B.

Vehicles for mixing with colours, paints, etc.; Liquid ——. F. H. Walker and C. E. Sohn. Fr. Pat. 411,964, Jan. 27, 1910. Under Int. Conv., Jan. 28, 1909.

See Eng. Pat. 2114 of 1909; this J., 1909, 1260.—T. F. B.

Red monoazo dyestuff and colour lakes therefrom. Eng. Pat. 12,426. *See* IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber tree of Tonkin and North Assam (Bleekrodea Tonkinensis). Gummi-Zeit., 1910, **24**, 1506—1509.

The present state of knowledge of this source of rubber is summarised by Eberhard and Dubard in "L'arbre à caoutchouc du Tonkin." Paris, 1910. The tree is found in Tonkin, Assam and Northern Laos, wherever the soil is rich in lime. The general habit of the tree is similar to that of other birches. The greatest girth of stem observed was from 1·3 to 1·6 metres. The outer bark is very thin and whitish; the wood is white, but of little value. The tree is characterised by the presence of bulb-shaped reserve-water containers on the roots, the size of these varying from that of a hazel-nut to that of a duck's egg. The natives—"Thos"—have been in the habit of mixing the latex of the tree with that of the various vines in the locality. The methods of obtaining the latex are very crude:—(1) The main stem and largest branches are incised by means of any sharp instrument as closely as possible, up to a height of 2·5 to 3 metres; (2) pieces of bark about 8—9 cm. long and 3—3·5 cm. wide are sliced out of the tree; (3) the stem is cut up into pieces and the latex extracted from each piece by warming one end over a small fire. The latex is collected in bamboo pots, but is also scraped off the tree with the fingers and transferred to the collecting vessels, so that the product is far from clean. Coagulation is effected by placing the bamboo pots in a vessel of water, and heating this to boiling point. The product thus becomes a sausage-shaped mass containing much impurity. The yield of latex is greatly affected by the atmospheric temperature. The authors obtained the best results at a temperature 24° to 28° C. The latex is brownish-yellow in colour, thickish, and similar in the way it runs from the tree to that of *Ficus elastica*. It coagulates rapidly without addition of chemicals, yielding in a particular instance, 42 per cent. of rubber, which gave the following results on analysis:—Water, 28·32; ash, 0·62; caoutchouc, 60·76, and resins, 3·67 per cent. A sample collected by the natives, coagulated spontaneously, and very impure, was valued at 5·50 francs (4s. 4½d.) fine Para being 9·50 francs (7s. 6½d.) The authors recommend tapping on the herring-bone system, collecting in cups half filled with water, diluting again with an equal volume of water, and coagulating by the addition of a 1 per cent. solution of sulphuric acid. —E. W. L.

Latex of Djera costulata (Getah Jelutong); Coagulation of ——. R. Derry. Agric. Bull. Straits and Fed. Malay States, 1909 [12]; Gummi-Zeit., 1910, **24**, 1540.

The trees, which grew in the botanical gardens at Singapore, were tapped on the herring-bone system, at first daily, afterwards at longer intervals. Altogether 4350 grms. of latex were obtained, yielding 1660 grms. of Jelutong. Daily tapping was not advantageous as affecting yield of latex and gutta-like substance. The latex was passed through a sieve, mixed with twice its volume of boiling water, and then, while being stirred, with "Purub" solution (1 : 8) drop by drop (see this J., 1908, 1029). The coagulated mass obtained yielded when freed from liquid a white, firm, odourless ball, superior to the product obtained by means of sulphuric acid and creosote. The balls submitted for valuation to a Continental firm contained moisture, 29·23; resins, 54·12; and rubber-like substance, 15 per cent.—E. W. L.

Rubber [Manihot]; Preparation of —— on German East African plantations. A. Zimmermann. Der Pflanzer, 1910; Gummi-Zeit., 1910, **24**, 1545—1546.

The low prices obtained for *Manihot* plantation rubber from German East Africa are mainly due, in the author's opinion, to faulty methods of preparation. It is advisable to wash the rubber before sending it out from the plantations. In cases where the rubber is not washed on the plantation, it is advisable to work it as little as possible, and to send it out in such a form that as small a surface as possible is exposed to the action of moulds, etc. The darkening of *Manihot* rubber is probably due to the presence of a substance which darkens on exposure to the air, and there is little hope of success in attempting to destroy this in the dried rubber. It is found, however, that by the use of other coagulants than, for example, orange juice, a much lighter-coloured rubber can be obtained. "Purub" (this J., 1908, 1029) appears to be particularly effective, and hydrochloric acid, nitric acid, and oxalic acid have also proved useful. Good results were also obtained by soaking a thin sheet of rubber, coagulated by means of orange juice, in a 1 per cent. solution of oxalic acid for 18—24 hours and then drying it in the dark.—E. W. L.

Rubber industry of Japan. Gummi-Zeit., 1910, 24, 1478.

The progress of the rubber industry in Japan is indicated by the following figures for the imports of raw rubber:—

Year.	Weight in lb.	Value.
		£
1906	606,728	59,800
1907	693,125	78,600
1908	1,039,430	90,500
1909	1,331,826	150,000

The increase is chiefly due to the extended use of rubber tyres for 'rickshaws, mainly in Tokio and Yokohama. The life of these tyres is estimated at about 2 years. The price of Japanese tyres is lower than that of imported goods, but the latter are more economical in use on account of their greater durability. In Osaka there are some small works making shoe-soles, rubber balls, etc. Some of these only employ from 10—15 hands. Cable insulation and waterproof clothing are other branches of manufacture in operation. Raw rubber is imported from the Straits Settlements, East Indies, Great Britain and America. Attempts are however being made to obtain the raw material from Formosa where certain rubber trees are indigenous.—E. W. L.

Rubber goods; Effect of heat and cold on ——. P. Breuil Caout. et Gutta-percha, 1910, 4073—4077, 4169—4173; Gummi-Zeit., 1910, 24, 1473—1474, and 1540.

Tensile strength, elongation, and compression tests were made with four samples of rubber at temperatures of −10°, +10°, +50° and +100° C. Sample A was composed of Para rubber, 95 per cent. and sulphur 5 per cent.; B consisted of rubber 50 per cent., sulphur and mineral matter, 50 per cent.; C was a jointing rubber, less elastic than B, and D was a sample of ebonite. The test pieces of A, B, and C were 100×50×5 mm., that of D was 100×20×5 mm. Each test-piece was exposed to the temperature at which it was to be tested for half an hour before testing, and all parts of the apparatus involved were kept at the same temperature. The results obtained were as follows:—

A. Tensile strength and elongation.

Sample	Tensile strength in kilos. per sq. mm.				Elongation (of 20 mm. length) per cent.			
	−10	+10°	+50°	+100°	−10°	+10°	+50°	+100
A ..	0·100	0·070	0·110	0·08	510	650	625	605
B ..	0·320	0·310	0·315	0·346	415	425	480	575
C ..	0·698	0·560	0·365	0·420	110	117	125	135
D ..	1·850	2·15	1·50	1·35	5	0	10	5

B. "Permanent" extension (a) immediately after rupture, (b) 2 hours after rupture.

Sample	Extension in mm.							
	−10°		+10°		+50°		+100°	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
A ..	2	1	3·0	2	2	1	2	1
B ..	2·5	1	1	0·5	2	1	3·5	2
C ..	0·0	0·0	0·5	0	2	2	1·5	1
D ..	1	1	0	0	2	1·5	1	1

C. Load (a) at rupture, (b) at $\frac{1}{4}$ elongation, (c) at $\frac{1}{2}$ elongation.

Sample	Load in kilos.								
	+12°			+50°			+100°		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
A	18·7	11	15	21·3	9	12·8	16·2	8·8	12·2
B	108	13	36	80	20	32	58	19	32
C	149	85	115	136	58	105	105	37	80

In the following compression tests the samples were cylinders 30 mm. in height and 20 mm. in diameter.

D. Compression under given load.

Sample	Compression in mm. under a load of:							
	300 kilos.				500 kilos.			
	−10°	+10°	+50°	+100°	−10°	+10°	+50°	+100°
A ..	26·0	25·0	27·0	24·0	—	—	—	—
B ..	22·0	22·0	25·5	25·0	23·5	23·5	27·5	24·0
C ..	7·0	9·5	14·5	14·0	16·5	17·5	19·5	19·5
D ..	1·0	1·0	2·0	8·0	1·5	1·0	3·0	11·0

E. Load required to compress the cylinders to (a) $\frac{3}{4}$, (b) $\frac{1}{2}$. (c) $\frac{1}{4}$ of their original height. (* indicates that the cylinder was crushed.)

Sample.	Load in kilos.											
	−10°			+13°			+50°			+100°		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
A	11·5	24·5	72·0	11·0	17·6	76·0	11·0	25·0	100·0	10·5	15·5	75·0
B	11·8	47·0	79·5	12·0	47·0	72·0	25·0	48·0	68·0	14·0	53·0	80·0
C	389·0	660·0	1000*	555·0	620·0	1000*	280·0	453·0	1000*	238·0	405·0	1000*

—E. W. L.

Rubber ; Physico-chemical studies of ——. F. W. Hinrichsen. Z. angew. Chem. 1910, 23, 1345—1347.

The author summarises the more recent contributions to the chemistry of rubber made by himself and others. He regards the constitution of the hydrocarbon as being definitely settled by the researches of Harries (this J., 1905, 24, 148 ; compare this J., 1910, 707) and refers to the possibility of synthetic production. The determination of the molecular weight of the substance present in the globules of the latex has given results which indicate that this substance is not the comparatively simple compound supposed by Weber, the molecular weight found being about 3000 (this J., 1910, 34). The rubber is undoubtedly present in the latex as a typical colloid. Reference is made to the recent work on the optical activity of the rubber resins (this J., 1910, 224, 439), and on vulcanisation by means of chloride of sulphur (this J., 1909, 843, compare 1910, 770, 891). The reaction occurring in the latter process appears to be a true chemical reaction, but in presence of moisture it is accompanied by the formation of sulphur, and the adsorption of the latter by the rubber. The maximum addition of S_2Cl_2 was found to be represented by the formula $(C_{10}H_{16})_2.S_2Cl_2$. The results obtained by Stern (this J., 1909, 1050) who studied the hot vulcanisation of rubber by means of sulphur, point, as shown by Wo. Ostwald (this J., 1910, 890), to this being a case of pure adsorption. There is need, however, for further work in this connection.—E. W. L.

Rubber ; Theory and practice of the regeneration of ——. P. Alexander. Chem.-Zeit., 1910, 34, 789—791, 779—801, 807—809.

A résumé is given of the literature of (1) the constitution and synthesis of caoutchouc, (2) rubber substitutes, (3) vulcanisation, and (4) the regeneration of waste rubber ; an historical retrospect of the latter industry is also given. The vulcanising of rubber is regarded by the author as a chemical process as stated by Weber (this J., 1902, 712) and not as an adsorption process (compare this J., 1910, 890, 891). Attention is also drawn to the fact that most of the patents for the reworking of waste rubber are useless on account of their unpractical nature or of their being anticipated in all important points.—A. Sbld.

Rubber industry of Brazil. Board of Trade J., Aug. 4, 1910. [T.R.]

H.M. Legation in Brazil have furnished the following information relative to the rubber industry in that country : In 1908, 38,206,461 kilogs. of rubber, valued at £11,784,637, were exported, while in 1909 the exports amounted to 39,026,738 kilogs. valued at £18,926,061, the price per kilog. having risen from 16s. in 1908 to 31s. in 1909. These figures show that the statements which have been made that the increase of price was due to a reduction in the amount of Brazilian rubber collected were unfounded; on the contrary, there was a small increase of some 820,000 kilogs. in the production.

It is only reasonable to suppose that, as the rubber-bearing territory secured to Brazil by her late treaty with Peru is worked, and as the communications by river and the Madeira-Mamoré railway, which is in course of construction, are opened up, the production will largely increase. It must be remembered that Brazil has an enormous advantage over the plantations in other parts of the world ; in Brazil the only expense in connection with the production of rubber is that of gathering it, while in the case of cultivated rubber there are all the expenses connected with the plantation to be considered. On the other hand, owing to the care taken, the plantation rubber is put upon the market in far better condition than is that of Brazil.

Although the natural supply of rubber in Brazil seems to be almost inexhaustible, it appears that the authorities of the State of Pará are alive to the dangers of the competition of plantation rubber and of the wasteful collection of "seringa," the growth of which is confined to the Amazon. This they show by encouraging the laying out and cultivation of plantations and granting various privileges to the cultivators.

Patents.

Caoutchouc ; Process for separating —— from resinous products. G. F. Flamant, Paris. U.S. Pat. 965,098, July 19, 1910.

The substance is treated with a solvent in just sufficient proportion to render the caoutchouc gelatinous, and is then comminuted in an apparatus with horizontal shafts. It is next treated with a solvent for resins, and the extract collected in an evaporating apparatus, the operation being repeated until all resin has been removed, after which the residual caoutchouc is freed from the last traces of solvent *in vacuo*, with or without the aid of heat. —C. A. M.

Rubber compounds. J. Smith. Fr. Pat. 411,933, Jan. 25, 1910. Under Int. Conv., May 14, 1909.

See Eng. Pat. 1207 of 1910 ; this J., 1910, 707.—T. F. B.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Skins, "rough" and "rough tanned" under the Australian Tariff. Board of Trade J., July 28. [T.R.]

Skins, "rough," and "rough-tanned."

There is a possibility of confusion of the terms "rough" skins dutiable (at 20 per cent. *ad val.*) under No. 353 (B 3) and "rough tanned" skins, free under No. 355.

The "rough" skin is one which has been tanned, shaved, set up and plastered, strained and finished (stoned or fluffed). When finished it is ready for use, *e.g.*, ledger binding, for which it is used with the flesh side outwards, so all the finish is put on that side.

A "rough tanned" skin is one that has only been tanned, or tanned and tabled. The "tabling" really only stretches the skin and improves its appearance by removing the crinkles and creases. The following are the main features of a "rough tanned" skin *after* the tabling process :

(*a*) A rough surface on the flesh side, showing presence of flesh still adhering to the pelt.

(*b*) An unevenness of substance in the skin, *i.e.*, the skin is thinner towards the offal (bellies) and thicker towards the spine. There is in fact a perceptible ridge down the spine line.

In the finished skin this unevenness has been shaved off and the skin runs in even thickness (or substance) throughout. Skins which have been shaved cannot be regarded as "rough tanned."

Emulsion of fatty matters. Meunier and Maury. *See* XII.

Patents.

Sewage, waste liquors, etc., of all kinds ; Treatment of ——. [Purifying waste tan-liquors and extracting tannin]. E. Bonjean and E. Kohn. First Addition, dated Feb. 4, 1910, to Fr. Pat. 407,018, Sept. 14, 1909 (this J., 1910, 590).

This addition applies the purification process described in the chief patent to waste tanning liquors. The amalgamated aluminium plates are immersed in the liquid and the tannin deposits upon them. The deposit can be separated by ordinary chemical methods. The process can be used also for the extraction of tannin from the original substances containing it, as oak-bark, chestnut-bark, gall-nuts, etc.—J. H. J.

Indurated albuminoid compound. B. B. Goldsmith, New York. U.S. Pat. 965,137, July 19, 1910.

A thermoplastic compound is produced by subjecting an intimate mixture of gluten, formaldehyde, and a "converting agent" to heat and pressure.—J. A.

Tanning ; Process of ——. Fitzroy Tanning Co., Ltd. Fr. Pat. 412,533, Feb. 11, 1910.

See Eng. Pat. 2499 of 1910 ; this J., 1910, 580.—T. F. B.

Leather ; Process for waterproofing ——. The Rubber Tanned Leather Co., Ltd. Fr. Pat. 411,963, Jan. 27, 1910. Under Int. Conv., April 26, 1909.

See Eng. Pat. 9870 of 1909 ; this J., 1910, 289.—T. F. B.

Leather ; Process for waterproofing —— by means of gum balata. W. K. L. Dickson. Fr. Pat. 412,024, Jan. 28, 1910. Under Int. Conv., Oct. 7, 1909.

See Eng. Pat. 22,903 of 1909 ; this J., 1910, 832.—T. F. B.

Casein compound ; Indurated ——. B. B. Goldsmith, New York. U.S. Pat. 964,964, July 19, 1910.

See Eng. Pat. 412 of 1909 ; this J., 1910, 227.—T. F. B.

Glue ; Apparatus for the preparation of colourless ——. J. Lehmann, Paris. U.S. Pat. 964,980, July 19, 1910.

See Fr. Pat. 398,598 of 1909 ; this J., 1909, 897.—T. F. B.

XVI.—SOILS ; FERTILISERS.

Flocculation and deflocculation ; The phenomena of ——. E. E. Free. J. Franklin Inst., 1910, **169**, 421—438 ; **170**, 46—57.

After dealing briefly with the general question of disperse systems (suspensions, emulsions, etc.), it is pointed out that flocculation and deflocculation are relative terms and that it is more accurate to speak of the degree of flocculation. The phenomena of flocculation are not characteristic of any particular substance or substances but of the condition of the substance and of the medium in which it is dispersed. The degree of flocculation is influenced by many factors (temperature, electrical charges, etc.), especially by added substances ; indeed the stability of so-called permanent suspensions of clay, kaolin, etc., is due to the impurities present, which prevent flocculation. Most acids and neutral salts increase the degree of flocculation, whilst the stronger alkalis decrease it. The action of salts, acids, and alkalis is probably at least twofold : (1), on the mutual interpenetration (solubility) of the suspended particles and the medium ; (2), on the electric charges on the surface of the particles. Most organic liquid particle or emulsion colloids act as deflocculators by preventing increase in the degree of flocculation, probably by coating the suspended particles with liquid films. Applications of the phenomena of flocculation are found in the treatment of fine-grained precipitates and suspensions, the preparation of permanent suspensions, the working of clay, and especially in biological chemistry (coagulation, agglutination, etc.).

Flocculation in soils. In the case of soils the phenomena at gas-liquid surfaces frequently play a predominant part. In a moist but unsaturated soil, the water exists mainly in the form of thin films around the particles of soil, and where the particles come in contact, the water-films fuse, and the interstitial spaces become filled with a continuous water-film enclosing gas (air). The surface-tension forces at the fusion surfaces of the water films is the main cause of the formation and preservation of aggregates in soil. The water-content at which the activity of the films is greatest has been called the "critical moisture content." It is practically identical with the optimum water content for the growth of ordinary plants, and represents the condition in which the soil will respond most readily to cultural operations. For clays, the amount of water which corresponds to the maximum of flocculation ranges from 30 to 40 per cent. by weight ; for sands, from 3—4 per cent. ; and for ordinary loams, from 10—20 per cent. In clays, where the soil particles are very small, the interstitial spaces will be almost entirely filled with water, and the conditions of a suspension of solid particlea in a liquid are more nearly approached. The effects of substances dissolved in the water are due to their action : (1) on the flocculating forces at the liquid-solid surfaces, and (2) on the gas-liquid surface tension of the water ; and it is probable that these effects, especially the second, are important items in the action of fertiliser salts on the soil. A bibliography relating to : (1), suspension and flocculation in general ; and (2), the mechanics of suspension, is appended to the paper.—A. S.

Manuring of tropical culture plants. Fesca. Tropenpflanzer, 1910, **14**, 381—392.

The paper contains a general resumé of the conditions applicable to the manuring of tropical culture plants. A rational system of manuring requires the addition in the form of manure of less nitrogen, generally of more potassium and of a good deal more phosphoric acid to the soil than is contained in that portion of the plant which is harvested. For example, in Tokio a rice crop containing 84—109 kilos. of nitrogen, 23·8—27·8 kilos. of phosphoric acid and 45·5—79 kilos. of potash is obtained on soil which gives the best results when manured with 75 kilos. of nitrogen, 135 kilos. of phosphoric acid and 50 kilos. of potash. Manuring affects the quality of the crop, the excess of food being mostly found in the vegetative parts. Too much nitrogenous manure causes delay and unevenness in ripening, and has other adverse influences. An excess of potassium salts acts adversely in moist hot countries. In the case of cotton the crop contains 2½ times as much nitrogen and 1½ times as much potash as phosphoric acid, but the best results are obtained with manures containing from 2 to 8 times as much phosphoric acid as nitrogen and potash. The sugar cane contains large quantities of phosphoric acid and potash, and these substances are valuable as manures for the cane. Yet in Java, in many instances, only nitrogenous manures effect an improvement in the harvest. Nitrate-nitrogen gives a cane containing more sugar and of greater purity than ammonia-nitrogen, but the latter is preferable on account of its slower and more persistent action. This behaviour of Java soils is due to the fact that the manufacturing residues are burnt and the residues returned to the soil, so supplying all the plant requirements except that for nitrogen. Manures, which are decomposed with difficulty and sparingly soluble, act more quickly in the hot, moist tropics than in the temperate zone and as they are generally cheaper than the soluble manures they are to be preferred on economical grounds. Ammonium sulphate is more suitable than nitrate, and the sparingly soluble phosphates may be used with advantage in the tropics. Tropical soils often lack humus substances and the addition of such greatly improves the physical properties of the soil. Potash is best added together with organic manures. In soils rich in humus, which is very rapidly decomposed in the tropics, it is not advisable to add indirect manures. The addition of lime facilitates the formation of soluble potassium and magnesium salts which are washed out by the rain. Leguminous plants grow in the tropics without lime. All vegetable refuse should be returned to the soil.—E. F. A.

Phosphates of calcium. F. K. Cameron and J. M. Bell. J. Amer. Chem. Soc., 1910, **32**, 869—873. (Compare Bassett, this J., 1907, 317.)

The presence of potassium chloride in solutions containing calcium oxide and phosphoric anhydride increases slightly the lime content of solutions in equilibrium with dicalcium and monocalcium phosphates. The composition of the solid phases is $CaHPO_4,2H_2O$ and $CaH_4(PO_4)_2,H_2O$, with a region between where the composition of the solid is probably $CaHPO_4$; this has not been studied. This result agrees with Bassett's determination of the transition interval of $CaHPO_4,2H_2O \rightleftarrows CaHPO_4+2H_2O$.—E. F. A.

Plant food constituents ; Rate of extraction of —— from the phosphates of calcium and from a loam soil. J. M. Bell. J. Amer. Chem. Soc., 1910, **32**, 879—884.

The usual equation representing the rate of solution $dy/dt=k\,(A-y)$, where A represents the concentration of the solution when final equilibrium is reached has been adversely criticised by Mitscherlich and others (Landw. Jahrb., 1910, 39, 299) in the case of the rate of solution of the two phosphates of calcium. The rate of solution of a substance depends upon its exposed surface, and experiments are usually made with large crystals of low solubility, the surface changing but slightly during the experiment. Mitscherlich used powdered material in which the surface exposed must have altered considerably. However, the greater part of the phosphoric anhydride passed into solution in the first hour, and this is taken for the starting-point in the recalculation of the results. Tables are given showing that the usual equation describes very well both the rate of solubility of the calcium phosphates and the extraction of lime from a loam soil by water containing carbon dioxide. This agreement is in spite of the fact that the phenomenon measured also involves hydrolysis. —E. F. A.

Calcium cyanamide; Transformation of —— in arable soil. C. Ulpiani. Gaz. chim. ital., 1910, **40**, I., 613—606.

After a discussion of the conflicting views as to the manner in which calcium cyanamide is rendered available in the soil, numerous experiments are described, the results of which confirm the author's view that the transformation of cyanamide is, at least primarily, a purely physico-chemical process, in which micro-organisms play no part (see this J., 1908, 1167). There are two separate stages in the transformation of calcium cyanamide in contact with soil: (1), formation of urea; and (2), conversion of the latter into ammonium carbonate. Micro-organisms play no part in the first stage, since: (1), the velocity of the formation of urea is at a maximum at first and then gradually falls; (2), the reaction proceeds in a similar manner in concentrations incompatible with life, and the absolute amount of calcium cyanamide transformed increases with the concentration; (3), the transformation takes place in presence of antiseptics and with sterilised soil, and at a higher velocity at 100° C. than at the ordinary temperature; (4), similar results are obtained when sterilised animal charcoal is used instead of soil. The transformation of calcium cyanamide into urea is a surface phenomenon, due to the colloidal substances present in the soil. If the colloidal properties of the soil be destroyed by calcination or by treatment with acids or alkalis, the soil loses its property of transforming calcium cyanamide into urea, but regains it when mixed with a colloid, such as gelatinous aluminium hydroxide or silicate or gelatinous hydrated silicates (zeolites). In the first 15 mins. after contact of the calcium cyanamide with the soil solution, concentration takes place in the layer between the liquid phase and the solid phase, and then the prevailing conditions (high pressure, molecular condensation, ionic concentration, etc.) determine or accelerate the formation of urea by hydrolysis. The author has not been able to decide definitely whether or not micro-organisms take part in the second stage of the process, the transformation of the urea into ammonium carbonate. The agricultural utilisation of calcium cyanamide is rendered possible only by the fact, experimentally proved by the author, that whilst in aqueous solution in glass vessels, a slow polymerisation into dicyanodiamide takes place, in presence of soil, rapid transformation into urea occurs.—A. S.

Lead arsenate; Composition of ——, and its action on foliage. J. K. Haywood and C. C. McDonnell. U.S. Dept. Agr. Bureau of Chem., Bull. No. 131, 1910, 50 pp.

Lead arsenate is used extensively in the United States for the protection of fruit trees from the larva of the gypsy moth. The composition of the lead arsenates on the market varies within wide limits. The same is true of the products obtained according to any of the published prescriptions, owing to the variable composition of the substances (particularly of the sodium arsenate) employed. For this reason it is advisable to prepare the lead arsenate by adding a solution of lead acetate or lead nitrate to a solution of sodium arsenate until a potassium iodide test-paper shows the presence of an excess of lead. As a result of spraying experiments conducted in two seasons, it was found that apple foliage sustained no injury from three applications of a lead arsenate solution containing $1\frac{1}{4}$ lb. to 50 galls. water. In the case of the peach, in one season no injury was observed, but in the other severe damage to foliage and fruit followed the use of the same water and chemicals. It is probable that the injury in the latter case was due to soluble arsenic compounds produced from the lead arsenate by the action of heat and moisture. In the second year the climatic conditions were most favourable to such a decomposition. The solution of the arsenic seems to be due chiefly to the presence of small quantities of salts (*e.g.*, sodium chloride) in the water used. When distilled water is employed, or when lime is added to the spraying mixture, the injury to foliage is much diminished.—R. V. S.

Fertilisers in Russia. Board of Trade J., Aug. 11, 1910. [T.R.]

H.M. Consul-General at Odessa reports as follows:—The use of fertilisers has begun in Russia, and the demand is already a growing one, as will be seen from the following table which shows the imports of fertilisers, etc. in recent years:—

—	1907.	1908.	1909.
	Tons.	Tons.	Tons.
Ground Thomas slag	69,271	64,813	97,693
Superphosphates	40,237	33,822	76,509
Stassfurt salts	17,749	22,327	36,255
Chile saltpetre	14,894	13,332	15,636

It is estimated that about 112,000 tons of artificial manures are made in Russia, viz., bone meal, horn powder, hide waste, ashes, superphosphates, etc. Artificial manures are used mostly in the Baltic provinces and in Poland. In the central parts of Russia locally-made fertilisers are generally used.

Patent.

Converting calcium cyanamide into nitrate of lime. Eng. Pat. 10,815. *See* VII.

XVII.—SUGARS; STARCHES; GUMS.

Sugar cane; The desiccation of ——. A. Nihoul. Bull. Assoc. Chim. Sucr. et Dist., 1910, **27**, 949—950.

Experiments have been made at the Preston works, Nipe Bay, Cuba, on the desiccation of sugar cane by a method similar to that used in drying beet slices. The dried cane will keep indefinitely, and it is proposed to ship it to the United States as raw material for the beet sugar factories which at present are idle for the greater portion of the year. If the project prove successful the output of a beet sugar factory will be trebled, and the relative cost of installation and upkeep thus considerably reduced. The exhausted bagasse will serve as raw material for the production of paper pulp, and its value for this purpose will, it is estimated, cover the cost of desiccation and transport of the cane.—A. S.

[Beetroot] slices; Conservation of sugar factory and distillery —— by means of "Lacto-Pülpe." R. Sarcin. Z. Ver. deut. Zuckerind., 1910, 105—107; and Z. Spiritusind., 1910, **33**, 359.

By inoculation with an acclimatised culture of the lactic acid ferment, called "lacto-pülpe," the author has been able to preserve beetroot slices in silos for a period of eight months without the development of the usual disagreeable smell. It is stated that slices thus treated may be fed to cattle with entirely satisfactory results, and a further advantage is that the loss due to the action of moulds is considerably diminished. The culture is used in the following way: Ten litres of water having in solution suitable nutrient salts, or five litres of raw beetroot juice diluted with an equal volume of water, are boiled for a quarter of an hour, and after cooling to 30° C. inoculated with the "lacto-pülpe." This liquid is transferred to a sterilised flask, the mouth of which is closed by a wad of cotton wool, then after having stood for 48 hours, it is mixed with nine times its volume of water and sprayed on the slices spread in layers 10 cm. to 15 cm. in height. The cost of the treatment is 0·1 franc per 1000 kilos. of slices (0·97d. per ton).—J. P. O.

Sugar factories; Evaporator incrustations in beet and cane ——. H. Pellet. Deutsche Zuckerind., 1910, **35**, 596—598. (Compare also this J., 1909, 1028).

From an examination of incrustations of multiple effects in beet sugar factories the author confirms the observation of other workers that the composition of the incrustation varies according to the vessel of the effect, and also deduces the following general rules governing the composition of the incrustation: Calcium carbonate predominates in the first vessel; the amount of silica, iron, and alumina deposited increases with the concentration of the juice; calcium oxalate deposits principally in the last vessels. If the juice has been sulphited then the amount of calcium sulphite separating out in any particular vessel is directly proportional to the amount of sulphited juice in the vessel, and inversely proportional to the amount of other substances present which are more readily deposited from solution than calcium sulphite or calcium sulphate; similarly the amount of phosphoric acid deposited increases with an increase of more readily precipitable bodies, but when the carbonate deposit already formed is small, then the phosphates deposit first. The same observation is found to hold good in the manufacture of cane sugar. It is also pointed out that the principal factor affecting the nature as well as the amount of the incrustation is the degree of efficiency with which the last filtration previous to evaporation has been carried out. Although the form of evaporator does not influence the nature of the incrustation, it determines to a large extent the amount of incrustation, the horizontal type giving the least satisfactory results in this respect. Amongst the many factors conditioning the composition of the incrustation, which are enumerated by the author, may be mentioned the ripeness of the beet; the quality and quantity of the lime used in defecation; the rapidity and extent of carbonatation; the temperature at which the saturations are operated; the number of filtrations; the extent of sulphitation; and the stage at which sulphitation is applied. In the cane sugar factory the evaporator incrustation is dependent upon the following conditions: The nature of the juice, whether extracted by simple milling, by diffusion, or by both milling and diffusion; the quality and amount of the lime; the method of clarification, whether simple defecation, or the carbonatation process; the method of separating the juice, whether by filtration or decantation, the method of decolorisation, whether by sulphitation, phosphoric acid or superphosphate, etc. The author is not in agreement with the statement of Peck (Deutsche Zuckerind. May 22, 1909) that the silica in the incrustation originates from the lime used in clarification, and shows that this source can only account for but a small proportion. His view is that the raw juice holds large amounts of silicic acid in the colloidal state, and that this is not separated by the presses, but passes into the evaporators where it is gradually deposited.—J. P. O.

Emulsion-lævulan, the product of the action of viscosaccharase on sucrose. M. W. Beijerinck and D. C. J. Minkmann. Koninkl. Akad. van Wetensch. Amsterdam, Wisk. en Natk. Afd., 1910, **18**, 898—902. Chem. Zentr., 1910, **2**, 147.

The mucilaginous substance produced by the action of *Bac. mesentericus* on sucrose (see this J., 1910, 710) is closely related to lævulan and has therefore been named emulsion-lævulan. It is readily obtained by preparing with 500 c.c. of tap water a solution containing 20 per cent. of sucrose and 0·05 per cent. each of potassium nitrate and di-potassium-hydrogen phosphate, inoculating with *Bac. mesentericus*, and keeping for 7—20 days at 27° C., when the liquid acquires a milky appearance. The emulsion-lævulan can be precipitated with alcohol. It is a snow-white, almost tasteless substance, slightly soluble in cold, and more easily in boiling water; $a_D = -80°$. It has no action on Fehling's solution. When decomposed by means of butyric ferments, with exclusion of air, it yields hydrogen, carbon dioxide, and volatile acids. When warmed with acids, emulsion-lævulan is converted into lævulose.—A. S.

Sugar anilides; Constitution and mutarotation of ——. J. C. Irvine and D. McNicoll. Trans. Chem. Soc., 1910, **97**, 1449—1456.

In continuation of previous work on the rotatory power and constitution of sugar derivatives containing nitrogen (Trans. Chem. Soc., 1908, **93**, 1429; 1909, **95**, 1545) the authors have now prepared and examined tetramethylmannoseanilide, tetramethylgalactoseanilide, and trimethyl rhamnoseanilide. Each of these new compounds was obtained in a crystalline form exhibiting extensive mutarotation. Their optical behaviour indicates that they are comparable with glucoseanilide and tetramethylglucoseanilide, and it would thus appear that the glucosidic structure indicated for the latter compounds (*loc. cit.*) is generally applicable to the anilides of the sugar group. Experimental evidence bearing directly on the constitution of sugar anilides is difficult to obtain, owing to the ease with which hydrolysis takes place. The authors were, however, able to apply the silver oxide reaction (methylation with silver oxide and methyl iodide) to the alkylated anilides, and found that in each case the compound resisted the methylating effect of the reagent completely. This result is consistent with the idea that the compounds in question are γ-oxides.—J. P. O.

Stachyose and lupeose. E. Schulze. Ber., 1910, **43** 2230—2234.

Stachyose, isolated by the author in 1890 from the rhizomes of *Stachys*, yields on hydrolysis a mixture of galactose, dextrose and lævulose. Determinations of its molecular weight point consistently to the formula, $C_{18}H_{32}O_{16}$, but the fact that the galactose composes one-half of the mixture of sugars obtained on hydrolysis, and the production of a trisaccharide and lævulose by the action of dilute acetic acid, prove almost conclusively that stachyose must be a tetrasaccharide. If stachyose be dissolved in four times its weight of water, and alcohol be stirred in until the solution becomes cloudy, crystallisation may be induced by sowing a crystal of stachyose. Stachyose crystallises in the rhombic system.

Lupeose is obtained from the seeds of certain species of *Lupinus*; it coincides almost exactly with stachyose in rotatory power and in the yield of galactose on hydrolysis, but it has not yet been obtained in the crystallised form. Lupeose yields the same products on hydrolysis as stachyose, and is therefore most probably a tetrasaccharide; it cannot however be regarded as identical with stachyose. Lupeose may be purified by taking advantage of the fact that it is far more soluble in methyl alcohol than in ethyl alcohol. The aqueous solution of the crude sugar is poured into methyl alcohol, the matters which are thereby precipitated are removed, and the lupeose is precipitated by the addition of absolute alcohol to the filtrate. The substance thus purified showed a rotatory power of $[a]_D = +148°$ in 5 per cent. solution at 17°—18° C. The carbohydrate obtained from *Phaseolus vulgaris*, when treated in the same way, is separated into two components, one of which shows $[a] = +140{\cdot}5°$ and is probably identical with lupeose. —J. F. B.

Hexoses: Formation of lævulinic acid from ——. W. A. van Ekenstein and J. J. Blanksma. Chem. Zentr., 1910, **2**, 292. (See this J., 1910, 833.)

Pentoses, methylpentoses, and hexoses all behave in an analogous manner when heated with dilute mineral acids. Pentoses yield furfural, methylpentoses yield methylfurfural, and hexoses yield ϖ-hydroxymethylfurfural. Furfural and methylfurfural remain as final reaction products, as they are not affected by dilute mineral acids, but ϖ-hydroxymethylfurfural is decomposed, with formation of lævulinic acid and formic acid.—A. S.

Carbohydrates ; Action of ultraviolet rays on certain ——. H. Bierry, V. Henri, and A. Ranc. Comptes rend, 1910, **151**, 316—318.

The authors have previously found that reducing substances are formed when solutions of certain polyoses (sucrose, gentianose, raffinose, etc.) and glucosides are exposed to ultraviolet rays. They now find that *d*-fructose, similarly treated, undergoes a molecular degradation, formaldehyde and carbon monoxide being produced from it. Such a decomposition of this sugar has not previously been effected without the aid of ferments or chemical reagents.—J. T. D.

Bagasse as a paper-making material. Raitt. *See* V.

Patents.

White sugar ; Process for the production of artificial honey or invert sugar syrup, and —— from raw sugar. M. Wolf, Landau Pfalz, Germany. Eng. Pat. 28,742, Dec. 8, 1909,

Raw sugar is covered with invert sugar-syrup containing 70 to 85 per cent. of sugar, in a centrifugal machine, or it is previously mashed with the syrup and then treated in a centrifugal machine. The syrup should be used at a temperature of about 50° C.—J. A.

Sugar ; Crystallisation of ——. J. F. P. Kestner. Fr. Pat. 412,285, Feb. 3, 1910. Under Int. Conv., Feb. 26, 1909.

The object of the improvements described is twofold, viz. : (1), to avoid keeping the concentrated syrup at too high a temperature for any length of time and so bringing about decomposition, and (2) to avoid the formation of very small crystals, which are liable to create difficulties in the subsequent centrifugal separation. These objects are achieved by carrying out concentration and crystallisation as a continuous process. The syrup is pumped from the triple-effect apparatus through a tubular heater, to an evaporator of the type described in Fr. Pat. 361,524 of May 29, 1905 (this J., 1906, 874). From this it passes through a tubular cooler to a series of (five) crystallising vessels which it traverses by gravitation. By passage through the tubular cooler the temperature of the syrup is rapidly reduced to within a degree or two of the crystallising point, and should this point be too high for safety, on account of the purity of the syrup, the latter is mixed in the cooler either with mother-liquors from the hydro-extractor, or with massecuite from one of the series of crystallising vessels. This admixture lowers the crystallising point, and at the same time assists in cooling the syrup. In the event of excessive cooling from this cause, the tubular cooler may be used as a heater to raise the temperature to just above the crystallising point. The use of the massecuite for this purpose is also helpful in conditioning the formation of larger crystals, owing to the presence of centres of crystallisation. The syrup in the crystallising vessels is kept agitated by means of tubular stirrers through which a reverse current of cooling water, or other cooling agent is caused to flow, thus ensuring that the temperature in each vessel is just below the crystallising point of the syrup in that particular vessel. This arrangement also assists the formation of the larger crystals.—E. W. L.

Gum giving a highly adhesive mass with cold water ; Manufacture of ——. J. Kantorowicz. Fr. Pat. 412,377, Feb. 7, 1910. Under Int. Conv., Feb. 13, 1909.

Starch, or starchy material, such as potatoes, or flour, is intimately mixed with water and heated in such a way —for example, by passage in a thin layer over steam-heated rollers—as to convert the starch first into paste, and then into a desiccated mass which can be removed from the roller in the form of flakes and, if necessary, ground. In order to effect this, the rollers, or other heating surface, must be maintained at a temperature of 110° C. A chemical reagent such as an alkali or an acid is added either before the heating process, or subsequently, in order to increase the adhesive power of the mass. For example, 100 kilos. of finely ground potatoes are mixed with 0·5 kilo. of hydrochloric acid (sp. gr. 1·2) and 300 litres of water. The mixture is converted by passing it over rollers heated to 110° C., first into a paste and then into a desiccated mass, which is removed from the rollers and ground. Instead of heating this mixture at once to 110° C., it may first be converted into paste at 75° C., and then desiccated at 110° C. As a second example of the process, 100 kilos. of flour are mixed with 500 litres of water, and the mixture is heated in a thin layer on rollers heated by steam to 120° C. The flaky mass obtained is coarsely powdered and mixed with 2 kilos. of powdered sodium carbonate. The amount of sodium-carbonate required is determined by trial and is dependent upon the degree of adhesiveness desired. —E. W. L.

Adhesive composition in powdered form ; Manufacture of an ——. F. Beckmann, Warsaw, Russia. Eng. Pat. 20,025, Sept. 1, 1909.

See Ger. Pat. 219,651 of 1908 ; this J., 1910, 582.—T. F. B

XVIII.—FERMENTATION INDUSTRIES.

Barley ; Notes on the hot-water steeping of ——. Goldacker. Z. ges. Brauw., 1910, **33**, 369—372.

The author has made parallel maltings of six different barleys with the hot-water and the usual cold-water steeps, pale malts being prepared. In the hot process the barley was run into water at 50° C. and at once subjected to a vigorous äeration and washing with Bothner's compressed air apparatus. Such äeration is an absolute essential of the process. This was continued for half an hour, the temperature falling to 40° C. The steep water was then discharged and the grain treated three times in succession with cold water ; during the rest of the time the water was changed every 12 hours in the ordinary course. The steeping results showed that the grain absorbed water more rapidly at first in the hot steeping process than in the cold process, but that subsequently the differences were equalised. The hot process did not permit any curtailment of the total duration of steeping. The parallel steeps behaved on the floor in practically the same manner. Owing to the more rapid absorption of water in the early stages, the hot-water steeps yielded fewer " swimmer " corns, and the bushel-weight and 1000 corn-weight of the malt were therefore slightly reduced. The yields of extract referred to the malt dry substance showed no appreciable differences. The development of the acrospires showed differences but of a very contradictory nature ; the same applies to the cutting test. The colour and clarification of the worts showed no differences. The protein percentages were generally somewhat higher in the hot-steeped malts than in the cold-steeped. The total malting losses were very slightly higher in the hot-steeped barley, but the loss in the form of " swimmers " was distinctly lower, so that the loss by respiration in the hot-steeped grain was appreciably higher, a difference of 0·58 per cent. being recorded. On the whole the author sees no advantage in the hot steeping process, except a better cleansing of the barley, but doubts strongly whether any technical or economic improvement is obtained. He prefers the äeration steeping process with the use of lime.—J. F. B.

Yeast ; Determination of the physiological condition of —— by its multiplication. W. Henneberg. Woch. f. Brau., 1910, **27**, 337—338, 350—352.

Hanging drop cultures of yeast are made in distilled water solutions of cane sugar and, after twenty-four hours, the increase in the number of cells is noted as is also the maximum number of cells produced from a single cell. In this way the condition of the cells as regards protein reserve is readily found. Observation has shown that yeast grown in the pure yeast apparatus, under conditions of full aeration, does not reproduce extensively, thus agreeing with the commonly noticed fact that such yeast does not crop well when first introduced into the brewery but yields normally after the first time round. This is explained by the fact that such yeast is rich in glycogen and poor in protein owing to the conditions of culture, but the balance is restored to the normal in the more natural circumstances of the fermenting vessel.—R. L. S.

Yeast; Preparation of the polypeptolytic ferment of ——. A. H. Koelker. Z. physiol. Chem., 1910, 67, 297—303.

A yeast extract which is very active in effecting the hydrolysis of polypeptides (alanylglycine) may be prepared as follows. 500 grms. of baker's yeast are thoroughly kneaded with 30 grms. of precipitated calcium carbonate, and treated with 30 c.c. of chloroform, which causes the yeast to liquefy in a short time. The mixture is kept for 3 or 4 days at the ordinary temperature, filtered, treated with toluene and incubated at 38° C., until the optical rotation is constant (10—40 hours). After filtration through infusorial earth, the clear, yellow liquid is ready for use. It has a greater hydrolytic power (as measured by its action on alanylglycine) than that of the fluid obtained from yeast by pressure. The activity is not affected by the addition of calcium salts, but if the liquid be not kept neutral with calcium carbonate during the treatment with chloroform, the product is much less active. The liquid prepared as described does not contain zymase.—R. L. S.

Fusel oil; Komarowsky's colour reaction for ——. T. von Fellenberg. Chem.-Zeit., 1910, 34, 791—792.

The author determines the fusel oil in brandy by Komarowsky's colorimetric method (this J., 1903, 1017, 1259; 1908, 248) as follows: 10 c.c. of the brandy distillate, after hydrolysis with alkali, are diluted to contain 30 per cent. of alcohol by volume (or 5 c.c. and 5 c.c. of 30 per cent. alcohol if the brandy contains much fusel oil) and mixed in a 100 c.c. flask with 1 c.c. of a 1 per cent. alcoholic solution of salicylic aldehyde; 20 c.c. of concentrated sulphuric acid are now added very slowly and then cautiously mixed with the liquid. After ¾ hour, 50 c.c. of 62 per cent. sulphuric acid (obtained by mixing equal volumes of acid and water) are added, and the colour compared with a standard in 30 per cent. alcohol. The colour is found to be fairly permanent in 62 per cent. acid, which in addition to being a suitable diluent, causes the disappearance of the yellowish colour given by salicylic aldehyde itself; the colorimetric comparison is rendered more exact and a series of standards is unnecessary. The reaction is given by the following bodies in addition to the higher alcohols of the fatty series and their esters: hydro-aromatic alcohols, phenols, compounds containing an ethylene linkage in the open chain or in the hydro-aromatic ring, and three-ringed substances such as thujone. It is not given by polyvalent alcohols, alcohols and phenols containing carboxyl groups, phenols having the hydroxyl groups in the *o*- and *p*-positions, and benzene derivatives with an ethylene chain having a carboxyl group in the side chain. Komarowsky's reaction can be utilised for the detection of impurities in a large number of substances.—A. Sbld.

Importation of spirits into Australia. Chem. and Drug., Aug. 6, 1910. [T.R.]

The Commonwealth Department of Trade and Customs has issued an Order (No. 1251), dated June 20, under the Australian Commerce Act, regarding the claims made relative to spirits containing medicinal properties on importation into the Commonwealth. It is stated in the Order that the description of spirits should be confined to the nature of the article, and that it cannot be truthfully asserted as a general statement that spirits are safe and beneficial, and that any statements, direct or indirect, which would infer medicinal properties, are not to be permitted. It is pointed out that this direction is not to affect any statement as to the *purity* of spirits. Importers are informed that an observance of these conditions will be strictly enforced from January 1, 1911, excepting as regards those spirits which are in bond on that date.

Manufacture and storage in bond. Continental regulations. F. T. Hasselbring. The Perfumery and Essential Oil Record, July, 1910, 167—168. [T.R.]

The burdens on the shoulders of Continental manufacturers are much lighter than those on English, and their respective Governments take a very great and active interest in favour of the spirit trade and its allies. Although in Germany and Austria there is a great and varied number of regulations pertaining to the manufacture, methylating, bonding and selling of spirit, they do not impose any special hardships so far as the pockets of the manufacturers are concerned. One of the main points is that the loss of interest involved in the storage for maturing purposes of preparations containing duty-paid spirit is almost entirely eliminated by the provision in the regulations that in respect of paying the duty, respite is granted for a time, varying between four months and two years. This is all the more significant and to the advantage of the Continental manufacturer in comparison with his English *confrère*, as the amount of the duty as levied in the countries in question is very much below that now in force in England. Worked out on the latest tariffs, the spirit duty in Germany is 3s. 3d. per proof gallon, and in Austria 3s. 6d. per proof gallon; that is to say, in both instances, less than one-fourth of the duty levied in England.

It is perhaps advisable to quote here some of the foreign regulations pertaining to the spirit duty, translated from the original.

The regulations in Germany provide as follows:—

"In respect of the payment of the excise duty, respite is to be granted for six months on application against full security. If the respite is requested for three months only, the security may be wholly or partly dispensed with, provided the debtor is known to be trustworthy and sufficiently safe."

"The Minister of Finance will determine the rules according to which the security is to be rendered and also those for cases in which payment of the duty can be demanded before the expiration of the respite."

("The hypothecation of spirit contained in a storeroom which is under lock and key, jointly of the Revenue and the debtor, is to be regarded as sufficient security.")

"The person to whom a respite of duty has been granted is to hand in an acknowledgment of such grant to the Customs Payment Office before the moment the duty would have fallen due. One acknowledgment may be given in respect of several amounts becoming due on the same day. In such acknowledgment the different amounts have to be entered separately. The amount of any one acknowledgment must not be less than £2 10s. The Customs authorities may grant exceptions:—The time of the respite counts from the day on which the duty falls due. The duty in respect of which the respite has been granted is due for payment at the latest on the 25th day of the month in which the time of respite expired, and if this day is a Sunday, or public holiday, on the previous working day."

The corresponding regulations in Austria provide that:—

"Persons wishing to take spirit from a distillery or bonded warehouse against payment of duty may obtain a grant of respite of payment of such excise (consumption duty) on request and against security, the duty which would be payable becoming due on the last day of the fourth month following the months in which the spirit was taken out of bond, and if such day be a Sunday or public holiday, the following working day."

"The Finance Minister is authorised to prolong the four months' respite of payment to two years in such cases where the spirit is to be used in the manufacture of alcoholic beverages requiring a long time for maturing."

"A respite of payment will only be granted during one distilling period (September 1st to August 31st).

"Excluded from grant of respite of payment are:—(1) All persons having been convicted previously for smuggling, unlawful dealings in business transactions, etc. (2) Bankrupts.

"The time for exclusion expires after a period of three years from the date of conviction, but the Finance

Minister has the right to shorten this period in deserving cases."

"Persons not paying the excise when due after respite of payment lose the right of further grant of respite during the distilling period; this refusal can also be extended over the subsequent distilling period. In such cases all outstanding amounts for duty up to the day of refusal become payable immediately, together with interest accrued, and execution will be levied at once if payment is not forthcoming."

A very important addition to the respite in the case of Austria is that spirits for use in preparations intended for exportation may be procured absolutely duty free. In such cases spirit is supplied from the bonded stores or distilleries against a special permit from the Customs, and the respective preparations may be manufactured without even so much as supervision by the Customs. On exportation the amount of spirit contained in the consignment is determined by the Customs, and the duty on any quantity exported less than that obtained duty free is charged up to the manufacturer.

There are still more points, though of minor importance, contained in the regulations which are favourable to the Continental manufacturer, but those given above will suffice to show under what serious disadvantages manufacturers in England are labouring.

PATENT.

ERRATUM.—This Journal, Aug. 15, 1910, p. 972, col. 1, line 27 from top, *for* "Woeller" *read* "Moeller."

XIXA.—FOODS.

Tomatoes; Utilisation of the residues obtained in the working up of ——. F. Perciabosco and F. Semeraro. Staz. sperim. agrar. ital., 1910, **43**, 260—272. Chem. Zentr., 1910, **2**, 169—170.

THE authors consider from the results of their experiments that it would prove remunerative to extract the oil from the residues obtained in the working up of tomatoes. The oil obtained by extraction with carbon bisulphide is of a yellowish colour and quite suitable for soap-making (compare also this J., 1908, 1072). The residue left after extraction of the oil is suitable for use as a fodder on account of its high content of digestible nitrogenous substances, or could be used as a manure.—A. S.

Avocado pear; Composition of ——. J. S. Jamieson. Chem. News, 1910, **102**, 61.

THE edible portion of the fruit is a semi-solid substance with a sweet taste. It is used as a condiment. A sample grown in Natal gave the following analytical results:—Water, 66·92; ethereal extract, 19·63; woody fibre, 4·94; sugar, 1·08; proteins, 5·71; and ash, 2·04 per cent. The ethereal extract was green and contained about 4 per cent. of resins. After removal of these the oil resembled bergamot oil and gave the following results:—Saponification value, 207; iodine value, 29·90; Zeiss butyrorefractometer reading at 20° C., 65; and oleorefractometer, +4. The composition of the Natal fruit differed widely from that of the American product, as given by Wiley (Foods and their Adulterations, p. 344).—C. A. M.

Oils and fats from rare fruits. Grimme. *See* XII.

Preparation of the polypeptolytic ferment of yeast. Koelker. *See* XVIII.

Kjeldahl determination of nitrogen in fatty substances. Brown. *See* XXIII.

PATENTS.

Cereals; Process of bleaching and ageing ——. J. M. Williams, Guthrie, Okla. U.S. Pat. 963,970, July 12, 1910.

A SOLUTION of nitric acid is electrolysed, the gases and vapours evolved are mixed with air, and the cereals are subjected to the action of the resulting mixture.—O. R.

Coffee; Extracting caffeine from ——. H. Trillich, Munich, Germany. U.S. Pat. 964,944, July 19, 1910.

THE coffee or other organic substance containing caffeine is immersed in a ten per cent. solution of an alkali and the liberated alkaloid extracted with warm water. The caffeine is removed from the water solution by extraction with a non-miscible solvent in the usual way.—J. A.

Caffeine; Extraction of —— from raw unground coffee-berries. Kaffee-Patent-Akt.-Ges. Fr. Pat. 412,550, Feb. 12, 1910.

THE invention consists in heating the coffee-berries in a closed vessel in presence of substances which combine with the caffeine, such as sodium salicylate. The mass is then distilled with steam under pressure, either directly or after covering with hot water containing substances favouring the solution of the caffeine. The distillate contains the caffeine, which can be extracted in the usual way. The remaining liquid is then evaporated and added to the berries in a vacuum or under pressure. Finally the berries are dried and are then ready for roasting.—J. H. J.

Milk poor in salts and sugar and normal in fat and casein; Preparation of a ——. P. Müller. Fr. Pat. 412,256, Feb. 2, 1910.

To a measured volume of cow's milk is added a determined quantity of casein and a corresponding quantity of water. The mixture is centrifugalised at a fixed speed, so that the fat separated contains the normal amount of casein from the original milk. This mass of fat and casein can also be obtained by coagulating whole milk with rennet, warming, and filtering. The mass thus obtained free from salts and sugar, is brought to a state of fine division by slow agitation and added to a volume of dilute butter-milk equal to that of the original milk taken. The butter-milk used is diluted with its own volume of water. The prepared milk is more easily digested by infants than whole milk or ordinary prepared milk.—J. H. J.

Albuminoid matter of vegetables; Apparatus for the extraction of ——. J. J. Geistdörfer. Fr. Pat. 412,654, Feb. 15, 1910. Under Int. Conv., Mar. 1, 1909.

THE process is designed for the extraction of any vegetable albuminoid matter which is soluble in alcohol, the precipitation of the extracted matter, and the recovery of the alcohol. The apparatus used comprises an extractor working under vacuum and a precipitating vessel with an agitator. The matter to be extracted is placed in a container with a perforated bottom in the extractor, the vacuum made and warm alcohol drawn in by means of the vacuum. After about 10 minutes the alcohol containing the albuminoid matter is passed into a second extractor by means of the vacuum, and a fresh supply of alcohol admitted to the first. By having three extractors in series, the vegetable matter in each of them can be extracted three times, the fresh alcohol always being passed over the nearly extracted material. The concentrated alcoholic solution is passed through a cooling worm into a collecting box, and a definite amount run off into the precipitating vessel containing the reagent (dilute acid, glycerin, etc.) and the stirrer started. The albuminoid matter is precipitated as short, non-glutinous, threads which settle well and are easily filtered off, and which are dried in the ordinary way. The alcoholic filtrate can be distilled and the alcohol used over again. The alcoholic vapours from the extractors are led to a condenser and the alcohol recovered. By having a large vacuum reservoir connected to the apparatus and exhausting the whole apparatus before beginning, it is not necessary to use the exhaust pump, except occasionally, during the process.—J. H. J.

Cheese curds; Process for obtaining a solid mass out of ——. L. Erasmus, Riga-Thorensberg, Russia. U.S. Pat. 964,504, July 19, 1910.

SEE Fr. Pat. 408,402 of 1909; this J., 1910, 580.—T. F. B.

Edible fat; Process of manufacturing an ——. D. Müller, Assignor to A. Meisels and J. Gottlieb, Krakow, Austria-Hungary. U.S. Pat. 964,674, July 19, 1910.

See Eng. Pat. 12,916 of 1906; this J., 1906, 903.—T. F. B.

Fat in milk and other dairy products: Process for the rapid determination of ——. N. Gerber's Co. Fr. Pat. 412,559, Feb. 12, 1910.

See U.S. Pat. 961,564 of 1910; this J., 1910, 896.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Sewage and sludge: Treatment of —— with nitrates. R. Weldert. Mitt. K. Prüfgs.-Anst. f. Wasserversorg. und Abwasserbeseit., 1910, **13**, 96—102.

A putrescible sewage can be rendered non-putrescible by addition of nitrate, the quantity of nitrate required for the decomposition of the putrescible substances depending upon the "strength" and character of the sewage. For sewage which has been passed through sedimentation tanks, the quantity of nitrate required may vary from 0·1 to 1 kilo. per cb. m., and the reaction may proceed for 2—4 days. The amount of insoluble matter separating from the sewage on standing is not appreciably affected by the treatment, which, however, leads to a diminution of the organic nitrogen (frequently very small) and the ammoniacal nitrogen, and of the permanganate consumed by the sewage. In many cases the decomposition of the nitrogenous compounds results in the production of free nitrogen. Sewage sludge behaves, on the whole, in an analogous manner to sewage on treatment with nitrates; after the treatment it separates into two portions, one of which sinks, whilst the other floats. From 1·5—1·8 kilos. of nitrate per cb. m. of sludge are required.—A. S.

Disinfection; Theory of ——. R. O. Herzog and R. Betzel. Z. physiol. Chem., 1910, **67**, 309—313.

The authors regard an antiseptic and the micro-organisms suspended in the solution as an heterogeneous system, and have therefore determined the apportioning of antiseptic between solvent and organism. For this purpose yeast has been used, for reasons of convenience, in preference to bacteria, the yeast being removed from the solution after a few hours' shaking and analysed. The authors find that silver nitrate is taken up in the manner which would be expected in a process of adsorption. Chloroform behaves similarly, except that the exponential of the curves obtained has an unusual value. Yeast takes up a constant quantity of formaldehyde independent of the concentration of the solution. Phenol remains unabsorbed.—R. V. S.

Disinfectants; The bacteriological testing of ——, and the results as affected by varying conditions. C. T. Kingzett and R. C. Woodcock. Brit. Pharm. Conf., Cambridge, July 1910. Pharm. J., 1910, **85**, 157—159.

A number of tables are given showing the results obtained with both emulsified and homogeneous disinfectants (alluded to by numbers) tested with various organisms, and also under slight modifications of the Rideal-Walker method. Taking the Rideal-Walker coefficient with *B. typhosus* as a standard, an increase for all the disinfectants examined was noted with *B. diphtheria* as the test organism, ranging from +11 to +100 per cent. Carbolic acid itself showed an increase of +80 per cent. With *coli* or *Staph. p. aureus* diminished values were obtained, which varied between −8 to −26 per cent. with *coli*, and from −17 to −56 per cent. with *Staph.* An exception was that carbolic acid with the latter organism gave the same value as with *B. typhosus.* The paper records the influence on the typhoid coefficients for different disinfectants of (1) raising the temperature of disinfection to 37° C.; (2) extension of the time of disinfection to 1¼ hours; (3) combined increase of temperature and extension of time. Again taking the ordinary Rideal-Walker coefficient as a standard, testing at 37° C. greatly increased the coefficients of 5 homogeneous disinfectants—as much as +125 per cent. with hydrogen peroxide (9—10 vols.) and +80 per cent. with carbolic acid. Two emulsified preparations tested under these conditions showed a slightly decreased value. A disinfection period of 1 to 1¼ hours increased the values of all but one of the disinfectants tested, the increment amounting to 400 per cent. with hydrogen peroxide. Testing at 37° C. for over 1¼ hours gave enormously increased values for hydrogen peroxide, formalin and carbolic acid— +875, +414 and +220 per cent. respectively, while four coal-tar disinfectants showed a small decrease. The authors draw attention to the low values obtained for hydrogen peroxide and formalin with the Rideal-Walker method, and consider that whilst the latter may very well serve for the comparison of "coal-tar" preparations, it does not express a true value for certain disinfectants of a different chemical nature. Results are also given for a series of coal-tar disinfectants tested in the presence of a quantity of organic matter both in solution and in suspension, as in the Lister Institute modification, and it is shown how the values of disinfectants having Rideal-Walker coefficients ranging from 4 to 20, are all brought within a few decimal points, *viz.*, 1·3 to 2·0 by the Lister test. With organic matter in solution alone the coefficients are only lowered a few points.—R. O.

Patents.

Water; Process for the rapid preparation of potable ——. M. Coplans, Headingly, Leeds. Eng. Pats. 13,702 of Dec. 13, 1909, 14,874 of June 26, 1909, 21,135 of Sept. 16, 1909, and 27,155 of Nov. 22, 1909.

An inorganic colloidal or "soluble" hydroxide of iron, alumina, magnesia or silica or certain colloidal forms of metal are added to the water to be treated and by rendering these insoluble by suitable means a gelatinous precipitate is formed which entangles floating particles. If the water contains dyestuffs and the like, finely powdered charcoal is added before or simultaneously with the soluble colloid to bring about their removal. A reagent which at once provides the soluble colloid and its coagulant is prepared by mixing finely powdered aluminium sulphate with more finely powdered lime, each rendered as far as possible anhydrous, charcoal being incorporated with the mixture if it is required.—J. A.

Water: Purification or clarification of ——. W. K. Richardson, Leavenworth, Kans., U.S.A. Eng. Pat. 3969, Feb. 17, 1910.

The water is pumped into the centre of a disc revolving in an air-tight chamber closed by a water seal. The heavy suspended matter in the water is forced to the periphery of the disc by blades and escapes by an opening regulated by a valve into a reservoir, whence it is discharged by the increased pressure of the contained air. The clarified water passes through another opening regulated by the above valve, and is also discharged by the increased pressure of the contained air. This air-cushion prevents racing of the water in the revolving disc and regulates the discharge.—J. H. J.

Filter for the purification of water, oil, and other liquids. F. Sehr. Fr. Pat. 412,045, Jan. 29, 1910.

The filter is made from quartz sand mixed dry with 5 per cent. of felspar and 15 per cent. of kaolin. This mixture is rammed into a hollow cylindrical mould and heated to about 1500° C., by which means it becomes hard and maintains its shape when the mould is detached. The top of the filter is closed by a plate carrying a slotted pipe passing down the interior. The filter is placed in a containing vessel closed at top and bottom. The water is admitted by an opening in the top and passes through the filter from the outside inwards and escapes by the slotted pipe through an opening in the bottom of the containing vessel. For cleaning the filter, the flow of water can be reversed by means of three-way taps at inlet and outlet and a by-pass pipe, so that the water passes from the inside of the filter outwards, and washes out the dirt through an opening in the bottom edge of the containing cylinder.—J. H. J.

Sewage purification plant. S. H. Adams, York. Eng. Pat. 22,834, Oct. 7, 1909.

The process is designed more especially for the separation and purification of sewage sludge. The sewage passes through a small tank over a paddle-wheel to break up the solids and into a channel in which screens, baffles, precipitants, etc., are placed at intervals, as well as a revolving drum. The solid matter removed by each of these appliances, drops through openings below into a pipe from which it is removed by a flush tank operated by the sewage or by storm water. The solids and the flush water pass to a tank from which they are raised by an archimedian screw and distributed over a coarse grade filter.—J. H. J.

Electrolytic purification of liquids; Apparatus for ——. S. Garrison, H. L. Williams, and J. E. McGinness. Fr. Pat. 412,584, Feb. 14, 1910.

The liquid is passed between plates of aluminium and is submitted to the action of an electric current by making and breaking the circuit at the times of the starting and the stopping of the flow, in such a manner as to maintain the passage of the current during a time sensibly longer than the flow of the liquid. For this purpose an alternating current is applied to the electrodes, and the breaking of the circuit by the stoppage of the flow is effected a little after the instant at which the flow ceases. By this means it is not possible for any portion of the liquid to escape the action of the current, and almost the whole of the organic matter, as well as the bacteria, is destroyed. The treated water passes successively either downwards or upwards through two filters filled with suitable material. —J. H. J.

Formic aldehyde; Preparation of ——. C. Bonhard. Fr. Pat. 412,501, Feb. 11, 1910.

The method consists in passing the vapour of methyl alcohol and air over finely-divided silver heated to redness, when the alcohol burns without flame and produces formic aldehyde. To prepare the silver, flax thread is immersed in silver nitrate solution and the liquid precipitated at the boiling point with formic acid; after evaporating to dryness, the flax is combed cautiously. The apparatus consists of an alcohol lamp, the upper portion of which is covered by a wire gauze chimney with a solid metal base resting on the lamp. Inside the chimney are fixed several rings of the silvered flax. Having removed the chimney and lighted the alcohol at the orifice of the lamp, the silvered flax is held in the flame until hot; the chimney is then replaced and the mixture of alcohol and air unites on the heated surface. The silver soon becomes red-hot and radiates sufficient heat, which is conducted by the base of the chimney to the lamp, to continue the vaporisation of the alcohol.—J. H. J.

Water; Process for purifying ——. J. Wetter, London. From J. D. Riedel A.-G., Berlin. Eng. Pat. 26,842, Nov. 18, 1909.

See Fr. Pat. 409,006 of 1909; this J., 1910, 779.—T. F. B.

Filters; Manufacture of ——. F. Sehr, Blankenheim, Germany. Eng. Pat. 2122, Jan. 27, 1910.

See Fr. Pat. 412,045 of 1910; preceding.—T. F. B.

Fats from effluents; Apparatus for removing ——. Eng. Pat. 2073, 1910. *See* XII.

Treatment of sewage, waste liquors, etc. [*Purifying waste tan-liquors and extracting tannin*]. Addition to Fr. Pat. 407,018. *See* XV.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Coca alkaloids; Extraction of, and products from ——. G. Cohn. Pharm. Zentralh., 1910, 51, 364—368.

Extraction of cocaine and allied bases. Coca leaves are moistened with sodium carbonate solution, 1:5, and extracted with ether, which removes all the alkaloids. The ether extract is shaken out with dilute hydrochloric acid and the bases again liberated from their acid combination by means of sodium carbonate. The mixed bases are then dissolved in a small quantity of hot alcohol; on cooling, the greater part of the cocaine crystallises out. The allied alkaloids are then obtained by evaporating the mother-liquor. The total alkaloids may also be isolated by precipitating the solution, freed from excess of acid, with a solution of zinc thiocyanate, or with a mixture of zinc sulphate and potassium thiocyanate. The precipitated alkaloidal zinc thiocyanates are very slightly soluble in water. The organic bases are liberated from this combination by treatment with sodium carbonate, and removed from the zinc carbonate, after drying, by extraction with benzene or with ether.

Ecgonine, $C_9H_{15}NO_3+H_2O$. The allied alkaloids are heated with an excess of hydrochloric acid, sp.gr. 1·1 to 1·2, for one or two hours, and the solution is cooled, filtered to remove the organic acid, and evaporated to dryness. The residue, after washing with a little warm water is almost pure ecgonine hydrochloride. From this the base may be liberated with an equivalent of alkali, or of alkali carbonate, and crystallised from alcohol.

Benzoyl ecgonine, $C_{16}H_{19}NO_4+4H_2O$. Ecgonine may be benzoylated in the usual manner with benzoyl chloride, or with benzoic anhydride. The best results are obtained by heating a solution of 2 parts of ecgonine in 1 part of hot water for about an hour with rather more than the theoretical amount of benzoic anhydride. After cooling, benzoic acid is removed by shaking out with ether, and from the aqueous portion benzoylecgonine separates as a crystalline mass. The mother-liquor may be treated for a further yield, or used for a subsequent benzoylation.

Cocaine, $C_{17}H_{21}NO_4$. Benzoylecgonine is esterified (methylated) in the usual manner.

Ecgonine methyl ester, $C_{10}H_{17}NO_3$. One part of ecgonine hydrochloride is treated with 10 parts of absolute methyl alcohol and the mixture is saturated with gaseous hydrochloric acid. The cold liquid is then treated with 10 parts of ether when the ester crystallises out as hydrochloride. It is sparingly soluble in alcohol, ether, benzene and petroleum spirit. From alcohol it crystallises in prisms, m.pt. 212° C. with decomposition. When the coca bases or their hydrochlorides are heated with methyl alcohol and acids, they are also converted into ecgonine methyl ester, with liberation of benzoic and other organic acids.

Ecgonine ethyl ester is obtained in a similar manner.

Cocaine is formed from ecgonine methyl ester, by heating the hydrochloride with benzoyl chloride until hydrochloric acid ceases to be given off. The cocaine hydrochloride formed is dissolved in water and the base liberated with sodium carbonate.

Cocaethyline; Homococaine, $C_{18}H_{23}NO_4$ is obtained by benzoylating ecgonine ethyl ester.

The processes for preparing *o*-phthalyldiecgonine methyl ester, isovalerylecgonine methyl ester, phenacetylecgonine methyl ester, dextroecgonine hydrochloride, dextroecgonine methyl ester, dextrococaine, benzoyl dextroecgonine ethyl ester hydrochloride, benzoyl dextroecgonine propyl ester hydrochloride, benzoyl dextroecgonine isobutyl ester hydrochloride, benzoyl dextroecgonine amyl ester hydrochloride, and other esters of the base are given.

Cocaine hydroiodide, $C_{17}H_{21}NO_4.HI$, occurs in colourless crystals sparingly soluble in water.

Cocaine nitrite, $C_{17}H_{21}NO_4.HNO_2$, forms pale yellow crystals very soluble in water; since it is very unstable it is put into commerce as a solution.

Cocaine lactate, $C_{17}H_{21}NO_4.C_3H_6O_3$, forms a yellowish, crystalline, honey-like mass, readily soluble in alcohol and in water.

Cocaine arabinate. Pure arabinic acid in aqueous solution is made alkaline with an alcoholic solution of cocaine. The alcohol is driven off; any free base is shaken out with ether; the aqueous portion is evaporated to dryness, and the residue, finely powdered, and again extracted with ether. This salt is used in the new method of producing lumbar anæsthesia.

Cocaine aluminium citrate is prepared by mixing 2 parts of neutral aluminium citrate with 1 part of cocaine and a little water. The almost clear mixture is evaporated to dryness at 60° C. and the residue extracted with ether to remove any free base, and with a very little water to remove aluminium citrate; after drying, the residue is powdered. It forms an antiseptic astringent anæsthetic.

Cocaine iodomethylate, chloromethylate, and bromomethylate are also described, as well as sundry oxidation and reduction products of cocaine and its allied bases.
—J. O. B.

Hyoscyamine; Specific rotatory power of —— and the relation between that of alkaloids and their salts. F. H. Carr and W. C. Reynolds. Chem. Soc. Trans., 1910, **97**, 1328—1336.

The authors find that the specific rotatory power of optically pure *l*-hyoscyamine is —22·0° in 50 per cent. alcohol. When this base is neutralised in aqueous solution, it has $[\alpha]_D$=—32·5°, the value being calculated for the basic ion. When converted into the *d*-camphorsulphonate, the salt has $[\alpha]_D$=—7·7°. The optical rotation of hyoscyamine is not affected by the concentration of its solution. The specific rotatory power of *d*-hyoscyamine when the free base is dissolved in 50 per cent. alcohol is +21°; when the base is neutralised with sulphuric acid and dissolved in the same solvent, $[\alpha]_D$ is +31·25° the value being calculated for the basic ion. The rotation of pure *l*-hyoscyamine *d*-camphorsulphonate decreases as the concentration increases; at the point of greatest dilution it has $[\alpha]_D$=—9·1°. There is no racemisation of the base, when converted into the camphorsulphonate and again liberated. Considerable differences in the optical rotation of certain alkaloids are produced according as they are dissolved in water or 50 per cent. alcohol. Hydrastine has $[\alpha]_D$=+115° in 50 per cent. alcohol, is optically inactive in 95 per cent. alcohol, and has $[\alpha]_D$= —49·8° in absolute alcohol. The following table shows the effect upon the optical rotation of several bases by neutralising them with mineral acids.

Free base.			Basic ion in solution of a salt.	
Alkaloid.	Solvent.	$[\alpha]_D$.	Acid used for neutralising	$[\alpha]_D$.
Cocaine	50% alcohol	—35·4	Hydrochloric	—78·5
Codeine	Water	—144·4	Hydrochloric	—133·8
Hyoscyamine	50% alcohol	—22·0	Sulphuric	—27·0
Hydrastine	50% alcohol	+115·2	Hydrochloric	+197
Nicotine ..	Water	—77·9	Sulphuric	+23·1
Quinine	50% alcohol	—170·5	Sulphuric	—262·1

When different acids are used to neutralise these bases and the salts dissolved in chloroform, differences are produced in the rotation value. A similar influence is produced upon the optical activity of an acid with an asymmetric carbon atom when this is combined with different bases.—F. Shdn.

isoQuinoline derivatives. Part V. Constitution of the reduction products of papaverine. F. L. Pyman and W. C. Reynolds. Chem. Soc. Trans., 1910, **97**, 1320—1328.

The authors propose to adopt the name *pavine* for the base, $C_{20}H_{23}O_4N$, m. pt. 201°—202° C., which has been termed "tetrahydropapaverine" by Goldschmiedt (Monatsh. Chem., 1886, **7**, 485; 1898, **19**, 324), and "1:2-dihydropapaverine" by Pyman (Chem. Soc. Trans., 1909, **95**, 1610). Pavine is always formed together with tetrahydropapaverine by reducing papaverine with tin and hydrochloric acid: its formation is not due to the presence of impurities. Laudanosine and N-methylpavine were obtained by the reduction of papaverine methosulphate with tin and hydrochloric acid. After removing the tin salts, laudanosine was precipitated by the addition of sodium carbonate and N-methylpavine was obtained by extracting this liquid with chloroform. Laudanosine hydrogen oxalate crystallises from alcohol in fine needles m. pt. 163°—165° C. (corr.); when crystallised from water it melts at 80°—82° C. (corr.). N-methylpavine, $C_{21}H_{25}O_4N$, crystallises from benzene in hard prisms, m. pt. 140°—141° C. (corr.). Several salts of this base have been prepared and are described. Pavine was heated with methyl iodide in chloroform, and the following substances, which had been formed, were isolated: N-methylpavine methiodide, m. pt. 118°—119° C. (corr.); N-methylpavine hydriodide, m. pt. 70°—87° C. (corr.); pavine hydriodide, melting at about 265° C. N-methylpavine is not reduced by either tin and hydrochloric acid or by sodium and amyl alcohol.—F. Shdn.

Kola (French Codex, 1908); Amount of caffeine in extract of ——. G. Allard. J. Pharm. Chim., 1910, **2**, 122—124.

Starting with kola nuts containing a normal amount of caffeine, it is possible to obtain therefrom an extract which does not conform to the Codex. If the official method be strictly followed there is always a loss of 3—4 per cent. of caffeine. The determination of the caffeine is often made on nuts previously dried at 100° C., whilst the extract is prepared from material not dried in this way. The author recommends that the material should be extracted till a colourless liquid is obtained, that filtration should be dispensed with, and that after the alcohol has been distilled off, the extract should be concentrated under reduced pressure.—F. Shdn.

Thebaine; Formation of pyrene from ——. M. Freund. Ber., 1910, **43**, 2128—2130.

The author has confirmed the production of pyrene, m. pt. 135°—140° C., from thebenol by distillation with zinc dust. The picrate of this hydrocarbon melts at 218°—220° C., and forms fine red needles. In thebaine the complex, $.CH_2.CH_2.N.CH_3$, acts as a bridge, the carbon atom being joined on to the phenanthrene residue in position 5 and the nitrogen to position 8 (Ber., 1905, **38**, 3236). Analogous observations have been made by Knorr respecting the constitution of morphine and codeine (this J., 1907, 943).—F. Shdn.

Gynocardin and gynocardase. C. W. Moore and F. Tutin. Chem. Soc. Trans., 1910, **97**, 1285—1289.

Under the action of hot barium hydroxide, gynocardin (this J., 1905, 558) yields barium gynocardinate and ammonia. The gynocardinic acid was methylated by means of methyl iodide and silver oxide, when methyl pentamethylgynocardinate, $C_{18}H_{32}O_{11}$, was produced. This substance is a thick oil boiling at 220° C. at 15 mm. On boiling with dilute sulphuric acid, it resinifies. The sodium derivative of gynocardin, $C_{13}H_{18}O_9NNa$, can be precipitated by adding excess of sodium ethoxide, or sodium hydroxide in water, to a solution of gynocardin in alcohol. It is soluble in water and methyl alcohol. Gynocardase (*loc. cit.*) rapidly hydrolyses gynocardin, which is only slowly hydrolysed by mineral acids. On the other hand, gynocardase acts very slowly upon amygdalin. Emulsin hydrolyses amygdalin rapidly, but acts on gynocardin slowly. Salicin is hydrolysed rapidly by emulsin, and slowly by gynocardase. Both enzymes have the same rate of activity towards *l*-mandelonitrile glucoside (this J., 1909, 258). Equimolecular quantities of gynocardin, amygdalin, and salicin, were boiled for 2 hours with a 2 per cent. aqueous solution of sulphuric acid; the amounts hydrolysed were, respectively, 6·5, 5·0, and 78·7 per cent. Gynocardin is not affected by diastase, and maltose is not changed by gynocardase. The glucoside, gynocardin, and the enzyme, gynocardase, both belong to the β-series.—F. Shdn.

Myrica Gale, L. (*Gale palustris* [*Lamk.*] *A. Chev.*); *Pharmacological study of* ——. E. Perrot. Bull. Sci. Pharmacol., 1910, **17**, 253—262. Chem. Zentr., 1910, **2**, 324.

The fresh branches of the plant when distilled without contact with steam yield 0·0452 per cent. of essential oil, of which 0·0369 per cent. can be separated from the aqueous distillate by decantation and 0·0083 per cent. by extraction with petroleum ether. The extracted oil has the sp. gr. 0·9190 at 25° C., and a rotatory power of about −6° in a 100 mm. tube. The decanted oil is a greenish-yellow liquid of sp. gr. 0·8984 at 25° C.; $[\alpha]_D^{25}$ = −5°16′. It is soluble in half its volume of 90 per cent. alcohol, but on addition of five or more volumes of alcohol, paraffins separate from the solution. The oil dissolves in 80 per cent. alcohol only on warming to 50° C. It has the saponification value, 17·98; ester value, 15·5; esters reckoned as linalyl acetate, 5·4 per cent.; alcohols present as esters, reckoned as linalool, 3·9 per cent.; saponification value after acetylation, 50·23; total alcohols (as linalool), 14·4 per cent. The oil begins to become cloudy at 5° C., but shows no signs of solidification even at —17° C. The aqueous-alcoholic extract of the plant contains no alkaloid or glucoside, but considerable quantities of a brownish, bitter resin, which is insoluble in water, soluble in dilute alkalis and alcohol, and has a drastic physiological action similar to that of aloes. The essential oil has a narcotic action. The action of the whole drug is much more powerful than that of the resin and essential oil taken individually.—A. S.

Asafœtida. J. C. Umney and S. W. Bunker. Brit. Pharm. Conf., July, 1910. Pharm. J., 1910, **85**, 147—149.

There are at least two distinct kinds of asafœtida in European commerce—one in the form of masses of a reddish or purplish red tint changing ultimately to a dull dark brown, and the other in the form of white tears, sometimes agglomerated and often containing pieces of stone covered with the dried milky juice; the white tears after many years acquire a pale yellowish brown colour, but never become purplish red. Experiments with typical commercial samples of the two kinds showed that whilst the percentage of volatile oil in the tears may sometimes equal or even exceed that in the purplish red masses, it is in general slightly lower. In both kinds, the content of volatile oil varies between 12 and 16 per cent. The tears however, and the tinctures prepared therefrom, have a much more pungent odour than the "mass" asafœtida, and from comparative experiments with tinctures prepared from the two varieties, it was found that the oil from the tears is richer in sulphur compounds. —A. S.

Oil of anise; Effect of age on the composition of ——. A. W. Knapp. Brit. Pharm. Conf., July, 1910. Pharm. J., 1910, **85**, 144—145.

As showing the effect of age on oil of anise, the author gives (see following table) the results of the examination of a sample of Chinese oil from star anise (*Illicium verum*), over twenty-three years old, together with corresponding figures for the fresh oil and for a sample of oil eight to ten years old, examined by J. F. Liverseege (Report of the public analyst for Birmingham, fourth quarter, 1909).

Age of sample.	Sp. gr. at 15·5° C.	Optical rotation (100 mm.)	Melting point.	Soluble in 90% (by vol.) alcohol.	Residue after evaporation at 100° C.	Iodine absorbed per cent. (Wijs)	Refractive index.	Fraction boiling above 230° C.
Fresh	0·980-0·990	0° to—2·0°	above 15° C.	1 in 3	9% (Umney)	115–125	1·5566 at 16·5°C.* (Parry)	15% (Umney)
Over 8-10 years	1·012	+0·2°	8° C.	miscible in all proportions.	18% (Umney) 25·8%	113	1·552–1·558 at 25° C.* (Hill and Umney)	—
Over 23 years	1·092	+1·5°	below —15° C.		63%	58	1·539 at 16° C.†	40%

* D line

† Sodium flame.

The residue after evaporation was determined by heating the oil in a shallow dish for 4 hours on the water-bath and 17 hours in the water-oven. The oil which had been kept for 23 years contained practically no anisic aldehyde or anisic acid and was neutral to phenolphthalein. It is concluded that the change in the character of the oil is probably due to polymerisation of the anethol to isanethol (liquid dianethol), $(C_{10}H_{12}O)_2$.—A. S.

Essential oil of Robinia pseudacacia. F. Elze. Chem.-Zeit., 1910, **34**, 814.

Large quantities of the fragrant blossoms of *Robinia pseudacacia*, which is widely distributed throughout Europe, were extracted with volatile solvents, the extract evaporated, and the residue freed from fats and resins by treatment with alcohol. The essential oil was dark in colour and when diluted with alcohol had the odour of the flowers. Its sp. gr. was 1·05 at 15° C., and it contained 9 per cent. of esters (calculated as methyl anthranilate), and a relatively large amount of indole. In alcoholic solution it showed a blue fluorescence. It boiled between 60° and 150° C., under a reduced pressure of 5 mm. In addition to the compounds mentioned, there were also present:—benzyl alcohol, α-terpineol, heliotropin, linalool, and ketonic or aldehydic bodies with a peach-like odour. Bases of a pyridine nature were also isolated, and the presence of nerol was regarded as probable.—C. A. M.

Sesquiterpene alcohols. H. Kimura. Ber. deutsch. Pharm. Ges., 1910, **20**, 293—297.

As the author has already obtained solid *iso*cryptomeriol from liquid cryptomeriol (this J., 1910, 43), he has endeavoured to obtain solid sesquiterpene alcohols from cedar wood oil and santalol. By the use of superheated steam on cedar wood oil free from hydrocarbons, a distillate was obtained which deposited crystals of cedrol after standing some months. When the same oil was treated with potassium and then distilled with superheated steam, the solid cedrol was deposited from the distillate in a week or two. The xanthate of this oil when decomposed yielded solid cedrol, behaving in this way like cryptomeriol. When santalol was converted into the xanthate and decomposed, no solid compound was obtained, but the optical rotation changed from —17° 15′ to —5°. No crystalline substances were obtained by treating these alcohols with solid carbon dioxide or ice, nor by the action of acetone on the potassium compounds.—F. Shdn.

Chemical changes effected by rays of different kinds. III. Conversion of benzoic acid into salicylic acid in sunlight. C. Neuberg. Biochem. Zeits., 1910, **27**, 271—272.

Besides uranium compounds (see this J., 1908, 1043), other metallic salts can act as catalysers accelerating chemical reactions caused by exposure to light. For example, benzoic acid when exposed to sunlight in presence of ferric salts is converted more or less rapidly into salicylic acid. In presence of a considerable quantity of ferric sulphate, 13 per cent. of the benzoic acid present was converted into salicylic acid by an exposure of 16 days in June in Berlin, whilst in Teneriffe at a height of 2200 m., the same result was attained by an exposure of 32 hours. Only small quantities of iron compounds are needed; ferrous salts also act catalytically, but to a lesser degree, and their activity depends upon the presence of oxygen. No formation of salicylic acid takes place in the dark, but artificial light acts similarly to sunlight. —A. S.

Hydrocyanic acid ; [Formation of —— from morphine, brucine, and vanillin]. A. Jorissen. Bull. Acad. roy. Belg., Classe des sci., 1910, 224—233. Chem. Zentr., 1910, **2**, 148.

If morphine, brucine, or vanillin be dissolved in excess of dilute (about N/1) nitric acid, and the solution allowed to stand for several days at the ordinary temperature, small quantities ot hydrocyanic acid are formed.—A. S.

Denatured alcohol [methyl alcohol and acetone] ; Detection of —— in tincture of iodine. G. Denigés. Bull. Soc. Pharm. Bordeaux, April, 1910. Nouveaux Remèdes, 1910, **27**, 306—308.

Detection of methyl alcohol. Ten c.c. of the tincture, in a large test-tube, are decolorised by a solution of sodium thiosulphate in an equal weight of water. The tube is then fitted to a tubular condenser, having a diameter of at least 7 or 8 mm. and ascending vertically 50 cm. before it is sharply bent. The tincture is gently boiled, until 2 c.c. of distillate have been collected. One c.c. of this is then tested as described in this J., 1910, 451, 585.

Detection of acetone. To 1 c.c. of the above original distillate, 1 c.c. of water, 2 drops of sodium nitroprusside solution, 5 : 100, and 2 drops of sodium hydroxide solution (sp. gr. 1·332) are added ; after mixing, a slight excess (5 or 6 drops) of acetic acid (50 per cent.) is added. On agitating, a reddish-purple colour appears if much acetone be present, or a pink tint with smaller quantities. The presence of acetone may be confirmed by treating 1 c.c. of the original distillate with 5 c.c. of water and 5 c.c. of mercuric sulphate reagent (mercuric oxide, 1 grm. ; sulphuric acid, 20 c.c. ; water, 100 c.c.). The tube containing the mixture is then plunged in a boiling water-bath. In the presence of acetone, a white precipitate will appear in 1 to 10 minutes.

These tests will detect the presence of one part of French denatured alcohol in 100 parts of tincture of iodine. —J. O. B.

Duty-free admission of chloroform for use in chemical works in the Netherlands. Board of Trade J., Aug. 11, 1910. [T.R.]

The Board of Trade are in receipt, through the Foreign Office, of translation of a Dutch Royal Decree of the 11th July providing for the duty-free admission, under certain conditions, of chloroform for use in chemical works in obtaining extracts from vegetable substances.

Errata.

This J. 1910, 371, col. 1, line 3 from top, *reverse the words* "caffeine" *and* "theobromine."

This J. 1910, 450, col. 2, line 33 from bottom, *for* "10° C." *read* "100° C." ; and line 18 from bottom, *for* "calcium chloride" *read* "calcium hypochlorite" ("chlorinated lime").

Patents.

p-Aminophenylarsinic acid ; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 28,361, Dec. 4, 1909.

Considerably increased yields of *p*-aminophenylarsinic acid are obtained by heating the di-aniline salt of arsenic acid, $AsO_4H_3,2C_6H_5.NH_2$, or a mixture of one molecule of aniline and one mol. of the mono-aniline salt of arsenic acid, or of two mols. of aniline and one mol. of ortho-arsenic acid, in such a manner that the water formed by the reaction is wholly or substantially retained in the reacting mass. The heating may be conducted at about 200° C., in which case the reaction is complete in about one hour.—T. F. B.

Aliphatic hydrocarbons with more than one double bond ; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8100, April 4, 1910. Under Int. Conv., April 8, 1909.

Saturated poly-acid bases containing at least four carbon atoms (*e.g.*, tetramethylenediamine or β-methyltetramethylenediamine) are completely alkylated, and their salts converted into quaternary ammonium bases, which are then heated or otherwise treated to produce the unsaturated hydrocarbon. Thus, tetramethylenehexamethyl iodide, obtained by the action of methyl iodide on tetramethylenediamine in presence of alkali hydroxide, is converted into the corresponding hydrate (*e.g.*, by means of silver oxide), which is decomposed on warming into water, trimethylamine, and divinyl. In a similar manner, methyldivinyl (b. pt. 33°—34° C.) is obtained from β-methyltetramethylenediamine.—T. F. B.

Formic acid ; Manufacture of concentrated ——. O. Imray, London. From Soc. Chem. Ind., Basle, Switzerland. Eng. Pat. 8438, April 7, 1910.

A formate is gradually introduced into a mixture of concentrated sulphuric acid and an indifferent diluent as free from water as possible, preferably formic acid, and when the reaction is complete, the mixture is distilled at ordinary or under diminished pressure.—O. R.

Guanidine compounds ; Process for making ——. Stockholms Superfosfat Fabriks Aktiebolag. Fr. Pat. 412,219, Feb. 1, 1910. Under Int. Conv., Feb. 4, 1909.

Dicyanodiamide, dicyanodiamidine, or their compounds are converted into the corresponding derivatives of guanidine when they are heated with water, under pressure, to suitable temperatures ; in some cases it is advantageous to add some inorganic compound which has no oxidising action, such as barium chloride. Yields of 98 per cent. were obtained by heating 40 grms. of dicyanodiamidine nitrate, dissolved in a litre of water, in an autoclave for an hour at 165° C. Ammonia and carbon dioxide are the by-products of the reaction.—T. F. B.

Urea ; Process for making salts of ——. Stockholms Superfosfat Fabriks Aktiebolag. Fr. Pat. 412,220, Feb. 1, 1910. Under Int. Conv., Feb. 4, 1909.

Salts of urea may be obtained in very high yield from cyanamides, particularly calcium cyanamide, by treatment with mineral acid, the concentration of the acid, temperature, and time of reaction being so adjusted that little formation of dicyanodiamidine and other compounds takes place. For example, by treating calcium cyanamide with 10 per cent. sulphuric acid at 50° C. for six hours, a 99 per cent. yield of urea sulphate was obtained ; again, a 97 per cent. yield of urea hydrochloride was produced by boiling the cyanamide with 20 per cent. hydrochloric acid for 15 minutes. At higher temperatures and concentration of acid the velocity of the reaction is greater, but the yield is lower owing to formation of dicyanodiamidine. —T. F. B.

Pinene ; Catalytic conversion of —— into camphene. British and Continental Camphor Co., Ltd. Fr. Pat. 412,668, May 7, 1909.

Pinene may be converted into camphene by subjecting it, either in the state of liquid or vapour, to the action of a suitable catalytic agent at temperatures between 200° and 300° C. The following substances are mentioned as being especially suitable :—Alumina, kaolin, silica, kieselguhr, clay, red phosphorus, calcium phosphate, and aluminium phosphate. It is stated that the pinene contained in 1000 kilos. of turpentine oil may be converted into camphene in ten hours, by boiling it, under a reflux condenser, with 50 kilos. of alumina.—T. F. B.

Vanillin ; Process for preparing —— from eugenol, isoeugenol, coniferin, or coniferyl alcohol. Genthe und Co. G. m. b. H. Ger. Pat. 224,071, May 19, 1908.

The known processes for preparing vanillin by oxidation have various disadvantages, such as impure products, low yields, etc. It is now proposed to treat eugenol, isoeugenol, coniferin, or coniferyl alcohol simultaneously with air and ultra-violet rays, at temperatures between 50° and 60° C. The substance to be oxidised may be used in powder or in solution in an indifferent solvent. In an example of the preparation of vanillin from eugenol, the yield amounted to 95 per cent. of the theoretical yield. —T. F. B.

Cinnamic esters of hydroxyarylurethanes, hydroxyarylureas, or hydroxyarylthioureas ; Process for preparing ——. Ges. f. Chem. Industrie in Basel. Ger. Pat. 224,107, Dec. 19, 1908.

Cinnamic esters of hydroxyaryl derivatives of urethanes, urea, or thiourea, are prepared by the action of cinnamic acid or its anhydride or a halogenide (or a derivative of these), with or without a condensing agent or diluent, on aminophenols the amino group of which is substituted by a carboxyl or thiocarboxyl group. These esters are stated to be of value in medicine, particularly for the treatment of tuberculosis.—T. F. B.

Xanthine bases ; Process for preparing halogenoxyalkyl-substituted ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 224,159, July 14, 1907.

Xanthine bases containing a free imino-group, when treated with halogen derivatives of alkylene oxides, are converted into the corresponding halogenhydroxyalkylxanthine derivatives. Thus, by the action of epichlorhydrin on theophylline, chlorohydroxypropyltheophylline is formed : this compound is converted by alkalis into dihydroxypropyltheophylline.—T. F. B.

Alkyl ethers of phenols or their derivatives ; Process for preparing ——. A. Einhorn. Ger. Pat. 224,160, Oct. 31, 1908.

Alkyl ethers of phenols or their derivatives (the alkyl groups may also be substituted by basic groups) are obtained by heating carboxyalkyl esters of phenols, either alone or in presence of catalytic agents such as zinc chloride, carbon dioxide being evolved in the process. It is not necessary to isolate the carboxyalkyl esters, but suffices to heat phenols or their salts with chlorocarboxylic alkyl esters, the alkyl group being substituted or not.—T. F. B.

Morphine esters of acidyl derivatives of aromatic hydroxycarboxylic acids ; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 224,197, June 19, 1909.

New esters of morphine are obtained by treating morphine with halogenides of acidyl derivatives of aromatic hydroxycarboxylic acids, Acidyl.O.Aryl.CO.X, where X represents halogen. The preparation and properties of *p*-acetoxybenzoylmorphine and *p*-carbomethoxybenzoylmorphine are described.—T. F. B.

Mono-iodosalicylic acid amide and its homologues ; Process for preparing ——. M. Haase. Ger. Pat. 224,346, Dec. 18, 1908.

The amide of mono-iodosalicylic acid or a homologue is obtained by treating salicylic acid amide or one of its homologues, in alkaline solution, with a solution of potassium iodide containing less free iodine than is necessary for the conversion of all the amide into its mono-iodo derivative.—T. F. B.

Codeine derivatives containing alkyl or aryl substituents in the alcoholic hydroxyl group ; Process for preparing ——. L. Knorr. Ger. Pat. 224,347, March 31, 1908.

When halogen-codides are heated, preferably under pressure, and in entire absence of water, with an alkali alcoholate or an alkali phenolate and an anhydrous alcohol, an alkyl or aryl group is introduced into the alcoholic-hydroxyl group of the codeine.—T. F. B.

Tuberculosis ; Process for producing a preparation for the diagnosis and cure of ——. W. Schultz. Ger. Pat. 224,396, April 30, 1909. Addition to Ger. Pat. 223,561, June 27, 1908 (see this J., 1910, 977).

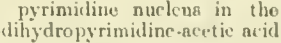
Pure cultures of tubercle bacilli are stirred up with the nutrient broth on which they have been cultivated, and the liquid is separated from the bacterial mass by pressure and then treated with ferric oxychloride as described in the principal patent.—T. F. B.

Mercury derivative of salicylic acid ; Preparation of easily soluble compounds of the ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 224,435, April 14, 1909.

Compounds of mercury salicylic acid, easily soluble in water and stable towards alkali hydroxides and carbonates, are obtained by treating it with amino-fatty acids and alkalis, or by first treating it with alkali and then with an amino-fatty acid. The products possess all the therapeutic properties of mercury salicylic acid, but are more active owing to their solubility.—T. F. B.

Pyrimidine derivatives containing mercury ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 224,491, April 28, 1909.

When the alkali salts of 2.6-dioxy-4-iminodihydropyrimidine-3-acetic acid,



$$\begin{array}{l}\mathrm{CO.CH_2.C:NH} \\ \dot{\mathrm{N}}\mathrm{H.CO.}\dot{\mathrm{N}}\mathrm{.CH_2COOMe''}\end{array}$$

is treated with a mercury compound, mercury is introduced into the pyrimidine nucleus in the 5-position. The dioxy-iminodihydropyrimidine-acetic acid is obtained by the action of cyanoacetic acid on hydantoic esters and treating the intermediate product with alkali. —T. F. B.

Ketone alcohols ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,087, Aug. 19, 1909.

See Fr. Pat. 409,403 of 1909 ; this J., 1910, 719.—T. F. B.

Terpenes from turpentine oils ; Process for producing ——. A. Skita. Fr. Pat. 411,012, Dec. 18, 1909.

See Eng. Pat. 13,902 of 1909 ; this J., 1910, 900.—T. F. B.

Coffee ; Process for extracting caffeine from ——. R. Hübner. Fr. Pat. 412,076, Jan. 31, 1910.

See U.S. Pat. 947,577 of 1910 ; this J., 1910, 293.—T. F. B.

Extracting caffeine from coffee. U.S. *Pat. 964,944. *See* XIXa.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photographic screen-plates for natural colour photography. H. W. H. Palmer, Tunbridge Wells. Eng. Pat. 16,313, July 13, 1909.

The coloured grains for preparing screen-plates are made from transparent casein or from gum tragacanth or other "East Indian or tree gum or like gummy substance" ; the material is stained, hardened, and ground to minute particles, which are spread in a single layer on plates coated with a "tacky" substance, from which they may absorb moisture (or moisture may be applied to them) ; they are then pressed to flatten them into a continuous layer, and the plate is finally coated with a varnish and a panchromatic emulsion in the usual manner. If desired, the material may be stained in the necessary colours after it has been formed into grains. It is claimed that the above process produces screen-plates of great transparency and brilliancy.—T. F. B.

Half-tone plates for printing purposes. J. Oliver, Oughtibridge. Eng. Pat. 17,303, July 26, 1909.

The lower or depressed surfaces of half-tone printing plates are coated with a suitable protective varnish, and a layer (or layers) of copper, silver, or other metal is deposited on the printing surface by electrolysis.—T. F. B.

Sensitised albumenised paper for photographic purposes. C. Hollingsworth, East Dulwich. Eng. Pat. 17,324, July 26, 1909.

A sheet of albumenised paper is floated for three minutes, with the prepared surface downwards, on a solution containing 1 oz. of silver nitrate in 10 oz. of distilled water; the adherent solution is removed by slight pressure between blotting paper, and the sheet is then floated, with the prepared surface upwards, on a solution containing 8¼ oz. of citric acid in 120 oz. of water; it is then immediately removed and dried. This treatment is said to produce a paper which may be kept for six months or more without deteriorating. The prints are toned in a solution containing 2 grms. of gold chloride and ⅛ oz. of anhydrous borax dissolved in 10 oz. of water. After the sensitising solution has been used a certain number of times (2½ quires of paper for 180 oz. of solution) it is strengthened by adding a stronger solution of silver nitrate containing a little ammonia and then treated with a "purifying solution" made by dissolving 1 oz. of potassium permanganate in 40 oz. of water.—T. F. B.

Cellulose acetate; Manufacture of films of ——. Knoll und Co. Fr. Pat. 412,503, Feb. 11, 1910. Under Int. Conv., Feb. 16, 1909.

In the manufacture of films from cellulose acetate, the solution of the material is spread on smooth surfaces and fixed by liquid precipitating agents, instead of by evaporation. It is convenient to use solvents of cellulose acetate which are soluble in water, and to fix the films by means of water. For this purpose the use of acetic acid as a solvent is claimed.—J. F. B.

Photographic images in colours; Process for obtaining ——. Comp. Gén. de Phonographes, Cinématographes, et Appareils de Précision. Fr. Pat. 412,517, May 3, 1909.

Photographs in natural colours may be obtained by printing successively on the same support, freshly emulsified for each printing, from three negatives of the same subject taken behind suitable screens, and toning each impression with a bath which will produce a transparent tone complementary to that of the screen behind which the negative was taken. The process is especially suitable for the production of coloured cinematograph films.—T. F. B.

Colour photography; Process for preparing a polychrome paper for ——. M. H. Poinsot. Fr. Pat. 412,628, May 6, 1909.

Paper on which colour prints can be obtained from negatives containing three-colour (line) screens, is prepared by applying to sensitised paper a system of coloured lines which will register exactly with that of the negative, the yellow, blue, and red lines of the paper screen registering with the violet, orange, and green lines of the negative screen, respectively. The screens are prepared in the usual manner by three stainings, the first and second of which are followed by the application of a reserve of fatty ink and the decolorisation of the exposed support.—T. F. B.

Photographic paper for producing grained photographs, and its preparation. A. Albert. Fr. Pat. 412,811, Jan. 28, 1910. Under Int. Conv., Jan. 29, 1909.

In order to prepare papers on which negatives can be printed producing black and white prints, without half-tones, the sensitive surface of the paper is covered with a number of separated grains, suitably coloured to prevent the printing of the half-tones. The grains may be applied by a printing process or by spraying a coloured solution on the surfaces of the paper.—T. F. B.

Carbon tissues for use in colour photography. E. Clifton and A. E. Wells. Fr. Pat. 412,043, Jan. 29, 1910.

See Eng. Pat. 23,273 of 1908; this J., 1910, 373.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives; Report of the Chief Inspector of —— for Cape Colony, for the year ending Dec. 31, 1909.

The following table gives the amount and values of explosives imported into the Colony for the years 1908 and 1909.

	1909	1908	1909	1908
	lb.	lb.	£	£
Dynamite blasting compounds and powder ..	479,050	4,374,050	16,909	149,039
Gunpowder	43,210	41,602	4,907	4,437
Nitrocotton	nil	237,449	nil	16,620
Fuse	—	—	12,161	9,914
Detonators	—	—	11,661	13,595

The reduction in the quantity of explosives imported amounted in value to £147,967. The reason for this decrease in imports was not due to decrease of consumption, but to increased facilities provided for manufacture in South Africa. The output of the Cape Explosives Company at Somerset West amounted, during the year, to a total of 346,761 cases of 50 lb. each, an excess over the previous year of 31,858 cases. 6132 cases were forwarded to Australia. The development of this oversea trade was retarded by:—(1) Opposition in Australia to the use of explosives made in South Africa, and to the fact that coloured labour is partly employed at the Cape Explosive Works. (2) By the disadvantage arising from the Australian Government allowing a preferential rate on explosives manufactured in Great Britain but not on those manufactured in South Africa. (3) Questions raised regarding the quality of the explosives.
—G. W. McD.

Trinitrotoluol. Times, Aug. 5, 1910. [T.R.]

An Order in Council has been made exempting trinitrotoluol from the provisions of the Explosives Act, 1875, when in process of manufacture and when kept or sold; also when conveyed or imported, provided it is packed in staunch and substantial barrels or in cases constructed of wood not less than one inch in thickness.

Erratum.

This J. 1910, 299; col. 1, line 17 from top, *for* "3m." *read* "30 m."

Patents.

Black powder and other explosives; Apparatus for the manufacture of ——. F. I. du Pont, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 964,550, July 19, 1910.

The apparatus consists of a receiving chamber with a heated closed lower portion, through which passes a travelling belt having on its outer portions orifices or perforations and intermediate perforations to receive the material to be formed, whilst means are provided for covering the first-named perforations to prevent them receiving material.—C. A. M.

Explosives; Method of considerably increasing the power of ——. M. Mallet. Fr. Pat. 412,751, Feb. 17, 1910.

The explosive is wrapped around, wholly or partially, with one or more sheets of a plastic explosive material capable of instantly developing sufficient heat to bring into rapid and complete interaction the ingredients of the inner explosive. Thus, as an example, it is suggested that such a plastic gelatinised sheet can be made by using 46 to 56 per cent. of nitroglycerin and 54 to 44 per cent. of collodion cotton.—C. A. M.

Smokeless powder. H. Maxim. Fr. Pat. 412,029, Jan. 29, 1910.

See U.S. Pat. 951,445 of 1910; this J., 1910, 518.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Indicators ; Quantitative application of the theory of —— to volumetric analysis. A. A. Noyes. J. Amer. Chem. Soc., 1910, **32**, 815—861.

A lengthy mathematical treatment of the theory of indicators applied to volumetric analysis is given. All indicators probably exist in two differently coloured structural forms in equilibrium, the pair of tautomeric substances showing sharply differentiated colours in acid and alkaline solution. The indicator can be treated in titrations as a single acid or base having an ionisation constant, which, though really a function of three equilibrium constants, can be determined by the colour changes exhibited in solutions of various hydrogen ion concentrations, or by methods such as the measurement of the electrical conductivity of the indicator acid or base or the study of the hydrolysis of its salt. The proportion of the indicator acid converted into its salt, or of the indicator base liberated from its salt depends on the ionisation constant (K_{IA} or K_{IB}) and on the hydrogen ion concentration (H^+). The end point of the titration is defined as the condition when a definite proportion (a) of the indicator as shown by the colour is so transformed. The term indicator function is given to the expression $K_1(1-a)/a=k$. The limits within which the fraction transformed can be varied are considered ; in the case of soluble one-colour indicators such as *p*-nitrophenol, variation from 0·1 to 25 per cent. is suggested as possible ; in the case of two-colour indicators like methyl orange the range is much smaller, since the fraction transformed must be large in order that its colour may not be masked by the colour of the untransformed part. Mathematical expressions are deduced for determining the fractional error (FE) incurred in the titration of all types of acids and bases and likewise for the maximum and minimum values which the indicator function (k) may have, without giving rise to a fractional error numerically greater than the assigned value. The deduction is made, amongst others, that it is advantageous to titrate in a solution as concentrated as possible whenever the titration is sensitive to error and a strong base or acid is involved in it. Finally the approximate expressions for the maximum, minimum and best values of the indicator-function are tabulated for the titration with a largely ionised base or acid of all possible varieties of acids and bases. In an appendix the ionisation constants of indicators are given as :—Dimethylaminoazobenzene, 7×10^{-4} ; methyl orange, 5×10^{-4} ; *p*-nitrophenol, 9×10^{-8} ; rosolic acid, 1×10^{-8} ; alizarin, 9×10^{-9} ; cyanine, 2×10^{-9} ; phenolphthalein, 2×10^{-10}. The provisional value of the indicator function attainable with some of these is :—Dimethylaminoazobenzene, 7×10^{-5} ; methyl orange, 5×10^{-5} ; *p*-nitrophenol, 9×10^{-5} to 3×10^{-7} ; phenolphthalein, 4×10^{-9} to 6×10^{-10}.—E. F. A.

Litmus solution ; Preparation of a sensitive and stable ——. A. Püschel. Oesterr. Chem.-Zeit., 1910, **13**, 185—186.

One hundred grms. of commercial litmus are extracted with successive quantities of hot water until the united extracts measure 600 c.c. The extract is then allowed to settle, preferably at a low temperature, and the clear solution is decanted and evaporated to a volume of about 200 c.c. After filtration, the solution is diluted with water to 300 c.c., 100 c.c. of 16 per cent. sulphuric acid are added, and the mixture is heated on a water-bath for 4 hours. The flocculent precipitate formed is separated by filtration and washed with cold water until all sulphuric acid has been removed and the faintly red wash water becomes bright blue when rendered alkaline. The precipitate on the filter is then dissolved in about 100 c.c. of hot alcohol, the latter being poured in small quantities at a time on the filter ; a few drops of ammonia may be added to the later quantities of alcohol. The alcoholic solution is now evaporated to dryness, the residue is dissolved in 600 c.c. of hot water, and the solution is neutralised.—W. P. S.

Barium ; Determination of —— [as sulphate]. M. Huybrechts. Bull. Soc. Chim. Belg., 1910, **24**, 281—283.

Results of experiments are given which are considered to indicate that for the accurate determination of barium as sulphate, it is best to use a considerable excess of the precipitant (ammonium sulphate) and to work with a solution containing about 0·5 per cent. of free hydrochloric acid. (Compare this J., 1910, 624.)—A. S.

Phosphoric acid and ammonium phosphate ; [Determination of ——]. T. E. Wallis. Brit. Pharm. Conf., July, 1910. Pharm. J., 1910, **85**, 137—138.

The author finds that the official (B.P.) method for the determination of phosphoric acid is considerably improved if the acid be evaporated with excess of heavy magnesia instead of with lead oxide. For the dilute acid, a weighed quantity is added to an excess of recently ignited magnesia and after evaporation on the water-bath, the residue is ignited till of constant weight. In the case of the concentrated acid, the magnesia is added cautiously, and in small quantities at a time, to the acid. The percentage of phosphoric acid in ammonium phosphate can also be readily determined by mixing the ammonium salt with excess of magnesia and igniting. Di-ammonium phosphate of the purity demanded by the British Pharmacopœia does not redden blue litmus paper, and it is suggested that this should be made an additional official test, since it would exclude many commercial samples of the salt deficient in ammonia.—A. S.

Vanadium and chromium ; The use of potassium ferricyanide in alkaline solution for the determination of ——. H. E. Palmer. Z. anorg. Chem., 1910, **67**, 448—453. Amer. J. Sci., 1910, **30**, 141—145.

The method is based upon the reactions represented by the equations :—

$$V_2O_4+2K_3Fe(CN)_6+2KOH=V_2O_5+2K_4Fe(CN)_6+H_2O,$$

$$Cr_2O_3+6K_3Fe(CN)_8+6KOH=$$
$$2CrO_3+6K_4Fe(CN)_6+3H_2O \qquad \text{and}$$

$$5K_4Fe(CN)_8+KMnO_4+4H_2SO_4=$$
$$5K_3Fe(CN)_6+3K_2SO_4+MnSO_4+4H_2O.$$

For the determination of vanadium, the solution is reduced, if necessary, by means of sulphur dioxide, after acidifying with hydrochloric acid, and excess of sulphur dioxide is removed by boiling in a current of carbon dioxide. The solution thus prepared is mixed with at least 10 times the theoretical quantity of potassium ferricyanide and a solution containing 6 grms. of potassium hydroxide, the total volume of solution amounting to not more than 100—125 c.c. The vanadium is then removed as barium vanadate by adding barium hydroxide, allowing the precipitate to settle, and filtering through asbestos, and the filtrate and washings are finally acidified with hydrochloric acid and titrated with permanganate. Chromium is similarly reduced and oxidised, and the chromate eliminated by precipitating with barium hydroxide ; the filtrate is then acidified with hydrochloric acid and titrated with permanganate by Bollenbach's method (this J., 1908, 1058) ; 15 times the theoretical quantity of ferricyanide should, however, be used. A correction must be made for the quantity of permanganate used by the ferricyanide. For the determination of vanadium and chromium in presence of each other, the solution, containing both elements in the higher stage of oxidation, is divided into 2 parts ; one part is reduced and oxidised as above, and then after standing for a few minutes, barium hydroxide solution is added, to precipitate barium chromate and vanadate, which are filtered off, and the filtrate, acidified with dilute hydrochloric acid, is mixed with a known quantity of permanganate in excess and titrated with $N/20$ potassium ferrocyanide; the other part (100 c.c.) is mixed with 10—15 c.c. of glacial acetic acid and hydrogen peroxide and is boiled for some minutes; it is then diluted and lead acetate solution is added, with vigorous stirring, after which it is boiled and filtered (by means of asbestos), and the precipitate of lead vanadate is washed and dissolved in potassium hydroxide solution; the solution is strongly acidified with sulphuric acid, and the vanadium, after reduction by sulphur dioxide, is determined by titrating the hot solution with permanganate. By subtracting the volume of permanganate solution from that previously used, the amount required by the chromium present is obtained.—F. Sodn.

Nitrogen; The Kjeldahl determination of —— in fatty substances. J. A. Brown. Chem. News, 1910, **102**, 51.

The frothing which takes place during the distillation part of the process when fatty substances have been digested with the sulphuric acid, may be prevented by diluting the acid mixture, and boiling it down to a volume of about 40 c.c. The alkali is then added and the determination is carried out in the usual way. The fatty acids which cause the frothing of the alkaline liquid appear to be identical with the insoluble volatile fatty acids obtained in the Reichert-Meissl distillation of butter fat.—W. P. S.

Determination of cellulose, and its application to wood and materials used in paper-making. Dmochowski and Tollens. *See* V.

Determining sulphur trioxide in fuming sulphuric acid. Vernon. *See* VII.

Colloidal barium sulphate. Kato. *See* VII.

Gravimetric determination of sulphuric acid in presence of alkali metals. Kato and Noda. *See* VII.

Volumetric determination of hydroferrocyanic and hydroferricyanic acids. Müller and Diefenthaler. *See* VII.

Detecting small quantities of cyanogen [cyanides, thiocyanates, etc.] in mixtures. Lockermann. *See* VII.

Sulphur in pyrites, burnt pyrites, and sulphates; Determination of ——. Zehetmayr. *See* X.

Determination of the physiological condition of yeast by its multiplication. Henneberg. *See* XVIII.

Komarowsky's colour reaction for fusel oil. Von Fellenberg. *See* XVIII.

Disinfectants; The bacteriological testing of ——; and the results as affected by varying conditions. C. T. Kingzett and R. C. Woodcock. *See* XIXb.

Detecting denatured alcohol [methyl alcohol and acetone] in tincture of iodine. Denigès. *See* XX.

Patents.

Gas calorimeter; Recording ——. C. H. and F. G. Beasley, Smethwick, and R. H. Bradbury, Oldbury. Eng. Pat. 16,647, July 16, 1909.

The combustion chamber is a copper vessel at the upper end of a long copper cylinder. The burner is a double cylindrical mantle of non-corrosive material, preferably silica, but may be of any construction. It is mounted on the end of a long tube, which is carried by a solid cylindrical block which, when the burner is placed in position in the combustion chamber after being lighted, closes the lower opening of the cylinder below the combustion chamber. The outlet from the combustion chamber is a pipe near the top, which is carried spirally downwards round the copper cylinder, and delivers the products of combustion at the bottom of the instrument, whence they either escape into the air or can be conveyed into an apparatus for analysis. The whole of this apparatus is contained in a closed water jacket, the supply for which is drawn from a tank carried on pillars above the jacket, where a constant level is maintained by the usual weir arrangement. The water flows out of this tank by a vertical tube, provided with a telescopic arrangement to adjust the rate of flow, through a quartz or glass jet, and falls into a deep cup, the bottom of which is a little below and the top considerably above the top of the water jacket. From this cup it travels by a tube to the bottom of the apparatus, so that it enters the jacket at the bottom. It leaves the jacket by a tube at the top and falls into a receiver with a vertical partition, arranged so that by rotating the receiver, the water can be either run to waste, or collected for a given time and weighed. The gas is passed in through a meter under pressure, and is mixed, by a fan and injector arrangement, with a quantity of air enough to burn it. The mixed gases pass through a coil of pipe in the water-tank so as to attain the temperature of the feed-water, thence through a water-vessel to become saturated with water-vapour, and finally to the burner. A constant difference of temperature is established between the incoming and outflowing water, from which, and from the rates of flow of gas and water, the calorific value is calculated. To measure and record this difference of temperature, metal vessels are placed in the entrance cup and in the water jacket above the combustion chamber, and are connected by capillary metal tubes with aneroid boxes, each thermometric system being filled with oil. The expansion or contraction of the oil causes alteration of shape of the aneroid boxes, and the differential effect of these is communicated by a system of levers to a thin metal strap wound round the axis of a pen lever working against a revolving cylinder in the usual way.—J. T. D.

Gas analysing apparatus; Automatic ——. C. Hohmann, Leipzig, Germany. Eng. Pat. 19,297, Aug. 21, 1909.

See Ger. Pat. 212,338 of 1907; this J., 1909, 1105.—T.F.B.

Gas; [Apparatus for] the analysis of ——. S. G. S. Dicker, London. From The Underfeed Stoker Co. of America, Chicago. Eng. Pat. 28,467, Dec. 6, 1909.

See Fr. Pat. 410,068 of 1909; this J., 1910, 844.—T. F. B.

Ebullioscope; Fractionating —— for the analysis of alcoholic liquids. P. Béraud. Fr. Pat. 412,574, Feb. 12, 1910.

Fat in milk and other dairy products; Process for rapidly determining ——. Fr. Pat. 412,559. *See* XIXa.

XXIV.—MISCELLANEOUS ABSTRACTS.

Colours assumed by colourless solutions of colourless substances, on solidification of their solvents. D. Gernez. Comptes rend., 1910, 151, 272—275.

Fused phosphorus dissolves a small amount of metallic mercury to a colourless solution; on cooling this remains superfused, but on seeding with a minute quantity of solid phosphorus, the mercury is thrown out of solution as the phosphorus solidifies, and the whole becomes black. Similar phenomena occur with solutions of mercuric iodide in many organic solvents in which it is but slightly soluble. Solutions in fused paraffins, naphthalene, spermaceti, stearic acid, heated to 100° C. and then rapidly cooled, become immediately yellow on solidifying, from separation of yellow mercuric iodide, which gradually changes to the red form. Solutions in chloral hydrate, heated to 70° C., or in ethylurethane, resorcinol, or catechol, heated to 120° C., behave similarly, save that the transformation from yellow to red is very much more rapid. Solutions in formanilide, salol, menthol, thymol, or benzophenone, remain superfused when cooled; but on seeding with the solidified solvent, solidification and separation of the yellow iodide occur, followed by the slow transformation into the red form. The phenomenon is similar to that in the case of the solution of mercury in phosphorus, save that the rate of propagation of the solidification is very much slower.—J. T. D.

Colloidal solutions; Filtration of ——. A. Schoep. Bull. Soc. Chim. Belg., 1910, 24, 278—280.

It is not correct to compare the action of a filter with that of a sieve: owing to electrical phenomena, adhesion, and adsorption by the filter of the substance in suspension, particles much smaller than the pores of the filter may be retained by the latter. In filtration through collodion membranes and in the "ultra-filtration" of Bechhold (see this J., 1906, 1177; 1907, 993; also Hatschek, this J., 1910, 125), a certain pressure (from 0·2 to 10 atmospheres) is needed. The author has succeeded in preparing membranes by means of which he has (1) filtered a colloidal solution of iron hydroxide, (2) separated a mixture of Prussian blue and hæmoglobin in aqueous solution, (3) separated colloidal arsenic sulphide, and (4) obtained a perfectly clear serum by the filtration of milk, without the use of external pressure. The membranes are composed of collodion modified by the addition of castor oil and glycerin to the nitrocellulose solution. By varying the proportions of the components, membranes of any desired permeability can be prepared.—A. S.

Trade Report.

Chemical industry of Germany. U.S. Cons. Report, July, 1910.

The U.S. Deputy Consul-General at Frankfort, states that Germany's chemical industries have in the first four months of this year increased their exports by about 25 per cent., compared with the corresponding period of last year, the values being $55,700,000 against $43,800,000. In spite of the higher tariff rates under the new law, the exports to the United States have not diminished. So far the profits exceed those of last year, while stocks of goods are lower. The new chemical factory at Heyden is competing strongly with the Badische Aniline and Soda Works in the sale of synthetic indigo; the factories producing tannin and other tanning stuffs are also competing with each other. The works manufacturing artificial fertilizers have already felt the competition coming from the sale of nitrogen preparations extracted from the air. The latter, it is stated, will soon be available in large quantities for the world markets, as the large plants which have been in course of erection in Norway are nearing completion.

Census of Production (1907). *Preliminary tables summarising the results of the returns received under the Census of Production Act,* 1906. [Cd. 5254.] 1910. Price 8d. (See this J., 1910, 652.)

The following short statement shows for the United Kingdom as a whole the gross output, the cost of materials used, the amount paid for work given out to other firms, the "net output" as above defined, the number employed, and the net output per person employed for the industries covered by the present report:—

——	Gross output. Selling value or value of work done. (1)	Materials used. cost. (2)	Work given out. Amount paid to other firms. (3)	Net output. Excess of column (1) over columns (2) and (3) (4)	Persons employed (except outworkers). Total. (5)	Net Output per person employed (excluding outworkers). (6)
	£	£	£	£		£
Iron mines under the Metalliferous Mines Regulation Act and Iron Quarries	1,970,000	244,000	—	1,726,000	11,008	157
Mines other than coal and iron	1,633,000	132,000	-	1,201,000	17,935	67
Copper and brass factories and workshops (smelting, rolling and casting)	17,040,000	14,059,000	29,000	2,952,000	20,827	142
Brass factories and workshops (finished goods)	6,315,000	3,138,000	28,000	3,149,000	36,541	86
Lead, tin, zinc, and other metal (except iron, copper, brass, gold, and silver) factories and workshops	9,002,000	7,862,000	10,000	1,130,000	8,194	138
Gold and silver refining factories	51,173,000	50,754,000	15,000	404,000	2,188	185
Wrought iron and steel tube factories	6,440,000	4,386,000	—	2,054,000	20,129	102
Wire factories and workshops	6,519,000	4,362,000	47,000	2,110,000	17,908	118
Cutlery factories and workshops	1,928,000	722,000	134,000	1,072,000	14,674	73
Tool and implement factories and workshops	3,665,000	1,554,000	74,000	2,037,000	23,455	87
Anchor, chain, nail, bolt, rivet, and screw factories and workshops	5,634,000	3,264,000	51,000	2,319,000	27,906	83
Lock and safe factories and workshops	961,000	342,000	9,000	610,000	7,418	82
Galvanised sheet, hardware, hollow-ware, tinned and japanned goods, and bedstead factories and workshops	15,191,000	8,956,000	72,000	6,163,000	69,700	88
Blacksmithing factories and workshops	2,269,000	899,000	—	1,370,000	19,848	69
Small arms factories and workshops	671,000	162,000	24,000	485,000	4,450	109
Railway carriage and wagon-building factories	9,609,000	6,027,000	14,000	3,568,000	28,193	127
Scientific instruments, apparatus, appliances, and accessories factories and workshops	2,526,000	993,000	26,000	1,507,000	14,122	107
Explosives, ammunition, and fireworks factories and workshops	4,184,000	2,631,000	—	1,553,000	13,446	116
Manufactured fuel factories	1,205,000	938,000	—	267,000	1,537	174
Total	147,935,000	111,725,000	533,000	35,677,000	359,479	—
Railways (construction, repair, and maintenance of permanent way, plant, rolling stock, etc.)	34,703,000	17,600,000	—	17,103,000	241,526	71
Royal ordnance factories	3,359,810	1,908,151	—	1,451,659	14,533	100

Summary of output of minerals from mines, quarries and brine wells for 1909. Mines and quarries: Home Office Report. Part I. [Cd. 5287.] 1910.

Mineral.	Output, 1909.	Output, 1908.
	Tons.	Tons.
Alum shale	9,120	5,373
Arsenic	2,880	1,936
Arsenical pyrites	179	3,218
Barium (compounds)	41,766	38,947
Bauxite	9,500	11,716
Bog ore	2,676	4,295
Chalk	4,436,923	4,261,585
Chert, flint, jasper, etc.	52,225	63,790
Clays and shale	14,067,810	14,407,470
Coal	263,774,312	261,528,795
Copper ore and copper precipitate	3,717	5,441
Diatomite	240	450
Fluor spar	42,483	34,700
Gold ore	5,538	7,123
Graphite	—	101
Gravel and sand	2,164,837	2,193,047
Gypsum	238,996	228,316
Igneous rocks	6,283,297	6,113,735
Iron ore	14,979,979	15,031,025
Iron pyrites	8,429	9,448
Lead ore	29,774	29,249
Limestone (other than chalk)	11,811,122	11,610,656
Manganese ore	2,768	6,308
Mica	23,927	21,161
Ochre, umber, etc.	16,313	15,396
Oil shale	2,967,057	2,892,039
Phosphate of lime	4	9
Rock salt	209,552	222,500
Salt from brine	1,613,192	1,621,459
Sandstone	4,600,084	5,024,832
Slate and slate slabs	402,184	414,329
Sulphate of strontia	14,042	16,469
Tin ore (dressed)	8,289	8,008
Uranium ore	6	71
Wolfram	376	233
Zinc ore	9,902	15,225

Books Received.

The Extra Pharmacopœia of Martindale and Westcott. Revised by W. Harrison Martindale and W. Wynn Westcott. Fourteenth edition. H. K. Lewis, 136, Gower Street, London, W.C. 1910. Price 12s.

This volume is of somewhat larger dimensions than former editions (med. 24mo.) and contains 1054 pages of matter, inclusive of the alphabetical index of subjects, and that of "Diseases and symptoms." There is an extensive posological table, and a list of poisons and their antidotes. The increase of matter is largely due to certain new chapters now added. These are upon the following subjects:—(1), *Acidi Lactici Bacilli*. In addition to a full resumé of the literature of the lactic acid bacilli therapy, the results of some original work by the authors, are given; (2), Organic arsenic compounds; (3), Iontophoresis, *i.e.*, "the electrical introduction into the tissues, of medicaments in the ionised condition"; (4), Radium; (5), A series of new pharmaceutical and chemical preparations. On patent or proprietary medicines, details of about one hundred more are given than in the former edition. Glossaries of words and phrases likely to occur as directions in foreign perscriptions, in the Danish, Dutch, French, German, Italian, Portuguese and Spanish languages, are given, and a tabulated arrangement appears of all the principal mineral waters, alphabetically arranged, giving the nature, chief chemical constituents, and the medical uses, and seasons. "Notes on antiseptic power of some chemicals and disinfectant preparations for surgeon's use," fill 13 pages. As a separate and supplementary volume, the following also now appears for the first time:—

Organic Analysis Chart. By W. Harrison Martindale, Ph..D. (A supplement of the Extra Pharmacopœia. Fourteenth edition.) H. K. Lewis, 136, Gower Street, London, W.C. 1910. Price 3s. 6d. net.

"Intended to assist in the recognition of a number of organic chemicals, both natural and synthetic, used therapeutically." It is stated that the data contained here, have been practically all obtained by personal trials in the author's laboratories. The chart fills pages 4—63, and deals with the tests for 319 individual substances. Following this is a list of "Corroborative Tests," for the substances, and the whole fills 80 pages.

Die Ätherischen Oele. Eine kurze Darstellung ihrer Gewinnung und ihrer Untersuchung. Eine Zusammenstellung ihrer wichtigsten Merkmale. Von Dr. Robt. Lelmbach. Heidelberg. Wilhelm Knapp's Verlag. Halle a. S. 1910. Price M. 16.

This volume, 8vo. size, forms one of the series of "Monographien über chemisch-technische Fabrikations-Methoden" Bd. XXI. It contains 321 pages of subject matter, with 25 illustrations, and an alphabetical index of subjects. I. The work commences with a definition of essential oils, then proceeding to consider the distribution of the vegetable essential oils in nature, and also the influence of culture on the development of the essential oil industry. II. History of distilling apparatus. III. Theory of distillation. IV. Preparation for the still. V. Distilling. VI. Calculations in steam distillation, &c. VII. Cooling and condensation, with special considerations necessary in the distillation of some oils. VIII. Preparation of some specially important essential oils in the land where the plants are cultivated. IX. Qualitative examination of the oils, physically and chemically. X. Determination of phenols, aldehydes, ketones, and other constituents of oils, such as hydrocarbons, saturated (methane series), unsaturated, hydrogenised cyclic hydrocarbons (terpenes and sesquiterpenes), and benzene hydrocarbons, etc. XI. Descriptive data on the foregoing, with the oxygenated constituents—alcohols, aldehydes, ketones, acids, and oxides of cyclic compounds; esters and ethers. XII. Sulphur and nitrogen compounds. From page 150 to 321 is a systematic tabulated arrangement of the essential oils under the following heads, "Names of oils"; "Derivation"; "Material for distilling, and yields of oil per cent."; "Spec. gravities of oils at 15° C."; Boiling pts. at 760 mm."; $[a]_D$ in the 100 mm. tube"; "Other properties"; "Proved constitutents present"; "Literature, and remarks."

An Introduction to the Chemistry of Paints. By J. Newton Friend, Ph.D., D.Sc. Longmans, Green, and Co., 39, Paternoster Row, London, E.C. New York, Bombay, and Calcutta. 1910. Price 3s. 6d. net.

8vo. volume, containing 196 pages of subject matter, with twenty illustrations, and an alphabetical index of subjects. The arrangement and classification of the text is seen in the following plan of the contents:—I. The air. II. Pigments containing oxide of iron. III. Miscellaneous oxide pigments. IV. Sulphur and the sulphide pigments. V. Sulphate pigments. VI. Carbon and the carbon blacks. VII. Carbonate pigments. VIII. Chromate pigments. IX. Prussian blue and ultramarine. X. Pigments with copper. XI. Organic colouring principles. XII. Lakes. XIII. Paint vehicles. XIV. Driers and linseed oil. XV. Resins and gum. XVI. Varnishes. XVII. Testing painter's materials.

Die Unterscheidung der natürlichen und künstlichen Seiden. Von Prof. Alois Herzog. Abteilungsvorsteher an der Preuss. Höh. Fachschule für Textil-Industrie zu Sorau in N.-L. Theodor Steinkopff's Verlag. Dresden. 1910. Price M. 3.

8vo. volume, containing 78 pages of subject matter, with 50 illustrations. The contents are arranged and classified according to the following scheme:—I. Methods of scientific investigation as applied to silk and like materials. II. Microscopic methods. (i) Instruments, etc. (ii) Tabulated results of microscopic characteristics of the most important natural and artificial silks. (iii) Preparation of the fibre sections. (iv) Fissures, impurities. Swelling in water. (v) Breadth of fibre of the most important artificial silks. III. Chemical methods. (i) Tables of the most important micro- and macro-chemical reactions. (ii) Preparation of the necessary reagents. IV. Optical methods. (a) Behaviour under the polarising microscope. (a) Capacities for refracting light. V. The ultramicroscope and its application. VI. Scheme for identification of silks by optical methods. VII. Scheme for identification silks by micro-chemical methods.

Engineering Chemistry. A Manual of Quantitative Chemical Analysis for the use of Students, Chemists, and Engineers. By Thomas B. Stillman. M.Sc., Ph.D. Chemical Publishing Co., Easton, Pa., U.S.A. 1910. Price $5.00. Williams and Norgate, 14, Henrietta Street, Covent Garden, London, W.C.

This is the fourth edition of the work (large 8vo.), and contains 725 pages of subject matter with 174 illustrations, and alphabetical indexes of names, and subjects. The following items from the table of contents, will serve to show the general course adopted of this system of analysis and valuation applied to chemical engineering. I. Proximate analysis of coal and coke. II. Analysis of iron ores. III. Determination of iron by the bichromate and permanganate methods. IV. Blast furnace slag analysis, etc. V. Analysis of boiler waters. VI. Sanitary analysis of waters. VII. Filtration of water. VIII. Water for locomotive work, etc. IX. Determination of the heating power of coal and coke, and calorimetry. X. Analysis of chimney gases, etc. XI. The Pintsch gas plant. XII. Liquid fuel and calorific value of petroleum oils, etc. XIII. Graphic method for determining blast furnace charges. XIV. The blast furnace as a power plant. XV. Standard methods for determining constituents of cast-iron, as adopted by the American Foundrymen's Association. XVI. Foundry chemistry. XVII. Analysis of tin plate. XVIII. Chemical and physical examination of Portland cement, and the composition of natural cements. XIX. Analysis of clay, fine sand, etc. XX. Tests of building stones, bricks, etc. XXI. Examination of paper. XXII. Composition and analysis of alloys; fuming sulphuric acid; sodium cyanide; gelatin-dynamites; also analysis of incandescent mantles, soaps, lubricating oils, illuminating oils, blown oils, Paris green, paints. XXIII. Pyrometry. The electrical units. Energy equivalents, etc.

Census of Production (1907), Preliminary Tables summarising the Results received under the Census of Production Act, 1906. Part IV.—[Cd. 5,254]. Price 8d. *See under* Trade Report, p. 1041.

Mines and Quarries: General Report with Statistics for 1909. By the Chief Inspector of Mines, Part I. District Statistics. [Cd. 5,287]. Price 8½d.

Statistics of the persons employed, output and accidents at mines and quarries in the United Kingdom in the year 1909, arranged according to the inspection districts, to which are added "Comparative Tables" showing the number of persons employed, output, and accidents in mines for each year from 1873 to 1909, and in quarries from 1895 to 1909. (See also p. 1042.)

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

18,511. Morton. App. for mixing or beating liquids or semi-liquids. Aug. 5.

18,677. Perks. Plate for rectifying, fractionating or distilling columns. Aug. 8.

18,698. Société l'Air Liquide (Soc. Anon Procédés Georges Claude). Desiccation of air and other gases.* [French Appl., Aug. 9, 1909.] Aug. 8.

Complete Specifications Accepted.

18,605 (1909). Smith, Mitchell, Askham and Hey. Method for the recovery of volatile solvents and the like. Aug. 17.

1199 (1910). Pottier. App. for drying any desired substance. Aug. 10.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

18,400. Bedford and Williams. *See under* VII.

18,401. Bedford and Williams. Catalytic synthesis of methane. Aug. 3.

18,405. Seaton-Snowdon and Young. Raising the flash-point of spirits and oils. Aug. 4.

18,406. Phillips. Construction of retorts to improve the quality of coke. Aug. 4.

18,458. Henri, Helbronner and Von Recklinghausen. App. for treating opaque liquids in thin films by ultra-violet rays. [Addition to No. 12,948 of 1910.] Aug. 4.

18,495. Brown. Gas retorts. Aug. 5.

18,825. Tunks and Jones. Furnace. Aug. 10.

18,922. Hiby. Charging of coke ovens. Aug. 11.

18,962. Lunt and Hartley. Circular kilns or ovens. Aug. 12.

19,008. Breitbart. Process and app. for ascertaining the proportions of ignitable admixture in the air.* Aug. 12.

19,022. Mathot. Regeneration gas producers.* [Belgian Appl., Aug. 31, 1909.] Aug. 12.

19,030. Arsem. Filaments for electric incandescent lamps.* [U.S. Appl., Aug. 18, 1909]. Aug. 12.

19,077. Siemens and Halske. A.G. Manufacture of metallic filament incandescent lamps*. [German Appl., June 9, 1910.] Aug. 13.

19,095. A. E. G. Union Elektricitats-Ges. Manufacture of tungsten filaments.* [Austrian Appl., Aug. 14, 1909.] Aug. 13.

Complete Specifications Accepted.

13,428 (1909). Masters and Hansford. App. for charging and discharging gas retorts and coking ovens. [Addition to No. 9057 of 1909.] Aug. 17.

13,589 (1909). Craig and Co. and Murray. Apparatus for refining paraffin wax. Aug. 17.

15,747 (1909). Laing. Liquid-fuel furnaces. Aug. 17.

17,889 (1909). Schuster. Regenerative coke-ovens. Aug. 10.

18,024 (1909). Collins. *See under* IX.

24,014 (1909). Du Thil. Producer gas plants. Aug. 10.

24,725 (1909). Sheldon. Gas producers. Aug. 10.

25,360 (1909). Simonin. Utilisation of materials employed for purifying illuminating gas. Aug. 10.

25,818 (1909). Ballantine. *See under* X.

2887 (1910). Reuleaux. Gas producers. Aug. 10.

4069 (1910). Hiby. Coke ovens. Aug. 10.

IV.—COLOURING MATTERS AND DYES.

Applications.

18,310. Newton (F. Bayer und Co.) New substantive azo dye-stuffs. [Addition to No. 9620 of Aug. 2, 1910.]

18,364. Johnson (Badische Anilin und Soda Fabrik). Azo colouring matters. Aug. 3.

18,761. Imray (Meister, Lucius, und Brüning). New form of indigo. Aug. 9.

19,000. Bloxam (Chem. Fab. Griesheim Elektron). New mono-azo dyestuff especially suitable for preparation of pigments.* Aug. 12.

Complete Specifications Accepted.

18,117 (1909). Imray (Meister, Lucius, und Brüning). New vat dye-stuffs. Aug. 10.

18,461 (1909). Wetter. (Chem. Fab. Grünau Landshoff und Meyer, A.G.) Manufacture of new alizarin preparations suitable for dyeing and printing. Aug. 17.

23,181 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of halogen derivatives of indigo. Aug. 17.

23,874 (1909). Johnson (Badische Anilin und Soda Fabrik). Reduction of indigo colouring matters. Aug. 10.

23,875 (1909). Johnson (Badische Anilin und Soda Fabrik). Vat colouring-matter. Aug. 10.

25,986 (1909). Newton. (F. Bayer und Co.) New vat dyes of the anthracene series. Aug. 10.

27,029 (1909). Newton. (F. Bayer und Co.) Manufacture of new vat dye-stuffs. [Addition to No. 7819 of 1909.] Aug. 17.

1781 (1910). Jäger and Carl. Azo dyes. [Date appl. for June 18, 1909.] Aug. 17.

9284 (1910). Société pour l'Industrie Chimique à Bâle. Manufacture of new dyestuffs of the anthracene series and of an intermediate product. [Date appl. for Apr. 17, 1909.] Aug. 17.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

18,416. Fielding. Treating viscose to render it pliable. Aug. 4.

18,479. Gebrüder Schmid. Rendering jute, etc., woolly.* [Ger. Appl., Aug. 4, 1909.] Aug. 4.

18,606. Hart. Manufacture of nitrated cellulose. Aug. 6.

18,607. Hart. Waterproofing of fabrics, yarns, etc. Aug. 6.

18,931. Silberrad. Isolation of cellulose. Aug. 11.

Complete Specifications Accepted.

18,086 (1909). Loewe. App. for manufacture of artificial silk or for coating or glossing textile fibres. [Date Appl. for, Sept. 18, 1908.] Aug. 17.

19,135 (1909). Ainley. Treating with liquids textile piece goods, warp yarns, etc. Aug. 10.

19,539 (1909). Von Alpenburg. Making prepared sheets from the cores of palm trees. Aug. 10.

20,911 (1909). Kuess. Production of pulp for the manufacture of paper, etc. Aug. 10.

476 (1910). Mijnssen. Acetyl cellulose foils. Aug 10.

13,898 (1910). Soc. Michelin et Cie. Process for rendering impermeable fabrics for construction of balloons. [Date appl. for, June 11, 1909.] Aug. 17.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

18,297. Wickham. Bleaching straw by means of hydrosulphites. Aug. 2.

18,356. Gessner. Finishing woollen textile fabrics.* Aug. 3.

18,920. Act. Ges. für Anilin-fabrikation. Process for dyeing hairs, furs, etc.* [Addition to No. 5134 of 1910. German Appl., April 5, 1910.] Aug. 11.

19,050. Milligan. Applying mercerising, dyeing, and other liquor to textile fabric.

Complete Specifications Accepted.

15,828 (1909). Schneider. Preparing wool for mordanting, dyeing, or printing. [Addition to No. 6152 of 1907.] Aug. 17.

25,489 (1909). Halstead. Rollers for use in dyeing and bleaching. Aug. 17.

5134 (1910). Akt. Ges. für Anilin Fabrikation. Dyeing hairs, furs, and the like. [Date appl. for, Oct. 23, 1909.] Aug. 17.

9982 (1910). Herzog. App. for use in bleaching yarn, etc. Aug. 10.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

18,300. Ges. für Chemische Industrie in Basel. App. for the electrolysis of fused alkali chlorides.* [German Appl., Dec. 22, 1909.] Aug. 2.

18,311. Glaser and Muller. Process of refining salt.* [Addition to No. 28,609 of 1909.] Date appl. for under Rule 13, Dec. 7, 1909. Aug. 2.

18,372. Wenk. Plant for mechanical discharge of vessels serving for the treatment of superphosphate.* Aug. 3.

18,378. Von der Linde. *See under* X.

18,400. Bedford and Williams. Purification of hydrogen. Aug. 3.

18,401. Bedford and Williams. *See under* II.

18,475. Société l'Air Liquide (Soc. Anon. Procedés Georges Claude). Fixation of oxygen and nitrogen at high temperatures.* [French Appl., Aug. 9, 1909.] Aug. 4.

18,523. Cusatelli. Manufacture of superphosphates.* [Italian Appl., June 8, 1910.] Aug. 5.

18,698. Société l'Air Liquide. *See under* I.

18,764. Wagner. Manufacturer of borax. Aug. 9.

19,039. Fabry. Extracting water from saturated solutions of ammonium sulphate.* Aug. 13.

19,074. Lowe and Ely. Treatment and purification of ammoniacal liquors. Aug. 13.

Complete Specifications Accepted.

10,164 (1909). Price. Manufacture of nitrous and nitric acids, nitrate, nitrite or sulphonitrate or sulphonitrite of lime, soda or potash. Aug. 10.

17,611 (1909). Serpek. Method of producing pure alumina. Aug. 10.

18,329 (1909). Wolff. Obtaining tetrachloride of tin from tin scrap, etc. Aug. 17.

23,629 (1909). New (*Weichert*). Manufacture of bleach liquors. Aug. 10.

25,460 (1909). Pettigrew. Saturator for ammonium sulphate, etc. Aug. 10.

30,151 (1909). Blake and Smart. Driers of kilns for the revivification of animal charcoal, etc. Aug. 10.

5361 (1910). Basset. Manufacture of caustic soda or sodium salts. Aug. 10.

7319 (1910). Presser. Production of oxides of nitrogen. [Date appl. for, June, 1, 1909.] Aug. 17.

8211 (1910). Sinding-Larsen and Storm. Separating the components of mixtures of gases and apparatus therefor. [Date appl. for, April 7, 1909.] Aug 17.

10,755 (1910). Price. Manufacture of nitrate, nitrite, sulpho-nitrate or -nitrite of lime, potash or soda. Aug. 10.

11,033 (1910). International Salt Co., and Royston. Manufacture of salt. Aug. 10.

VIII.—GLASS; CERAMICS.

Applications.

18,301. Smythe. Glass pot-heating furnaces.* [U.S. Appl., June 8, 1910.] Aug. 2.

18,492. Brookes. Combined glass melting furnace and lear kiln. Aug. 5.

18,508. Bateson and Bateson. Glass furnaces. Aug. 5.

Complete Specifications Accepted.

18,118 (1909). Sauvageon. Electric furnaces for the continuous manufacture of glass. Aug. 17.

20,400 (1909). Garros. Manufacturing ceramic ware and glass ware, enamelling metals and the like. [Date appl. for, Sept. 5, 1908.] Aug. 17.

IX.—BUILDING MATERIALS.

Applications.

18,338. Rhodin. Production of white hydraulic cement from natural minerals at a moderate temperature. Aug. 3.

18,715, 18,716, 18,717. McTellan. Heating and coating stone, brick, earthenware, etc. with metals, vitreous materials, etc. Aug. 9.

Complete Specifications Accepted.

18,024 (1909). Collins. Gas-fired kilns for burning bricks, etc. Aug. 10.
18,357 (1909). Pink. Method of making artificial marble and floor and wall coverings. Aug. 17.
19,459 (1909). Lake (Pine St. Patents Co.). Making cement clinker. Aug. 17.
3423 (1910). Weithaler. Production of glazed mortar coating on cement goods, walls, and the like. Aug. 17.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

18,272. Hicks. Blast-furnace.* Aug. 2.
18,378. Von der Linde. Recovery of tin from tin-plate waste by chlorine.* Aug. 3.
18,452. Baker. Treatment of oils. Aug. 4.
18,679. Simpson and Oviatt. Direct production of iron or steel from iron oxide ores and furnaces therefor. Aug. 8.
18,780. Marks. (Siemens and Halske, A.G.) Process for surface hardening tantalum.* Aug. 9.
18,943. Minerals Separation, Ltd. (H. H. Greenway). Concentration of copper ores. [Addition to No. 26,852 of 1908.] Aug. 11.
18,945. Coln-Musener Bergwerks Act. Verein. Manufacture of ferro-manganese and by-products from manganese ores.* [Ger. Appl., Aug. 12, 1909.] Aug. 11.
19,095. A. E. G. Union Elektricitats-Ges. *See under* II.

Complete Specifications Accepted.

18,329 (1909). Wolff. *See under* VII.
22,201 (1909). Talbot. Manufacture of iron and steel. Aug. 17.
25,818 (1909). Ballantine. Gas-fired furnaces for re-heating iron and steel. Aug. 10.
29,983 (1909). Kilker. App. for handling matte and the like from blast furnaces, smelters and reduction works. Aug. 10.
452 (1910). Howard and Hadley. Treating fumes from zinc retorts. Aug. 17.

XI.—ELECTRO-CHEMISTRY.

Application.

18,969. Higgins (Eric Higgins). Electrolytic reduction of organic bodies. Aug. 12.

Complete Specifications Accepted.

18,118 (1909). Sauvageon. *See under* VIII.
18,590 (1909). Marino. Means for preserving or protecting the lead supports of positive electrodes of secondary batteries from peroxidation. Aug. 17.
1461 and 1462 (1910). Hartman. *See under* XIX.
9176 (1910). Newlands and Parkinson. Preparation for making electrolyte for primary batteries. Aug. 10.

XII.—FATS; OILS; WAXES.

Applications.

19,051. Bettcher and Reihl. Manufacture of oil to be used in making linoleum and as a rubber substitute. Aug. 13.
19,061. Houghton. Composition for cleaning purposes, and for removing paint, varnish, grease, stains, etc. Aug. 13.

Complete Specification Accepted.

17,655 (1909). Laroche and Juillard. Rendering mixtures of fatty matters and other organic materials, such as solvents, soluble in water. Aug. 10.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

18,375. Haddan (Guignet). App. for extracting rubber and other gums from plants, barks, fibres, etc. and for cleansing crude rubber, etc. Aug. 3.
18,491. Silberrad. Manufacture of rubber by the gas process. Aug. 5.
18,497. Clarkson. Process of vulcanising latex. Aug. 5.
19,051. Bettcher and Reihl. *See under* XII.

Complete Specifications Accepted.

15,299 (1909). Wallace and Morton. Artificial production of india-rubber or caoutchouc. Aug. 10.
23,110 (1909). Meyer. Process for devulcanising and reclaiming rubber waste. Aug. 17.
29,864 (1909). Dreyfus, Friedl, Bentley and Clayton Aniline Co. Treatment of waste vulcanised rubber to recover rubber therefrom. Aug. 17.
9588 (1910). Elsner and Meyer. Manufacture of pure rubber or gutta-percha from crude rubber or gutta-percha. [Date appl. for, Nov. 18, 1909.] Aug. 17.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

18,930. Forel. Production of artificial leather.* [Fr. Appl., Sept. 23, 1909.] Aug. 11.

Complete Specifications Accepted.

3437 (1910). Stiepel. Preliminarily preparing chrome tanned leather for making glue. Aug. 17.
14,360 (1910). Utley. App. for clarifying gelatin and other liquors. Aug. 17.

XVI.—SOILS; FERTILISERS.

Applications.

18,372. Wonk. *See under* VII.
18,523. Cusatelli. *See under* VII.

XVII.—SUGARS; STARCHES; GUMS.

Complete Specifications Accepted.

22,655 (1909). Moore. Treating cassava and other succulent vegetables, and the manufacture of starch and other products therefrom. Aug. 17.
3004 (1910). Kantorowicz. Manufacture of adhesive substances soluble in cold water from starch-bearing fruits, roots, bulbs and the like. [Date appl. for, Feb. 13, 1909.] Aug. 17.
9083 (1910). Melhuish. *See under* XVIII.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

18,677. Perks. *See under* I.
18,696. Kuhn. Brewing of beer. Aug. 8.

18,826. Hunt. Maturation of potable spirits. Aug. 10.

18,925. Heron and Heron. Manufacture of preparation for priming malt liquors. Aug. 11.

18,938. Brangier. Manufacture of purified potable spirits.* Aug. 11.

19,024. Jarraud. Artificial ageing of wines, spirits and liqueurs.* Aug. 12.

Complete Specifications Accepted.

18,216 (1909). Kuhn. Manufacture of fermented beverages. [Addition to No. 4622 of 1908.] Aug. 17.

18,218 (1909). Kuhn. Manufacture of beverages. Aug. 17.

18,219 (1909). Kuhn. Process relating to the manufacture of temperance beer. [See 22,259 of 1909 and 771 of 1910.] Aug. 17.

29,534 (1909). Parkhurst and West. System of treating liquids during the process of fermentation. Aug. 10.

30,181 (1909). Boult (Wahl). Manufacture of fermented hopped beverages. Aug. 10.

4177 (1910). Overbeck. Process for obtaining alcohol from distillers' wort. Aug. 10.

9083 (1910). Melhuish. Manufacture of a preparation of lactose for use in brewing or priming ale, beer and stout. Aug. 17.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

18,315. Chavassieu. Process for the solution and subsequent coagulation of proteids.* [Addition to No. 26,155 of 1908. French Appl., July 31, 1909.] Aug. 2.

18,458. Henri, Helbronner, and Von Recklinghausen. App. for treating opaque liquids in thin films by ultra-violet rays. [Addition to No. 12,948 of 1910.] Aug. 4.

18,680. Rideal. Method for sterilising water, etc. Aug. 8.

18,768. Henri, Helbronner, and Von Recklinghausen. App. for treating liquids by means of ultra-violet rays. Aug. 9.

Complete Specifications Accepted.

13,488 (1909). Adams. Sewage purification apparatus. Aug. 17.

25,956 (1909). Martin, Bartholomew, and Schaaf. Curing and ageing tobacco. Aug. 10.

29,866 (1909). Froment. Improving the quality of wheat, etc., which have not been well harvested or have been damaged. Aug. 10.

834 (1910). Henri, Helbronner, and Von Recklinghausen. Sterilisation of milk and other liquids, serums, and the like. [Date appl. for, Mar. 2, 1909.] Aug. 17.

1231 (1910). Sefton-Jones (Hans Reisert Ges.) Process for purifying water. Aug. 10.

1461 and 1462 (1910). Hartman. App. for purifying liquids by electricity. Aug. 10.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Application.

18,626. Silberrad. Manufacture of hemiterpenes and allied products. Aug. 8.

Complete Specifications Accepted.

28,715 and 28,719 (1909). Newton. (F. Bayer und Co.) New pharmaceutical compounds. Aug. 10.

28,044 (1909). Newton. (F. Bayer und Co.) New pharmaceutical compounds. Aug. 7.

29,247 (1909). Merck. Preparation of concentrated solutions of thiosinamine. [Addition to No. 22,533 of 1905. Date appl. for, Feb. 26, 1909.] Aug. 17.

12,129 (1910). Meister, Lucius, und Brüning. Manufacture of β-anthraquinonylureas. [Date appl. for, May 19, 1909.] Aug. 17.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

18,912. Simpson and Gunnill. Toning and fixing solutions for photographic purposes. Aug. 11.

XXII.—EXPLOSIVES; MATCHES.

Application.

18,827, 18,828. Silberrad. Explosives. Aug. 10.

XXIII.—ANALYTICAL PROCESSES.

Complete Specification Accepted.

1329 (1910). Parr. Calorimetric processes and apparatus. Aug. 10.

Journal of the Society of Chemical Industry.

No. 17, Vol. XXIX. SEPTEMBER 15, 1910. No. 17, Vol. XXIX.

Obituary.

CONSTANTIN FAHLBERG.

Constantin Fahlberg was born December 22nd, 1850, at Tambow, in Russia. He studied chemistry in Leipsic, and took the Ph.D. degree, later on proceeding to Baltimore in the United States, where he entered Remsen's laboratory in the Johns Hopkins University, and acted as assistant and demonstrator. Here he commenced in 1879, in conjunction with Remsen, a research on the oxidation of orthotoluenesulphonic amide (see this J. 1887, 587—589), in the course of which these chemists obtained, not, as expected, the corresponding orthosulphaminobenzoic acid, but the latter minus the elements of water, in other words, benzoylsulphonic imide (this J., 1886, 75—76). This substance is described by Fahlberg and Remsen as having a pleasant taste, sweeter than cane sugar, so that in very dilute solutions its presence can easily be recognised by this characteristic. (Ber. 1879, 470). Fahlberg subsequently termed this substance "saccharin," and perceiving great commercial possibilities in its development, he patented the process for preparing it, and opened in 1884, with the financial aid of his uncle, Adolph List of Leipsic, a small experimental factory in New York. Later, Fahlberg and List decided to transfer their works to Germany, and the firm of Fahlberg, List and Co. was eventually formed in 1892, with works at Salbke-Westerhüsen on the Elbe; this being subsequently converted into an Aktiengesellschaft, with a capital of M.3,000,000, and employing over 300 workpeople. Amongst other inventions of Fahlberg, may be mentioned, as possessing special technical importance, a method, devised by him and Semper and patented in 1881, for removing iron from saline solutions (such as those of alum, prepared from bauxite) by the use of plumbic dioxide, with subsequent recovery of the dioxide (this J. 1882, 275).

The many anxieties connected with the development and maintenance of the saccharin industry in general, and the business of his firm in particular, seem to have told greatly upon Fahlberg's health, so that in 1905 he was obliged to resign the management of the works. Since that date he had resided at Nassau an der Lahn in the Taunus, and after years of suffering from disease of the heart, he died on August 16th.

Fahlberg was an original member of this Society, and one of the earliest contributors to its Journal (see this J. 1882, 275).

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.).

German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Regenerative gas furnaces; Regulating and reversing apparatus for ——. H. Kopper, Bruckhausen-Rhein, Germany. Eng. Pat. 30,294, Dec. 28, 1909.

The current of gases to be burnt and the current of waste gases are caused to flow through different sets of compartments in a vessel having dividing walls, some of which reach from top to bottom, and others not quite to the top or not quite to the bottom, the arrangement being such that the direction of flow of the gases can be reversed by altering the water-levels in the two sets of compartments. The walls of the vessel and the partitions are all hollow, and water is circulated through them, and thence through a pair of cylinders placed beneath the vessel. The water from each cylinder passes up into one of the sets of compartments to a level determined by the position of the upper open end of a hollow piston rod carried by a piston movable in the cylinder. The water-levels are interchanged by raising one and lowering the other of the pistons.—A. T. L.

Inflammable liquids; Apparatus for storage and delivery of ——. Grümer und Grimberg Ges.m.b.H. Bochum, Germany. Eng. Pat. 9628, April 20, 1910. Under Int. Conv., May 10, 1909.

The patent relates to apparatus of the type in which a main storage vessel below ground is periodically filled from portable barrels which may be connected to the supply-pipe for that purpose, the delivery of the liquid from the underground vessel being effected through a rising pipe by forcing in an inert gas such as carbon dioxide. In order to prevent the admission of air into the storage vessel, a cock in the supply-pipe is connected to a cock in the delivery-pipe so that when one is open the other is closed. Thus during delivery, air cannot be drawn in through leaks or faulty connections between the supply-pipe and the barrel. The cocks are normally held by a spring in the position for delivery, and are turned automatically into the position for supply when a barrel is placed in position and connected up.—A. T. L.

Deflocculating insoluble bodies; Method of ——. E. G. Acheson, Stamford, Canada. U.S. Pat. 964,478 July 19, 1910.

The claim is for a method of deflocculating insoluble bodies, which consists in progressively adding a deflocculating agent as the deflocculation proceeds, and frictionally incorporating the agent with the mass undergoing the treatment, in the presence of a soluble colloid, such as dextrin.—O. R.

Separators; Centrifugal ——. K. Michaelis, Cöln a. Rhein, Germany. Eng. Pat. 14,024, June 15, 1909.

See Fr. Pat. 401,693 of 1909; this J., 1909, 1114.—T. F. B.

Filters for liquids. A. Tixier, Billancourt, France. Eng. Pat. 23,978, Oct. 19, 1909. Under Int. Conv., Oct. 21, 1908.

See Fr. Pat. 395,542 of 1908; this J., 1909, 591.—T. F. B.

Drying any desired substances; Apparatus for ——. A. J. Pottier, Marq-en-Baroeul, France. Eng. Pat. 1199, Jan. 17, 1910.

See Fr. Pat. 409,960 of 1909; this J., 1910, 804.—T. F. B.

Evaporating or concentrating liquids; Apparatus for ——. E. Shaw, Dartford Heath. U.S. Pat. 965,759, July 26, 1910.

See Eng. Pat. 20,765 of 1908; this J., 1910, 200.—T. F. B.

Concentrating liquids; Process of ——. P. Kestner' Lille, France, Assignor to Kestner Evaporator Co.' Philadelphia. U.S. Pat. 965,822, July 26, 1910.

See Fr. Pat. 361,524 of 1905; this J., 1906, 874.—T. F. B.

Liquefying gases; Process of ——. G. Claude and Soc. l'Air Liquide, Paris. U.S. Pat. 967,104, Aug. 9, 1910.

See Fr. Pat. 322,107 of 1902; this J., 1903, 288.—T. F. B.

Separation of gaseous mixtures into their elements; Process for the ——. G. Claude, Nogent, and R. J. Lévy, Boulogne sur Seine, Assignors to Soc. l'Air Liquide, Paris. U.S. Pat. 967,105, Aug. 9, 1910.

See Fr. Pat. 338,843 of 1903; this J., 1904, 823.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coke; Determination of sulphur in ——. M. Holliger. Stahl u. Eisen, 1910, 30, 1376—1378.

Whilst for coals the author prefers (this J., 1909, 357) a modified Brunck's method or Dennstedt's method of determining sulphur, yet as coke contains but little "volatile sulphur," Eschka's method is sufficiently accurate with coke, and possesses the great advantage, for laboratories dealing with many samples, that several tests can be burnt off at once in the same muffle. In such cases, also, the volumetric determination of the oxidised sulphur by the chromate method saves much time, and is equally accurate with the gravimetric determination as barium sulphate. The details of the method, as adopted in the Zürich fuel-testing laboratory, are as follows:—The barium chromate suspension is prepared by dissolving 19·44 grms. of normal potassium chromate and 24·44 grms. of barium chloride each in 400—500 c.c. of boiling water, thoroughly mixing the solutions, and washing the precipitate by decantation with hot water, till 100 c.c. of the washings, filtered, cooled, treated with 20 c.c. of concentrated hydrochloric acid and 20 c.c. of 10 per cent. potassium iodide solution, require after half an hour's standing not more than 0·16 c.c. of $N/10$ thiosulphate solution to destroy the iodine liberated. The volume of the suspension is then made up to 500 c.c., and it is well shaken each time before taking out quantities of 5 c.c. with a pipette having a wide outlet. The $N/10$ sodium thiosulphate solution is made up three weeks before standardising, and standardised by means of pure potassium bichromate and potassium iodide and hydrochloric acid. To the solution containing the sulphur, freed from bromine, and neutralised, are added 1 c.c. of concentrated hydrochloric acid, and 5 c.c. (10 c.c. for a highly sulphurous coke) of the barium chromate suspension; the whole is boiled for a few minutes, three drops of approximately $N/1$ ferric chloride solution are added (to help the subsequent filtration), followed by ammonia in slight excess, which excess is then boiled off. The liquid is then filtered into a stoppered conical flask of about 800 c.c. capacity, the precipitate rinsed on (portions adhering to the beaker need not be removed), washed three times with hot water, and the flask cooled under the tap. After adding 20 c.c. of concentrated hydrochloric acid and 20 c.c. of 10 per cent. potassium iodide solution, with water to make 400—500 c.c., the flask is stoppered, and after half an hour the iodine titrated by thiosulphate and starch indicator. If this method be used to titrate sulphur after combustions in the bomb, the liquid from the bomb must be first boiled with 0·5 c.c. of concentrated hydrochloric acid to expel any nitrous acid; nitric acid, in the quantities possible under these circumstances, is not harmful.—J. T. D.

Blue water-gas v. carburetted water-gas. J. van Rossum du Chattel. J. Gas Lighting, 1910, 111, 511.

At the Amsterdam gas works there are two water-gas installations: the Western, a blue water-gas plant (Kramers and Aarts system), and the Eastern, a carburetted water-gas plant (S. Cutler & Son's arrangement). The two plants are of the same capacity and have been worked for four years, the results obtained being given in the table below.

Cost Prices of Water Gas per 100,000 *Cubic Feet.*

	Western Works (Blue Water Gas).				Eastern Works (Carburetted Water Gas).			
	1906	1907.	1908.	1900.	1906.	1907.	1908.	1909.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Coke for generators	1 10 11	1 15 11	1 13 4	1 11 10	1 13 9	1 16 4	1 16 1	1 10 3
Fuel for boilers	0 3 11	0 3 9	0 5 3	0 6 2	0 7 4	0 8 8	0 8 5	0 6 9
Wages for gas makers, engineers, and firemen..	0 11 5	0 11 4	0 10 5	0 10 9	0 10 3	0 10 7	0 10 9	0 10 1
Purification (including wages)	..	..	..	..	0 1 10	0 0 11	0 0 11	0 1 3
Carburation	2 18 2	3 5 3	3 5 1	2 19 6	2 15 5	2 5 11	2 8 5	2 17 3
Repairs	0 6 4	0 8 11	0 7 1	0 6 6	0 3 8	0 5 8	0 5 7	0 5 7
Oil, lubrication, &c.	0 0 4	0 0 4	0 0 4	0 0 5	0 0 5	0 0 3	0 0 4	0 0 3
Gas	0 0 9	0 0 8	0 0 7	0 0 9	0 0 5	0 0 5	0 0 4	0 0 5
Sundries for manufacture	0 1 4	0 1 4	0 1 6	0 1 3	0 1 4	0 1 2	0 1 3	0 1 1
Written off, 4 per cent. ..	0 7 0	0 7 3	0 6 10	0 7 1	0 6 3	0 5 8	0 5 8	0 5 10
Interest, 4 per cent.	0 7 1	0 6 8	0 6 1	0 5 11	0 6 5	0 5 6	0 5 5	0 5 5
	6 7 3	7 1 5	6 16 6	6 10 2	6 7 1	6 1 1	6 3 2	6 4 2
Less water-gas tar	..	..	..	..	0 3 5	0 5 6	0 9 10	0 12 1
					6 3 8	5 15 7	5 13 4	5 12 1
Average price of coke per ton..................	1 0 6	1 1 2·5	1 0 2	0 18 6	1 0 3	1 1 3	1 0 2	0 18 6·5

It will be seen that the cost of carburetted water-gas is considerably less than that of blue water-gas. About 25 to 30 per cent. of blue water-gas is mixed with the coal gas and the mixture carburetted with petroleum benzine of 0·740 sp. gr., and it has been found that a considerable quantity of the benzine added to the gas falls out again in the mains. This happens not only in the winter but also in the summer.—W. H. C.

Cooling of gas and naphthalene removal. E. Ott. J. Gasbeleucht., 1910, 53, 784—785.

The author finds that less anthracene oil is required in the naphthalene washer if the gas is well cooled before washing. Formerly at Schlieren-Zürich the temperature of the gas in the washer was 35° C., and 5 to 6 kilos. of oil were required per cb. metre of gas; in this case the oil from chamber I. contained 23 per cent. of naphthalene, and that from chamber IV. 12 per cent. When the temperature of the crude gas in the Bolz coolers was reduced from 40° C.

to 20° C., which reduced the temperature in the washer to 20°—25 C., 400,000 cb.m. of gas could be washed with the same quantity of oil which formerly washed 190,000 cb.m. only, showing a saving of at least 50 per cent. of oil. The oil from chamber I. then contained about 21 per cent. of naphthalene and from chamber IV. about 11 per cent. The gas contained 20 grms. of naphthalene per 100 cb.m. before passing the washer and practically negligible traces afterwards. It appears to be inadvisable to cool the gas in the washer much below 15° to 20° C., as other substances are then washed out which appear to prevent stoppage through condensation of naphthalene in the pipes. It is advisable to cool rapidly to 15° to 20° C., for which purpose an "intensive-washer" such as the Reutter cooler is advisable. By again cooling the gas, if necessary, before passing the ammonia scrubbers, less water is used in these. Thus if the gas was at 19° C. on entering and at 20° C. on leaving the scrubber, 5·23 litres of water were used per minute and the water at the outlet contained 3·5 per cent. of ammonia. If the temperature of the gas was 26° C. on entering and 24·5 ° C. on leaving the scrubber, 7·56 litres of water were used per minute, and this left the scrubbers containing 2·8 per cent. of ammonia only. No ammonia escaped the scrubber at the lower temperature. The lowering of the temperature of the gas also had a very satisfactory effect on the Bueb cyanogen washers; on working in the old way the cyanogen mud contained 8 per cent. of Prussian blue, whereas at the lower temperature it contained 10 to 11 per cent. This leads to an increased value of the mud of 7 centimes (about ¾d.) per 100 kilos.—E. F.

Petroleum from Maikop; Optical examination of ——. M. A. Rakusin. Petroleum, 1910, 5, 1319—1320.

The crude oil gave the following fractions on distillation:—

Nos.	Temperature.	Weight (per cent.)	Sp. gr.
1	32°—100° C.	10·57	0·691
2	100°—120° C.	5·85	0·739
3	120°—140° C.	6·00	0·760
4	140°—150° C.	2·14	0·764
5	150°—225° C.	17·28	0·803
6	225°—275° C.	12·14	0·867
7	Residue	45·28	0·937

A mixture of fractions Nos. 4 and 5 gave a distillate of sp. gr. 0·800, and flash-point 27° C. The residue, which contained 36 per cent. of resinous matter, was diluted with light petroleum, washed with acid and with alkali, and distilled in steam at 280° C. The distillate, amounting to 30 per cent., was suitable for a machine oil. The optical examination of the crude oil showed that it is a "polarimetrically semi-transparent" oil (carbonisation coefficient, K=1⅛ per cent.; see this J., 1907, 678; 1909, 514), which has already undergone natural filtration in the sense indicated by Day (this J., 1900, 890) and thus has travelled a great part of the distance from the place of formation to the surface of the earth.—A. T. L.

Carbon monoxide and hydrogen, or carbon dioxide and hydrogen; Action of mixtures of ——, *on iron oxides.* [*Origin of petroleum*]. A. Gautier and P. Clausmann. Comptes rend., 1910, 151. 355—359.

A mixture of 3 volumes of carbon monoxide and 1 volume of hydrogen was passed at 500° C. over the ferroso-ferric oxide derived from the calcination of a native ferrous carbonate. The substance formed contained about 7 per cent. of carbon, and 93 per cent. of ferrous oxide and iron carbides in approximately equal proportions. When steam was passed over this substance at 400° C., a gas was obtained containing 96 per cent. of hydrogen and 4 per cent. of methane. Over iron (reduced from the oxalate spread over pumice) at 1250° C. was passed a mixture of 2 volumes of carbon dioxide and 1 volume of hydrogen. The issuing gas, besides 23 per cent. of carbon monoxide and 76 per cent. of hydrogen, contained 0·15 per cent. of methane. A mixture of equal volumes of carbon monoxide and hydrogen, saturated with aqueous vapour, was passed over ferric oxide at 250°—300° C., and the resulting gas was then heated to 500° or 600° C. Besides permanent gases, the issuing gas contained a small proportion of a substance condensable to a jelly-like solid, having properties similar to those of vaseline. It is suggested that these experiments possibly have some bearing on the geological formation of hydrocarbon gases and petroleum.—J. T. D.

Coal dust experiments. Czaplinski and Jicinsky. *See* XXII.

Explosion indicator. Teclu. *See* XXIII.

Patents.

Gas retorts; Vertical ——. W. P. Gibbons and J. R. Masters, London. Eng. Pat. 16,925, July 20, 1909.

A retort is made in two halves placed back to back so that it comprises two coking chambers with a gas-collecting duct between them. The gas from the coking chambers enters the central duct through apertures inclined upward and spaced at intervals throughout the height of the retort. The walls of the central duct may be integral with the walls of the coking chambers, or they may be formed by tiles dropped into grooves in the side walls of the retort. Multiple, instead of double, retorts may be similarly constructed.—A. T. L.

Vertical gas retorts. W. P. Gibbons and J. R. Masters, London. Eng. Pat. 17,112, July 22, 1909.

The patent relates to the type of setting in which the retorts are sub-divided into groups and the heating and secondary air ducts and the regenerators are arranged so that one or more groups of retorts may be cut out and repairs may be effected without interrupting the working of the whole of the retorts. The gas-producer is arranged between two sets of retorts and the heating gases are delivered to a central duct between the two rows. To allow of repairs to the producer without shutting down the whole of the retorts, two producer furnaces are arranged back to back, and either may be used to deliver gas to the central flue.—A. T. L.

Gas obtained in the distillation of carbonaceous materials; Treatment of —— *for the recovery of useful products, and apparatus therefor.* G. Wilton, London. Eng. Pat. 16,355, July 13, 1909.

In order to recover the ammonia and at the same time to avoid an objectionable effluent, the liquor obtained from the distillation is sprayed into the hot gases to remove free ammonia, which is afterwards recovered from the gas, and the liquor is then evaporated in open trays formed around the hot gas-conduit. The liquor may be mixed with lime or alkali before spraying, as described in Eng. Pat. 23,043 of 1908 (this J., 1910, 144).—A. T. L.

Highly volatile liquids [*petroleum spirit, etc.*]; *Process and apparatus for stopping the burning of* —— *in receptacles and tanks.* A. Flachs, Berlin. Eng. Pat. 8089, April 4, 1910. Under Int. Conv., April 5, 1909.

A storage tank is fitted with sheets of metal gauze in the space above the liquid, and means are provided for admitting an inert gas such as nitrogen or carbon dioxide beneath the gauze. This gas may be admitted in the event of a fire in the vicinity of the tank. The tank is also provided with safety-valves, and if an explosion should occur in the tank the movement of the safety-valves opens cocks for automatically admitting the inert gas to prevent the continued burning of the liquid. —A. T. L.

Charcoal; Process for converting peat into ——. X. M. Roux, Paris. Eng. Pat. 17,139, July 22, 1909. Under Int. Conv., July 22, 1908.

See Fr. Pat. 401,419 of 1909; this J., 1909, 1116.—T. F. B.

Artificial fuel ; Manufacture of ——. A. W. H. Vivian, G. L. Davies, and L. Grote, Assignors to Composite Fuel Synd., Ltd., London. U.S. Pat. 967,863, Aug. 16, 1910.

See Fr. Pat. 393,218 of 1908 ; this J., 1909, 16.—T. F. B.

Producer gas plants. A. H. du Thil, Paris. Eng. Pat. 24,014, Oct. 19, 1909.

See Fr. Pat. 407,662 of 1909 ; this J., 1910, 551.—T. F. B.

Gas producers. J. Reuleaux, Wilkinsburg, Pa., U.S.A. Eng. Pat. 2887, Feb. 5, 1910.

See U.S. Pat. 948,249 of 1910 ; this J., 1910, 263.—T.F.B.

Gas producer. W. Thomas, Vancouver, B.C. U.S. Pat. 966,718, Aug. 9, 1910.

See Eng. Pat. 15,661 of 1909 ; this J., 1910, 550.—T. F. B.

Gas for inflating aerostats ; Process of manufacturing ——. O. Nauss, Breslau, Germany. U.S. Pat. 965,482, July 26, 1910.

See Eng. Pat. 2298 of 1910 ; this J., 1910, 934.—T. F. B.

Illuminating-gas ; Process for the utilisation of materials employed for purifying ——. H. Simonin, Pierrefitte, France. Eng. Pat. 25,360, Nov. 3, 1909. Under Int. Conv., Nov. 5, 1908.

See Fr. Pat. 405,096 of 1908 ; this J., 1910, 204.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Patent.

Gases produced by destructive distillation of coal or the like ; Treatment of ——. W. Hiby, London. Eng. Pat. 17,420, July 27, 1909.

In the process of separating ammonia from the crude hot gases by treatment with concentrated sulphuric acid after removal of the tar, an objectionable waste liquor is produced owing to the cooling of the gases. In order to avoid the production of this liquor, and to prevent the deposition of naphthalene, the gases are kept at a temperature above the dew-point of the naphthalene until they are burnt or until they are treated with a solvent for removal of the naphthalene. The solvent may be introduced into the gas in the state of vapour, the mixed gases being then passed through a condenser. —A. T. L.

III.—TAR AND TAR PRODUCTS.

Nitrobenzene ; [Electrolytic] Reduction of —— to aniline. C. N. Otin. Z. Elektrochem., 1910, 16, 674—680.

After careful study and repetition of previous work on this subject, particularly that of Elbs and Silbermann (this J., 1901, 725), and of Chilesotti (this J., 1901, 1001), the author has attempted to modify the methods so that a sufficient yield of a pure product can be obtained to make the process of commercial value. At present the yields are too small and the cost of incidental materials is too high to allow electrolytically reduced aniline to compete with the ordinary chemical product. It is impossible by Chilesotti's methods to obtain a product free from *o*-chloraniline, which is produced at the higher current densities. The author therefore proposes a cathode of maximum surface consisting of lead wool or fine nickel wire. To avoid a rise in E.M.F. and heating of the electrolyte it is necessary to have 120 c.c. of hydrochloric acid (sp. gr. 1·19) to 20 grms. of nitrobenzene. This emulsion forms the cathode liquid and with its electrode fills a central porous pot. The anode of lead dips into 10 per cent. sulphuric acid. The current concentration (current strength per litre of cathode liquid) is 32—40 or 90 to 100 amps. and the E.M.F. 3—4 volts. In this way the yields are from 90 to 95 per cent. in material and over 95 per cent. in current efficiency. The yields with smaller quantities of hydrochloric acid are very much smaller and contain much chloro-aniline. In such experiments the temperature rises, water evaporates and the E.M.F. is never lower than 9·1 volts. If corresponding results can be obtained on the large scale it should be possible to produce electrolytic aniline at a reasonable price.—W. H. P.

Patents.

Acenaphthene-quinone, etc. ; Process of condensing reduction products of ——. K. Elbel, Assignor to Kalle und Co., A.-G., Biebrich, Germany. U.S. Pat. 965,170, July 26, 1910.

See Fr. Pat. 407,225 of 1909 ; this J., 1910, 482.—T. F. B.

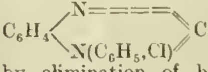
Hydroxyl derivatives of aromatic hydrocarbons ; Process of rendering —— soluble in water. A. Friedlaender, Berlin-Halensee, Assignor to A. Horowitz, Berlin. U.S. Pat. 966,820, Aug. 9, 1910.

See Eng. Pat. 7550 of 1907 ; this J., 1908, 399.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Safranines ; Synthesis of ——. W. Schaposchnikow and N. Orlow. J. Russ. Phys.-Chem. Ges., 1910, 42, 505—530. Chem. Zentr., 1910, 2, 480—481.

The Safranine, pheno-2-methyl-3·6-aminophenazonium chloride, can be prepared by heating together for 1 hour on the water-bath, 1 mol. of dichloroquinonedi-imine and 2 mols. of phenyl-*m*-tolylenediamine in alcoholic solution. After diluting with water and expelling the alcohol, the dyestuff is salted out. Yields of up to 93·2 per cent. are obtained. The dyestuff forms yellowish-green crystals, easily soluble in water, and giving an emerald-green solution with concentrated sulphuric acid. The chromate, $(C_{19}H_{17}N_4)_2Cr_2O_7$, is only slightly soluble in water. By elimination of an amino-group by way of the diazo-compound, monomethylaposafranine chloride,



$$C_6H_4\left\langle\begin{matrix}N=\!=\!=\!=\\ N(C_6H_5,Cl)\end{matrix}\right\rangle C_6H_2(NH_2)CH_3$$

is obtained, whilst by elimination of both amino-groups, phenotoluphenazonium chloride is produced. On diazotisation and combination with β-naphthol, the Safranine yields a blue dyestuff. A Safranine containing a naphthalene nucleus, pheno-2-methyl-3·6-aminophenonaphthazonium chloride can be obtained from naphthoquinonedichlorodi-imine and phenyl-*m*-tolylenediamine. It forms yellowish-green crystals from alcohol. The chromate has the composition, $(C_{23}H_{19}N_4)_2Cr_2O_7$. This Safranine also yields a blue dyestuff when diazotised and combined with β-naphthol. —A. S.

Patents.

Dyestuffs ; New —— of the safranine series. A. G. Bloxam, London. From Act. Ges. für Anilin-Fabrikation, Berlin, Germany. Eng. Pat. 20,029, Sept. 1, 1909.

In the preparation of the new dyestuffs, aminodiphenylaminesulphonic acids or derivatives thereof are oxidised in the presence of alkylbenzylanilinesulphonic acids. The derivatives thus obtained, which possess an indamine character, are oxidised in conjunction with primary aromatic amines and yield dyestuffs belonging to the safranine series which dye wool from an acid bath in blue-violet to blue shades.—F. M.

Azo dyestuffs ; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,717, Dec. 8, 1909.

By combining the diazo compound of 2·4-dinitraniline with aryl-β-naphthylaminesulphonic acid derivatives, dyestuffs are obtained which dye wool from an acid bath in brown to black shades of good fastness to light, fulling, and the action of boiling mineral acids.—F. M.

Azo dyestuff ; Manufacture of a new ——. P. A. Newton, London. From Fabrenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 29,458, Dec. 16, 1909.

An acid dyestuff which dyes wool in level blue-black shades, fast to fulling and light and of very good fastness to boiling mineral acids, is obtained by diazotising 183 parts of 2 : 4-dinitraniline with nitrosyl chloride, diluting the diazo-compound with ice and adding this, at about 0° C., to a suspension of 239 parts of 2-amino-8-naphthol-6-sulphonic acid. The resulting dyestuff is filtered off and dried.—F. M.

Indigo-white preparations ; Production of stable ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 30,197, Dec. 24, 1909.

A soluble hydrosulphite is added to the solution of an alkali salt of indigo-white, together with dextrin, molasses, or waste sulphite-cellulose liquors, and the mixture evaporated to dryness in thin layers *in vacuo*.—F. M.

Azo dyes ; Manufacture of ——. Kalle und Co., Biebrich, Germany. Eng. Pat. 8127, April 4, 1910. Under Int. Conv., April 13, 1909.

By the interaction of phenylhydrazine or its derivatives and 2-amino-5-naphthol-7-sulphonic acid in the presence of sulphurous acid, compounds are obtained which are probably carbazole derivatives of 1-naphthol-3-sulphonic acid. These combine readily with diazo compounds of aromatic amines, yielding dyestuffs which may be used for the dyeing of both cotton and wool.—F. M.

Monoazo dyestuff ; Manufacture of a ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/M., Germany. Eng. Pat. 9497, April 19, 1910. Under Int. Conv., April 27, 1909.

By combining diazotised 2·4-dinitraniline-6-sulphonic acid with 2-naphthol-3-carboxylic acid (m.p. 216° C.), a dyestuff is obtained which is soluble with difficulty and, from its good fastness to light, is very suitable for the manufacture of colour lakes, and for printing, wall paper and oil colours.—F. M.

Vat [thioindigo] dyestuffs ; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst a/M., Germany. Eng. Pat. 18,117, Aug. 5, 1909.

See U.S. Pat. 959,617 of 1910 ; this J., 1910, 809.—T. F. B.

Indigo colouring matters ; Reduction of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 23,874, Oct. 18, 1909.

See Addition of Oct. 21, 1909, to Fr. Pat. 348,360 of 1904 ; this J., 1910, 623.—T. F. B.

Vat [anthracene] colouring matter ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 23,875, Oct. 18, 1909.

See Fr. Pat. 409,381 of 1909 ; this J., 1910, 686.—T. F. B.

Vat dyes of the anthracene series ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,986, Nov. 10, 1909.

See Fr. Pat. 409,407 of 1909 ; this J., 1910, 686.—T. F. B.

Azo dye. O. Diessel, Elberfeld, and R. Kothe and H. Hoerlein, Vohwinkel. Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 965,882, Aug. 2, 1910.

See Eng. Pat. 12,205 of 1909 ; this J., 1910, 554.—T. F. B.

Monoazo dyestuff for wool ; Manufacture of a ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 29,674, Dec. 18, 1909.

See Fr. Pat. 410,639 of 1909 ; this J., 1910, 809.—T. F. B.

Indophenolic compound and process of making same. R. Herz, Frankfort, Germany, Assignor to Cassella Color Co., New York. U.S. Pat. 966,092, Aug. 2, 1910.

See Eng. Pat. 9689 of 1909 ; this J., 1910, 481.—T. F. B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

African wild silks. F. W. Barwick. Bull. Imp. Inst., 1910, 8, 150—151.

At the present time the most important African silk-producing insects are those of *Anaphe* species, belonging to the *Eupterotidæ*. The genus *Anaphe* occurs in many parts of Africa, and the following species have been recorded :—*Anaphe panda* and *A. reticulata* in Natal ; *A. infracta*, *A. Carteri* and *A. Moloneyi* in East and West Africa ; *A. ambrizia* in Portuguese West Africa, Northern Nigeria and Uganda ; *A. venata* in West Africa ; *A. subsordida* in Lagos and Southern Nigeria, and *A. clarilla* in Rhodesia. The silkworms live in large companies and move together in search of food. The colonies or nests are of irregular shape and size ; the larger ones containing a hundred or more cocoons, whilst others are small and contain ten or even fewer cocoons. The nests usually consist of several layers of silken material ; the outer layers are somewhat coarse and loosely spun, whilst the inner layer is hard and of a parchment-like texture. The nests and single cocoons are usually of a dull reddish-brown colour, but it is stated that when the worms are enclosed in the dark they spin white cocoons. The silkworms are said to feed principally on the leaves of species of *Ficus*, but the nests are found on almost all forest trees. *Anaphe* silk contains a considerable quantity of "gum," which is more resistant to the action of ordinary degumming media than that of *Bombyx* or Tussur silk. Experiment has shown that treatment with alkali and soap solution will effect the removal of the gum. Specimens of nests, which have been examined, have been found to yield about 33 per cent. of clean degummed silk. This figure must be regarded as approximate only, since the composition and size of the nests vary to a considerable extent. *Anaphe* silk resembles *Bombyx* silk and is capable of being spun into satisfactory yarn, but, unfortunately, the actual yield of clean degummed silk is very small. The probable value of the crude nests is about one franc per kilo. (4.3d. per lb.), or two to three francs per kilo. (8.6d. to 12.9d. per lb.) for the clean and sorted silk, in the gum. Whether a constant supply of the material can be obtained at such a price as to render its collection and manufacture profitable has not yet been definitely established.

Sunn ["San"] hemp from India. Bull. Imp. Inst., 1910, 8, 121—125.

Ten samples of "sunn" or "san" hemp (*Crotalaria juncea*) from the Pabna District of Eastern Bengal and Assam were examined. The fibres were of very good quality, several of them being above the average length, and would find a ready market. Of the samples, three were from Talgachi, three from Ullapara, and four from Kaijuri. Their probable commercial value in May, 1909, when prices were fully £4 per ton above the normal, owing to a shortage in supply, was as follows :- Talgachi samples : No. 1, length of staple, 7 ft., £25 per ton ; No. 2, length, 4 ft., £18 ; No. 3, length, 6 ft., £25. Ullapara samples : No. 1, length, 6 ft., £25 ; No. 2, length, 5 ft. 9 in., £24 ; No. 3, length, 6 ft. 6 in., £23. Kaijuri samples : No. 1, length, 5 ft. 6 in., £27 ; No. 2, length, 6 ft. 6 in., £25 ; No. 3, length, 5 ft. 3 in., £20 ; No. 4, length, 4—5 ft., £17. The results of the chemical examination of three of the samples are shown in the following table :—

	Talgachi No. 3.	Ullapara No. 2.	Kaijuri No. 1.
	per cent.	per cent.	per cent.
Moisture..............	8·0	8·3	8·2
Ash	0·3	0·3	0·3
α-Hydrolysis (loss) * ..	7·5	6·3	6·7
β-Hydrolysis (loss)	16·0	15·7	15·7
Acid purification (loss)	1·0	1·0	1·4
Cellulose..............	87·9	88·8	87·6

* See this J., 1907, 757.

—A. S.

Cellulose ; Chemistry of ——. *I. Hydrocellulose.* H. Jentgen. Z. angew. Chem., 1910, 23, 1541—1546.

For the preparation of hydrocellulose, the author finds Girard's method difficult to control and prefers to distribute the acid through the cellulose by means of a solvent which does not dissociate the acid, heating the material in presence of an excess of the solvent. Suitable solvents are glacial acetic acid, ether, amyl acetate, ethyl acetate, ethyl acetoacetate, formic acid, glycerol, etc. The degree of conversion of the cellulose into hydrocellulose is preferably measured by Schwalbe's cupric-reduction method (this J., 1910, 689), which the author has considerably simplified ; the conversion increases with the time and temperature of the treatment up to a certain point. Very satisfactory results are obtained by boiling 10 grms. of cellulose for 10—15 minutes with 300 c.c. of glacial acetic acid containing 2 c.c. of hydrochloric acid. When sulphuric acid is used the conversion is very rapid, but the hydrocellulose tends to gelatinise on washing. The "copper value" of hydrocellulose falls generally between 4 and 6, but higher and lower values are occasionally found. Several salts of strong acids with weak bases also convert cellulose into hydrocellulose under similar conditions ; the action of these salts is direct and does not depend on dissociation as has sometimes been assumed. In the production of hydrocellulose the acid enters into association with the cellulose by adsorption, and hydrolysis proceeds by the action of finely-divided water on the adsorption compound, the acid acting as a contact agent. It is necessary that the acid be in a finely-divided, concentrated (molecular or non-ionised) condition. If moisture be rigorously excluded, which is very difficult to ensure, the cellulose is recovered practically unchanged by washing the adsorption compound with water. Experiments with dry cellulose, anhydrous ether and hydrogen chloride, showed an adsorption of the acid amounting to 0·46 per cent. of the cellulose after washing with dry ether. Hydrocellulose is soluble in all the solvents of cellulose and is attacked by strong sulphuric acid in the same manner as cellulose. Strong caustic soda lye dissolves a portion of the hydrocellulose (generally about one-third), the residue being mercerised and its copper value being reduced. About 85 per cent. of the soluble portion is re-precipitated by acid ; the remainder is permanently soluble and profoundly decomposed. In the case of hydrocellulose the refraction colours of ordinary cotton cellulose in polarised light are considerably weakened.—J. F. B.

Alcohol from sulphite-cellulose waste lyes ; Manufacture of ——. C. G. Schwalbe. Z. angew. Chem., 1910, 23, 1537—1540.

In 1891 Lindsay and Tollens made an investigation of a sulphite-cellulose waste lye, containing 9—10 per cent. of dry solids, and found in it 1·2 per cent. of fermentable sugar, the yield of alcohol being 58—67 litres per ton of cellulose. Recently, in Sweden, Wallin, at Forss, and Ekström, at Skutskär (see this J., 1910, 810), have attempted to develop an industrial process on this basis. The two processes are identical in all essentials except that for the neutralisation of the crude acid lyes, the former uses lime and the latter the waste causticisation sludge from sulphate-cellulose mills. The lyes are first neutralised in large vats ; they are then cooled, *e.g.* in towers, and are simultaneously aërated. It is claimed that the neutralisation-sludge obtained in the filter-presses after this process, if used for the preparation of fresh lyes, contains sufficient calcium sulphite to effect a saving of 40—45 per cent. of the sulphur required. In a mill producing 10 tons of cellulose per 24 hours the volume of the lyes to be treated amounts to about 100 cub. m. per day and the quantity of neutralisation-sludge may be taken at about 1½ tons dry or 3 tons moist. A yeast-nutrient, malt-extract or dead yeast, is added to the neutralised, cooled, and aërated liquid, which is transferred to the fermentation tuns. These must be large enough to allow of a storage of at least 3 days' duration. After fermentation and separation of the yeast, the lye is distilled in a continuous still. The column apparatus designed by Kubierschky is particularly suitable for the distillation of sulphite lyes. The alcohol in these is in an extremely dilute condition and the consumption of steam in their distillation is far larger than in a molasses distillery. The alcohol obtained is already denatured ; it contains considerable proportions of methyl alcohol, pre-existing in the unfermented lyes, also of aldehydes, furfural and probably acetone ; it appears to be practically free from terpenes. The process is being worked on a considerable scale at Skutskär ; the average yield of alcohol may be taken as about 60 litres per ton of cellulose, and the present out-turn is 50,980 litres monthly. It is stated that, under Swedish conditions, the treatment shows a profit, but the author points out that it offers no solution of the problem of the disposal of the waste lyes ; on the contrary, it may even happen that owing to the presence of dead yeast, etc., in the spent wash, the nuisance may be aggravated rather than abated.

—J. F. B.

Wood pulp and paper mills ; Losses of fibre in ——. E. Bosaeus. Kemi och Bergvetenskap, 1910, Heft 3 ; Papierfabrikant, 1910, 8, 737—739, 767—770.

The author criticises some statistics prepared by Carlson (this J., 1910, 343) relating to the losses of fibre in the effluents from wood pulp and paper mills. He considers Carlson's estimate of a loss of about 5·5 per cent. of fibre, in the effluents from mechanical pulp grinding mills, to be distinctly in excess of the true value. Moreover, not more than 35 per cent. of this consists of fibres having a commercial value ; the remainder consists of debris and resinous impurities which, if recovered, would be highly prejudicial in the manufacture of paper. Similarly with the losses of fibre in the effluents from sulphite-cellulose mills, Carlson's estimate of 2—3 per cent. is distinctly higher than the results of determinations made in the author's mill, which showed 1·8 per cent. for unbleached, well boiled pulp. Here again, only about 30 per cent. of the loss could be reckoned as valuable fibres, the remainder consisting of parenchyma cells, the elimination of which from high-grade pulp is practically a necessity. The average loss of fibre in the manufacture of paper is estimated by Carlson at about 6 per cent. But he fails to state the thickness of the papers on which the estimate is based, and the stage of the process at which the losses were measured. Thin papera show much larger losses than thick papers, and the variations are so great that no average figure can be taken as having a general significance. Further, in a modern paper mill the losses of fibre in suspension in the effluents should, apart from accidents, be nothing at all. Practically all mills return the greater part of their "back-waters" into the circulation of the pulp, and in most mills the remainder is subjected to treatment by filtration or sedimentation. In some mills, the pulp thus recovered is not sufficiently clean for use and the water which is not returned to the circulation is allowed to run to waste without treatment. The author estimates that in such cases, *i.e.*, with only partial return of the machine "back-waters" and no recovery of the fibres in the rest, the losses may amount to about 3 per cent. for papers of ordinary thickness and 6 per cent. for thin papers such as "news." But here also the proportion of valuable fibres present in the suspended fibrous waste is certainly less than 30 per cent. and the remainder possesses no value greater than that of a filling material.—J. F. B.

Paper from megasse. Carmody. Bull. Imp. Inst., 1910, **8**, 151—152.

Experiments by Bert de Lamarre in Trinidad have shown that megasse (refuse from cane sugar factories) is more suitable for paper-making when it is mixed with other fibrous materials such as banana leaves and stems, maize residues, *Agave*, *Hibiscus*, bamboo, "*bois de Canon*" (*Cecropia peltata*), sunflower, native grasses, etc. The best results have been obtained with a mixture of megasse, bamboo, and Para grass. It is estimated that there are 50,000 tons of megasse available per annum in Trinidad. This quantity would yield 40,000 tons of pulp of a value of at least £200,000, or 30,000 tons of a pulp of better quality worth £360,000. If the megasse were mixed with bamboo and Para grass, the pulp would be worth £450,000. (See also Raitt, this J., 1910, 1003.)—A. S.

Paper ; Sulphuric acid (aluminium sulphate) in ——. T. Edlund. Papierfabrikant, 1910, **8**, 765—766.

The author has determined the proportions of sulphuric acid present in papers, mainly animal-sized papers, as the result of the use of alum or aluminium sulphate in their manufacture. Strips of the sample were extracted with warm water and the extract was titrated with $N/10$ potassium hydroxide in presence of phenolphthalein as indicator. Several extractions were usually necessary before the paper was completely exhausted and a neutral extract obtained. In the case of an animal-sized bond paper, the proportion of sulphuric acid found by titration amounted to 1·6 per cent. ; the same value was found by precipitation as barium sulphate, and the proportion of alumina found in the extract was practically equivalent to the sulphuric acid value. Other animal-sized papers showed from 0·3 to 1·35 per cent. of sulphuric acid, whilst a rosin-sized paper showed 0·4 per cent. The author raises the question whether the presence of such appreciable quantities of an acid salt, such as aluminium sulphate might injuriously affect the durability of the paper.

—J. F. B.

Paper-making factory in Hokkaido, Japan. Board of Trade J., Aug. 18, 1910. [T.R.]

The British Vice-Consul at Hakodate reports that the new factory of the Oji Paper Manufacturing Company at Tomakomai, Iburi province, Hokkaido, which has been under construction since 1907, is now complete and on the point of starting work. The factory is the largest in the Far East and has cost £714,500. The production is to be limited to paper for books and newspapers, and will reach, at full capacity, an output of 300 to 400 ft. per minute of paper 100 to 120 inches in width. Felling concessions over a very extensive area of pine forests in neighbouring mountains have been granted to the company by the Government. The motive power of the machinery in the factory is electricity generated at the company's own power station at the outlet of Lake Shikotsu, 15 miles distant, which is capable of producing 15,000 h.p. ; 8,000 h.p. is required for the factory. About 300 or 400 workmen will be employed, the number being comparatively few owing to the exclusive employment, where possible, of mechanical processes.

Patents.

Paper-making materials ; Engines for breaking and bleaching ——. G. T. Temperley, J. H. and W. Wild, Radcliffe, Lancs. Eng. Pat. 17,952, Aug. 3, 1909.

The breaking and bleaching engine described consists of a horse-shoe shaped trough, the two ends coming close together and being connected by means of a casing containing a circulating device. The circulator consists of a number of impeller blades revolving in a vertical plane, having a curved shape and rounded inwardly curved triangular section. These blades are provided with serrations or corrugations at the edges of their wider portions near their root ends. The trough and circulator are so arranged that the pulp enters the central portion of the casing and is delivered peripherally by the impeller blades up a rise and over a back-fall, whence it travels round the trough.—J. F. B.

Palm trees ; Process of making prepared sheets from the cores of ——. V. and L. von Alpenburg, Hoboken, N.J., U.S.A. Eng. Pat. 19,539, Aug. 25, 1909. Under Int. Conv., Aug. 27, 1908.

See U.S. Pat. 917,516 of 1909 ; this J., 1909, 541. T. F. B.

Pulp for the manufacture of paper and for other purposes to which such pulp may be applied ; Process for the production of ——. V. J. Kuess, Tunis. Eng. Pat. 20,911, Sept. 13, 1909. Under Int. Conv., Sept. 15, 1908.

See Fr. Pat. 394,494 of 1908 ; this J., 1909, 257.—T. F. B.

Cellulose threads ; Alkaline precipitating baths for ——. Le Crinoid Soc. Anon., Rouen, France. Eng. Pat. 22,413, Oct. 1, 1909.

See Fr. Pat. 410,827 of 1909 ; this J., 1910, 810.—T. F. B.

Cellulose ; Digester for the production of ——. E. Morterud, Torderód, Norway. U.S. Pat. 966,112, Aug. 2, 1910.

See Ger. Pat. 209,443 of 1908 ; this J., 1909, 691.—T. F. B.

Cellulose ; Process of manufacturing ——. A. Deiss, St. Barnabé, France. U.S. Pat. 967,001, Aug. 9, 1910.

See Fr. Pat. 403,518 of 1909 ; this J., 1910, 84.—T. F. B.

Threads, filaments, or bands of cellulose ; Manufacture of ——. A. Lecœur, Rouen, France. U.S. Pat. 967,397, Aug. 16, 1910.

See Fr. Pat. 381,939 of 1906 ; this J., 1908, 221.—T. F. B.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Patents.

Mercerisation-lyes ; Process of purifying waste ——. O. Venter, Chemnitz, Germany. U.S. Pat. 967,272, Aug. 16, 1910.

See Fr. Pat. 387,621 of 1908 ; this J., 1908, 852.—T. F. B.

Dyeing wood ; Process of ——. C. J. Faller, Zürich, Switzerland. Eng. Pat. 17,018, July 21, 1909. Under Int. Conv., July 25, 1908.

See Fr. Pat. 405,234 of 1909 ; this J., 1910, 214.—T. F. B.

Alizarin preparation and process of making. E. Franke, Assignor to Chem. Fabr. Grünau, Landshoff und Meyer A.-G., Grünau, Germany. U.S. Pat. 965,804, July 26, 1910.

See Ger. Pat. 219,757 of 1907 ; this J., 1910, 484.—T. F. B.

Article coating process. J. M. Talmadge, Brooklyn, U.S.A. Eng. Pat. 19,696, Aug. 27, 1908.

See U.S. Pat. 933,598 of 1909 ; this J., 1909, 1050.—T. F. B.

Drying proofed and like fabrics or material ; Apparatus for ——. J. Spenlé, Salford. U.S. Pat. 967,076, Aug. 9, 1910.

See Eng. Pat. 17,780 of 1907 ; this J., 1908, 746.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON METALLIC ELEMENTS.

The inventor of the black-ash furnace. W. Ramsay. Chem. News, 1910, **102**, 69—70.

In examining the correspondence of Dr. Joseph Black, the following letter was discovered :—

Linen Hall, Edinburgh.
March 19, 1782.

"Dear Sir.—I beg leave to send you herewith some samples of ashes manufactured by Messrs. Collison and Co., of London, which I beg the favour you will examine and give me your opinion of them.

"You have herewith copies of some letters on the subject; Mr. Sandeman, of Lanark, and others have seen and approved of them so far as they can judge without trial.—I am, respectfully, Sir, your most obedient servant,

"GEO. GOLDER.

"Dr. Joseph Black, Physician, Nicolson's Street."

The accompanying paper was enclosed by Mr. Golder :—

"*Copy of Collison's Specification for making Mineral and Vegetable Alkali.*

"Now know ye, that in compliance with the said proviso, I, the said John Collison Do hereby declare that the nature of my said invention of a new art of producing or making vegetable or mineral alkali, and the manner in which the same is to be performed, is described and ascertained in the manner following, that is to say, as to for touching and concerning Mineral Alkali.

"I take Glauber's Salt, or any substance or liquor containing Glauber's salt, or I take rock-salt, sea-salt, or common salt, and any substance or liquor containing vitriolic acid, and mix these, so that the weight of the salt shall be nearly twice the weight of the concentrated vitriolic acid, which I heat together in an open fire, reverberatory furnace, iron pot, or other utensil, together with from a quarter to half its weight of some, or one, or more of the following substances :—Videlicet, mortar, sopers' ashes, clay, gypsum, loam, calcareous, or other earth, and the same quantity, more or less, according to their different qualities, of horns, hoofs, hair, leather, scraps, pitch, tar, small vegetables, breeze, charcoal, pit-coal, or any other substances containing, or supposed to contain, an inflammable principle or phlogiston, or some, or one, or more of them; which, when properly heated, melted, or fluxed, produce a mineral alkali. And as for touching and concerning the vegetable alkali, I pursue the same process as above, except that I take Sal Polychrest, vitriolated tartar, or any substance or liquor containing vegetable alkali, instead of the salts and mixtures above mentioned."

Then follows a report by Black in draft :—

"DEAR SIR,—I have examined the ash prepared by Collison and Co., and find it to be very strong and powerful. It contains more alkali than the best Alicant Barilla in the proportion of 68 to 44, and more than the best Kelp in the proportion of 68 to 10; and the alkali which it contains is in a more active state than that of Barilla, insomuch that it would be dangerous in bleaching to use more than one hundred wt. of this ash in place of two or somewhat more of the best Barilla. It is an excellent ash for the Soap-boilers. It will take a quantity of tallow proportional to the alkali which it contains; that is, one-half more than the best Barilla; and there is no need to use lime in drawing the leys from it, as it is already in a caustic state.

"I made my essays on the black or grey ash; the bits of white ash appeared much weaker, but too little of it for an essay."

Since the patent granted to Leblanc for the process of manufacturing soda and sodium carbonate was dated Sept. 23, 1791 (Wurtz's Dictionary, edition 1876, p. 1556), there appears little doubt that it was Collison who invented the black-ash furnace.

Calcium carbonate ; Thermal dissociation of ——. J. Johnston. J. Amer. Chem. Soc., 1910, **32**, 938—946.

IN preceding measurements of the equilibrium pressure of the reaction, $CaCO_3 \rightleftarrows CaO + CO_2$, the errors have been mainly due to variations in the temperature of different portions of the substance subjected to the heat of the electric furnace. In the author's experiments this difficulty has been obviated by the use of a very small quantity (0·1 grm.) of material, by which means the extreme temperature variation throughout the charge did not exceed 2° C. This necessitated the use of a form of apparatus in which the vapour space was always small; this, and the mode of measuring the temperature accurately, are described in the paper. It is considered that the uncertainty in the temperature is not greater than $+2°$ C. The results of four separate series of measurements can be well reproduced by the equation :

$$\log p = \frac{-9340}{T} + 1{\cdot}1 \log T - 0{\cdot}0012T + 8{\cdot}882$$

where p is the equilibrium pressure (expressed in mm. of mercury) at the absolute temperature T. The pressure reaches one atmosphere at 898° C. Two of the numerical coefficients of the above equation are derived from the heat of reaction and the heat capacities of the components.
—R. C. P.

Oxidation of oxalic acid by the higher oxides of manganese ; Co-operation of atmospheric oxygen in the ——. *[Determination of available oxygen and of oxalic acid.]* K. Schröder. Z. öffentl. Chem., 1910, **16**, 270—283; 290—305.

EXPERIMENTS on the determination of available oxygen in pyrolusite by the oxalic acid method (titrating the excess of acid) show that the action of free oxygen upon oxalic acid is accelerated to a marked extent by manganous salts, which, unless air be excluded, lead to high results; if the decomposition be slow, several per cent. of the oxalic acid taken may be thus oxidised in a few hours in the hot sulphuric acid solution; absorption of the carbon dioxide produced also gives high results when taken as a measure of the available oxygen. Titration of oxalic acid by permanganate is only reliable under certain conditions of working, and then only owing to a compensation of errors which are discussed at length in the paper; the best results are obtained by titrating rapidly, in the presence of oxygen and in strongly acid solution; it is recommended, therefore, that the approximate volume of permanganate solution required should be ascertained by a preliminary titration, a strongly acid solution (30 c.c. of sulphuric acid, 1 : 1, to 200 c.c. of water), warmed to about 50° C., being employed; the addition of manganous salts leads to low results and should be avoided.—F. SODN.

Ferrous oxide in silicates ; Determination of ——. M. Dittrich and A. Leonhard. Ber. Versamml. Oberrhein. geol. Ver., 1910, **2**, 92—93. Chem. Zentr., 1910, **2**, 596

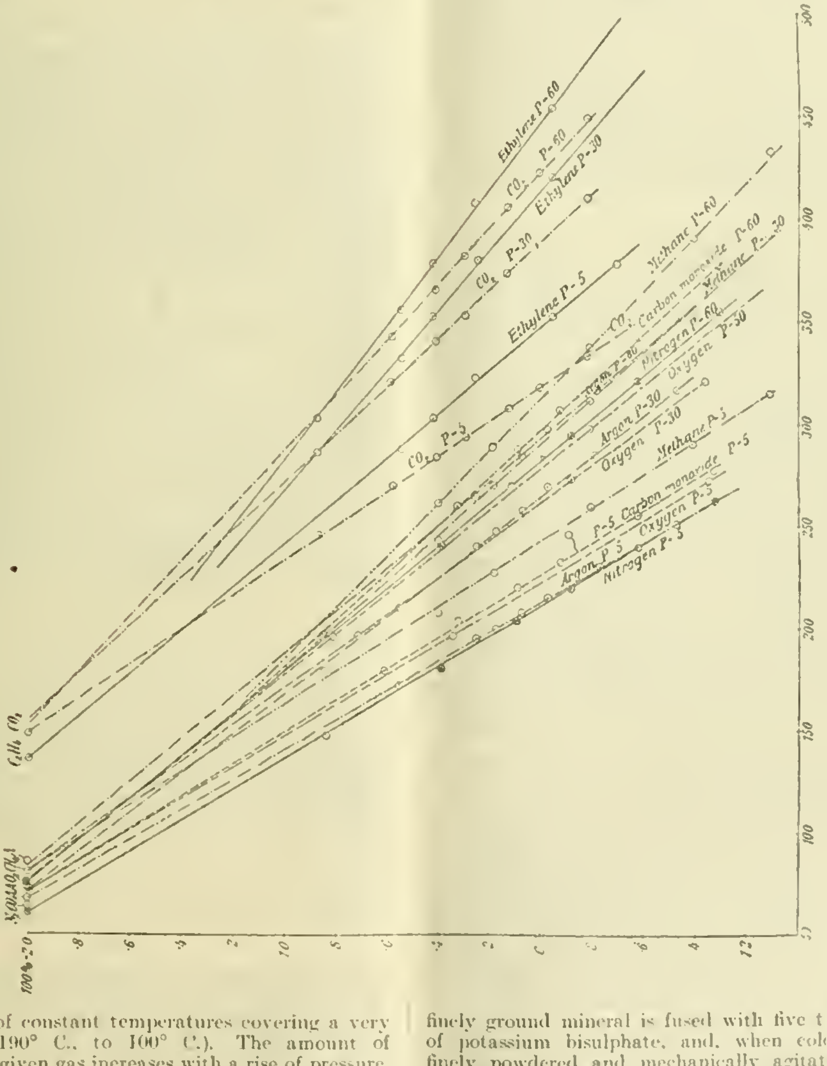
THE author has tested, by means of solutions of ferrous salts of known concentration, the Pebal-Dölder method for the determination of ferrous oxide in silicates. He found that by heating a mixture of ferrous sulphate, hydrofluoric acid, and sulphuric acid in a current of carbon dioxide on the water-bath, a decrease in the amount of permanganate subsequently required took place, this decrease being greater the longer the period of heating and the larger the quantity of hydrofluoric acid. In absence of manganese the errors are small, but they may be considerable in the case of manganiferous minerals. Accurate results can however be obtained, even in the latter case, if 1—2 grms. of potassium or sodium sulphate (not ammonium sulphate) be added to the reaction-mixture.—A. S.

Amblygonite ; Analysis of ——. H. Cormimboeuf. Ann. Chim. Analyt., 1910, **15**, 295—298.

THE following scheme is given for the analysis of amblygonite, some commercial samples of which are now found to contain potash and silica in addition to the constituents normally present. Decomposition is effected by intimately mixing 2 grms. of the finely powdered mineral with 4 grms. of pure quicklime, and maintaining at white heat for a quarter of an hour. The semi-fused button obtained is completely dissolved by water acidified with nitric acid, the liquid evaporated to dryness, and the silica separated after taking up with dilute nitric acid. The phosphoric acid is determined by precipitating with a solution of bismuth nitrate acidified with nitric acid, and weighed as bismuth phosphate. In order to remove excess of bismuth from the filtrate, it is saturated with sulphuretted hydrogen, then the alumina precipitated by adding a slight excess of ammonia, being afterwards re-precipitated in the cold. Lime remaining in solution in the liquid is now removed by boiling with 10 grms. of ammonium oxalate, the resulting filtrate and washings evaporated to dryness after adding 10—15 c.c. of concentrated sulphuric acid, and the sulphates of sodium and lithium weighed. The lithium is precipitated as phosphate, being weighed as such, and the sodium calculated from the weight of combined sulphates. Fluorine is taken by difference.—J. P. O.

Charcoal ; Absorption of gases by ——. I. F. Homfray. Z. physik. Chem., 1910, **74**, 129—201.

The author gives the numerical results obtained for the absorption of argon, nitrogen, carbon monoxide, methane, ethylene, and carbon dioxide, at pressures up to 70 cm. and at a series of constant temperatures covering a very wide range (—190° C. to 100° C.). The amount of absorption for a given gas increases with a rise of pressure, and with a fall of temperature, and generally speaking the absorption is greatest in the case of the gases with the highest boiling points. The comparative results for the different gases at pressures of 5, 30, and 60 cm. are given in the diagram where the temperature is plotted against the logarithm of the concentration. For this purpose the concentration is expressed in grms. of gas per 100 grms. of gas plus charcoal and it is then found that if the curves at low pressures are extrapolated to 100 per cent. concentration, the temperature is the boiling point of the gas at the pressure in question. The general results lead to the opinion that absorption is closely analogous to ordinary solution, and that the charcoal plays the part of a very much supercooled liquid. The general diagram is of practical value in the determination of the most suitable temperature and pressure for the separation of two gases by selective absorption. The curves given for oxygen are those calculated theoretically by means of the laws of solution from an otherwise insufficient number of experimental results.—W. H. P.



Scandium. Sir W. Crookes. Phil. Trans. Roy. Soc., 1908, A, **209**, 15—46, and Proc. Roy. Soc., 1910, A, **84**, 79—85.

Scandium has been found, to the extent of more than 1 per cent., in the mineral wiikite from Finland and, in amounts below 0·01 per cent., in many other minerals. Scandia is best extracted from wiikite as follows :—The finely ground mineral is fused with five times its weight of potassium bisulphate, and, when cold, the melt is finely powdered and mechanically agitated with water (5 litres to every kilo.), for about 12 hours. After filtration, the residue is washed, and the solution is supersaturated with ammonia and well boiled : this gives a precipitate of crude earths which are filtered off and washed, and then the pasty precipitate is heated in a dish with crystals of oxalic acid, added gradually, excess being avoided as far as possible. When cold, the oxalates, thus obtained, are filtered off, and the iron, etc., in the filtrate is precipitated by ammonia, the precipitate, which contains a little scandium oxalate, being reserved for subsequent treatment. The washed oxalates are dried and ignited, and the crude oxides produced, containing about 7 per cent. of scandia are converted into sulphates by heating with sulphuric acid, the excess of acid being driven off by heating as gently as possible. The dry sulphates are agitated with plenty of water and filtered, and then ammonia is added to the filtrate, and the precipitated oxides are washed and again converted into oxalates, to be re-ignited to oxides. These oxides are boiled with dilute nitric acid, insoluble matter is filtered off, and the filtrate is evaporated to dryness; the residue is then fused with an equal bulk of potassium nitrate, with constant stirring, until the mass has the appearance of cream, and it is finally boiled with water, when the dense white basic nitrate separates. By a systematic series of fractionations it is thus possible to separate scandium from most associated elements, ytterbium being the most difficult to separate, because its nitrate is decomposed by heat almost as readily as that of scandium. Descriptions and analyses of many of the salts of scandium are given in the papers and also descriptions (without analyses) of other salts, especially those of organic acids; a bibliography of scandium and photographs of spectra are appended. In view of atomic weight relationships and of the frequency with which these elements occur together in nature, the suggestion is made that yttrium and scandium are degradation products of ytterbium. Scandium may be separated from yttrium and ytterbium by precipitating as metanitrobenzoate (compare, A. C. Neish: this J., 1904, 839). (See also this J., 1910, 1008).—F. Sodn.

Thorium chloride; Compounds of —— with ammonia. E. Chauvenet. Comptes rend., 1910, **151**, 387—389.

Thorium chloride is capable of forming three different series of compounds with ammonia. The compounds of the first series are decomposed by water into thoria and ammonia. They are obtained by treating anhydrous thorium chloride with liquefied ammonia, and then allowing the temperature to rise gradually. The compositions and approximate temperatures of formation of the compounds are: $ThCl_4,18NH_3$, −23°; $ThCl_4,12NH_3$, −5°; $ThCl_4,7NH_3$, +15°; $ThCl_4,6NH_3$, +45° C.; on subjecting these compounds to the action of a vacuum at 15° C., they all yield the final member of the series, $ThCl_4,4NH_3$. The compounds of the second series are much more stable, not being decomposed either by water or by the action of a vacuum. They are prepared by treating thorium chloride with gaseous ammonia either at the ordinary temperature or with the aid of heat. The formulæ and conditions of formation are:—$ThCl_4,7NH_3$, 25 days at 20°; $ThCl_4,6NH_3$, 1 month at 90°—100°; $ThCl_4,4NH_3$, 4 or 5 days at 120° C. The compounds of the third series are produced by the action of liquefied ammonia on those of the second series. Their compositions and temperatures of formation are:—$ThCl_4,18NH_3$, −23°; $ThCl_4,12NH_3$, −5°; $ThCl_4,7NH_3$, +20°; $ThCl_4,6NH_3$, +55° C. The last two members of the series are identical with the corresponding compounds of the second series. The first two compounds of the third series are decomposed by water, and by the action of a vacuum they are converted into the third compound, $ThCl_4,7NH_3$. The compounds of the first series when heated above 100° C. yield first the final compound of the same series, $ThCl_4,4NH_3$; this is next transformed into its isomeride of the second series, which is the only compound of thorium chloride and ammonia stable above 120° C. The compounds of the first series, in which thorium behaves analogously to aluminium, are addition-compounds of the type, $ThCl_4 + nNH_3$. The second series of compounds, in which thorium behaves more like metalloids of the carbon family (titanium, zirconium, etc.), are regarded as compounds of thorium tetra-amide, of the type $Th(NH_3Cl)_4$ or $Th(NH_3Cl)[NH_2(NH_4)Cl]_3$. The third series comprises compounds of the type, $Th(NH_3Cl)_4 + nNH_3$. The compound, $ThCl_4,4NH_3$ or better, $Th(NH_3Cl)_4$, of the second series, when heated at 250°—300° C., is converted into thorium tetra-amide: $Th(NH_3Cl)_4 = 4HCl + Th(NH_2)_4$, and the latter when heated to redness, yields thorium di-imide: $Th(NH_2)_4 = 2NH_3 + Th(NH)_2$.—A. S

Phosphorus; Relations among white, red, and pyromorphic ——. P. Jolibois. Comptes rend., 1910, **151**, 382—384.

Study of the curves of vapour-pressure and of the critical points of the varieties of phosphorus shows that pyromorphic phosphorus (obtained by heating ordinary red phosphorus *in vacuo*), is stable below 450° C., ordinary red phosphorus between 450° and 610° C., and white phosphorus above 610° C. Cohen and Olie's view (this J., 1910, 86) that red phosphorus of sp. gr. 2·18 is a solid solution of white phosphorus in phosphorus of sp. gr. 2·34 is not upheld by these results.—J. T. D.

Destruction of cyanide. Moir and Gray. *See* X.

Precipitation of the iron group and composition of certain ferric formates. Tower. *See* XXIII.

Cyanamide manufacture in France. Times, Eng. Suppl., Aug. 17, 1910. [T.R.]

The Société Commerciale de Carbure et de Produits Chimiques has founded extensive cyanamide works on the banks of the Isère, near the village of Notre Dame de Briançon, close to the plant of the Metal Carbide Company. The energy is supplied by the power-house of the Metal Carbide Company, which can dispose of a total amount of 13,000 h.p., of which 3,000 h.p. is derived from the Ean Rousse and 10,000 h.p. from the St. Jean river at Belleville. The carbide factory works under the Bullier patents. The carbide is crushed into lumps of 20 to 40 kgs. each, and lifted by an elevator to the upper storey of the carbide hall. After being further crushed in a stamp-mill, it is taken by a conveyer to a ball-mill, and finally it is collected in a hopper and charged directly into the furnaces. The nitrogen required is recovered from the atmosphere by means of a Linde apparatus. The compressors are of the Burckhardt type, working in three stages, and are actuated by an electric motor of 150 h.p. There are 30 furnaces, each of a capacity of 300 kgs. of carbide, and the average production is 10 tons of cyanamide a day, or over 3,000 tons a year, though both the buildings and the machinery are adequate for a production twice as great. The cyanamide comes from the furnaces in the form of compact lumps, which are crushed in a stamp-mill; a horizontal ball-mill then reduces it to powder, and finally it is automatically packed into bags.

Production of calcium carbide. U.S. Cons. Report, July, 1910. [T.R.]

The U.S. Consul-General at Frankfort reports that the world's production of calcium carbide in 1908 was 200,000 tons, one-fifth of which was produced in the United States and Canada. The production in the other countries was as follows, in tons:—Italy, 32,000; France, 27,000; Norway, 25,000; Switzerland and Austria-Hungary, 20,000 each; Sweden, 12,000; Germany, 9,000; England, 800. There were 70 factories employed in the manufacture of the article.

Phosphate deposits near Suez. Board of Trade J., Aug. 25. [T.R.]

A most important find of phosphate deposits has been made at Safage, on the western side of the Red Sea, about 260 miles from Suez. The field has been carefully examined during the past two years, and serious work has now, it appears, been decided upon. A large industry is likely to develop.

Use of copper sulphate for spraying currant trees and vines. Board of Trade J., Aug. 25. [T.R.]

The great damage sustained by currant and grape vineyards, notwithstanding repeated and careful spraying with Bordeaux mixture, caused many growers to suspect that much of the copper sulphate was not of proper strength (99 per cent.), but this, says H.M. Consul, seems to be a mistaken notion. French growers have for some time expressed great doubts as to the efficacy of copper sulphate as a preventive of pernospora, and are seeking some other preventive, such as silver sulphate.

Patents.

Hydrogen gas-producing apparatus; Construction and method of operation of ——. H. Lane, Birmingham. Eng. Pat. 17,591, July 29, 1909.

Hydrogen is prepared by passing steam over heated iron, or other easily oxidisable material, and the oxidised product is then reduced by means of a reducing medium, such as water-gas. In practice it has been found that the latter reaction takes considerably longer than the generation of hydrogen; the process is therefore carried out in three or more groups of retorts, the greater part of which are constantly subjected to the action of reducing gases for the regeneration of the iron, or other hydrogen-producing substance. The retorts communicate with one another by means of a series of suitable pipes, fitted with controlling valves, so that steam or the reducing gases may be admitted as required. The hydrogen, which is evolved in the first few minutes of the operation, being impure, is diverted from the collector of pure hydrogen, and mixed with the water-gas used for reduction. A considerable excess of water-gas is used for this purpose, and it undergoes a very thorough system of purification before being admitted to the retorts; the excess, which issues, is freed from the accompanying steam and used again. Means are provided for forcing hot air through the apparatus, which is done periodically between the two reactions, so as to burn out objectionable impurities, especially sulphur.—O. R.

Silicon carbide; Method of making ——. F. J. Tone, Assignor to Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 965,142, July 19, 1910.

A core of conducting resistance material is embedded in a charge of silicious and carbonaceous material between two electrodes, through which a suitable electric current is passing. The core and its surrounding charge move from one electrode to the other, and are supplied and removed in a continuous manner.—O. R.

Caustic soda or sodium salts; Manufacture of ——. L. P. Basset, Enghien, France. Eng. Pat. 5361, March 3, 1910. Under Int. Conv., March 4, 1909.

See Fr. Pat. 410,038 of 1909; this J., 1910, 816.—T. F. B.

Ammonia; Manufacture of —— and apparatus therefor. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 17,951, Aug. 3, 1909.

See Fr. Pat. 406,943 of 1909; this J., 1910, 488.—T. F. B.

Alumina; Method of producing pure ——. O. Serpek, Niedermorschweiler, Germany. Eng. Pat. 17,611, July 29, 1909. Under Int. Conv., April 10, 1909.

See Fr. Pat. 404,923 of 1909; this J., 1910, 212. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 21,755 of 1895.—T. F. B.

Briquettes for producing oxygen; Method of making ——. *Briquette for making oxygen.* G. F. Jaubert, Paris. U.S. Pats. 965,630 and 965,631, July 26, 1910.

See Fr. Pat. 361,522 of 1905; this J., 1906, 885.—T. F. B.

Calcium carbide; Method of making ——. H. L. Hartenstein, Constantine, Assignor to Continental Investment Co., Duluth, Mich. U.S. Pat. 966,542, Aug. 9, 1910.

See Fr. Pat. 383,053 of 1907; this J., 1908, 280.—T. F. B.

VIII.—GLASS; CERAMICS.

Belgian glass industry. Z. angew. Chem., 1910, 23, 1503.

The principal centres of the Belgian glass industry are in the provinces of Namur, Hennegau and Lüttich. Between the years 1880 and 1906 the number of factories rose from 31 to 69, the period of most rapid development being from 1896 to 1906. The composition of the principal types of glass manufactured in Belgium is given in the following table:—

	Bottle glass	Window glass	Mirror glass	Fancy glass	Crystal glass (baccarat)
	per cent.	per cent.	per cent.	per cent.	per cent.
Silica	61·75	73·31	75·90	70·40	51·10
Soda	4·10	13·08	17·50	9·13	1·70
Potash	—	. .	—	9·66	7·60
Lime	19·60	13·24	3·80	10·00	—
Magnesia	4·55	—	—	—	—
Alumina	7·10	0·83	2·80	0·99	0·50
Ferric oxide	2·70			0·02	0·30
Manganese peroxide	0·11			0·50	8·50
Lead oxide	—	—	—	—	38·30

The sand used is mostly obtained in the district. The sand of Fontainebleau which is much in demand on account of its purity (0·005—0·015 per cent. of ferric oxide) costs 2·50 frcs. per metric ton (2s. per long ton) at the pit. Sands from Campine, containing about 0·04 per cent. of ferric oxide, cost 1·50 frcs. (1s. 2½d. per long ton); ordinary sand of the same origin fetches 1 frc. per metric ton (9·7d. per long ton).—J. F. B.

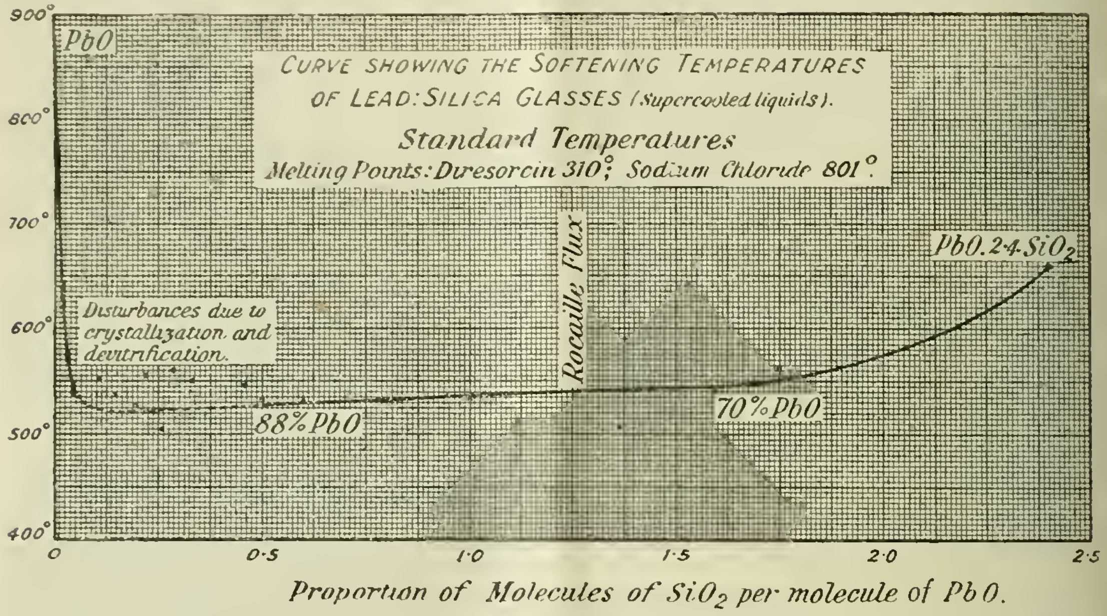
Glass electrolysis. A. Heydweiller and F. Kopfermann. Ann. der Physik, 1910, [4], 32, 739—748. Chem. Zentr., 1910, 2, 536.

The authors have succeeded in introducing heavy metals into glass electrolytically by using fused salts of the metals as anodes. A small tube of soda- or potash-glass, closed below, and containing a fused mixture of sodium and potassium nitrates to act as cathode, was immersed in the fused salt of the heavy metal acting as anode, and current was supplied by means of platinum wires. In this way, sodium, potassium, barium, strontium, tin, lead, copper, iron, cobalt, and silver were introduced into the glass at temperatures above 200° C.; successful results could not be obtained in the case of gold, platinum, and uranium. The metals penetrate the glass in the colloidal state, the colour varying according to the conditions. On heating the colloidal solution is coagulated, the more noble metals separating as metal, whilst the baser metals separate in the form of oxides. Even without the aid of the electric current, metals diffuse into glass from their fused salts, but much more slowly than under the influence of electrolysis.—A. S.

Lead-silica glasses; Softening temperatures of ——. J. W. Mellor, A. Latimer, and A. D. Holdcroft. Trans. Engl. Ceramic Soc., 1910, 9, 126—149.

The softening temperature of a glass, glaze, or frit, which are really undercooled solutions, is defined as the temperature at which the inward surface pressure (surface tension) of the substance becomes greater than those intermolecular forces which hinder the molecules from taking up a position of stable equilibrium, that is of minimum surface area. In the authors' experiments the softening temperature was measured by heating a small quantity of the powdered substance, or a small angular fragment, in a quartz capsule or on a platinum plate in a small Doelter platinum foil resistance furnace and observing when deformation began with the aid of a microscope. The temperature was measured by means of a thermo-couple (connected with a D'Arsonval reflecting galvanometer) calibrated by means of the melting points of diresorcinol (310° C.) and sodium chloride (801° C.). The softening and melting of the surface of different substances takes place at a lower temperature than the softening or melting of the substance *en masse*. With particles having a relatively large superficies in comparison with their mass, the softening temperature is lower the finer the grain. The results obtained with lead-silica glasses are shown in the accompanying diagram (see Fig.). It was observed that the softening temperature of a lead-silica glass is lower than the melting point of a crystalline silicate of the same composition. The addition of gradually increasing quantities of silica to lead

monoxide (m.pt. 870° C.) rapidly lowers the softening temperature to about 526° C. for a glass of the composition, $PbO.0{\cdot}21SiO_2$. Then with further increasing quantities of silica, the softening temperature rises gradually to 661° C. for $PbO.2{\cdot}4SiO_2$. The well-known Rocaille flux (3 of red lead or litharge to 1 of sand) is one of the most fusible of the lead-silica glasses. The glass. $PbO,2{\cdot}4SiO_2$, which softens at 661° C., cannot be obtained even at 1200° C. by heating lead oxide and silica together in potters' ovens, but it, as also other glasses rich in silica, can be prepared readily at a comparatively low temperature by heating together silica and a low-melting lead silicate. *e.g.*, lead monosilicate. $PbO.SiO_2$. The effect of gradually increasing additions of copper oxide, ferric oxide, and cobalt oxide respectively to lead monosilicate is first to raise the softening temperature to a maximum (about 560° with 3 per cent. of copper oxide ; 560° with 1 per cent. of ferric oxide ; 602° C. with 4 per cent. of cobalt oxide), after which the softening temperature falls again until the glass is almost saturated with the added oxide (535° with 6·9 per cent. of copper oxide ; 538° with 14·1 per cent. of ferric oxide ; 567° C. with 6·6 per cent. of cobalt oxide).
—A. S.



Lead contained in the glazes on finished articles made of earthenware and china ; Accuracy of a suggested method of quickly determining the percentage of ——. H. R. Rogers. Report of the Committee on Lead, etc., in Potteries, Vol. 2, 118—119. (See also this J., 1910, 950, 981, and 1086.)

THE method, which was suggested by H. H. S. Cunynghame, is as follows. Hydrofluoric acid is applied to the glaze, and after a certain time the liquid is absorbed by means of filter paper, the paper is heated to expel excess of hydrofluoric acid, and then immersed in sulphuric acid. After washing out soluble sulphates by means of water, ammonium sulphide is added to convert the lead sulphate into sulphide, and after drying, the black stain on the paper is compared with stains produced by known quantities of lead. Experiments showed that by allowing the hydrofluoric acid to act for 40 seconds and then removing the liquid (and lead fluoride) by means of rough filter paper with a uniform surface, applying a slight sharp pressure when removing the paper, the method would be of great value in estimating approximately whether ware had been dipped in a leadless glaze, or a glaze containing respectively less than 2, less than 5, or more than 5 per cent. of lead. The depth of the stain is stated to be not affected by the presence in the glaze of compounds of metals other than lead (*e.g.*, cobalt, manganese, copper, etc.)—A. S.

Air of work-places in potteries ; Report on an investigation of the ——. G. E. Duckering. Report of the Committee on Lead, etc., in Potteries. Vol. 2. 93—113. (See also this J., 1910, 950, 981, and 1086.)

THE results of the determination of the proportion of dust in the air (and of lead in the dust) from different work-places in potteries are given in a series of tables. The dust was determined by passing a measured volume of the air through a filter composed of cotton-wool packed in the bulb of a thistle funnel, the filter being afterwards dried in a steam bath by the passage of a current of dry, dust-free air for 2½ hours. The results are stated to show that no accurate conclusions can be drawn as to the proportion of dust from the appearance of the atmosphere in a workroom or from tests of the exhaust by means of an anemometer. It is considered that the best method of regulation would be to fix limits for the proportions of dust in the air and of lead in the dust, and allow the manufacturers a free choice of methods for attaining the desired results.—A. S.

Determining ferrous oxide in silicates. Dittrich and Leonhard. *See* VII.

PATENTS.

Mirrors ; Manufacture of silvered-glass ——. E. Hoorickx, Brussels. U.S. Pat. 966,097, Aug. 2, 1910.

SEE Eng. Pat. 2490 of 1909 ; this J., 1909, 841.—T. F. B.

Artificial teeth ; Composition for use in burning ——. H. Wienand, Frankfort on Maine, Germany. U.S. Pat. 965,267, July 26, 1910.

SEE Ger. Pat. 214,282 of 1908 ; this J., 1909, 1200.—T. F. B.

IX.—BUILDING MATERIALS.

Wood ; Colouring of —— *by the action of gases and vapours to increase its industrial value.* H. Wislicenus. Z. angew. Chem., 1910, 23, 1441—1446.

THE improvement of the colour of wood, and of the artistic effects it produces, by the action of gases and vapours is entirely distinct from the effects produced by mere "daubing" of the surface. Organic colouring matters, dissolved in alcohol penetrate wood deepest, but are not the best colours; colours dissolved in water only penetrate a fraction of a millimetre below the surface of wood in the direction of length of the fibres, whilst turpentine and wax colours only affect the surface. In order to stain wood throughout its mass, apparatus similar to that used for impregnating wood with tar, etc., must be employed. Although tar gives a not unpleasant brown colour to wood, it is not a true colouring material. On the other hand, gases, and especially ammonia, have the power of rapidly producing the deepest colours in wood. Only small amounts of gases or vapours are required to colour the whole mass of the wood. The change of colour is really produced by the action of the gases on those unstable and easily decomposable constituents of the sap and woody substance, which are readily separated from the resistant cellulose fibres; tannins, and less resistant carbohydrates, such as sugars, gums, etc., are turned to a dark colour by alkalis, ammonia, and superheated steam, or are decomposed, with the formation of brown, "humus" bodies. Fibres are easily penetrated by gases and vapours, and the colouring effects are heightened by such factors as high temperature, light, moisture, oxidising agents, etc. A characteristic of these processes is the throwing into bold relief of dull, matt tones of colour, which produce the impression of colour from age, and in fact the object of these processes is to hasten those natural changes which occur in the ageing of wood. Cut wood turns yellow or brown naturally under the influence of the oxygen of the air, light, warmth, and moisture, and the coloration is also affected by dust (especially particles of iron), fungi, bacteria, and the action of the ultra-violet rays. The side exposed to constant rain and snow becomes grey, the side exposed to the sun according to its age becomes more or less brown, and the freely exposed ends of beams of very old houses become quite charred. The brown colour is a typical superficial colour, which is easily removed by moist ammonia fumes, and the surface then consists of pure white cellulose fibres which give no lignin reactions. In low-lying country, wood never acquires the exquisite brown observed in the Alpine districts. Wood exposed freely to air, and protected from moisture acquires a superficial grey colour, probably formed by the action of traces of iron on the sap materials, and entirely distinct from the grey colour due to age which penetrates the interior of the wood. Among artificial processes of colouring wood the comparatively new process of "fuming" with ammonia has only been applied to woods rich in tannin materials, in order to produce the greyish brown of old oak. The wooden articles are enclosed in a vessel filled with air and ammonia fumes for 2 or 3 days, and are coloured to a depth of from 2 to 3 mm., which is much deeper than would be effected by liquid colours. In cases where tannin material must be added to the wood, a 5 to 10 per cent. hot solution of pyrogallic acid is used. Solutions of salts which can be coloured by ammonia or sulphuretted hydrogen are also employed, but only the surface is coloured by them. Even for oak, the "ammonia fuming" process is limited by the varying amounts of tannin substance present, by the fact that only made articles can be fumed, if a uniform appearance is to be obtained, and by the want of resistance of the colour to water. The steaming of wood is chiefly used in order to bend the wood, but it also produces a uniform brown colour throughout the mass, and with certain kinds of wood, colouring by a gas process can often be combined with drying by means of superheated steam. Another artificial process of colouring wood brown, and imparting to it the appearance of age, consists in embedding planks and blocks in trenches in the ground, and covering them with loose earth, or coal cinders. The loose soil is wetted with rain or by watering, and the draining off of the water maintains a moist atmosphere in the soil. The colouring is brought about by the soil gases: water vapour, air, ammonia, carbonic acid, and possibly hydrogen peroxide. Soils with a low content of humus are suitable, and the ammonia may be increased by adding ammonia-producing substances to them. The process is essentially different from the colouring of wood by laying it in mud, slime, or soil soaked with manure, as in the case of "sub-fossil" woods found in bogs.—W. C. H.

Kilns for burning cement; Pure cement concrete as a material for the refractory lining of ——. Valeur. Z. angew. Chem. 1910, **23**, 1458—1460

The author has found that pure cement concrete possesses many advantages over other materials which have been used as linings for cement kilns. It has only to resist the mechanical wear and tear of the sintered cement mass, which exerts no chemical effect upon it. The concrete is composed of 2 or 3 parts by weight of hard burnt cement clinker (the size of grain being from 2 to 20 mm.) and 1 or 2 parts by weight of ground slow-setting cement, and is mixed with just enough water to cause the mass to cohere when pressed together. When such freshly-prepared concrete is heated to a red or white heat, it hardens quickly, remains hard at high temperatures, and retains its form and hardness, whether heated slowly or quickly, in the sintering zone of a Dietzsch kiln in full work. The concrete begins to set in about an hour, and only about as much as can be used in that time is prepared at once. The concrete lining 20 cm. thick can be conveniently rammed into the whole length of a rotary kiln, by using an iron ring about 40 cm. smaller than the diameter of the kiln as a mould. A rim of concrete about 2·5 m. wide can be formed in a day, and left to set over night; the next morning the moulding ring is moved and a second rim of concrete rammed against the first. No special care is required in heating the kiln to its full working condition. The examination of a layer of cement concrete only 10 cm. thick, which was tried in the sintering zone of a rotary kiln for 14 days, and then cooled, showed that a thin layer of cement had formed on the concrete and split away again on cooling, and the mechanical wear and tear amounted to 3 cm.; otherwise the concrete was intact. As the molten basic cement does not act chemically on the concrete, it does not adhere as it does to a fireclay lining, except for the cohesive effect of the ash contained in the coal. A cement concrete lining will last from 3 to 6 months in the sintering zone of a kiln, and is also suitable for the end shoot, which can be re-lined with concrete in an hour without interrupting the work, whereas re-lining with fireclay necessitates stopping and cooling the kiln. The concrete answers well not only with rotary kilns but also with other types, such as the Dietzsch, and Schneider. The lining can also be composed of blocks of concrete, kept ready for use, and mortared in with cement. The cost of repairing the concrete lining is much less than that of a fireclay lining, being only about 12 to 14 M. per metre (3s. 6d. to 4s. 2d. per foot), against about 230 M. per metre (£3 8s. 3d. per foot) for fireclay lining, and as the former lasts longer than the latter, the repairs are less frequent. In actual practice, the cost of repairing the fireclay lining of a a Dietzsch kiln amounted to 5 Pf., and of a Schneider kiln to 2·5 Pf. per barrel of cement of 170 kilos. (0·6d. and 0·3d. respectively per barrel of 374 lb.), whereas, for these kilns the repairs of a cement lining amounted to 0·7 and 0·8 Pf. (0·8d. and 0·9d.) respectively. The process is patented in Germany and other countries, and has already been adopted in 26 works.—W. C. H.

Patent.

Cement: Process and apparatus for making ——. W. E. Lake, London. From Pine Street Patents Co., Jersey City, U.S.A. Eng. Pat. 17,381, July 26, 1909.

See U.S. Pat. 934,056 of 1909; this J., 1909, 1089. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 27,008 of 1898.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Electric smelting of iron ore at Heroult, Cal. J. Tyssowski. Eng. and Min. J., 1910, **90**, 269—271.

A description is given of the inception and evolution of direct electric smelting of magnetite iron ore at Heroult, Cal. A 1500 kilowatt three-phase furnace of the resistance type, was first erected, but this was found unsatisfactory and abandoned. Experiments were then continued in a 160 kilowatt single-phase furnace; with good results, and a 1500 kilowatt shaft furnace was finally erected, which has been in more or less continual operation since May, 1909. This furnace is of the three-phase type with six electrodes so arranged that the current passing them produces sufficient heat to smelt the charge. Tuyères are introduced at the bottom of the shaft above the electrodes. The molten iron and slag collect in the crucible and are tapped in the usual way. At first considerable difficulties were encountered, owing to the breaking of the carbon electrodes, the arcing set up between the broken pieces melting out the roof of the crucible, but the substitution of graphite electrodes has reduced this trouble. The author considers that for the economical production of pig iron in the electric furnace, electrical power should be obtainable at a maximum of £2 10s. per h.p.-year.—F. R.

Steels; Examination of ——, by corrosion. M. F. Cloup. Rev. de Métall., 1910, 7, 605—611.

The author describes a method for the examination of manufactured steel (forgings, etc.), in which the polished metal surface is treated with either a 4 per cent. solution of picric acid in absolute alcohol, or (as a less active reagent) an iodine solution consisting of 10 parts of iodine, 20 of potassium iodide, and 100 of water. By the action of the solvent, the lines of flow (induced in the metal by the mechanical treatment) become visible to the naked eye; and it is thus possible to discover the course adopted in the manufacture of the piece under examination. The effects due to mechanical treatment alone are, as a rule, easily distinguishable from initial defects in the metal and from alterations caused by heating; but in doubtful cases the use of the microscope is recommended.
—W. E. F. P.

Steel plates; The pickling of ——. W. Krämer. Stahl u. Eisen, 1910, 30, 1443—1449.

The author describes various modifications in use for the manipulation of steel plates in the pickling process, and for keeping them in motion in the baths. Sulphuric acid, though cheaper, does not give such good results as hydrochloric acid. For drying, the method of placing the wet plates direct into the furnace is favoured, provided they are packed so that the liquid can run from them, and that they are not allowed to stand too long between the washing and the final heating. Spots on the plates have been wrongly attributed to dirty washing water or to insufficient washing. The real fault is in having too weak a pickling bath, or one containing arsenic. Plates which are to be tinned undergo the pickling process a second time with somewhat stronger acid, to remove the oxide formed in the first heating. The loss in weight of the plates for the double process is from 3 to 3·3 per cent., and the consumption of acid for 1 kilo. of plates is 0·09 kilo. of sulphuric acid, and 0·18 kilo. of hydrochloric acid.—T. St.

Alloys of nickel and copper with electrolytic iron; Hardness tests on ——. G. A. Roush. Met. and Chem. Eng., 1910, 8, 468—470.

By means of the Shore scleroscope, determinations of hardness were made upon two series of alloys, one containing from 0·25 to 45·0 per cent. of nickel, and the other from 0·1 to 8·5 per cent. of copper, each alloy being tested in both the forged and the annealed condition. The addition of nickel to iron was found to give a maximum range of hardness between 10 per cent. and 20 per cent.; while the addition of copper to iron, up to 8 per cent., gave a gradual but irregular increase in hardness. The author concludes that these alloys—in the range studied—are exceptions to the law of hardness formulated by Kurnakow and Shemtschushny (see this J., 1909, 28, 93).
—W. E. F. P.

Alloys of electrolytic iron and Monel metal; Strength of ——. C. F. Burgess and J. Aston. Met. and Chem. Eng., 1910, 8, 452—456.

Continuing their study of the physical and mechanical properties of the alloys of electrolytic iron with copper (this J., 1910, 28, 431 and 569), and with copper and nickel (this J., 1910, 863), the authors have examined a series of alloys produced by the direct addition of Monel metal to electrolytic iron, and compared them with similar ternary and binary alloys obtained by additions of the pure metals to the iron. They find that the improvements in mechanical quality effected by nickel alone are not only maintained, but augmented by the presence of copper, the two metals being present in the proportions (about 3 to 1 respectively) in which they are found in commercial Monel metal. The latter, produced by the direct smelting of certain ores (see this J., 1909, 28, 94), affords a cheap and convenient source of nickel and copper together, and contains only small amounts of iron and manganese in addition. The results of the investigation will be best observed by reference to the following table which indicates the values obtained for the annealed samples:—

Per cent. addition.	Yield point (lb. per sq. inch).				Maximum stress (lb. per sq. inch).				Per cent. elongation (per 2 inch).				Per cent. reduction of area.			
	Ni	Monel	Ni Cu	Cu	Ni	Monel	Ni Cu	Cu	Ni	Monel	Ni Cu	Cu	Ni	Monel	Ni Cu	Cu
1·5	—	—	—	51750	—	—	—	65720	—	—	—	29·2	—	—	—	63·1
2·0	48770	40250	—	51620	64400	63000	—	63200	34·2	30·0	—	29·5	65·4	64·0	—	64·4
2·7	—	—	48600	—	—	—	68700	—	—	—	30·0	—	—	—	61·5	—
3·0	55400	—	—	50890	70670	—	—	62360	27·5	—	—	26·9	67·6	—	—	61·7
4·0	52100	71300	56800	53570	70070	87800	72500	66540	28·4	23·7	31·0	24·8	66·7	60·2	59·1	54·2
5·0	58320	—	—	54460	73230	—	—	68250	31·4	—	—	24·2	68·1	—	—	50·3
5·3	—	—	67600	—	—	—	84700	—	—	—	28·0	—	—	—	55·6	—
6·0	56400	91000	—	54420	75300	107300	—	64530	29·5	18·7	—	20·8	64·2	49·5	—	49·9
6·6	—	—	74200	—	—	—	86400	—	—	—	—	—	—	—	—	—
8·0	63320	88100	83200	—	78470	102970	103700	—	30·2	19·8	22·0	—	64·4	62·5	56·2	—
10·0	71800	144400	—	—	89300	150000	—	—	22·3	15·7	—	—	59·1	51·9	—	—
12·0	97730	145930	—	—	121800	151400	—	—	14·5	12·2	—	—	35·8	39·0	—	—
14·0	—	146800	—	—	—	151500	—	—	—	10·0	—	—	—	38·3	—	—
15·0	126300	—	—	—	153300	—	—	—	10·5	—	—	—	35·8	—	—	—
16·0	—	138000	—	—	—	153000	—	—	—	10·8	—	—	—	40·5	—	—
18·0	137700	130000	—	—	181550	162250	—	—	10·0	10·5	—	—	34·4	15·7	—	—
19·0	116150	—	—	—	180700	—	—	—	10·7	—	—	—	38·7	—	—	—
20·0	111000	126700	—	—	124900	154950	—	—	21·5	3·8	—	—	62·5	1·1	—	—

—W. E. F. P.

Steel; Cupro-nickel ——. G. H. Clamer. Amer. Soc. for Testing Materials, June, 1910. Eng. and Min. J., 1910, 90, 215.

The iron-nickel and iron-copper series of alloys are reviewed in relation to the iron-nickel-copper alloys (see Burgess and

Aston, this J., 1910, 883; also preceding abstract). Steel containing from 5 to 20 per cent. of copper, which is hard, brittle and red short, becomes highly ductile and forgeable by the addition of from 20 to 50 per cent. of nickel. The following are two typical alloys within these ranges, which can be rolled into sheets or rods and machined without difficulty:

	No. 1.	No. 2.
Copper, per cent.	9·00	19·50
Nickel, per cent.	22·00	45·00
Carbon, per cent.	0·22	0·2
Ultimate strength, lb.	101,000	98,230
Elastic limit, lb.	57,300	54,150
Elongation, per cent.	42·5	35·00
Reduction of area, per cent.	61·5	47·9

It is also found that the nickel in nickel-steel may be partly replaced by copper without materially altering the physical properties, so that in addition to the reduction in the cost of materials, nickel-steel could be produced directly from the Sudbury nickel ores, or from Monel metal (this J., 1909, 94 and 313).—F. R.

Titanium [in ores]; Rapid and accurate method for the determination of ——. O. L. Barnebey and R. M. Isham. J. Amer. Chem. Soc., 1910, **32**, 957—962.

The method as outlined for the determination of titanium in rutile and iron ores is based on the volatilisation of the silica by hydrofluoric acid in the presence of sulphuric acid, evaporation to dryness and fusion with sodium carbonate and a little sodium nitrate to convert the iron and titanium to insoluble ferric oxide and sodium titanate, extraction with hot water to remove the soluble phosphates, sulphates and aluminates; solution of the ferric oxide and sodium titanate in hydrochloric acid, extraction of ferric chloride with ether; and then either reduction of slight traces of iron with sulphur dioxide, precipitation of the titanic acid by boiling in acetic acid solution, filtration and ignition to titanium oxide; or a colorimetric determination by means of hydrogen peroxide. The authors find that the volumetric method based on the reduction of titanium to the trivalent state and oxidation with permanganate gives low results. With the sulphur dioxide reduction when considerable iron is present, the titanium product is usually contaminated with some iron. The ether separation removes practically all iron from the titanium very quickly. Re-fusion of the ignited product with sodium carbonate for purification, which requires considerable time, is never necessary by use of this method. The final titanium oxide is pure, unless zirconium is present, in which case this element is removed by the usual phosphate precipitation. This method combines the colorimetric and gravimetric determinations and the colour comparison is made in solutions always totally free from iron. For convenience hydrochloric rather than sulphuric acid solutions of titanic acid are used. The method is accurate and not long.—R. C. P.

Cyanide; Destruction of ——. J. Moir and J. Gray. J. Chem., Met. and Min. Soc., S. Africa, 1910, **10**, 433—449.

The object of this research was to ascertain the best method of rendering innocuous the residues from the cyanide extraction of gold ores, in relation to their subsequent utilisation in filling the worked-out stopes in mines, the chief advantages of "sand" filling, in addition to the disposal of residue dumps, being the prevention of subsidences and improvement in the ventilation underground. The authors considered that the ferrocyanide reaction was the only method of rapidly and efficiently destroying the residual cyanide at a reasonable cost, the reaction being as follows: $6KCN + 2FeSO_4 \cdot 7Aq = K_2Fe(FeCy_6) + 2K_2SO_4$, etc. A modified method of estimating the residual cyanide after treatment had to be adapted, as the strong alkaline solution, necessary in the ordinary method, decomposed the reaction product, $K_2Fe_2Cy_6$, into potassium ferrocyanide and ferrous hydroxide, the latter attacking the free cyanide present. The methods employed were either the oxidation of the reaction product with an acid solution of chromium trioxide or potassium bichromate, and immediately adding an excess of caustic soda and titrating the filtrate, or the coagulation of the reaction product with a comparatively inert substance such as magnesia, chalk, kieselguhr, charcoal, etc. and filtering before adding the strong alkali. It was found that less cyanide was converted into ferrocyanide when an excess of alkali was present, that rise of temperature above 20° C. was harmful, that the results were entirely independent of dilution, that the action was as complete in from 5 to 10 seconds as on long standing, and that unless the alkalinity was most carefully adjusted to suit the amount of iron used, an excess of ferrous sulphate gave no better result than the theoretical quantity. Entire destruction of cyanide was not accomplished, but under favourable conditions it was reduced to a negligible amount. Tabulated results, illustrated by curves, are given of the effect of varying the conditions of alkalinity, acidity, iron content, temperature and dilution. In discussion, H. A. White gave an account of his research on the destruction of cyanide by the use of alkaline permanganate, alkali picrates, aldehydes and ketones. With permanganate in alkaline solutions the destruction of the cyanide was complete, an alkalinity of 0·1 per cent. of caustic soda, which would be generally present in current residues, being sufficient for the permanganate to entirely destroy all residual cyanide, with the production of carbon dioxide, ammonia or nitrogen. Aldehydes and ketones generally react slowly or require heat, but formaldehyde reacts instantly in the cold with the formation of cyanhydrin ,$CH_2(OH)CN$, and possibly potassium glycollate, ,$CH_2OH \cdot COOK$, and ammonia. Picric acid converts potassium cyanide into potassium isopurpurate, ,$C_8H_4KN_5O_6$, ammonia and potassium carbonate, but it is not quite certain if the isopurpurate would be sufficiently stable under working conditions. The relative costs for chemicals, assuming that 1 ton of residues contains 200 lb. of a 0·025 per cent. cyanide solution would be 0·6d. per ton for alkaline permanganates, 0·9d. for formaldehyde and 0·77d. for picric acid.—F. R.

Copper ores; Interactions during the chlorination of —— *by wet and dry methods.* R. Franke. Metallurgie, 1910, **7**, 484—490.

The various stages in the production of silver-free cement copper, as well as silver and gold, from copper ores are detailed, with the formation of copper chloride by either a wet or dry process. The reactions involve a large number of chemical equations which are given in complete detail. In the Stadtberger process an ore containing sulphide, carbonate, and oxide of copper is treated with dilute hydrochloric acid and ferrous chloride. In the Hunt-Douglas process the ore containing copper oxide, or the roasted ore, is treated with sodium chloride and neutral ferrous chloride, atmospheric oxygen taking part in the reaction. In the Sterry-Hunt process the roasted ore is treated with dilute sulphuric acid followed by calcium or ferrous chloride and then sulphur dioxide. In the Doetsch process the sulphide ore is treated with ferric chloride. In the Henderson process the ore is roasted with sodium chloride. A table is given showing details of the scheme of the Henderson process.—A. H. C.

Basic-lined converters for leady-copper mattes. R. R. Moore. Eng. and Min. J., 1910, **90**, 263—264.

A description is given of the working of a basic-lined converter at Perth Amboy, on leady-copper mattes containing from 150 to 200 oz. of silver per ton. It was found that with careful working, basic lining was more economical than that of the ordinary acid type. Although the matte contained a considerable percentage of lead, no large silver losses occurred, the flue dust from the bag-house containing less than 6 oz. of silver per ton, and over 50 per cent. of lead. Sulphuric acid, formed from the sulphurous gases evolved during the blowing, rapidly destroyed the cotton bags, and the only method found at all efficient for checking the formation of the sulphuric acid, was the admission of large quantities of air near the inlet of the gases to the flue.

The acid had however practically no effect on woollen bags, which latter are to be used in future in place of cotton. —F. R.

Manganese bronze ; Analysis of ——. H. B. Swan. Met. and Chem. Eng., 1910, **8**, 463—464.

By the following method, a complete and very accurate analysis of manganese bronze—involving determinations of tin, copper, iron, aluminium, manganese, zinc, and possibly lead—may be effected in from 6 to 7 hours. 5 grms. of the sample are treated with nitric acid (1 : 1), boiled, and filtered for the separation of metastannic acid. The filtrate is evaporated with sulphuric acid until all the nitric acid is expelled, the lead sulphate being afterwards filtered off and the filtrate diluted to exactly 500 c.c. Successive 100 c.c. portions are then taken for the determination of the remaining constituents, as follows :—*Copper, aluminium and iron.*—Copper is determined simultaneously in two portions by the electrolytic process, one of the copper-free solutions being then employed for the estimation of aluminium by the phosphate method, and the other for the iron determination by titration with permanganate. *Manganese.*—After removal of the copper by electrolysis or other means, the aluminium, iron and manganese are co-precipitated with bromine water and ammonia. The precipitate is then re-dissolved in sulphurous acid, the manganese being determined by conversion to permanganate with sodium bismuthate, and subsequent titration. *Zinc.*—After removal of the copper, zinc is determined either by electrolysis or as pyrophosphate, the separation in the latter case being effected by hydrogen sulphide from the solution slightly acidified with formic acid.—W. E. F. P.

Bronze powders and coloured bronze powders ; Composition of ——. E. Grant Hooper and T. E. Thorpe. Report on Bronzing (see page 1056). Appendices I. and II.

The composition of a number of bronze powders was as follows :—

Description of Powder. (1)	Copper. (2)	Zinc. (3)	Lead. (4)	Tin. (5)	Arsenic. (6)	Iron and aluminium. (7)	Aluminium with a little aluminium oxide. (8)	Impurities. (9)
Gold and Bronze	70·02	29·64	0·05	—	0·05	0·24	—	—
	71·11	28·54	0·06	0·07	0·04	0·18	—	—
	76·98	22·68	0·04	—	—	0·30	—	—
	77·63	21·46	0·19	—	0·05	0·67	—	—
	80·32	18·58	0·27	0·12	—	0·11	—	—
	81·96	17·62	0·18	0·07	—	0·17	—	—
	82·32	17·13	0·24	0·06	—	0·25	—	—
	82·43	17·09	0·10	—	0·07	0·31	—	—
	82·59	16·76	0·14	—	0·04	0·47	—	—
	84·82	14·85	Trace	—	0·06	0·27	—	—
Aluminium	—	0·33	—	—	—	—	99·03	0·64
	—	Trace	—	—	—	—	97·90	2·10
Silver	—	77·04	—	—	—	—	21·53	1·43

Six coloured bronze powders were also examined. The pink-coloured powder consisted of metallic copper, just tinted with Azine Scarlet G, and containing 0·3 per cent. of organic matter, chiefly red dye-substance. The blue powder was an alloy of tin and zinc, coloured with Victoria Blue 4 R, and containing 3·8 per cent. of total organic matter. The deep copper-coloured powder consisted of copper containing a relatively small percentage of zinc, coloured with Safranine, and containing 5·5 per cent. of total organic matter. The violet-coloured powder consisted of tin containing a small proportion of copper and coloured with Fast Neutral Violet B mixed with a little red colouring matter. The total organic matter amounted to 3·8 per cent. The pale green coloured powder was brass (copper, zinc and a trace of lead), coloured with Malachite Green, and containing 4·3 per cent. of total organic matter. The olive green coloured powder was also brass. It was coloured with Brilliant Green or Malachite Green G, and contained 5·9 per cent. of total organic matter.

Iodides of the alkaline-earths ; Electrolysis of the —— *in pyridine solution.* G. von Hevesy. Z. Elektrochem., 1910, **16**, 672—673.

The iodides of the alkaline-earths are fairly soluble in pyridine (barium iodide at 25° C. dissolves to the extent of 20·358 grms. per litre) and the solutions thus produced are good electrolytes. If the pyridine contains water a protective layer is formed on the cathode, consisting principally of barium hydroxide with a quantity of carbonate. This method is suggested for producing adherent deposits of the hydroxides on metals, and using a radium salt instead of barium iodide, would probably prove a simple method for producing a radio-active coating on metals. The effect of the layer of hydroxide is of course to interrupt and prevent the electrolysis. If the pyridine is first freed from the last traces of water by electrolysis (60 hours with 1 to 0·001 milliamp.), the solutions show no formation of a protective layer. The metal which separates reacts with the pyridine to form a red brown slimy mass even at temperatures as low as—40° C. If a mercury cathode is used it is possible to prepare concentrated amalgams. A 30 per cent. barium amalgam can be obtained with a current efficiency of 80 per cent. Stronger amalgams give much poorer yields. —W. H. P.

Mercury vapour ; Reactions of ——. [*Carbonisation of rubber.*] W. von Bolton. Z. Elektrochem., 1910, **16**, 667—669.

Starting from an observation of the carbonising of the rubber stopper in a tube containing barium amalgam, the author shows that mercury vapour exerts a decomposing influence on volatile hydrocarbons, chloroform, carbon tetrachloride, carbon bisulphide, carbon dioxide, and hydrogen sulphide, with separation of carbon or sulphur. The reaction is not produced by liquid mercury, even at its boiling point, but only by the monatomic vapour. Amalgams seem to produce the vapour more rapidly than the pure metal probably on account of their larger surface, but the action is quite noticeable in presence of mercury heated to 100° C. for about three weeks. The presence of sulphur accelerates the action, while selenium and tellurium both retard it. Traces of moisture are also necessary. A plug of wadding between the mercury and the rubber stopper does not prevent the reaction, but if the stopper be kept very cold, the vapour is apparently condensed before it can react. If the mercury vapour is allowed to reach pure non-vulcanised rubber which does not give off any gases, no carbon is separated but the rubber becomes hard and brittle and a trace of mercury can be detected in it. The carbon separated in the ordinary experiments is found to contain small microscopic crystals of diamond. No electrical charge can be detected on the evolved mercury vapour. After 24 hours exposure to the vapour a decided effect is produced on a photographic plate.—W. H. P.

Determining ferrous oxide in silicates. Dittrich and Leonhard. *See* VII.

Softening temperatures of lead–silica glasses. Mellor and others. *See* VIII.

Patents.

Smelting of pyritic and other sulphide ores. B. J. Wildbore, London. From A. Haggenmiller, Tarica, Peru. Eng. Pat. 9958, April 27, 1909.

Sulphide ores are subjected, in an ordinary blast-furnace, to a blast of cold air at a pressure of from 2—6 or more atmospheres, for the purposes of producing a highly concentrated matte.—F. R.

Furnace ; Revolving muffled calcining and smelting ——. W. Harries, Cardiff. Eng. Pat. 12,927, Oct. 11, 1909.

The furnace consists of an inclined revolving iron cylinder, containing a fireclay structure having a central longitudinal cavity for the ore, surrounded by parallel longitudinal flues for the heating gases. The end plates of the furnace are secured by means of tie-rods passing through recesses in the fireclay structure adjacent to the outer iron casing. Uptake and exhaust flues are situated respectively at the upper and lower ends of the cylinder. The outer wall of the uptake flue is furnished with a concentric series of rotatable shutters for the regulated admission of air to the gas flues.—F. R.

Furnace ; Ore-roasting ——. U. Wedge, Ardmore, Pa. U.S. Pat. 966,277, Aug. 2, 1910.

The furnace in general construction is of the usual vertical type, being provided with a number of superposed chambers in which the ore can be agitated by means of rakes connected to a hollow shaft extending up the centre. The lower portion of the furnace is however cut off from the upper portion by a sealed passage through which the material can fall, and two gas outlets are provided, one of these being employed for the production of an up-draught through the bottom chambers. At the same time, by means of the other outlet, connected with an intermediate chamber above the seal, a down draught can be produced in the upper chambers and worked quite independently.
—C. A. W.

Tin from tin scruff ; Recovery of ——. H. J. Bailey, Pontypridd, Wales. Eng. Pat. 17,474, July 27, 1909.

The tin content of scruff (*i.e.*, the skimmings from the tin vats of tinplate works) is recovered, without excessive formation of volatile chlorides, by mixing it with a reducing agent, such as coal dust, and sufficient alkaline fluxing agent to neutralise the free acid, and feeding the mixture into a bath consisting of a fused alkaline flux containing a reducing agent, at a temperature of about 1050° to 1150°C.
—F. R.

Metals and their alloys ; Treatment of ——. G. Stoker, London. Eng. Pat. 17,718, July 30, 1909.

Tin, lead, zinc or alloys containing any of these metals, other than with aluminium, have their tensile strength, flexibility and toughness improved, and their capacity for being soldered increased, by passing ozone, or ozonised air, through the metal, maintained at a temperature very little above its melting point. Solid metal, heated to a little below its melting point, may be subjected to the action of ozone for a similar purpose.—F. R.

Oxide of zinc for smelting. R. W. E. MacIvor, W. Hommel and the Metals Extraction Corporation, Ltd., London. Eng. Pat. 19,386, Aug. 23, 1909.

The difficulty of smelting zinc oxide, on account of its light and voluminous character, is overcome by first converting it into oxychloride by admixture with a strong solution of zinc chloride, with or without carbonaceous matter, and then distilling off the zinc chloride, which may be repeatedly used, leaving a dense residue of zinc oxide, or zinc oxide and carbon, suitable for smelting. If desired, electrodes consisting of carbon and zinc oxide may be thus produced.—F. R.

Zinc ; Method and furnace for the reduction of ——. A. R. Lindblad and O. Stalhane, Ludvika, Sweden. Eng. Pat. 25,979, Nov. 10, 1909. Under Int. Conv., Nov. 11, 1908.

A mixture of zinc ore, with the necessary reducing agent and flux, is fed into an electric shaft furnace, having two gas outlets, one adjacent to the base, and the other near the top of the shaft. At first the gases and vaporised zinc pass up through the charge in the shaft, where the zinc condenses, and is carried down again to the smelting zone, thereby continuously enriching the charge. When the zinc has become sufficiently concentrated, the lower gas outlet is opened and the volatilised zinc passed into external condensers.—F. R.

Gold ore slime ; Separation of liquids from finely divided material such as ——. A. Swan, London. Eng. Pat. 25,809, Nov. 9, 1909.

The apparatus consists essentially of an inverted conical box having an outlet for the thickened ore pulp at its apex, and an overflow collar launder for the clear solution. One or more superimposed baffle-plates are placed immediately over the pulp outlet to prevent the formation of channels in the settling material, through which rushes of unthickened pulp may occur. One or more slowly revolving paddles are also situated adjacent to the baffle-plates to prevent clogging.—F. R.

[Gold] ores ; Process and apparatus for dressing ——. C. Giesecke, Braunschweig, Germany. Eng. Pats. 3698, Feb. 15, and 8220, April 5, 1910.

The ore is first broken in stone breakers to about 2—2½ inches cube and then ground to a fine slime, with about 33⅓ per cent. of water, in a tubular mill, preferably containing steel balls. The thick mud so formed issues from the grinding chamber through perforations in a vertical retaining plate, into a mixing compartment, which consists practically of an enlarged portion of the tube-mill. In this mixing chamber from 500—1000 per cent. of water are added to the thick pulp, or in certain cases (*e.g.*, with ores containing free gold in a state of very fine division), only 100 per cent. need be added. The precious metals are subsequently extracted by means of potassium cyanide or other suitable means.—F. R.

Precious values ; Process of extracting or separating —— *from ores.* J. S. Island, Toronto. U.S. Pat. 965,714, July 26, 1910.

The pulverised ores are heated, removed to a rotary vessel, and there subjected simultaneously to separate streams of sulphuryl chloride and steam for a period of four hours. Sulphuric and hydrochloric acids are produced, and the metal values are converted into soluble salts which are separated from the refuse. The sulphuryl chloride is obtained by passing a mixture of sulphur dioxide and chlorine over camphor.—C. A. W.

Alloy for electrical resistances. W. B. Driver, East Orange, N.J. U.S. Pat. 961,217, June 14, 1910.

The electrical resistance element comprises an alloy containing from 1 to 9 per cent. of aluminium, with at least two other ingredients, such as copper and nickel, or copper and manganese, or the alloy may contain copper, nickel, and manganese. The amount of aluminium used is greater, the greater the percentage of copper present, but it should not be less than 1 to 2 per cent., nor greater than 8 to 9 per cent.—B. N.

Iron-nickel-copper alloys; Manufacture of ——. G. H. Clamer, Philadelphia, Pa. U.S. Pat. 965,871, Aug. 2, 1910.

An iron-nickel-copper matte is obtained from a sulphide ore containing the three metals, and is bessemerised to the extent required, the proportion of iron desired in the finished product being retained. Subsequently, the matte having been calcined in order to convert the sulphides into oxides, a reduction is effected, when copper, nickel or iron may be added to the resulting alloy, as desired. —C. A. W.

Lead: Apparatus for refining and desilverising ——. G. P. Hulst, Omaha, Nebr. U.S. Pat. 965,464, July 26, 1910.

A series of crystallising vessels, of rectangular form, are arranged one above another in a series of steps, each discharging into the next lower one. By means of an overhead arrangement, a cylinder and piston, with pressure-plate connected, can be moved along the line, and means are provided for heating each vessel. The metal being melted in one of the vessels, it is caused to crystallise by the introduction of steam, when the press is attached and the uncrystallised liquid forced into the vessel above. The crystals remaining are then remelted and the resulting liquid discharged into the next lowermost vessel, when the operation is repeated as before.—C. A. W.

Hardening metallic surfaces; [Electrolytic] Process of ——. J. H. Reid, Newark, N.J., Assignor to G. Goodwin, Ottawa, Canada. U.S. Pat. 966,121, Aug. 2, 1910.

The process relates to a method of hardening previously-formed metallic plates or articles, and consists in embedding the bottom and part of the sides of the article in granular conducting material, acting as resistance material to the passage of an electric current. The material, which is thus heated, is of such a character as not to combine with the metal of the plates or articles. A fluid bath containing hardening materials is applied to the exposed surfaces of the plates or articles, suitable insulation being provided on the sides of the latter between the bath and the bed. An electric current is then passed through the bath, the plates or articles, and the bed of resistant material.—B. N.

Purifying electrometallurgical products; Process of ——. F. W. Higgins, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 966,399, Aug. 2, 1910.

Impurities containing silicon are removed from carborundum, or other non-metallic non-acid electrometallurgical products, by treating the mass with a solution containing sulphuric and hydrofluoric acids, and an oxidising agent such as nitric acid. The silicon is first converted into oxide, which is then dissolved by the hydrofluoric acid. —B. N.

Slag; Method of obtaining soluble —— in the aluminothermic reducing process for the production of metals. J. Büchel, Vorarlberg, Austria. Eng. Pat. 16,956, July 20, 1909.

See Fr. Pat. 405,131 of 1909; this J., 1910, 285.—T. F. B.

Agglomerating minerals, combustibles, metals, and other material which is in small fragments; Process for ——. P. Claes, Brussels. Eng. Pat. 29,691, Dec. 18, 1909.

See Fr. Pat. 411,128 of 1909; this J., 1910, 933.—T. F. B.

Case-hardening purposes; Mixture for ——. H. Rodman, Pittsburg, U.S.A. Eng. Pat. 484, Jan. 7, 1910.

See U.S. Pats. 949,444, 949,446, 949,447, 949,448, and 949,449 of 1910; this J., 1910, 361.—T. F. B.

Article of manufacture [Magnesium alloy]. G. Pistor and P. Rakowicz, Griesheim, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 965,485, July 26, 1910.

See Fr. Pat. 401,648 of 1909; this J., 1909, 1142.—T. F. B.

Zinc oxide; Obtaining —— from zinc ores and products. W. Hommel and H. L. Sulman, Assignors to The Metals Extraction Corporation, Ltd., London. U.S. Pat. 966,209, Aug. 2, 1910.

See Eng. Pat. 23,901 of 1907; this J., 1909, 26.—T. F. B.

Ores; Wet process for the treatment of ——. H. T. Durant, H. L. Sulman, and W. Hommel, London. U.S. Pat. 966,389, Aug. 2, 1910.

See Eng. Pat. 1882 of 1909; this J., 1910, 284.—T. F. B.

Pyrophoric metallic substance. A. Huber, Assignor to Kunheim und Co., Berlin. U.S. Pat. 967,775, Aug. 16, 1910.

See Fr. Pat. 405,021 of 1909; this J., 1910, 359.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

[Electrolytic] Reduction of nitrobenzene to aniline. Otin. *See* III.

Glass electrolysis. Heydweiller and Kopfermann. *See* VIII.

Patents.

Electrolyte for electric batteries. The New Ignition Syndicate, Ltd., and W. J. L. Sandy, London. Eng. Pat. 26,649, Nov. 17, 1909. Addition to Eng. Pat. 10,520 of 1908 (this J., 1909, 610).

Sodium bichromate is first rendered anhydrous, and 32 oz. of the dry salt are mixed with 18 oz. of concentrated sulphuric acid to form a hard mass. This is ground to a powder, mixed with 4 oz. of salt, and with water until the liquid has a density of about 52° Tw.—B. N.

Electrolyte for primary batteries; Preparation to be employed in making ——. B. E. R. Newlands, London, and R. M. Parkinson, Bedford. Eng. Pat. 9176, April 15, 1910. Addition to Eng. Pat. 11,926 of 1909 (this J., 1910, 362).

200 grms. of sodium bichromate (or 197·385 grms. of the potassium salt) are mixed with 125 c.c. of concentrated sulphuric acid (sp. gr. 1·84), and 21·5 to 34·4 grms. of dry sodium sulphate. In place of the latter, 36·33 to 58·1 grms. of dry sodium bisulphate may be used, the concentrated acid being diminished in amount to 112·5 to 117 c.c.—B. N.

Accumulator plates. H. de Laminière, and Soc. Anon. des Accumulateurs de Laminière, Laon, France. Eng. Pat. 27,976, Nov. 30, 1909. Under Int. Conv., Dec. 8, 1908.

The paste, which may be used with or without a support in the formation of accumulator plates, comprises a mixture of lead oxide, such as minium, litharge, or a mixture of the two oxides, with a solution in distilled water of potassium tartrate, sodium tartrate, or sodium potassium tartrate (Rochelle or Seignette salt).—B. N.

Carbon [electrodes, etc.]; Protective coating for bodies consisting of ——. Gebr. Siemens und Co., Lichtenberg, Germany. Eng. Pat. 12,425, May 21, 1910. Under Int. Conv., May 24, 1909.

The composition "silit," described in Eng. Pat. 26,384 of 1905 (this J., 1906, 428) is applied, whilst still plastic, to the surface of the carbon body to be coated, and the coated mass is then heated in an atmosphere of nitrogen. The "silit" coating unites firmly with the carbon mass, does not split or scale off at high temperatures, and is chemically more resistant than carbon, especially in electro-chemical operations.—O. R.

[*Calcium carbide.*] *Electrochemical apparatus and process.* E. H. Meyer and J. M. A. Stillesen, Niagara Falls, Canada. U.S. Pat. 965,393, July 26, 1910.

Calcium carbide is obtained by feeding carbon and lime directly into an arc formed between suitable electrodes in an electric furnace. The liberated carbon monoxide is mixed with air, and burnt in a separate reducing chamber containing a mass of coal and limestone, thus forming the carbon and lime necessary for the charge. The reduced mixture is discharged downwardly into a separate inclosure, and the desired quantity tapped off, without cooling, directly into the electric furnace.—B. N.

Electric furnaces; Method of utilising the gases resulting from reduction operations carried out in ——, and electric furnaces for carrying out the same. A. Helfenstein, Vienna. Eng. Pat. 24,498, Oct. 25, 1909.

See Fr. Pat. 408,245 of 1909; this J., 1910, 638.—T. F. B.

Method of making silicon carbide. U.S. Pat. 965,142. *See* VII.

XII.—FATS; OILS; WAXES.

Fatty acids. [*Separation of solid and liquid acids.*] S. Fachini and G. Dorta. Boll. Chim. Farm., 1910, **49**, 237—247. Chem. Zentr., 1910, **2**, 597—598.

The authors propose the use of petroleum ether for the separation of liquid from solid fatty acids, the liquid acids being soluble in all proportions in this solvent. The solid acids dissolve on warming, but separate again on cooling. From 100 grms. of a solution containing 1 grm. of the respective acid, there separated in 1 hour on cooling:—

	Stearic acid.	Palmitic acid.	Myristic acid.	Lauric acid.
	grm.	grm.	grm.	
0° C.	0·9533	0·7422	none	none.
—18° to —20° C.	0·9899	0·9709	0·9081	

On cooling to —40° to —45° C., only traces of stearic, palmitic, and myristic acids remained dissolved. In making a determination, the mixed fatty acids are dissolved in such a quantity of petroleum ether that 100 grms. of the solution do not contain more than 1 grm. of solid acids. The solution is cooled for 1 hour at —40° to —50° C., and then filtered through a jacketed funnel cooled by a suitable refrigerant. The method is useful for the separation of arachidic acid from the fatty acids of arachis oil; the arachidic and lignoceric acids separate completely at —18° to —20° C.—A. S.

Soap stock; Valuation of ——. W. Fahrion. Seifensieder-Zeit., 1910, **37**, 696—697, 745—746. Chem. Zentr., 1910, **2**, 500.

According to the author the dark-coloured impurities of soap stock are hydroxy-acids, the autoxidation products of linolic acid. For the separation of the hydroxy-acids, 5 grms. of the sample were warmed with 15 c.c. of 2*N* alcoholic alkali on the water-bath until the alcohol was expelled, the residual soap was dissolved in 100 c.c. of boiling water, and the solution treated with 100 c.c. of ether and acidified with hydrochloric acid. After shaking and allowing to stand, the ether solution was poured off through a dry filter, and the acid solution extracted with a further 50 c.c. of ether. The combined ether solutions were evaporated, the residue was extracted first with 100 c.c. and then with 50 c.c. of petroleum ether, and the petroleum ether solution, after standing overnight, filtered, evaporated, and the residue weighed. The values obtained were: fatty acids, 44·6; hydroxy-acids, 7·4 per cent. The fatty acids were red; they still contained up to 1·5 per cent. of hydroxy-acids and also 5·6 per cent. (2·4 per cent. on the soap stock) of unsaponifiable matter. By Varrentrapp's method, 25·6 per cent. of yellowish, crystallised solid fatty acids were separated, which melted at 54° C. and had the iodine value, 13. The red liquid fatty acids had the iodine value, 126·9. The hydroxy-acids were not volatile. They could be converted into soap by means of alkali carbonate.—A. S.

Soaps; Some colloidal properties of soluble ——. F. Bottazzi and C. Victorow. Atti R. Accad. dei Lincei, Roma, 1910, [5], **19**, I., 659—665.

Experiments were made with white Marseilles soap, which consists mainly of sodium oleate together with smaller proportions of palmitate, stearate, etc. The hot concentrated solution of the soap was clear, and viscous; it was alkaline to litmus but not to phenolphthalein. On dialysis, the volume of the liquid in the dialyser increased considerably, and the solution became milky. When equilibrium was attained, the contents of the dialyser were found to consist of three layers, of which the bottom one was a mixture of fatty acids and "acid soap" and the middle one a micro-granular suspension of fatty acids and "acid soap" in a dilute soap solution. The hydrolysis of the soap on dialysis is greatly accelerated by the migration of the alkali through the membrane. Viscosity and surface-tension tests were made with the original soap solution and with the hydrolysed (dialysed) solutions. The results of the observations all indicate that the original concentrated soap solutions are true colloidal solutions, which through removal of alkali by dialysis, are converted into more or less coarse-grained suspensions of fatty acids and "acid soap."—A. S.

Emulsions; Filtration of —— and the deformation of the particles of emulsions under pressure. E. Hatschek. Z. Chem. Ind. Kolloide, 1910, **7**, 81—86.

The author has previously shown (this J., 1910, 125) that oil-water emulsions can be separated by filtration through different porous media wetted with water, and in explanation thereof has suggested that below certain limits of pressure the oil globules suspended in the water are not deformed sufficiently to pass through the pores of the filter. In the present paper the subject is treated mathematically and formulæ are deduced connecting the pressure *p*, the surface tension (oil-water), σ, in dynes per cm., and the ratio of the radius of the oil globules (R) to that of the pores (*r*), or $\frac{R}{r} = n$, viz.,

(1) $p = \frac{\sigma C(n-1)}{gR}$ and (2) $n = \frac{gpR}{C\sigma} + 1$ (C is a constant which varies according to the value of n, on an average 1·8 to 1·9). Formula 1 shows that with a constant value for n, the pressure required to force a globule through a capillary pore is inversely proportional to the radius of the globule, whilst with a constant value for R, it increases with, and more rapidly than, n. For an oil-water emulsion such as those examined by Lewis and by the author (*loc. cit.*), where R = 0·00002 cm., and $\sigma = 45$, the pressure required to force an oil globule through a capillary of half its radius would be $p = \frac{45 \times 1·92}{0·00002 \times 980} = 4400$ grms. per sq. cm., or nearly 4·5 atmospheres. This agrees tolerably well with the results obtained in filtration through calcium carbonate: at the pressure mentioned the oil-water emulsion yielded a turbid filtrate. Since any liquid not miscible with, nor wetted by, water can be used instead of oil, the author determined experimentally the pressure required to force a globule of mercury into a glass capillary wetted with water and found that, with suitable precautions, the observed and calculated results agreed well. Satisfactory concordance between observed and calculated results was also obtained with drops of nitrobenzene. The formula 2 (see above) represents a very satisfactory means of determining the size of the pores of a porous

septum which is wetted by water (or generally by the continuous phase of an emulsion). It is only necessary to filter an emulsion containing particles of known size and observe the pressure at which the disperse phase passes through, *i.e.*, at which the filtrate becomes turbid.—A. S.

Ground nut; Cultivation, preparation, and utilisation of the ——. Bull. Imp. Inst., 1910, **8**, 153—172.

Analyses of ghee. Bolton and Revis. *See* XIXa.

Patents.

Fatty matters and other organic materials such as solvents; Rendering mixtures of —— soluble in water. J. Laroche and P. Juillard, Lyons, France. Eng. Pat. 17,655, July 29, 1909.

See Fr. Pat. 401,764 of 1908; this J., 1909, 1147.—T. F. B.

Soaps; Medicinal ——. W. Schoeller and W. Schrauth, Berlin, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 967,840, Aug. 16, 1910.

See Fr. Pat. 402,740 of 1909; this J., 1909, 1211.—T. F. B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Ultramarine. J. Hoffmann. Chem.-Zeit., 1910, **34**, 821—823.

Discussing the results of his own investigations and those of other workers, the author concludes that the homogeneous character of ultramarine and the fact that changes in the constituent oxides are often unaccompanied by any essential alteration in colour, may be best explained by regarding it as a dilute solid solution containing, besides alumina, boric anhydride, silica, or oxides of sulphur, dissociation products of thiosulphates, probably sulphur itself.—F. Sodn.

Benin copal. A. Tschirch and M. Kahan. Arch. Pharm., 1910, **248**, 433—442.

Benin copal belongs to the copaiba copals. It was extracted first with ether, then with a mixture of alcohol and ether. The ethereal extract when treated with ammonium carbonate solution gave benincopalic acid, $C_{17}H_{32}O_4$, which melts at 137° C., and is monobasic. By extracting the ethereal solution with sodium carbonate solution, α-and β-benincopalolic acids, $C_{13}H_{32}O_6$, and $C_{20}H_{30}O_2$, melting at 81° and 119° C. respectively, were obtained. When the ethereal extract was shaken with potassium hydroxide solution, benincopalenic acid, $C_{27}H_{48}O_2$, m.pt. 101° C., was isolated. This extract also contained an essential oil. The alcohol-ether extract contained α-benincopalinic acid, $C_{21}H_{30}O_3$, m.pt. 187° C., β-benincopalinic acid, $C_{15}H_{28}O_3$, m.pt. 193°—197° C., β-benincopal resin, $C_{12}H_{30}O_{10}$, and γ-benincopal resin, $C_{13}H_{26}O_4$, m.pt. 192°—195° C. The original copal dissolves to the extent of 50 per cent. in ether, and about 2 per cent. is insoluble in a mixture of alcohol and ether. The copal melts at 166° C. The direct acid value is 101·15 and the iodine value 61·02.—F. Shdn.

Accra copal. A. Tschirch and M. Kahan. Arch. Pharm., 1910, **248**, 443—450.

The method used for the examination of Accra copal was the same as that used for Benin copal (see preceding abstract). 50 per cent. will dissolve in ether, 54 per cent. in alcohol, 87 per cent. in pyridine, and the whole in a mixture of ether and alcohol. The direct acid value is 121·8 and the iodine value 58·54. The copal melts between 106° and 156° C. The following acids were isolated from the ethereal extract: accracopalic acid, $C_{21}H_{34}O_3$, m.pt. 104°—106° C., α-accracopalolic acid $C_{18}H_{30}O_2$, m.pt. 152°—155° C.; β-accracopalolic acid $C_{19}H_{32}O_2$, m.pt. 144°—148° C., α-accracopalenic acid $C_{10}H_{20}O_2$, m.pt. 142°—146° C.; β-accracopalenic acid $C_{12}H_{20}O_3$, m.pt. 150°—152° C.; α-accracopal resin $C_{15}H_{36}O_6$, m.pt. 178°—180° C.; and an essential oil The portion of the oil insoluble in ether contained accracopalinic acid, $C_{14}H_{26}O_3$, m.pt. 122°—124° C., γ-accracopal resin, $C_{10}H_{20}O_3$, m.pt. 184°—186° C., and β-accracopal resin, $C_{13}H_{26}O_3$, m.pt. 197°—199° C.—F. Shdn.

Bronze powders and coloured bronze powders. Gran Hooper and Thorpe. *See* X.

Honduras balsam and cabureiba balsam. Tschirch and Werdmüller. *See* XX.

Patents.

Asphaltum; Process for treating —— to make varnish. D. T. Day, Washington, D.C. U.S. Pat. 967,337, Aug. 16, 1910.

Asphaltum is treated with nitric acid, the undissolved oil which forms a surface layer is removed, and the nitric acid solution is diluted with water to precipitate the nitro-products. The latter are washed free from acid, dried, and dissolved in a suitable solvent.—A. S.

Linoleum product, and process of making same. B. S. Summers, Port Huron, Mich. U.S. Pat. 965,344, July 26, 1910.

The woody portion of flax straw is ground to a suitable degree of fineness, and is then roasted, either alone, or after the addition of a relatively small percentage of resin, and finally mixed with a suitable oil cement.—E. W. L.

Colouring-matters from titaniferous iron ores; Manufacture of ——. P. Farup, Christiania. U.S. Pat. 966,815, Aug. 9, 1910.

See Fr. Pat. 412,563 of 1910; this J., 1910, 1023.—T. F. B.

Antifouling paint and varnish. W. Schoeller and W. Schrauth, Berlin, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 967,841 and 967,842, Aug. 16, 1910.

See Ger. Pat. 219,966 of 1908; this J., 1910, 577.—T. F. B.

Condensation products from phenols and aldehydes; Process for hardening ——. H. Lebach, Assignor to Knoll und Co., Ludwigshafen on Rhine, Germany. U.S. Pat. 965,823, July 26, 1910.

See Fr. Pat. 397,051 of 1908; this J., 1909, 803.—T. F. B.

Varnish. F. Ephraim, Santa Barbara, Cal., Assignor to L. Oettinger, Mexico. U.S. Pat. 966,814, Aug. 9, 1910.

See Eng. Pat. 17,961 of 1908; this J., 1909, 842.—T. F. B.

Substances to be used as varnishes and for impregnation and insulation and method for their production. G. G. Diesser, Zürich-Wollishofen, Switzerland. U.S. Pat. 967,737, Aug. 16, 1910.

See Fr. Pat. 393,948 of 1908; this J., 1909, 210.—T. F. B.

Monoazo dyestuff [for lakes.] Eng. Pat. 9497. *See* IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber resources of West Africa. H. Brown. Bull. Imp. Inst., 1910, **8**, 135—136.

Gambia.—The indigenous rubber-yielding plants are species of Landolphia, principally *L. Heudelotii*, but the vast majority of the vines have been destroyed by the methods of collection employed, and since 1905 very little rubber has been collected in the Colony itself. The exports in 1907 and 1908 were 61,405 lb. and 18,568 lb. respectively. No systematic cultivation of rubber plants has been attempted in the Gambia. *Sierra Leone.*—The indigenous rubber plants include species of Landolphia and Clitandra (*L. Heudelotii*, *L. owariensis*, and *Clitandra* sp.) and the West African rubber tree, *Funtumia elastica*. The bulk of the rubber is collected in the Bandajuma, Panguma, and Koinadugu districts. The exports in 1907 and 1908 were 164,463 lb. and 92,016 lb. respectively. The Para rubber tree (*Hevea brasiliensis*) and *Funtumia elastica* are being experimentally cultivated in the Colony. *Gold Coast.*—The rubber of this Colony is derived from *Funtumia elastica*, *Landolphia* sp. (principally *L. owariensis* and *Ficus Vogelii*. Most of the Funtumia rubber is exported in the form of "lump," and owing to defective methods of preparation it is usually of inferior quality; attempts are, however, being made to remedy this. The rubber of *Ficus Vogelii* contains a high percentage of resin. The chief sources of Gold Coast rubber are the forests of Ashanti, Sefwhi and Akim. The exports in 1907 and 1908 were 3,549,548 lb. and 1,773,248 lb. respectively. Plantations of Para and Funtumia trees have been successfully established in the Gold Coast, and promise to give very good results. Experiments with other rubber-yielding plants are also in progress. *Nigeria.*—The principal sources of rubber in Northern and Southern Nigeria are *Funtumia elastica*, and species of Landolphia, Clitandra and Carpodinus vines. The Funtumia rubber is exported in the form of "lump," as in the Gold Coast, but efforts are being made to induce the natives to prepare it in "biscuits." The exports from Southern Nigeria, including those from Northern Nigeria, were 2,843,823 lb. and 1,222,203 lb. in 1907 and 1908 respectively; the production in Northern Nigeria was 1,187,588 lb. in 1907, and 509,454 lb. in 1908. Experiments with a number of exotic rubber trees are in progress in Southern Nigeria. Plantations of the Para tree have been established in several localities, and so far have given very promising results. Large numbers of Funtumia trees have also been planted. In Northern Nigeria plantations of Funtumia trees have been established.

Ceará rubber from Nyasaland. Bull. Imp. Inst., 1910, **8**, 128.

The sample consisted of five biscuits of pale rubber of very good elasticity and tenacity, and contained a quantity of the so-called insoluble caoutchouc, which was white and very tenacious when dry. It was valued at 5s. 4d. per lb., compared with fine hard Para from S. America at the same price, and fine plantation Para biscuits at 5s. 4¾d. to 5s. 5¾d. per lb. The chemical composition of the rubber was:—Moisture, 1·2; caoutchouc, 85·1; resin, 6·7; protein, 6·1, and ash, 0·9 per cent.—A. S.

Rubbers from the West Indies. Bull. Imp. Inst., 1910, **8**, 125—128.

Samples of Castilloa rubber from Tobago, St. Lucia, and Dominica, and a sample of Para rubber from Dominica were examined. All of the rubbers were of good quality. The results of the chemical examination of the samples are shown in the following table:—

	Castilloa rubber from:			Para rubber from Dominica
	Tobago	St. Lucia	Dominica	
	per cent.	per cent.	per cent.	per cent.
Moisture	1·0	0·3	1·9	0·4
Caoutchouc	91·1	88·6	84·0	93·0
Resin	6·1	9·1	9·2	4·2
Protein	0·8	1·3	3·7	2·1
Insoluble	1·0	0·7	1·2	—
Ash	2·2	0·46	2·09	0·3

The Castilloa rubbers from St. Lucia and Dominica were valued at 3s. 6d. per lb., compared with fine hard Para from S. America at 4s. 3½d. per lb. The Tobago Castilloa rubber was valued at 4s. 4d. per lb., compared with fine hard Para from S. America at 5s. per lb. The Para rubber from Dominica compared favourably in composition with plantation Para rubber from Ceylon and the Federated Malay States. It was valued at 4s. 3d. per lb., compared with fine hard Para from S. America at 4s. 3½d. per lb., and plantation Para biscuits at 4s. 4d. to 4s. 11d. per lb.—A. S.

Rubber; Madagascar ——. Caout. et Gutta-percha, 1910, **7**, 4277—4281.

The results of experiments in rubber planting in Madagascar during the last two years are summarised.

(1) The planting of indigenous species mainly is recommended, and reproduction from seed advised.

(2) *Castilloa* has done well on the East coast; trees planted in 1902 are more than 10 metres high and 1200 mm. in circumference at 1 metre from the ground. On September 28, 1909, each tree gave approximately 185 grms. of latex when tapped on the herring bone system. The latex is contaminated with brownish filaments of resin which comes from vessels situated in tissues external to the laticiferous vessels. The quantity of this resinous matter is less when coagulation is effected by addition of ether or of alcohol, than when addition of sulphuric acid or drying in the sun is used. It is least when the latex is washed with water on filter-paper and dried in the dark. In the same situations as *Castilloa*, *Hevea* grows slowly, and the soil is probably too wet for *Funtumia*.

(3) The best rubber is obtained from the vines of the East coast. The results of different methods of coagulation are given in the following table:—

Method of coagulation.	Fingibary (Density of latex = 0·980)				Voaheaa (Density of latex = 1·000)		
	Quantity of latex used	Amount of coagulant	Wet rubber	Dry rubber	Quantity of latex	Amount of coagulant	Wet rubber
	litres	litres	grms.	grms.			
Boiling	0·500		94	80			
Citric acid (5% solution)	0·500	0·325	66	59	0·250	0·100	20
Sulphuric acid (5% solution)	0·500	0·010	60	46	0·250	0·030	30*
Absolute alcohol	0·500	0·290	64	46			
Nitric acid (5% solution)............	0·500	0·100	63	50			
Mercuric chloride (7% solution)........	0·500	0·300	No result				
Sea salt (7% solution)	0·500	0·070	74	56	0·250	0·240	12

* Tacky inelastic product from Voabena.

The following table gives a summary of analytical results for the various rubbers in question in Madagascar :—

	Hevea	Funtuuiia	Fingibary	Ficus elastica	Bocabe	Bocabe	Castilloa	Ficus Vogelii
Moisture	11·96	19·09	11·82	4·77	11·08	12·56	4·74	4·23
Soluble and "Mechanical" impurities	0·54	—	—	—	4·57	1·44	1·01	3·27
Resins	4·24	5·92	6·18	21·69	22·98	20·44	25·80	51·37
Ash	1·13	1·80	0·06	1·64	1·64	1·00	0·52	0·67

—E. W. L.

Rubber mixings; Determination of filling ingredients [mineral matter] in ——. J. Marcusson and F. W. Hinrichsen. Chem.-Zeit., 1910, **34**, 839—840.

Recently suggested methods for separating the mineral matter from rubber mixings suffer from the disadvantage that at the temperatures employed certain of the mineral matters in common use, *e.g.*, "golden" sulphide of antimony and magnesium carbonate, are subject to decomposition. The authors find, however, that certain mixed aromatic-fatty ethers, in particular anisole and phenetole may be employed as solvents for vulcanised rubber at such comparatively low temperatures that the more sensitive mineral ingredients remain unaffected, and can be separated from the solution in their original condition. In carrying out the determination of mineral matter, the finely-divided sample is first extracted with acetone, and then 1 grm. is heated with 20—30 c.c. of anisole or phenetole in a weighed Erlenmeyer flask, of 100—200 c.c. capacity, at 90°—120°C. until all the rubber has passed into solution and the mineral matter has settled at the bottom of the flask. As a rule solution is complete in from 1 to 2 hours. The solution is diluted with petroleum benzine and centrifugalised. The clear liquid is poured off and the residue shaken up and centrifugalised several times with petroleum benzine, then with alcohol and ether, and the flask is finally dried at 105°C. and weighed.—E. W. L.

Reactions of mercury vapour. [*Carbonisation of rubber.*] Von Bolton. *See* X.

Exports of rubber from Pará district of Brazil in 1909-10 Board of Trade J., Aug. 18, 1910. [T.R.]

H.M. Consul at Pará has forwarded the following statistics of the exports of rubber from Pará, Manaos, Iquitos and Itacoatiara during the crop year (year ended 30th June) 1909-10 :—

	Fine.	Medium.	Coarse.	Caucho.	Total.
	Kilogs.	Kilogs.	Kilogs.	Kilogs.	Kilogs.
To the United States from					
Pará	3,774,101	552,159	3,556,988	594,625	8,477,873
Manaos	4,944,138	1,077,193	1,446,885	949,744	8,417,960
Iquitos	58,827	3,203	21,958	91,622	175,610
Itacoatiara	—	—	—	—	—
Total	8,777,066	1,632,555	5,025,831	1,635,991	17,071,443
To Europe from					
Pará	6,035,667	631,981	2,171,729	1,921,256	10,760,633
Manaos	4,178,762	721,676	1,019,782	2,736,426	8,656,646
Iquitos	717,565	88,848	309,725	1,201,491	2,317,629
Itacoatiara	71,088	13,997	56,022	6,017	147,124
Total	11,003,082	1,456,502	3,557,258	5,865,190	21,882,032
Grand total	19,780,148	3,089,057	8,583,089	7,501,181	38,953,475

Kilo. = 2·2046 lb.

The total exports of rubber from the Pará district in 1908-9 amounted to 38,234,871 kilogs., and in 1907-8 to 36,422,806 kilogs.

Patents.

India-rubber; Artificial production of ——. R. W. Wallace and G. A. Morton, London. Eng. Pat. 15,299, June 30, 1909.

Material consisting of, or containing, certain substances of the terpene series, more particularly isoprene or its homologues,—prepared by the distillation of the gums, resins, and oils obtained from the trees of the *Xanthorrhœa* family, or by other means—is treated with natural rubber or latex containing micro-organisms or enzymes, or with cultures of the bacilli or enzymes obtained therefrom. The chief characteristics of two types of the bacilli in question are as follows :—Type A. Bacilli anaerobic with endospores; rods, laterally swollen at sporulation; spore germination approximately polar and sometimes bi-polar. Rod-shaped containing granulations which stain readily. Not decolorised by Gram's method. Liquefy gelatin, and do not coagulate milk. Optimum temperature 30° to 35° C. Type B. Bacilli anaerobic, facultative, aerobic without endospores. Multiplication by cell division. Long rods containing granulations which stain with iodine. Rapidly liquefy gelatin and do not coagulate milk. Optimum temperature 30° to 35° C. The kinds of bacilli chosen would preferably be anaerobic, because if bacilli requiring oxygen are used, the oxygen is liable to convert the isoprene into camphene or other substances. In carrying out the process, the isoprene (etc.) is placed in a vessel from which air can be excluded, a quantity of culture medium is added, then the transforming agent (bacilli, etc.), and the vessel is kept closed and at 30° C. until the transformation is complete. This usually occurs within two months, but by the use of certain culture media (*e.g.*, 10 grms. of "lemco," 20 grms. of glucose, and 10 grms. of sodium chloride in 1 litre of water), as well as by agitation, etc., it is possible to effect the change in a few days. The fraction of *Xanthorrhœa* gum distillate which gives the greatest yield of rubber is that which boils at 30° to 34° C., and has a sp. gr. of 0·70 to 0·72.—E. W. L.

Rubber; Process for regenerating old ——. W. van Oesterzee, Raismes, France. Eng. Pat. 22,222, Sept. 29, 1909. Under Int. Conv., Sept. 30, 1908.

The cuttings of vulcanised waste are sorted, ground, and washed by boiling with water. The ground waste is then dried, mixed with from 10 to 30 per cent. of its weight of one of the ordinary rubber solvents, *e.g.*, petroleum benzine or petrol, and then heated for from 2 to 4 hours at 130°—140° C. under a pressure of from 50—100 kilos. per sq. cm. The pressure is preferably applied by means of plates heated to 140° C. and actuated hydraulically. A special press has been designed for the purpose.

The plastic mass thus obtained is run into the form of sheet through rollers.—E. W. L.

India-rubber ; Manufacture or purification of —— and obtainment of bye-products therefrom. C. Dreyfus, A. Friedl, W. H. Bentley, and the Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 27,130, Nov. 22, 1909.

The raw rubber, balata, etc., either directly or after a preliminary cleaning, is treated (after comminution if necessary) with pyridine or a pyridine base, either alone or in admixture with an ordinary solvent of resin, such as alcohol and acetone. In the presence of water—either added or contained in the raw product—pyridine does not dissolve india-rubber, but still dissolves the resins. As examples of the manner in which the process may be conducted, the following are given :—(1) The raw rubber—*e.g.*, pontianak, almeidina, euphorbia, or flakes—is mixed with about six times its weight of a pyridine base boiling between 130° and 220° C. and with its own weight of water. The mixture is agitated and heated to about 100° C. for 2—4 hours. The extracted rubber is then removed, and the resin recovered from the solvent by distillation or by extracting the pyridine oil with dilute sulphuric acid. (2). A quantity of a low-grade rubber (containing water) is treated with 5—6 times its weight of a pyridine base for 2—4 hours in a water-bath. For dry rubber gums such as the Madagascar gums, 5—6 parts of pyridine base are used, with or without addition of water, the temperature being kept below 120° C. during the process. In all cases the resins are dissolved, the rubber remaining undissolved and uninjured.—E. W. L.

Rubber ; Recovery of ——. M. Delafond, Mexico. U.S. Pat. 966,385, Aug. 2, 1910.

Rubber plants are soaked in cold water until the resins contained in the bark or skin are exuded, and heat is then applied until the resins are melted and float on the surface of the water. The bark resins being removed, the plants are ground and the denser resins and woody fibre separated from the rubber.—E. W. L.

India-rubber goods ; Manufacture and repair of ——. T. Gare, New Brighton. U.S. Pat. 967,751, Aug. 16, 1910.

See Eng. Pat. 12,454 of 1906 ; this J., 1907, 539.—T. F. B.

XV.—LEATHER ; BONE ; HORN ; GLUE.

Oil dressing [of chamois leather] : A new fungus, Monascus Olei, occurring in the ——. A. Piedallu. Comptes rend., 1910, 151, 395—397.

The fungus which the author observed during the oil-dressing of chamois leather, and which he succeeded in isolating (see this J., 1909, 432), was described as *Monascus purpureus*. On comparing it with authentic specimens of *M. purpureus* and *M. Barkeri*, however, certain differences in the forms and colours of the colonies and of the characters of growth on various media were observed, sufficient to characterise the fungus isolated by the author as a new variety, for which the name *Monascus Olei* is proposed. —A. S.

Glue ; A sensitive reaction for ——. E. Schmidt. Chem.-Zeit., 1910, 34, 839.

The following observations are recorded, and form the basis of a suggested quantitative process :—The solutions employed were 1 grm. of glue in 500 c.c. of water, and 3 grms. of ammonium molybdate in 250 c.c. of water. (1). On mixing the two solutions, no precipitate is produced, and (2), only a slight turbidity, after heating for 3 minutes. (3) The glue solution when treated with the molybdate solution and two drops of dilute nitric acid gives an immediate white precipitate. This dissolves on heating, reappearing as a strong turbidity on cooling. (4) Nitric acid added after 3 minutes' heating of the mixed solutions produces a strong turbidity only. (5 and 6) Large excess of nitric acid in the cold or after heating inhibits precipitation. (7—10) Dilute sulphuric and hydrochloric acids produce similar results ; acetic, tartaric, and oxalic acids produce a turbidity only ; that produced by oxalic acid disappears on heating, but reappears on cooling. (11) On mixing glue solution with molybdate and dilute nitric acid and allowing the precipitate to stand for some time, the latter only dissolves in excess of nitric acid after shaking violently or heating, and a turbidity always remains. The precipitate dissolves readily in concentrated nitric and hydrochloric acids ; less readily in concentrated sulphuric acid, with difficulty and imperfectly in 80 per cent. acetic acid. (12) The precipitate formed as in (3), as well as the mother liquor, becomes bluish-green on standing. The reaction is extremely sensitive. For example, 0·002 grm. of glue when treated with 5 c.c. of water, 2 c.c. of molybdate solution, and 1 drop of dilute nitric acid gives a heavy precipitate, whilst 0·00007 grm. of glue with 2·5 c.c. of water, 1 c.c. of molybdate, and 1 drop of acid gives an appreciable turbidity, and a precipitate in the course of an hour. The presence of only 0·00001 grm. of glue is sufficient to produce a distinct turbidity. The reaction is characteristic of glue, and the slight turbidity produced with gum arabic, linseed, and egg albumin in the presence of molybdate and nitric acid is readily distinguished from it. The reaction is particularly useful in the examination of dressed fabrics and dressings.

Quantitative experiments. Preliminary experiments have yielded promising results. A solution of 1 grm. of gelatin in 250 c.c. of water was prepared ; 25 c.c. of this were diluted with 200 c.c. of water in a beaker, and 50 c.c. of molybdate solution and 5 c.c. of dilute nitric acid (sp. gr. 1·2) were added. The precipitate was allowed to settle, the liquid decanted through a weighed filter, the precipitate washed by decantation and finally on the filter with water acidified with nitric acid, and dried at 80° C., then at 100° C., till constant in weight. The percentages of glue found in 6 determinations were 105·8, 104·6, 105·5, 103·9, 105·3 and 100·2.—E. W. L.

Determination of glucose [in leather, etc.]. Kohnstein. *See* XVII.

Hemlock extract and sulphite liquor. U.S. Cons. Report, July, 1910. Oil, Paint and Drug Rep., Aug. 15, 1910. [T.R.]

The U.S. Consular Agent at Newcastle, New Brunswick, states that at a factory engaged in making extract of hemlock bark for tanning purposes there an important discovery has been utilised. The residual liquor from sulphite pulp mills acts on the liquor from the digested hemlock bark, producing a larger percentage of tannin. This discovery has been the salvation of this industry.

Patents.

Hides and skins ; Method of tanning ——. S. L. Evans, Taunton, and C. J. Innes-Baillie, London. Eng. Pat. 7819, Mar. 31, 1910.

The hides and skins are prepared for tanning in any suitable manner as by soaking in arsenicated water. The ordinary system of liming may be employed, or they may be treated with sodium sulphide, by painting, or in the lime-pits. The de-liming is suitably effected by means of such materials as boric, formic or lactic acids, or, in other cases, sugar of glucose. The hides are then suspended on a frame which swings slowly in weak tan liquor. In a few hours, when any calcium salts are purged and a good grain colour set, the leather is moved into a stronger liquor, to which boric acid (1 lb. per 100 galls.), saltpetre (same proportions), and common salt (5 to 10 lb. per 100 galls.) are preferably added. The salt renders the liquor a good conductor, it preserves the hide substance, and the chlorine evolved when an electric current is applied assists in bleaching the leather. A weak current (from 9 cells) is passed, during the tanning process, through the hides, and has the effect of producing a " permanent distension and solidification and close amalgamation of the contents of the cells with the cell walls."—E. W. L.

Leather board: Waterproof ——, *and process of preparing the same.* E. S. Buffum, Newton, and W. W. Carter, Needham, Mass., Assignors to The Newton Co., Newton, Mass. U.S. Pat. 965,152. July 26, 1910.

A PULP containing fibres of tanned leather is prepared, and to this are added alkaline reagents which combine with the acids derived from the leather to form soluble compounds thereof, and render the pulp receptive to waterproofing agents. The latter consist of soluble compounds of fatty acids and alkaline bases, which are mixed with the alkaline pulp, and from which the insoluble acids are then precipitated by means of a suitable reagent. The deposition of this insoluble precipitate on the fibres renders the mass subsequently prepared from them waterproof. Soluble salts may also be added to the pulp with the waterproofing agents, with the object of producing, by their subsequent decomposition by the precipitant, colour in the body of the pulp. The pulp is subsequently formed into the desired product.—E. W. L.

Glue from leather; Process of forming ——. H. G. Halloran, Brighton, Mass., Assignor to Methalco Chemical Co., Providence, R.I. U.S. Pat. 967,762, Aug. 16, 1910.

LEATHER is de-tanned preparatory to the manufacture of glue therefrom by immersing it in a solution of sodium chloride through which an electric current is passed. The leather is then washed, treated in "a bath of chlorine," and again washed. The caustic soda produced by the electrolysis of the sodium chloride is treated with the "chlorine fluid containing the chrome or tanning agent in solution," whereby the tanning agent is precipitated and sodium hypochlorite and chloride are produced.—A. S.

XVI.—SOILS; FERTILISERS.

Fertility of a soil; Relation between the —— *and the phosphoric acid soluble in water.* I. Pouget and D. Chouchak. Rev. gen. Chim. pure et appl., 1910, **13**, 157—178, 198—201. Chem. Zentr., 1910, **2**, 491.

IN seventeen soils which, in pot experiments, responded very differently to phosphatic fertilisers, the authors determined, by means of their method (this J., 1909, 261), the amounts of phosphoric acid extracted by 1 per cent. citric acid (Dyer) and by water containing calcium bicarbonate respectively. From the results of their experiments they conclude that the phosphoric acid compounds in soils are composed of a readily soluble form, mostly present in organic combination, and a less soluble form. Both forms are assimilable, the absorption of phosphoric acid by the plants depending only upon the concentration of the soil solution, which is governed by the relative proportions of the two forms and the amount of other mineral constituents. In the less fertile soils the easily soluble form is present only in small quantities and is exhausted long before the plant is fully developed. The application of phosphatic fertilisers increases the quantity of phosphoric acid present in the easily soluble form. By repeated extraction of the soil with 10 times and 20 times the quantity of water respectively, it was found that in both cases, after an equal number of extractions, nearly constant values are obtained. The total quantity of phosphoric acid extracted does not however bear any definite relation to the effect of phosphatic fertilisers on the soil. A better method of ascertaining the need of a soil for phosphoric acid is to determine (1) the initial concentration (Ci) of the soil solution (the quantity of phosphoric anhydride removed by extracting 100 grms. of soil with 100 grms. of water), and (2) the quantity of phosphoric anhydride (P_2O_5 in mgrms. per kilo. of soil) dissolved in the second of two successive extractions of the soil with 500 times its weight of water. If Ci is not greater than 1 and P_2 is less than 52, the soil will respond to the application of a phosphatic fertiliser. The authors are of the opinion that the concentration of the soil solution is an essential factor in the supply of phosphoric acid to plants, and that Whitney's view that the concentration is the same for all soils and that the effect of manuring is due to other causes (*e.g.* destruction of toxic substances secreted by the roots) is untenable.
—A. S.

Phosphoric acid in solution; Absorption of —— *by plants.* I. Pouget and D. Chouchak. Rev. gen. Chim. pure et appl., 1910, **13**, 219—222. Chem. Zentr., 1910, **2**, 491—492.

THE results of water-culture experiments in which phosphoric acid was supplied in very dilute solutions, showed that at concentrations between 0·14 and 4 mgrms. of phosphoric anhydride per litre, absorption of phosphoric acid by the plant takes place. The absorption is directly proportional to the concentration when the latter is greater than 1 mgrm. per litre, but it decreases much more rapidly than the concentration when the latter is less than 1 mgrm. per litre. Phosphoric acid is no longer absorbed when the concentration falls below 0·1 mgrm. of phosphoric anhydride per litre; on the other hand the amount of phosphoric acid in the solution increases. After some time the whole of the phosphoric acid is in organic combination, since the reaction with strychnine nitromolybdate (this J., 1909, 261) can only be obtained after evaporating the solution and igniting the residue.—A. S.

Phosphatic fertilisers; Experiments with ——. W. Schneidewind and D. Meyer. Landw. Jahrbb., 1910, **39**, Erg.-Bd. III., 236—247. Chem. Zentr., 1910, **2**, 405—406.

POT experiments showed that in the case of soils with a sufficient lime content, but containing only small proportions of iron and aluminium, Thomas meal, "precipitated phosphate," and superphosphate maintained their activity over a long series of years. Using sufficient quantities of the fertilisers, the yields with superphosphate were in the first and second years higher than, in the third, fourth, and fifth years equal to, and in the sixth and seventh years lower than those with Thomas meal. The effect of superphosphate was diminished by mixing it with "Kalkstickstoff" ("nitrolim," crude calcium cyanamide). "Agricultural phosphate," on a loose loamy soil, had a very slight action, and yielded only very small quantities of phosphoric acid to the plants.—A. S.

Potash fertilisers; Experiments with ——. W. Schneidewind, D. Meyer, and F. Münter. Landw. Jahrbb., 1910, **39**, Erg.-Bd. III., 247—253. Chem. Zentr., 1910, **2**, 406.

IN pot experiments with potatoes, summer wheat, and a mixture of clover and grass, phonolith gave very poor results in comparison with potassium chloride. Even the potassium compounds soluble in hydrochloric acid extracted from phonolith were not nearly so effective as potassium chloride. The application of sodium chloride and sodium sulphate in conjunction with a small quantity of potassium silicate soluble in water considerably increased the yield in the case of turnips, whilst the corresponding magnesium salts had no such effect, magnesium chloride indeed acting injuriously. Sodium chloride and magnesium chloride caused an increase in the utilisation of the soil potash, without however leading to an increased yield.
—A. S.

Nitrogenous fertilisers; Experiments with ——. W. Schneidewind, D. Meyer, F. Münter, and J. Graff. Landw. Jahrbb., 1910, **39**, Erg.-Bd. III., 209—236. Chem. Zentr., 1910, **2**, 405.

TAKING the increased yield produced with sodium nitrate as 100, the corresponding figures for the other fertilisers used were: ammonium sulphate, 93; Norwegian calcium nitrate, 96; crude calcium cyanamide ("Kalkstickstoff" and "Stickstoffkalk") on suitable soils, 85; animal guano, 67; fish meal, 73; meat meal, 71; blood meal, 56; horn meal, 55; leather meal, 15. On top dressing with ammonium sulphate and "Kalkstickstoff," no loss of nitrogen was observed with either on a sandy soil poor in lime, and only in the case of ammonium sulphate on a soil rich in lime; the loss was less on a soil richer in clay. On natural soils neither the zeolites present therein, nor strongly absorbent artificial zeolites added thereto, were found capable of fixing measurable quantities of ammoniacal nitrogen for a long period. For green crop manuring, clover gave better results than peas, beans, and vetches, especially on incompletely aerated loamy soils.—A. S.

Lime and magnesia fertilisers; Experiments with ——. D. Meyer. Landw. Jahrbb., 1910, **39**, Erg.-Bd. III., 254—298. Chem. Zentr., 1910, **2**, 406.

In experiments with buckwheat and oats the suggested dependence of the maximum yield upon a certain ratio of lime to magnesia could not be confirmed. Correction of an excess of magnesia due to manuring reduced the yield in the case of both crops. With soils containing sufficient magnesia, magnesium sulphate and magnesium chloride, as well as sodium chloride, had a favourable influence on the yield of cereals, but not on that of fodder plants. In larger quantities (2 per cent.) magnesium chloride and sodium chloride acted more injuriously than magnesium sulphate; the ill effect was greater the lighter the soil and the lower the lime content of the latter. In judging the requirement of a soil for lime, the reaction of the soil must be considered as well as the lime content. Neutral soils even when relatively poor in lime frequently do not respond to an application of lime. Soils with a high lime-content are not directly affected by the application of lime even when they are of acid reaction. In such cases, however, application of a quantity of lime sufficient to neutralise the acidity is advantageous, since acidity is detrimental to the progress of the chemical-biological processes and to the action of physiologically acid fertilisers. On acid soils poor in lime, calcium carbonate and magnesium carbonate act favourably, whilst calcium sulphate is injurious.—A. S.

Bone superphosphate; Detection of adulteration of ——. G. Masoni. Staz. sperim. agrar. ital., 1910, **43**, 297—328. Chem. Zentr., 1910, **2**, 595—596.

Bone superphosphate when heated in a porcelain dish and then ignited in a platinum crucible does not evolve white fumes or become yellow during the ignition; the residue, after cooling, is white or, at the most, pale brick-red, and dissolves almost completely in 10 per cent. hydrochloric acid. The author recommends determinations of the moisture, total and citrate-soluble phosphoric acid (P_2O_5), total sulphuric acid (SO_3), and residue insoluble in *aqua regia*, the results being referred to the substance dried at 100° C. The quotients: $ST = \frac{\text{total sulphuric acid}}{\text{total phosphoric acid}} \times 100$, and $SS = \frac{\text{total sulphuric acid}}{\text{citrate sol. phosphoric acid}} \times 100$ should not differ appreciably and should not be greater than 130. The insoluble residue should be less than 1·3 per cent. If SS and ST be much less than 110, an addition of precipitated phosphate may be suspected. Other confirmatory tests and a microscopical examination may also be made.—A. S.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beet; Strumose formation in the ——. K. Spisar. Z. Zuckerind. Böhm., 1910, **34**, 629—634.

Neither a microscopical nor a bacteriological examination of sections gave any insight into the origin of the protuberances sometimes appearing on both sound and altered roots. It was, however, observed that on slicing such beets longitudinally in such a way that both root and struma are equally divided, a small fissure about 2 mm. long containing particles of earth is invariably found on the axis of the root. This pointed to strumose formation being caused by the wounding of the root in the early stages of its development, and by cutting a number of different normal roots more or less deeply with a knife, strumose formation was caused, but not in every case. It is evident that certain physiological conditions are necessary, and these the author now has under investigation.—J. P. O.

Sugar in the beetroot; Determination of —— by the hot aqueous digestion method. V. Stanek and J. Urban. Z. Zuckerind. Böhm., 1910, **34**, 625—628. (See also this J., 1909, 1154.)

From a series of comparative determinations the authors find that the Herzfeld modification of the Sachs-Le Docte method (this J., 1909, 846) gives results which agree within the limit of experimental error with those obtained by the Herles-Pellet method. It is immaterial whether the pulp be prepared with an ordinary rasp, with the Stanek rasp, or by chopping, and the extraction is quite complete in 30 minutes. As a rapid and trustworthy method for the analysis of beets for the purpose of seed selection, the Herzfeld modification is strongly recommended.—J. P. O.

Phosphoric acid; Use of —— in the cane sugar factory. P. de Sornay. Bull. Assoc. Chim. Sucr. et Dist., 1910, **27**, 1190—1200.

It is pointed out that, contrary to sulphurous acid which has no special decolorising action on the juice (this J., 1910, 366), phosphoric acid is a true decoloriser. When mixed with defecated juice the precipitate formed entrains the brown colouring matters, carrying them as a more or less dark mass to the bottom. If, however, the raw juice has remained for some time in contact with air, so that the colouring matters have absorbed oxygen, the decolorising action of the phosphoric acid is then rendered much slower and less complete. On investigating the action of phosphoric acid on the composition of sulphited green juice the author found that although the organic matter somewhat decreases, the purity remains about the same. It was also observed that the degree of decolorisation is neither proportional to the amount of acid used nor to the temperature. Further experiments carried out with the object of determining the maximum amount of superphosphate which may be added to the syrups without inversion occurring, showed that at 65° C. (the temperature to which the syrups fall on running from the effect to the syrup-tank) a slight inversion commences with 1·5 grms. of superphosphate per litre, and that inversion becomes quite pronounced on increasing the amount to 2·0 grms. per litre. In general the author's investigations show that phosphoric acid, if used in a rational manner and in small amount, whilst giving a fine white sugar, does not decrease the rendement.—J. P. O.

Lactose; Manufacture of —— from whey. T. Aufsberg. Chem.-Zeit., 1910, **34**, 885.

Cheese-makers usually send their supply of whey to a central factory where the lactose is separated. Before the whey is concentrated it is heated, and treated with from 1 to 3 per cent. of acid (whey-vinegar) in order to coagulate any albuminous substances present, the latter being removed by suitable means. The whey is then concentrated at a temperature of from 60° to 70° C. under reduced pressure until it contains about 60 per cent. of total solids; the concentrated liquid is run into rectangular vessels, each holding about 700 litres and surrounded by a cold-water jacket, and, after the lapse of 10 hours, the thick liquid is stirred, this operation being repeated at intervals. At the end of 24 hours the pasty mass is submitted to centrifugal action, the crude, moist lactose thus obtained amounting to about 3·85 per cent. of the weight of the original whey; a further quantity of crude lactose, amounting to about 0·5 per cent., is obtained by evaporating the mother-liquor and allowing it to crystallise. The second mother-liquor may be used for feeding pigs, or for the preparation of lactic acid. The crude lactose is now refined by dissolving it in water so as to form a solution having a density of 13° to 15° B., adding to the solution a quantity of bone-charcoal and about 0·2 per cent. of acetic acid, heating the mixture to 90° C., then adding a small quantity of magnesium sulphate, and heating the whole to boiling.

The flocculent precipitate (which, after treatment with sulphuric acid, may be used as a manure) is removed by filtration and the filtrate is evaporated by heating under reduced pressure until it has a density of 35° B. Crystallisation is then allowed to take place, and the crystals are separated. The lactose thus obtained is again subjected to a similar refining treatment, the final yield of crystalline lactose being dried in a centrifugal machine supplied with a current of hot air. The dry product, amounting to about 2·5 per cent. of the weight of the original whey, is then ground and sifted.—W. P. S.

Honeys; Detection of invert sugar in commercial ——. H. Quantin. Ann. Chim. Analyt., 1910, 15, 299—301.

Honey in the comb, and also that which has been extracted by expression or running off at the ordinary temperature, gives no coloration with Fiehe's reagent (see this J., 1908, 1127, 1171) or with a solution of aniline acetate. When, however, as is often the case with commercial samples, the honey has been prepared by melting in basins heated by direct fire to a temperature over 100° C., furfural is formed, so that both these tests become valueless as means of indicating the presence of added invert sugar. A number of experiments carried out with the object of studying the conditions under which furfural is formed when honey is prepared by the aid of heat are here described. Samples, giving negative reactions by both tests, on being heated to 98° C. for half-an-hour with an amount of formic acid corresponing to the natural acidity of honey gave distinct indications of the presence of furfural, whilst no trace of this body was found after carefully neutralising and heating for the same time to 108° C. in a calcium chloride bath. According to the author furfural is inevitably formed, as the result of local superheating, when honey has been prepared by the aid of heat in the manner indicated.—J. P. O.

Honey; Examination of ——. F. Reinhardt. Z. Unters. Nahr. Genussm., 1910, **20**, 113—152.

Except for natural honey adulterated with more than 50 per cent. of invert sugar, or in the case of artificial honey, Ley's reaction is pronounced by the author to be quite untrustworthy unless supported by other tests. Fiehe's reaction, on the contrary, is considered to be an excellent means of differentiating between natural and artificial honey, as well as of identifying added invert sugar in natural honey. It should, however, only be taken as positive when the characteristic coloration, produced in the presence of either 25 or 38 per cent. hydrochloric acid, persists for at least 48 hours. Genuine honeys, even if previously heated during preparation, are stated never to respond to this test (compare preceding abstract). Equally trustworthy is Jägerschmid's reaction, but it is of importance to use only chemically pure acetone and pure hydrochloric acid of sp. gr. 1·19. The content in nitrogenous substances, owing to its very considerable variation in natural honey, is valueless as a criterion of purity. Lund's tannin test is unreliable for the same reason, unless the volume of precipitate is less than 0·3 or 0·4 c.c., in which case adulteration is indicated, the minimum amount obtainable from pure honey being 0·6 c.c. It is recommended to carry out the following determinations and tests in examining honey: the water content, the polarisation of a 10 per cent. solution before and after inversion, Fiehe's and Jägerschmid's reactions, Lund's tannin precipitate, and, provided positive indications are obtained by the two colour tests, also Ley's reaction and determination of the ash.—J. P. O.

Glucose (dextrose); Determination of —— [*in leather, sugar products, etc.*]. B. Kohnstein. Collegium, 1910, 301—304.

The proposed method depends upon the conversion of *o*-nitrophenylpropiolic acid to indigo blue by the reducing action of glucose. The liquid under examination, suitably diluted if dark coloured, is rendered alkaline with sodium hydroxide, and boiled with about 0·05 grm. of *o*-nitrophenylpropiolic acid for ¼ minute. The indigo blue formed is filtered off, washed with very dilute sulphuric acid, and with dilute alcohol, then dissolved in chloroform. After evaporating off the solvent at the ordinary temperature the residue is weighed, and finally ignited in order to make a deduction for any inorganic matter in the precipitate. When the method is applied to leather extracts, a preliminary treatment with freshly calcined magnesium hydroxide to adsorb the tannin is recommended.—J. P. O.

Caramel; Preparation of ——. A. Herzfeld. Deutsche Zuckerind., 1910, **35**, 617—618.

On heating dry sucrose to 180°—190° C. in the manner prescribed by Ehrlich for the preparation of saccharane (this J., 1910, 506), it was found that whether this is done *in vacuo*, in an atmosphere of carbon dioxide, or with the addition of fixed alkali, the resulting product is always insoluble in strong alcohol. Lævulose when heated under the same conditions yields a caramel soluble in 80 per cent. alcohol, but this alcoholic solution gives a heavy deposit on being cooled to −8° C. The product from dextrose is very readily soluble in 80 per cent. alcohol, and its alcoholic solution on being cooled becomes but slightly turbid. These results suggested that in order to obtain a suitable spirit caramel from sucrose, inversion must always precede caramelisation, and from subsequent experiments the conclusion was drawn that the formation of the body producing the turbidity in alcohol at low temperatures is due, not only to incomplete inversion, but also to the influence of the acids which are always formed on heating the inverted solution. Accordingly an 80 per cent. solution of invert sugar contained in a glass flask was heated in an oil-bath to boiling point, then ammonium hydroxide dropped in whilst the water gradually evaporated, after which the temperature was raised to 170°—180° C. The caramel thus made is almost tasteless, dissolves readily in 80 per cent. alcohol, and solutions of it in strong spirit and in lager beer remain quite clear on being kept at low temperatures (—8° C.). Its solution does not alter in intensity of colour on being acidified with acetic acid, nor does it give a precipitate with lead acetate. A 0·5 per cent. solution gives in the Stammer colorimeter a value of 100°, as compared with 53° for the best commercial products.—J. P. O.

Paper from megasse. Carmody. *See* V.

Mechanism of photochemical reactions and the formation of vegetable principles; decomposition of solutions of sugars. Berthelot and Gaudechon. *See* XX.

Patents.

Sugar-juices; Apparatus for treating ——. E. W. Deming, New York, and A. F. Gaiennie, New Orleans, Assignors to Deming Apparatus Co., New York. U.S. Pat. 967,340, Aug. 16, 1910.

The apparatus comprises a continuous-flow receiving tank with inlets at the bottom for the juice and for sulphur dioxide respectively, and having at the top an overflow trough, which communicates with a second tank adjacent to the first. A juice conduit leads from the second tank, which is provided with a float, and in the conduit is a circulating pump, the speed of which is regulated by the float so that a constant level of juice is maintained in the tank. Means are provided for the introduction of acid and alkaline reagents into the receiving tank, these means and also means for regulating the admission and discharge of sulphur dioxide being controlled by the volume of juice traversing the system.—A. S.

Refinery syrups; Apparatus for the concentration of the juices of ——. Soc. Anon. Raffinerie Moderne Procédé Natta, Malpassé-Marseille, France. Eng. Pat. 16,824, July 19, 1909. Under Int. Conv., July 22, 1908.

See Fr. Pat. 392,539 of 1908; this J., 1909, 34.—J. P. O.

XVIII.—FERMENTATION INDUSTRIES.

Methylglucase in beer yeast; Existence of a specific ——. Bresson. Comptes rend., 1910, **151**, 485—487.

Fischer has shown that yeast extract hydrolyses α-methylglucoside, and Bierry (this J., 1909, 951) has found that the intestine of the dog contains an α-glucosidase which decomposes α-methylglucoside. The author has made experiments with top- and bottom yeasts of the Frohberg type, and finds that an extract of the former, but not of the latter yeast, hydrolyses α-methylglucoside, though both extracts contain invertase and maltase. At a temperature of 45° C., the extract of the top yeast ceases to act on α-methylglucoside, though it is still capable of acting on maltose and sucrose. Hence, the top yeast appears to contain a specific enzyme capable of decomposing α-methylglucoside.—L. E.

Enzymes. II. F. Münter. Landw. Jahrbb, 1910, **39**, Erg.-Bd. III., 298—314. Chem. Zentr., 1910, **2**, 398. (See Schneidewind, Meyer, and Münter, this J., 1907, 513.)

Aspergillus-diastase (Takadiastase) was prepared by cultivating *Aspergillus oryzae* in suitable nutrient liquids and filtering the solution through paper and Pukal filters. Its activity was found to be injured by alcohol and ether. Of the salts examined, only ammonium sulphate was found to be useful for salting-out the enzyme; addition of solid substances (albumin, starch, calcium phosphate, $CaHPO_4$) to the solution had no favourable effect on the action of the ammonium sulphate. No relation could be found between the activity and nitrogen content of different preparations. It was not found possible to separate diastatic enzymes by dialysis through parchment-paper. Small additions of different sugars to the enzyme solutions had no influence on the hydrolytic action, but the reaction products of saccharification (maltose), in higher concentrations, injured the activity of the diastase. The temperature of optimal activity and the temperature at which the enzyme was destroyed were different for diastases of different origin. The diastatic power of preparations which had been weakened by heating, could be strengthened by addition of organic nitrogenous compounds. The chemical-biological method of Fränkel and Hamburg (this J., 1906, 945) proved unsuitable for the preparation of pure diastase.—A. S.

Government laboratory; Report of the principal chemist of the —— *upon the work of the laboratory for the year ended March* 31, 1910. With Appendices. Wyman and Sons, Ltd., Fetter Lane, London, E.C.; Oliver and Boyd, Tweeddale Court, Edinburgh; E. Ponsonby, Ltd., 116, Grafton Street, Dublin. [Cd. 5283]. Price 3d.

The total number of analyses and examinations made in the two branches of the Government Laboratory during the year ended 31st March, 1910, was 170,033, against 176,922 for the preceding year. Including the samples examined at the Testing and Chemical Stations the total number of analyses and examinations for the year was 323,464.

Arsenic in beer, etc. 412 samples of beer, wort, and materials used by brewers have been tested for the presence of arsenic. Of these, 35 were found to contain it in excess of the limits laid down by the Royal Commission on Arsenical Poisoning, namely, the equivalent of one-hundredth of a grain of arsenious oxide per pound in the case of solids, or per gallon in the case of liquids. Of the 116 samples of malt examined, eight exceeded the limit, the amount varying from $\frac{1}{50}$th to $\frac{1}{4}$th of a grain per pound. Of 236 samples of glucose, invert sugar, caramel, etc., none exceeded the limit. The sample of malt containing $\frac{1}{4}$th of a grain of arsenic per pound was examined in November of last year. The beer brewed from this malt contained arsenic considerably in excess of the quantity deemed permissible by the Royal Commission. Investigation showed that the contamination was due to the fuel used in kiln-drying the malt, and that the contamination was practically confined to one brewery. Coal was obtained from a different source, and other means were taken by the brewer to ensure freedom from contamination. Subsequent samples of wort and beer show that the beer as now produced is practically free from arsenic. In addition to the above, 164 samples of mineral acids, chemicals, drugs, vinegar, etc., were also tested for this impurity.

Denatured and duty-free spirit for manufacturing purposes. 770 samples of wood naphtha, representing 282,752 gallons, submitted for approval for methylating purposes were examined. Nine samples, representing 1,844 gallons, could not be approved.

——	1910.	1909.	1908.
Number of samples approved	761	785	771
„ „ rejected	9	4	11
Gallons approved	280,908	283,337	289,031
„ rejected	1,844	1,251	2,864

The number of samples rejected last year was somewhat greater than in 1909 but less than in 1908, and the quantity rejected, as for several years past, was a very small percentage (0·6) of the total quantity presented for approval. Both industrial and mineralized methylated spirit showed a slight reduction in the quantities made as compared with 1909 and 1908. The quantities of each kind of methylated spirit sent into consumption by the makers were:—

——	1910.	1909.	1908.
	Bulk gallons.	Bulk gallons.	Bulk gallons.
Industrial methylated spirit for manufacturing purposes ..	2,404,019	2,542,910	2,589,500
Mineralized methylated spirit, mainly for domestic use ..	1,558,393	1,628,190	1,583,900

From this it will be seen that the industrial spirit issued to manufacturers during the year was less by 138,891 gallons than in 1909. This was partly due to an increased issue of duty-free alcohol otherwise denatured amounting to about 50,000 gallons, but there was no doubt a diminished use of the spirit during the early part of the year owing partly to the general trade depression then prevailing, and partly to the higher prices of alcohol which, no doubt, tended to make manufacturers more economical in its use, and more careful about recovering it during their operations where this was possible. During the year 461 applications connected with the use of methylated spirit have been referred to the Department, making a total of 2,365 since the introduction of industrial methylated spirit in October, 1906. For the preparation of mineralized methylated spirit 205 samples of mineral naphtha representing 6,154 gallons were examined, and 202 samples representing 6,064 gallons were approved. 80 samples of "petroleum ether," representing 2,666 gallons, were examined, and were all found suitable for mixing with industrial methylated spirits used in certain manufacturing operations where additional Revenue protection is required. The use of pure duty-free ethyl and methyl alcohols in the science laboratories of universities, colleges, etc., showed a slight increase compared with 1909 and previous years, and there has been a very considerable increase in the quantity of specially denatured alcohol used for manufacturing purposes. This is mainly due to sanction having been given to the use of specially denatured ethyl alcohol in the manufacture of certain explosives, and to a somewhat increased use of methyl alcohol. Practically the whole of the alcohol used for manufacturing purposes, except 44,004 proof gallons of methyl alcohol which is not made in this country, was of British manufacture. The quantities of British and Foreign spirits issued duty free during the years ending 31st March 1908, 1909, and 1910, under the provisions of the Finance Act, 1902, were:—

—	1910.			1909.			1908.		
	Proof gallons.			Proof gallons.			Proof gallons.		
	British.	Foreign	Total.	British.	Foreign.	Total.	British.	Foreign.	Total.
Universities, colleges, &c. ..	1,173	3,778	4,951	989	3,826	4,815	930	3,393	4,323
Manufacturers	475,515	44,303	519,818	418,057	21,341	439,038	467,758	5,751	473,509

The total quantity of spirit expressed in proof gallons issued duty-free for all purposes, domestic and manufacturing, during the years ended 31st March, 1908, 1909, and 1910, was as follows :—

—	1910.	1909.	1908.
	Proof gallons.	Proof gallons.	Proof gallons.
Mineralized methylated spirit for domestic use	2,302,091	2,395,306	2,339,782
Industrial methylated spirit for manufacturing purposes	3,859,158	3,884,739	4,115,593
Spirit otherwise denatured for manufacturing purposes	519,818	439,038	473,509
Science laboratories at universities, colleges, &c.	4,951	4,815	4,323

The total quantity of foreign spirit used for manufacturing purposes during the year ended 31st March, 1910 (including 44,004 proof gallons of methyl alcohol), was equivalent to 48,081 proof gallons, or about 30,000 bulk gallons.

For the purpose of controlling the use of methylated spirit a large number of samples have been examined. A few instances were found where methylated spirit was being used for purposes not in themselves illegal, but for which the requisite authorisation had not been obtained. In these instances the traders were cautioned against a repetition of the irregularity. Ten cases of unlicensed sale of methylated spirit were dealt with, proceedings being taken and penalties recovered in most instances. Many traders are authorised to use industrial alcohol in making special articles. In order to ensure that the conditions laid down for safeguarding the use of industrial methylated spirit are complied with, the Board of Customs and Excise have directed that preparations authorised to be made with this industrial alcohol shall be occasionally examined.

—	Nature of Manufacturing Operations or other purposes for which the Industrial Methylated Spirit is used.		Quantity used.	
			1910.	1909.
			Gallons.	Gallons.
1	Manufacture of	Finish for sale	337,787	336,135
2	,,	Varnishes, Polishes, and Lacquers for sale	811,252	858,278
3	,,	Stains, Paints, Enamels, &c. for sale	31,244	66,184
4	,,	Varnishes. Finish, Stains, Lacquers, &c., and Spirit used for Polishing Purposes in Manufacturers' own Workshops	231,032	253,689
5	,,	Felt Hats	121,340	120,643
6	,,	Celluloid, Xylonite and similar substances	24,194	28,554
7	,,	Oil-cloths, Leather-cloths, Pegamoid and similar substances	141,663	111,892
8	,,	Linoleum and similar substances	807	320
9	,,	Smokeless Powders, Fulminates and other Explosives	11,487	19,702
10	,,	Soap	144,636	140,964
11	,,	Electric Lamp Filaments	11,346	14,688
12	,,	Electric Cables	3,564	3,511
13	,,	Incandescent Gas Mantles	18,351	18,060
14	,,	Ether	166,167	160,294
15	,,	Chloroform	11,038	11,808
16	,,	Ethyl Chloride and Bromide	716	932
17	,,	Solid Medicinal Extracts	39,831	23,224
18	,,	Alkaloids and Fine Chemicals	15,788	17,263
19	,,	Embrocations, Liniments, and Lotions	44,641	30,717
20	,,	Surgical Dressings	15,309	9,095
21	,,	Capsules and other Medicinal Appliances	1,361	1,232
22	,,	Hair Washes	14,719	10,583
23	,,	Cattle Medicines	1,863	1,677
24	,,	Plant Washes, Insecticides, and Sheep Dips	12,981	9,617
25 26	,,	Aniline and other Dyes	4,639	2,988
27	,,	Fireworks and Matches	4,796	5,716
28	,,	Photographic Plates and Papers, and other Photographic Purposes	42,077	39,418
29	,,	Steel Pens	3,180	3,251
30	,,	Silk, Crape, and Embroidery	6,606	8,397
31	,,	Artificial Flowers	5,444	3,867
32	,,	Rubber	1,469	1,990
33	,,	Artificial Silk..	—	—
34	,,	Ships' Compasses, Spirit Levels, &c.	632	620
35	,,	Inks	417	2,002
36	For	Dyeing and Cleaning Operations in Laundries and Dye Works	42,011	47,319
37	,,	Calico Printing	6,480	4,495
38	,,	Preservation of Specimens in Museums and Hospitals	8,400	8,737
39	,,	Educational and Scientific Purposes in Colleges and Schools	6,160	4,951
40	,,	Analytical and Scientific Purposes in the Laboratories of Analysts, Works Chemists, etc.	5,107	8,322
41	,,	use in Hospitals, Asylums, and Infirmaries	40,710	36,718
42	,,	Electrotyping and Printing	452	1,542
43	,,	various Miscellaneous Manufactures, including Cements, Disinfectants, &c.	3,887	9,102
44	,,	Admiralty Dockyards and War Office, Arsenals and Workshops, chiefly for Varnishes and Polishes	4,439	16,832
		Total Quantity used	2,401,013	2,476,586

Twenty-seven samples have been analysed for this purpose during the past year. No cause for complaint was found in respect of most of the samples. A few, however, were not in accordance with the requirements, and the traders were cautioned against further disregard of the restrictions imposed. The result is not unsatisfactory, as the irregularities in question were not in any case suggestive of intentional fraud, but rather of carelessness or an imperfect sense of responsibility.

The preceding return of the quantities of industrial methylated spirit used in manufacturing operations and for other purposes in the United Kingdom during the years ended 31st March, 1909 and 1910, has been prepared from official returns made by manufacturers and other users.

Cellase and emulsin ; Individuality of ——. G. Bertrand and A. Compton. Comptes rend., 1910, **151**, 402—404.

The authors examined, under identical conditions, the relative activity of enzyme preparations from apricot kernels, sweet almonds, maize corns, and wheat bran, towards cellose and amygdalin. The numerical results are expressed as the number of mgrms. of the enzyme preparation required (C) to decompose ½ mgrm.-mol. of cellose, and (A) to decompose ½ mgrm.-mol. of amygdalin under the experimental conditions. The ratio C/A was found to vary from 85·63 to 0·60, thus indicating that the relative proportions of cellase and emulsin in different plants differ widely, and at the same time establishing clearly that the two enzymes are not identical. Neither cellase nor emulsin could be detected in enzyme preparations from white mustard seed and Persian berries, but these preparations were rich in myrosin and rhamninase respectively. (See also Bertrand and Holderer, this J., 1910, 292.)—A. S.

Malt vinegar ; Composition of ——. E. Russell and T. R. Hodgson. Analyst, 1910, **35**, 346—348.

The following results were obtained on the analysis of 13 samples of genuine malt vinegar and 2 samples of wood vinegar :—

——	Malt vinegars.		Wood vinegars.	
	Lowest.	Highest	1.	2.
Sp. gr.	1013·7	1022·1	1012·1	1012·4
Acetic acid, per cent.	3·85	6·36	2·20	2·30
Total solids, per cent.	1·47	3·15	0·47	0·43
Ash, per cent. ..	0·18	0·60	0·04	0·03
Alkalinity of ash (as K_2O) per cent.	0·016	0·040	0·014	0·022
Phosphoric acid (P_2O_5), per cent.	0·047	0·092	Nil.	Nil.

In the determinations of the total solids it was found that the residues retained quantities of acetic acid varying from 0·15 to 0·22 per cent., and that a neutral residue was obtained only when the residue was moistened with water and evaporated three successive times. It is suggested that 3·5 per cent. of acetic acid and 0·05 per cent. of phosphoric acid should be taken as the minimum standards for malt vinegar.—W. P. S.

Alcohol from sulphite-cellulose waste lyes. Schwalbe. *See* V.

Preparation of caramel. Herzfeld. *See* XVII.

Denatured alcohol ; Production of —— *in the United States.* Oil, Paint, and Drug Rep., Aug. 29, 1910. [T.R.]

According to the official figures of the Internal Revenue Bureau the total production of denatured alcohol in wine gallons, for the month of July, 1910, was 252,394 gallons of completely denatured and 389,496 gallons of specially denatured alcohol. The figures for the fiscal year ending June 30, 1910, show 3,076,924 and 3,002,063 gallons, respectively, of the two grades of denatured alcohol.

The detailed statistics showing the production in 1909—1910 by districts and the gain over the previous fiscal year are as follows :—

District.	Completely denatured.	Specially denatured.
First California	293,035.73	33,030.19
Sixth California	70,105.28	....
Fifth Illinois	265,511.32	426,418.90
Sixth Indiana	122,613.51	255,285.30
Sixth Kentucky	....	77,210.88
Louisiana	1,853,764.39	1,580,364.13
Maryland	1,930.44	....
Massachusetts	353,849.45	487,657.73
Fifth New Jersey	....	130,358.80
First Wisconsin	15,214.43	11,737.87
Totals	3,076,924.55	3,002,063.89
Total		6,078,988.44
Increase over year ended June 30, 1909........		2,522,560.59

Patent.

Cultures ; Enriching bacteria and like ——. C. Löloff, Breslau, Germany. Eng. Pat. 21,174, Sep. 16, 1909. Under Int. Conv., May 29, 1909.

The bacteria or other organisms, the enriched culture of which it is desired to obtain, are separated from the liquid containing them by the production of a precipitate therein, either of a substance already present, as casein in milk, or a substance added, as gelatin. The precipitated mass containing the bacteria is removed from the liquid, pressed, and placed in a nutrient medium which penetrates the mass and causes the organisms to multiply and at the same time absorbs the products of their growth. By draining off this medium and replacing by fresh, and repeating, a gradual enrichment of the solid mass with the organism desired is obtained. The enriched culture can then be dried and ground, or otherwise prepared in the usual manner.—J. H. J.

Alcohols, aldehydes, acids, and ketones ; Photochemical decomposition of ——. Berthelot and Gaudechon. *See* XX.

XIXa.—FOODS.

Wheats from African Colonies and India. Bull. Imp. Inst., 1910, 8, 115—121.

Samples of wheat from the East African Protectorate (4), Uganda (1), Northern Nigeria (2), and Sind, India (1) were examined. The percentages of gluten and gliadin in the four East African samples are shown in the following table :—

	No. 1. "Gluyas."	No. 2. "Bobs' rust-proof."	No. 3. "Gluyas."	No. 4. "Rietta."
Gluten, per cent.	12·6	12·2	11·7	10·6
Gliadin, per cent.	7·5	7·4	6·9	6·5

Nos. 1. 2. and 3 would, it is considered, be saleable at from 37s. to 38s. per quarter of 480 lb. c.i.f. London, and No. 4 at a slightly lower price. The "Rietta" wheat was stated by A. E. Humphreys to behave in milling and baking very much like English "Rivett" wheat. The Uganda wheat was of the "durum" type. It contained 13·04 per cent. of total protein, 12·04 of crude gluten, and 5·53 of gliadin. It was valued at 35s. per quarter c.i.f. London, but would probably sell in continental markets at prices fully equal to those obtained for American "durum" wheats. The wheats from N. Nigeria contained : (1), 11·3 per cent. of gluten and 5·9 per cent. of gliadin, and (2) 10·7 of gluten and 6·3 of gliadin. They were valued at 36s. 6d. and 37s. 6d. respectively per quarter c.i.f. London. A. E. Humphreys, as the result of milling and baking trials with sample No. 1, reported that it would find a ready sale in the United

Kingdom. The macaroni wheat from India contained 11·70 per cent. of gluten (13·46 per cent. on the dry wheat), and 13·1 of moisture. Italian firms reported that the wheat would be suitable for the manufacture of macaroni.—A. S.

Milk; Occurrence of sulphates in ——. J. Tillmans and W. Sutthoff. Z. Unters. Nahr. Genussm., 1910, 20, 49—63.

It is shown that sulphuric acid, in the form of sulphates, is a normal constituent of milk; the precipitate obtained on treating milk serum (prepared by precipitating milk with a mixture of hydrochloric acid and mercuric chloride) with barium chloride consists of barium sulphate, and is free from organic substances. All the sulphate present is found in the serum. The following quantities of sulphuric acid (SO_3) were found in different milks:—cows' milk 92·1 mgrms; goats' milk, 50·4 mgrms.; mares' milk, 22·8 mgrms.; and human milk, 23·7 mgrms. per litre. The total sulphur in milk is present in three forms, namely, as protein sulphur, organic non-protein sulphur, and sulphate; the proportions of these different forms of sulphur calculated as percentages of the total sulphur, is as follows:

	Protein sulphur.	Organic non-protein sulphur.	Sulphate sulphur.
Cows' milk	84·7	4·9	10·4
Goats' milk	87·9	6·3	5·8
Mares' milk	90·2	5·8	4·0

—W. P. S.

Milk serum prepared by the use of calcium chloride; The physical chemistry of ——. G. Wiegner. Z. Unters. Nahr. Genussm., 1910, 20, 70—86.

The specific refraction of milk serum prepared by precipitating milk with calcium chloride is the sum of the specific refractions of the constituents of the serum, and is a constant. If N be the refractive index of the serum at 17·5° C., and d^{15}_{15} the specific gravity at 15° C., then

$$\frac{N^2 - 1}{N^2 + 1} \times \frac{1}{d^{15}_{15}} = 0\cdot2056$$

If N be determined at a temperature, t, and the specific gravity (d^t_4) taken at the same temperature be compared with that of water at 4° C., then

$$\frac{N^2 - 1}{N^2 + 1} \times \frac{1}{d^t_4} = 0\cdot2058$$

The specific volume of the serum also depends on the specific volumes of the constituents, and, taking into consideration the solution-contractions of the latter, the specific volume may be calculated from the chemical composition. The specific gravity, being the reciprocal of the specific volume, is similarly dependent on the composition. The specific gravity of the dry solids of the serum is constant, namely, 1·685 at 20° C. compared with water at 4° C. The total solids (t) of the serum may, therefore, be calculated by the aid of this factor:

(1) From the specific gravity of the serum, according to the formula: $t = 245\cdot36 - 244\cdot92 \frac{1}{d^{20}_4}$

(2) From the refractive index of the serum at 20° C.:

$$t = 245\cdot36 - \frac{N^2 + 2}{N^2 + 1} \times 50\cdot405$$

If the serum be prepared exactly as described by Ackerman, the non-fatty-solids (T) of the milk may be calculated:

(1) From the specific gravity of the serum by the formula:

$$T = 344\cdot83 - 344\cdot22 \times \frac{1}{d^{20}_4}$$

(2) From the refractive index by the formula:

$$T = 344\cdot83 - \frac{N^2 + 2}{N^2 - 1} \times 70\cdot840$$

—W. P. S.

Ghee; Analyses of ——. E. R. Bolton and C. Revis. Analyst, 1910, 35, 343—345.

The article sold in Eastern countries as ghee is a clarified milk-fat, being prepared in most cases from buffalo milk, and also from cows', goats', and sheep's milks. It is, however, frequently adulterated by the addition of other fats and oils, mostly vegetable, of which the following are most commonly used: cocoanut, earthnut (arachis), cottonseed, safflower, poppyseed, sesamé, and nigerseed oils; whilst mahua, salvadora, and castor oils are sometimes used. Three samples of genuine ghee examined by the authors yielded the following results:—Reichert-Meissl value, 30·58, 30·42, 31·50; Polenske value (titration number of insoluble volatile acids), 1·62, 2·42, 1·66; saponification value, 228·8, 228·7, 229·1; iodine value (Wijs), 30·63, 30·75, 29·60; butyro-refractometer reading at 40° C., 41·4, 41·4, 41·5; Valenta value, 24·0° C., 24·5° C., 23·5° C.; baryta value (Avé-Lallemant's process, this J., 1907, 1068), total, 312·8, 312·6, 313·5; insoluble, 251·7, 253·3, 248·7; free fatty acids (as oleic acid), 3·68, 2·60, 2·59 per cent. Analyses are also given of various samples sold as ghee, but which were obviously adulterated; in one case the sample was entirely devoid of butter-fat. Ghee must not be confused with "ghee-butter," a term applied to a vegetable fat obtained from the seeds of *Bassia butyracea*; this fat has a Reichert-Meissl value of 1·31, a saponification value of 188·2, an iodine value of 42·6, and a total baryta value of 257·3, the "insoluble baryta value" being 255·7.—W. P. S.

Tobacco: Burning quality of ——. T. A. Henry and S. J. M. Auld. Bull. Imp. Inst., 1910, 8, 142.

In order that a tobacco should smoke in a satisfactory manner, it is essential that it should burn evenly, slowly, and completely. For cigar tobacco it is further necessary that it should leave a white or at least a pale grey ash, and the ash should be coherent and show no tendency to break up easily into powder or flakes. These properties depend almost entirely on the nature of the mineral constituents of tobacco, and this in turn depends on the soil in which the tobacco is grown and the nature of the manures applied to it. The authors have made analyses of a large number of tobaccos of the principal kinds used in commerce, and on the basis of these results confirm the view that the chief factor influencing the burning quality of tobacco is the amount of potash in the ash. Lime and magnesia are also important and invariable constituents of tobacco ash, but their influence is practically confined to whitening the ash, and they are therefore of greatest importance in cigar tobaccos. Excess of lime, however, usually means reduction of potash, so that soils containing excess of lime are unsuitable for tobacco cultivation. Sulphates and chlorides are disadvantageous to the burning quality, and soils containing them are unsuitable for the cultivation of tobacco. In manuring tobacco, potash should be liberally applied unless the soil is rich in this constituent, but nitrogenous manures and phosphates should only be applied in such amounts as will ensure satisfactory growth. Potash is best applied in the form of plant or wood ashes or as vegetable refuse. The paramount position of Cuba, Java and Sumatra in the cigar tobacco industry is probably mainly due to the great reserves of available potash accumulated in their soils by the deposition of the leaves of forest trees.

Patents.

Coffee; Process of extracting caffeine from ——. R. Hübner, New York. Eng. Pat. 1328, Jan 18, 1910.

See U.S. Pat. 947,577 of 1910; this J., 1910, 293.—T. F. B.

Tobacco; Process of curing and ageing ——. S. G. Martin, Chicago, W. O. Bartholomew, St. Louis, and E. Schaaf, St. Mary's, U.S.A. Eng. Pat. 25,956, Nov. 10, 1909. Under Int. Conv., Nov. 30, 1908.

See U.S. Pat. 942,838 of 1909; this J., 1910, 106.—T. F. B.

XIXb—WATER PURIFICATION; SANITATION.

Water softening. H. Noll. Z. angew. Chem., 1910, 23, 1462—1464.

Drawe's process for determining the chemicals required for softening a water is as follows. 200 c.c. of the water, and 50 c.c. of saturated lime water (the strength of which must be determined for each experiment) are heated nearly to boiling, and after cooling and filtering, 200 c.c. of the filtrate are neutralised with $N/10$ hydrochloric acid in presence of methyl orange. Suppose b c.c. are required, and that a c.c. of $N/10$ lime are contained in the 50 c.c. of lime water used. 20 c.c. of $N/10$ caustic soda solution are added to the neutralised liquid, and the mixture is heated to boiling. In this way the lime combined with sulphuric, hydrochloric and nitric acids is precipitated. These calcium salts may be due (1) to those present in the raw water (2) to the excess of lime water added, or (3) to the decomposition of the lime water by magnesium salts and free mineral acids. The mixture is made up to 250 c.c., well shaken, and filtered. 200 c.c. of the filtrate are withdrawn, and the excess of soda measured by titration with $N/10$ hydrochloric acid (say c c.c.) The chemicals required for 1 cub. metre of the water can be calculated from the formulæ:—$(4a - 5b)\,3{\cdot}5$ grms. of lime and $(20 - b - \frac{3}{4}c)33{\cdot}1$ grms. of sodium carbonate. The above amounts are suitable for waters with up to 20 German degrees of hardness. With waters containing alkali carbonates, in which the "carbonate hardness" is greater than the "total hardness," the value b would be too great by an amount d, d being = (carbonate hardness − total hardness) 4/7. If the corrected value for b be substituted in the first equation, the addition of lime would be too great, since in titrating back the excess of lime water, not only the excess lime, but also the caustic alkalis derived from the bicarbonates would be included. With waters which besides alkali carbonates also possess permanent hardness, the sodium carbonate addition would appear lower by an amount corresponding with the alkali carbonates present; on the other hand with waters which only contain carbonate compounds, a negative value would be obtained for the sodium carbonate, which would indicate the amount of alkali carbonate present. The addition of calculated amounts of lime water and sodium carbonate may cause the residual amounts of lime and magnesia to be injurious. This may be due to a too large or too small addition of lime water for the removal of the temporary hardness, or to the calculated amount of sodium carbonate being insufficient for the complete removal of the permanent lime hardness. Experiments were made on the effect produced by the use of increasing amounts of the reagents. In the case of a water containing alkali carbonates, a further addition of lime water was unimportant, since the alkali carbonates reprecipitated any excess. In the case of Hamburg tap-water, the best results were obtained when the calculated amount of lime water was slightly reduced, and the sodium carbonate increased in order to ensure complete destruction of the permanent hardness. At the same time an excess of sodium carbonate must be avoided on account of its injurious effect in the boiler, but in order to completely remove the permanent hardness, the amount found by Drawe's process should be exceeded. Ristenpart has discussed methods of controlling the amounts of lime water and sodium carbonate (this J., 1910, 447).—W. C. H.

Bronze powders; Report on the examination of —— with reference to the solubility of the constituents in dilute hydrochloric acid, and the possible formation of albuminates of the heavy metals, when the solutions are mixed with milk. E. Grant Hooper. Report on Bronzing (see page 1086), Appendix III.

Tests were made with a "gold" powder composed of a copper-zinc alloy, a "silver" powder (tin, 88; aluminium, 9; and zinc, 3 per cent.), and an "aluminium" powder (aluminium with a small proportion of zinc). A weighed quantity of the dried powder was shaken continuously for 1 hour at the ordinary temperature with 1000 times its weight of 0·25 per cent. aqueous hydrochloric acid, and then after standing for another hour, the solution was filtered. Under these conditions the solutions were found to contain the following percentages (reckoned on the metal powder) of dissolved metals:—"gold" powder: copper, 22·9; zinc, 10·3; iron, 0·2; "silver" powder: tin, 11·9; zinc, 2·6; aluminium, 1·1; "aluminium" powder: aluminium, 0·5; zinc, 0·1. Milk, whether in small or large proportions, produced no precipitate in the acid solutions, but if the solutions were first neutralised, milk then caused precipitation, and if the amount of milk was limited to 8 per cent. of the solution, practically the whole of the dissolved metal was precipitated. With larger quantities of milk, the separation of the metals was not nearly so complete. Similar results were obtained with other proteins, such as raw white of egg and the soluble proteins of malt extract. When more than a small quantity of milk was present, lime water did not precipitate the dissolved metals. Lime water and sodium sulphide together precipitated the metals even in presence of milk, but the precipitate could be separated only by several successive filtrations. An infusion of tea also precipitated the metals in neutral solution, and the precipitate was insoluble in excess of the tea infusion and was not affected by the presence of a quantity of milk equal to one-fifth of the volume of tea infusion.—A. S.

Disinfectants; Standardisation of ——. G. Sims Woodhead, C. W. Ponder, S. A. Vasey, and J. E. Purvis. Lancet, 1909, 177, 1454—1458, 1516—1531, 1612—1616.

The investigation was concerned with the so-called coal tar disinfectants.

I. *Chemical analysis of disinfectants.* The method devised is termed the "Lancet acetone-baryta (L.A.B.) method." 10 grms. of the disinfectant fluid are shaken with 100 c.c. of water and heated for half-an-hour in the water-bath with 15 grms. of crystallised barium hydroxide. After cooling, the solution is decanted off and filtered through a plug of moist asbestos, and the insoluble residue (barium soaps and resinates and neutral oils) washed with warm baryta solution. The solution is made up to a definite volume and in an aliquot portion the phenolic compounds are liberated by means of hydrochloric acid, treated with calcium chloride, and extracted with ether. The ethereal solution is evaporated by means of a current of air at 100° F. and the residue of phenolic compounds weighed. The bromine-absorption value of the residue is then determined by means of a solution of bromine in caustic soda, and the result calculated in terms of carbolic acid, according to the equation: $C_6H_5OH + 6Br = C_6H_2Br_3OH + 3HBr$. In the insoluble baryta precipitate, the fatty and resin acids can be determined in the usual manner after removing the neutral oils by extraction with acetone. Water is determined by adding 10 c.c. of 10 per cent. sulphuric acid and 25 c.c. of light petroleum (white spirit) to 25 grms. of the disinfectant, shaking well, and after separation, observing the volume of the aqueous layer, any excess over 10 c.c. being taken as water. In the case of disinfectants containing other substances than soaps or resins as emulsifiers, the treatment with baryta is not necessary. The disinfectant is treated with excess of absolute alcohol or acetone, and the precipitated emulsifier (dextrin or gelatin) washed well with the solvent, dried, and weighed. From the acetone solution the phenolic compounds are extracted by caustic soda and determined as described. The results of the analysis by these methods of crude carbolic acid and the chief proprietary disinfectants are given. It was found that the percentage of phenolic constituents ranges from 5·13 to 66·27, whilst taking the price of 100 units of phenols as 2½d. in the case of crude carbolic acid, the cost of 100 units in the different proprietary disinfectants ranges from 5d. to over 6s.

II. *Bacteriological examination of disinfectants.* In the hands of the authors, the Rideal-Walker method (see Lloyd, this J., 1906, 405—409; Winter-Blyth, this J., 1906, 1183—1193), which has been adopted by Government departments and many public authorities, has proved disappointing. A modified method has therefore been devised. *Bacillus coli communis* is used instead of

B. typhosus as test-organism, it having the advantages of being non-pathogenic and of giving a colour reaction with a specific culture medium. McConkey's bile salts-litmus medium (5 grms. of sodium taurocholate, 5 grms. of glucose, 20 grms. of peptone, and 100 c.c. of 5 per cent. litmus solution per litre). It is grown on a broth prepared from fat-free bullock's heart. The mode of working is similar to that in the Rideal-Walker method but the temperature is kept constant at 62°—67° F., and the time periods are increased so as to obtain samples in which the disinfectant has been acting for 30 minutes. Glass specimen pots. 2½ ins. high and ⅞ in. diam. are used instead of test-tubes and small platinum spoons (which remove about 0·08 c.c. of liquid) instead of platinum loops. An automatic sterilising apparatus is described consisting of a pair of wheels provided with oblique notches, by means of which the platinum spoons are successively sterilised in a flame, allowed to cool, and delivered on to a small platform ready for use. By the use of this apparatus sub-cultures can be made with great rapidity. The results obtained are recorded on a chart. The figure representing the percentage composition of the weakest dilution of the disinfectant which kills the bacteria at 2½ mins. is divided by the corresponding figure for carbolic acid, and a similar quotient is obtained for the 30 mins. period; the mean of the two quotients is taken as the carbolic acid coefficient of the disinfectant. The results of the examination of the chief proprietary disinfectants are given. These show that the cost in pence of 100 units of germicidal efficiency calculated by means of the formula:

$$\frac{\text{price ratio to carbolic acid} \times 100}{\text{carbolic acid coefficient}}$$

ranges from 11·5 to 160. The authors state that neither with the Rideal-Walker method nor with the modified method, have they ever, under any conditions, obtained a carbolic acid coefficient figure higher than 13.

In comparing the results of the chemical and bacteriological tests, it was observed that there appeared to be a relation between the bromine absorption value of the phenolic constituents and the germicidal power of the disinfectant. In most cases the formula $\frac{P-B}{3}$ ($P=$ percentage of phenols, $B=$bromine value in terms of carbolic acid) gives a figure corresponding with the carbolic acid coefficient determined bacteriologically. The preparations which do not conform to this rule, are those which do not produce emulsions with water and the solutions of which do not exhibit Brownian motion. It is suggested that determination of the value $\frac{P-B}{3}$ by chemical analysis may prove useful for the rapid differentiation of tar disinfectants. (See also this J., 1906, 555; 1909, 903; 1910, 1032.)—A. S.

Disinfectants; Bacteriological standardisation of ——. G. Sims Woodhead and C. W. Ponder. Brit. Pharm. Conf., July 1910; Pharm. J., 1910, **85,** 155—156. 169—172.

The authors give further results obtained with their method (see preceding abstract) and also the reasons for the points of difference between that method and the Rideal-Walker method. In the discussion, S. Rideal referred to the difficulty of obtaining accurate and concordant results by the L.A.B. method (*loc. cit.*) and criticised the statement as to a relation existing between the value $\frac{P-B}{3}$ and the germicidal power of a disinfectant. He considered that the different results obtained by the authors' bacteriological test and the Rideal-Walker method might be due to three reasons:—(1). Bullocks' heart broth is less uniform in character, and gives a culture more resistant to disinfectants, than the "Lemco" broth used in the Rideal-Walker method. (2). *B. coli* is about 10 per cent. more resistant than *B. typhosus*. (3). The use of spoons instead of loops, whereby a relatively large quantity of diluted disinfectant is carried over into the sub-cultures.—A. S.

Disinfectants; Note on the Woodhead-Ponder method of testing ——. R. T. Hewlett. Brit. Pharm. Conf., Cambridge, July, 1910. Pharm. J., 1910, **85,** 159.

The proposed modifications of the carbolic acid coefficient test are criticised. The author is doubtful whether a uniform degree of resistance would be given by different strains of *B. coli*, and also suggests that most of the points raised by Woodhead and Ponder could be more readily dealt with in the original process without the elaborate alterations suggested. Calculating the coefficient from the mean of results obtained at 2½ and 30 minutes tends to raise tho value over that obtained at an early period and so reduces the "safety factor" given with the Rideal-Walker method.—R. O.

Thymol; Germicidal value of ——. E. W. Schmidt. Z. physiol. Chem., 1910, **67,** 412—432.

Thymol has been used as an antiseptic and disinfectant especially in physiological experiments on digestion. The author critically examines its value in this respect. Numerous experiments were made with albumin, peptone, fibrin, organisms, and enzymes in the presence of saturated thymol water. All the experiments were made at a temperature of 25° C., which is the most favourable to putrefactive organisms. No difference could be found in the digestive or putrefactive actions whether the experiment was made in the presence or absence of thymol. The author draws the conclusion that thymol has no power to inhibit bacterial growth and is of no value as an antiseptic or disinfectant.—J. H. J.

Patents.

Filter beds; Bacterial ——. W. E. Farrer, Birmingham. Eng. Pat. 19,734, Aug. 28, 1909.

The retaining wall of the bed is pierced with holes along the top, above the level of the material. Also it is made hollow; at the bottom the hollow communicates with the space beneath the false bottom of the bed, and at the top with the holes just mentioned. As atmospheric air passes through the holes in the wall, it draws air up the hollow of the wall from the false bottom and consequently through the bed from top to bottom. In this way a current of air is induced through the bed additional to that caused by the flow of the sewage. The sewage passes out from the bottom of the bed by a sealed trap at the bottom of the hollow in the wall.—J. H. J.

Sewage; Treatment of ——. A. Dickson, Dublin. Eng. Pat. 20,558, Sept. 8, 1909.

The fresh sewage or sewage sludge is treated with yeast in a tank, to the amount of 10 cwt. of brewer's yeast to 100 tons of sewage, and the mixture is allowed to ferment for two days, when the organic matter rises to the top and can thus be separated. The separated matter can be used directly as a fertiliser or may be first passed through phosphates to neutralise acidity. The separated matter also can be mixed with fine coal and pressed into briquettes, which are used for gas production, with recovery of ammonia.—J. H. J.

Water; Process and apparatus for purifying ——. H. Sefton-Jones, London. From Hans Reisert Ges. m.b.H., Braunefeld, Germany. Eng. Pat. 1231, Jan. 17, 1910.

See Fr. Pat. 411,532 of 1910; this J., 1910, 974.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloid reactions with perhydrol [concentrated hydrogen peroxide]. E. Schaer. Arch. Pharm., 1910, **248.** 458—462. (See this J., 1909, 1163.)

A solution containing 30 per cent. of hydrogen peroxide (perhydrol) is mixed with 10 times its volume of pure sulphuric acid ; one c.c. of the cool mixture is put on 5—10 mgrms. of the alkaloid. The mixture must be used soon after its preparation. Atropine, cocaine, coniine, aconitine, and pilocarpine give no coloration, even after the addition of colloidal platinum. Quinine gives a lemon-yellow colour. Strychnine, brucine, the opium alkaloids, hydrastine, berberine, and emetine give red to purple colorations, as also do nicotine and veratrine. If the perhydrol be mixed with hydrochloric acid and warmed with caffeine, a red residue is left, which becomes purple on the addition of ammonia. Similar results are obtained with quinine and quinidine.—F. Shdn.

Arbutin ; Preparation of pure ——. H. Hérissey.
Comptes rend., 1910, **151**, 444—447.

For the separation of arbutin, the glucoside of quinol, from commercial arbutin, which contains a considerable quantity of methylarbutin, the glucoside of methylquinol (this J., 1910, 975), the commercial product (15 grms.) is dissolved in 500 c.c. of 95 per cent. alcohol, and a cold solution of 10 grms. of potassium hydroxide in 125 c.c. of alcohol is added. The crystalline precipitate which forms, is removed, washed with alcohol, and boiled with a mixture of 75 c.c. of alcohol and 7 c.c. of glacial acetic acid. When all the solid has dissolved, 5 grms. of precipitated chalk are added, and the alcohol distilled off. The residue is extracted with 100, 50 and 50 c.c. of hot water, and 2 grms. of chalk are added to the extract, which is then evaporated in a vacuum. The residue is extracted repeatedly with ethyl acetate containing water, and the solution is concentrated and allowed to stand, when crystals are deposited. The substance obtained is arbutin, agreeing in its properties with those observed by Bourquelot and Fichtenholz (this J., 1910, 295).—F. Shdn.

Honduras balsam. A. Tschirch and J. O. Werdmüller.
Arch. Pharm., 1910, **248**. 420—430.

Three samples of the light coloured Honduras balsam were examined, having the sp. gr., respectively, 1·0886, 1·0905 and 1·0884. The average of the acid value was 32·67 and of the saponification value 173·2, these figures corresponding to a total amount of 45·66 per cent. of cinnamic acid and 8·614 per cent. of the free acid. The samples each had an odour resembling that of storax. On shaking out with sodium carbonate solution, cinnamic acid and a resin ester were isolated. The latter on hydrolysis yielded cinnamic acid and honduroresinol $(C_{16}H_{26}O_2)_n$, melting at 166°—167° C. When boiled with a strong solution of potassium hydroxide, the potassium compound was precipitated on cooling. It gave the phytosterol reactions. By extracting the resin with 1 per cent. potassium hydroxide, further quantities of the above substances were obtained. An amorphous substance separated from the alkaline solution. After boiling with dilute alcoholic potassium hydroxide solution, it still remained insoluble. It did not dissolve in alcohol, acetone, ether, or light petroleum, melted above 300° C., and did not give the phytosterol reaction. It has been styled *β-honduroresin*, and has the composition $(C_{38}H_{39}O_4)_n$. The balsam after extracting with alkali is the so-called cinnameïn. It contained a hydrocarbon, hondurane, C_8H_{10}, b.pt. 154°—155° C., small quantities of distyrene, another hydrocarbon, C_9H_{12}, b.pt. 140°—155° C., the cinnamic acid esters of cinnamyl alcohol and of phenylpropyl alcohol, and *hondurol*. Two other samples of Honduras balsam were dark in colour and had the sp. gr. 1·0897 and 1·0915 respectively. The acid value was 29·9 and the saponification value 153·9. They were examined in the same way and yielded similar products. When shaken with potassium hydroxide, a resene separated which melted between 169° and 172° C. The "cinnameïn" of this dark-coloured balsam yielded hondurol, $C_{17}H_{16}O_2$, which is a dihydroxy-alcohol. It crystallises from light petroleum in clusters of needles, m.pt. 42·5° C., and from its iodine value appears to possess one double linkage.—F. Shdn.

Cabureiba balsam. A. Tschirch and J. O. Werdmüller.
Arch. Pharm., 1910, **248**. 431—432.

The substance known as Cabureiba balsam is of Peruvian origin and is obtained from *Myrocarpus fastigiatus* and *frondosus*. It contains benzoic acid, but no cinnamic acid, also a new resinotannol, $C_{14}H_{18}O_4$, and vanillin. The balsam does not contain a cinnameïn.—F. Shdn.

Copaiba balsam oil. E. Deussen and A. Hahn.
Chem.-Zeit., 1910, **34**, 873.

It is found that the oil of copaiba balsam consists, for the most part, of sesquiterpene hydrocarbons, which are bicyclic in their constitution. The substance found in this oil by Wallach and described as caryophyllene (Annalen, 1892, **271**, 294) has been characterised by the authors as *a*-caryophyllene. There is also evidence of the presence of a second hydrocarbon of the sesquiterpene series.—F. Shdn.

Cananga oil from Java ; Nerol and farnesol in ——. F. Elze.
Chem.-Zeit., 1910, **34**, 857.

After working up a large sample of Java cananga oil, nerol and farnesol were isolated. The former alcohol was obtained by saponifying the portion of the oil which contains the geraniol and fractionating in a vacuum. The primary alcohols were converted into their phthalic acid esters and treated with calcium chloride to remove the geraniol. The nerol so obtained was optically inactive, and had the sp gr. 0·880 at 15° C. The diphenylurethane melted at 50°—50·5° C. The original oil contains about 0·2 per cent. of this alcohol. The high-boiling portion of the oil was saponified and fractionated under reduced pressure. The portion distilling between 130° and 160° C. at 3 mm. was purified by means of phthalic anhydride. A primary, unsaturated, aliphatic, sesquiterpene alcohol was then isolated. It is optically inactive, has the sp. gr. 0·895 at 15 mm., and boils at 145°—146° C. at 3 mm. It is identical with the farnesol found by Haarmann and Reimer in the oil of quassia flowers (Ger. Pat. 149,603). Nerol has been found in the following oils: bergamot, cananga, myrtle, champacca flower, and Spanish wormwood. Farnesol has been found in Peru balsam, Tolu balsam and palmarosa oils.—F. Shdn.

Aromatic grass oils. S. S. Pickles.
Bull. Imp. Inst., 1910, **8**, 144—145.

Citronella oils.—The following general conclusions can be drawn from the results obtained with these oils:—(A) Speaking generally, the grass grown (Bandarawela, Ceylon) in the period, June to September, gives a larger yield of oil, generally better in quality than the older grass which is grown during the months September to June. (B) The effect of manuring is to produce a general improvement in the quality of the oils. (C) The marked difference in chemical composition of the "Maha-pengiri" and "Lena-batu" grass oils seems to indicate that the two oils are derived from different species. (D) The results obtained in the analysis of the oils from the wild "mana" grasses show that, in character, many of them are similar to the "Lena-batu" oils. The chief difference is in the yield, the "Lena-batu" grass giving from 2 to 3 times the amount of oil obtained from most of the "mana" grasses. *Lemongrass oils.*—Comparison of the oils of *C. citratus* and *C. flexuosus* confirms the view recently expressed by Stapf, that the former produces the so-called "insoluble" lemongrass oil, whilst the latter yields the so-called "soluble" oil. *"Fiji lemongrass oil."*—This oil was received from Fiji as "Lemongrass oil." On examination it was found to resemble a mixture of lemongrass and citronella oils. A botanical specimen of the plant yielding the oil was identified at Kew as *C. coloratus*, Stapf. *Oil of Cymbopogon polyneuros, Stapf.*—This oil has not been described previously. It has a pleasant, penetrating odour, recalling that of anise. The grass occurs in considerable quantities in certain parts of India, and the oil may prove to be of commercial value. *Oil of C. Jwarancusa, from the Sudan.*—This is an interesting oil which, in general properties, somewhat resembles oil of pennyroyal. The principal constituent of the oil is an aromatic ketone, having an odour like that of pulegone. It is the first example of an oil of this type yielded by a Cymbopogon grass. The botanical identity of the grass has not yet been confirmed.

Celery seed oil. J. Swenholt. Midl. Drug. and Pharm. Rev., 1910, **44**, 220—221. Chem. Zentr., 1910, 2. 389—390.

By distilling about 25 kilos. of celery seed with steam 2·446 per cent. of an essential oil was obtained. which was divided into two fractions. The more volatile portion was only slightly coloured and had an odour resembling that of limonene; its sp. gr. was 0·8408 at 20° C.: $\alpha_D^{20°} = +46° 57'$ (50 mm. tube); saponification value, on the average, 9·5. The less volatile portion was yellow and had an odour like that of celery; its sp. gr. was 0·8774 at 20° C., $\alpha_D^{20°} = +32° 53'$ (50 mm. tube); saponif. value, 63—64·5. The oil as a whole was of a lemon-yellow colour and had the sp. gr. 0·8596 at 20° C., $\alpha_D = +40°$ (50 mm. tube). After keeping for 8 months the odour of the more volatile fraction had become faintly celery-like, whilst that of the less volatile portion resembled that of resinified oil of turpentine. With both fractions the acetyl value of the saponified oil was smaller than that of the original oil, the difference being greater in the case of the less volatile fraction.—A. S.

Refractive indices of essential oils. E. J. Parry. Chem. and Drug., 1910, **77**, 52—53.

The author lays stress on the importance of refractometric determinations in the analysis of essential oils, especially when tests are made not only on the oil itself. but also on the distillation fractions of the oil. The refractive indices of: (1), numerous individual constituents of essential oils; (2), fractionated oils; and (3), a large number of samples of various essential oils are given in the paper. (See also this J., 1910, 232).—A. S.

Odours resembling that of geraniol; Certain causes of ——. G. Austerweil and G. Cochin. Comptes rend., 1910, **151**, 440—441. (See this J., 1910, 899.)

The authors have already examined the odours of derivatives of citronellol (*loc. cit.*) and now give the results for certain derivatives of geraniol. The substances prepared each contain two double linkages, one of which is comprised in the grouping =CH·CRROH. 1-Methylgeraniol (b. pt. 105°—106° C. at 18 mm.) has an odour resembling that of pelargonium leaves, whilst the odour of 1·1-dimethylgeraniol (b. pt. 104° C. at 16 mm.) is very similar, but slightly more rose-like. Similar odours are possessed by 1-ethylgeraniol, and 1·1-diethylgeraniol (b. pt. 123°—125° C. at 20 mm.). 1-Phenylgeraniol (b. pt. 135°—138° C. at 22 mm.) and 1-isobutylgeraniol (b. pt. 115° C. at 26 mm.) have similar, but less strong, odours. As the influence of the grouping ·CRROH preponderates, so the influence of the neighbouring double linkage decreases, thus with 1-phenylgeraniol a rose-like smell becomes apparent. Substances containing the group $=CH\cdot C(OR) : R_1R_2$, together with an aromatic grouping, show an odour like that of geraniol. Thus diphenyl oxide (J. Chem. Soc., 1886, **49**, 27) possesses this odour, whilst monomethylcyclogeraniol does not. Since nerol has a decided rose-like odour, it should contain the grouping $\cdot CH_2\cdot CH_2OH$. Its formula therefore should be $CH_2 : C(CH_3)\cdot CH_2\cdot CH_2CH : C(CH_3)\cdot CH_2\cdot CH_2OH$, or $CH : C(CH_3)\cdot CH_2\cdot CH_2\cdot CH_2\cdot C : (CH_2)\cdot CH_2\cdot CH_2OH$.—F. Shdn.

Pyramidone [dimethylaminoantipyrine]; Alkalimetric (French) official test for ——. P. Lemaire. Ann. Chim. Analyt., 1910, **15**, 307—308.

In the official method of testing pyramidone given in the French Pharmacopœia it would be desirable to prescribe the number of drops of one per cent. methyl orange to be used as indicator. It is also pointed out that the amount of substance to be taken for the titration should be 5 grms., not 0·5 grm.; or if 0·5 grm. is the amount operated upon, then the sulphuric acid should be N/10 strength, not N/1. as prescribed. If the larger amount of pyramidone be taken, heat must be used to effect solution in the 50 c.c. of water stipulated. in which case the proportion of acid required would be slightly more than if 0·5 grm. has been titrated in the cold.—J. P. O.

Chloroform for anæsthetic purposes. F. Stadlmayr. Z. angew. Chem., 1910, **23**, 1546—1549.

The method for testing the purity of chloroform which consists in shaking with concentrated potassium hydroxide solution, is not reliable; no chloroform which contains alcohol will pass this test, owing to the presence of aldehyde. The sulphuric acid test for "organic" impurities is to a certain extent satisfactory, but the formaldehyde-sulphuric acid test is far more rapid and serves the same purpose. In fact, some samples. which give no coloration with sulphuric acid alone, react strongly with formaldehyde-sulphuric acid. The latter is therefore the sharper and more reliable test, and it is stated that the new German pharmacopœia will require that chloroform for anæsthetic purposes must give no coloration with the formaldehyde sulphuric acid reagent. The presence of phosgene may generally be recognised by its acrid odour. If phosgene is present, hydrochloric acid or free chlorine may always be detected also. Ramsay detects phosgene by means of baryta water, carbon dioxide being formed at the surface of contact of the two liquids. The chloroform should be tested for free chlorine, and its aqueous extract should be tested for neutrality and the presence of chlorides.—J. F. B.

Vegetable principles; Mechanism of photochemical reactions and the formation of ——; decomposition of solutions of sugars. D. Berthelot and H.G audechon. Comptes rend., 1910, **151**, 395—397

The previous experiments of the authors (this J., 1910, 724. 725, 754, 904) have shown that the photochemical effect of ultra-violet rays is to lower the temperature of reaction, oxidations and decompositions being effected below 100° C. which otherwise are only produced at red heat, and to accelerate the reaction velocity. The reactions produced are reversible, and the rays possess a high polymerising power, acetylene for instance being converted not into benzene but into a solid polymeride. In these and other respects photochemical action resembles the chemical reactions produced in living organisms, especially in plants. Just as in plants methyl compounds are met with much more frequently than ethyl compounds, so in photochemical reactions methyl compounds are easily synthesised, but the production of ethyl compounds is difficult and uncertain. In photochemical reactions with ethylenic and acetylenic compounds in presence of oxygen, the double and triple linkages are ruptured, and simple acids are formed, whilst in presence of ammonia, cyclic compounds are formed. Ethylene, for example, yields first amino-ethylenes, and then ring-formation takes place with production of compounds of the pyrrolidine and pyridine types. which may be regarded as the mother-substances of alkaloids. The authors have studied the action of ultra-violet rays on alcohols, aldehydes. acids, ketones and amides. In the case of aqueous solutions, the water also is decomposed to a small extent. The results of experiments with 10 per cent. aqueous solutions of different sugars, exposed for 10 hours at a distance of 2 cm. from a 110-volt mercury vapour lamp are given,.so far as the gaseous reaction products are concerned. They show that: (1), dextrose gives approximately equal volumes of carbon monoxide and methane, and about six times as much hydrogen; (2), lævulose gives about ten times as much carbon monoxide as of methane; (3), maltose gives similar results to dextrose; (4), sucrose gives results intermediate between those given by dextrose and lævulose. The numerical results, calculated to a basis of 100 vols. of combustible gas, were as follows:—

	Carbon monoxide	Methane	Hydrogen	Carbon dioxide
Lævulose	83	8	9	15
Dextrose	12	12	76	22
Maltose	12	11	77	21
Sucrose	45	8	47	16

—A. S.

Alcohols, aldehydes, acids, and ketones; Photochemical decomposition of ——. D. Berthelot and H. Gaudechon. Comptes rend., 1910, **151**, 478—481.

Methyl, ethyl, and propyl alcohols, and the corresponding aldehydes and acids, were exposed to the ultraviolet rays from a 110-volt mercury vapour lamp, the temperature being allowed to rise to 80°—90° C., and in some cases, only to 50°—60° C. Under these conditions, the compounds containing an alkyl group, R, were found to yield the hydrocarbon, R_2, in quantity amounting to 15—20 per cent. by volume of the gas produced. Besides this, 60—70 per cent. of hydrogen, and 10—20 per cent. of carbon monoxide, as well as water, are derived from the CH_2OH-group of the alcohols; about 40 per cent. of carbon monoxide, slightly less hydrogen, and 5—10 per cent. of carbon dioxide, are derived from the COH-group of the aldehydes; 40—60 per cent. of carbon dioxide, and 15—20 per cent. each of carbon monoxide and hydrogen are derived from the COOH-group of the acids. Acetone is readily decomposed by the same treatment, giving 49 volumes of carbon monoxide, 46 volumes of ethane and 5 volumes of methane, whilst diethylacetone yields carbon monoxide, methane and butane; the decomposition of ketones is distinguished from that of aldehydes in that no hydrogen is produced in the former case. The gaseous product obtained by the decomposition of formamide contains 63 volumes of carbon monoxide and 37 volumes of hydrogen; the latter gas appears to be formed by decomposition of part of the ammonia produced in the first instance. Solid calcium lactate yields a gaseous product containing 32 volumes of carbon dioxide, 9 of carbon monoxide, 29 of methane, and 30 of hydrogen. Solid urea gives 7 volumes of carbon dioxide, 65 of hydrogen, and 28 of methane; an aqueous solution of urea gives 84 volumes of hydrogen and 16 of methane; the residual solution possesses reducing power, and contains ammonia and ammonium carbonate. (See also this J., 1910, 724, 725, 754, and 904.)—L. E.

Mixed alkyl-aryl oxides; Catalytic preparation of ——. P. Sabatier and A. Mailhe. Comptes rend., 1910, **151**, 359—362.

When a mixture of the vapours of methyl alcohol and a phenol is passed over thoria at 390°—420° C., fractional distillation of the condensed liquid separates, besides unaltered methyl alcohol and phenol, the mixed oxide of the two radicals. Such oxides have been formed from phenol, meta- and ortho-cresol, xylenol, thymol, carvacrol, α- and β-naphthol, and others. Polyhydric phenols do not behave in the same way; they form compounds with the thoria, which are stable at the temperature of the experiment. Similar compounds have been obtained with ethyl alcohol and phenols, though the yields are not so satisfactory.—J. T. D.

Catalytic reactions by the wet method, using aluminium sulphate. [Preparation of ether and ethylenic hydrocarbons.] J. B. Senderens. Comptes rend., 1910, **151**, 392—394.

In the preparation of ethylene by the action of sulphuric acid on ethyl alcohol, it is usual to add a small quantity of sand to prevent bumping. The author has found that the sand also acts catalytically, accelerating the reaction. Anhydrous aluminium sulphate is a still more powerful catalyser. For instance, with the usual mixture (1 vol. of 95 per cent. alcohol and 2 vols. of sulphuric acid), at 157° C., the volume of ethylene obtained per minute was:—without any addition, 12 c.c.; with Bordeaux sand, 50; with Fontainebleau sand, 51; and with anhydrous aluminium sulphate (10 grms. per 200 c.c. of liquid) from ammonia-alum, 160 c.c. A similar catalytic action is effected by aluminium sulphate in the formation of ether. With a mixture of 4 vols. of 95 per cent. alcohol and 3 vols. of sulphuric acid, the production of ether begins at about 140° C., whilst in presence of aluminium sulphate (5 grms. per 100 c.c. of liquid) ether begins to be formed at 110° C., distils regularly at 120° C., and rapidly at 130° C. Above 140° C., ethylene passes over with the ether, in increasing quantities as the temperature rises. With higher alcohols (propyl, isobutyl) the chief reaction is the production of the ethylenic hydrocarbon, the formation of which is accelerated by aluminium sulphate.—A. S.

Ammonium bitartrate; Preparation of laevo-rotatory ——. A. Kling. Bull. Soc. Chim., 1910, **7**, 774—776.

Two kilos. of ordinary tartaric acid are dissolved in 15 litres of sodium hydroxide solution of 30° B., and the solution is boiled for 10 hours in a copper vessel attached to a reflux condenser; towards the end of this period, portions of the solution are examined from time to time to ascertain whether racemisation is complete (for this purpose, a quantity of the solution is acidified with hydrochloric acid, any dissolved copper is precipitated with hydrogen sulphide, and the solution is examined in the polariscope). The whole solution is then treated with 1 litre of acetic acid, rendered acid by the addition of hydrochloric acid, filtered, and precipitated while hot, by the addition of an excess of calcium chloride. The calcium racemate is washed by decantation with 50 litres of ordinary water, then collected on a filter, and dried at a temperature of 110° C.; the salt should weigh 2·550 kilos. The racemate is now mixed with hot water and treated with a quantity of sulphuric acid exactly sufficient to effect its decomposition; after boiling, the calcium sulphate is separated by filtration, washed with a little water, and the filtrate and washings are evaporated on a water-bath. The crystalline residue, consisting of racemic acid and calcium sulphate, is dissolved in three times its weight of boiling water, the solution is treated with its own volume of alcohol, the precipitated calcium sulphate is separated by filtration, and the filtrate is evaporated; the residue is re-dissolved in its own weight of boiling water, and allowed to crystallise. About 1 kilo. of pure racemic acid is thus obtained. This acid is dissolved in three times its weight of boiling water and to the boiling solution cinchonine is added, 0·87 part of the alkaloid being used for every 1 part by weight of racemic acid. After filtration, the solution is cooled and laevo-rotatory cinchonine tartrate separates out; this is re-crystallised from water, and its boiling solution is treated with an excess of ammonia, the separated cinchonine being collected on a filter. Traces of dextro-rotatory ammonium tartrate remaining in the filtrate are removed by boiling the solution and adding small quantities of calcium acetate solution from time to time as long as the precipitate formed exhibits crystals of racemate when examined under the microscope. When all the racemate has been precipitated, the mixture is filtered and the filtrate is concentrated by evaporation; laevo-rotatory ammonium bitartrate crystallises out from the residual solution on cooling. *l*-Ammonium bitartrate is used in the author's method of determining tartaric acid as calcium racemate (this J., 1910, 451).—W. P. S.

The Japanese camphor industry. British and Colonial Druggist, Aug. 26, 1910. [T.R.]

The *Osaka Mainichi* states that the total production of camphor this year is estimated by the Monopoly Bureau at 4,062 tons, of which 3,540 tons will be produced in Formosa, and 522 tons in Shikoku and Kyushu. Of this quantity 2,321 tons is to be shipped to Europe and 1,451 tons to America, the remainder being kept for the home market. The total demand for camphor in Europe and America is given as between 4,000 or 4,600 tons. No definite figures have yet been ascertained, but the actual demand is certainly not less than 4,350 tons. This being so, there is expected to be a deficit of some 580 tons in the supply shipped from Japan this year, and naturally the deficit may send up the price, while an impulse may also be given to the revival of the South China camphor industry and the manufacture of artificial camphor. The price of the camphor sold in Europe and America by the Monopoly Bureau is now only a fraction of the rate when the market reached the highest point. For this reason the revenue from the Camphor Monopoly has been seriously affected, and the Government is trying to increase the price to a certain degree. The net profit of the Camphor Monopoly in Formosa last year was £140,000, while that in

Japan proper did not exceed £10,000. The Osaka journal adds that the world's supply of camphor is almost entirely monopolised by Japan, and yet the revenue therefrom cannot be made an important item of the revenue of the Treasury. The total export of camphor from Formosa in 1909 was valued at £218,891. but the expenses of the Monopoly Office, including tobacco, salt, opium and camphor amounted to as much as £378,261.

Patents.

Alkali phenolates of ortho-oxymercuric salicylic anhydride. Secondary alkali salts of ortho-oxymercuric salicylic acid. W. Schoeller and W. Schrauth, Berlin. Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 967,838 and 967,839, Aug. 16, 1910.

See Fr. Pat. 404,491 of 1909; this J., 1910, 234.—T. F. B.

Alkylated iminopyrimidines; Manufacture of acetyl derivatives of the —— and of the alkylbarbituric acids derived therefrom. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 16,721, July 17, 1909.

See Fr. Pats. 409,223 and 409,224 of 1909; this J., 1910, 719.—T. F. B.

Extracts from aperient drugs; Manufacture of purified ——. Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 17,830, July 31, 1909. Under Int. Conv., Aug. 24, 1908.

See Ger. Pat. 214,805 of 1908; this J., 1909, 1223.—T. F. B.

Chemical compounds [alkyl- and aryloxyacidylsalicylic acids]; Manufacture of a new class of ——. Chem. Fabr. von Heyden, Radebeul, Germany. Eng. Pat. 3083, Feb. 8, 1910. Under Int. Conv., Feb. 10, 1909.

See Ger. Pat. 221,385 of 1909; this J., 1910, 650.—T. F. B.

Tetramethylenediamine; Process of making ——. F. Hofmann and C. Coutelle, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 965,903, Aug. 2, 1910.

See Ger. Pat. 216,808 of 1908; this J., 1910, 234.—T. F. B.

Casein derivatives or compounds and process of making same. R. Tambach, Assignor to Knoll und Co., Ludwigshafen on Rhine, Germany. U.S. Pat. 967,584, Aug. 16, 1910.

See Eng. Pat. 5087 of 1908; this J., 1908, 1128.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Acetyl cellulose foils. C. Mijnssen, Wilmersdorf, Germany. Eng. Pat. 476, Jan 7, 1910. Under Int. Conv., Jan. 9, 1909.

See Fr. Pat. 411,298 of 1910; this J., 1910, 978.—T. F. B.

Films from acetyl-cellulose; Manufacture of ——. Knoll und Co., Ludwigshafen on Rhine, Germany. Eng. Pat. 3559, Feb. 14, 1910. Under Int. Conv., Feb. 15, 1909.

See Fr. Pat. 412,503 of 1910; this J., 1910, 1038.—T. F. B.

Photographic emulsion. Y. Schwartz. Reissue No. 13,144, dated Aug. 16, 1910, of U.S. Pat. 710,019, Sept. 30, 1902.

See Fr. Pat. 320,451 of 1902; this J., 1903, 44.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives; Thirty-fourth Annual Report of H.M. Inspectors of ——, 1909.

Factories and magazines. There were under continuing certificate 33 factories and 90 magazines, and under licence 107 factories and 350 magazines. 261 visits were paid to factories and 494 to magazines.

Accidents. The number of accidents by fire and explosion of which the department had cognisance was 453, causing 60 deaths and injuring 445 persons. The number of accidents in factories for explosives was 51, causing 6 deaths, and injuring 12 persons. The number of deaths was below the average for the decade (7·3).

Importation. The amount of foreign blasting explosives containing nitroglycerin, imported in 1909, was 1,311,488 lb., against 1,086,205 lb. in 1908. Of the former amount 829,480 lb. were transhipped to other countries. The non-nitroglycerin explosives imported amounted to 11,635 lb. against 6100 lb. in 1908. The number of detonators imported was 18,146,815. The importations of fireworks amounted to 783,502 lb.

Chemical Advisers' Report. Messrs. Dupré report that of 496 samples examined by them, 62 were rejected for the following reasons: Low heat test (21), exudation (20), and incorrect composition (21). 41 new explosives were examined, of which 30 were passed, 8 passed preliminary tests, and 3 were rejected.

Testing station at Woolwich. Captain Desborough reports that 66 explosives are on the "permitted list." 15 explosives were tested during the year, of which 5 successfully passed the test.

Amount of explosives used in mines and quarries in Great Britain. The following table gives the details:—

Explosive.	Lb.	Percentage of total.
Permitted explosives	8,502,232	28·3
Gunpowder	17,595,475	58·3
Gelignite	3,085,529	10·2
Blasting-gelatin and gelatin-dynamite	616,436	2·0
Cheddite	123,531	0·4
Dynamite	117,260	0·4
Various	51,424	0·2
Total	30,091,887	100·0

The following list gives, in tons of 2000 lb., the quantity of the various permitted explosives, with a consumption of more than fifty tons annually. Bobbinite (559 tons), Arkite (375), Monobel (369), Ammonite (277), Samsonite (253), Saxonite (252), Rippite (242), Rohurite (239), Westfalite (222), Bellite (221), Carbonite (215), Stow-ite (130), Faversham powder (113), *Ammonal (107), Albionite (101), Excellite (88), Rexite (83), Abbcite (60), and Permonite (60 tons.).—G. W. McD.

Explosives; Report of the Chief Inspector (R. J. Lewis) of —— for the State of Victoria for the year 1909.

Reference is made to the retirement of Mr. C. N. Hake from the post of Chief Inspector, a position he had occupied for nearly 20 years. No accidents occurred during the year in the manufacture, transport or storage of explosives. There were five factories and 250 magazines under licence, and 16 Rack-a-rock licences were issued during the year. The blasting-gelatin imported from European ports was more satisfactory than that imported during 1908, only 4·4 per cent. being defective owing to exudation of nitroglycerin. The gelatin-dynamite was of a very satisfactory nature. The gelignite imported was also satisfactory with the exception of one consignment (52,050 lb.) condemned on account of exudation. On being sorted over it was found that 21,550 lb. were free from exudation, and this quantity was passed. A total of 1085 tests were carried out during the year; of these 646 were for samples of gelignite, of which 60 were rejected. The following table gives the nature and weight of explosives imported in the years 1908 and 1909.

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* Including non-permitted Ammonal.

	1909	1908
	lb.	lb.
Gelignite	1,144,500	752,550
Gelatin-dynamite	170,900	244,250
Blasting-gelatin	120,250	104,400
Cheddite	5,000	15,000
Rippite	9,000	10,000
Monobel	250	nil.
Lignin-dynamite	2,000	nil.
Fuse powder	75,000	75,000
Blasting powder	217,250	202,125
Sporting powder	34,350	31,050
Total	1,778,500	1,434,375
Detonators (number)	2,870,000	2,015,000

—G. W. McD.

Powder and explosives; Decomposition of ——. O. Poppenberg and E. Stephan. Z. ges. Schiess- und Sprengstoffw., 1910, **5**, 291—296, 310—313.

Sodium carbonate and bicarbonate and various oxalates, lactates and tartrates have been used as additions to propellants for the purpose of reducing muzzle flame. The authors have investigated the products of decomposition when explosives, containing these substances, are fired in a calorimetric bomb. (See this J., 1909, 1064.) The addition of 3 per cent. of either sodium carbonate or bicarbonate raised the proportion of methane in the gas by about 0·4 per cent. As regards the calories developed, the addition of 1·5 per cent. of sodium oxalate made practically no difference, whilst 1·5 per cent. of sodium bicarbonate caused a slight reduction. The addition of sodium carbonate, on the other hand, caused an increase in the calories. This increase is explained on the grounds of secondary reactions taking place. When ammonium oxalate was present, some 70 to 80 per cent. of the ammonia remained, after explosion, in combination with carbon dioxide. When sodium bicarbonate was added to the powder it remained, after explosion, as carbonate. The presence of 2 per cent. of sodium carbonate increased the carbon dioxide in the gases by about 0·5 per cent. An investigation was made of the products of decomposition of picric acid, trinitrotoluene and dinitrobenzene, when exploded, under varying conditions, in the bomb. They all contain insufficient oxygen for complete oxidation and consequently carbon was always deposited. A gradual increase in the proportion of carbon dioxide and methane takes place in the gases resulting from the explosion of picric acid as the charging density is increased. The theory offered to explain this fact is that, with higher charging density, the hot gases take a considerable time to cool down, and secondary changes take place, resulting in the production of methane. On placing the explosive in the bore-hole of a small lead block, tamping it with sand, and then firing it in a partially exhausted bomb the percentage of methane in the gas was very much reduced. The work done in expanding the lead block caused a very rapid cooling of the gases and reduced the possibility of secondary reactions taking place. The resulting gas, under these conditions, only contained from 0·2 to 0·5 per cent. of methane, whilst that obtained when a charging density of 0·5 was employed, contained 7·83 per cent. of methane. Acetylene (1·84 per cent.) and ammonia (6 per cent.) were present in the gases from the explosion of trinitrotoluene. When dinitrobenzene was exploded in a lead block in the bomb, the gas produced contained 4·75 per cent. of methane and 2·7 per cent. of other hydrocarbons. The amount of carbon deposited from 10 grms. of explosive was as follows. With a charging density of 0·02, picric acid deposited 0·029 grm. of carbon and trinitrotoluene 0·482 grm. When 10 grms. were fired in a lead block, picric acid deposited 0·6 grm., trinitrotoluene 1·72 grms., and dinitrobenzene 1·937 grms. of carbon. A sample of "Ammonal" experimented with had the following composition. Ammonium nitrate (58·68), charcoal (2·4), trinitrotoluene (17·96) and aluminium (20·96 per cent.). With a charging density of 0·02, more than half the aluminium present was unoxidised, whilst with a charging density of unity and in the lead block, practically the whole of the aluminium was oxidised.

—G. W. McD.

Cellulose nitrates; Non-nitrogenous decomposition products produced by the alkaline hydrolysis of ——. E. Berl and A. Fodor. Z. ges. Schiess- und Sprengstoffw., 1910, **5**, 296—297, 313—316.

The work of Will, and of Berl and Watson Smith, jun., amongst others, is referred to, especially on the question of the production of hydroxypyruvic acid. Cellulose nitrate was hydrolysed with an alcoholic solution of potassium hydroxide (30 per cent.). The alkali salts so produced are very hygroscopic. Oxalic acid was present in considerable quantity but no saccharic acid. Hydroxypyruvic acid was separated as its lead salt and was further identified by its *p*-nitrophenylosazone derivative; 80 grms. of cellulose nitrate (13 per cent. of nitrogen), were continuously agitated for 24 hours with 400 c.c. of 10 per cent. aqueous caustic potash. After filtering, the dark brown liquid was acidified with sulphuric acid and was concentrated to separate the potassium sulphate. After filtration, barium hydroxide was added and the precipitate of barium salts so produced was fractionally separated on the basis of the different solubilities of the various salts in water. The following acids were proved to be present:—Oxalic, malic, glycollic, trihydroxyglutaric, dihydroxybutyric, malonic and tartronic. When the nitrate of dextrose, dissolved in alcohol, is treated with sodium amalgam a very energetic reaction begins, when the temperature is raised to 60° C., with the liberation of ammonia. The sodium salts, when dissolved in water and acidified evolve carbon dioxide, nitric acid, nitrogen and hydrogen, and the liquid when heated to 35° C. gives a distillate containing aldehyde and hydrocyanic acid. The liquid remaining in the distillation flask contained glycollic acid in addition to oxalic acid, but no hydroxypyruvic acid could be detected. (See also this J., 1910, 978.)—G. W. McD.

Explosion of partly manufactured "Arkite"; Circumstances attending an —— *which occurred on March* 16, 1910, *at the works of Messrs. Kynoch, Ltd., at Ferrybank, near Arklow in the county of Wicklow.* Capt. A. P. H. Desborough. H.M. Inspector of Explosives. [Cd. 5330.]

Arkite paste is a mixture of nitroglycerin and nitrocotton. Two men who were killed by the explosion had loaded ten brass-lined wooden boxes containing paste on a bogie. The total weight of the explosive was about 1000 lb. The tramway lines passed a guncotton stove which contained 700 lb. of nitrocotton. The points of a branch line were immediately opposite this building. The explosion occurred when the bogie was three or four yards from the points. The site of the bogie was marked by a crater 18 feet in diameter and 8 feet deep and the nitrocotton stove was completely destroyed. Examinations of the *débris* showed that the Arkite paste must have exploded first, the explosion being communicated to the nitrocotton in the stove. Capt. Desborough considers that the men, noticing that the points were against them, attempted to hold back the bogie. As the bogie itself offered no projections to which they could readily lay hold, it is probable that they caught hold of the covering tarpaulin and thus displaced a box, which fell to the ground and originated the explosion. It is suggested that the addition of removable supports at either end of the platform of the bogie would afford a better means of controlling its movements.

—G. W. McD.

Coal dust experiments in the testing gallery of the Rossitz coal district, Austria. Czaplinski and Jicinsky. Oesterr. Zeits. Berg-u. Hüttenw., 1909, **57**, 535—540; 1910, **58**, 295—298, 311—318. Chem. Zentr., 1910, **2**, 509.

See this J., 1909, 1224. With the coal dust used, explosibility was destroyed by a moisture-content of 7·55 per cent., or an ash-content of 47 per cent., or by an admixture of 57 per cent. of stone dust. The propagation of the explosion was prevented by wet zones only when the latter were at least 60 m. long.—A. S.

Explosion indicator. Teclu. *See* XXIII.

Relations among white, red, and pyromorphic phosphorus. Jolibois. *See* VII.

Patents.

Smokeless gunpowders. C. Claessen, Berlin. Eng. Pat. 11,365, May 7, 1910.

In the preparation of pure gunpowders containing nitrocellulose or nitrocellulose and nitroglycerin, fenchone is added for the purpose of reducing the combustion temperature, of regulating the ratio between the gas pressure and the initial velocity and of increasing the stability of the products.—G. W. McD.

Explosive compound; Process of manufacturing an ——. L. Gray, Cleveland, Ohio. U.S. Pat. 967,185, Aug. 16, 1910.

See Eng. Pat. 25,553 of 1909; this J., 1910, 235.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Temperature scale between 100° *and* 500° *C.; Note on the* ——. C. W. Waidner and G. K. Burgess. Bull. Bureau of Standards, U.S.A., **7**, No. 1, Reprint No. 143, May 27, 1910.

From the results of further measurements with platinum resistance thermometers, calibrated in ice, steam, and sulphur vapour (440·70°C. on the constant-volume nitrogen thermometer), of the boiling points of naphthalene and benzophenone and of the freezing points of cadmium, tin, and zinc, the authors conclude that the following table of fixed points represents the constant-volume scale which appears to satisfy best the available observations for the reproduction of temperatures between 100° and 500°C.

Freezing points.		Boiling points.	
Tin	231·9° C.	Naphthalene	218·0° C.
Cadmium	321·0° C.	Benzophenone	306·0° C.
Zinc	419·4° C.	Sulphur	444·7° C.

—A. S.

Boiling points under reduced pressure; Thermometric error in determination of ——. A. Smith and A. W. C. Menzies. J. Amer. Chem. Soc., 1910, **32**, 905—907.

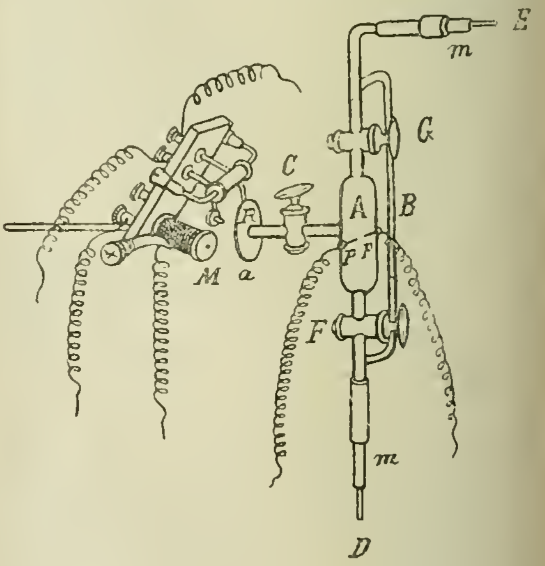
When a thermometer is immersed in a vapour under reduced pressure a dilatation of the bulb ensues, causing an apparent lowering of the temperature. The following observations show that the effect cannot be ignored in any but the roughest work. Eleven thermometers with bulbs of very various lengths and diameters, fitting tightly through rubber stoppers, were partially enclosed in test-tubes, provided with side tubes. The tubes were supported in a thermostat, the temperature of which remained constant +0·005°. After the reading of each thermometer had become constant the test-tube was exhausted to 20 mm. through the side tube, and the new reading, after constancy was reached, was taken. Air was then re-admitted, and the readings were repeated, to ascertain that no permanent change in the value at one atmosphere pressure had occurred. The change due to the expansion of the bulbs was thus found to vary between 0·10 and 0·17° C. In vacuum distillation, special investigation of the behaviour of each thermometer is required. In view of the behaviour of the eleven thermometers, which showed no relation to the size of the bulb, an error much greater than 0·2° C. might be involved in the case of an individual instrument. In measurements of vapour pressures, by methods in which the bulb of the thermometer is immersed in the vapour, an error of 0·15°C. or more may exist in the temperature readings.—R. C. P.

Measurement of quantities of gas by means of diaphragms. O. Muller. Rev. de Métall., 1910, **7**, 620—647.

With the object of determining, as the basis of calculation, the relation of the coefficient of contraction of a gas (when passing through the aperture of a diaphragm situated in a pipe) to the diaphragm aperture and the diameter of the pipe, a number of experiments were made with air under varying conditions. The results indicate that, under favourable circumstances—such as the experimental conditions described—measurements of gas may be effected with a sufficient approximation to accuracy by this means; but the method cannot be regarded as being of general application.—W. E. F. P.

Explosion indicator. N. Teclu. J. prakt. Chem., 1910, **82**, 237—240.

The instrument is intended to detect in a convenient place and at a distance from the locality tested, the existence of explosive gases in mines, etc. The figure shows the construction of the instrument which is an explosion pipette, A, with safety packings of wire gauze at *m*, *m*, and provided with a by-pass, *B*. The end, *D*, is connected by a long "composition" or tinned iron pipe with the place the air of which is to be tested, and the end, *E*, with a pump, so that a continuous current of the air is drawn through. The cocks, *F*, and *G*, are closed (the current still streaming through the by-pass) and the spark from an induction coil passed between the wires. If no explosion occurs, it is because the proportion of combustible gas is either above or below the explosion limit. Should it be above, then on opening for a while the cock, *C*, enough air will diffuse in to cause an explosion on sparking again. Should it be below, then if *F* and *G* are opened and sparks passed while the gas is streaming through, flame will be seen in a darkened room with a proportion of combustible gas considerably below that necessary for explosion. If the explosion be made to take place with the cocks, *F* and *G* closed and *C* open, and the suspended iron plate, *R*, closing the side tube, the force of the explosion will drive *R* against the electromagnet, *M*, which will hold it, and electrical connections made by this contact may be made to ring a bell at the place tested, and thus give warning.—J. T. D.



Copper ; New reaction for ——. R. Uhlenhuth. Chem.-Zeit., 1910, **34**, 887.

An intense blue coloration is obtained when a dilute solution of a copper salt is treated with an alkaline solution of 1·2-diaminoanthraquinone-3-sulphonic acid. The latter solution is prepared by dissolving 0·5 grm. of the 1·2-diaminoanthraquinone-3-sulphonic acid in 500 c.c. of water and adding 40 c.c. of a solution of sodium hydroxide of 40° B. The blue coloration is plainly visible with 0·0000019 grm. of copper in 1 c.c. of solution, and even one-tenth of this quantity may be detected by means of the test. The reaction is characteristic of copper, other metals not yielding a blue coloration.—W. P. S.

Manganese in presence of iron ; Colorimetric determination of ——. M. R. Schmidt. J. Amer. Chem. Soc., 1910, **32**, 965—967.

A standard solution containing 2 mgrms. of manganese in each 10 c.c. is prepared by running 182·1 c.c. of *N*/10 potassium permanganate solution into a litre flask, and adding about 100 c.c. of 10 per cent. sulphuric acid and 12 c.c. of 3 per cent. hydrogen peroxide. The flask is warmed until the oxygen is driven off ; then cooled and the solution diluted to 1 litre. A solution of silver nitrate, containing 20 grms. per litre is also prepared : 1 c.c. of this solution must be used with each mgrm. of manganese present. To make a determination, 5 c.c. of the solution under examination are diluted to about 100 c.c., and 2 or 3 c.c. of ether are added, followed by ammonium sulphide. The solution is warmed on the steam bath, stirring vigorously, and after the precipitate is settled, the liquid is filtered through a small folded filter and the precipitate washed thoroughly with water containing a little ammonium sulphide. The precipitate is next dissolved off the filter with the smallest possible quantity of dilute sulphuric acid, the filtrate and washings being collected in a small Erlenmeyer flask. After boiling to expel hydrogen sulphide, a little nitric acid is added to oxidise the iron, and then one drop of silver nitrate solution. If a turbidity occurs, which indicates imperfect washing of the sulphides, silver nitrate is added in very slight excess, and the whole boiled again, and filtered through a small dense filter into a 100 c.c. flask. To this solution, which should be perfectly clear, 1 c.c. of silver nitrate is added for each mgrm. of manganese which is present, followed by about 1 grm. of ammonium persulphate, and the flask is placed on a steam bath. After about one minute the purple colour of permanganic acid is fully developed, and the flask is then cooled, and filled up to the mark. The colour is compared with that of a standard prepared by treating 10 c.c. of the standard manganese solution with about 20 c.c. of dilute sulphuric acid, 2 c.c. of the silver nitrate solution, and 1 grm. of ammonium persulphate, and proceeding exactly as described above. If the oxidation of the manganese be only partial, and the solution be clouded by a brown precipitate, a few mgrms. of sodium sulphite or bisulphite, or a few drops of sulphurous acid solution are added, until the solution becomes clear again. Then more silver solution is added, and another portion of ammonium persulphate.—R. C. P.

Iron group ; Precipitation of the ——, and composition of certain ferric formates. O. F. Tower. J. Amer. Chem. Soc., 1910, **32**, 953—957.

The most complete method of separation of this group, no matter what other common metals may be present, is to precipitate them as basic acetates. There is, however, great difficulty in filtering and washing the precipitate of basic acetates, hence the method of precipitating iron and aluminium as basic formates. Both iron and aluminium can be practically completely precipitated by boiling with ammonium formate provided the solution is sufficiently dilute. The boiling need be continued only for a moment. The precipitate has a flocculent appearance, and can be filtered in less time than in the case of the basic acetates. Chromium by itself is not precipitated, but is carried down by basic ferric formate, hence the presence of a per-salt of iron is required for the complete precipitation of the group. It was found impossible by any of the methods heretofore described to prepare normal ferric formate. In its place was always obtained a good crystalline precipitate corresponding to the formula, $Fe_3(OH)_2(CHO_2)_7$. The basic formate precipitated under the usual conditions possesses a composition expressed by the formula, $Fe_3(CHO_2)(OH)_2O_3$.—R. C. P.

Lime and magnesia ; Separation of ——. E. Murmann. Z. anal. Chem., 1910, **49**, 688—698.

The precipitation of calcium oxalate from acid solutions in the presence of ammonium chloride is always incomplete, and the precipitate is not free from magnesium. In alkaline solutions, the separation from magnesium is very incomplete. A good separation from magnesium is only possible by adding to a solution of the salts in 90 per cent. alcohol just sufficient sulphuric acid to form calcium sulphate. A small quantity of magnesium is thrown down at the same time, and this must be removed by washing with 90 per cent. alcohol. Dilute alcohol dissolves considerable quantities of calcium sulphate. This method gives results within 0·15 per cent. of the true value ; the error in the ordinary sulphate method, and in the oxalate method is from 0·5 to 2·0 per cent.—A. T. L.

Potassium cyanide and silver nitrate. J. C. Bailar. Western Chem. and Met. ; Mining World, Chicago, Aug. 13, 1910.

The interaction of potassium cyanide and silver nitrate is generally represented by the equations :—

$$(1).\ 2KCN + AgNO_3 = KAg(CN)_2 + KNO_3\ ;$$

$$(2).\ KAg(CN)_2 + AgNO_3 = 2AgCN + KNO_3\ .$$

Experiments were made with a silver nitrate solution of such strength that 10 c.c. were just sufficient to produce a white precipitate of silver cyanide with 10 c.c. of the potassium cyanide solution. If equation (2) be correct, excess of silver nitrate should be present after 20 c.c. of the silver solution have been added. The author found however that 25 c.c. were needed before a reaction for silver nitrate in the solution could be obtained with potassium bichromate or sodium arsenate.—A. S.

Co-operation of atmospheric oxygen in the oxidation of oxalic acid by the higher oxides of manganese. [Determination of available oxygen and of oxalic acid. Schröder. *See* VII.

Determining ferrous oxide in silicates. Dittrich and Leonhard. *See* VII.

Analysis of amblygonite. Cormimbeuf. *See* VII.

Determining lead contained in glazes on finished articles. Rogers. *See* VIII.

Determination of titanium [in ores]. Barneby and Isham. *See* X.

Destruction of cyanide. Moir and Gray. *See* X.

Analysis of manganese bronze. Swan. *See* X.

Fatty acids [Separation of solid and liquid fatty acids]. Fachini and Dorta. *See* XII.

Valuation of soap stock. Fahrion. *See* XII.

Determination of filling ingredients in rubber mixings. Marcusson and Hinrichsen. *See* XIV.

Sensitive reaction for glue. Schmidt. *See* XV.

Detection of adulteration of bone superphosphate. Masoni. *See* XVI.

Determination of sugar in the beetroot by the hot aqueous digestion method. Stanek and Urban. *See* XVII.

Detecting invert sugar in commercial honeys. Quantin. *See* XVII.

Examination of honey. Reinhardt. *See* XVII.

Determination of glucose [in leather, sugar products, etc.]. Kohnstein. *See* XVII.

Physical chemistry of milk serum prepared by the use of calcium chloride. Wiegner. *See* XIXa.

Standardisation of disinfectants. Sims Woodhead and others. *See* XIXb.

Note on the Woodhead-Ponder method of testing disinfectants. Hewlett. *See* XIXb.

Alkaloid reactions with perhydrol. Schaer. *See* XX.

Alkalimetric test for pyramidone. Lemaire. *See* XX.

Chloroform for anæsthetic purposes. Stadlmayr. *See* XX.

Determination of sulphur in coke. Holliger. *See* IIa.

Patent.

Calorimetric process and apparatus. S. W. Parr, Urbana, Ill., U.S.A. Eng. Pat. 1329, Jan. 18, 1910.

See U.S. Pat. 947,418 of 1910; this J., 1910, 300.—T. F. B.

Trade Report.

Output of certain minerals and metals in the world. Board of Trade J., Aug. 18, 1910.

The Colonial and Foreign section of the Mines and Quarries Report for the year 1908 contains a table showing the output of certain minerals and metals in the United Kingdom, British Colonies and Possessions, and Foreign Countries during 1908, which may be summarised as follows :—

		United Kingdom.	British Colonies and Possessions.	Foreign Countries.	Total for the World.
Coal	Metric tons	265,725,704	40,289,442	762,143,133	1,068,158,279
Copper	,,	588	78,117	711,533	790,238
Fine gold	Kilogs.	24	392,056	263,250	655,330
Iron	Metric tons	4,925,238	659,805	42,520,842	48,105,885
Lead	,,	21,366	220,115	781,735	1,023,216
Petroleum	,,	—	781,662	36,402,087	37,183,749
Salt	,,	1,873,550	1,671,600	13,013,526	16,558,676
Fine silver	Kilogs.	4,207	1,269,577	4,785,089	6,058,873
Tin	Metric tons	5,133	62,468	45,357	112,958
Zinc	,,	5,926	116,835	657,299	780,060

The quantities of iron and of other metals included in the above table, are those which are considered obtainable from the ores *raised* in the countries in question, and must not necessarily be taken as a measure of the metallurgical industries of those countries. The total value of the figures shown in the table may be roughly taken as representing about £818,000,000.

The value of the coal produced in the world in 1908, 1,068,158,000 tons, is estimated at more than £409,500,000. The following figures show the main sources from which the coal supply of the world is obtained :—

Countries.	1907.		1908.	
	Quantity.	Value.	Quantity.	Value.
	Metric tons.	£	Metric tons.	£
United States of America	435,783,000	126,242,000	377,250,000	109,305,000
Great Britain	272,129,000	120,528,000	265,726,000	116,599,000
Germany	205,732,000	77,531,000	215,286,000	85,140,000
Austria-Hungary	47,878,000	13,390,000	48,966,000	11,926,000
France	36,753,000	22,013,000	37,384,000	23,694,000
Russia	26,000,000	Not stated	25,059,000	Not stated
Belgium	23,705,000	15,986,000	23,558,000	15,223,000

Books Received.

Thirty-fourth Annual Report of His Majesty's Inspectors of Explosives; being their Annual Report for the year 1909. Wyman and Sons, Ltd., Fetter Lane, E.C.; and 32, Abingdon Street, Westminster, London, S.W. Oliver and Boyd, Tweeddale Court, Edinburgh; or E. Ponsonby, Ltd., 116, Grafton Street, Dublin. 1910. Price 1s.

Government Report, containing 117 pages of subject matter, and an alphabetical index. The subjects dealt with are classified under the following heads :—I. Manufacture. II. Storage. III. Packing and conveyance of explosives. IV. Importation. V. Government inspection and search. VI. Report of Chemical advisers. VII. Working of the Act by the Local Authorities. VIII. Accidents. IX. Experiments. X. Use of explosives in coal mines. XI. Petroleum. XII. Carbide of calcium and acetylene. XIII. Appendices.

Report of the Departmental Committee appointed to inquire into the Dangers attendant on the use of Lead, and the Danger or Injury to Health arising from Dust and other causes in the manufacture of Earthenware and China and in processes incidental thereto, including the making of lithographic transfers. Vol. II. Appendices. Wyman & Sons, Ltd., 109, Fetter Lane, Fleet Street, E.C.; and 32, Abingdon Street, Westminster, London, S.W.; or Oliver and Boyd, Tweeddale Court, Edinburgh; or E. Ponsonby, Ltd., 116, Grafton Street, Dublin. 1910. Price 1s. 9d. [Cd. 5278.]

This Government Report forms Vol. II., Vol. I. having been referred to in this J., 1910, pages 950 and 981. It contains 128 pages of subject matter, in which occurs Appendix LIV., which is of value in the perusal of the Report being a "Glossary of Technical Terms" used therein. See also this J., under VIII., page 1058.

Bronzing; Report upon the conditions under which —— is carried on in factories and workshops. E. L. Collis, W. S. Smith, and R. E. Squire. Wyman and Sons, Ltd., Fetter Lane, London, E.C.; Oliver and Boyd, Tweeddale Court, Edinburgh; E. Ponsonby, Ltd., 116, Grafton Street, Dublin. [Cd. 5328.] Price 4½d. See also pages 1062 and 1077.

Mines and Quarries: General Report and Statistics for 1908. Part IV. Colonial and Foreign Statistics. [Cd. 5284.] Price 1s. 8d.

This part of the Report includes statistics relating to persons employed, output, and accidents at mines and quarries in the British colonies and in foreign countries during 1908. (See also p. 332.)

Bulletin of the Imperial Institute. Vol. VIII. No. 2. Price 1s.

This issue of the Bulletin contains the results of investigations in connection with wheats from African Colonies and India, sunn hemp from India, rubbers from the West Indies and Nyasaland; also notes on the cultivation and preparation of the ground-nut and of "bright" tobaccos, the relative value of the principal tanning materials, the manufacture of hydraulic cement from blast furnace slag, on *Heveas* in West Africa, etc.

Finance (1910–10) Act, 1910. Motor Spirit. Copy of Regulations made by the Commissioners of Customs and Excise under Section 84 (6) of the Finance (1909–10) Act 1910. 280. Price 1d.

The Analysis of Silicate and Carbonate Rocks. By W. F. Hillebrand. U.S. Geological Survey, Washington. Bulletin No. 422. A revision of Bulletin No. 305.

8vo volume of 232 pages, with a combined name and subject index covering seven pages, devoted to a description of the various methods for the analysis of silicate and carbonate rocks.

The Purchase of Coal by the Government under Specifications, with Analyses of Coal Delivered for the Fiscal Year 1908–9. By G. S. Pope. U.S. Geological Survey, Washington. Bulletin No. 428.

8vo volume consisting of 80 pages of subject matter, including an index.

Report of the Principal Chemist of the Government Laboratory, upon the Work of the Laboratory, for the year ended 31st March, 1910. With Appendices. Presented to both Houses of Parliament by command of His Majesty. [See under XVIII., page 1073.] Darling and Son, Ltd., 34—40, Bacon Street, E. 1910. Price 3d. [Cd. 5283.] Wyman and Sons, Ltd., Fetter Lane, E.C.; and Oliver and Boyd, Tweeddale Court, Edinburgh; E. Ponsonby, Ltd., 116, Grafton Street, Dublin.

A Text-book of Physical Chemistry, Theory and Practice. By Arthur W. Ewell, Ph.D. J. and A. Churchill, 7, Great Marlborough Street, London. 1910. Price 9s. 6d.

8vo volume, containing 362 pages of subject matter, with 102 illustrations, 63 tables, and an alphabetical index. The text is classified as follows:—I. Gases, vapours, and liquids. II. Thermodynamics. III. Solutions. IV. Thermochemistry. V. Light. VI. Chemical kinetics. VII. Chemical statics. VIII. Electrolytic conduction. IX. Potential differences. X. Gaseous ions, radioactivity. The introduction is one setting forth the symbols to be used in the work, defining the units employed, errors encountered, and describing apparatus to be used, etc.

Conduction of Electricity through Gases, and Radio-activity. A text-book with experiments. By R. K. McClung, M.A., D.Sc., Lecturer in Physics, University of Manitoba. J. and A. Churchill, 7, Great Marlborough Street, London, 1910. Price 7s. 6d.

8vo volume, containing 232 pages of subject matter, with 75 illustrations, preface, and alphabetical indexes of subjects and names. The subject matter is classified as follows:—I. Introductory experiments on electric discharge. II. Apparatus and general methods. III. Cathode rays. IV. Röntgen rays. V. Other sources of ionization. VI. Ions as nuclei. VII. Radio-activity, and experiments on radio-active substances. VIII. Complexity of radiations. IX. General properties of radiations. X. Special properties and constants of the rays. XI. Uranium X., Thorium X., Actinium X. XII. Emanations. XIII. Excited activity. XIV. Special method of analysis by absorption curves. XV. Radio-activity of the atmosphere.

*New Books.

Arlt, Dr. F. R. v.: Laboratoriumsbuch f. die Zementindustrie. (VIII, 97 S. m. 33 Abbildgn.) 1910. M. 4.50. Halle, W. Knapp.

Arthus, M.: Elemente der physiologischen Chemie. Deutsch v. Johs. Starke. 3. vollständig neu durchgesch. u. verm. Aufl. (VI, 353 S. m. 15 Abbildgn.) kl. 8 . Leipzig, J. A. Barth. 1910. Cloth M. 6.75.

Benson, H. T.: Benson's compendium on mines, mining, minerals, ores, rocks, weights of metals and rocks, effect of heat on various substances, water measure, tanks and piping; atomic weights explained, chemical symbols, etc. Denver, Colo., Hall & Williams, [1942–1948 Stout St., 1910.] c. '09. 105 p. il. D. limp leath., $2.

Blouet, M.: Nouvelles manipulations de chimie, exercices pratiques correspondant au nouveau précis de chimie de MM. Joly et Lespieau, préface de R. Lespieau, fasc. 1, classe de seconde et de première C et D, 3e édit. rev., in 16. Paris, Hachette. 1910. 2 fr.

Boeke, Dr. H. E.: Uebersicht der Mineralogie, Petrographie u. Geologie der Kalisalz-Lagerstätten. [Aus: "Illustr. Jahrb. d. Wirtsch. u. Techn. im deut. Kalisalz-Bergbau."] (50 S. m. Fig.) Lex. 8 . Berlin, Montan-Verlag. 1910. Cloth M. 3.50.

Bollenbach, Dr. H.: Laboratoriumsbuch f. die Tonindustrie. (X, 80 S. m. 27 Abbildgn.) 1910. Halle, W. Knapp. M. 3.60.

Crookes, Sir Wm.: On Scandium. Part 2. 4to, Dulau. London. 1910. Net. 1s. 6d.

Dennstedt, Dr. M.: Anleitung zur vereinfachten Elementaranalyse f. wissenschaftliche u. technische Zwecke. 3. Aufl. (139 S. m. Abbildgn.) 8°. Hamburg, O. Meissner's Verl. 1910. M. 3.

Doelter, C.: Die Elektrizitätsleitung in Krystallen bei hohen Temperaturen. [Aus: "Sitzungsber. der k. Akad. d. Wiss."] (63 S. m. 18 Fig.) gr. 8°. Wien, A. Hölder. 1910. M. 2.25.

Doelter u. H. *Sirk*: Beitrag zur Radioaktivität der Mineralo. (I. Mitteilg.) [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (10 S.) gr. 8°: Wien, A. Hölder. 1910. 35 Pf.

Domek, E.: Das Emissionsspektrum des Eisenoxyds im elektrischen Lichtbogen. [Aus: "Sitzungsber. d. k. Akad. d. Wiss."] (16 S. m. 1 Taf.) gr. 8°. Wien, A. Hölder. 1910. 70 Pf.

Exner, Dr. F.: Über Radiumforschung. Vortrag. (24 S.) 8°. Wien, A. Hölder. 1910. 70 Pf.

Fabrikanten-Adressbuch, deutsches. Ein Verzeichnis v. üb. 20000 renommierten u. leistungsfäh. Fabrikanten u. Produzenten des Deutschen Reiches, m. genauer Angabe ihrer Spezialerzeugnisse, Arbeiterzahl, Betriebskräfte usw. Jahrg 1910/11. (XIV, 336, 76, 14 u. 26 S.) Lex. 8°. Leipzig, Schulze and Co. Cloth M. 15.

Fauvelle, Dr.: La physico-chimie, son rôle dans les phénomènes naturels astronomiques, géologiques et biologiques, in-8°. Paris, Schleicher. 1910. 1 fr. 95; bds. 2 fr. 45.

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Fischer, E.: Introduction to the preparation of organic compounds; tr. with author's sanction from the new (8th) German ed. by R. V. Stanford. N.Y., Van Nostrand. 1910. 194 p. il. 12 . $1.25 net.

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Grimmer, Dr. W.: Chemie u. Physiologie der Milch. Kurzes Lehrbuch f. Human- u. Veterinärmediziner, Nahrungsmittelchemiker u. Studierende, sowie Milchwirtschaftler. Nebst e. Einleitg. v. Prof. Dr. Zietzschmann: "Bau u. Funktion der Milchdrüse." (XII, 364 S. m. 37 Abbildgn.) gr. 8°. Berlin, P. Parey. 1910. Cloth M. 10.

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Jahrbuch, illustriertes, der Wirtschaft u. Technik im deutschen Kalisalz-Bergbau, in Verbindg. m. hervorrag. Männern der Wissenschaft u. Praxis, hrsg. v. Dr. Alb. Stange. Nebst: Reichs-Kaligesetz (nach den Beschlüssen des Reichstages in 3. Lesung), m. e. krit. Einleitg. (VIII, 668 u. 15 S. m. Abbildgn. u. 2 Taf.) 30,5 × 21.5 cm. Berlin, Montan-Verlag. 1910. M. 18; Cloth M. 20.

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Nierenstein, Dr. M.: Chemie der Gerbstoffe. [Aus: "Sammlg. chem. u. chemisch-techn. Vorträge."] (58 S.) Lex. 8°. Stuttgart, F. Enke. 1910. M. 1.20.

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Rettberg, Dr. H.: I. Abbau des Morphothebaïns. (Ein Beitrag zur Morphinforschung.) II. Uber einige Additionsprodukte zyklischer Basen m. Hydrochinon. (35 S. m. 2 Tab.) gr. 8°. Berlin, R. Trenkel. 1910. M. 2.

Richter, M. M.: Lexikon der Kohlenstoff-Verbindungen. 3. Aufl. (In etwa 30 Lfgn.) 1—3. Lfg. (S. 1—480.) Lex. 8°. Hamburg, L. Voss. 1910. Each Lfg. M. 6.

Sitzungsberichte der Heidelberger Akademie der Wissenschaften. Heidelberg, C. Winter.

Franzen, H.: Über die Bildung der Aminosäuren in den Pflanzen u. üb. die Einwirkung v. Formaldehyd auf Cyankalium. I. Theoretischer Tl. (54 S.) 1910. M. 1.80.

Gattermann, L.: Die Merkaptane des Anthrachinons u. e. neue Klasse schwefelhaltiger Farbstoffe (Disulfidfarbstoffe). (18 S.) 1910. 90 Pf.

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Vogel, Dr. E., Taschenbuch der Photographie. Ein Leitfaden f. Anfänger u. Fortgeschrittene. Bearb. v. Paul Hanneko. 23—25. Aufl. 83—91. Taus. Mit 149 Abbildgen., 24 Taf. u. e. Anh. v. 21 Bildvorlagen. (VIII, 336 S.) kl. 8°. Berlin, G. Schmidt. 1910. Cloth M. 2.50.

Wallach, Prof. O.: Tabellen zur chemischen Analyse zum Gebrauch im Laboratorium u. bei der Repetition. 1. Tl.: A. Theoretisches u. B. Verhalten der Elemente u. ihrer Verbindgn. 2. Tl.: Methoden zur Auffindg. u. Trenng. der Elemente. 4. Aufl. (69 S.) gr. 8°. Bonn, A. Marcus & E. Weber. 1910. Cloth M. 4.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

19,425. Van der Made. Filters. [Fr. Appl., Feb. 19, 1910.]* Aug. 18.

19,473. De Guide and Briart. *See under* V.

19,617. Humphrey. Raising or forcing liquids. Aug. 22.

19,644. Haas. Deodorising waste gases. Aug. 23.

20,041. Ramén. Channel furnaces.* Aug. 27.

Complete Specifications Accepted.

14,251 (1909). Weiser. Stills. Aug. 24.

20,880 (1909) and 6315 (1910). Leask. Apparatus for cooling water or treating air or gases with liquids. Aug. 31.

20,919 (1909). Maxaner. Apparatus for removing dust from gases. Aug. 24.

24,805 (1909). Johnson (Koepp und Co.). Absorption of gas from a mixture of gases by hot liquor. Aug. 31.

27,457 (1909). Gaede. Apparatus for producing high vacua. Aug. 24.

30,070 (1909). Haddan (Aktiebolaget Separator). Centrifugal separators with filtering apparatus. Aug. 31.

2409 (1910). Erith. Separation of suspended matter or impurities from gases or vapours. Aug. 24.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

19,104. Fabry. Horizontal or inclined non-regenerative coke ovens.* Aug. 15.

19,155. Otto und Co. Recovery of tar and ammonia from distillation gases. [Ger. Appl., Sept. 22, 1909.]* Aug. 15.

19,181. Schachtel. Production of a combustible gas. [Ger. Appl., Jan. 6, 1910.]* Aug. 15.

19,422. Piggott. Manufacture of artificial fuel. Aug. 18.

19,552. Otto und Co. Obtaining ammonia from hot tar-free distillation gases. [Ger. Appl., Oct. 25, 1909.]* Aug. 20.

19,653. Hall-Brown. Gas producers of the rising grate type. Aug. 23.

19,681. Felizat. Furnaces for making wood charcoal. [Comprised in No. 5010, Feb. 28, 1910.]* Aug. 23.

19,761. Gilbert. Solvent for carbon. Aug. 24.

19,939. Ely and Rollason. Treatment of coke. Aug. 26.

Complete Specifications Accepted.

11,359 (1909). Kamo and Naka. Freeing petroleum oil from smoke-producing elements. Aug. 24.

16,217 (1909). Reynolds. Gas producers. Aug. 24.

19,157 (1909). Denner-Meier. Treatment of mineral oils and their distillates. Aug. 31.

19,196 (1909). Johnston and Clark. Gas manufacture. Aug. 31.

26,125 (1909). Otto Hilgenstock Coke-Oven Co. (Otto und Co.). Coke ovens. Aug. 31.

262 (1910). Blake and Smart. Kilns for decarbonising and revivifying animal charcoal. Aug. 24.

826 (1910). Benninghoff and Klönne. Gas-fired retort oven and like furnaces. Aug. 21.

4543 (1910). Davis. Gas washers. Aug. 31.

4890 (1910). Kros. Coke ovens. Aug. 31.

6502 (1910). Sandmann. Gas producers. Aug. 31.

6813 (1910). Fabry. Regenerative coke ovens. Aug. 24.

8369 (1910). Benninghoff and Klönne. Gas retort furnaces. Aug. 31.

III.—TAR AND TAR PRODUCTS.

Applications.

19,155. Otto und Co. *See under* II.

19,340. Johnson (Kalle und Co.). Manufacture of nitrogen compounds of acenaphthene and colouring matters therefrom.* Aug. 17.

19,341. Kalle und Co. Manufacture of an oxidation product of acenaphthene. [Ger. Appl., Aug. 17, 1909.]* Aug. 17.

Complete Specifications Accepted.

16,312 (1909). Wetter (Chem. Fabr. Grünau, Landshoff, und Meyer). Manufacture of anthraquinone. Aug. 24.

23,766 (1909). Hugendick. Continuous distillation of tar. Aug. 24.

IV.—COLOURING MATTERS AND DYES.

Applications.

19,340. Johnson (Kalle und Co.). *See under* III.

19,487. Newton (Bayer und Co.). Manufacture of trisazo dyestuffs. Aug. 19.

19,545. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Aug. 20.

20,025. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Aug. 27.

Complete Specification Accepted.

18,822 (1909). Ransford (Cassella und Co.). Manufacture of sulphide dyestuffs derived from carbazole. Aug. 24.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

19,142. Schwalbe. Obtaining cellulose from vegetable fibres. [Ger. Appl., Aug. 14, 1909.]* Aug. 15.

19,166. Hübner. Finishing artificial silk. Aug. 15.

19,172. Marks (Middleton). *See under* IX.

19,473. De Guide and Briart. Protecting textile fibres, bags, etc., from the action of acids and acid salts.* Aug. 19.

Complete Specifications Accepted.

19,150 (1909). Smith. Production of useful products from *Cyperus Papyrus* and other tropical aquatic plants. Aug. 31.

19,211 (1909). Drews and Bennett. Extraction of fibre from fibrous vegetable matter. Aug. 31.

20,593 (1909). Leclaire. Manufacture of viscose and similar compositions. Aug. 31.

23,625 (1909). Deiss. Manufacture of cellulose. Aug. 24.

26,657 (19 9). Parkin and Williams. Non-inflammable celluloid or celluloid substitute. Aug. 24.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

19,117. Knecht, and Spence and Sons, Ltd. Discharging dyed textile fibres. Aug. 15.

19,133. Horton. Carbonised fabrics and their production. [U.S. Appl., Aug. 18, 1909.]* Aug. 15.

19,954. Heberlein und Co. Apparatus for drying fabrics. [Swiss Appl., Aug. 28, 1909.]* Aug. 26.

Complete Specification Accepted.

19,926 (1909). Wooster. Treatment of fabrics for use as belting, fire or garden hose, etc. Aug. 31.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

19,141. Henry. Manufacture of ammonium nitrate and chloride. Aug. 15.

19,153. Sulphates, Ltd., Thwaites, and Ralph. Obtaining iron, zinc, and cobalt compounds from liquors containing metallic compounds. Aug. 15.

19,155. Otto und Co. *See under* II.

19,249 to 19,251. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia and catalytic agents for use therein. Aug. 15.

19,336. Hildebrand. Liquefying carbonic acid. [Ger. Appl., June 3, 1910.]* Aug. 17.

19,552. Otto und Co. *See under* II.

19,562. Chem. Werke vorm. Dr. H. Byk. Process for dehydrating perborates. [Ger. Appl., Aug. 21, 1909.]* Aug. 20.

19,602. Magnesite Co. Freeing liquefied carbon dioxide from air. [Ger. Appl., Aug. 21, 1909.]* Aug. 22.

19,677. Wedekind und Co. Production of granular sodium bichromate. [Ger. Appl., April 12, 1910.]* Aug. 23.

19,679. Deiss and Fournier. Manufacture of oxalic and other organic acids and other oxygenated products of carbon. [Fr. Appl., Sept. 2, 1909.]* Aug. 23.

19,778. Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia and catalytic agents for use therein. Aug. 24.

20,021. Smith. Utilising the waste sediments from solutions of bleaching powder.* Aug. 27.

20,048. Emanuel. Manufacture of sodium aluminate. [U.S. Appl., Sept. 29, 1909.]* Aug. 27.

Complete Specifications Accepted.

12,106 (1909). Carrick and Pattison. Preparation of iron compounds. Aug. 31.

18,945 (1909). Beindl. Production of hydrocyanic acid and cyanides. Aug. 24.

20,907 (1909). Nydegger, and Wedekind und Co. Manufacture of pure ammonium nitrate. Aug. 31.

28,755 (1909). Von Schlippenbach. Recovering gases rich in sulphur dioxide separately from gases poor therein, in roasting and oxidising processes. Aug. 31.

VIII.—GLASS; CERAMICS.

Applications.

19,233. Sonntag and Sonntag. Process for enamelling metal.* Aug. 16.

19,428. Woodall. Kilns for burning pottery, etc. Aug. 18.

19,553. Bicheroux. Manufacture of rolled plate glass for mirror glass.* Aug. 20.

Complete Specification Accepted.

12,180 (1909). Dennis. Kiln for firing pottery, enamel ware, glass ware, enamelling, etc. Aug. 31.

IX.—BUILDING MATERIALS.

Applications.

19,172. Marks (Middleton). Impregnating wood and other fibrous materials.* Aug. 15.

19,346. Accettola. Manufacture of artificial marble. Aug. 17.

19,808. Rible. Utilising volcanic or other infusible rock to make industrial or other objects.* Aug. 24.

19,866. Gebr. Siemens und Co. Manufacture of fireproof electrically conductive materials. [Ger. Appl., Oct. 4, 1909.]* Aug. 25.

Complete Specifications Accepted.

18,727 (1909). Hemming and Kennett. Brick and lime kilns. Aug. 24.

18,997 (1909). Nash. Cement kiln. Aug. 24.

23,996 (1909). Goddard. Compositions for building and like purposes. Aug. 31.

24,584 (1909). De Caudemberg. Making cement for the manufacture of artificial paving blocks, etc. Aug. 24.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

19,275. Scott. Treatment of complex ores.* Aug. 16.

19,278. Kern. Smelting and casting pure magnesium and magnesium alloys. Aug. 16.

19,449. Martin. Separation by magnetic influence of zinc, copper, and other sulphide ores. Aug. 19.

19,518. Gabriel. Alloy. Aug. 20.

19,620. Dunham-Massey. Blast furnaces. Aug. 22.

19,772. Ruthenburg. Electrolytic production of antimony. Aug. 24.

19,962. Siemens und Halske A.-G. Manufacture of metal tubes, especially of tantalum. [Ger. Appl., Oct. 7, 1909.]* Aug. 26.

20,046 and 20,047. Emanuel. Processes of treating ores. [U.S. Appls., Sept 29, 1909.]* Aug. 27.

Complete Specifications Accepted.

13,625 (1909). Merton and Ridge. Roasting furnaces. Aug. 24.

16,940 (1909). Heskett. Manufacture of steel. Aug. 31.

19,764 (1909). Timm. Production of metals. Aug. 31.

22,394 (1909). Talbot. Converters for refining iron and steel. Aug. 24.

25,244 (1909). Kjellin. Treatment of ores in blast furnaces. Aug. 31.

28,755 (1909). Von Schlippenbach. *See under* VII.

672 (1910). Mulacek and Hatlanek. Electric induction smelting furnaces. Aug. 31.

5916 (1910). Barbanson and Lepersonne. Open-hearth process of refining steel. Aug. 24.

7315 (1910). Wagner. Granulation of metals, etc. Aug. 31.

XI.—ELECTRO-CHEMISTRY.

Applications.

19,804. Reid. Electric furnaces.* Aug. 24.

19,805. Reid. Means for regulating electrodes of electric furnaces.* Aug. 24.

19,866. Gebr. Siemens und Co. *See under* IX.

Complete Specification Accepted.

23,351 (1909). British Thomson-Houston Co. (General Electric Co.). Refractory insulating materials. Aug. 31.

XII.—FATS; OILS; WAXES.

Applications.

19,150. Newton (Bayer und Co.). Medicinal soaps and process of making them. [Addition to No. 10,075 of 1909.] Aug. 15.

19,494. Wolffenstein. Soaps containing peroxides.* Aug. 19.

Complete Specification Accepted.

3579 (1910). Dussich. Recovery and purification of lubricating oil. Aug. 31.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

19,502. Bradley. Manufacture of artificial india-rubber. Aug. 19.

19,676. Rankin and Clarkson. Treatment of the latex from rubber and analogous trees. Aug. 23.

19,730. Da Costa and Bridge. Coagulating and otherwise treating rubber latex. Aug. 24.

19,739. Tarver. Manufacture of articles from waste rubber, vulcanite, ebonite, etc. Aug. 24.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

19,853. Kelly. Flexible composition or glue.* Aug. 25.

XVI.—SOILS; FERTILISERS.

Application.

19,706. Forbes and Macfarlane. Fertilisers.* Aug. 23.

XVII.—SUGARS; STARCHES; GUMS.

Application.

19,719. Homans. Separating scum and precipitates from sugar juice.* Aug. 23.

Complete Specification Accepted.

3414 (1910). Kantorowicz. Manufacture of dry preparations for forming liquid adhesive substances with cold water. Aug. 24.

XVIII.—FERMENTATION INDUSTRIES.

Complete Specifications Accepted.

19,391 (1909). Board and Ling. Conversion of starch in brewing or distilling, and manufacture of a brewing material. Aug. 31.

21,685 (1909). Boake, Roberts, and Co., and Berry. Bleaching and fumigating hops. Aug. 31.

7829 (1910). Holzer. Manufacture of beer. Aug. 31.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Application.

19,637. Hildesheim. Manufacture of cocoa, chocolate, etc. Aug. 22

Complete Specifications Accepted.

16,375 (1909). Ekenberg. Desiccation of milk and milk preparations. Aug 24.

24,741 (1909). Brightmore. Bacteria filtering-beds. Aug. 24.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

19,350. Ges. f. Chem. Industrie in Basel. Manufacture of acetyl esters of di-iodo fatty acids of high molecular weight. [Ger. Appl., Feb. 3, 1910.]* Aug. 17.

19,679. Deiss and Fournier. *See under* VII.

Complete Specifications Accepted.

19,088 (1909). Newton (Bayer und Co.). Manufacture of methylene ketones. Aug. 24.

19,820 (1909). Ulzer and Sommer. Manufacture of radium salts or compounds containing large proportions of radium. Aug. 31.

28,045 (1909). Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Aug. 31.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

19,253. Mitchell and Ginger. Production of coloured photographs, prints, etc. Aug. 16.

19,289. Turnbull. Photographic plates. Aug. 17.

19,554. Ruth. Manufacture of colour screens for colour photography. [Addition to No. 16,273 of 1910. Ger. Appl., Feb. 8, 1910.]* Aug. 20.

19,601. Caille. Photographic reproduction of colours. [Addition to No. 15,050 of 1908. Fr. Appl., Aug. 23, 1909.]* Aug. 22.

XXII.—EXPLOSIVES; MATCHES.

Complete Specifications Accepted.

22,095 (1909). Steele. Safety explosive. Aug. 31.

28,929 (1909). Delvigne. Explosives. Aug. 31.

XXIII.—ANALYTICAL PROCESSES.

Application.

19,564. Savory. Apparatus for ascertaining the specific gravity of fluids and vapours. Aug. 20.

Journal of the Society of Chemical Industry.

No. 18, Vol. XXIX. SEPTEMBER 30, 1910. No. 18, Vol. XXIX.

Yorkshire Section.

THE SYNTHESIS OF A GLAZE, GLASS, OR OTHER COMPLEX SILICATE.

BY JOHN W. COBB.

Errata.

	Journal.	Page.	Column.	Line.	
Part I.	Jan. 31	73	2	9 from bottom	*For* " $CaSiO_4$ " *read* " $CaSO_4$."
,,	,,	74	Table II.		*Delete* $\overset{\text{" Notes "}}{SiO_2}$, *and for* " Al_2O " *read* " Al_2O_3."
Part II.	March 15	254	1	3 from bottom	*For* " carbonate " *read* " sulphate."
,,	,,	254	1	3—5	*Delete the words* " the silica . . . . 24 hours' heatings."
,,	,,	254	2	11 from bottom	*Delete the words* " is formed."
,,	,,	257	Table VIIIB.		*In heading, for* " $CaSO_4 + 10SiO_2$ " *read* " $CaSO_4 + 10Al_2O_3$.
Part IV.	April 15	401	Table XI.		*In heading, for* " SO_2 n N_2CO_3 " *read* " SiO_2 in Na_2CO_3."
,,	,,	401	Table XI.		*Under* " Remarks," *for* " Tl. Na_2O " *read* " Total Na_2O."
,,	,,	401	2	18	*For* " NaO " *read* " Na_2O."
Part V.	May 31	612	2	3	*Insert* " 0·5 " *before* " Al_2O_3," *and for* " $10SiO_2$ " *read* " $5SiO_2$."
Part VI.	July 15	802	2	10 from bottom	*For* " double " *read* " direct "
,,	,,	802	2	9 from bottom	*Delete the words* " and closed chains."

Communication.

CATHA EDULIS.

BY F. J. OWEN, ANALYTICAL CHEMIST TO THE AFGHAN GOVERNMENT.

This plant is found in the south of Turkistan and certain parts of Afghanistan to the east of Kabul. I was struck by the flavour of the tea offered to me on several occasions in Afghan houses and by the fact that it gave instant relief from neuralgia. The beverage had a taste like tea, and it was evidently made from some plant containing a principle allied to caffeine.

After inspecting a specimen brought to me for analysis I recognised it as the *Catha edulis* plant. The natives say that men by its aid can do long marches at night without feeling the least fatigue, also that among the wrestling fraternity here it is used on a large scale, as it greatly increases the muscular powers of the men. The leaves when dry are crumbled up and placed in an urn with boiling water and boiled for fifteen minutes. The natives seem to have no hard and fast rule as to the strength of the beverage. It is drunk by many Afghans as a substitute for tea. (See this J. 1899, 1049.)

Journal and Patent Literature.

Patent specifications may be obtained by post by remitting as follows:—

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Lagging of pipes and wires. A. W. Porter and E. R. Martin. Phil. Mag., 1910, **20**, 511—522.

It is not generally recognised that a coat of poor thermal conductivity may keep a hot pipe or wire cooler than it would be without such a coat, though the fact is evident from the coolness of the portion of platinum wire which is enclosed in the glass of an incandescent lamp. If a good conducting wire of radius a is surrounded by a concentric sheath of conductivity k and radius b, then a simple calculation shows that only when b is greater than k/e (where e is the thermal emissivity from the outside of the sheath) does an addition to the sheath lower the temperature of the wire. For crown glass, k/e (which is independent of the diameter of the wire) is 8 cm., for shellac 2 cm.; for guttapercha 1·5 cm. and so on. Thus coating a wire with glass up to 8 cm. radius actually lowers its temperature instead of maintaining it. After this critical radius the effect is reversed and a slow improvement in lagging efficiency takes place until the neutral radius (where the effect of the coating is nil) is reached. This radius depends on the diameter of the wire and is therefore not so simply expressed, but with Para rubber on a wire 0·25 cm. radius it is 10 cm. and for a wire 0·5 cm. radius it is 2·9 cm., while on a wire of 1 cm. it is 1 cm. In this last case the lagging effect obviously begins with the thinnest coating of rubber, but in the others a considerable thickness of sheath is required. There are certain minor deviations from this simple theory owing to variation of emissivity and conductivity with temperature, and of emissivity with the radius of the sheath. Applied experimentally to narrow steam pipes up to about 0·5 cm. external radius, these principles lead to the discovery that an asbestos coating may encourage the escape of heat, so that the application of lagging to such pipes in experimental apparatus is a matter of some delicacy. If the radius is much smaller than 0·5 cm. the coating must have an external radius much greater than half a centimetre before there is any lagging effect at all. The experimental results indicate that, in the case of a pipe 0·19 cm. radius, the escape of heat is the same for coatings of external radii 0·24 and 2·0 cm.—W. H. P.

Patents.

Steam or pressure fluid delivered through a pipe; Apparatus for the continuous automatic determination of the quantity of ——. A. Lomschakow, St. Petersburg. Eng. Pat. 17,354, July 26, 1909.

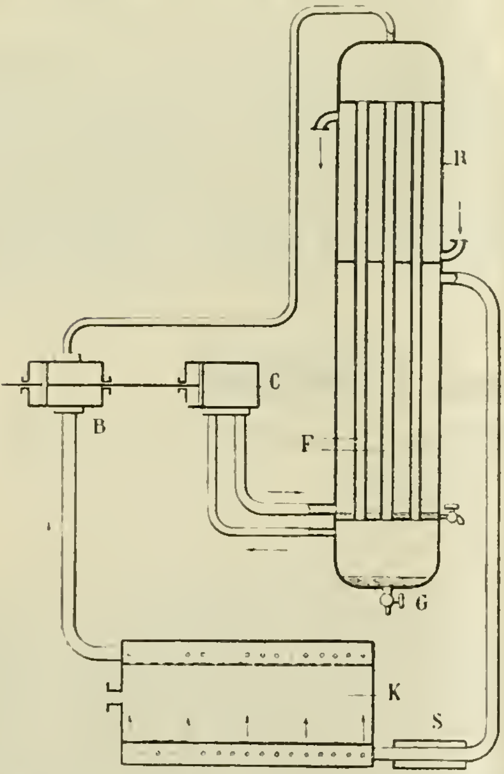
The difference between the pressures on either side of a constriction in the main through which the steam flows, is utilised to determine the quantity of steam passing, by combining a number of integrating devices of the cam type actuated by the pressures in such a manner, that the total effect of all the devices represents the quantity of steam passing per unit of time.—W. H. C.

Recovery of volatile solvents and like liquids. J. Smith, H. L. Mitchell and W. H. Askham, Ravensthorpe, and H. Hey, Dewsbury. Eng. Pat. 18,605, Aug. 12, 1909.

The air containing the vapour of the solvent is drawn into the cylinder of a suitable pump and at each stroke of the pump a quantity of absorbing oil is drawn into the cylinder along with the vapour-laden air. These become intimately mixed in the cylinder and the solvent is absorbed by the oil. Oil and air are discharged from the pump, the air now freed from the solvent, escapes and the oil containing the solvent is collected in a reservoir and subsequently distilled to regain the solvent for use.—W. H. C.

Recovery of volatile liquids from air charged with their vapours; Process for the ——. Soc. l'Air Liquide. Soc. anon. pour l'Etude et l'Exploit. des Proc. G. Claude. Fr. Pat. 413,571. May 29, 1909.

The air from the chamber, K (see fig.), in which the vapour is produced, is withdrawn by the pump, B, compressed, and, passing through the tubular heat exchanger, F, is cooled by cold water surrounding the tubes at R; then on expanding in F, it is again cooled and deposits liquid which is removed by means of the tap, G. Another pump, C, arranged in tandem with the pump, B, withdraws the air and delivers it on the outside of the tubes of the heat exchanger, F, so that a further deposition of liquid takes place. The air being now comparatively free from vapour is returned to the chamber, K, for further use in drying and may be reheated by a re-heater, S, beforehand, as required.—J. W. H.



Boiler-scale; Compound for preventing the formation of ——. R. Burstinghaus and O. H. Schroeder, London. Eng. Pat. 23,618, Oct. 15, 1909.

The compound consists essentially of barium tannate, with or without the admixture of free tannic acid, and may be mixed with the feed water before it enters the boiler, or be fed into the latter at suitable intervals.—O. R.

Dryers of kilns for the revivification of animal charcoal and the like. M. Blake and R. H. Smart, Greenock. Eng. Pat. 30,151, Dec. 24, 1909.

The gothic or D-shaped pipes through which the waste gas from the burning furnaces passes to dry the char before it reaches the kilns proper, have ordinarily an interior section corresponding in shape to their exterior and are difficult to keep clean on this account. This causes an accumulation of soot which prevents the transmission of heat. To remedy this the internal section of these pipes is made circular so that they are easily brushed out. Further instead of providing chimneys for the escape of the vapour from the vapour-collecting chambers at the sides and ends of the dryers, openings are provided in the external walls of such chambers through which the vapours escape directly into the air.—W. H. C.

Drying goods. L. von Süsskind, St. Georgen, Switzerland. U.S. Pat. 965,251, July 26, 1910.

A current of compressed air is divided into two streams, one of which is forced to pass through the substance to be dried and the other in a parallel direction through the jacket of the casing containing the material.—W. H. C.

Drying, baking, re-heating, roasting or calcining industrial products; Plant for ——. A. J. Coulhon. Fr. Pat. 413,968, Mar. 24, 1910.

Chambers in which the final operation of heating, drying, or roasting is carried out are arranged in the middle of a building so that their radiated heat is fully utilised in drying the material stored on the different floors. These chambers form two arched tunnels with a charging opening between each pair of fire-grates. Each chamber is separated from its neighbour when required by a removable air-tight blind. The ash-pit of each chamber may be made to communicate with the outer air or with the chimney flue or remain sealed as required. In the arched roof over each fire-grate a slot is formed, closed normally by tiles, for the charging of the fuel. The tunnels communicate at each end with each other by means of vertical slots also capable of being closed. In operation, a number of the chambers, in order, are charged with material and the charging openings bricked up. An air-proof screen or blind is then fixed to separate these from the uncharged chambers, and a fire lighted on the first grate, the dampers being arranged so that the ash-pit of the first grate is in communication with the outer air, and the ash-pits of the four or more chambers next the screen are in communication with the chimney. When the material in the first chamber is finished, a fire is made on the second grate and the dampers re-arranged so that only the second ash-pit is in communication with the outer air. In the meantime another chamber has been charged, a screen inserted in front of it, and the first screen removed. In this way the circuit of the chambers is continuously carried on.
—J. W. H.

Mixtures of gases; Completely or partially separating the components of ——. A. Sinding-Larsen and O. J. Storm, Christiania, Norway. Eng. Pat. 8211, April 5, 1910. Under Int. Conv., April 7, 1909.

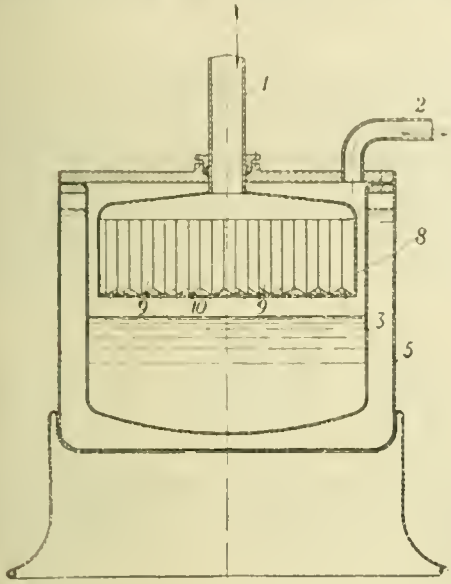
The mixture of gases is brought into intimate contact with a hæmoglobin or other organic iron compound which is capable of absorbing one or more of the gaseous constituents of the mixture. When saturated, the solution of hæmoglobin is exposed to a lower pressure than that at which the absorption took place and the absorbed gas is again given off.—W. H. C.

Separating the constituents from mixtures of gases and vapours. C. Philippart. Fr. Pat. 413,285, May 22, 1909.

When the pressure to which a mixture of gases or vapours is subjected is suddenly lowered considerably, the different gases exhibit different velocities. The velocity of any gas treated in this way depends on the density of the gas. The mixture of gases, after the lowering of the pressure, is caused to pass along a pipe or channel filled with internal, conical baffles and a series of outlet pipes, the gases of different densities escaping by different pipes.—W. H. C.

Absorption of gases or vapours by a liquid absorbent. P. Schou. Fr. Pat. 412,883, Feb. 21, 1910.

The gas, some of the constituents of which are to be absorbed, is passed through a pipe, 1, into the closed chamber, 8, provided with a number of vertical tubes, 9, or other suitable means of providing a large surface and having a perforated bottom, 10. This chamber is enclosed in the outer chamber, 3, containing the absorbing liquid, and kept cool by the water jacket, 5. At intervals the chamber, 8, is lowered, immersed in the liquid and raised again, and the absorption takes place in the film of liquid, adhering to the tubes. In this way violent agitation of the liquid is avoided. The washed gas escapes through the pipe, 2.—W. H. C.



Concentrating solutions by means of air. W. D. Niermans. Fr. Pat. 412,914, Feb. 21, 1910.

The solution to be concentrated is, after suitable heating, sent down a tower, up which a strong current of air is caused to pass by a blower or fan. The air may be preheated if desired. The preheating of the liquid is effected by external means.—W. H. C.

Centrifugal separator. J. J. Berrigan, Orange, N.J. U.S. Pat. 965,558, July 26, 1910.

A number of cylinders having perforated cones at one end and open at the other end are arranged horizontally in series, the conical portion of one chamber projecting slightly into the open cylindrical portion of the next. The whole series is arranged in a casing and is rotated. The material to be treated is fed into the open cylindrical end of the casing at one end of the series and is caused to pass through the series in succession, passing from the apex of the cone of one into the open end of the next and being finally discharged from the cone of the last of the series. The liquid is discharged through suitable openings in the casing.—W. H. C.

Separating mixtures of liquids by centrifugal force. C. Philippart. Fr. Pat. 413,286, May 22, 1909.

The liquids to be separated are sent, under pressure, and at a high speed through a coil of pipe, provided with movable internal partitions to guide the liquids, which separate in the coil under the influence of the centrifugal force set up, and pass into separate outlet channels. —W. H. C.

Distilling apparatus; Fire heated ——. L. A. du F. Chevalet. Fr. Pat. 413,237, March 1, 1910.

In order to obtain a steady evolution of vapour from the boiler or still, the pipe leading the vapoura from the top of the column to the condenser is provided with a thermoregulator which is actuated by the temperature of the escaping vapours and opens or closes the damper which admits the air to the furnace. The latter receives its fuel from a hopper. If the temperature of the escaping vapours rises, the damper automatically closes and the supply of air is reduced, lowering the temperature of the boiler and *vice versa.* The regulator consists of a vessel which surrounds the vapour pipe at the point at which it leaves the column and is filled with an easily dilatable liquid, which is not miscible with water. It is connected to the device actuating the damper by a pipe filled with water, which serves to transmit the alteration in pressure in the dilatable liquid to a membrane in the regulator which actuates the damper.—W. H. C.

Mixing apparatus for obtaining emulsions of liquids of different densities. R. Valette. Fr. Pat. 413,426, March 5, 1910.

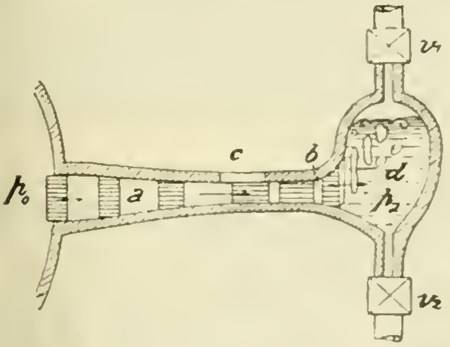
The apparatus consists of a vertical cylinder into which the liquids to be emulsified are put. Three vertical shafts pass through the top cover of the cylinder and are provided with external means of rotation. The centre shaft projects only a short distance below the top and is provided at its lower end with a horizontal disc. The other two shafts pass to the bottom of the cylinder, and are provided with a number of horizontal stirring blades. When the liquids have been charged into the apparatus, the stirrers are set in motion and a centrifugal pump continually withdraws liquid from the bottom of the cylinder and discharges it into the top, where it falls upon the rotating disc attached to the centre shaft and is sprayed against the sides of the cylinder.—W. H. C.

Crushing and cooling heated products; Apparatus for ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 413,802, March 17, 1910. Under Int. Conv., March 25, 1909.

Materials (salts, etc.) which leave the furnace, in which they have been treated, in a red-hot condition, are crushed and cooled simultaneously in a water-jacketed drum directly connected with the furnace and provided with a central shaft carrying arms which break up the material and cause it to advance to the outlet.—J. W. H.

Gas- (vapour-) liquid mixtures; Process for the separation of gases (vapours) from ——. G. Meyersberg. Ger. Pat. 224,106, May 10, 1908.

In utilising the expansion-energy of gases or vapours carried along between portions of liquid, the velocity of which is accelerated by the expansion of the gas, it is necessary in some cases (*e.g.*, driving turbines, raising liquids) to separate most of the gas before utilising the kinetic energy of the liquid. For this purpose the device shown in the figure is proposed. The mixture of gas and liquid under the pressure, p_0, enters the expansion channel, *a*, and then flows through the second channel, *b*, into the



outlet-chamber, *d*. The channel, *a b*, is provided with an opening, *c*. By means of the throttle-valves, v_1, v_2, a higher pressure, p_2, is maintained in *d* than that which can be exerted on the gas by the moving liquid by virtue of its kinetic energy. According to the difference between the two pressures a greater or smaller proportion of the gas is caused to escape through *c*. It has been found that in this way over 80 per cent. of the gas can be expelled through *c* without any liquid being also forced out.—A. S.

Filtering apparatus for use in connection with the washing of slimes and for other similar purposes. J. F. Webb, Assignor to P. Tarbutt, London. U.S. Pat. 968,720, Aug. 30, 1910.

See Eng. Pat. 21,474 of 1908; this J., 1909, 1113.—T. F. B.

Drying wet material; Process of and apparatus for ——. W. Bratkowski, Berlin. U.S. Pat. 969,031, Aug. 30, 1910.

See Fr. Pat. 412,040 of 1910; this J., 1910, 997.—T. F. B.

Separation of constituents; Apparatus for the uninterrupted ——. F. W. Ilges, Cologne-Bayenthal, Germany. U.S. Pat. 968,478, Aug. 23, 1910.

See Eng. Pat. 3302 of 1909; this J., 1910, 544.—T. F. B.

Air, vapours, or gases; Apparatus for removing dust from ——. K. Maxaner, Frankfort on Maine, Germany. Eng. Pat. 20,919, Sept. 13, 1909. Under Int. Conv., Sept. 14, 1908.

See Fr. Pat. 406,978 of 1909; this J., 1910, 547.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Benzene in illuminating gas; Comparison of the efficiency of Otto Pfeiffer's and Dennis and McCarthy's method for determining ——. E. P. Harding and C. Taylor. J. Ind. Eng. Chem., 1910, 2, 345—347.

By the aid of the more exact method of Pfeiffer (oxidation to nitrobenzene and reduction with standard stannous chloride; this J., 1904, 1116) the authors have standardised the more rapid method of Dennis and McCarthy (this J., 1908, 215) for the estimation of benzene. The latter consists in passing the gas backwards and forwards in a pipette containing nickel ammonium cyanide for about two minutes, and then repeating the process for about the same time with 5 per cent. sulphuric acid. It was found that if the reagents are allowed to react for more than two minutes the Dennis and McCarthy method gives high results, and that both reagents continue the absorption after two minutes. The continued absorption is that of unsaturated hydrocarbons which subsequently show a correspondingly low result. Separate experiment shows that both reagents will absorb ethylene and acetylene in the pure state.—W. H. P.

Sulphates; Influence of aluminium salts on the determination of ——. [*Determination of sulphur in coal gas.*] H. J. M. Creighton. Proc. and Trans. Nova Scotian Inst. Sci., 1907—1908, 12, 207—211.

In the determination of sulphur in coal gas by burning a known volume of the gas in a special burner surrounded with lumps of ammonium carbonate, and passing the combustion-gases into a glass tower filled with glass balls, the alkaline liquid collected in a beaker below the tower was occasionally observed to contain a precipitate of aluminium hydroxide. This was derived from the glass balls, some of which were greatly corroded. The corrosion could not have been due to the ammonium carbonate, as the white precipitate was observed only in the case of gas from coals high in sulphur (largely in organic combination). Experiments as to the effect of aluminium compounds on the determination of the sulphur as barium sulphate (see this J., 1909, 817) showed that in a solution containing 0·5 grm. of ammonium sulphate and 0·025 grm. of aluminium, there would be an error of about 1 per cent. in the sulphur determination. To avoid this error it is necessary to use glass balls free from aluminium when determining sulphur in gas by the method described above. —A. S.

Petroleum from Maikop; Distillation of ——, for the production of lubricating oil. Charitschkoff. Nepthanoje Djelo, 1910, Nr. 12. Chem.-Zeit., 1910, 34, Rep. 426.

Maikop petroleum residue, having the sp.gr. 0·9305 at 15° C., and a flash point of 142° C., was distilled by means of superheated steam, the following fractions being obtained:

Limits of temperature.	Yield.	Sp. gr.	Flash point (Pensky-Martens).	Viscosity (Engler).
Up to 200° C.	14·27	0·866	—	—
200—220°	9·30	0·9034	141°	3
220—235°	13·03	0·9168	170°	3·5
235—250°	7·27	0·9245	199°	6
250—265°	6·70	0·9297	205°	9·1
265—280°	14·33	0·934	229°	20·1
280—295°	4·84	0·9395		

Maikop petroleum is therefore suitable for the manufacture of mineral lubricating oils, which, moreover, compared with those from Baku, are specifically heavier, and capable of withstanding lower temperatures without solidifying.—C. A. W.

Mineral oils; Modification of the usual method of determining the ash of ——. N. Hviid and E. Severin. Petroleum, 1910, 5, 1454—1456.

In determining the ash of mineral oils, the combustion of the oil is stated to be easily regulated and losses avoided, if fine nickel wire gauze be fitted in the crucible. Berlin porcelain crucibles of 47 mm. and 25 mm. diameter at the top and bottom respectively and 68 mm. deep are used and fine nickel gauze (100-mesh) made to fit at 30 mm. above the bottom. An inverted glass funnel is suspended just above the crucible. Very exact results are thus obtained with 5 grms. of oil.—A. Sbld.

Crude petroleum and its distillates; Condensation of —— with methylal and sulphuric acid. V. F. Herr. Chem.-Zeit., 1910, 34, 893—894.

Acetaldehyde and methylal, $CH_2(OCH_3)_2$, form condensation products with the aromatic constituents (naphthenes) of petroleum oil and its distillates, in the presence of sulphuric acid, the reaction being similar to Nastjukoff's formalin reaction (this J., 1904, 1082). One part by weight of the oil is dissolved in 2 parts of methylal, and 4 parts of concentrated sulphuric acid are run in as a thin stream. The product is separated by pouring the liquid into water, neutralising with ammonia, and filtering. If the liquid is kept cool during the reaction, the product obtained is soluble in chlorobenzene. If the liquid is allowed to become hot, and is finally heated on the water-bath for half an hour, a larger yield is obtained of an insoluble product. The presence of 0·05 per cent. of benzene in a light petroleum distilling below 50° C. can be detected by this reaction. A rapid rough comparative determination of the unsaturated constituents of an oil can be made by taking 2 c.c. of the oil in a graduated stoppered cylinder, adding 4 c.c. of methylal, dissolving in 10 c.c. of light petroleum, adding 2 c.c. of sulphuric acid and shaking for one minute. After standing for half an hour, the volume of the condensation product which has settled at the bottom is read off.—A. T. L.

Gaseous decomposition-products of black powder, with special reference to the use of black powder in coal mines. Young. *See* XXII.

Patents.

Washing water from the treatment of coal or ores; Apparatus for cleaning the ——. C. R. *dit* G. Pinette and L. Graillot. Fr. Pat. 413,517, Mar. 11, 1910.

The apparatus consists of a centrifugal machine in which the rotating basket is not perforated and carries a concentric inner cylinder into which the water to be cleansed is delivered. Through an annulus in the base of this cylinder the water passes into the basket, and, after depositing its solids on the inner surface passes over an internal flange at the top of the basket into an annular trough surrounding the casing of the machine. The deposited solids are removed, when the basket is brought to rest, by raising a false bottom attached to a cylindrical guide surrounding the internal cylinder, and at the same time lowering a cylindrical valve which closes the opening (for the clean water) to the annular trough. The mud flows away to suitable troughs, and the cleansed water is carried from the annular trough to the treating apparatus for further use.—J. W. H.

Fuels; Process for increasing the calarific power of ——. M. Recondo. Fr. Pat. 413,025, Feb. 24, 1910. Under Int. Conv., Jan. 28, 1910.

The fuel is sprinkled with water in which sodium chloride, potassium nitrate and oxide of iron have been dissolved. It is stated that the rate of combustion and the density of the smoke are diminished and the calorific power of the fuel is increased.—J. W. H.

Briquettes; Manufacture of insoluble, smokeless and odourless —— *from anthracite by means of "cellulide."* A. E. Tavernier and C. Oulman. Fr. Pat. 413,152, Feb. 16, 1910.

The binding material, "cellulide," is prepared by concentrating the lyes obtained in treating wood for the manufacture of paper pulp, the lyes being first mixed with sulphuric acid. The solid substance, in the form of thin sheets, is mixed with anthracite dust, the mass is treated in a vessel heated by steam, and the pasty mass thus produced is briquetted. The briquettes are stacked on trolleys and passed through a special furnace where they are heated to 300° C., out of contact with the air, in order to render them insoluble, smokeless, and odourless. This furnace comprises three compartments separated by sliding doors. In the first compartment the temperature is raised to 100° C., and in the second, to 300° C., and in the third compartment the briquettes are cooled to about 120° C. by introducing steam or by a water spray.—A. T. L.

Briquettes; Production of —— *from waste fuel.* O. Crochet. Fr. Pat. 413,803, Mar. 17, 1910.

Briquettes are made from coal-dust, anthracite, lignite, peat, etc., with a binding agent consisting of the pith of the sago-palm together with a small proportion of pitch or tar. The briquettes burn with less smoke than those made with a binding agent consisting wholly of pitch or tar.—A. T. L.

Coke ovens; Regenerative ——. N. Schuster, London. Eng. Pat. 17,889, Aug. 3, 1909.

In order to avoid the strains in the brickwork of the heating flues of regenerative ovens caused by the frequent reversal of the direction of the gas through them, it is proposed to do away with this reversal in so far as it applies to the heating flues. This is to be effected by arranging waste gas flues between every pair or pair of groups of heating flues and maintaining the direction of the gases through these flues constant. The reversal of direction through the regenerators is effected by means of dampers. —W. H. C.

Coke ovens. W. Hiby, Crigglestone, Yorks. Eng. Pat. 4069, Feb. 18, 1910.

Some types of horizontal coke-ovens are provided with a flue beneath the sole which is used only during the period of heating up or starting the ovens to convey the products of combustion to the waste gas flue. During the normal working of the ovens this flue is closed and no air or gas passes through it, the consequence being that the bottom of the charge becomes overheated and spoiled. To remedy this defect it is proposed to cause part of the air necessary for the combustion of the gas by which the ovens are heated to pass through this sole flue. To this end the usual air inlets around the burners are closed or constricted and an inlet for air is made in the sole flue, and outlets opposite the burners, so that part of the air for combustion passes through this flue.—W. H. C.

Coke ovens. J. Kros. Fr. Pat. 413,705, Mar. 17, 1910.

In order to obtain the greatest possible heating surface, the heating chambers formed in the walls between adjacent coking chambers are without any baffles for directing the flow of the heating gases. The products from the heating chambers are led to a down-take by means of a horizontal flue directly above each chamber, and a uniform distribution of the gases in the heating chambers is ensured by a series of adjustable apertures leading to the escape flue at intervals along its length.—A. T. L.

Gas producers [for use in metallurgical operations and in the fixation of atmospheric nitrogen]. A. Reynolds, London. Eng. Pat. 16,217, July 12, 1909.

The patent relates to a producer which may be combined with a regenerator and a kiln and used for metallurgical operations requiring high temperature, and for the fixation of atmospheric nitrogen. The producer, which is mounted above a water-trough, has a long steel retort-chamber, of greatest diameter at the base, arranged above the incandescent fuel in the path of the hot gases, and a separate outlet is provided at the top of this chamber for the rich gases which are distilled from the fuel during its passage through the retort. The producer may be arranged above a regenerator chamber and to one side of a kiln in which lime may be burnt. The producer is then worked so as to form chiefly carbon dioxide, and part of the producer gases passes through the kiln and the remainder through the regenerator. For fixing atmospheric nitrogen, the process is intermittent. When the regenerator has been heated as described, air is passed through it and the hot air is supplied to the kiln together with rich gas from the retort chamber of the producer, the air being in excess. "N_2O" is stated to be formed and "to combine with the lime to form calcium nitrite." By duplicating the arrangement the process may be made continuous.—A. T. L.

Water-gas apparatus. A. G. Glasgow, Richmond, Va., U.S.A. Eng. Pat. 25,474, Nov. 4, 1909.

To facilitate the manipulation of large stack-valves, which are made of sufficient weight not to be lifted by the normal gas-pressure during the operation of the producer, an arrangement is adopted whereby the first movement of a hand-lever lifts the valve through a small height with a great mechanical advantage, and further movement of the lever brings the valve away horizontally, and with a small mechanical advantage, so as to uncover the orifice for blowing off.—A. T. L.

Producer-gas; Process of making ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 967,213, Aug. 16, 1910.

The process consists in first passing air through a bed of fuel to bring it to incandescence, and then passing oil and air downwards through the fuel so as to decompose the oil into gases and heavy hydrocarbons, and to convert the latter into gases and solid carbon, the carbon being burnt with the air.—A. T. L.

Suction gas-producer. C. L. Straub, Milwaukee, Wis., Assignor to Loomis Pettibone Co. U.S. Pat. 967,459, Aug. 16, 1910.

The producer comprises a cylindrical furnace-chamber, closed in at the top by an annular flash-boiler on which rests a feeding hopper. An annular gas-outlet flue is formed in the walls of the furnace-chamber immediately beneath the flash-boiler. The gas-outlet pipe is turned downwards and is enclosed in a casing through which the air supply is drawn. The hot air from this casing passes into the flash-boiler through a contracted inlet pipe provided with a water spraying device at its narrowest point, and the cross-section at this point can be regulated by a gate-valve.—A. T. L.

Gas producer. J. O. E. Trotz, Worcester, Mass. U.S. Pat. 968,000, Aug. 23, 1910.

A coking chamber for the raw fuel is arranged above and to one side of the producer and is normally shut off from the producer by a door to prevent the descent of the raw fuel. Air is forced into this coking chamber at about the middle of its height so as to bring the fuel to incandescence. The coked fuel is transferred from time to time to the upper part of the producer. The roof of the producer and the upper part of the walls are so arranged that the fuel thus admitted rests against the rear wall of the producer and leaves a space adjacent to the upper part of the front wall. The gases formed by combustion and distillation in the coking chamber, are led to this space from the top of the coking chamber. The producer outlet is in the rear wall and some distance below the roof.
—A. T. L.

Gas purifier. H. I. Lea, Pittsburg, Pa., Assignor to The Westinghouse Machine Co., U.S. Pat. 968,370, Aug. 23, 1910.

A vertical casing is provided with a series of vertical partitions, and screens inclined alternately in opposite directions are supported on ledges, in the spaces between the partitions.—A. T. L.

Naphthalene; Process of recovering —— from gas. R. H. Bots, Syracuse, N.Y. U.S. Pat. 968,509, Aug. 23, 1910.

The naphthalene is absorbed by a solution of picric acid, and recovered from the "naphthalene picrate" by steam distillation.—A. T. L.

Oil-wells; Method of, and apparatus for pumping ——. A. Sattler, Carpinteria, Cal. U.S. Pat. 966,772, Aug. 9, 1910.

A method of pumping viscous oil from a well consists in introducing a lighter oil into the well, pumping up the mixture, and recovering the diluent by distillation.
—A. T. L.

Petroleum oil; Method of freeing —— from smoke producing elements. S. Kamo, Oita, and Y. Naka, Osaka, Japan. Eng. Pat. 11,359, May 13, 1909.

The oil is thoroughly mixed with an equal bulk of sea water containing 1 to 4 per cent. of wood vinegar, and allowed to stand for 3 to 4 hours. A precipitate is formed containing the impurities and the clear oil is run off. The treatment is repeated if necessary, and the oil may be heated to 60°—75° C. The sea water should be of density 3° B., and salt or ammonium chloride is added if necessary. Crude, heavy, and light oils may be treated in this way, and the product is suitable for burning.—A. T. L.

Paraffin wax; Refining ——. A. F. Craig and Co., Ltd., and W. F. Murray, Paisley. Eng. Pat. 13,589, June 10, 1909.

The crude wax is melted and floated on water contained in a tank having movable side-plates which act as a conveyor to continuously remove wax from the surface of the water in a continuous sheet. The sheet of wax is cooled by cold water and passed by a series of endless band conveyors through a series of steam-heated sweating chambers, each of which is maintained at a suitable temperature so that the wax is progressively sweated and refined by the removal of oil, and the refined product is finally dropped from the last band into a tank where it is melted and run into a suitable receiver.—W. H. C.

Solidification of crude oil and of its distillates; Process for the ——. V. Roșculeț. Fr. Pat. 412,892. Feb. 21, 1910.

Stearine, or other fat of high melting point, is heated for several hours with an equal quantity of a mineral acid, preferably hydrochloric acid, and after cooling is separated from the acid. This treatment renders the stearine soluble in hydrocarbon oils at the ordinary temperature. 0·5 to 5 per cent. of the stearine thus treated is dissolved in the oil to be solidified, the solution is heated to 70°—100° C., and 1 to 10 per cent. of a hot saturated solution of sodium hydroxide in alcohol, or in a mixture of alcohol and benzene, is added. On cooling, the mass solidifies.
—A. T. L.

Fuel; Process for making an artificial ——. H. C. Morris. Fr. Pat. 413,592. March 14, 1910. Under Int. Conv., March 15, 1909.

See Eng. Pat. 6163 of 1909; this J., 1909, 1186.—T. F. B.

Coke ovens; Regenerative and non-regenerative ——. R. F. F. Fabry. Fr. Pat. 413,301, March 5, 1910. Under Int. Conv., April 15, 1909.

See Eng. Pat. 8920 of 1909; this J., 1909, 1026.—T. F. B.

Coking processes. L. L. Summers. Fr. Pat. 413,440, Feb. 7, 1910. Under Int. Conv., Feb. 9, 1909.

See U.S. Pat. 935,175 of 1909; this J., 1909, 1079.—T.F.B.

Coke ovens. L. L. Summers. Fr. Pat. 413,811, March 18, 1910. Under Int. Conv., March 19, 1909.

See U.S. Pats. 943,609 and 943,610 of 1909; this J., 1910, 144.—T. F. B.

Ammonia; Process and apparatus for producing recoverable —— in the manufacture of producer gas. Q. Moore, J. Cunningham, and J. W. B. Stokes. Fr. Pat. 413,651, March 16, 1910.

See Eng. Pats. 28,053 and 28,054 of 1908; this J., 1910, 550.—T. F. B.

Producing pure carbon dioxide from the scrubbing water obtained in the manufacture of lighting gas and of coke oven gas. Fr. Pat. 412,975. *See* VII.

Apparatus for testing lubricating products. Fr. Pat. 413,996. *See* XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Electric incandescence lamps; Radiation of ——. G. Leimbach. Z. wiss. Photogr., Photophysik, u. Photochem., 1910, 8, 333—360, 365—380. Chem. Zentr., 1910, 2, 695—696.

The author has determined for a number of lamps on the market the watt-consumption, the total radiation by means of the bolometer, and the luminous radiation in the same way after absorbing the infra-red rays by a solution of ferrous-ammonium sulphate. The results are shown in the following table, wherein (1) represents the specific consumption of watts per mean candle-power, (2) the relative radiating power = the energy value of the total radiation divided by the energy consumed, (3) the luminous effect = the energy value of the luminous radiation divided by that of the total radiation, (4) the efficiency = the energy value of the luminous radiation divided by the energy consumed, (5) the absolute luminous radiation = the mean spherical luminous radiation divided by the mean spherical candle-power, and (6) the absolute specific luminous radiation divided by the absolute specific luminous radiation of the Hefner candle.

	(1)	(2)	(3)	(4)	(5)	(6)
		per cent.	per cent.	per cent.	Watts per sq. cm.	
Carbon filament lamp	3·8	61·9	2·85	1·75	531×10^{-9}	0·62
Nernst lamp ..	2·0	49·2	4·43	2·17	340 ,,	0·40
Tantalum lamp	2·0	64·8	4·26	2·75	419 ,,	0·52
Osram lamp....	1·5	75·6	4·63	3·50	418 ,,	0·49
A.E.G. lamp ..	1·7	80·5	4·41	3·55	482 ,,	0·56
Bergmann lamp	1·7	68·5	5·03	3·44	473 ,,	0·55
Just tungsten lamp	1·7	72·2	4·44	3·20	437 ,,	0·51
Sirius colloid lamp	1·5	65·4	5·42	3·55	436 ,,	0·51

—A. S.

Patents.

Incandescent gas lamp mantles. I. Kreidl and G. Heller, Vienna. Eng. Pat. 17,862, July 31, 1909.

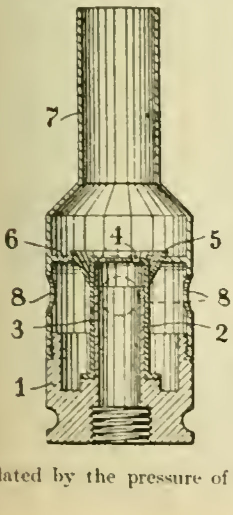
The raw mantle is impregnated with a solution of colloidal thorium hydroxide mixed with a suitable proportion of a cerium compound. The impregnated mantle is then heated with a solution of ammonia in order to convert the "sol" into a "gel," that is to render the colloidal thorium hydroxide insoluble. The mantle is then finished in the usual manner. The advantage of this method is that as no ammonium salts are formed as from the interaction of the ammonia and the acid of the thorium salt used in the ordinary process, the mantle does not require to be washed before being finished.—W. H. C.

Gas-mantle, and art of making same; Incandescent ——. A. P. White, Caldwell, N.J. U.S. Pat. 966,283, Aug. 2, 1910.

The gas mantles are made by impregnating a suitable fabric with a solution of thorium nitrate. The impregnated fabric is treated with hydrogen peroxide, and before burning off is further impregnated with a solution of thorium nitrate, containing a salt of another rare earth to act as an excitant. A web for making incandescent mantles is also claimed, consisting of threads containing denitrated salts of thorium, and coated with a thorium compound containing another salt to act as an excitant. —W. H. C.

Bunsen burner for illuminating purposes. E. Meyer-Zimmerli, Zurich. Eng. Pat. 830, Jan. 12, 1910. Under Int. Conv., Jan. 19, 1909.

The gas enters through the inner pipe, 2, over which the outer pipe, 3, provided with orifices, 4, for the escape of gas to the mixing chamber, 7, slides. An inverted cone, 5, is attached to the pipe, 3, and fits into the opening in the horizontal partition, 6. When no gas is passing, the parts of the apparatus are in the position, shown in the figure, but when gas is admitted, the pressure causes the outer telescopic tube, 3, to rise vertically so that the cone, 5, also rises and allows the air, which enters through the holes, 8, to pass between the cone, 5, and the plate, 6, into the mixing chamber, 7. The greater the pressure of the gas the higher the tube, 3, rises, and consequently the greater the opening between 5 and 6. The result is that the amount of air is automatically regulated by the pressure of the gas.—W. H. C.



Filament or resistor for heating units or lamps. H. W. Lake, London. From Parker-Clark Electric Co., New York. Eng. Pat. 18,954, Aug. 17, 1909.

A strong, rigid conductor of high resistance which will withstand a high temperature in the open and is suitable for use in lamps and in electrical heaters, is made as follows. A core of carbon is arranged in a flashing jar, through which a current of gas is passed containing an excess of hydrogen, together with about 2 per cent. of a hydrocarbon, preferably ethylene, and the vapour of silicon chloride. The new silicon carbide, SiC_2, is thus deposited so as to build up a filament of any desired size. The reaction is:— $C_2H_4+SiCl_4 = SiC_2+4HCl$. In place of ethylene, the following gases or vapours may be used; methane, acetylene, benzene, acetaldehyde, and ether. (See also Eng. Pats. 7637 and 7642 of 1907; this J., 1907, 1079; 1908, 438).—A. T. L.

[*Mercury*] *Vapour lamps; Electrode for* ——. P. C. Hewitt, Assignor to Cooper Hewitt Electric Co., New York. U.S. Pat. 965,900, Aug. 2, 1910.

This electrode for mercury vapour apparatus consists of an amalgam of approximately one part of lead, one part of tin, and four parts of mercury.—W. C. H.

Filaments for electric lamps; Manufacture of ——. F. J. Planchon, Paris. U.S. Pat. 968,407, Aug. 23, 1910.

See Eng. Pat. 12,139 of 1907; this J., 1908, 554.—T. F. B.

Incandescent lamp filaments; Solder for ——. H. Kuzel, Baden, Austria-Hungary, Assignor to General Electric Co., New York. U.S. Pat. 969,109, Aug. 30, 1910.

See Addition of Nov. 21, 1906, to Fr. Pat. 366,267 of 1906; this J., 1907, 520.—T. F. B.

Filaments of difficultly fusible metals [for electric lamps, etc.]; Process for diminishing the brittleness of ——. C. H. Weber. Fr. Pat. 413,544, March 12, 1910.

See Eng. Pat. 18,808 of 1909: this J., 1910, 807.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Patents.

Solidifying tar; Apparatus for ——. E. T. Leaver, London. Eng. Pat. 17,209, July 23, 1909.

The tar after the naphtha has been distilled off is run by gravity into a lead-lined tank placed at a lower level and independently heated to about 200° F., wherein it is mixed by means of a hand-driven stirrer with the requisite quantity of sulphuric acid added through a sprinkling device. The mixing tank is provided with a cover and with means for conducting away the gases and vapours given off, so that nuisance is avoided. The bottom of the tank slopes towards the outlet so that when the mixing is complete, the resulting mass can be run out into tanks or moulds.—W. H. C.

Tar oils; Process for improving the odour of heavy ——. Rütgerswerke A.-G. Ger. Pat. 223,868, May 31, 1907.

When heavy coal-tar oils are treated with dilute (50—60 per cent.) sulphuric acid, at temperatures of 80—90° C., a considerable portion of the acidic and basic constituents separates in a resinous condition, and can be readily removed from the oils. For example, 1000 kilos. of heavy oil are treated with 100 kilos. of 60 per cent. sulphuric acid at 90° C. for some time; after cooling, the acid and resinous mass are separated, and the oil is washed with 100 kilos. of caustic soda lye of sp. gr. 1·3, and may finally be treated with steam until no more naphthalene distils over.—T. F. B.

Anthraquinone or halogen-anthraquinones; Process for introducing chlorine into ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 412,979, Feb. 23, 1910. Under Int. Conv., March 6, 1909.

When anthraquinone or its halogen derivatives are treated with chlorine in concentrated sulphuric acid solution, preferably in presence of chlorine-carriers, chlorine atoms may be introduced successively into the anthraquinone molecule. Thus, 1·4·5·8-tetrachloro-anthraquinone is produced by the action of a current of chlorine on 50 kilos. of anthraquinone and 1 kilo. of iodine dissolved in 500 kilos. of sulphuric acid monohydrate, heated to about 130° C. The chlorine is passed until the equivalent of "4 atoms" is absorbed. The same product is obtained by chlorinating 1-chloro- or 1·5-dichloro-anthraquinone. Hexachloro-anthraquinones are formed in a similar manner from 2·6- and 2·7-dichloro-anthraquinone, β-chloro-anthraquinone furnishes a new pentachloro-derivative, and 1- and 2-bromo-anthraquinone give rise to 1-bromo-4·5·8-trichloro- and 2-bromotetra-chloro-anthraquinone respectively.—T. F. B.

Reaction mixtures containing chlorosulphonic acid; Process for working-up ——. Saccharinfabr. A.-G., vorm. Fahlberg, List, und Co. Ger. Pat. 224,386, Nov. 7, 1908.

The residual liquid produced by pouring into ice-water the reaction-product of chlorosulphonic acid on hydrocarbons consists of dilute hydrochloric and sulphuric acids, and is valueless. In order to recover the acids it is proposed to merely dilute the reaction mixture with a small quantity of water or dilute hydrochloric acid, in such a way that all the hydrochloric acid escapes in the gaseous form, the sulphuric acid being separated from the organic derivative by further dilution. For example, to the product obtained by the action of 350 kilos. of chlorosulphonic acid on 100 kilos. of toluol, is added slowly, and with constant stirring, 18 kilos. of water: the temperature will not rise much above 30° C., and hydrochloric acid gas will be briskly evolved. On addition of a further 18 kilos. of water the toluene sulphochloride separates from the sulphuric acid.—T. F. B.

Dihydroxycarbazoledisulphonic acid; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 224,952, May 11, 1909.

Carbazole is converted into its tetrasulphonic acid by treatment with sulphuric acid monohydrate at 90°—100° C., and then with fuming acid at the same temperature. 575 parts of the potassium salt of this acid are added to a mixture of 2500 parts of caustic potash and 250 parts of water heated to 240° C., and the temperature is maintained at 260° C. until the carbazolesulphonic acid is melted; the melt is treated with acid and the potassium salt of the dihydroxydisulphonic acid of carbazole dissolved out. The free acid is easily soluble in water, sparingly in alcohol, and insoluble in benzene. It may be utilised in making azo dyestuffs, being able to combine with two mols. of a diazo compound.—T. F. B.

Arylsulphaminoanthraquinones; Process for preparing ——. F. Ullmann. Ger. Pat. 224,982, July 20, 1909.

Halogen derivatives of anthraquinone react readily with arylsulphamides, forming arylsulphaminoanthraquinones: the reaction is preferably carried out in presence of a catalytic agent and of a substance which will combine with the hydrochloric acid liberated. For example, a mixture of 10 parts of 1-chloro-anthraquinone, 10 parts of *p*-toluenesulphamide, 8 parts of potassium carbonate, 1 part of copper acetate, and 100 parts of nitrobenzene is boiled under a reflux condenser for two or three hours. By distilling off the nitrobenzene and crystallising from acetic acid, the 1-*p*-toluenesulphamino-anthraquinone is obtained in the form of yellow needles, of m. pt. 225° C., insoluble in alcohol and ether.—T. F. B.

Tar; Process for the continuous distillation of ——. W. Hugendick, Essen-Ruttenscheid, Germany. Eng. Pat. 23,766, Oct. 16, 1909. Under Int. Conv., Oct. 17, 1908.

See Fr. Pat. 407,906 of 1909; this J., 1910, 552.—T. F. B.

Anthraquinone; Process for the manufacture of ——. J. Wetter, London. From Chem. Fabr. Grünau, Landshoff und Meyer A.-G., Grünau, Germany. Eng. Pat. 16,312, July 13, 1909.

See Ger. Pat. 215,335 of 1908; this J., 1909, 1310.—T. F. B.

Anthraquinonesulphonic acids; Production of chlorinated ——. F. Ullmann. Fr. Pat. 413,412, March 9, 1910. Under Int. Conv., May 10, 1909.

See Eng. Pat. 544 of 1910; this J., 1910, 808.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Azoxy-compounds; Preparation of ——. F. Reitzenstein. J. prakt. Chem., 1910, **82**, 252—270.

The author finds that many amines, and particularly their sulphonic acids, can be oxidised to azoxy-compounds by means of potassium ferricyanide in alkaline solution. Benzidinesulphondisulphonic acid, when treated in this way, is readily oxidised and the dyestuff produced can be easily salted out of solution. It is a red, substantive dye for cotton and can be diazotised and developed on the fibre or in substance. Similarly benzidinemonosulphonic acid, benzidine-*m*-disulphonic acid, naphthidine, *o*-diaminodiphenic acid and dianisidine furnish analogous products. *p*-Phenylenediaminemonosulphonic acid also yields a dyestuff which can be diazotised and combined with the usual components: for example, the product obtained with β-naphthol dyes wool in raspberry red shades which become brown on chroming. Sulphanilic acid gives an azoxy-compound (azoxybenzene-*pp*-disulphonic acid) which dyes wool in sulphur-yellow shades, and dibromosulphanilic acid yields a dye producing more intense, orange yellow tints on wool than those furnished by the unsubstituted product. Naphthionic acid yields a dye giving yellow shades on wool and diaminostilbenedisulphonic acid gives a dye producing yellowish brown shades on wool; when diazotised and combined with β-naphthol a brick red, and with 1-amino-7-naphthol a dark brown, dyestuff is obtained. The oxidation can even be effected on the fibre itself: thus when cotton dipped into an alkaline solution of benzidinemonosulphonic acid, is brought into a solution of potassium ferricyanide, a level, olive-yellow is produced which is fast to washing. Congo Red and Benzopurpurin 4B, when similarly treated, on the fibre yield yellowish red and flesh red shades. After separating the dyestuff in the above operations the solution may be treated with chlorine in order to convert the ferro- into ferri-cyanide which can then be used for further oxidations.—J. C. C.

Tetramethylchrysaniline. O. Fischer and E. Schmidt. J. prakt. Chem., 1910, **82**, 288—291.

In 1884 it was found that when the condensation product of *o*-nitrobenzaldehyde and dimethylaniline (ortho-di-para-tetramethyltriaminotriphenylmethane) was treated with arsenic acid, a yellow dyestuff was produced which was probably tetramethylchrysaniline. The yield of oxidation product was, however, small and it is only recently that it has been found that a much better yield (40 per cent.) can be obtained by oxidising the leuco-compound with yellow mercuric oxide, which operation is carried out in boiling xylene solution. The hydrochloride, platinichloride, picrate and nitrate as well as the free base have been prepared. The latter crystallises from benzene in large reddish yellow prisms melting at 229° C. Dyeings produced with salts of tetramethylchrysaniline are distinctly redder than those obtained by the use of chrysaniline.—J. C. C.

Patents.

Vat dyestuffs; Production of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,029, Nov. 20, 1909. Addition to Eng. Pat. 7819, April 1, 1909 (this J., 1910, 81).

Instead of 1-naphthol or 1-anthrol, used in the chief patent, 4-hydroxyacenaphthene is condensed, not only with the isatins previously mentioned but also with the respective β-naphthisatins. The condensation product of 4-hydroxyacenaphthene with dibromoisatin chloride gives a yellow vat from which cotton is dyed in pure fast blue shades; that with α-isatinanilide produces fast bluish gray shades, and that with bromo-β-naphthisatin chloride dyes cotton in bluish green shades.—J. C. C.

Vat dyestuff; New —. P. Thomaschewski, Vohwinkel. Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 961,387, June 14, 1910.

OLIVE to gray and brownish black vat dyestuffs are obtained by treating with alkali polysulphides anthraquinone-mercaptans or the corresponding disulphides or derivatives which yield mercaptans in the reaction. Example:—1 part of 1-aminoanthraquinone-5-sulphonic acid is heated in an autoclave to 170° C. for 10 hours with 2 parts of sulphur, 10 parts of sodium sulphide, and 8 parts of water. After cooling, the product of the reaction is filtered off and washed with hot water. From an alkaline hydrosulphite vat it dyes cotton in fast, greenish black blown shades.—J. C. C.

Vat-dyestuff. P. Thomaschewski, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 961,388, June 14, 1910.

OLIVE to gray and brownish black dyestuffs are obtained by treating anthraquinone-mercaptans or the corresponding disulphides with sulphur. Example:—1 part of anthraquinone-1:5-dimercaptan is heated with 8 parts of sulphur to 300° C. until no more hydrogen sulphide is evolved. The product is extracted with sodium sulphide solution to remove sulphur, and washed. From an alkaline hydrosulphite vat it dyes cotton in fast olive shades.—J. C. C.

Leucodiethylgallocyanine. W. Lommel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat., 962,712, June 28, 1910.

THE leuco-compound of diethylgallocyanine (compare this J., 1910, 412) is prepared as follows:—36 parts of diethylgallocyanine hydrochloride are stirred with water and 30 parts of hydrochloric acid (19° B.), and 9 parts of zinc dust are slowly added. The reaction is complete after the mixture has been stirred for some time and heated gently. The separated leuco-compound can be used as a paste or may be filtered off, washed, and dried.—J. C. C.

Azo-dyestuff. W. Bergdolt, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 963,739, July 12, 1910.

BLUISH black to black trisazo-dyestuffs are prepared by combining the tetrazo-compounds obtained from *p*-aminobenzeneazo-2-amino-8-naphthol-6-sulphonic acid or from *p*-aminobenzeneazo-2-amino-5-naphthol-7-sulphonic acid with one molecule of a *m*-diaminobenzene- or toluenesulphonic acid and with one molecule of 2-amino-5-naphthol-7-sulphonic acid or of a derivative of the latter acid or *vice versa*. An example is given illustrating the preparation of such a dyestuff from the tetrazo-compound of *p*-aminobenzeneazo-2-amino-8-naphthol-6-sulphonic acid which is combined first with one molecule of *m*-phenylenediamine-4-sulphonic acid and then with one molecule of 2-phenylamino-5-naphthol-7-sulphonic acid. It dyes cotton in deep blue black shades.—J. C. C.

Anthracene series; Production of dyestuffs of the —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 413,127, Feb. 2, 1910. Under Int. Conv., March 16, 1909.

DYESTUFFS for wool are obtained by treating aminoanthraquinonesulphonic acids with acylating agents. The dyestuffs prepared from 1-aminoanthraquinone-6-sulphonic acid and acetic anhydride, oxalic acid (in the presence of pyridine), benzoyl chloride (in the presence of pyridine and nitrobenzene) and thionyl chloride (in the presence of nitrobenzene, pyridine and salicylic acid) respectively dye wool in yellow shades and that from 1-amino-4-methylaminoanthraquinonesulphonic acid and acetyl chloride produces violet shades.—J. C. C.

Triphenylmethane series; Production of chrome dyestuffs of the —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 413,383, March 8, 1910. Under Int. Conv., June 9 and July 22, 1909.

DYESTUFFS which produce yellow to red shades on wool from an acid bath and become green to blue or black on chroming are prepared by condensing aminobenzaldehyde or its nuclear substitution products, with two molecules of an aromatic hydroxycarboxylic acid, diazotising the resulting leuco-compounds and combining the diazo-compound with the usual components, and finally oxidising the leuco-azo-compounds. Alternatively the leuco-compounds can be oxidised before or after the diazotisation and then combined as described. Example: 100 kilos. of the leuco-compound prepared by condensing one molecule of *o*-chloro-*m*-aminobenzaldehyde and two molecules of *o*-cresotic acid are dissolved by the addition of 14 kilos. of sodium carbonate and the leuco-compound is precipitated by adding 63 kilos. of hydrochloric acid (19° B.) and 300 kilos. of ice. Diazotisation is effected by adding 6·9 kilos. of sodium nitrite dissolved in water and the diazo-compound is poured into a well cooled solution of 15·5 kilos. of *o*-cresotic acid in 500 kilos. of water and 27 kilos. of sodium carbonate. The combination is completed by adding 40 kilos. of 30 per cent. sodium hydroxide, the dyestuff is precipitated by hydrochloric acid, washed and dried. For the oxidation this product (60 kilos.) is dissolved in concentrated sulphuric acid (300 kilos.) and a solution of sodium nitrite (7 kilos.) in concentrated sulphuric acid (100 kilos.) is stirred in. After heating the mixture to 50°—60° C., it is thrown on ice, filtered and dried. A table is given in the patent showing the properties of analogous dyestuffs.—J. C. C.

β-Anthraquinonyl-ureas; Manufacture of —. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on Maine, Germany. Eng. Pat. 12,129, May 17, 1910. Under Int. Conv., May 19, 1909.

β-ANTHRAQUINONYL-UREAS are prepared by treating β-anthraquinonyl isocyanate with a primary or secondary amine in presence or absence of a solvent. (Compare this J., 1910, 749, 1002.) The condensation products from aniline, β-aminoanthraquinone, *p*-aminobenzoyl-α-aminoanthraquinone and benzylamine or diethylamine, etc. dye cotton from the vat in yellow shades.—J. C. C.

Chlorotoluidinesulphonic acid; A new — and process of preparing dyestuffs therefrom. Badische Anilin und Soda Fabrik. First Addition, dated Feb. 21, 1910, to Fr. Pat. 398,602, Jan. 18, 1909. Under Int. Conv., Nov. 20, 1909.

PYRAZOLONE dyestuffs similar to those mentioned in the chief patent (this J., 1909, 832) are obtained by employing 3-bromo-2-amino-1-methylbenzene-5-sulphonic acid instead of the chloro-acid previously used.—J. C. C.

Sulphide dyestuffs; Production of new blue —. L. Cassella und Co. Ges. m. b. H. Fr. Pat. 413,716, June 1, 1909.

THE dyestuffs prepared by heating with polysulphides the products of condensation of carbazole with *p*-nitrosophenols (this J., 1909, 517; 1910, 482) contain two different substances which can be separated by making use of their different degrees of solubility in dilute alkali sulphides. The more sparingly soluble dyestuff gives a vat from which cotton is dyed in deep blue shades very fast to washing, light and chlorine. In order largely to increase the proportion of this dyestuff in the above preparation, a polysulphide of the composition, Na_2S_6, should be employed and the operation is preferably carried out in alcoholic solution.
—J. C. C.

Vat dyestuffs; Manufacture of —. Kalle und Co. A.-G. Fr Pat. 413,799, March 17, 1910. Under Int. Conv., March 19, 1909.

INDIGOID dyestuffs, obtained by condensing derivatives of α-isatin with aromatic compounds containing the group, $CH_2 \cdot CO$ (except indoxyl and 3-oxy-1-thionaphthene) are brominated, or the latter compounds are condensed with bromo-derivatives of *o*-isatin. The dyestuff produced by treating the product of condensation of 1 : 4-dihydroxynaphthalene monomethyl ether and *a*-anilidoisatin with a solution of bromine in sulphuric acid gives a vat from which cotton is dyed in fast blue shades. A similar dyestuff is produced by treating in the like manner the product of condensation of *a*-naphthol and dibromoisatin chloride. —J. C. C.

Sulphide dyestuffs derived from carbazole; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 18,822, Aug. 16, 1909.

See Fr. Pat. 413,716 of 1909; preceding.—T. F. B.

Sulphide dyestuffs; Process for preparing black ——. L. Cassella und Co. Fr. Pat. 413,755, June 2, 1909.

See Eng. Pat. 14,143 of 1909; this J., 1910, 481.—T. F. B.

Halogen derivatives of indigo; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 23,181, Oct. 11, 1909.

See Fr. Pat. 409,618 of 1909; this J., 1910, 686.—T. F. B.

Azo dyes. E. R. Jäger and R. W. Carl, Dusseldorf-Derendorf, Germany. Eng. Pat. 1781, Jan. 24, 1910. Under Int. Conv., June 18, 1909.

See Fr. Pat. 412,138 of 1910; this J., 1910, 1063.—T. F. B.

Dyestuffs of the anthracene series; Manufacture of —— and of an intermediate product. Soc. pour l'Industrie Chimique à Bâle, Basle, Switzerland. Eng. Pat. 9284, April 16, 1910. Under Int. Conv., April 17, 1909.

See Fr. Pat. 411,750 of 1909; this J., 1910, 939.—T. F. B.

Vat [anthracene] dyes and process of making; Gray ——. H. Broniatowski, Assignor to Soc. of Chem. Ind. in Basle, Basle. U.S. Pat. 968,533, Aug. 30, 1910.

See Fr. Pat. 411,750 of 1909; this J., 1910, 939.—T. F. B.

Vat dye and process of making same. A. Schmidt, E. Bryk, and R. Voss, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 968,697, Aug. 30, 1910.

See Eng. Pat. 17,265 of 1909; this J., 1910, 81.—T. F. B.

Vat [anthracene] dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 412,900, Feb. 21, 1910. Under Int. Conv., March 4, 1909.

See U.S. Pat. 961,387 of 1910; preceding.—T. F. B.

Vat [anthracene] dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 412,938, Feb. 22, 1910. Under Int. Conv., March 4, 1909.

See U.S. Pat. 961,388 of 1910; preceding.—T. F. B.

Leuco compound of the oxazine series [leuco-diethylgallocyanine]; Process for producing a ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 413,349, March 7, 1910. Under Int. Conv., June 8, 1909.

See U.S. Pat. 962,712 of 1910; preceding.—T. F. B.

Monoazo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 413,982, March 10, 1910. Under Int. Conv., April 28, 1909.

See Eng. Pat. 28,717 of 1909; this J., 1910, 1050.—T. F. B.

Preparing bluish-green lakes. Ger. Pat. 224,442. *See* XIII.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Japanese celluloid industry. Chamber of Comm. J., Sept., 1910. [T.R.]

The Japanese Monopoly Bureau has promised to supply the Sakai Celluloid Company, which is expected to open operations shortly, with 300 tons of camphor a year, and the Aboshi Celluloid Company with 600 tons. In manufacturing celluloid camphor represents 50 per cent. of the material employed, so that the amount of celluloid manufactured by these two firms is estimated at 1800 tons per annum. The demand for celluloid in Japan is not more than 300 tons, so that when these celluloid companies are in full operation there will be a surplus of 1500 tons of celluloid over and above the present home demand. A field for the sale of this celluloid must be sought, and both companies will export their goods to China and Korea, and even to Europe and America. Here they will meet keen competition, and it naturally follows that their raw material must be obtained as cheaply as possible. Camphor can be obtained about 12s. per lb. cheaper in Japan than in Europe, but the refined camphor made in Japan contains a certain amount of oil which makes it useless for the manufacture of celluloid without further refining. Moreover, the spirit used for making celluloid must contain not less than 95 per cent. of pure alcohol. The spirit produced in Japan will not answer the purpose, and a supply of alcohol must either be obtained from Europe or America, or the ordinary Japanese alcohol must be refined. In Japan nitric acid is also very dear, so that although camphor can be obtained a little cheaper in Japan, the other materials are dearer. Consequently the celluloid made in Japan will cost about the same, as far as raw material is concerned, as abroad. The only advantage in Japan is cheap labour, but in exporting the article to Europe and America, freight, insurance, and other charges must be allowed for, so that here again the advantage of cheaper labour is counter-balanced. The only thing to be done to encourage the industry is to devise some means of obtaining cheaper material in order to meet competition in Europe and America.

Patents.

Fabrics for construction of balloons; Process for rendering impermeable ——. Soc. Michelin et Cie., Clerment-Ferrand, France. Eng. Pat. 13,898, June 8, 1910. Under Int. Conv., June 11, 1909.

A coating of caoutchouc weighing about 35 grms. per square metre is applied to a cloth weighing 85—90 grms. per square metre. This coating is next covered with a layer of drying oil varnish of the same weight as the caoutchouc. If a fabric is then prepared by combining three or more folds of the cloth thus prepared, a material is obtained of less weight and better impermeability than are possessed by an analogous material simply coated with caoutchouc.—P. F. C.

Broom; Process for the production of fine textile fibres, suitable as a substitute for cotton and flax, from ——. R. Sütterlin. Ger. Pat. 224,593, Jan. 1, 1909.

The air-dried stems of the plants are boiled twice with water under steam pressure (up to 150° C.), and then whilst still warm passed between revolving brushes in order to remove the woody fibre. The fibres are next submitted to a retting process in the usual manner in order to free them from adherent bark, and are afterwards washed, bleached, again washed, dried until they contain only 5—6 per cent. of moisture and then stored in the form of balls or heaps until they become soft and flexible.—A. S.

Alcohol and ether vapours from air [of artificial silk works]; Collection and recovery of ——. A. de Chardonnet. Fr. Pat. 413,359, May 24, 1909. (See also this J., 1907, 1088.)

In the preparation of artificial filaments, etc., from collodion, the concentration of the vapours of the solvent in the air must be kept as high as possible. The spinning apparatus is enclosed in a glass case which is opened only when necessary. The ordinary rail carrying the spinnerets is replaced by a revolving plate having spinnerets arranged in the form of a circle. Each plate is provided with a control tap and a special filter, and when the spinning from any particular plate is interrupted a tight-fitting globe is placed over the plate to prevent loss of solvent. The filaments pass up through guide-forks on to the bobbins, which, when full, are placed in the lower part of the casing until all the ether and most of the alcohol have evaporated. The unwinding of the bobbins is effected after immersing them in water in order to collect some of the alcohol, and the spindle of the bobbin during the unwinding process is surrounded by a light metal cylinder against which the dilute alcohol is thrown by centrifugal force and collected. For the absorption of the ether and alcohol vapours, amyl alcohol (or its homologues) is employed, as described *loc. cit.*, in a vessel containing plates. The vapours of the amyl alcohol carried off from the first absorption vessel by the issuing air are absorbed in a second plate-apparatus charged with dilute ethyl alcohol, which may be obtained from the bobbins. The vapours carried off from the second vessel are absorbed in a third, which is charged with water. The alcohol and ether absorbed by the amyl alcohol are recovered by rectification in a rectifying plate-column, and the alcohol from the second and third absorption vessels is recovered in a second rectifying column.—J. F. B.

Fibrous plants ; Process for the chemical retting of —— and conversion of any plants into paper pulp. L. Penfaillit. Fr. Pat. 413,097, Feb. 28, 1910.

FOR the retting or degumming of fibrous plants for textile purposes or for conversion into paper pulp, the use of petroleum or other hydrocarbon is claimed. The plants are boiled under pressure at a temperature of 120°—180° C. with an alkaline solution containing about 5 per cent. of sodium carbonate and at least 5 per cent. of petroleum, calculated on the weight of the material. Caustic alkali or a dilute acid may be used instead of sodium carbonate if desired.—J. F. B.

Plastic material [cellulose acetate] ; A non-inflammable ——. W. Merckens and H. B. Manissadjian. Fr. Pat. 413,657. March 16, 1910.

CELLULOSE acetate is converted into a non-inflammable plastic material having all the industrial properties of celluloid by combining it with the phosphoric, thiophosphoric or sulphonic esters of phenols, cresols or naphthols or their derivatives. The product is worked up in exactly the same manner as celluloid, a solvent being added to assist the incorporation of the materials if necessary. A suitable mixture consists of 100 kilos. of cellulose acetate, 35 kilos. of phenyl phosphate and a sufficient quantity of a solvent such as glacial acetic acid, chloroform or acetone.—J. F. B.

Cellulose derivatives [esters] ; Process for the manufacture of ——. H. Dreyfus. Fr. Pat. 413,671, March 16, 1910.

CELLULOSE acetate is prepared by the action of acetic anhydride on cellulose or its derivatives, in presence of lead chamber crystals as a catalysing agent. The acetylating mixture may be diluted with liquids which may be solvents or non-solvents of the product. Cellulose formate may be prepared by the action of formic acid in a similar manner, and it is stated that esters of other acids of the fatty series may also be produced. Lead chamber crystals are claimed to have a more specific influence in favouring the esterification than free sulphuric acid. Example: 10 parts of cellulose are treated with a mixture of 35 parts of acetic anhydride, 30 of glacial acetic acid and 0·5 of lead chamber crystals; the reaction proceeds gradually at a relatively low temperature.—J. F. B.

Artificial silk ; Manufacture of ——. H. Dreyfus and L. Schneeberger. Fr. Pat. 413,787, March 16, 1910.

THE cellulose esters, chiefly the acetate, prepared by the process described in Fr. Pat. 413,671 (see preceding abstract) are applied to the manufacture of artificial silk by any of the known processes of manufacture.—J. F. B.

Cellulose acetate ; Preparation of brilliant, matt or decorated coatings of ——. A. Eichengrun. Fr. Pat. 413,901, March 21, 1910. Under Int. Conv., Apr. 15, 1909.

THE spreading of fine films or coatings of cellulose acetate on materials or fabrics of porous or uneven surface is difficult, because the coating tends to sink into or take the form of the body-material. According to this invention a thin film of a solution of the acetate is spread on a support having an even, close or polished surface, to which the film, when fully dried, will not adhere. The film, before it is completely dry, is then pressed in contact with the body-material to be coated, and drying is completed. The film then peels off the temporary support and adheres firmly to the body-material, whilst its surface presents an exact reproduction of the surface of the support. Suitable supports are made of metal foil, metallised paper, rubber, waxed cloth, varnished leather, etc. The body-material may be previously moistened with a solvent of the acetate in order to promote adhesion of the film.—J. F. B.

Artificial silk ; Apparatus for the manufacture of —— or for coating or glossing textile fibres. B. Loewe, Paris. Eng. Pat. 18,086, Aug. 5, 1909. Under Int. Conv., Sept. 18, 1908.

SEE Fr. Pat. 403,242 of 1908 ; this J., 1909, 1310.—T. F. B.

Volatile solvents in the manufacture of artificial silk ; Apparatus for recovering vapours of ——. Fabr. de Soie Artific. de Tubize. Fr. Pat. 412,887, May 12, 1909.

SEE Eng. Pat. 11,729 of 1910 ; this J., 1910, 1004.—T. F. B.

Cellulose ; Process for the manufacture of ——. A. Deiss, Marseilles, France. Eng. Pat. 23,625, Oct. 15, 1909.

SEE Fr. Pat. 403,518 of 1909 ; this J., 1910, 84.—T. F. B.

Paper ; Product for simultaneously colouring and sizing ——, and its application. F. Curtius und Co. Fr. Pat. 412,933, Feb. 22, 1910. Under Int. Conv., March 25, 1909.

SEE Eng. Pat. 4067 of 1910 ; this J., 1910, 751.—T. F. B.

Briquettes from anthracite by means of "celluloid." Fr. Pat. 413,152. *See* IIA.

Tanning extract from sulphite-cellulose liquors. Fr. Pat. 413,849. *See* XV.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Tinctorial properties of certain dyestuffs belonging to the group of isocyanines. J. Larguier des Bancels and H. Siegrist. Rev. gen. Mat. Col., 1910, 14, 249—250.

WHEN immersed in an aqueous solution of Pinacyanol, silk is dyed blue, wool, violet, and cotton, bluish-violet. In Pinachrome the fibres are dyed greenish blue, rose, and violet respectively. Previous treatment of wool with basic reagents tends to produce a stronger tint, whilst a lighter shade is obtained by similar treatment with acids. Addition of acids or alkalis to the dye-bath has the same effect. Silk, however, retains its characteristic blue shades both in the presence of alkalis and acids. Both wool and silk retain their colours when left in the air, but when placed in a desiccator the former becomes blue and it also acquires this colour if the dye-bath is heated, although the original violet colour returns on cooling. The critical point, in the case of both Pinacyanol and Pinachrome, is about 50° C. In alcoholic solution wool is dyed greenish blue by Pinachrome and blue by Pinacyanol, but the shades turn violet on exposure to the atmosphere. This phenomenon is probably due to the presence of water vapour as, if the dyed fibres are transferred to a desiccator, the blue shade is retained. The authors discuss these phenomena from a theoretical point of view.—J. C. C.

Azo dyestuffs on the fibre; Application of dihydroxydiphenylmethane to the production of ——. J. Brandt. Sealed packet No. 1085, Feb. 10, 1899. Bull. Soc. Ind. Mulhouse, 1910, **80**, 195—198.

Cloth is padded with a solution containing 30 grms. of dihydroxydiphenylmethane, 35 grms. of sodium hydroxide of 40° B., and 1 litre of water. When such cloth is passed through diazo-solutions the corresponding azo-dyestuffs are developed on the fibre. The shades produced are fast to soap and light and the colours do not sublime. In a report on the process, Battegay confirms these results and mentions that the azo-dyestuffs have already been prepared in substance by Durand, Huguenin & Co.—J. C. C.

Puffed crêpe effects on silk by means of thiocyanates or stannous chloride. Koechlin Bros. Sealed packet No. 1063, Nov. 12, 1898. Bull. Soc. Ind. Mulhouse, 1910, **80**, 200—201.

The effects are produced by steaming silk which has been treated with concentrated solutions of thiocyanates or stannous chloride. In a report on the note, Battegay states that this note forms the conclusion of a series of papers by Grandmougin, Siefert and Jaquet and that, reporting on Siefert's Fr. Pat. 101,915 (Feb 15, 1898), Schoen and Grandmougin stated that excellent results were obtained on wool with thiocyanates.—J. C. C.

Patents.

Wool scouring and degreasing lyes; Process and arrangement for the separate electrolytic treatment of ——. J. Baudot. Fr. Pat. 413,442, Feb. 9, 1910.

According to this invention the lyes used for scouring and degreasing wool are separated from the wool and collected in special tanks where they are vigorously beaten in order to emulsify the fatty matters extracted from the wool. The same pump which beats the lyes also delivers them to a separating tank from which the fatty matters, which then float on the surface of the liquid, are removed, whilst the liquid passes into an electrolysing apparatus where the lyes are regenerated for further use. Another type of apparatus is adapted for the treatment of lyes used in continuous scouring and degreasing machines, in which the wool is sprayed with the lye. The vats below and above the travelling layer of wool are divided into a number of compartments worked on the counter-current battery system. The used lye falls through the wool into the lower series of compartments in which it is electrolysed. The regenerated liquor is then pumped into a corresponding series of separating tanks above the wool in which the fats are separated and the lye is delivered to the wool one step further along the series. Water is fed in at one end and exhausted lye is drawn off at the other. The lyes are rejected as incapable of further regeneration when their density reaches 10°—12° B.—J. F. B.

Bleach liquors; [Electrolytic] Manufacture of ——. M. New, London. Eng. Pat. 23,629, Oct. 15, 1909.

The apparatus described belongs to the type in which double pole electrodes penetrate the walls of insulating material, and the solution to be electrolysed is made to flow along narrow, parallel troughs. The partitions between adjacent troughs are formed of bricks of refractory material, with strips of platinum (or other material) between them, and projecting into the compartments, the whole being cemented together to form an impervious partition.—F. M.

Bleaching yarn, yarn babbins, cops, and the like; Apparatus for ——. E. Herzog, Erlach, Lower Austria. Eng. Pat. 9982, April 23, 1910. Under Int. Conv., April 28, 1909.

In machines in which yarn, in hanks or on bobbins or cops, is placed in a receptacle and bleach liquor is pumped on to the perforated cover and percolates through the mass, the upper layers of the yarn receive a more severe treatment than the lower ones. To obviate this and obtain a more uniform bleaching effect, the receptacle is so made that it may be rotated through an angle of 180°, whereby the course of the liquor in relation to the yarn may be changed, and the rate of bleaching rendered more uniform throughout the mass.—F. M.

Bleaching seaweed (varech) by chlorine or other agents; Apparatus for ——. C. A. Sabourin and E. E. Marinier. Fr. Pat. 412,909, Feb. 21, 1910.

The well washed material is packed in cages which are arranged to fit inside a series of vats made of material resistant to chlorine and having tightly fitting lids from which the cages are hung. Each vat is provided near its bottom with a pipe, which places it in communication with the upper part of the vat before it, and the first vat can be connected by means of a three-way tap with either a hot air reservoir, a chlorine generator or the atmosphere. By means of this apparatus the material, without removing it from the cages, can be bleached with chlorine, afterwards treated with a solution containing sodium carbonate and sodium sulphite and can be finally washed and dried, an injector being used to force the necessary liquors into each vat of the system. After each process the spent liquors can be discharged from every vat in the series by manipulating one handle. Devices for taking out samples of the various liquors are also attached to the vats.—P. F. C.

Wool or other animal fibre; Method of preparing —— for mordanting, dyeing or printing. J. Schneider, Hawick, N.B. Eng. Pat. 15,828, July 7, 1909. Addition to Eng. Pat. 6152, Mar. 14, 1907 (this J., 1908, 331).

The material is treated at the boil for a short time with very weak solutions of caustic alkalis or alkaline-earths. This treatment is sufficient to transform the sulphur compounds of the wool into sulphides and yet does not injure the handle or strength of the material. Example:—112·6 grms. of woollen yarn were worked cold for 5 minutes in a litre of a 0·05 per cent. solution of sodium hydroxide. The bath was then raised to the boil in 7 minutes and kept boiling for a further 5 minutes. 10 c.c. of formic acid of 21° Tw. were then added and finally 10 c.c. of a 10 per cent. solution of potassium bichromate. The whole of the chromium was absorbed by the wool in 30 minutes and fixed as pure sesquioxide. Sulphuric acid can be used instead of formic acid.—P. F. C.

Textile piece goods, warp yarns, and the like; Method and means for treating —— with liquids. J. S. Ainley, Huddersfield. Eng. Pat. 19,135, Aug. 20, 1909.

The machine is provided with two sets of nipping rollers, one set being below the surface of the liquor and at the front of the machine, the other pair being at the back and above the surface. The material (warps, or cloth in the rope form) is led up and down between the rollers, being kept in position by guide pegs, and the two ends being joined together it forms an endless band which may be conveniently and rapidly treated. The last draft from the top rollers is led over a leading roller (which travels at a higher speed than the others), and is carried over a second leading roller to the other end of the machine, and through the bottom nips to the first draft. An arrangement is described for maintaining the material during the first draft at a constant tension.—F. M.

Rollers for use in dyeing, bleaching and other operations. H. D. Halstead, Manchester. Eng. Pat. 25,489, Nov. 5, 1909.

A hollow glass, porcelain or earthenware cylinder is gripped at its ends by two metallic end caps (of a diameter not greater than the diameter of the cylinder) which are arranged along the shaft of the roller on which the cylinder is to be mounted; one cap being fixed on the shaft whilst the other can slide along it. The inner faces of the caps are internally coned so as to engage closely with corresponding external cones formed at the ends of the cylinder and a tight grip is ensured by means of a nut working on a screw-threaded shaft against the outer face of the movable cap, a spring washer being preferably inserted between the cap and the nut to allow for subsequent expansion or contraction. In order to drive the cylinder positively and not by means of the frictional grip between the caps and the cylinder, the inner surfaces of the cylinder ends are provided with projections which engage with recesses in the end caps. The joints of the cylinder with the caps are packed with cement or some other material which is proof against the liquids with which the roller will be employed. P. F. C.

Dyeing hairs, furs and the like ; Process for ——. Actienges. für Anilin-Fabrikation, Berlin. Eng. Pat. 5134, Mar. 1, 1910. Under Int. Conv., Oct. 23, 1909.

Bright blue-black shades of great stability can be obtained on animal hairs by treating them with a bath containing a para diamine, diamino-anisol ,($C_6H_3.OCH_3 : NH_2 : NH_2$ 1 : 2 : 4) or diaminophenetol ($C_6H_3.OC_2H_5 : NH_2 : NH_2$ 1 : 2 : 4) together with an oxidising agent. Example : 3 parts of *p*-phenylenediamine and 2 parts of diaminoanisol are dissolved in 500 parts of boiling water and 400 parts of cold water and 100 parts of hydrogen peroxide of 3 per cent. strength are added. The previously washed furs are introduced into the bath, cooled to 30—35° C. and worked for 6—12 hours. They are then washed and dried.—P. F. C.

Dyeing piece goods ; Apparatus for ——. J. A. Aubrée and P. Chardon. Fr. Pat. 413,031, May 15, 1909.

A vat is divided by a vertical partition into two compartments. A perforated metallic bobbin, around which the material to be dyed is wound, is arranged vertically in each compartment and each bobbin is connected tightly at its lower end with a reversible pump. The lid of the vat carries two caps, which are so placed that when the lid is in position the caps fit over and close the upper ends of the bobbins. A reservoir containing the dye-liquor is connected to the pump by a pipe provided with stopcocks. Another pipe places the upper part of the vat in connection with the reservoir. When the machine is working, the dye-liquor is drawn from the outside of the roll of cloth into the interior of the bobbin in one compartment, and in the other is forced radially through the roll in the opposite direction.—P. F. C.

Printing webs of textile fabrics ; Machine for ——. E. Bontemps, Ivanovo-Vosnessensk, Russia. Eng. Pat. 19,217, Aug. 20, 1909.

The machine is designed to print such parts of the surface of the fabric as are raised or in relief. Means are described whereby the distances between the printing and pressure roller are regulated, and adjusted to suit the thickness of the material printed upon. A pattern-chain is employed to control the printing, the projections upon the chain moving adjustable levers which actuate the arms upon which the rollers are carried.—F. M.

Alizarin printing ; Organic compounds which can be used in —— and their preparation. Meister, Lucius und Brüning. Fr. Pat. 413,836, Mar. 18, 1910. Under Int. Conv., April 3, 1909.

By adding a mixture of ricinoleic acid and a saturated fatty acid of high molecular weight to an alizarin printing colour the preliminary oiling of the material can be omitted. The mixture prepared by stirring together 40 parts of ricinoleic acid and 60 parts of "cocinic acid" until a limpid solution is obtained is given as an example.
—P. F. C.

Gluten or substances containing gluten ; Process for rendering —— soluble. Erste Triester Reisschäl-Fabriks Atkien-Ges., Trieste, Austria. Eng. Pat. 8203, April 5, 1910. Under Int. Conv., Mar. 1, 1910.

The process consists in mixing the gluten with 1—10 per cent. of a per-salt of an alkali (preferably a perborate or a percarbonate) and boiling the mixture with water. The nascent oxygen converts the gluten into a form in which it is readily soluble in presence of the small amount of free alkali resulting from the hydrolysis of the persalt.—F. M.

Permanent protective layer on fabrics ; Process for producing a thin and transparent ——. J. Eck und Söhne. Fr. Pat. 413,007, Feb. 24, 1910 Under Int. Conv., Jan. 31, 1910.

Very strong solutions of gelatin and formaldehyde are mixed so as to produce a viscous liquid. In order to prevent the formation of an insoluble product in this mixture, the formaldehyde solution is previously acidified with an organic acid. The gelatin-formaldehyde mixture is applied in a thin layer to the surface of the fabric and the material is afterwards exposed to ammonia vapour. The ammonia neutralises the acid in the mixture and the formaldehyde then reacts with the gelatin, producing a thin insoluble film on the surface of the fabric.—P. F. C.

Alizarin preparations suitable for dyeing and printing ; Manufacture of ——. J. Wetter, London. From Chem. Fabr. Grünau, Landshoff und Meyer A.-G., Grünau, Germany. Eng. Pat. 18,461, Aug. 10, 1909

See Ger. Pat. 219,757 of 1907 ; this J., 1910, 484.—T. F. B.

Fabrics ; Apparatus for impregnating ——. E. de Journo, Allentown, Pa. U.S. Pat. 969,041, Aug. 30, 1910.

See Fr. Pat. 403,013 of 1909 ; this J., 1909, 1311.—T.F.B.

Dyeing ; Process of ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Feb. 14, 1910, to Fr. Pat. 395,679, Oct. 26, 1908. Under Int. Conv., May 24, 1909

See Eng. Pat. 17,624 of 1909 ; this J., 1910, 942.—T. F. B.

Dyeing hairs and furs ; Process and compositions for ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 413,877, March 21, 1910. Under Int. Conv., Oct. 23, 1909.

See Eng Pat. 5134 of 1910 ; preceding.—T. F. B.

Discharging coloured grounds ; Process for ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 413,554, March 12, 1910. Under Int. Conv., Feb. 14, 1910.

See Eng. Pat. 7094 of 1910 ; this J., 1910, 1006.—T. F. B.

Proteins in substances containing protein ; Process for rendering soluble the ——. Erste Triester Reisschäl-Fabriks A.-G. Fr. Pat. 413,425, March 9, 1910.

See Eng. Pat. 8203 of 1910 ; preceding.—T. F. B.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Sensitive reaction for phosphoric acid and phosphates. Denigès. *See* XXIII.

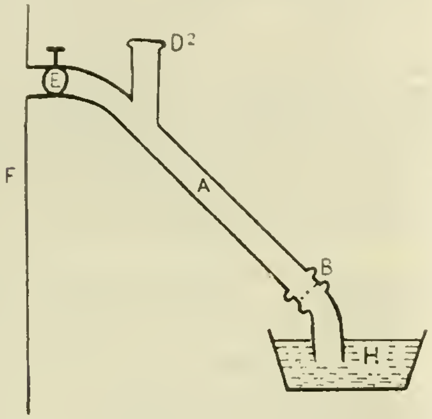
Pyrogalloldimethyl ether, a delicate reagent for chromic acid, ferric salts, and nitrous acid. Meyerfeld. *See* XXIII.

Zinc sulphate : An acid ——, from a Gaillard concentrating apparatus. A. Hoffmann. Z. angew. Chem., 1910, 23, 1672—1673.

On concentrating in a Gaillard apparatus the acid from the first of a set of chambers making sulphuric acid from the roasting of zinc blende, there separated out on cooling large white crystalline flocks composed of fine needles, which had the composition corresponding to the formula, $ZnSO_4.3H_2SO_4$. The crystals rapidly absorb moisture from the air, and dissociate into anhydrous zinc sulphate and sulphuric acid.—J. T. D.

Sulphur; New process for the extraction of —— from minerals or rocks. A. de Gregorio Rocasolano. Anales Soc. española de Fisica y Quimica. 1910, **8**, 264. Chem.-Zeit., 1910, **34**, Rep., 434.

The principle of the method can be seen from the accompanying diagram. The sulphur ore is charged through D, into the inclined pipe, A, which is provided with a grate at B. On heating A, the sulphur melts and flows through B, collecting in H. The first portion is dark-coloured, owing to bituminous substances, and has a purity of only 97—98·5 per cent., but later fused sulphur of 99·2—99·7 per cent. purity is obtained. When the temperature rises still higher, the sulphur begins to sublime, the vapour passing through E into the condensing chamber, F. The pipe, A, has a capacity of 640 kilos. and can be emptied and recharged in 10 minutes. It is stated that from 600 kilos. of a 30 per cent. sulphur ore, working so as to obtain a maximum yield of fused sulphur, 155 kilos. of fused sulphur and 12 kilos. of flowers of sulphur were recovered, or a total yield of 92·7 per cent.—A. S.



New colloidal phenomenon in analysis. Interaction of colloidal molybdic and tungstic acids. Wöhler and Engels. *See* XXIII.

Precipitation of ammonium phosphomolybdate in presence of organic acids. Maderna. *See* XXIII.

Patents.

Sulphuric acid; Apparatus for concentrating ——. O. Proelss, Kansas City, Mo., and W. S. Hall, Argentine, Kansas. U.S. Pat. 960,702, June 7, 1910.

A primary boiling pot, preferably of cast iron, is mounted over a suitable furnace, and the upper part of the boiler is surrounded by an annular flange and rim, which together form a concentric chamber constituting a secondary boiler. The common cover to these boilers has a central opening leading to an upward extension with interstitial filling which is moistened by weak acid on its way to the boiler and serves to condense the acid vapours, the condensed acid flowing back into the primary boiler. As the level of the weak acid, boiling in the central vessel, rises above the flange, that from the bottom, where it is strongest, passes out through an exit and upwards by a vertical tube into the secondary boiler; here, by means of a partition, the acid is made to travel in a thin layer over the entire bottom of the outer vessel, thus becoming highly concentrated before passing out to the cooling apparatus. The parts of the apparatus exposed to acid fumes are lined with acid tiles, and a lateral extension is provided at the bottom of the primary boiler, for withdrawing acid when required and for cleaning. Acid of 98·2 per cent. strength can be continuously produced with the apparatus.—F. Sodn.

Nitrous and nitric acids, nitrate, nitrite, sulpho-nitrate, or sulpho-nitrite of lime, soda, or potash; Manufacture of ——. J. Price, London. Eng. Pats. 10,164, April 29, 1909, and 10,755 of 1910; date of application, April 29, 1909.

(1) Oxygen and nitrogen, in the proportion to form oxides of nitrogen, are led into water or basic solutions, either directly, if suitable converting agents or carrying media be present, or after combination has been effected by passage through an intensely hot flame (*e.g.*, oxy-hydrogen) or an electrical discharge apparatus, a supply of oxygen, nitrogen, and hydrogen being obtained by separating the constituents of air and superheated steam respectively, preferably by the barium oxide process. By adding sulphites or sulphates, sulpho-nitrites or sulpho-nitrates (nitrososulphates, etc.) are obtained. (2) Nitrogen and hydrogen, either combined or in the proportion in which they combine to form ammonia, are introduced into saturated solutions of basic substances, at a low temperature (—80° to —120° C.) and under moderate pressure (20—30 atmos.); nitrates and nitrites are thus produced and hydrogen is evolved, reaction being facilitated, if desired, by the use of converting agents or carrying media, with or without silent electric discharges. Sulpho-nitrates or sulpho-nitrites are produced, as before, by adding sulphates or sulphites to the basic solutions.
—F. Sodn.

Nitrous compounds; Manufacture of ——. K. Söderman. Fr. Pat. 413,117, Jan. 21, 1910, and First Addition thereto, dated March 17, 1910.

A mixture of nitrogen and oxygen is burnt in a tube, in the walls of which, at any desired point, a cooling liquid or gas is circulated; a mixture of "N_2O, nitrogen protoxide" and "NO, nitrogen binoxide" (as a secondary product) is thus produced, in proportions depending on the particular zone of the flame which is cooled. In the addition to the patent, claim is made for the introduction of acetylene or other gaseous hydrocarbon into a flame of nitrogen and oxygen, with subsequent rapid cooling of the reaction products, whereby the yield of oxides of nitrogen is much increased.—F. Sodn.

Salt; Manufacture of ——. International Salt Co., Ltd., London, and E. R. Royston, Liverpool. Eng. Pat. 11,033 of 1910; date of application, May 4, 1909.

Moist salt, obtained by the use of vacuum evaporating apparatus, is dried and conveyed to the melting furnace by means essentially similar to those described in Eng. Pat. 10,517 of 1909 (this J., 1910, 756).—F. Sodn.

Waste liquors [resulting from pickling iron for galvanising, etc.]; Treatment of ——. G. F. Thomson, Bedford. Eng. Pat. 17,279, July 24, 1909.

Ammonium sulphate is heated with magnesia (calcined magnesite), and the resulting ammonia gas is passed into the solution of the iron chlorides or sulphates, with formation of iron hydroxides and ammonium chloride or sulphate, magnesium sulphate being obtained as a by-product.
—O. R.

Sulphate of ammonia and other salts; Saturator for ——. G. Pettigrew, Thornaby-on-Tees. Eng. Pat. 25,460, Nov. 4, 1909.

The saturator, which is provided with an "apron" or "midfeather," has an inclined bottom, in the upper part of which is a pocket, and this, with a top plate, forms a "cracker box"; the top plate is perforated over its entire surface, and the perforations increase in area as they recede from the gas inlet, so as to ensure an equal distribution of gas. The manhole cover of the saturator has openings for gas and acid inlet pipes and waste gas outlet, and the gas inlet pipe extends through the top plate of the cracker box, which is preferably made separate from the body of the saturator, and rests on the bottom. A pipe admitting steam to the underside of the top plate of the cracker box may also be provided.—F. Sodn.

Cuprammonium solution; Process of making ——. H. Bernstein, Philadelphia, Pa. U.S. Pats. 965,273 and 965,557, July 26, 1910.

A solution of sugar or molasses in ammonia is added to ammonia of suitable strength, and the mixture is placed in contact with metallic copper, air or any suitable gas containing free oxygen, being forced through the liquid. —F. Sodn.

Stannic chloride solutions; Process of producing clear ——. E. A. Sperry, Brooklyn, N.Y., Assignor to Goldschmidt Detinning Co., New York. U.S. Pat. 967,990, Aug. 23, 1910.

Clear aqueous solutions are produced by adding alternately fuming stannic chloride and water to a strong aqueous solution of stannic chloride under the following conditions, namely, the temperature of the solution is kept below 105° C., and the concentration of the solution is kept above that at which insoluble tin compounds are produced at the particular temperature, that is a content of not less than 3 per cent. of tin.—W. C. H.

Pyrites residues, mattes, or all residues of copper and other metals; Process for the treatment of —— with a view to their conversion into soluble salts. J. Parent. First Addition, dated Feb. 10, 1910, to Fr. Pat. 411,863, Jan. 20, 1910 (this J., 1910, 959).

The residues are mixed with electrolytic liquors, containing ferrous and ferric sulphates and sulphuric acid, in place of the materials specified in the principal patent, and the apparatus is modified by the introduction of two charging hoppers, one feeding the sulphating hearth at the top of the furnace, and the other delivering material to be desulphurised on to the hearth immediately below; a vertical passage also is provided in the back wall of the furnace, for discharging the sulphated material from the top hearth.—F. Sodn.

Cupric dimethanaldisulphite; Process and apparatus for the preparation of ——. F. Malvezin. Fr. Pat. 412,954, May 13, 1909.

Cupric dimethanaldisulphite, $(\mathrm{HCH.OH.SO_3})_2\mathrm{Cu}$, and analogous compounds, known commercially as "tri-inidem," and designed more particularly for use in treating cryptogamic diseases of the vine and other plants, are made by saturating metallic hydroxides or carbonates with sulphur dioxide, in the presence of formaldehyde. The apparatus described consists of a series of interchangeable, cylindrical vessels, in which sulphur dioxide may be forced through the mixture, and from the bottom of which the product may be withdrawn when solution is complete.—F. Sodn.

Carbon dioxide; Production of pure —— from the scrubbing water obtained in the manufacture of lighting gas and of coke oven gas. A. Fillunger. Fr. Pat. 412,975, Feb. 23, 1910. Under Int. Conv., Mar. 26, 1909.

The gases obtained in distilling the liquor for the recovery of the ammonia consist, after the absorption of the ammonia by acid, of carbon dioxide, water vapour, sulphuretted hydrogen, cyanogen compounds, and traces of sulphur dioxide and of hydrocarbons. These impurities are removed by bringing the gases into contact with lyes containing metallic salts, for example, the liquor obtained in extracting copper from burnt pyrites. The gases are further purified by passing them over red hot copper oxide, or by absorbing them in potash so as to form potassium bicarbonate and then decomposing the bicarbonate by heat.—A. T. L.

Carbon dioxide; Manufacture of ——. L. J. B. Déoune. Fr. Pat. 413,777, Mar. 12, 1910.

The patent relates to the manufacture of carbon dioxide by the combustion of carbon. The combustion is effected beneath a boiler, and the combustion gases are led through coke-scrubbers and then through absorption towers supplied with alkaline liquor. The liquor from these towers is brought to boiling, in order to liberate the carbon dioxide, by passing it through four heating vessels in succession. The last of these vessels is heated by steam from the boiler, the third by the combustion gases from the boiler furnace, the second by the carbon dioxide in its passage from the last heating vessel to the gas holder, and the first by the overflow from the last vessel. The washing water used in the coke-scrubbers is cooled and circulated through the scrubbers repeatedly until saturated with sulphuric acid, in order to reduce the loss of carbon dioxide.—A. T. L.

Lithium [-sodium] tricitrate; Manufacture of chemically pure ——. I. Szinmay and V. Arany. Fr. Pat. 413,161, Feb. 19, 1910. Under Int. Conv., Feb. 22, 1909.

Double citrates of sodium and lithium are prepared by evaporating solutions of the mixed citrates, such as may be obtained by treating the corresponding carbonates or hydroxide with citric acid. For example, 0·1909 kilo. of sodium hydroxide ("pure by alcohol") and 0·34 kilo. of pure lithium carbonate are dissolved together in 2 litres of water; this solution is boiled for some time, and added to a solution of citric acid (1 kilo. in 3 litres of water). Sufficient lithium carbonate (0·04—0·05 kilo.) is added to neutralise the solution or leave it slightly acid, and the volume is then reduced to 2 litres, when the syrupy solution is poured into 8·5 litres of 90 per cent. alcohol; the crystals of the double salt are separated after 24 hours and dried in the air at a low temperature.—F. Sodn.

Magnesia from magnesian rocks; Process of extracting ——. G. Moressee. Fr. Pat. 413,793, Mar. 17, 1910.

The process depends on the fact that when calcined dolomite is suspended in water and treated with carbon dioxide, the magnesium dissolves completely as bicarbonate, before any calcium bicarbonate is formed, and may therefore be separated by filtration from the calcium carbonate and impurities (silica, etc.), and precipitated subsequently as carbonate by boiling the filtrate. It may be carried out by passing the milk of calcined dolomite, or other rock containing magnesium carbonate, successively into a series of absorption towers, through which a current of compressed carbon dioxide is made to bubble in the reverse direction, the pressure of gas thus being greatest in the tower in which the liquor is last treated; from the last tower the mixture is sent to a filter-press, and the filtrate from this enters a vessel containing a steam coil, where the magnesium carbonate is precipitated. The carbon dioxide required is supplied by the process itself (calcination, etc.), and, instead of completely decomposing the bicarbonate solution, the residual liquor may be used again; the manipulation of the liquid throughout is effected by means of the compressed gas. Complete extraction of the magnesia, in a pure state, is said to be attained. —F. Sodn.

Tetrachloride of tin from tin scrap and other materials containing tin; Obtaining ——. P. Wolff, Wetzlar, Germany. Eng. Pat. 18,329, Aug. 9, 1909.

See Fr. Pat. 405,851 of 1909; this J., 1910, 424.—T. F. B.

Hydrocyanic acid and cyanides; Process for the production of ——. C. Beindl, Munich, Germany. Eng. Pat. 18,945, Aug. 17, 1909.

See Ger. Pat. 216,264 of 1908; this J., 1909, 1314.—T. F. B.

Magnesite; Method of preparing powdered ——. J. Leese, Manchester. U.S. Pat. 968,669, Aug. 30, 1910.

See Eng. Pat. 612 of 1909; this J., 1909, 835.—T. F. B.

Hydrosulphite; Process for producing anhydrous ——. L. Cassella und Co. Fr. Pat. 413,032, May 15, 1909.

See Eng. Pat. 11,906 of 1910; this J., 1910, 1010.—T. F. B.

Zinc hydrosulphite and sodium sulphite; Production of a double salt of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 413,231, March 2, 1910. Under Int. Conv., March 20, 1909.

See Ger. Pat. 217,038 of 1909; this J., 1910, 152.—T. F. B.

Ferric oxide: Process for making ——. J. Gill. Fr. Pat. 413,192, March 1, 1910. Under Int. Conv., March 9, 1909.

See Eng. Pat. 5618 of 1909; this J., 1910, 223.—T. F. B.

Salt: Process for refining —— and recovering its impurities as by-products. C. Glaser and G. J. Muller. Fr. Pat. 413,747, Feb. 22, 1910.

See U.S. Pats. 957,416 and 957,417 of 1910; this J., 1910, 756.—T. F. B.

Oxalates; Process for the production of —— by heating formates. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 413,947, March 23, 1910. Under Int. Conv., Aug. 19, 1909.

See Eng. Pat. 8093 of 1910; this J., 1910, 816.—T. F. B.

Gas producers [for use in metallurgical operations and in the fixation of atmospheric nitrogen]. Eng. Pat. 16,217. *See* IIa.

VIII.—GLASS; CERAMICS.

Clay: Behaviour of —— with acetic acid. R. van der Leeden. Sprechsaal, 1910, 43, 515—517.

In an attempt to form an artificial aluminium silicate similar to allophane, halloysite, and other natural products, Stremme failed to obtain a substance of constant composition. The author treated clay with *N*/1 and 2*N* acetic acid for 8 days and examined the extract. The clays so treated were Zettlitz kaolin and an allophane from Ohio. The former, which has a molecular ratio of $2SiO_2 : 1Al_2O_3$ yielded less than one-half per cent. of its weight, the extract having the ratio 1 : 1; whilst the latter, with an initial ratio of 0·756 : 1, was decomposed to the extent of 10 per cent., the ratio being unaltered. Half the lime present was dissolved in each case, and of the alkalis one-fourth from the kaolin and the whole from the allophane. The experiments are being extended to other acids.—H. H. S.

Aluminium and calcium silicates and calcium aluminates. Neumann. *See* X.

Patents.

Glass-drawing apparatus. L. Mambourg and V. Houze, Mount Vernon, Ohio. U.S. Pat. 965,205, July 26, 1910.

The glass is supplied from a tank to a shallow pot through a conduit-neck which opens into the centre of the floor of the pot. The floor of the pot is also provided with an elevated annular ridge. A furnace is arranged to supply heat to the exterior of the pot, the sides of which are supported by a pair of pier walls which straddle the conduit-neck by which the pot is supplied with glass. A pier is also arranged below the conduit-neck. The top of the furnace is practically level with the top of the pot, and is closed by removable segmental plates, which rest on the furnace and pot walls, and the inner ends of which are rabbeted to the wall of the pot. The adjoining edges of the plates are tongued and grooved together. —W. C. H.

Sheet-glass-drawing machines; Method and apparatus for tempering the sheet source in ——. I. W. Colburn, Assignor to Colburn Machine Glass Co., Franklin, Pa. U.S. Pats. 966,652 and 966,653, Aug. 9, 1910.

The main body of molten glass is superheated, and that part of it from which the sheet is to be drawn is then brought to the proper temperature by exposing the surface to the atmosphere, so as to allow radiation, or by circulating a cooling fluid in proximity to it.—A. T. L.

Glass-furnace and method of manufacturing glass articles therein. R. S. Pease, Allegheny, Pa., Assignor to A. M. Lee, Pittsburg, Pa. U.S. Pat 967,966, Aug. 23, 1910.

A drawing tank is attached to the side of and communicates with the main melting tank, so that the level of the molten glass in both is continuous. The drawing tank is provided with a permanent cover, and has a drawing opening with a movable cover, and an intervening space for the circulation of gas, which is supplied from the main tank. In the wall between the tanks is a flue leading vertically upwards to a stack, and provided with a vertically adjustable cut-off gate to stop direct circulation of gas from one tank to the other. The space for the circulation of gas in the drawing tank is also provided with an off-take flue, extending downwards and outwards, in which a controlling valve is arranged.—W. C. H.

Glass-tank. R. S. Pease and J. A. Sweet, Hartford City, Ind., Assignors to A. M. Lee, Pittsburg, Pa. U.S. Pat. 967,967, Aug. 23, 1910.

The tank is provided with a horizontal extension which is in open communication with the tank, but closed against outward circulation of the gases. The extension has a supporting bottom and rectangular side and end walls, whilst the covering consists of a horizontal portion adjacent to the tank, and close to the surface of the glass, and an upwardly inclined portion on the outer side away from the tank. A drawing opening, provided with a vertically adjustable ring is arranged in the horizontal portion of the cover. The side and end walls of the extension have openings in them, some of which are provided with covers, whilst fuel supply devices are inserted in the others to direct burning fuel down into the tank.—W. C. H.

Clays for the manufacture of pottery and other articles; Treatment of ——. J. Martin, Dolton, Devon. Eng. Pat. 16,935, July 20, 1909.

Two cylinders, each containing a vertical shaft, which carries a series of beaters or stirrers, are erected next to one another. The material to be treated is introduced into one of the cylinders, and after undergoing a partial disintegration by the rotating beaters, is carried by a current of water from the upper end of that cylinder to the lower end of the other cylinder. In the second cylinder the material is subjected to further disintegration, and the fine sludge, freed from heavier impurities, is finally discharged from the upper part of the cylinder through a screen. A rotating drum, provided with a series of blades, is mounted immediately underneath the screen, and keeps the latter free from pieces of clay or other impurities. —O. R.

Pottery; The decoration of ——. H. L. Doulton and C. J. Noke, Burslem, Staffs. Eng. Pat. 19,080, Aug. 19, 1909.

In the decoration of fired ware with a raised ornament, the "raising paste," or substance of which the raised ornament is composed, is mixed with a binding material, preferably "fat oil of turpentine," applied to the ware, and impressed with a die when it has attained the desired stiffness by exposure to the air. The mixture consists of approximately three pints of raising paste, and one pint of "fat oil of turpentine."—W. C. H.

Pottery-kiln. F. G. Haney, Assignor to A. Moore and W. Simpson, East Liverpool, Ohio. U.S. Pat. 965,892, Aug. 2, 1910.

The pottery-kiln comprises a chamber having a suitable lining provided with annular grooves, into which a number of shelf sections can be fitted. On each tier of shelves a number of short separable piers can be arranged to support the tier above. A number of shield-pieces, made of heat-resisting material, are arranged to enclose the shelves, and are provided on the edges with connecting tabs and sockets to lock each with the other so as to form a continuous wall for the shelf sections. A number of interposed platforms, also made of heat-resisting materials, are adapted to be built up from the floor of the kiln between the shelves.—W. C. H.

Pottery product. M. W. Marsden, Philadelphia, Pa. U.S. Pat. 968,379, Aug. 23, 1910.

A product said to be fireproof is made consisting of 60—80 per cent. of pottery composition, and 20—40 per cent. of a quick setting or hardening material, *e.g.*, Portland cement.—W. C. H.

Glass ; Electric furnaces for the continuous manufacture of ——. M. Sauvageon, Colombes, France. Eng. Pat. 18,118, Aug. 5, 1909.

See Fr. Pat. 401,744 of 1909 and First and Second Additions thereto ; this J., 1909, 1130 and 1200 ; 1910, 426.—T. F. B.

Ceramic ware, glassware, enamelling metals, and the like ; Apparatus for the manufacture of ——. F. Garros, Arcueil, France. Eng. Pat. 20,400, Sept. 6, 1909. Under Int. Conv., Sept. 5, 1908.

See Fr. Pat. 394,666 of 1908 ; this J., 1909, 310.—T. F. B.

Pottery ; Tunnel kiln for baking ——. S. Vincart-Mouzin, Nimy, Belgium. U.S. Pat. 969,125, Aug. 30, 1910.

See Fr. Pat. 388,585 of 1908 ; this J., 1908, 983.—T.F.B.

IX.—BUILDING MATERIALS.

Fire-resistive properties of various building materials. R. L. Humphrey. U.S. Geol. Survey, Bull. No. 370, 1909.

Tests were made in a gas-furnace to determine the effect of fire and subsequent quenching with water on mortar building blocks made with river and slag sands ; common, hydraulic-pressed, and sand-lime bricks ; gravel, cinder, limestone, and granite concretes ; glazed building and partition terra-cotta tiles ; and limestone, granite, sandstone, and marble building stones. The material to be tested was built up as a panel in an arched opening 6 feet wide and 9 feet high in a movable steel-frame firebrick wall (14 inches thick) of a gas-furnace such as is used for testing the fire-resisting qualities of fire-doors and windows. The gas flames were forced against the panel by a blast of air, the heating being continued for two hours, after which, except in the case of five tests, the panels were immediately quenched by water forced under a pressure of 50 lb. per square inch through a ¾-inch nozzle, held 20 feet distant. The conditions of the tests were probably more severe than those of an ordinary fire and they were also subject to unavoidable variations. The detailed results are given in the form of curves, and photographs of the panels after firing and quenching are also given. All the materials tested cracked more or less, mainly owing to internal stresses. The concrete cracked least, but the results indicated the necessity for using metal reinforcement in order to distribute the effects of the expansion. One of the most important results was the evidence afforded of the low rate of heat transmission of Portland cement mortars and concretes. The cement building blocks were marked by linen tags fastened by wire nails to the interior walls at the time of moulding, and these tags were not damaged in any way by the firing. The webs of ordinary hollow mortar building blocks were found to be not strong enough to withstand the stresses set up during the tests. The richer mortars and those mixed with the larger proportions of water gave the better results ; slag sand was more satisfactory than river sand. The brick panels appeared to withstand the tests better than any of the other materials. Of the concretes, that made with granite appeared to behave the best ; in no case did the damage extend to a greater depth than about 1½ inches. The natural building stones and the terra-cotta tiles all suffered more or less severely.—A. S.

Portland cement, and "iron" Portland cement [slag cement]; German regulations for the standard supply and testing of ——. Mitt. Kgl. Materialprüfungsamt, 1910, **28**, 293—302.

Definitions.—*Portland cement* is a hydraulic binding material with not less than 1·7 parts by weight of calcium oxide to 1 part by weight of soluble silica + alumina + ferric oxide, prepared by intimately mixing the finely ground ingredients, burning this mixture to incipient fusion and grinding the resulting clinker. The amount of magnesia must not exceed 5 per cent., and that of sulphuric anhydride must not exceed 2½ per cent. in the burnt cement. "*Iron*" *Portland cement* is a hydraulic binding material consisting of at least 70 per cent. of Portland cement and at most 30 per cent. of powdered blast-furnace slag. The Portland cement is to be as defined above and the slag must be a calcium-aluminium silicate produced in the blast-furnace. The slag must contain at least 1 part by weight of calcium oxide and magnesia to 1 part by weight of soluble silica + alumina. *Remarks.*—Naturally occurring material resembling Portland cement in composition which has been prepared for the market by simply burning, must be marked "Natural cement." Magnesia to the extent of 5 per cent. is harmless if it is not additional to the correct amount of lime. Sulphuric anhydride up to 2½ per cent. has been proved to be harmless. It has been established by extensive State-controlled tests that Portland cement mixed with up to 30 per cent. of suitable blast-furnace slag is equal to pure Portland cement, and is to be tested in the same way. The addition of other ingredients for special purposes, such as to regulate the time of setting, are not forbidden, but are limited to 3 per cent. of the whole. *Packing and weight.*—Portland cement and "iron" Portland cement are, as a rule, supplied in bags or casks. These must be plainly marked with the weight, the name of the firm, and the description "Portland cement" or "Iron Portland cement." A margin of 2 per cent. on the weight is allowed for casual loss, etc. *Setting.*—Normal Portland cement must not begin to harden within an hour of being made up. For special purposes a more quickly setting cement may be demanded, but in such cases it must always be described as such. The time taken for hardening to begin is considered of great importance, but the time of the final setting is of little importance and should not be specified within narrow limits. *Method of test.*—About 300 grms. of cement are stirred with water to a stiff paste. Generally 27—30 per cent. of water are required. A conical ring of hard rubber, 4 cm. in height and 7 cm. mean diameter, is placed on a glass plate and filled with the paste. The test is then made with a standard needle, 300 grms. in weight and 1 sq. mm. cross-section. The time for hardening to begin is the time which elapses until the needle will not entirely pierce the cement in the ring. The time of final setting is attained when the needle no longer makes an impression on the cake of cement. Since a high temperature accelerates the setting of cement, the cement, water, apparatus and air should all be brought to a temperature of 15—18° C. before a test is made. The idea that Portland cement depreciates on keeping is wrong, provided the cement be kept dry and properly stored, and consequently it is undesirable that contracts should be entered into which stipulate for fresh material. *Soundness. Method of test.*—A cake of cement is very carefully prepared and laid on a sheet of glass. This is placed in a covered box for 24 hours (or until the cement has set) and then is immersed in water. The cake must not crumble or develope cracks. Generally, a faulty cement reveals itself in 3 days, but the cake should be kept under observation for 28 days. *Fineness.*—When tested on a sieve containing 900 meshes to the sq. cm. the cement must not leave more than 5 per cent. on the sieve. *Remarks.*—100 grms. of cement should be used for a test. The width of the meshes of the sieve may be from 0·215 to 0·240 mm. As Portland cement is often used with a large

proportion of sand. it is of great importance that it shall be very fine, as, for a given mixture, the strength of the mortar will be greater, the finer the cement. The value of a cement, however, cannot be judged from its fineness. *Strength.*—As, by testing pure cement, a true idea of its value as a mortar ingredient cannot be obtained, the strength tests must always be made on a mixture of cement and sand. A mortar made up with 3 parts by weight of standard sand to 1 part by weight of Portland cement must, after hardening for 7 days (1 day in damp air and 6 days under water), give a crushing test of at least 120 kilos. per sq. cm.; after a further hardening for 21 days in air at a temperature of 15°—20° C., it must give a crushing test of at least 250 kilos. per sq. cm. In contested cases, the test after 28 days is to be recognised only. Portland cement to be used under water must, after hardening 28 days (1 day in damp air and 27 days under water) give a crushing test of at least 200 kilos. per sq. cm. The tests are to be made on cubes of 50 sq. cm. side. For convenience in controlling cement at the building place, tensile tests may be made. A mixture of 1 part of cement to 3 parts of standard sand must, after 7 days' hardening (1 day in air and 6 days under water), give a tensile test of at least 12 kilos. per sq. cm. As quick-setting cements generally give smaller values than these, the strength and time of setting should always be specified together. Only the standard sand, specially prepared and supplied for the purpose, should be used for these tests if comparable results are desired. It is, however, recommended that tests should also be made with the sand, and in the proportions, that will actually be used in any work. *Mixing of mortar for test.*—400 grms. of Portland cement and 1200 grms. of standard sand are first mixed in the dry state for 1 minute in a dish with a spoon. The estimated amount of water is then added, and the damp mass mixed for another minute. The mixture is then uniformly distributed in the mortar-mixer (of standard design) and worked up by 20 revolutions of the bowl. This amount of mortar serves for the preparation of 2 test pieces. *Estimation of the water to be added.*—A preliminary test is first made with 128 grms. of water, then, if necessary, a second one with 160 grms. From 850 to 860 grms. of the mortar thus obtained are placed in the standard mould for preparing the test pieces. This is then introduced into the hammer-apparatus (of standard design), and the mortar subjected to 150 blows of the hammer. The water content is correct if, between the 90th and the 110th blows, the mortar flows out of one of two grooves, each 3 mm. wide, which are provided on the lower edge of the upper part of the mould for the purpose. A test made with the dry apparatus is untrustworthy. *Preparation of test pieces.*—850 to 860 grms. of the mortar are placed in the mould and subjected to 150 blows of the hammer. The surface of the test-piece thus made is scraped and smoothed with a knife, and marked. The test-piece in the mould is then placed in a damp covered box. After about 20 hours the test-piece is taken from the mould, and at the end of 24 hours is removed from the box and immersed in water at 15°—20°C. The water must stand not more than 2 cm. above the test-piece, and must be renewed every 14 days. Whilst hardening in air, test-pieces must stand on non-absorbent material and must be kept in a closed room. When a test is made, the pressure must be applied to 2 " side " surfaces. The mean of 5 tests is taken as representing the " crushing " strength.
—T. St.

Portland cement ; The influence of calcium chloride on ——. H. Burchartz. Mitt. Kgl. Materialprüfungsamt, 1910, **28**, 338—343.

A small addition of calcium chloride to quick-setting Portland cement causes the cement to set more slowly. When added beyond a limited amount, however, the cement again becomes quick-setting. To ascertain the effect of calcium chloride on the " soundness " of cement, experiments were made with four cements, to each of which an addition of 20 per cent. of calcium chloride was made. Of the cements chosen, two were quick-setting and two were slow-setting. Of each kind, one was a good cement and the other a bad one. All four cements gave satisfactory " soundness " tests when tested alone. The results of the experiments showed that cements containing 20 per cent. of calcium chloride neither conform to the standard requirements as regards soundness, nor do they give satisfactory results when subjected to " accelerated " soundness tests.—T. St.

Aluminium and calcium silicates and calcium aluminates. Neumann. *See* X.

Destruction of concrete [sewage tanks] by hydrogen sulphide. Stephan. *See* XIXb.

Patents.

Kilns for burning bricks and other articles ; Gas-fired ——. W. F. Collins, London. Eng. Pat. 18,024, Aug. 4, 1909.

The kilns are designed to be heated by producer gas. Immediately beneath the floor of the kiln a combustion chamber is provided in which the heating gases are burned. The kiln floor is constructed of chequered or crossed rows of brickwork, which have openings between them through which flame jets issue from the combustion chamber beneath the floor, and into which regulated quantities of air and gas are admitted and burned. A gas passage and air passages are arranged beneath the floor of the combustion chamber, and the ports connecting these passages with the combustion chamber are arranged opposite one another to ensure complete mixing of the air and gas before these enter the combustion chamber. The air passages being adjacent to the gas passage also ensure the preheating of the air supply.—W. C. H.

Cement kiln. R. J. Nash, Mitcheldean, Gloucestershire. Eng. Pat. 18,997, Aug. 18, 1909.

The kiln is of the " continuous shaft " type, and consists of a smoking or seasoning chamber, a preheating chamber, a revolving clinkering chamber or zone, and a cooling chamber, all of which are arranged vertically one above another. Means are provided for feeding raw material and fuel to the kiln, and for discharging the calcined product. The raw material is passed through a horizontal drying chamber, composed of one or more inter-communicating compartments, by means of conveyor blades, and delivered from it to the smoking or seasoning chamber. A revolving drum is arranged between the drying chamber and the smoking or seasoning chamber, and is furnished internally with blades for the purpose of moulding the raw material into balls or lumps. The clinkering chamber is made to rotate to prevent any semi-molten material from clinging to its sides.—W. C. H.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Cast-iron ; Effect of sulphur and silicon on the condition of carbon in ——. J. E. Stead. Brit. Assoc. Sheffield, 1910. Chem. News. 1910, **102**, 121—127.

After briefly referring to the work of previous investigators on the effect of sulphur and silicon on the condition of carbon in commercial cast-iron, the author gives his results of a purely microscopic research on the same subject. He found that carbide of iron, in presence of iron sulphide, crystallises with a minute quantity of sulphur, not exceeding 1/1000th part of the weight of the carbide, and that this contained sulphur is the cause of the stability of the carbide which results in a white iron. He also showed that when low-silicon hypoeutectic alloys freeze, *i.e.* those containing less than the eutectic proportion of 4·3 per cent. of carbon, nearly all the silicon crystallises out with the primary austenite, so that if the formation of the austenite is reduced by the addition of carbon, the remainder becomes correspondingly enriched up to saturation, after which the excess of silicon crystallises out with a portion of the carbide of iron, forming carbo-silicide of iron. If however, the conditions are such that no austenite is formed, the silicon then crystallises primarily with the carbide. In Cleveland white iron containing about 1·5 per cent. of phosphorus, 3 of carbon, and under 2 of silicon, the primary austenite, carrying practically all the silicon, first falls out of solution, then in place of the formation of iron-iron-carbide, independent plates of cementite form, until the residual mother-liquor arrives at the composition of the ternary iron-carbon-phosphorus eutectic, which solidifies at 945° C. In grey Cleveland iron, in which there is no primary austenite, the above ternary eutectic is the only eutectic formed, but two independent cementites crystallise, the exact composition of which has not yet been determined. The first formed is a silico-carbide which is exceedingly unstable, decomposing into graphite and silico-austenite, this instability being the cause of the greyness of iron rich in silicon and low in sulphur. In the absence of sensible quantities of phosphorus, the two cementites crystallise together as a eutectic mixture.—F. R.

Iron; Influence of thermal treatment on the size of grain of ——. A. Joisten. Stahl u. Eisen. 1910, **30**, 1562—1563.

IRON in the form of wire containing 0·07 per cent. of carbon, 0·009 of silicon, 0·43 of manganese, 0·104 of phosphorus, and 0·042 of sulphur, and with a homogeneous microscopical structure, was heated in a vacuum for one, five, ten, and twenty hours at varying temperatures. The samples were then quenched in ice-cold water, polished, etched, and photographed. From the photographs by means of a planimeter the alteration in the size of grain at constant temperatures for varying times was determined, and a diagram is given showing the curves for various temperatures. At a temperature of 850° C. there was only a slow growth of grain, the rate being somewhat quicker at the beginning than towards the end of twenty hours heating. At 700° C. the rate of growth up to five hours heating was fairly proportional to the time of heating after which time the rate was suddenly enormously increased. A similar change took place after ten hours heating at 650° C. but the rate of growth was very much slower. At 500° C. the rate of growth was very slow, being closely proportional to the time of heating, while even at 400° C. there was a distinctly perceptible increase in the growth of the grain.—A. H. C.

Blowholes in steel ingots; The closing and welding of ——. Henry M. Howe. Brit. Assoc. 1910, Sect. B., Sheffield.

IN the solidification of molten or liquid substances, especially those of high melting point, two classes of cavities are likely to form: gas bubbles called "blowholes," and a central contraction cavity called a "pipe." The blowholes represent (*a*) the progressive concentration in the molten or liquid mother mass of the gases initially present, a concentration carried on to supersaturation, and to the liberation of part of this gas from the supersaturated layers; and perhaps (*b*) in some cases, such as that of the solidification of steel ingots, the formation of a gas from chemical reaction brought about by fall of temperature or by passage from the liquid to the solid state. In the case of steel ingots there are indications that carbonic oxide is thus formed during solidification by the union of carbon and oxygen present side by side in the molten metal. The formation of the central "pipe" is due to the cooling, and hence contraction of the different layers of the mass æoliotachically, *i.e.* at different rates *inter se*. In the first stages of solidification the outside of the mass, especially if it is cast in a cold iron mould, cools much faster than the still molten interior. The early excess of contraction of the outside, caused by this excess of cooling, is resisted by the lagging interior, with the result that the outer layers are virtually stretched beyond their normal dimensions, so that when solidification is complete the interior, which in the latter part of the cooling has to cool through a greater range of temperature and hence has to contract more than the outside, no longer suffices to fill that outside completely, and this deficit of volume of the interior is represented by a central cavity overlying the region in which the last of the solidification occurs. This same excess of contraction of the earth's crust in its early stages should later throw that crust into great compression, which may be an important element in volcanic and earthquake phenomena. Blowholes themselves tend in effect to expand the volume of the interior as a whole without changing its outer dimensions and thus to lessen the deficit or pipe. In case of steel ingots this pipe may reach very deep into the axis, and, because it is hard to work up, may compel us to disregard as much as one-third of the ingot in order to get sound unpiped metal. To avoid this some makers of steel of a composition favourable to welding have purposely allowed blowholes to form rather abundantly, so as to prevent the formation of a pipe, and, relying on the ease with which such steel welds, have tried to get flawless metal by welding these blowholes up in the process of rolling the ingot out into its final form, such as that of a boiler plate. This procedure is of great economic importance, in that it enables the steel-maker to avoid the serious discarding which would be necessary in case his ingots were free from blowholes and hence deeply piped. But many intelligent metallurgists have condemned this practice on the ground that the closing of blowholes is impossible, because the gas which they contain must remain ever present during the rolling, even though somewhat compressed. In some late investigations the author carried out two lines of inquiry as to whether the gas of the blowholes is qualitatively absorbable and whether the sides of the blowholes themselves are qualitatively weldable under the conditions of actual manufacture. Both lines proceed by comparing the metal in slabs cut from the original ingot without rolling, with metal cut from a boiler plate into which that same ingot was rolled, and cut in such a way as to separate and distinguish those parts of the metal in the plate which had originally been porous when in the ingot from those which had originally been compact. The first line showed that the enormous differences in density which existed between the porous and the compact parts of the ingot were practically completely obliterated in rolling the metal down into a boiler plate. In one case the initial difference of 16 per cent. in density was completely removed; in the other the initial difference of 10 per cent. in density was reduced to one-fiftieth its original quantity. This tended strongly to confirm the strong antecedent probability that the blowhole gases could be reabsorbed during the rolling process, thanks to its high temperature and pressure. The second line of inquiry disclosed what traces of blowholes remained in the boiler plate by cutting very thin slices lengthwise and crosswise from that plate, mirror-polishing them, and then bending them double in such a way that any blowhole traces present ought to gape open like the cards of a bent pack. Had there been no welding of blowholes this bending should have disclosed unwelded seams about 3·5 inches long and 1·3 inches wide. In point of fact the traces detected were so short as to indicate strongly that a very great degree of welding had occurred. It had seemed extremely probable, antecedently, that such welding ought to occur; but here some very competent writers had differed. The longest single trace was 0·7 inch long. Only one important "string" of such traces was found and this was only 0·3 inch long. Further the scantiness of these relics of blowholes tends to show that the blowhole gases have been reabsorbed by the metal to a very great degree. The author suggests that such relics of blowholes as have persisted represent in most cases spots where the reabsorption of the gas has become complete after the temperature has fallen too low to permit welding. He suggests prolonging the exposure to a temperature above the welding point, so as to complete the reabsorption of gas while the metal is still weldable. The reabsorption of the blowhole gases and the welding of the blowholes ought to be promoted rather by the practice of "reheating" than by that of "direct rolling." In the former the ingot is rolled part way towards its final shape, and the resulting "bloom" is then reheated before further rolling; in the latter the ingot is rolled to its final shape, such as a rail or a boiler plate, at a single heat. During the early part of the rolling the metal surrounding each blowhole should become strongly charged with gas reabsorbed from that blowhole because of the enormous pressure caused by rolling. To reheat the bloom exposes it for a long time to a high temperature in the heating furnace, during which time the gas dissolved in the neighbourhood of the blowhole has an opportunity to diffuse away, and the gas in the blowhole has a chance to be reabsorbed by the adjacent metal. And further, the high temperature of the rolling immediately after this reheating facilitates both the further absorption and outward diffusion of whatever gas remains in the blowholes and the welding up of their sides.

[*Gold cyaniding.*] *Notes on precipitation.* F. D. Phillips. J. Chem., Met., and Min. Soc., S. Africa, 1910, **11**, 13—15.

In order to ascertain the minimum amount of zinc that could be safely employed for the precipitation of gold from cyanide solutions, a series of samples was taken of the solution entering and leaving each compartment of a zinc extractor box. The seven compartments had each a capacity of 18 cb. ft., and were dressed with 23·3 lb. of zinc per cb. ft. The first test was made two days after dressing, the rate of flow being 1·54 tons of a 0·029 per cent. potassium cyanide solution containing 0·005 per cent. of sodium hydroxide per cb. ft. of zinc per 24 hours. The first compartment showed an extraction of 81·2 per cent.; in the next four compartments the extraction varied from 70 to 50 per cent. of the values of the incoming solutions. A second test on the same box, 14 days after dressing, showed a lower extraction in the top compartment, with a corresponding increase in values in the others, but six compartments were found to be adequate. Tests made on a weak cyanide solution, (0·014 per cent. of potassium cyanide) eight days after dressing the extractor box, showed that the total extraction occurred in the first four compartments of the box. Solution from the slime plant also gave similar results. Lighter dressing of the extractor boxes, thus using less zinc, was tried but found to be inefficient, giving high tail values.—F. R.

Slimes ; The chemical control of ——. H. E. Ashley. Trans. Amer. Inst. Min. Eng., 1910, 617—632.

The author considers that the chemical control of slimes depends on recognition of the fact that clays and slimes in suspension consist of crystalline grains enveloped in a coating of colloidal matter. When the colloidal coating is dissolved by a suitable reagent the crystalline grains settle unhindered, while the dissolved colloid may be subsequently coagulated into aggregations large enough to settle down; any excess of the coagulant however, hinders the settlement owing to the increase of the viscosity of the solution, so that the minimum quantity of the most efficient coagulant should be used. It is curious to note that lime in small quantities acts as a colloid solvent, while larger amounts act as a coagulant. Curves are given showing the comparative effects of different reagents as clarifiers of solutions containing clay, felspar and quartz respectively. In the case of clay containing some potassium cyanide, calcium chloride was found to be three times as efficient a coagulant as lime. The solvent effect of water on quartz is also considered. —F. R.

Bronze ; The influence of heat-treatment on the hardness of ——. E. Heyn and O. Bauer. Mitt. Kgl. Materialprüfungsamt, 1910, **28**, 344—348.

The object of this paper is to give an illustration of the value of micrographic investigations in solving practical metallurgical problems. Some new bronze bushes had "smeared" the shafts running in them, and it was desired to find the reason. Chemical analysis showed that they had the same composition as others which had behaved satisfactorily, viz., 93 per cent. of copper and 7 per cent. of tin. Hardness tests proved that the new bushes were softer than the old, and microphotographs revealed quite different structures. The hard samples showed two distinct constituents, one rich in copper and the other rich in tin. The soft samples were composed of crystals of copper-tin alloy. The hard samples had been quickly, and the soft samples slowly cooled between two critical temperatures, which for an alloy of this composition are 1030° and 850° C. To confirm this view, a sample showing the "hard" structure was slowly heated to 900° C., kept at this temperature for half an hour, and allowed to cool during 1½ hours to 765° C. It was then cooled more quickly. The "hard" structure was found to be completely altered to the "soft" structure.—T. St.

White-metals ; A new method for the analysis of ——. E. Schürmann. Mitt. Kgl. Materialprüfungsamt, 1910, **28**, 349—351.

1 grm. of white-metal shavings is treated with 20 c.c. of chloroform and 5 c.c. of bromine, and heated if necessary. The action is almost complete in a few minutes. The solution is kept warm for about half an hour and any undecomposed filings are crushed with a glass rod. Tin, antimony and arsenic are thus obtained in solution. The cooled solution is filtered through asbestos, and 60 c.c. of a 10 per cent. solution of oxalic acid in water added and the whole shaken. The chloroform is run off and shaken with 60 c.c. of a 4 per cent. solution of oxalic acid in water. The two oxalic acid solutions are mixed, and the bromine is driven off by means of a current of carbon dioxide. The solution is diluted to 300 c.c., heated to boiling, and the antimony precipitated by sulphuretted hydrogen. The tin in the filtrate can then be precipitated as sulphide, or, after making the solution alkaline, can be deposited electrolytically. The latter process does not however remove all the tin and must therefore be supplemented by precipitation with sulphuretted hydrogen. The accuracy of the method is demonstrated by results obtained with known solutions, and with white-metals analysed by an older method.—T. St.

Lead ; Assay of ——. E. W. Buskett. Eng. and Min. J., 1910, **90**, 408.

The following method is especially adapted to the determination of lead in tailings, slags, and other materials containing not more than 5 per cent. of lead. 1 grm. of ore is boiled with 10 c.c. of nitric acid, evaporated to complete dryness, taken up with 25 c.c. of ammonium acetate solution, boiled and filtered, and the residue washed once with hot water. The lead in the filtrate is precipitated with a saturated solution of potassium bichromate, to which has been added enough ammonia to produce a yellow colour. The mixture is boiled and filtered, the precipitate washed at least three times with boiling water, and the lead chromate dissolved on the filter wtih dilute hydrochloric acid (1—3) and washed once with cold water. The solution is titrated cold with a standard solution of ferrous-ammonium sulphate, using a solution of potassium ferricyanide as indicator, the finish being shown by the production of a green colour. The standard ferrous-ammonium sulphate solution is made by dissolving 14·19 grms. of the pure salt in a litre of water in which is contained about 10 c.c. of sulphuric acid and a strip of aluminium to prevent subsequent oxidation. 1 c.c. of the solution is equivalent to 0·0025 grm. of lead. The ammonium acetate solution consists of 100 c.c. of ammonia, 250 c.c. of glacial acetic acid, and 600 c.c. of water. A modified method is also given for zinc ores containing small quantities of lead.—F. R.

Lead ; Rapid determination of —— *in ores by electrolysis with stationary electrodes.* R. C. Benner. J. Ind. Eng. Chem., 1910, **2**, 348—349.

The author describes his results for the analysis of lead ores containing copper. After removing the sulphur with hydrochloric acid or *aqua regia*, the lead is converted to nitrate and electrolysed in nitric acid solution at a temperature of 94°—97° C. All the lead is deposited as peroxide from such a solution (containing 0·5 grm. of lead) in 5—10 mins. The solution must be free from ammonium salts and from oxides of nitrogen.—W. H. P.

Lead; Determination of small amounts of —— in antimony copper-tin alloys (bearing metals). W. Mann. Chem.-Zeit., 1910, **34**, 917.

Assuming a lead content of about 0·5 per cent., 10 grms. of the alloy are dissolved in 45 c.c. of hydrochloric acid (sp. gr. 1·19) and 5 c.c. of nitric acid (sp. gr. 1·40). After the addition of 10 grms. of tartaric acid, the liquid is diluted to 200 c.c., cooled, and neutralised approximately with aqueous ammonia (sp. gr. 0·91), 100 c.c. excess of the ammonia being subsequently added. The blue colour having been destroyed with aqueous potassium cyanide, the solution is mixed with 5 grms. of solid potassium cyanide and heated to 70° C., when, finally, the lead is precipitated as sulphide by a quick current of sulphuretted hydrogen. The precipitate having settled, it is filtered off and washed superficially with a hot solution of ammonium sulphide and potassium cyanide (50 grms. of ammonium sulphide and 10 grms. of potassium cyanide dissolved in 1000 c.c. of water, the solution being boiled until colourless). It is finally washed back into the precipitation flask, and dissolved, together with the remainder adhering to the filter, by means of brominated hydrochloric acid (sp. gr. 1·11). After the bromine has been removed by boiling, the solution is cooled, mixed with an excess of ammonia and with 5 grms. of solid potassium cyanide and again saturated with sulphuretted hydrogen. The precipitate of lead sulphide is washed once with the sulphide-cyanide solution and rinsed with hot water into a porcelain basin, the residue adhering to the filter being removed by brominated hydrochloric acid. Finally, the sulphide is converted into sulphate by evaporation with 10 c.c. of sulphuric acid (50 per cent.) until copious fumes of sulphur trioxide are evolved. The sulphate, separated in this way, still contains small quantities of antimony and tin. It must, therefore, after ignition and weighing, be extracted repeatedly with dilute ammoniacal ammonium acetate solution, the weight of the ignited residue being subtracted from that of the sulphate obtained as above.—C. A. W.

Metallic silicides. Action of silicon carbides on some metallic oxides. L. Baradue-Muller. Rev. de Mét., 1910, 7, 657—834.

The recuperative furnace used in the investigation was constructed of carborundum and was heated by means of a burner supplied with illuminating gas and compressed air. The heating gases from the combustion chamber were caused to circulate through two concentric flues around the chamber before passing to the exit flue. In the exit flue were a serpentine tube and a straight tube for preheating the primary and secondary air supplies respectively. The crucible was made of carborundum or of a mixture of plastic refractory clay, kaolin, and fireclay. It was found possible with this furnace to attain rapidly a temperature of about 1750° C. Pure quartz was found to sublime at 1650° C., to begin to soften at 1702°—1706° C., and to become pasty at 1754° C. The simplest form of the reaction between silicon carbide and metallic oxides was found to be represented by the equation: $SiC + MO = SiM + CO$. To attain this reaction with higher oxides than the monoxide, it is necessary to add to the charge a reducing agent in quantity sufficient to reduce the higher oxide to the monoxide. By using a larger quantity of the oxide, together with sufficient of a reducing agent to reduce the excess to metal, it is possible to produce silicides of the type SiM_2 instead of SiM. Results obtained with a large number of different metallic oxides are described. The oxides which react most readily with silicon carbide to form metallic silicides are those of copper, cobalt, nickel, iron, manganese, and chromium. In the case of chromium oxide a certain quantity of chromium carbide is always formed in addition to chromium silicide, but contrary to what is observed in the case of cast irons containing silicon, the proportion of combined carbon in silicon-chromium-carbon alloys does not appear to be influenced by the silicon content. With very ferruginous chromium oxide, the silicon combines almost entirely with the iron, and the carbon for the most part with the chromium. Except in the case of chromium, the alloys produced by the action of silicon carbide on metallic oxides contain only small proportions of carbon, viz., copper-silicon 0·05; iron-silicon, 0·29; nickel-silicon, 0·55; and manganese-silicon, 0·65 per cent. In some cases the metal-silicon alloys are capable of producing certain reactions when added to fused metals. For example when molten cast iron is treated with a nickel-silicon alloy, iron silicide (solid solution of iron and silicon) and metallic nickel are produced; the iron silicide displaces the carbon from the remainder of the cast-iron, and the nickel transforms the iron into γ-iron. With increasing additions of the nickel-silicon alloy, the proportions of iron silicide and nickel increase and the amount of γ-iron diminishes, until finally an alloy of iron silicide, nickel silicide, and nickel is produced. The results of determinations of the dilatation (between 15° and 1000° C.) of silicon carbide, silicon, and the various metal-silicon alloys are also given. If an apparatus for the automatic registration of the dilatation on heating and the contraction on cooling could be devised, determinations of this kind would afford, in the author's opinion, a useful means of ascertaining the effect on an alloy of quenching and annealing.—A. S.

Thorium; Metallic ——. Chauvenet. Assoc. Franç. pour l'Avancement des Sci., Aug., 1910. Chem.-Zeit., 1910, **34**, 940.

The author attempted to prepare metallic thorium free from oxide by using metallic lithium in place of sodium for reducing thorium chloride. By heating the mixture in an iron boat in a quartz tube from which air was carefully excluded, a product containing 96—96·6 per cent. of metallic thorium was obtained. This, however, contained 3·2 per cent. of thorium oxide which could not be removed. A purer product (96—97 per cent. of metallic thorium) was prepared by heating thorium hydride (obtained by heating together thorium chloride and lithium hydride to 600° C.) in a vacuum of 10 mm. The metallic thorium thus obtained is black; it is not oxidised by air or by pure oxygen at atmospheric pressure, but is acted upon by oxygen under pressure. It takes fire with a luminous flame in fused potassium chlorate. It combines with chlorine to form thorium chloride, $ThCl_4$, with the liberation of 339·43 calories.—A. S.

Radium; Metallic ——. P. Curie and A. Debierne. Comptes rend., 1910, **151**, 523—525.

By making use of the method described by Guntz (this J., 1903, 800; 1905, 278; 1906, 80) for the preparation of barium, the authors have succeeded in isolating metallic radium. A liquid radium amalgam, unstable in the air, was prepared by the electrolysis of a solution of 0·106 grm. of pure radium chloride, using a mercury cathode (10 grms.) and a platinum-iridium anode. The amalgam was rapidly dried, transferred to an iron boat and heated in a quartz tube in an atmosphere of pure hydrogen, the pressure of the latter being kept above the vapour pressure of mercury at the temperature of the iron boat. Most of the mercury had distilled over at 270° C., and the temperature was then raised gradually to 700° C., when the whole of the mercury appeared to have been expelled, and the radium commenced to volatilise; the radium vapour vigorously attacked the quartz tube. The residue in the boat consisted of a bright white metal, melting at 700° C., which adhered strongly to the iron. The metal is rapidly attacked by the air, becoming black, probably owing to the formation of a nitride. It blackens paper and decomposes water, passing for the most part into solution; the dark-coloured residue dissolves almost completely on addition of a few drops of hydrochloric acid. The radio-active properties of the metal appear to be normal. As radium is much more volatile than barium, the authors propose to purify the metal by sublimation *in vacuo*.—A. S.

Furnace gases ; Condensation of fume and the neutralisation of ——. F. T. Havard. Trans. Amer. Inst. Min. Eng., 1910, 599—615.

THE subject is considered mainly in relation to the damage done to vegetation and live stock by furnace gases and fume. An account is given of the different methods that have been employed to condense and collect the fume, the principal methods being : 1. Settlement in dust chambers ; 2. Cooling the gases by the admission of air, by radiation or by spraying with cold water ; 3. Recovery of fume by filtration, as in a bag-house, or by friction through the interposition of baffles in the flue, or by passing the gases through centrifugal scrubbers ; 4. The Cottrell process in which the gases are passed through a vessel charged at numerous points with static electricity, from which the fume and condensed acids are repelled, and become deposited upon the floor or sides of the flue or chamber which form the opposite poles. Dust chambers without baffles are of little use for the deposition of fume, and are practically confined to the settling of particles of the charge which have been mechanically carried over. The usual method of depositing antimony fume by water in centrifugal scrubbers is highly efficient, but this method is unsuited for most other metals. For copper and argentiferous lead smelting, long flues with baffles in conjunction with an adequate bag-house at the foot of the stack give the best results. When much acid is present, cotton filter bags are rapidly destroyed and asbestos, in spite of its increased first cost, has been found to be the best bag material. Sulphuric acid plants, in conjunction with smelters, have been erected to cope with the immense quantities of sulphurous gases, and zinc oxide, in the form of fume in the flues or of dust on the filter bags, has also been used to neutralise the acid in the gases.—F. R.

Aluminium and calcium silicates, and calcium aluminates. B. Neumann. Stahl. u. Eisen, 1910, 30, 1505—1514.

A REVIEW of work done on the melting-points of slags and their constituents. The modes of determining melting-points by Seger cones and by thermo-couples or other forms of pyrometer are discussed, and also the difficulty of assigning a definite temperature as the melting-point or softening point of substances which change gradually and not sharply from solids to liquids. Melting-points, however, can be determined, in such substances with closer approximation than solidifying points. A résumé and discussion of results obtained by various observers is given, which may be summarised as follows :—The melting points of quartz, alumina, and lime may be taken as 1770°, 2000°, and over 2000° C. respectively. The melting-points of aluminium silicates exhibit an almost continuous fall from alumina to a substance corresponding to the formula, $Al_2O_3,15SiO_2$, which melts at 1600° C., and then a continuous rise to quartz. There is, however, a slight but noticeable rise in the curve about 1850° C. corresponding to the compound, Al_2O_3,SiO_2 (andalusite, sillimanite, disthene). The curve of the calcium silicates shows a descent from quartz to a eutectic minimum about 1410° C. (65 per cent. of silica), then a rise to a maximum at 1520° C. (52 per cent. of silica, $CaO.SiO_2$), a fall to another eutectic at 1420° C. (43 per cent. of silica), then a steep rise to a maximum about 2080° C. (35 per cent. of silica, $2CaO,SiO_2$), followed by a very slight fall and a further rise. The calcium aluminate curve falls from either end towards the centre, and shows maxima at 1590° C. and 1400° C. (corresponding respectively to CaO,Al_2O_3 and $5CaO,3Al_2O_3$), and minima at 1385° C. (52 per cent. and 45 per cent. of lime).—J. T. D.

Mineral production of New South Wales. Board of Trade J., Sept. 8, 1910. [T.R.]

THE following statistics of the mineral production of the State of New South Wales during the years 1908 and 1909 are taken from the annual report for 1909 of the Department of Mines of that State :—

Minerals.	1908.		1909.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Alunite .. Tons	1,082	2,705	3,500	8,791
Antimony (metal and ore) Tons	117	1,141	95	711
Bismuth (metal and ore) Tons	9	2,017	9	1,624
Coal .... ,,	9,147,025	3,353,093	7,019,879	2,618,596
Coke .... ,,	283,873	199,933	204,274	137,194
Copper (ingots, matte, and ore) (*a*) .... Tons	9,071	502,812	6,966	424,737
Diamonds Cts.	2,205	1,358	5,474	3,959
Gold ....Oz. fine	224,792	954,854	204,709	869,546
Iron (*b*) .. Tons	40,207	118,224	29,762	106,357
Iron " oxide " ,,	1,827	1,857	4,900	4,948
Ironstone flux ,,	8,087	6,199	4,339	3,471
Lead (pig, etc.) (*c*) Tons	14,936	186,746	15,476	186,073
Lime .... ,,	24,922	21,610	25,849	24,283
Limestone (flux) (*d*) .... Tons	53,668	14,779	45,078	13,851
Marble (*e*) ..	—	2,200	—	1,700
Molybdenite Tons	8	929	28	3,249
Noble opal	—	41,800	—	61,800
Platinum Oz.	135	439	440	1,720
Portland cement	—	184,400	—	202,200
Silver (ingots and matte) (*f*) .. Oz.	2,490,163	253,920	1,718,005	168,974
Silver-lead, ore, concentrates, etc. Tons	358,730	1,906,275	269,306	1,484,641
Shale (oil) ,,	46,303	26,068	48,718	23,617
Scheelite ,,	154	11,082	193	14,618
Stone (building, etc.) (*g*)	—	229	—	378
Stone (grindstones) (*g*)	—	204	—	192
Tin (ingots and ore) (*h*) Tons	1,795	205,447	1,943	211,029
Wolfram ,,	86	6,742	127	11,249
Zinc (spelter and concentrates) Tons	276,720	600,883	373,906	1,011,280
Sundry minerals and ores	—	1,661	—	4,905
Total value	—	8,609,607	—	7,635,693

(*a*) Exclusive of the copper produced in the State during the year from ore imported for treatment from other States of the Commonwealth. (*b*) Including iron made from scrap. (*c*) See silver-lead. (*d*) Value at smelting works. (*e*) Value at quarries of quantity disposed of. (*f*) The bulk of the silver is contained in the concentrates, etc., despatched from the Broken Hill Field and treated outside the State. (*g*) Quantity exported only. (*h*) Exclusive of tin refined in the State from imported ores.

PATENTS.

Iron and steel ; Manufacture of ——. B. Talbot, Middlesbrough. Eng. Pat. 22.201, Sept. 29, 1909.

A CONVERTER, having a capacity of 50 to 100 tons and preferably lined with magnesite or other basic material, is employed. One-half of the charge, which contains, for example, 3·7 per cent. of carbon, 1·25 of silicon and 0·8 of manganese, is run from the blast-furnace or mixer into this converter, where it is blown, the blowing being effected at a comparatively short distance below the level of the metal. This operation is continued until the silicon has been oxidised to about 0·25 per cent., the manganese to about 0·5 per cent., or even a trace, and the carbon to about one-half or two-thirds of its original value. The metal now contains practically all its remaining carbon in the combined form, so that, graphite being no longer present, foaming and explosions in the subsequent treatment are avoided. The other half of the impure charge having been added to the partially purified bath, blowing is resumed until the silicon and manganese have been again reduced to about the proportions stated above, the carbon being practically all converted into the combined form, with a content of about 2·75. The purification is, of course, facilitated by the considerable oxide of iron slag produced in the first operation. The bath is then ready for tapping, the metal being transferred to a finishing furnace which is advantageously of the continuous open-hearth type.—C. A. W.

Iron and steel; Convertors or vessels for refining ——. B. Talbot, Middlesbrough. Eng. Pat. 22,394, Oct. 1, 1909.

The vessel resembles in general form a normally inclined steel mixer, but with the addition of an outlet in the roof similar to the spout or neck of a Bessemer converter. An inlet for metal is provided at the larger end, and a tap-hole for discharging at the smaller end. One or more tuyères are situated immediately over the tap-hole. In use the tap-hole is plugged and the vessel turned downwards, until the surface of the contained metal submerges the tuyères; the air blast, under low pressure, thus enters very slightly below the surface. If desired, the gases may be prevented from escaping at the metal inlet by means of an arch descending to the surface of the metal from the side of the spout farthest from the blast. —F. R.

Steel; Open hearth process of refining ——. G. Barbanson and M. Lepersonne, Brussels. Eng. Pat. 5916, March 9, 1910. Under Int. Conv., July 3, 1909.

In order to project a highly concentrated localised flame on to the surface of the bath of steel, coal dust is injected by means of a blast of cold air. The respective quantities of air and coal dust may be so regulated that an oxidising, reducing or carburising effect can be produced as required. —F. R.

Steel manufacture. J. M. Darke, Lynn, Mass., Assignor to General Electric Co., New York, U.S. Pat. 967,335, Aug. 16, 1910.

In the preparation of alloy steel, some of the components are melted first, then materials are added to form a protective layer of slag, and finally a metal having a high chemical affinity for the slag is introduced through a tube projecting below the layer of slag.—A. S.

Steel; Manufacture of ——. W. R. Walker, New York. U.S. Pat. 967,590, Aug. 16, 1910.

Iron is treated in an acid-lined open-hearth furnace or Bessemer converter until the silicon is removed and the carbon is reduced to 0·3 per cent., then, after skimming off the slag, the metal is transferred to a mixer containing a basic slag, for the removal of part of the phosphorus, after which the final refining is effected in a basic-lined electric furnace having a non-oxidising atmosphere.—A. S.

Iron or steel; Treatment of —— with a view to preventing rust or corrosion. P. Martin. Fr. Pat. 413,842, March 19, 1910.

The plate having been treated with acids, or in any way most convenient for the removal of its rust, it is placed horizontally in a furnace, and heated to a temperature somewhat above the melting point of tin. A stick of tin is then rubbed over the hot surface, whilst at the same time, or subsequently, powdered ammonium chloride is applied with a tuft of cotton waste. Whilst the plate is still hot, a temperature of about 310° C. being sufficient, a stick composed of equal parts of zinc and lead is applied in the same manner. The stick of zinc and lead is obtained by casting the two metals one after another into a mould, the heavier lead sinking to the bottom and adhering, when cold, to the zinc.—C. A. W.

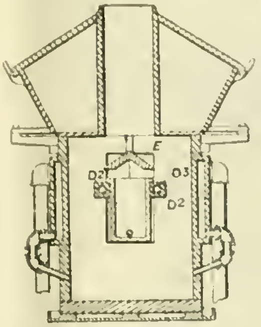
Furnace; Roasting ——. T. D. Merton, Watford and H. M. Ridge, Seaton Carew, Durham. Eng. Pat. 13,625, June 10, 1909.

In a rectangular reverberatory furnace, two or more vertical rotatable shafts having rabbles attached, are arranged along the centre of its long axis, with the radius of the rabbles only just overlapping, thus dividing the furnace into a series of independently rabbled zones. The ore passes in definite progression along the furnace, being deflected outwards by the rabbles of one zone until it reaches the periphery overlapped by the adjoining rabble, whereupon it becomes transferred to the next zone. Two or more superimposed hearths may also be employed.—F. R.

Furnace; Roasting ——. C. Robinson, New York. U.S. Pat. 968,265, Aug. 23, 1910.

A reverberatory furnace is provided with a reciprocating rabble actuated by means of the furnace draught. The rabble, which is also furnished with an ore-conveying device, may be advanced, reversed, or made inoperative at will. Space is provided beyond the rear end of the hearth, for the withdrawal of the rabble, to permit of the adjustment of the ore on the hearth.—F. R.

Furnace; Combined reduction and crucible ——. W. J. Shaw, Assignor to International Tool Steel Co., Ltd., Toronto, Canada. U.S. Pat. 967,069, Aug. 9, 1910.



A casing of rectangular form provided with tuyères and suitable for an ordinary process of reduction. By means, however, of hollow bars, D², containing water circulation pipes, D³, and extending through the ends of the furnace, a crucible can be supported in the bed of fuel so that its ends abut the ends of the walls of the furnace, an inverted V-shaped hood, E, being arranged above it in order to deflect the fuel. The end doors of the casing, for the passage of the bloom, are placed above the level of the hearth the slag below the metal passing out through a spout immediately beneath.—C. A. W.

Crucible furnace; Method and —— for the fusion of easily oxidisable heavy metals. Soc. Anon. d'Electricité Ganz. Fr. Pat. 413,514, March 11, 1910. Under Int. Conv., March 24, 1909.

In order to prevent the oxidation of the metal by traces of air imprisoned between individual pieces during the fusion, it is proposed to conduct the operation in a molten bath of some inert salt which has been previously heated to a temperature beyond that required. The crucible containing the salt may advantageously be arranged in a second molten bath, in which, if the heating be effected by electrical means, the electrodes can be placed. The furnace, arranged in this manner, is provided with a cover and charging arrangement, a plugged channel being contrived in the bottom of the crucible for the tapping of the molten metal. By varying the current, the bath is heated to the desired temperature, when finally the metal is thrown in and fusion is effected almost immediately. In this way, it is possible to recast old copper conductors, the metal obtained being free from oxide and possessing practically the same electrical conductivity as the original samples.—C. A. W.

Furnace; Method for increasing in a melting —— fed by molten metal the solidity of that part which contains the fusion channel. Poldihütte Tiegelgussstahlfabrik. Fr. Pat. 413,207, March 1, 1910. Under Int. Conv., March 2, 1909.

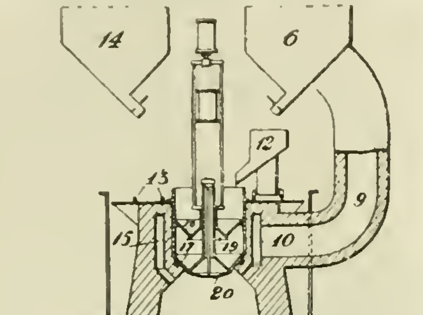
The molten metal as it enters the furnace is made to impinge on a body fixed horizontally or vertically, or suspended, in the fusion channel, so that the whole shock of the heavy jet is taken up and damage to the furnace is prevented, the metal being made to flow quietly into position. For this purpose, perforated plates or receptacles of some refractory material may be employed and afterwards removed, or, alternatively, the body may be composed of sheet iron which, in the subsequent operation, becomes fused and enters the bath.—C. A. W.

Furnace; Electric ——. J. H. Reid, Newark, N.J. U.S. Pat. 968,079, Aug. 23, 1910.

The furnace consists of a series of superimposed chambers, each having means for producing a centrally situated arc, together with flues for the withdrawal of volatile products. The base of the furnace is provided with heating means of the electric resistance type. The ore is fed in at the top of the furnace and becomes increasingly heated as it descends by gravity through each arc, the residue being finally withdrawn in a molten condition through a tap-hole in the lowest chamber.—F. R.

Electric shaft furnace. H. Boholm. Fr. Pat. 413,733, Feb. 17, 1910. Under Int. Conv., April 13, 1909.

THE furnace comprises a crucible, 1, provided with an arched roof through which electrodes, 5, descend into the material. The body, 2, of the furnace communicates with the crucible by means of an opening, 4, the body becoming narrower at the part, 3, towards the opening. The circular form of the roof of the crucible prevents the material from coming into contact with the roof. The charging arrangement consists of a reservoir, 14, for the coke or charcoal used in the process, and a heater, 6, supplying the material for the charge. The heater, 6, communicates, by means of the tube, 9, with a circular chamber, 10, which is also in connection with the interior, 7, of the furnace mouth. The materials are delivered from the reservoir, 14, or heater, 6, into a small waggon, 12, which runs round the circular track, 13, so that the material is distributed from the waggon into the receptacle, 15. The latter is provided with two conical valves, 19 and 20, which act against the two checks, 16 and 17, the lower valve, 20, being water-cooled.—B. N.



Induction-furnace for metallurgical purposes. Ges. für Elektrostahlanlagen m.b.H. Ger. Pat. 224,696, June 4, 1909.

IN order to overcome the difficulties caused by the so-called "pinch" effect (see this J., 1909, 1143) in electric induction-furnaces, those parts of the fusion trough where the phenomenon is observed are lined with a material which is a feeble conductor compared with the molten metal in the trough, but suffices to conduct the current when owing to the "pinch" effect, the normal path of the current is broken. The lining may be composed of a mixture of graphite with kaolin or fireclay, and in order to prevent excessive heating at the upper part and consequent loss of graphite by oxidation, it is made of increasing thickness from top to bottom. Where the use of carbonaceous matter is not advisable, magnesia or other solid conductors of the second class may be used as lining.—A. S.

Zinc retorts; Treatment of fumes from ——. H. E. Howard and G. Hadley, Birmingham. Eng. Pat. 452, Jan. 7, 1910. Addition to Eng. Pat. 4563 of 1909 (this J., 1910, 284).

THE carbon or coke employed in the filters described in the original specification may be replaced, with less advantage however, by other materials such as broken bricks or glass.—C. A. W.

Zinc; Electrolyte and method of electro-depositing ——. E. F. Kern, Knoxville, Tenn., Assignor to P. S. Brown, New York. U.S. Pat. 967,200, Aug. 16, 1910.

THE electrolyte consists of a solution of zinc fluosilicate, a fluosilicate of a metal standing higher than zinc in the solution pressure series, such as the aluminium salt, an organic addition agent and ammonium fluoride. The last salt may be added periodically in portions during the electrolysis and, as an organic agent, grape sugar (dextrose) may be employed.—C. A. W.

Mattes; Separation of nickel and copper from ——. D. P. Shuler, Sudbury, Ontario. U.S. Pat. 967,072, Aug. 9, 1910.

THE matte, in a finely powdered condition, is extracted with dilute sulphuric acid or ground while wet with the same reagent, the operation being facilitated, if necessary, by heat and agitation. In this way, the nickel is dissolved as sulphate, whilst the solution of the copper is prevented by constantly maintaining in the liquid sufficient hydrogen sulphide. If desired, the removal of the nickel may be effected only partially in the first operation, the residue being extracted with a second portion of acid, with the same precautions, as regards hydrogen sulphide, as before. The nickel sulphate is finally separated and converted into oxide.—C. A. W.

Ores; Method of reducing ——. F. M. Becket, Niagara Falls, Assignor to Electro-metallurgical Co. U.S. Pat. 967,159, Aug. 16, 1910.

A MOLTEN mixture, containing a compound of a metal and a reducing agent, is submitted to electrolysis, the current being carried by an electrode, or electrodes of opposite polarity, depending into the bath. The electrode has a melting point substantially higher than that of iron, and, in order to protect it from the electrolyte and metallic reduction products, the immersed portion is kept sufficiently cooled so that a solid electrically conducting coating of the bath constituents is formed upon it.—C.A.W.

Minerals; Method of separating ——. A. S. Ramage, Detroit, Mich., Assignor to Chemical Development Co., Buffalo, N.Y. U.S. Pat. 967,671, Aug. 16, 1910.

THE material, containing a number of mineral components, is immersed in a suitable solution, which may, perhaps, contain free nitric acid. The temperature of the solution being raised progressively, the product separated by flotation at each rise of temperature is removed from the liquid.—C. A. W.

Aluminium solder. J. Silver, New York. U.S. Pat. 968,203, Aug. 23, 1910.

A SOLDER for aluminium, consisting substantially of 10·8 per cent. of aluminium, 2·75 of magnesium, 85·1 of tin, and 1·35 of cadmium, is made by heating a graphite crucible to about 650° C. and introducing the metals in the above order, increasing the temperature until the mass fuses, stirring and adding a flux.—F. R.

Solder. Gourdon et Cie. Fr. Pat. 413,522, March 11, 1910.

THE solder is composed of tin powder, pure or mixed with lead, and powdered rosin or some such cleansing agent, the whole being mixed into a paste by the addition of fatty bodies. The pieces rubbed with the sticky composition being made to adhere provisionally, it is only necessary to apply the heat of a match or candle in order to complete the operation.—C. A. W.

Metals; Apparatus for the rapid electrolysis of —— and the complete exhaustion of all metallic solutions. J. Parent. Fr. Pat. 412,996, Feb. 24, 1910.

The apparatus comprises a cylindrical metallic cathode presenting two cylindrical cathode surfaces, insulated from each other, the one internal and the other external, and two cylindrical perforated sheets of lead, acting as anodes, placed concentrically at the interior and exterior of the cathode. A rotary movement is given to the cathode or anodes, the surfaces of one of the electrodes being formed of undulations arranged in vertical helices, or they may be provided with spiral ribs, so that during the rotation the electrolyte receives a spiral movement, either ascending or descending. Each anode may be formed of two waved, perforated sheets of lead, arranged concentrically and united by a base of lead, so that each forms an annular magazine for the material to be treated. The process may be employed for the treatment of copper sulphate solutions obtained in certain industries, such as the refining of precious metals, with the object of obtaining sulphuric acid, the solutions being passed through a group of electrolysers in series, so as to totally exhaust the solutions and also effect their concentration.—B. N.

Electrolytic galvanisation; Apparatus for ——. G. I. Roman. Fr. Pat. 413,239, March 3, 1910. Under Int. Conv., March 14 and Dec. 16, 1909.

The apparatus is employed for the electrolytic coating of articles manufactured on a large scale, such as parts of telephones, hooks, eyelets, screws, etc., and comprises a cathode body turning around a vertical axis, and containing the material to be treated in circular trenches. The cathode body consists of a perforated cathode, which is bound between insulated linings of such a shape as to form a circular trench, the perforated cathode being insulated at all parts except at the base of the trench. Anodes and agitators dip into and adapt themselves to the shape of the trench, the agitators being elastic so as to clear obstacles during the agitation, or they may be rigidly bound to their supports. In the latter case, each agitator adapts itself by its lower edge to the cathode trench, but presenting helical ascending faces to the articles, the latter are caused to rise in the trench with a turning movement. An arrangement is provided for stopping the rotating cathode when the articles become wedged in the agitator. By means of a threaded rod, the anodes and agitators may be removed vertically from the bath, the removal rendering the cathode stationary and interrupting automatically the passage of the current.—B. N.

Lead ore and blende; Separation of —— from pyrites. C. A. Brackelsberg. Fr. Pat. 413,093, Feb. 28, 1910.

The crushed ore mixture is heated rapidly to redness, the reaction produced being interrupted by plunging the incandescent mass into water, or by rapidly cooling it in some other way. Alternatively, the ores may be heated out of contact with air, the cooling being effected in the same manner, and in this case certain oxides, chiefly iron oxide, may be added to the mixture. In either case, before cooling, the heated mass containing arsenides and sulphides may be treated with reducing or sulphurising agents, particularly hydrogen sulphide or carbon monoxide. The treatment has the effect of modifying the properties of the pyrites, which is rendered strongly magnetic, and hence can be removed subsequently by magnetic separation. —C. A. W.

Alloy; Metallic —— for reflectors and its method of manufacture. H. Lavaine. Fr. Pat. 413,132, Feb. 5, 1910.

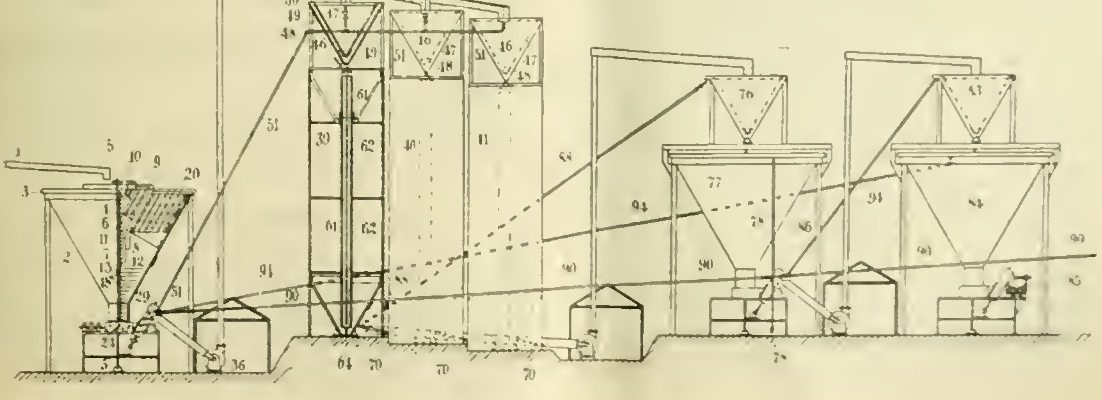
The alloy may be composed of electrolytic copper, 80; tin, 12; antimony, 6; bismuth, 1; and silver, 1 per cent., but these proportions may be varied; thus, a greater proportion of silver may be employed if a whiter metal be required. The copper is introduced into a crucible which has been previously brought to redness. The temperature is raised and, as the copper commences to boil, the tin is introduced, the mass being stirred energetically with a piece of wood. The crucible is removed from the furnace and the temperature allowed to fall about 100°, when, finally, the antimony, bismuth, and silver are introduced successively into the molten bath, the mass being stirred after each addition and powdered with a small amount of arsenious salt in order to prevent the volatilisation of the metals with a low fusing point. The alloy having been cast directly into the mould, it is hardened by removing the piece and immersing it while hot in boiling paraffin, wherein it is allowed to cool.—C. A. W.

Converter with special arrangement permitting the metallic bath to be maintained in fusion. J. Cros. Fr. Pat. 413,252, March 2, 1910.

The oscillating converter possesses an almost circular section, and is of small capacity, although the heating arrangement may be applied to one of any other form. It is lined with refractory material, and contains a casting orifice at the side and a charging aperture with removable plug at the top. The conduit leading from the blast-box at the side to the interior of the apparatus, is partly occupied by a chamber into which some gaseous or liquid combustible can be introduced. This combustible can thence be forced under a certain pressure in very thin jets into the air blast immediately before the latter enters the vessel and comes into contact with the molten metal. In this way there is produced a very considerable disengagement of heat which can be regulated by varying the proportions of air and combustible, a screw valve for the latter and a sliding plate at the back of the blast-box being provided for this purpose. The apparatus is suitable for the production of small quantities of steel from scrap iron, a very hot and fluid metal being obtained, and for the manufacture of malleable cast iron which subsequently requires only a few hours of annealing, so exactly can the point of decarburisation be regulated.—C. A. W.

Ores: Apparatus for the treatment of crushed —— in order to recover the metal contents. A. J. Arbuckle. Fr. Pat. 413,417, March 9, 1910.

The apparatus is intended for the treatment of crushed ores by cyanide or other solvents. It may be employed



for the extraction of the total pulp as it comes from the mill, and this without the necessity of a previous separation into sands and slime. The liquid pulp as it comes from the battery is directed by the trough or pipe, 1, into the de-watering vessel, 2. Up the centre of this vessel there passes a vertical shaft, 5, carrying at the top a small cone, 4. Larger inverted cones, 6, 7, 8, with vertical cylindrical prolongations, 11, 12 and 13, are arranged underneath. The liquid pulp being distributed by the pipe, 1, into the space comprised between the cone, 4, and the internal conical ring, 10, the liquid runs downwards and under the lower edge of the cylindrical prolongation, 11, and thence passes in and out between the cones until it rises in the vat and overflows as clear water into the annular discharge, 3. During the circulation the solids are deposited upon the small truncated surfaces, 9, between the cones, 6 and 7, and upon the outer truncated surfaces, 20, whence they afterwards fall to the bottom of the vessel, the operation being assisted by the revolving radial arms, 18, carried by the vertical shaft, 5. The partially drained solids, falling to the bottom of the vat, are thence removed by means of the conveyors, 24 and 29, and the pumps, 36, to one or other of the classifiers, 46, 46, 46, being mixed on the way with a suitable quantity of the extracting solution conveyed from a reservoir by the pipe, 90. The classifiers, in which any desired proportion of the dissolving solution is separated, comprise internal and external cones, 47 and 48, an intermediate conical passage, 49, and an annular overflow, 50, by means of which a certain proportion of solution is returned through the pipe, 51, and again mixed with the solids as they emerge from the drainer. The extraction vessels, 39, 40, and 41, into one of which the mixture, containing about 3 parts of solution and 1 of solids, now passes, are simple in construction, the necessary agitation being obtained by means of an air-lift arrangement. Whilst the vessel is being filled, the deposition of solids is prevented by a current of air passed in near the bottom, but subsequently, the vessel being replenished, the circulation is obtained by means of an air-current which, forced down the central pipe, 62, escapes through valves at 64 and passes up the larger concentric pipe, 61. The subsequent course of the extracted mixture as it is conveyed away through discharge pipes at 70 to classifiers and separators, 76, 77, and 83, 84, can be readily observed from the diagram; the clear liquid overflowing from these vessels is brought back through pipes, 86, 88, and 94, and again mixed in the desired proportions with the ongoing pulp. Finally the solids coming from the deposition vat, 84, are received upon the transporter table, 85, and conveyed to the waste heap. The solution may be taken from the overflow of the depositing vat, 77, through the pipe, 78, and removed for the precipitation of the metallic contents.—C. A. W.

Copper; Preparation of —— by the wet way. A. Gadomsky. Fr. Pat. 413,727, Feb. 5, 1910.

The method consists essentially in extracting roasted cupriferous ores or non-calcined copper slags with an ammoniacal ammonium carbonate solution, in presence of air, the solution obtained being afterwards heated in order to recover the copper as oxide. The sheet iron extraction vessel, of square section, is provided with a pyramidal top and bottom, its interior being divided into three parts by means of a sieve and a filter. This vessel having been filled with crushed material, which is supported upon the sieve, it is closed and the extracting solution introduced through a pipe at the top. The solution consists of equal parts of aqueous ammonia (4 per cent.) and a solution of ammonium carbonate (4 per cent.), the weight employed being about one-quarter of that of the crushed ore. The pyramidal chamber beneath the filter is then exhausted, whilst at the same time compressed air is forced in at the top of the vessel. The liquid penetrates the ore, producing copper carbonates and cuprammonium compounds which dissolve in the excess of liquid. The cupriferous solution passes through the sieve, and filter, and is conveyed to a reservoir, when it may be employed again and again until it is saturated with copper. In order to extract the metal completely from the crushed material, it is generally sufficient to pass the solution slowly through the latter five times in succession, the arrival of the reagent being stopped after each passage and a violent current of air circulated through the apparatus in order to promote the reaction. The gases evolved escape from the upper part of the chamber and are conveyed to a vessel where they are absorbed in water, the solution obtained being subsequently mixed with the reserve of reagent. When sufficient copper solution has been obtained, it is distilled in an alembic; the ammonia and carbon dioxide evolved are recuperated and subsequently employed again, and the residual liquid, containing suspended copper oxide, is filtered. The dried oxide is finally reduced in the ordinary way for the recovery of the copper.—C. A. W.

Pulverulent ores; Process for the briquetting of —— with production of chlorine compounds. C. A. Brackelsberg. Ger. Pats. 224,816, Dec. 1, 1908, and 224,817, Feb. 23, 1909. Additions to Ger. Pat. 224,309, Sept. 23, 1908.

(1) The fine ore after treatment with magnesium chloride as described in the chief patent (this J., 1910, 1016) is agglomerated by drying in rotating drums or the like. (2) As an addition to the process of briquetting fine ores by means of magnesium chloride described in the chief patent (*loc. cit.*), it is proposed to allow the chlorine compounds evolved on heating the briquettes to act on magnesium carbonate (dolomite) and thus regenerate magnesium chloride.—A. S.

Iron; Process of refining ——. J. Flohr, Rodange, Assignor to Soc. Anon. des Hauts Fourneaux et Forges Dudelange, Luxemburg. U.S. Pat. 968,758, Aug. 30, 1910.

See Eng. Pat. 19,348 of 1907; this J., 1908, 943.—T. F. B.

Steel; Manufacture of ——. C. M. Johnson. Fr. Pat. 413,711, March 18, 1910. Under Int. Conv., Nov. 15, 1909, and Jan. 31, 1910.

See U.S. Pats. 964,869 and 964,870 of 1910; this J., 1910, 1015.—T. F. B.

Metallic oxides; Reduction of ——. C. M. Johnson. Fr. Pat. 413,712, March 18, 1910. Under Int. Conv., June 19, 1909, and Feb. 4, 1910.

See U.S. Pats. 964,868 and 964,871 of 1910; this J., 1910, 1015.—T. F. B.

[Metallic] articles with the use of colloids; Process of manufacturing ——. H. Kuzel, Baden, Austria-Hungary, Assignor to General Electric Co., New York. U.S. Pat. 969,064, Aug. 30, 1910.

See Addition of March 9, 1907, to Fr. Pat. 359,025 of 1905; this J., 1907, 1002.—T. F. B.

Ores; Process for separating complex ——. W. M. Martin. Fr. Pat. 412,984, Feb. 23, 1910. Under Int. Conv., Feb. 24, 1909.

See Eng. Pat. 4531 of 1909; this J., 1910, 825.—T. F. B.

Minerals; Process for reducing ——. H. E. T. Haultain and J. W. Moffat. Fr. Pat. 413,170, Feb. 24, 1910.

See U.S. Pat. 950,595 of 1910; this J., 1910, 434.—T. F. B.

Gas producers [for use in metallurgical operations and in the fixation of atmospheric nitrogen]. Eng. Pat. 16,217. *See* IIa.

Apparatus for cleaning the washing water from the treatment of coal or ores. Fr. Pat. 413,517. *See* IIa.

XI.—ELECTRO-CHEMISTRY.

Rotating graphite anode. J. W. Turrentine. J. Ind. Eng. Chem., 1910, 2, 342—345.

The author has designed a satisfactory graphite anode for use in connection with the graphite cathode dish (this J., 1909, 890). The anode is in the form of a dish, 4 cm. deep with walls 2—3 mm. thick, cylindrical for 2 cm.

of its depth and then a truncated cone narrowing from 8 cm. to 3 cm. There is a hole in the bottom 1·2 cm. in diameter and four equidistant radial slits in the sloping portion of the side. It is supported for rotation by the outward pressure on its inner wall of three aluminium prongs attached to the rotating shaft. The rotation brings the bulk of the solution between the cathode dish and the outer walls of the dish-shaped anode. In such electrolyses the anodic oxygen does not pass over and tend to oxidise the metal on the cathode. The porosity of the graphite is greatly reduced, without greatly impairing the conductivity, by treatment with paraffin or ceresin, while the tendency to flake is not conspicuous except at fairly high current densities (6 amp. per sq. dcm.).
—W. H. P.

Radiation of electric incandescence lamps. Leimbach. *See* IIb.

Patents.

Secondary or storage batteries; Means for preserving or protecting the lead supports of the positive electrodes of —— from peroxidation. P. Marino, London. Eng. Pat. 18,590, Aug. 12, 1909.

The lead supports for the positive electrodes receive a thin coating of a composition obtained by mixing a solution of pure gutta-percha with finely powdered antimony or graphite. In order to prepare this composition, pure gutta-percha or, less advantageously, india-rubber or celluloid, is dissolved by means of some suitable solvent in a closed vessel, and is then well mixed with a sufficient quantity of finely pulverized graphite or antimony powder to yield a mass of the consistence of paint. If desired, antimony and graphite can be employed together, in which case a mixture containing two parts of the former to one of the latter is recommended. Coated in this way, the lead supports can be made much thinner, since they no longer become peroxidised, the electrolytic action being confined to the active material upon them; finally, the composition being conducting, the metallic surface suffers no loss of conductivity.—C. A. W.

Electrolytic cell. P. McDorman, Assignor to the National Laundry Machinery Co., Dayton, Ohio. U.S. Pat. 968,492, Aug. 23, 1910.

The cell consists of a series of electrodes placed vertically and parallel to one another, within an outer vessel. Plates are mounted above and below each electrode, dividing the containing vessel into separate compartments. Each alternate upper plate is provided with an aperture at its lower edge, and alternate lower plates are provided with apertures at their upper corners. The apertures are arranged alternately above and below the electrodes so that liquids passing through the cell converge and diverge as they pass alternately up and down through the compartments.—F. R.

Arc; Self-regulating apparatus for submitting gases and vapours to the action of the electric ——. A. A. Naville, P. A. and C. E. Guye. First Addition, dated May 22, 1909, to Fr. Pat. 350,120, Aug. 17, 1904 (this J., 1905, 1178).

The column of gas penetrating to the lower part of each chimney is divided, the lower parts of several chimneys being disposed in a single distribution case.—B. N.

Voltaic arcs burning permanently; Process for the production of ——. Badische Anilin und Soda Fabrik and Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 413,421, March 9, 1910. Under Int. Conv., April 21 and June 26, 1909.

The gas to be treated is intensely heated by establishing one or more electric arcs by means of one or more electrodes placed at the periphery of a furnace. The gas is admitted tangentially through one or more openings in the periphery, and leaves the furnace through one or more openings near the centre. A spiral movement, towards the centre of the furnace, is thus produced in the gas, which also entrains with it the electric arcs.—B. N.

Insulating material; Process of manufacture of an ——. A. Kraenzlé. First Addition, dated March 16, 1910, to Fr. Pat. 396,766, Nov. 17, 1908 (this J., 1909, 640).

The material may be composed of a mixture in variable proportions of bitumen, tar or caoutchouc, with linseed oil, gum or resin, zinc oxide or calcium carbonate, barium sulphate and carbonate of sodium or potassium.—B. N.

Insulating and elastic varnish-enamel for threads, electric cables and other applications. Debange et Cie. Fr. Pat. 413,063, Feb. 26, 1910.

Black coatings of stearine-pitch or similar substances, are obtained on metals, by heating the object to be coated to the point at which polymerisation of the pitch occurs, thus fixing the material whilst retaining its brilliancy and elasticity. The stearine pitch may be dissolved in benzene, alcohol, carbon tetrachloride, or other solvent in order to obtain thin layers, either single or multiple, or the covering may be accomplished by heating the pitch without a solvent.—B. N.

Furnaces; Electric induction ——. J. E. Evans-Jackson, London. From A. Hiorth, Christiania. Eng. Pat. 24,302, Oct. 22, 1909.

See Fr. Pat. 403,038 of 1909; this J., 1909, 1318.—T. F. B.

Furnaces; Method of charging electric resistance ——. A. Petersson, Odda, Norway. Eng. Pat. 27,674, Nov. 27, 1909. Under Int. Conv., Jan. 7, 1909.

See Fr. Pat. 408,397 of 1909; this J., 1910, 638.—T. F. B.

Furnaces; Electric ——. J. Härdén, Assignor to Grondal-Kjellin Co., Ltd., London. U.S. Pats. 967,908 and 967,909, Aug. 23, 1910.

See Eng. Pats. 26,251 and 26,266 of 1909; this J., 1910, 763 and 885.—T. F. B.

Filament or resistor for heating units or lamps. Eng. Pat. 18,954. *See* IIb.

Electrode for [mercury] vapour lamps. U.S. Pat. 965,900. *See* IIb.

Electrolytic manufacture of bleach liquors. Eng. Pat. 23,629. *See* VI.

XII.—FATS; OILS; WAXES.

Detecting and determining cocoanut oil in butter and margarine. Shrewsbury and Knapp. *See* XIXa.

Patents.

Marine soap; (detergent composition containing sodium carbonate, alumina, and silica, suitable for cleansing all kinds of articles, and for use with sea water, selenitic waters and fresh water). L. Soulier and G. Reisdorff. Fr. Pat. 413,964, March 11, 1910.

A detergent composition, termed "savon de mer," which can be used with sea water or hard waters, is prepared by thoroughly incorporating 42 parts of an impalpable powder of the composition "$26SiO_3H_2 - 6Si$ anhydrous $+ 4Al_2O_3.2H_2O. + 6Al_2O_3$." with a solution of 8 parts of anhydrous sodium carbonate in 50 parts of water, together with a sufficient quantity of the following compounds:—"$(CH_3)_2Cl$, $C_{20}H_{18}O_2$, and $n(C_6H_{10}O_5)$." The preparation is put upon the market in the forms of a powder, liquid, paste, solid bar, etc.—C. A. M.

Alkaline solvents, completely soluble in water, with basis of chlorinated hydrocarbons of the ethane and ethylene series, and their manufacture. Nauton frères et de Marsac, and T. F. Tesse. Fr. Pat. 413,572, May 29, 1909.

See Eng. Pat. 14,725 of 1909; this J., 1910, 437.—T. F. B.

Albumose soap; Process for the manufacture of ——. P. Runge, Hamburg, Germany. U.S. Pat. 968,423, Aug. 23, 1910.

See Eng. Pat. 22,441 of 1908; this J., 1909, 373.—T. F. B.

Soap; Process for the manufacture of bleached ——. F. Wiedermann, Assignor to Verein. Chem. Werke, Charlottenburg, Germany. U.S. Pat. 968,438, Aug. 23, 1910.

See Fr. Pat. 377,720 of 1907; this J., 1907, 1099.—T. F. B.

Apparatus for testing lubricating products. Fr. Pat. 413,996. *See* XXIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Basic lead carbonates; Theory of the ——. L. Falk. Chem.-Zeit., 1910, **34**, 937—938.

The author discusses further the probable constitution of the several basic lead carbonates (this J., 1910, 768, 769). He considers that these may be arranged in two series of homologous compounds according to the number of carbonic acid residues they contain. To the first series belong the polymeric compounds, $2PbCO_3,Pb(OH)_2$; $4PbCO_3,2Pb(OH)_2$; etc., containing an even number of carbonic acid residues. They are obtained only at relatively high temperatures by the decomposition of higher basic carbonates or by the hydrolysis of normal carbonate, and form the chief constituent of white lead produced by the chamber process. The second series comprises the compounds, $PbCO_3,PbO$; $3PbCO_3,Pb(OH)_2,PbO$, and $5PbCO_3,2Pb(OH)_2,PbO$, containing an odd number of carbonic acid residues. They are considered to be formed by the addition of one or more molecules of $2PbCO_3,Pb(OH)_2$ to the hypothetical compound, $PbCO_3,PbO$. They are stable only in the cold, or at moderate temperatures. The most stable of them, $5PbCO_3,2Pb(OH)_2,PbO$, forms the chief constituent of white lead prepared by the Dutch or Russian methods (*loc. cit.*). The author has observed that whilst the several kinds of commercial white lead are attacked strongly by hydrogen sulphide, this gas has only a slight action on crystallised basic lead carbonate. White lead made by the chamber process which has been shown previously to contain both crystallised and amorphous basic lead carbonate is less affected by hydrogen sulphide than any other kind of white lead made by a cold process. —A. S.

Manila copal. G. F. Richmond. Philippine J. Sci., 1910, **5**, 177—201.

Manila copal as exported from the Philippine Islands is obtained from a large coniferous tree, *Agathis alba* (Lam.). Some is found in large masses among the roots of the trees, but by far the greater quantity is obtained by "blazing" the trees. It is graded for the market according to cleanness, colour, and the size of the lumps. It is used commercially almost exclusively as an ingredient of oleo-resin varnishes. Chemically, it consists essentially of free amorphous acids, a volatile hydrocarbon, a neutral saponifiable substance, probably a lactone, and an unsaponifiable resin. The free acids appear to bear no relation to each other, or to the known resin acids of other coniferous resins. Over 80 per cent. of the crude resin is soluble in dilute aqueous solutions of the fixed alkalis, and is precipitated as a pale yellow, amorphous resinous solid when the alkaline solution is neutralised. The author has separated three different resin acids. One, which forms about 4 per cent. of the original resin, is a white crystalline body melting at 185° to 187° C. It is monobasic, and has the formula, $C_{10}H_{15}O_2$. The second is amorphous, monobasic, and has the formula, $C_{22}H_{34}O_4$. The third, which however, was not obtained pure, corresponded to a monobasic acid of the formula, $C_{32}H_{50}O_4$. The author has investigated the changes which occur when Manila copal is fused in an open receptacle over a free flame. Samples heated to 275°C. and 300°C. melted to homogeneous mobile liquids, losing about 16 per cent. by weight. The melted resin differed from the raw resin only in the amount and nature of the unsaponifiable portion, and consequently the resin which enters into varnish manufacture consists essentially of free acids of the same composition as they had when in the original copal. In view of this fact, the author attempted to form varnishes without previously heating the resin in the customary way. It was found that raw or boiled linseed oil, containing the free, mixed fatty acids of linseed oil in the proportions of 10 to 30 per cent., formed homogeneous solutions with raw or fused Manila copal when the latter was added "in the proportion of 10 to 30 gallon varnishes" and heated for a time at a maximum of 200° C. When the turpentine was added before the oil, the boiling point of turpentine, 155° to 165° C., was sufficiently high to effect complete solution with the exception of such foreign matter as was present in the resin. The subsequent addition of turpentine to the oil and resin did not produce any cloudiness. The varnishes thus prepared gave good permanent surfaces when applied to wood. The author concludes, therefore, that the changes which take place during the cooking of varnish are largely changes in the oil rather than in the resin.—T. St.

Manila copal; Destructive distillation of ——. B. T. Brooks, Philippine J. Sci., 1910, **5**, 203—217.

When Manila copal is subjected to destructive distillation, decomposition takes place in two stages. The first is characterised by much frothing and lasts until the temperature has risen to about 330° C. The mass then becomes fluid, and appears to boil quietly, resin oil distilling in large quantity. The loss in weight during the first stage amounts usually to 12—14 per cent. of the original sample. The products of distillation are carbon dioxide (3·2 per cent.,) water (2·4 per cent.), terpenes (1·5 to 11·2 per cent.), and resin oil (3·0 to 6·0 per cent.). Besides these, the author has identified carbon monoxide and gaseous hydrocarbons; formic and acetic acids; formaldehyde, acetyl-formaldehyde, furfuraldehyde, methyl alcohol, and acetone. The water evolved is undoubtedly a product of decomposition. The terpenes consist of pinene, limonene, dipentene, β-pinene, and camphene. In discussing the effect of heating Manila copal, with regard to the manufacture of varnish, the author considers that the loss of these bodies does not affect the solubility of the copal in linseed oil to any considerable extent. The important thing, he considers, is the production of copal oil. The saponification values of melted copals are always lower than those of the original copals, and the decrease depends upon the duration and temperature of fusion. The author has found that copal oil is formed at the common working temperature of varnish manufacture, and that it assists in the solution of the resin in linseed oil. Samples of melted resin containing much oil may be mixed with larger quantities of linseed oil without separating on cooling, than those having only a small amount. This the author showed by partially removing the oil from a sample of melted resin, under reduced pressure, and adding linseed oil slowly to the residue until drop tests showed a marked cloudiness. The removed oil was then re-added, and the hot mixture stirred for several minutes. Drop tests then showed no cloudiness on cooling, and small test-tube samples, taken before and after thinning with 25 c.c. of turpentine, remained perfectly clear after cooling. The formation of copal oil is much more rapid at a temperature of 320° C. or above, than it is at 300°C. Between 320° and 360° C. large quantities of oil distil from the melt. The author gives the solubilities of Manila copal in several of the more common solvents.—T. St.

Manila copal; Oxidation of —— by the air. B. T. Brooks. Philippine J. Sci., 1910, **5**, 219—227.

Manila copal, when exposed to air, rapidly absorbs oxygen, and the absorption is accelerated by sunlight. Copal which has been thus exposed gives off carbon dioxide at ordinary temperatures, or when gently heated, and gives the reaction for peroxides. Unexposed samples do neither.

The saponification value of a copal is also increased by such exposure. The formation of carbon dioxide at low temperatures cannot be accounted for by the decomposition of a carboxyl group, though this is probably the explanation of the copious evolution of carbon dioxide when Manila copal is strongly heated. Besides carbon dioxide, the author has found that formic acid, formaldehyde and hydrogen peroxide are also products of the oxidation of Manila copal. The probable explanation of these observed facts is that the primary effect of oxidation is the formation of organic peroxides. These then undergo decomposition giving rise to secondary products.—T. St.

Oleoresin of Pinus insularis Endl. B. T. Brooks. Philippine J. Sci., 1910, **5**, 229—231.

With the view of determining the commercial value of the resin derived from *Pinus insularis* Endl., the author has subjected samples to distillation, and examined the products. The oil was found to consist for the greater part of ordinary pinene, 96 per cent. distilling between 154° and 165·5° C. The colophony remaining after the distillation of the turpentine was proved to contain over 90 per cent. of abietic acid. The turpentine and colophony from *Pinus insularis* Endl. are thus practically identical with those produced in America.—T. St.

Japanese lacquer industry. H. Pudor. Z. öffentl. Chem., 1910, **16**, 315—321.

An historical review of somo 21 varieties of Japanese lacquer with their physical characters and uses. Japanese lacquer is the juice of a tree (*Rhus vernicifera*) from which it is obtained by making incisions in the trunk and branches and collecting the exuding liquid in bamboo tubes. Only one side of the tree is cut at a time. The best juice is obtained when the tree is from 14 to 15 years old; trees of from 40 to 50 years are cut down to the roots from which new shoots then grow. The best lacquer comes from the Yoshino district of Yamato and is classified under three heads dependent on its mode of preparation. The best (Ki-urushi) occurs between the outer and inner barks of the trunk; the yield from a single tree is very small and the quality deteriorates if tapping is performed more frequently than once every two years. The second quality (Seshime-urushi) is obtained by steeping the branches and twigs for a month in water, after which incisions are made and the gum caused to exude by warming the water; it is not of such good quality and being harder is used for ground work. The third (Mokuyshi) is a still poorer form which is mixed with Ki-urushi before this is put on the market. The best Yoshino-urushi thus obtained contains 40 per cent. of Mokuyshi while inferior qualities contain up to 70 per cent. The preparation of the lacquer consists in filtration and subsequent drying; the product is then mixed with an oil (Ye-no-abura) and coloured with suitable pigments. (See also this J., 1909, 318, 532, 1212; 1910, 639.)
—B. G. McL.

Mineral paints; Production of —— in the United States. U.S. Geol. Survey. Oil, Paint, and Drug Rep., Aug. 29, 1910. [T.R.]

In 1909 the total production of the natural pigments—ochre, umber, sienna, metallic paints, mortar colours, slate and shale—reported to the Survey amounted to 61,137 short tons, valued at $613,133 as compared with 49,853 short tons, valued at $536,344, in 1908, an increase of 11,284 short tons in quantity and of $76,289 in value.

Ochre.—The quantity of ochre reported to the Survey as having been mined in the United States in 1909 was 14,310 short tons, valued at $137,880; in 1908 there were reported as produced 17,019 short tons, valued at $156,360. Aside from the demand for ochre in the paint trade, there is generally a good market for it in the manufacture of oil-cloths and linoleums.

Umber and sienna.—The combined production of umber and sienna in 1909 amounted to 1,546 short tons, valued at $43,872, as compared with 2,756 short tons, valued at $70,996 in 1908.

Metallic paint and *mortar colours* are red and brown oxides, produced either by grinding the mineral found in the natural state or by roasting iron carbonate. The production of metallic paint and mortar colours in 1909, as reported to the Survey, amounted to 37,034 short tons, valued at $372,499, a large increase over the 1908 production, which was 25,250 short tons, valued at $268,968.

The important pigments made directly from ores of volatile metals are zinc oxide, leaded zinc oxide, zinc-lead, sublimed white lead, and sublimed blue lead. The ores utilised in making these pigments are the franklinite ores of New Jersey, the sphalerite and galena ores of the Mississippi Valley—mined in the Platteville district of Wisconsin and the Joplin district of Missouri, Kansas, and Oklahoma—and the sulphide, carbonate, and silicate ores of zinc and lead produced in Colorado and New Mexico.

Zinc oxide.—The production of zinc oxide in 1909 as reported to the Survey was 68,974 short tons valued at £6,156,755, as compared with 56,292 short tons, valued at $5,072,460, in 1908.

Zinc-lead.—The production of zinc-lead, including leaded zinc oxide, in 1909, was 7,655 short tons, valued at $634,714, as compared with 8,430 short tons, valued at $778,200 in 1908.

Sublimed white lead.—In 1909 there were produced in the United States 9,915 short tons of sublimed white lead, valued at $1,070,820, an average value of $108 per ton; in 1908 the production amounted to 9,100 short tons, valued at $973,700, an average value of $107 per ton.

Sublimed blue lead.—There were 981 short tons of sublimed blue lead produced in 1909, valued at $101,043, as compared with 1,311 short tons, valued at $121,923, in 1908.

Under the heading "*Chemically manufactured pigments,*" are grouped the important lead pigments made from pig lead and lead compounds, and such minor pigments as lithopone and Venetian red, both of which are chemically precipitated from mineral salts. Much of the material now sold as Venetian red, however, instead of being precipitated from ferrous sulphate and calcium hydroxide, is made in several ways, such as by calcining both pyrites and a mixture of ferrous sulphate and terra alba, and also by grinding natural red iron oxide with a white base, such as ground oyster shells. The total production of this group of pigments increased in quantity from 182,364 short tons in 1908 to 211,687 short tons in 1909, and in value from $20,708,940 in 1908 to $24,253,620 in 1909.

Basic carbonate white lead.—The production of basic carbonate (corroded) white lead in 1909, as reported to the Survey, was 148,099 short tons, valued at $18,205,082. This includes white leads produced by both the Dutch process and the mild process. Of this total 115,259 short tons, valued at $14,736,360, were sold in oil, and 32,840 short tons, valued at $3,468,722, were reported sold dry.

Red lead.—The production of red lead rose from 16,720 short tons, valued at $2,065,202, in 1908, to 19,103 short tons, valued at $2,335,799, in 1909.

Litharge.—In 1909 litharge was produced to the extent of 20,690 short tons, valued at $2,363,002, as compared with 15,542 short tons, valued at $1,887,506, in 1908.

Orange mineral.—Orange mineral likewise showed an increase in output, there being produced in 1909 590 short tons, valued at $98,723, as compared with 397 short tons, valued at $65,498, in 1908.

The production of *lithopone* in 1909 was reported as 14,847 short tons, valued at $1,105,281, as compared with 8,292 short tons, valued at $639,483 in 1908.

Venetian red.—The production of Venetian red in 1909 amounted to 8,358 short tons, valued at $145,733, as compared with 8,825 short tons, valued at $159,650 in 1908.

Patents.

Substitute for white lead; Process of making a white and harmless ——. G. de Velna and C. Folie-Desjardins de Cool. Fr. Pat. 413,275, March 4, 1910.

A substitute for white lead, which is to be termed "*blanc de France,*" is obtained by precipitating aluminium carbonate in a gelatinous form by mixing together solutions of ordinary alum and sodium carbonate. This precipitate is mixed with a suitable proportion of calcium carbonate, magnesium carbonate, or other white non-poisonous powder, and the mixture dried, powdered, and incorporated with linseed or poppy oil. It is stated that painting done with this pigment remains brilliant without the application of varnish.—C. A. M.

Oxides of lead and white lead ; Process and apparatus for the manufacture of ——. J. W. Bailey. Fr. Pats. 413,507 and 413,508, March 11, 1910. Under Int. Conv., March 12, 1909.

Metallic lead is oxidised by means of oxygen in the presence of water at about 100° C., the moist particles being meanwhile vigorously agitated. Or the moist finely divided lead may be made to circulate in an atmosphere of air at a temperature near that of boiling water, the water being thus decomposed and giving up its oxygen to the lead. According to the duration of the process the oxide or dioxide of lead is produced. These oxides are then treated with carbon dioxide and an acid to obtain white lead. The apparatus claimed for this purpose consists essentially of a rotatable drum, into which is introduced the moist granulated lead, this drum being divided into several compartments in such a manner that its contents can only pass through it in one direction. The communications between each compartment are covered with wire gauze of constantly diminishing mesh, so that only particles of a certain size can pass through. An energetic agitation of the particles is effected by means of radiating arms revolving at high speed within the drum, and in the opposite direction to the latter. The friction produces sufficient heat to decompose part of the water. A channel may also be provided in the axle, so that, if desired, carbon dioxide and an acid may be introduced during the rotation.—C. A. M.

Lakes ; Process for preparing bluish-green ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 224,442, July 28, 1909.

Bluish-green lakes, fast to water, acids, alkalis, lime, spirit, and oil, and very fast to light, are obtained by the usual process of lake-making from the dyestuffs produced by the action of ferric salts on sulphonic acids of 1.2-naphthylenediamine in which the 8-position is unoccupied. —T. F. B.

Iron-gall colours for inking ribbons, stamp-pads, drawing inks, etc. ; Process for the preparation of ——. E. Beyer. Ger. Pat. 224,637, Oct. 3, 1909.

By the action of aldehydes, especially formaldehyde, on ammonium ammoniumoxyferrigallate or analogous ferro- or ferri-gallic acid compounds (see this J., 1908, 974), insoluble precipitates are obtained, which after washing and drying, are mixed in the usual manner with oil and glycerin, or with an aqueous shellac solution for the production of stamping and drawing inks, etc.—A. S.

Resinous substances ; Apparatus for the purification and filtration of ——. G. Col. Third Addition, dated Feb. 11, 1910, to Fr. Pat. 378,965, June 18, 1907 (this J., 1907, 1207).

The apparatus may be so modified as to permit of the fusion, purification and filtration of the resinous substances being carried out in a closed receptacle under the influence of diffused steam, at a pressure varying with the season and the nature of the substances under treatment. —C. A. M.

Transfer papers and products obtained therefrom ; Manufacture of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 413,562, March 12, 1910. Under Int. Conv., March 31, 1909.

Transfer papers made with mineral or lake colours and an aqueous medium, such as gum, when applied to an oil-painted ground, *e.g.*, in graining painted wood or marbling walls, possess the drawback of causing the oil paint to crack after a longer or shorter period of exposure. In the present specification the use of a soapy medium is claimed for carrying the water-colour transfers. This kind of medium entirely prevents the cracking of the paint, and the transfers may be used several times. A suitable coating for transfer is composed of 50 grms. of rosin, 12 grms. of sodium carbonate, 350 grms. of water, boiled with the occasional addition of water, then incorporated with 250 grms of "heavy spar" 50 grms. of *caput mortuum* and 25 grms. of Fast Brown ("Brun solide").—J. F. B.

Ultramarines ; Apparatus for manufacturing artificial ——. J. Luciani, Paris. U.S. Pat. 968,172, Aug. 23, 1910.

See Fr. Pat. 399,211 of 1908 ; this J., 1909, 992.—T. F. B.

Pigment. A Lüttringhaus, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 968,376, Aug. 23, 1910.

See Eng. Pat. 18,618 of 1908 ; this J., 1909, 532.—T. F. B.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber growing in Demerora, British Guiana. J. B. Harrison and F. A. Stockdale. Official Gazette, July 13, 1910, pp. 29—34.

The results of trials by the Department of Science and Agriculture are given in detail, and may be summarised as follows :—(1) *Castilloa elastica* has failed at all stations. (2) *Funtumia elastica* has entirely failed on the heavy clay of the Botanic Gardens, but appears to be succeeding on sandy loam at Onderneeming School farm, and on the laterite hill slopes at Issorora. (3) *Hevea brasiliensis* does fairly well on clayey loams at Onderneeming, very well on pegassy-clay bottom lands at Issorora, not so well on the laterite hill slopes, and not at all well on the heavy clay of the Botanic Gardens, typical of abandoned coastal sugar lands. A certain amount of success has been achieved with young plants in clay soil at Christianburg. Protection from wind, "topping" at about 12 to 15 feet, and planting in well-drained, fully cleared land and not under shade, are advisable for rapid growth and development of girth. (4) *Sapium Jenmani* grows vigorously on the Issorora pegassy-clay lands, and well on "Moran-reef" soil at Christianburg. It is a failure on the wind-swept coastal lands. As in the case of *Hevea*, planting in fully-cleared, well-drained land is advisable. Careful pruning to obtain well formed trees is necessary from the earliest stages, and the liability of the tree to scale necessitates spraying, and points to the desirability of planting in 50 to 100 acre sections, separated by forest belts.—E. W. L.

Patents.

Rubber ; Treatment of old or waste vulcanised —— *for the recovery of rubber therefrom.* C. Dreyfus, A. Friedl, W. H. Bentley, and The Clayton Aniline Co. Ltd., Manchester. Eng. Pat. 29,864, Dec. 21, 1909.

500 lb. of finely comminuted vulcanised waste are mixed with 2000 lb. of 10 per cent. sulphuric acid, the mixture is agitated for 24 hours, and then boiled for 6 hours. Fibrous matter and a portion of the inorganic constituents are thus removed. The residue is washed with water and boiled for 3—5 hours with 1500 lb. of 10 per cent. sodium hydroxide, a further portion of the inorganic constituents, including all the uncombined sulphur, being thus eliminated. The residue is washed, pressed, dried, mixed with 3—5 times its weight of aniline (or a homologue thereof), and heated until agglomeration of the mass takes place, at a temperature of 140°—170° C. The mixture is agitated during the heating process. The agglomerated mass is pressed to free it as far as possible from aniline, etc., the last portions of which are removed by means of any suitable pressing or washing machine. Rubber of high resiliency is obtained by this process.—E. W. L.

Rubber and guttapercha ; Manufacture of pure —— from crude rubber, crude guttapercha, and the like. W. Elsner and O. Meyer, Hanover, Germany. Eng. Pat. 9588, April 20, 1910. Under Int. Conv., Nov. 18, 1909.

"Acetone oils," a mixture of aliphatic ketones obtained as a by-product in the manufacture of acetone, is used for the extraction of the resins from such low-grade raw materials as "dead Borneo," "Palembang," "Flakes," "Guayquil," etc. The advantages claimed for the use of this solvent are:—(1) The water present in the raw material does not pass into the acetone oils during extraction but settles under them and can be readily and completely separated from the resin solution. (2) and (3) Water or alkaline solutions may be added during extraction for the purpose of removing soluble impurities such as vegetable acids, salts, albumin, etc., which are insoluble in acetone oils. (4) The acetone oils have no injurious effect on the human skin. The process of extraction is favourably influenced by the addition of alcohols, esters, etc.—E. W. L.

Rubber waste ; Process for devulcanising and reclaiming ——. E. E. A. G. Meyer, Detroit, U.S.A. Eng. Pat. 23,110, Oct. 9, 1909.

See U.S. Pat. 936,468 of 1909 ; this J., 1909, 1149.—T. F. B.

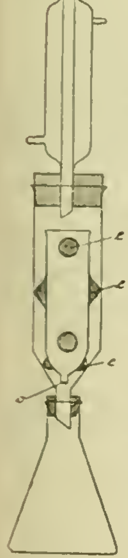
Rubber; Machine for reducing vulcanised —— to powder. T. Gare, New Brighton. U.S. Pat. 969,100, Aug. 30, 1910.

See Eng. Pat. 22,893 of 1908 ; this J., 1909, 1051.—T.F.B.

Rubber or analogous substances ; Manufacture or purification of ——, and production of by-products. C. Dreyfus, A. Friedl, W. H. Bentley, and The Clayton Aniline Co., Ltd. Fr. Pat. 413,800, March 17, 1910. Under Int. Conv., Nov. 22, 1909.

See Eng. Pat. 27,130 of 1909 ; this J., 1910, 1069.—T. F. B.

XV.—LEATHER ; BONE ; HORN ; GLUE.



Tannin extraction : Apparatus for ——. G. Grasser Collegium, 1910, 345—347.

The disadvantages of Procter's sand filter extractor are clogging, and inefficient extraction. Tho apparatus used by the author obviates these difficulties. It consists of two copper cylinders as shown (see Fig.), the inner one being supported by the projections, *c*. The extremity, o, is closed with a small pad of cotton wool. The material is packed in the inner tube, and a litro flask is attached to the outer one. Water of a temperature rising gradually from 25° to 60° C. is poured on until the volume of the extract reaches 400 c.c. when the litre flask is replaced by an Erlenmeyer flask containing 250 c.c. of water and the condenser is attached. Extraction is then continued for one hour and the extract is added to the original, the operation being repeated until the material is exhausted. For spent materials the first operation may be omitted, a single boiling with 300 c.c. of water being sufficient.—A. T. H.

Goatskins ; The disinfection of —— in the Rubner apparatus. H. A. Gins. Gerber, 1910, 36, 239.

The skins are treated with a mixture of steam and formaldehyde at 60° C. and 160 mm. of mercury pressure. The conclusion arrived at is that the process is unsuitable for the treatment of skins because of the high temperature, but that it is both efficient and convenient for the treatment of hair. Where anthrax is not suspected it is sufficient to treat the hides with a 2 per cent. solution of formaldehyde ; but for goods infected with anthrax a 4 per cent. solution must be used. This does not injure the hide, since the grain is protected by the epidermis, and the flesh by the subcutaneous tissue, which, although affected by the treatment, are removed after liming.—A. T. H.

Patents.

Leather ; Process of dyeing ——. A. Bühler. Fr. Pat. 412,862, Feb. 19, 1910.

This process has reference to a method for obtaining watered or flaming effects. The leather is first dyed with a ground colour, folded in pleats and hung up to dry ; while still damp they are slightly stretched, care being taken not to remove the folds. The parts of the leather in relief are then lightly stained with a pad soaked in an aniline dye ; this top colour should be distinct from the ground colour.—A. T. H.

Leather ; Preparing chrome-tanned —— for making glue. K. Stiepel, Hanover, Germany. Eng. Pat. 3437, Feb. 11, 1910.

Two slightly different processes are described : (1) The waste chrome leather is cut up into pieces and heated in a 0·2 per cent. solution of hydrochloric or sulphuric acid to a temperature of 50° to 100° C. The leather is "untanned" almost instantaneously, the insoluble chromium salt, $Cr_4(SO_4)_6.Cr_8O_1$, present in the leather, being converted into the soluble sulphate, $Cr_2(SO_4)_3$. The chrome liquor is then drawn off, and the "untanned" leather washed with water. (2) The waste leather is soaked for 24 hours in a cold 2 per cent. solution of hydrochloric acid, containing a sufficient quantity of barium chloride to convert the sulphuric acid present in the waste leather into barium sulphate. The chromium is thus converted into soluble normal chromium chloride which is removed by washing with water.—E. W. L.

Stripping leather ; Process for ——. A. G. Manns. Fr. Pat. 413,613, March 15, 1910.

The patent covers a process for the removal of chromium salts from the leather prepared with them, in such a manner as to reduce it again to pelt. Chrome leather waste may be so treated and then made into glue. The leather is first thoroughly soaked in hot water and then treated for from 6—12 hours with saturated lime water, or other weak alkali. It is then freed from this, as far as possible, by washing in water and afterwards treated with a weak acid solution to dissolve out the chromium salts ; a 1—2 per cent. solution of sulphuric acid or sulphurous acid is suggested. From this solution the chromium salts may be recovered. The material is again washed, neutralised by a second treatment with lime water or weak alkali, and finally washed with water.—A. T. H.

Deliming skins ; Process for ——. E. Simon. Fr. Pat. 413,635, March 15, 1910.

This process of deliming is distinct from others in that oxygen and powdered castor seeds are employed for the purpose. The oxygen may be introduced in any form ; either in the gaseous or fluid state, or by generation from peroxides.—A. T. H.

Tanning extract ; Process for manufacture of —— from sulphite-cellulose liquors. M. Hönig. Fr. Pat. 413,849, March 19, 1910. Under Int. Conv., April 19, 1909.

The lye obtained from the treatment of cellulose with calcium bisulphite is analysed ; from the analysis is calculated the quantity of sulphuric acid necessary to decompose the esters and salts of sulphurous acid which are present, and to partly liberate the sulphonic acids of lignin, present largely as calcium salts. After the addition of the sulphuric acid, the solution is filtered through tanning material to remove iron, and then concentrated.—A. T. H.

Process for obtaining sebacate of calcium or barium from glue works residues. G. Napp. Fr. Pat. 413.509, March 11, 1910.

From the muddy residues remaining in glue works boilers, calcium or barium sebacate may be prepared by digesting the material in an open, or closed vessel with quicklime, or barium hydroxide. The salt is separated from other matters by flushing the digested mass with water and passing it over a series of sieves.—A. T. H.

Gelatine and other liquors; Apparatus for clarifying ——. J. H. Utley, Camden, N.J., U.S.A. Eng. Pat. 14,360, June 14, 1910. Addition to Eng. Pat. 28,297 of 1909, dated Dec. 12, 1908.

See U.S. Pat. 961,180 of 1910; this J., 1910, 892.—T.F.B.

XVI.—SOILS; FERTILISERS.

Soil; Testing the capacity of a —— to decompose cellulose. H. R. Christensen. Zentr. Bakt. u. Parasitenk., 1910, II. Abt., **27**, 449—451. Chem. Zentr., 1910, 2, 683.

A quantity of the soil representing 50 grms. of dry substance is placed in a 300 c.c. Erlenmeyer flask in such a way that it forms a level, loosely packed layer covering about four-fifths of the surface of the bottom of the flask. On to the uncovered part distilled water is introduced from a pipette and allowed to soak into the soil until the latter is nearly saturated. Two strips of ash-free filter-paper are then laid on the wet soil. After some time the paper is seen to be attacked; the cellulose is gradually transformed into a viscous gray slime or mucilage in which the cellulose-splitting microbes are contained. When the decomposition of the cellulose is effected by mould-fungi, a black coloration is produced, but there is no formation of mucilage.—A. S.

Calcium cyanamide, Chile saltpetre and ammonium sulphate; Action of ——. J. J. Vanha. Biedermann's Zentralbl., 1910, **39**, 524—532.

The author describes five series of experiments.

I. Comparison with sugar beet on a heavy clay soil of the three manures applied to the extent of 40 kilos. of nitrogen per hectare (35·6 lb. per acre) with and without potash, phosphoric acid and lime. The effect of the nitrogen was not very pronounced though the cyanamide seemed to be less efficient than either the ammonium sulphate or the sodium nitrate. II. The effect of cyanamide corresponding to 60 kilos. of nitrogen per hectare (53·4 lb. per acre) on sugar beet on different soils, together with the effect of firmly rolling in the seed after sowing, leaving the soil between the drills untouched and loose. The four soils chosen were a sand (29 per cent. of clayey matter), a calcareous soil (52 per cent.), a clay (61 per cent.) and a loam (38 per cent.). The sand was produced from the clay by washing and the calcareous soil by adding chalk, the loam being from another source. In all cases the effect of the rolling was very marked, though without nitrogen the increase was principally in the head and leaves. In the sandy soil the effect directly traceable to the cyanamide was nil, and in the chalk the effect of the manure was trifling compared with that of the rolling. The clay and the loam however, which give the best actual crops give also the best response to the manure. The percentage of sugar in the roots was scarcely affected by the cyanamide and only slightly reduced by the rolling treatment. III. Comparative small scale experiments with wheat in a loamy clay soil, the different nitrogenous manures being applied at the rate of 40 kilos. of nitrogen per hectare (35·6 lb. per acre). The saltpetre and the sulphate were used both with and without an amount of lime equal to that in the cyanamide. The results are summarised in the table.

Fertiliser.	Improvement in yield. Chile saltpetre = 100	Av. length of stalk, = 76·73 cm. without fertiliser.	Weight of 100 cm. of stalk in grms.	Percentage of grain from plants, = 39·90 without fertiliser.
Chile saltpetre	100	100·87	1·054	34·81
Ammonium sulphate	96	98·36	1·052	36·09
Calcium cyanamide	89	100·36	0·958	36·64
Chile saltpetre and lime ..	97	103·95	0·964	35·54
Ammonium sulphate and lime	99	102·46	—	35·21

IV. The same soil a year later planted with barley without any further nitrogen gave the following relative efficiencies: Chile saltpetre, 100; ammonium sulphate, 99; cyanamide, 97; Chile saltpetre and lime, 84; ammonium sulphate and lime, 91. The striking effect of lime with the saltpetre is probably due to its rendering the phosphates of the soil insoluble. V. The influence of the mechanical state of the soil on wheat production with calcium cyanamide. By mechanical separation of a soil and reconstitution in new proportions seven soils of the same origin with from 15 to 85 per cent. of clay were prepared. In all these soils the cyanamide improved the yield of grain, the length of stalk and the weight of 1000 corns. The effect was most marked in the less fruitful lighter soils, the yield being increased by 165 per cent. in the one containing only 15 per cent. of clay. Two natural soils, one sandy, the other a rich loamy calcareous clay also gave favourable results, though they were not so much in need of nitrogen as the reconstituted soils. In all cases the protein content of the dry grain was somewhat diminished by the use of the cyanamide.—W. H. P.

XVII.—SUGARS; STARCHES; GUMS.

Beet; Determination of the dry substance and marc content of the ——. K. E. Skärblom. Z. Ver. deut. Zuckerind., 1910, 931—951.

It is shown that in determining the amount of dry substance in beets or exhausted slices by the ordinary desiccation process the use of sand is unnecessary, whether the sample be prepared by pressing, rasping, or chopping. After examining the different methods which have been proposed for determining the marc content of the beet, the author gives preference to the following: 10 grms. of the finely divided sample are well mixed with 40 c.c. of cold water, and thrown on a filter, the filtrate being returned until free from fine particles of marc. The residue is washed with boiling water until the a-naphthol test shows it to be quite free from sugar, after which 20 c.c. of alcohol (at least 90 per cent.) are poured over it. Finally the filter is placed in an oven at 100°—102° C., and dried to constant weight.—J. P. O.

Sugar-beets; Valuation of —— on the basis of their content of "objectionable" [melassigenic] nitrogen. Friedl. Oesterr.-Ung. Zeits. Zuckerind. u. Landw., 1910, **39**, 235—239; Deutsche Zuckerind., 1910, **35**, 673.

Andrlik and Urban (this J., 1905, 808; 1906, 385) have already shown that the quotient of purity of the various factory juices should, with the aid of certain constants, be calculable from the content of melassigenic nitrogen in the beet. The author has investigated 130 samples of beet, and finds that there is a marked relation between their content of melassigenic nitrogen and the purity quotient determined by Krause's method, the latter rising as the former falls, with a deviation here and there. The relationship is much more uniform between the melassigenic nitrogen content of thick juices and their purity quotient. The determination of melassigenic nitrogen can be made very accurately, and it has the advantage of rendering possible the calculation of the purity quotient of saturated juices, whilst the Krause method only gives that of unsaturated juices. Further experiments will be made to test the general applicability of the method in view of the different factory conditions likely to be encountered.—J. H. L.

Nitrogen in the beet ; A colorimetric method of determining the "objectionable" [melassigenic] ——. Friedl. Oesterr.-Ung. Zeits. Zuckerind. u. Landw., 1910, **39**, 240—246 ; Deutsche Zuckerind., 1910, **35**, 673—674.

In carrying out the estimation of objectionable nitrogen (see Andrlik, this J., 1905, 808) using Barnsteiner's solution in place of the Stutzer reagent in accordance with the proposal of Herke, the author observed that the colour intensity of the filtrate varies with the amount of nitrogen present, and that colour differences corresponding to 0·005 per cent. of nitrogen are perceptible to the eye. It is proposed to base on this a colorimetric method for determining objectionable nitrogen. The standard solution suggested is Fehling's solution to which a little Schweinfurt green has been added ; it is suitably diluted and standardised empirically. The author intends to carry out further experiments towards perfecting the process, if the determination of objectionable nitrogen should be found to give better results than Krause's method, for determining the purity quotient of beets (see preceding abstract).—J. H. L.

Calcium sucrate ; Determination of the alkalinity of ——. W. Taegener. Deutsche Zuckerind., 1910, **35**, 671.

The method of direct titration with acid, described by Frühling, gives variable results, the sample rapidly becoming alkaline again after the addition of acid has been stopped at the neutral point. The author attributes this to impurities originally present in the lime, such as the isomorphous carbonates of calcium, magnesium, iron and manganese, and decomposition-products of silicates. As the neutral point is approached in titrating with acid, these may become partially hydrolysed or may pass into solution as bicarbonates owing to the carbon dioxide liberated by the acid ; the effect, in either case, is to increase the apparent amount of lime in the sample. The author recommends the following procedure :—5 grms. of the sample are heated for an hour with 100 c.c. of water to decompose the calcium sucrate, and then filtered hot, the impurities mentioned being thereby removed. Excess of $N/5$ or $N/2$ hydrochloric acid is added to the hot filtrate and the excess determined by titrating back with caustic soda, using phenolphthalein as indicator. One c.c. of $N/1$ acid corresponds to 0·028 grm. of calcium oxide in the sample.—J. H. L.

Sucrose ; Determination of —— in cane molasses. N. Deerr. Bull. No. 31, 1910, Agric. and Chem. Series. Expt. Station, Hawaiian Sugar Planters' Assoc.

In a study of the various sources of error attendant on the Clerget process of determining sucrose in cane molasses, it is claimed that in taking the direct reading any appreciable influence exerted by the volume of the lead precipitate may be eliminated by using a one-sixth normal sugar weight solution, the error of observation thus introduced being overcome by reading in a 60 cm. tube, whilst the effect of the basic lead acetate on the lævulose may be obviated by the addition of acetic acid or aluminium sulphate after removal of the lead precipitate. By following the Herzfeld modification there is a considerable experimental error incident upon the small magnitude of the inversion reading, but this may be diminished by adhering to the original Clerget routine. The procedure now proposed, embodying these improvements, is as follows :—"9·881 ($26{\cdot}048 \times \frac{1}{2} \times \frac{1}{3} \times 1{\cdot}1 \times 2$) grms." of the sample are dissolved and introduced into a 200 c.c. flask, sufficient basic lead acetate added to effect the maximum decolorisation (generally 25 c.c. of solution of sp. gr. 1·26), the liquid adjusted to volume, and filtered. To take the direct reading 50 c.c. of the filtrate are transferred to a 50—55 c.c. flask, 1 c.c. of a saturated solution of aluminium sulphate added, the liquid made up to 55 c.c., filtered, and polarised in the 60 cm. tube, the reading being multiplied by 2. For the inversion reading 50 c.c. are pipetted into a 50—55 c.c. flask, 2·75 c.c. of hydrochloric acid of 1·18 sp. gr. added, and the Herzfeld procedure followed, or 5 c.c. of hydrochloric acid are used and the original Clerget routine adhered to ; then a small amount of zinc dust is added, the liquid made up to the mark, filtered, polarised in the 60 cm. tube, and the observed reading multiplied by 2. In calculating the percentage of sucrose after following the Herzfeld modification, the correct constant is selected from the table of values found by Herzfeld, and confirmed by Ling (this J. 1898, 110), but if the Clerget procedure be adhered to, then the constant is taken from a table now given by the author. Some results obtained by this method of working indicate that although the direct reading varies according to the amount of basic lead acetate added, and in consequence also the inversion reading, the difference of the two is remarkably constant (compare also Eynon, this J., 1909, 729).—J. P. O.

Patents.

Potassium compounds [from sugar juices, molasses, vinasse, etc.] ; Separation of —— by insoluble double fluorine-salts. L. Rivière. Fr. Pat. 413,677, Dec. 8, 1909. Under Int. Conv., June 14, 1910.

Processes for removing potassium salts from saccharine liquids, etc., by hydrofluosilicic acid or soluble fluosilicates, have already been claimed (Fr. Pats. 362,654 ; 375,989 ; 385,139 ; and additions thereto ; this J., 1906, 773 ; 1907, 936, 939 ; 1908, 281, 584, 702, 869, 1076 ; 1909, 599). In the present invention, various insoluble or sparingly soluble double fluorine-salts such as fluosilicates of sodium, strontium, calcium, and barium, or fluoborates, or fluoaluminates, are used. When these compounds, which may be used in the pure state or in the form of a crude silicious magma, are introduced into solutions containing potassium salts, an interchange between the potash and the bases of the compounds occurs, the former being precipitated as potassium fluosilicate. The absorption of potash in this way is never complete, though in certain cases, it may amount to 95 per cent. or even more. The period of contact is varied according to the conditions, and the action is stopped before the interchange becomes reversed in direction. The process may be applied to the removal of potash from diffusion juice either in the diffusion battery, or, preferably, the juice is treated after it has left the battery and prior to defecation with lime. The magma containing the potassium fluosilicate is separated by filtration, pressed, washed, and regenerated, in which last operation, the potash is converted into marketable potassium carbonate. Syrups and waste liquors may be treated in a more concentrated condition than diffusion juice ; molasses may be treated directly, or after dilution, the mixture requiring constant agitation in the former case. In the case of vinasses, extracts of grape marcs, etc., the liquors are concentrated after the potash has been removed, the glycerol then being extracted with alcohol ; when the liquors have been derived from grape marcs, both glycerol and tartaric acid are extracted by the alcohol. The part insoluble in alcohol constitutes a nitrogenous manure.—L. E.

Cassava and other succulent vegetables ; Treating ——, and the manufacture of starch and other products therefrom. C. C. Moore, Washington, U.S.A. Eng. Pat. 22,655, Oct. 5, 1909.

The finely comminuted cassava is sprinkled with a solution of sulphurous acid or of a sulphite such as calcium bisulphite (preferably in the proportion of 10 lb. of calcium bisulphite per ton of material), and subsequently dried by any of the ordinary methods. This treatment not only prevents or restrains deleterious changes due to enzyme actions and thus preserves the full content of starch and sugars in the cassava, but also converts the less dense starch granules into a denser form and thus increases the yield of marketable starch. The dried product is worked up for starch by the usual methods, the separated starch liquor being utilised for the production of sugars or alcohol. Claim is also made for a dried cassava containing enzyme-restraining chemicals such as sulphites.—L. E.

Adhesive and coating material [*from yeast*]. C. Beyer. Ger. Pat. 224,443, Sept. 1, 1909.

The use of yeast which has been treated with alkalis as an adhesive and coating material is claimed.—A. S.

Adhesive substances soluble in cold water: Manufacture of —— from starch-bearing fruits, roots, bulbs, and the like. J. Kantorowicz, Breslau, Germany. Eng. Pat. 3004, Feb. 7, 1910. Under Int. Conv., Feb. 13, 1909.

See Fr. Pat. 412,377 of 1910: this J., 1910, 1029.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Malt: Re-drying of ——. Opitz and Schön. Z. ges. Brauw., 1910, 33, 425—428.

The apparatus used consists of a perforated, rotating drum fitted with steam pipes. A continuous, rippling motion is imparted to the malt as it passes through the apparatus. The steam pressure in the pipes may be about 3 atmospheres, and the apparatus deals with about 50 cwt. in 3 hours, every part of the malt being exposed to the drying process for about 10 minutes. Under these conditions, 1·5—1·7 per cent. of moisture is removed from a malt containing about 6·5 per cent. without injury to the quality of the malt: with a longer period of drying, the malt is injuriously affected, especially in respect of colour. It is not practicable to reduce the moisture-content of a stored malt to a degree lower than that of the malt as taken from the kiln. The malt leaves the apparatus at a temperature of about 80° C. (measured in the heaped malt), and is best ground at once. In comparison with the undried malt, the dried product presents several advantages; the filtration of the wort is improved, the yield of extract, calculated on dry substance, is increased by about 0·3 per cent., and beers of greater palate-fulness are obtained. It is shown that whilst the total cost of drying 25 cwt. of malt is only M. 2·4 (2s. 4·2d.) the saving in the malt tax is M. 8 (7s. 10d.), and that due to increase in extract is M. 5 (4s. 10·75d.).—L. E.

Extract of malt and the character of the beer obtained therefrom; Influence of kilning on the ——. K. Winter. Woch. f. Brau., 1910, 27, 434—435.

The author agrees with Wlokka (this J., 1910, 776) in finding that modern kilns tend to produce malts of lower extract than those from kilns of older construction, the extract being calculated on the dry malt solids. He attributes the lower extract, however, to the more thorough drying of the malt, owing to the stronger air-draught in modern kilns, rather than to higher kilning-off temperatures. Thus, from the same sample of green malt, an old kiln gave a malt of 4·34 per cent. of moisture and 80·00 per cent. of extract, whilst a modern kiln of stronger draught produced one containing 3·82 per cent. of moisture, with an extract of 79·03 per cent. The final temperature was in both cases 68° R. (185° F.), and the extracts are referred to the dry malt solids. The author considers that too much importance is at present attached to securing malts of high extract, these often having a tendency to produce worts which attenuate too far, and give beers deficient in palate-fulness.—J. H. L.

Invertase; Effect of alcohol on ——. C. S. Hudson and H. S. Paine. U.S. Dept. Agric., Bureau of Chem., Circular No. 58, July 30, 1910.

Determinations of the activity of purified invertase in inverting sucrose dissolved in ethyl alcohol of different concentrations showed that the activity is diminished by alcohol. The relation between the alcohol concentration and the activity may be represented as a logarithmic function: in weak alcohol solutions there is almost a linear relation (see O'Sullivan and Tompson, this J., 1890, 816, 1049). The destruction of invertase by alcohol follows the course of unimolecular reactions; it is not noticeable below 20 per cent. of alcohol at 30° C., is almost instantaneous at 50 per cent., and decreases to nearly *nil* at 80 per cent. of alcohol. The decrease in the rate of destruction in presence of more than 50 per cent. of alcohol appears to be due to precipitation of the enzyme. The rate of destruction of invertase by alcohol is much lower when sucrose is present, 6 per cent. of sucrose reducing the rate in 50 per cent. alcohol to about 1 per cent. of its original value. Invertase with 78 per cent. of its original activity can be precipitated by alcohol if the concentration of the latter in the final solution be approximately 90 per cent. In presence of sucrose, preparations having from 94 to 96 per cent. of their original activity can be obtained by precipitation with 70 per cent. alcohol.—A. S.

Amylase [*Diastase*]. A. Wohl and E. Glimm. Biochem. Zeits., 1910, 27, 349—375.

V. Henri has observed that in the hydrolysis of sucrose by invertase, the enzyme appears to combine, not only with the sucrose, but also with the products of hydrolysis (this J., 1902, 1546); his subsequent work on the action of trypsin on gelatin, and the results obtained by other investigators bear out this view. Hence, it seems probable that the retardation of hydrolysis observed in the action of amylase on starch, is also due to this cause without the conjunction of any reversion process of synthesis to higher carbohydrate complexes. The authors first show that if a solution containing maltose (5, 10, or 26·7 per cent.), or dextrose (13·3 per cent.), and amylase (Merck's diastase) is left to stand, under various conditions of time and temperature, no increase or decrease in the cupric-reducing power of the solution occurs, *i.e.*, there is no reversion. This is not inconsistent with the results obtained by Croft Hill (this J. 1898, 684), since this worker not only employed a different enzyme (yeast maltase), but used more concentrated solutions of sugar, and left the reacting substances in contact for a much longer period. The authors have also investigated the extent to which the saccharification of starch by amylase is inhibited by addition of various sugars; in most cases, 100 c.c. of 3 per cent. starch paste were treated with a known quantity of the sugar, made up to 200 c.c., and treated with 5 c.c. of a 1 per cent. solution of amylase. The action was allowed to go on for 1 hour at 17° C. The inhibiting effect of the various substances used is shown in the following table, the degree of saccharification of a solution to which no addition was made, being taken as unity.

Amount of sugar added to the solution.	Saccharification.	Diastatic inhibition. per cent.
10 per cent. dextrose ..	0	100
15 „ maltose ..	0	100
15 „ dextrin	$\frac{1}{4}$	75
20 „ galactose ..	$\frac{2}{3}$	33
10 „ mannose ..	$\frac{4}{5}$	20
20 „ sucrose	1	0
20 „ laevulose ..	1	0

These results accord best with the view that a combination of sugar and enzyme is responsible for the inhibition of starch-hydrolysis. The inhibiting effect of dextrin is the greater, the higher its reducing power, *i.e.*, it is effective in so far as it presents the properties of a sugar. The results also indicate that the aldose character of a sugar is the primary factor that governs the property of combining with the enzyme. Experience has shown that with solutions containing about 16 and 20 per cent. of starch, the limits of saccharification are about 80 and 67 per cent. respectively of the theoretical amount, *i.e.*, when the amylase-action ceases, or is so retarded that the increase of sugar in 1 hour becomes inappreciable, the solution contains about 13—14 per cent. of maltose, a result which agrees with that obtained by the authors. It is the complex nature of amylase-action that has given rise to the incorrect view that maltose exerts no influence on saccharification or only in concentrated solution. The authors' further experiments throw light on this subject. A saccharified solution of starch was heated in order to destroy the amylase, and subsequently fermented; the solution finally obtained, which contained 8·8 per cent. of dextrin and 4·82 per cent. of maltose, was submitted to the action of amylase, with and without addition of maltose, and similar experiments were made with more dilute solutions of dextrin and maltose. The results of these experiments show that the removal of part of the maltose (by fermentation) renders the dextrin susceptible to saccharification, that addition of maltose does inhibit the action of the amylase on the dextrin, and that this inhibiting action of maltose is exhibited at much lower concentrations when the amylase acts on dextrin than when it acts on a fresh solution of starch. The apparent equilibrium observed by Brown and Heron in the action of amylase on a dilute solution of starch is likewise due to the effect of an accumulation of maltose. The authors have also investigated the effects of various sugars, etc., in protecting amylase against the destructive influence of heat. Of the compounds examined maltose was found to exert the strongest protective action. dextrose, invert sugar, and dextrin (yellow dextrin presenting some reducing power), are less efficient, sucrose still less, and starch has the least protective action; in all cases, with increasing concentration of sugar, there is an increase of protective action, and the coagulation of protein from the heated solution is increasingly retarded. This last observation bears out the view of Brown and Heron, that weakening of the enzyme and coagulation of protein, on heating the enzyme solution, are closely related. The authors' work appears to indicate that amylase is a colloidal catalyst resembling the proteins in its chemical character. There appears to be no ground for assuming the existence of several amylases. The work of Michaelis and Ehrenreich (this J., 1908, 701) indicates that amylase has the character of an amphoteric acid in which the acid nature predominates. In the feebly acid solutions in which it is active, amylase must be positively charged. In approximately neutral solutions, starch wanders to the anode, and hence is negatively charged. It follows, that on coming together, the starch and amylase must be colloidally distributed on each other, and that a certain H-ion concentration represents an optimum at which the amphoteric amylase is so charged that an isoelectric point is attained by precipitation of the oppositely charged starch. The non-colloidal, or only slightly colloidal intermediate dextrins are adsorbed by the enzyme, and the maltose is also adsorbed. The progress of the primary decomposition of starch, and of the further formation of sugar, are dependent on the distribution of the colloidal enzyme between these possible combinations. Thus, the inhibition of saccharification by the maltose formed is not absolute, but corresponds to the reduction of free amylase-surface; again, in presence of a large excess of amylase, there is no inhibition since despite adsorption of maltose, sufficient active enzyme-surface is left. If fresh starch paste is added to a solution in which saccharification has been arrested by accumulation of maltose, the amylase attacks the added starch with almost undiminished speed; the new, heterogeneous phase (gelatinised starch) must cause a redistribution of the enzyme. The authors' theory of the mechanism of diastatic saccharification also accounts for the difference, observed by Grüss, between the influence of added maltose on the liquefying and saccharifying powers; though the added maltose may so completely bind the amylase that the dextrin is no longer perceptibly adsorbed, *i.e.*, can no longer undergo saccharification, the enzyme can still combine with the oppositely charged colloidal starch and liquefy it; that this liquefaction should be accompanied by sugar-formation speaks for the homogeneous nature of the hydrolytic agent. Again, the fact that heating affects the liquefying and saccharifying powers to different extents, is explained by the influence of heat on the colloidal state. The colloidal amylase, rendered coarser by heating, can still be precipitated by the other colloid, starch paste, but does not retain its power of adsorbing soluble dextrins, so that the saccharifying power is more injured than the liquefying power. The weakening of amylase by repeated precipitation corresponds to the alteration of the degree of dispersion. Similarly, when amylase is separated by filtration (cp. Fränkel and Hambourg, this J., 1906, 945), into a diffusible (strongly dispersed) and a non-diffusible (less dispersed) fraction, the former fraction has considerably more adsorptive power and therefore has a saccharifying action on the dextrins, whilst the latter fraction can only combine with, and hydrolyse, highly colloidal starch, *i.e.*, chiefly exerts a liquefying action.—L. E.

Yeast cells; Influence of the method of culture on the morphological and physiological condition of ——. W. Henneberg. Woch. f. Brau., 1910, **27**, 429—432, 450—453.

The yeasts investigated were the "press" yeast strain XII. and the distillery yeast strain II. of the Berlin Yeast Institute, together with the bottom fermentation beer yeasts of strains D and K of the Berlin Brewing School. By cultivation in worts of high and low nitrogen content and with and without aeration, yeasts can be obtained in many different states of nutrition distinguishable by microscopic examination or by suitable tests. 1. *Starved yeast:* The cells have large vacuoles, the plasma is transparent and not refractive, granulations are well marked and sometimes show Brownian motion. Glycogen is absent but fat is sometimes present in large quantities. These cells occur in old cultures or in those grown at high temperatures or in dilute worts over-aerated. 2. *Fat yeast:* The cells are similar in appearance to starved cells; the protein content is low and glycogen is absent while fat is present in large quantity. These cells are produced in dilute over-aerated worts and in cultures on solid media; they are found on the surface of masses of pressed yeast. 3. *Glycogenous yeasts:* These cells have marked vacuoles, and with a high glycogen content the plasma may be highly refractive, suggesting a high nitrogen content, which is disproved however by the iodine test. These cells are found in crops taken before the sugar of the nutritive medium has all been fermented or in cultures grown in media relatively poor in nitrogen. These yeasts are not to be recommended as baker's yeast or for pitching purposes. 4. *Glycogenous fat yeast* is a type intermediate between the second and third classes. It occurs in yeast grown at low temperatures or in well aerated saccharine solutions; it is frequently unsuited to baker's use. 5. *Glycogenous and albuminous yeast:* This contains moderate amounts of glycogen and protein. The normal produce of a good pressed-yeast factory should belong to this class, and similar bottom fermentation beer yeasts are often suitable baker's yeast. The cells are produced in solutions not very rich in protein when the aeration is discontinued before all the sugar has been removed and the cells have been allowed to ripen at a suitable temperature. 6. *Fat albuminous yeast* is produced by full aeration of a culture in wort rich in protein; it contains much fat and protein. 7. *Albuminous yeast* cells have either no vacuoles or very small ones; the cell plasma is strongly refractive so that the vacuoles are well marked; granulation is absent while glycogen is, at the most, present only in traces. These cells are either very young or have grown slowly at a low temperature in worts of medium concentration, or in worts very rich in protein. This class produces the best pitching yeast and, except the bottom fermentation yeasts, the best baker's yeast.—R. L. S.

Yeast; Phosphorus-content of —— and some yeast preparations. E. Buchner and H. Haehn. Biochem. Zeits., 1910, **27**, 418—426. (Cp. Harden and Young, this J., 1906, 490, 1111; 1907, 62; 1908, 824; 1909, 1157; 1910, 711.)

It is shown that if fresh, bottom-fermentation beer yeast is stored under a large volume of water for 1—4 days at 18°—23° C., phosphorus-free, and phosphorus-containing substances are extracted, the amount of the former predominating to such an extent that the phosphorus-content of the yeast increases quite appreciably during the storage. The juice expressed from the stored yeast, however, contains less phosphorus, has a lower density, and possesses less fermenting power than the juice expressed from the fresh yeast. The acetone-precipitate obtained from the juice decreases as the period of storage is increased, and with the decrease in the density of the juice; the fermenting power of the precipitates is about the same as that of the juices from which the precipitates are obtained (cp. Buchner and Duchacek, this J., 1909, 154). Whilst living yeast retains some co-enzyme when stored under water, acetone-permanent yeast may be completely freed from co-enzyme by washing with cold water on a filter for 5 hours; this treatment deprives the yeast of fermenting power, but the latter may be restored by addition of boiled juice, and also, though only partially in the cases examined by the authors, by addition of the concentrated wash-water. Some of the phosphorus compounds of yeast (*e.g.*, the nucleins) belong to the undissolved cell-contents, whilst the others (*e.g.*, alkali phosphates and the co-enzyme) are dissolved in the cell-juice. The authors' examination of a bottom yeast show that the greater part of the phosphorus is in the undissolved form. It is shown, in the case of various bottom fermentation yeasts, that the expressed juices which have higher densities and yield more abundant precipitates with acetone also have higher fermenting power than the other juices; the authors do not, however, find any relation between the phosphorus-content and the fermenting power of the juice.—L. E.

Fermentation industries; Importance of mineral salts in the ——. H. Wüstenfeld. Woch. f. Brau., 1910, **27**, 361—363, 377—379, 391—393, 405—409, 417—418, 432—434, 454—456.

This is a review of the literature of the subject which the author divides under five heads, viz., 1, salts as nutrient material in relation to yeast growth and fermentation; 2, the more important researches on the influence of salts in malting and mashing processes; 3, the effect of salts on the purely enzymatic actions of the yeast cell; 4, salts in relation to vinegar making; and, 5, ash analyses of the more important materials used in the fermentation industries.—R. L. S.

Wines; Fluorine-content of ——. A. Kickton and W. Behncke. Z. Untersuch. Nahr.- und Genussm., 1910, **20**, 193—208.

From an examination of 139 samples, the authors conclude that fluorine to the extent of less than 1 mgrm. in 200 c.c. is normally present in wines; but those from Spain, particularly southern wines (Südweine), frequently contain larger quantities, and in some cases more than 10 mgrms. in 200 c.c. The extra amounts present in these Spanish wines are probably introduced in the course of manufacture, either intentionally, fluorine compounds being added as preservatives, or accidentally, perhaps owing to the imperfect removal of fluorides from the vessels in the cleansing of which they are employed. The fluorine was detected by a modification of Vandam's method. 200 or 100 c.c. of the sample of wine were treated in a measuring cylinder with 0·5—1·0 c.c. of a 20 per cent. solution of sodium sulphate and then shaken vigorously in the cold with 10 c.c. of a 10 per cent. solution of barium acetate. After standing overnight the clear upper liquid was withdrawn, and the deposit first washed by decantation with about 100 c.c. of hot water, then transferred to a filter with a further 50 c.c. and washed there with hot water. When dry the sample was transferred to a platinum dish and incinerated at a dull red heat; after treating the ash with sulphuric acid, an etching test was carried out. The etched marks varied in distinctness in different tests and in many cases were perceptible only after breathing on the glass. Although differences in the quality of the glass employed made strict comparisons worthless, the authors were able, by taking account of the degree of distinctness of the markings, to estimate roughly quantities of fluorine up to 1 mgrm. Larger amounts produced strongly marked etchings which could not be graded. Eighty-eight wines investigated were from countries other than Spain. Eleven of them gave no indication of fluorine; 75 gave etchings visible only after breathing on the glass, and therefore they contained less than 1 mgrm. in 200 c.c. and the remaining two contained rather more. Of the 51 wines from Spain, all except two gave indication of fluorine, and 32 of them contained more than 1 mgrm. in 200 c.c. Unsuccessful attempts were made to determine accurately some of these larger quantities of fluorine by the method of Treadwell and Koch (this J., 1904, 1016); the most satisfactory modification of the method (6—8 c.c. of a 20 per cent. solution of calcium chloride for precipitating the fluorine, and repeated extraction of the ignited precipitate with from 2 drops to 0·5 c.c. of 1·5 *N* acetic acid for dissolving the lime) gave values for the fluorine-content of some of the Spanish wines, ranging from 5—10 mgrms. in 200 c.c., and these values are probably too low.—J. H. L.

Wines; Bitterness ("amertume") of ——, *and the acrylic fermentation of glycerol.* E. Voisenet. Comptes rend., 1910, **151**, 518—520.

The author has already shown (this J., 1910, 894) that wines which have become bitter contain acrolein, and that the bacilli which cause this bitterness are capable of producing acrolein from glycerol. The acrolein-content of several affected wines varied from 0·002 grm. to 0·12 grm. per litre, according to the extent to which the disease had advanced. The acrolein is present both in combination with the colouring matter and also in a polymerised form in the deposits. It may be regenerated by distilling an aqueous suspension of these deposits after acidifying with sulphuric or phosphoric acid. A determination of the quantity of acrolein, free and combined, in a wine, does not, however, serve as a measure of the amount of acrylic fermentation which has occurred, for the acrolein readily undergoes further transformations. Of these the most important are (1) oxidation, which is facilitated by the oxydases and yeasts of the wine, (2) polymerisation to insoluble flocks of disacryl, with simultaneous formation of acrylic, formic and acetic acids, and if alcohol is present, with formation also of the ethyl acetal of acrolein, (3) production of resinous substances which are probably largely responsible for the characteristic flavour of bitter wines. The acrolein may be detected by treatment with saturated bromine water, then with barium hydroxide solution, and after removing barium with carbonic acid and concentrating, testing for dihydroxyacetone by Denigès' method (this J., 1909, 219), but the author's protein-nitrous acid reagent (see this J., 1910, 584) remains the most convenient one for the recognition of this aldehyde.—J. H. L.

Dried yeast as feeding stuff. Kellner. *See* XIXa.

Patents.

Fermented beverages; Manufacture of ——. E. W. Kuhn, London. Eng. Pat. 18,216. Aug. 6, 1909. Addition to Eng. Pat. 4622, Feb. 29, 1908 (this J., 1908, 826).

A ram or plunger is mounted on the top of the fermentation vessel, or in a separate casing connected therewith. The piston of this ram, or the ram itself, slides within a cylinder in which it is subjected to such pressure that the ram protrudes into the fermenting vessel, which is completely filled with the liquid to be treated. The piston may be operated by water- or air-pressure, or by other means such as a hand-operated screw device. The parts in contact with the liquid are preferably made of silver or provided with a coating of some inert material. The ram may be constructed to fit the fermenting vessel and to have such a stroke that, after fermentation is ended, the outlet valve may be opened and pressure applied to the ram to discharge the yeast and sediment. The fermentation is effected at a pressure determined according to the nature of the liquid under treatment. In the case of beer, it is unnecessary to exceed a pressure of 10 atmospheres, but with wines, a higher pressure (up to about 20 atmospheres) is required.—L. E.

Beverages; Manufacture of ——. E. W. Kuhn, London. Eng. Pat. 18,218, Aug. 6, 1909.

Claim is made for a process of manufacturing beverages, in particular from any alimentary liquid capable of being fermented up to 2 per cent. of proof spirit. Fermentation may be carried out in any suitable vessel provided with means for exerting pressure on the contained liquid, and advantageously in apparatus of the kind described in Eng. Pat. 4622 of 1908 (this J., 1908, 826); before fermentation begins, however, the pressure may be produced in the fermentation vessel by means of the apparatus described in Eng. Pat. 18,216 of 1909 (see preceding abstract). The pressure is increased during fermentation by the carbon dioxide evolved. Again, the liquid may be aerated before fermentation, and the fermentation begun whilst the liquid is not subjected to pressure, the pressure being applied for the completion of the fermentation. The liquid is filtered, and the fermentation arrested by sterilisation, whilst the liquid is subjected to the same pressure as that applied during fermentation. A suitable apparatus for the sterilising operation is described in Eng. Pat. 8823 of 1907 (this J., 1908, 764).—L. E.

Beer; Manufacture of temperance ——. E. W. Kuhn, London. Eng. Pats. 18,219, Aug. 6, 1909; 22,259, Sept. 30, 1909; and 771, Jan. 11, 1910.

A quantity of malt (*e.g.*, 23 lb. per barrel) is mashed at a temperature of say 145°—153° F. in the usual way, the weight of malt being determined according to the required amount of fermentable matter to be produced; the wort is then boiled to prevent further diastatic action. Another quantity of malt (*e.g.*, 15 lb. per barrel) is mashed with water at a temperature of say 175°—185° F. so that the diastase can only exert its liquefying and dextrin-producing properties. The wort thus obtained is united with the first wort, the whole being boiled in the ordinary way with the required amount of hops. If malt, undermodified owing to insufficient germination, is used, the following procedure is advantageous:—The wort from the first saccharifying operation is boiled with the required amount of malt flour, or the latter is boiled with water; the liquid obtained is cooled to say 176° F., and mixed with a sufficient amount of malt extract which has been previously heated to the same temperature for a few minutes. The operation is completed according to the method previously described. The wort is fermented in a closed vessel; the carbon dioxide formed thus produces pressure which maintains the gas in solution and causes it to combine, in the nascent state, with the special substances introduced into the wort by the method of mashing; the pressure is maintained between 2 and 5 atmospheres according to the nature of the wort. When fermentation is complete, the liquid, containing less than 0·9 per cent. of alcohol, is suitably cooled to a low temperature. The finished product is received in casks or drawn in bottles under isobarometric conditions. The bottles may be subsequently submitted to pasteurisation.—L. E.

Fermentation; System of treating liquids during the process of ——. S. W. Parkhurst and B. P. West, Marlow. Eng. Pat. 29,534, Dec. 17, 1909.

A "non-alcoholic beer"—*i.e.*, a beer containing not more than 2 per cent. of alcohol is obtained by arresting the primary fermentation of the wort at the desired stage, either by chilling the liquid to say, 32° F., or by pasteurising it at say, 145° F.; the liquid is kept at the abnormal temperature for say, a week, by which time practically the whole of the yeast is deposited at the bottom of the vessel; a shorter time will suffice if the subsequent process of filtration is sufficiently efficient to remove any suspended yeast. The liquid is filtered, whilst at the abnormal temperature, to remove all traces of yeast and thus prevent any danger of secondary fermentation.—L. E.

Fermented hopped beverages; Manufacture of ——. A. J. Boult, London. From Dr. Wahl, Chicago. Eng. Pat. 30,181, Dec. 24, 1909.

In order to produce a fermented, hopped beverage, such as beer, that shall not be liable to become cloudy when exposed to low temperatures, the wort is boiled with hop lupulin separated from the remaining parts of the hops by tearing and screening. The fermented wort is treated at a temperature below 45° F., with a solution of tannic acid, preferably extracted from the leaves and stems of the hops by treatment with water or with a saccharine solution. If desired, the lupulin may be added to the wort or the beer in a cold condition, and at any stage of manufacture subsequent to that of boiling the wort. Again, instead of adding lupulin separately, an aqueous or saccharine extract of entire hops may be added to the cold wort or beer, since the tannic acid, when added to the cold liquid, accomplishes complete separation of the substances that cause the cloudiness; or again, the wort may be hopped in the ordinary way with entire hops, the cold wort or beer being subsequently treated with the solution of tannic acid. In any case, the quantity of tannic acid employed should be, at least, about 0·01 per cent. of the weight of liquid under treatment.—L. E.

Alcohol from distillers' wort; Process for obtaining ——. O. G. C. L. J. Overbeck, Great Grimsby. Eng. Pat. 4177, Feb. 19, 1910.

The fermented wort is heated to about 90° F. in an atmosphere of carbon dioxide; a current of the same gas is then passed through the wort to remove the alcohol, and heating is continued until the temperature reaches 170° F. The mixture of carbon dioxide and alcohol vapour is passed through any usual form of closed condenser where the alcohol is collected, the carbon dioxide being returned to the vessel containing the wort; the cycle of operations is continuous until practically all the alcohol has been collected.—L. E.

Lactose; Manufacture of a preparation of —— *for use in brewing, or priming ale, beer, and stout.* W. J. Melhuish, Glasgow. Eng. Pat. 9083, April 14, 1910.

Sweet whey is treated with acid material, heated, and filtered, in order to remove the proteids, any remaining fat being separated by mechanical means. The liquid is then evaporated to a syrup, or to such a degree that lactose crystallises out on cooling and standing, or it may be evaporated to dryness. The product may be used alone or in conjunction with other sweetening or colouring agents for the purposes referred to in Eng. Pats. 13,528 of 1908, and 1269 of 1909 (this J., 1909, 255, 538).—L. E.

Brewing; Art of ——. J. Schneible, Weehawken, N.J. U.S. Pat. 961,539, June 14, 1910.

In the ordinary process of hop boiling, with a short period of boiling the hops are incompletely extracted, whilst with a long period of boiling, undesirable albuminoids are redissolved; moreover, boiling the hops with the wort permits reaction of the hop tannin principally on the desirable soluble albumin of the malt with its consequent loss, and again, certain undesirable hop resins are dissolved. In the present process, part, or preferably, all of the hops, are cooked, usually for two hours or more, either with part of the malt mash, or with the raw cereal mash, if such be used. The mash is then mixed with the ordinary malt mash before conversion of the starch.—L. E.

Distillery slop; Reducing —— *to dry feed.* E. A. Hoffmann, Frankfort, Ky. U.S. Pat. 965,521, July 26, 1910.

The slop, as it is formed in the distillery still, is separated into thick and thin slop. The thin slop is heated to boiling, and treated with sufficient alkaline substance to coagulate it. The thick slop and the treated thin slop are then mixed together, filtered, and the separated solids dried.—L. E.

Organic materials; Method of separating —— *from aqueous liquids* [*distillers' slop*]. H. M. Goodman, Louisville, Ky. U.S. Pat. 966,196, Aug. 2, 1910.

Distiller's slop, having an acid reaction, is treated with a soluble salt of iron, whereby part of the albuminous organic material is coagulated. The coagulum is separated and recovered by filtration; the acid filtrate is treated with a second portion of the soluble iron salt, and then neutralised, the second coagulum of albuminous organic materials now obtained, being separated as before.—L. E.

Yeast ; Method of cultivating ——. K. Kruis and F. Ringhoffer. First Addition, dated March 10, 1910, to Fr. Pat. 366,533, May 23, 1906 (this J., 1906, 1062).

In preparing the culture medium, beet juice treated with suitable (nitrogenous and mineral) nutritive substances, or a mixture of beet juice and molasses (the proportion of molasses being, say, 5 per cent.), or a mixture of beet and potato juices with molasses, is submitted to acidification, sterilisation, and filtration.—L. E.

Yeasts ; Process and apparatus for separating inferior yeasts from normal ——. O. Selg and C. Guntrum. First Addition, dated March 9, 1910, to Fr. Pat. 396,869, Nov. 28, 1908 (this J., 1909, 619).

The apparatus previously described is modified in that the reversible tube contained within the upper and lower vessels is replaced by a cock fitted in the neck connecting the two vessels, and a tube, exterior to, and connecting the vessels at their upper parts. A cock is intercalated between the upper part of this exterior tube and the upper vessel. When the cocks are opened, the heavy normal yeast descends into the lower vessel, displacing water which carries with it the lighter, inferior yeast through the exterior tube into the upper vessel.—L. E.

Alcohol from seaweed ; Manufacture of ——. H. Simonin and J. Jean. Fr. Pat. 412,955, May 13, 1909.

The seaweed is first washed with fresh water, and then treated with sufficient phosphoric acid to produce an acidity of 20 grms. of free phosphoric acid per litre. The mixture is submitted to saccharification for 2—3 hours under a pressure of 2—3 kilos. The liquid is then neutralised with calcium carbonate, and filtered, the filtrate being fermented and distilled.—L. E.

Beer ; Process and apparatus for pasteurising ——. C. H. Loew. Fr. Pat. 413,848, Mar. 19, 1910.

The apparatus includes a cylindrical box, on the top of which is arranged a series of seven water-cisterns having perforated bottoms. The bottles of beer are placed upright in a bottle-holder which rotates slowly inside the box and in juxtaposition with its cylindrical wall. As the holder rotates, the bottles are subjected to showers of water from the cisterns, the temperatures of the water from these cisterns being, 21°, 32°, 49°, 60°, 49°, 32°, 21° C., so that the temperature of the bottles is raised gradually to 60° C. (the pasteurising temperature) and lowered gradually to the ordinary temperature ; the bottles are submitted to the temperature of 60° C. for more than half-an-hour, one revolution being completed in an hour. The bottles are then removed, a fresh set being substituted and submitted to the same cycle. The cisterns are in communication with each other, so that there is a mingling of water from the central, hottest cistern and from the two end, cold cisterns, in the intermediate cisterns. The cylindrical box is so divided that the water that falls at a temperature of 60° C. is kept separate from the rest ; it is heated afresh and pumped back to the cistern from whence it came. The water from the other cisterns is pumped back into the cisterns delivering water at a temperature of 32° C.—L. E.

Bacteria cultures ; Process for enriching ——. Löloff and Mayer. Ger. Pat. 223,757, May 30, 1909.

Preparations containing bacteria (*e.g.*, masses of casein containing lactic acid bacilli) are introduced into a considerable quantity of nutrient medium (*e.g.*, milk) in which the mass does not dissolve, but which is sufficiently great to induce the diffusion of the decomposition products which might prevent the further development of the bacteria.—T. F. B.

Maturing process and apparatus therefor. Process of purifying spirits and apparatus therefor. J. E. Carroll, London. U.S. Pats. 968,832 and 968,833, Aug. 30, 1910.

See Eng. Pat. 19,348 of 1908 ; this J., 1909, 849.—T.F.B.

Separating potassium compounds [from sugar juices, molasses, vinasse, etc.]. Fr. Pat. 413,677. *See* XVII.

Adhesive and coating material [from yeast]. Ger. Pat. 224,443. *See* XVII.

XIXa.—FOODS.

Milk ; The enzymes occurring in —— and their origin. J. Wohlgemuth and M. Strich. Sitzungsber. Konigl. Preuss. Akad. Wiss., 1910, 520—524.

The authors find that human, cows', goats', rabbits', and guinea-pigs' milk all contain a peptolytic enzyme, this being ascertained from experiments in which the milks were mixed with glycyltryptophane solution and incubated under toluene for 24 hours ; in every case free tryptophane could be detected in the mixtures at the end of this period, whilst other experiments, in which boiled milk was used, yielded negative results. When milk is curdled, the enzyme remains in the curd. The authors are of opinion that the enzymes of milk, particularly diastase, are for the greater part a product of the activity of the mammary glands. A part may be derived from the blood, but the milk generally contains at least 100 times as much diastase as the blood. Cows' and goats' milk do not contain diastase, but it is present in dogs', rabbits', and guinea-pigs' milk, dogs' milk containing the most and guinea-pigs' the least.—W. P. S.

Cocoanut oil ; Short method for detecting and determining —— in butter and margarine. H. S. Shrewsbury and A. W. Knapp. Analyst, 1910, 35, 385—392.

The method is based upon the solubility of the predominating fatty acid of cocoanut oil (lauric acid) in a mixture of alcohol and water. Five grms. of the filtered fat are saponified with 20 c.c. of glycerol sodium hydroxide solution (100 c.c. of $N/10$ sodium hydroxide solution with 500 c.c. of glycerol) and the resulting soap solution washed with the aid of exactly 200 c.c. of boiling water into a separating funnel, and treated with 5 c.c. of dilute (approximately $7N$-) sulphuric acid. The funnel is vigorously shaken for a minute, and allowed to stand for 5 minutes, after which the aqueous layer, containing butyric and other acids soluble in water, is drawn off. The insoluble fatty acids in the funnel are dissolved in 50 c.c. of methylated spirit (sp. gr. 0·822 ; 90 per cent. of alcohol by weight) and the solution heated until it just boils, a piece of pumice being placed in the flask to prevent bumping. In the meantime 36 c.c. of cold water (15° to 17° C.) are placed in the separating funnel, and immediately the alcoholic solution boils, it is poured into this water. The mixture is next poured back into the flask, and after being rotated, is again returned to the funnel, where it is shaken for half a minute, and allowed to stand for three minutes, for the insoluble fatty acids to separate. Finally, 70 c.c. of the alcoholic solution are drawn off and titrated with $N/10$ sodium hydroxide solution, with phenolphthalein as indicator. The following results were thus obtained with pure triglycerides :—tributyrin, 0 ; trilaurin, 176 ; trimyristin, 51 ; tripalmitin, 16 ; tristearin, 6 ; and triolein, 65 c.c. Cocoanut oil gave a value of 163, whilst 14 samples of pure butter of known origin gave figures ranging from 23·6 to 31·2, the average being 27·7. The fat from cream gave a value of 30, and lard a value of 15·7, so that the method would readily detect the presence of " nut lard " in lard. A butter with an average value 28 gave the following results when mixed with various proportions of cocoanut oil :—with 5 per cent., 33·0 ; with 15 per cent., 38·0 ; with 25 per cent., 50·0 ; and with 50 per cent., 80 c.c. In the calculation of the proportion of cocoanut oil in test mixtures the results were all too high by about 5 per cent. Whereas a butter containing 20 per cent. of cocoanut oil may give a Reichert-Meissl value falling within the limits recorded for genuine butter, the authors' process will, it is claimed, detect such an addition with certainty. The method also gives good results in the determination of cocoanut oil in margarine, and will be found of use in the examination of samples in which the Reichert value suggests the presence of more than 10 per cent. of butter.—C. A. M.

Lactic acid; Influence of —— on the quality of cheese of the Cheddar type. C. F. Doane. U.S. Dept. of Agric., Bureau of Animal Ind., 1910, Bull. 123.

The author reports on the manufacture of a large number of samples of cheese of the Cheddar type, prepared with whey of different degrees of acidity and kept in cold storage at various temperatures and for varying periods. Marks were given to the samples by competent judges for flavour, texture, colour, and make-up, and the total "scores" were tabulated with reference to the acidity of the several samples. The author concludes that: (1) Too high a development of lactic acid injures the flavour as well as the texture of the curd: (2) The development of acid in the matted curd excludes gas and bad taints and does not injure the flavour and texture: (3) Cheese with high acid content should be put into cold storage as early as possible to minimise the bad effect of the acid.—O. R.

Flour; Sterilisation of —— for use in experiments on panary fermentation. A. J. J. Vandevelde. Bull. Soc. Chim. Belg., 1910, **24**, 328—337.

In an endeavour to obtain sterile flour for use in the investigation of panary fermentation, the author has made a number of experiments with various sterilising agents. He has not, so far, discovered any means of sterilising flour without completely destroying the characteristics of the gluten. By treating the flour with a mixture of chloroform and dimethylketone, it was found that, after the removal of the latter substances, the flour still fermented when mixed with sterile water; in this instance, the organisms present were identified as *Bacilli mesentericus vulgatus*. Formaldehyde ,was also found to be useless for sterilising flour unless the treatment was carried out at a temperature of 45° C.; in this case, however, the gluten was completely altered and such quantities of formaldehyde remained in the flour that the latter would not ferment even when inoculated with organisms capable of producing fermentation.—W. P. S.

Cocoa; Determination of shell in ——. F. Filsinger and W. Bötticher. Z. öffentl. Chem., 1910, **16**, 311—312.

The authors have examined the method of flotation in a solution of calcium chloride of known strength suggested by Goske (this J., 1910, 369). The tests were made on samples of reputable commercial cocoa powders and also on roasted Ariba cocoa nibs carefully picked free from shell and on known mixtures of this with cocoa shell. The results show that the separation is by no means complete, *e.g.*, an equal mixture of shell and nib yielded by the Goske method only 19·6 per cent. of shell (by Filsinger's elutriation method 53 per cent.) The correction recommended of subtracting 6 per cent. as the mean unavoidable shell content, leads, especially in cases of very pure cocoa powders to quite impossible results.—B. G. McL.

Yeast; Dried —— as feeding stuff. O. Kellner. Deutsch. Landwirtschaftl. Presse, 1910, Nr. 53. Woch. f. Brau., 1910, **27**, 409.

Sheep were fed daily with 750 grms. of hay and 300 grms. of dried yeast. It was found that 90·9 per cent. of the yeast protein and the whole of its non-nitrogenous constituents were absorbed. The animals showed no ill-effects from the yeast and the author concludes that it is a readily digestible food of particular value on account of the large proportion (43 per cent.) of protein which it contains.
—R. L. S.

Influence of the method of culture on the morphological and physiological condition of yeast cells. Henneberg. *See* XVIII.

Patents.

Food products formed from germs of wheat and the like. A. Charonnat, Puteaux, France. Eng. Pat. 17,003, July 21, 1909.

Fatty matters are removed from germs of wheat, barley, or other cereals, by extraction with ether or by mechanical pressure. The germs are then roasted and may be used for preparing a beverage, or, when ground, may be employed in making bread, biscuits, porridge, etc. The ground, roasted germs may also be mixed with "cocoa butter" and pressed into tablets.—W. P. S.

Wheat for flour-milling purposes; Treatment of ——. C. W. Chitty, Dover, and W. Jago, London. Eng. Pat. 22,434, Oct. 2, 1909.

The wheat is treated in a suitable mixing apparatus with a dilute solution of phosphoric acid prepared by mixing 1 part of phosphoric acid of sp. gr. 1·45 with 70 parts of water. The wheat should receive and absorb about 1 per cent. of its weight of the dilute acid. It is advisable not to grind the wheat until 24 hours have elapsed after the treatment, and, if the wheat be subsequently washed, such washing should not be carried out until the phosphoric acid has been thoroughly absorbed by the wheat. Ten per cent. solutions of calcium acid phosphate, potassium acid phosphate, magnesium acid phosphate, or magnesium sulphate, or mixtures of the same may be employed instead of the phosphoric acid.—W. P. S.

Wheaten stock and flour; Treatment of ——. C. W. Chitty, Dover and W. Jago, London. Eng. Pats. 23,839, Oct. 18, 1909, and 8948, April 13, 1910.

Wheaten stock and flour are submitted, while in a state of agitation, to the action of a current of steam, so that the temperature of the wheat or flour is raised to a point exceeding 140° F., but not above 212° F. The flour thus treated, or that obtained from the wheat, is mixed in suitable proportions with other flour used in breadmaking. Wheat may also be treated with steam so that its temperature is raised above 212° F., and then mixed and ground with other wheat.—W. P. S.

Wheat and other granulous or leguminous products; Improving the quality of —— which have not been well harvested or have been damaged. L. Froment, Lagoy, France. Eng. Pat. 29,866, Dec. 21, 1909.

Wheat, etc., that has been harvested in a condition of excessive humidity, or that contains excess of moisture due to storage in damp places, or that has acquired a permanent strong odour, is incorporated with 5—20 per cent. of disintegrated peat, the mixture being allowed to stand for 10—15 days. The peat absorbs excess of moisture and the objectionable odour, and disinfects the grain. The mixture is subsequently conveyed to a suitable bolting machine in which the grain is separated from the peat. The latter may be regenerated by spreading it out in the open air and stirring it from time to time.—L. E.

Flour; Manufacture or treatment of ——. B. I. Levin, Manchester. Eng. Pat. 3673, Feb. 15, 1910.

"Semolina," or other granulated constituent of wheat, is dried and impregnated with a quantity of "liquid phosphoric acid"; the mixture is dried, ground, and again dried. Definite amounts of the preparation thus obtained are added to flour or wheat during the grinding or mixing process.—W. P. S.

Milk and other liquid foods, medicines, serums, etc.; Sterilisation of ——. V. Henri, A. Helbronner, and M. von Recklinghausen. First Addition, dated Mar. 1, 1910, to Fr. Pat. 400,602, Mar. 2, 1909 (this J., 1909, 1060).

The liquid to be sterilised by the process described in the original specification (*loc. cit.*) is introduced at the lower part of a rotating, funnel-shaped drum, the sides of which are corrugated. The liquid rises up the sides of the drum, owing to centrifugal action, and is collected at the upper edge of the drum by means of a channel or pipe and conducted to suitable vessels in which it is stored. The liquid is submitted, during its passage up the sides of the drum, to the action of ultra-violet rays proceeding from a mercury vapour lamp suspended in the drum, and jets of water are thrown on the outer surface of the drum in order to cool the liquid during the treatment.—W. P. S.

Alimentary product resembling whole milk; Process for obtaining an —— from skimmed milk. W. Mehrdorff. Fr. Pat. 413.390. Mar. 8. 1910.

Separated milk is concentrated in steam-jacketed pans until about 25 per cent. of the water present has been evaporated. The liquid is then cooled rapidly, filled into bottles, and sterilised. The bottles are sprayed with cold water as they are taken from the steriliser. To prevent the development of a cooked flavour in the milk, the latter may be treated, before and after the concentrating process, with suitable quantities of a solution containing mono-calcium phosphate, sodium carbonate, and calcium citrate.—W. P. S.

Coffee berries free from caffeine; Process of obtaining ——. L. Klein. Second Addition, dated Mar. 4, 1910, and Third Addition, dated March 5, 1910, to Fr. Pat. 409.700, Nov. 11, 1909 (this J., 1910, 779 and 837).

(1). Coffee berries are first treated with a cold alkaline solution of the composition described in the original specification (*loc. cit.*) and are then transferred to a drum where they are submitted alternately to the action of steam and of hot alkaline solution. The berries are finally washed, dried, and roasted. (2). An apparatus is described for carrying out the modified process described in the Second Addition. It consists of a vertical boiler provided with a stirring device and mounted above a furnace. The alkaline solution employed in the process is heated in this boiler and means are provided for allowing either the steam generated or the hot alkaline solution to pass into the drum containing the coffee berries under treatment. Provision is also made for the supply of water to the drum for the purpose of washing the treated berries.—W. P. S.

Coffee berries free from caffeine or containing but little caffeine; Process for preparing ——. Kaffee-Patent Akt.-Ges., Fr. Pat. 412.925. Feb. 22. 1910.

One hundred kilos. of coffee berries are sprayed with about 12 kilos. of 10 per cent. ammonia solution, and are then agitated with 30 litres of hot water. The caffeine dissolved from the berries is removed from the surrounding liquid by means of carbon tetrachloride which is passed through the liquid and siphoned off continuously until caffeine is no longer extracted. The remaining solvent is then removed by distillation, and the mixture of coffee berries and liquid is evaporated. The moist berries are next dried at a temperature of from 60° to 70° C., and roasted in the usual manner. The treatment with ammonia may be replaced by subjecting the berries to the action of an electric current before or during the extraction of the caffeine, by employing pressure during the extraction, by the use of acetic or sulphurous acids, or by the use of ethyl acetate as a solvent. These methods may be employed alone or simultaneously.—W. P. S.

Sterilisation of milk and other liquid foods, liquids used for medicinal and surgical purposes, serums, and the like. V. Henri and A. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 834, Jan. 12, 1910. Under Int. Conv., March 2, 1909.

See Fr. Pat. 400.602 of 1909; this J., 1909, 1060.—T.F.B.

Butter; Process for making ——. A. Witte, Hamburg. Eng. Pat. 1743, Jan. 24, 1910.

See Fr. Pat. 410.820 of 1909; this J., 1910, 836.—W.P.S.

Malted food; Making ——. S. Felix, Dresden, Germany. U.S. Pat. 968.841, Aug. 30, 1910.

See Fr. Pat. 362,773 of 1906; this J., 1906, 774.—T. F. B.

Reducing distillery slop to dry feed. U.S. Pat. 965.521. *See* XVIII.

XIXb.—WATER PURIFICATION; SANITATION.

Concrete [sewage tanks]; Destruction of —— by hydrogen sulphide. E. Stephan. Beton u. Eisen, 1910, 9, 22—24.

The author describes an investigation of the cause of failure of the concrete covering of some sewage tanks. Although in the sewage-water a strong smell of hydrogen sulphide was perceptible, no trace of this compound could be detected in the atmosphere of the sewage tanks, which was also free from sulphur trioxide, but contained carbon dioxide. The outer layers of the defective concrete were so soft that they could readily be removed by a powerful jet of water; the firm concrete beneath was of a brownish tint. A considerable portion of the lime in the decomposed concrete was in the form of calcium sulphate, but small quantities of calcium hydrogen sulphide were also present, indicating that the decomposition was caused by hydrogen sulphide, the calcium sulphide formed at first becoming ultimately converted into sulphate. The author recommends the application of a coating of tar to the concrete after the latter has hardened to some extent and is thoroughly dry. (See also Chambers, this J., 1910, 647.) —A. S.

Patents.

Sewage and other waters; Apparatus for purification of ——. L. G. Lautzenhiser and C. P. Chandler, Assignors to De W. A. Slemmer, S. C. Ward, and W. K. Reese, jun., Los Angeles, Cal. U.S. Pat. 966,025, Aug. 2, 1910.

The apparatus includes a flume or trough having a smooth, continuous, imperforate bottom, and sets of electrodes supported therein. The cast-iron electrodes extend in planes parallel to the length of the trough; of the two sets of electrodes (cathodes and anodes), one set is provided with an electrode portion consisting of copper in contact with the iron. Means are provided for supplying sewage at one end of the trough; a cross board extends transversely of the other end of the trough, and is separated from the bottom to form a discharge outlet. A weir adjustable vertically, adjacent to the cross board, is provided for controlling the level of the sewage in, and the normal discharge from, the trough. A discharge gate, hinged to the cross-board and extending downwards to the bottom of the trough is provided for closing the discharge outlet, means also being provided for opening this discharge gate by hand.—L. E.

Sterilising agents; Process and apparatus for the production of —— for use in sterilising or purifying water and other liquids. M. P. Otto. Fr. Pat. 413,296, March 5, 1910.

The apparatus consists of a turbine, a dynamo, and a mixing tank or the like. The turbine is driven by the water under treatment and in turn actuates the dynamo. The current from the latter may be used for generating ozone or for lighting mercury vapour lamps. The water, after it leaves the turbine, is treated, as it enters the mixing tank, with the ozone or is subjected to the ultraviolet rays emitted by the lamps.—W. P. S.

Lime-water; Apparatus for the preparation of clear, saturated —— for use in purifying water. Farbleder-Werke S. Marx und Söhne. Fr. Pat. 413,346, March 7, 1910.

A layer of filtering material is packed in a space between two perforated plates fitted across a vertical tank having the shape of an inverted cone, at a short distance above the bottom. Water is admitted into the space below this filter layer and, as it rises in the vessel, mixes with milk-of-lime introduced through a pipe ending in a perforated spiral just above the upper perforated plate. The water thus becomes saturated with calcium hydroxide and the clear solution is drawn off from the top of the vessel.

Rods are fitted to the perforated plates so that they may be lifted when it is necessary to flush out the vessel, and a sludge-cock is provided at the bottom.—W. P. S.

Disinfectants. Schülke und Mayr. Ger. Pat. 224,812, May 12, 1908. Addition to Ger. Pat. 189,960, Feb. 17, 1906.

It was shown in the main patent that the disinfecting power of phenol and its derivatives is increased by the addition of oxalic acid. Claim is now made for the use of ortho-oxalic acid esters of phenols as disinfectants. These esters have the advantage of being only very slightly hygroscopic and of possessing high melting points. In aqueous solution they decompose into oxalic acid and the corresponding phenols.—A. S.

Purifying liquids [water, etc.] by electricity; Apparatus for ——. H. B. Hartman, Pittsburg, U.S.A. Eng. Pat. 1461, Jan. 19, 1910.

The specification describes control mechanism for use with the apparatus described in U.S. Pat. 951,313 of 1910 (this J., 1910, 514), for automatically making and breaking the electric current when the liquid is turned on and off.
—T. F. B.

Purifying liquids [water, etc.] by electricity; Apparatus for ——. H. B. Hartman, Pittsburg, U.S.A. Eng. Pat. 1462, Jan. 19, 1910.

See U.S. Pat. 951,313 of 1910; this J., 1910, 514.—T. F. B.

Water; Process and apparatus for purifying and clarifying ——. W. K. Richardson. Fr. Pat. 412,960, Feb. 22, 1910.

See Eng. Pat. 3969 of 1910; this J., 1910, 1032.—T. F. B.

Preparation of cupric dimethanaldisulphite. Fr. Pat. 412,954. *See* VII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchona leaves; Alkaloid content of ——. P. Van Leersum. Koninkl. Akad van Wetensch. Amsterdam, Wisk. en Natk. Afd., 1910, **19**, 119—136. Chem. Zentr., 1910, **2**, 666—667.

The author determined the alkaloid content of leaves of *Cinchona succirubra* and *C. Ledgeriana*, using (1) normal living leaves, (2) fallen leaves, and (3) leaves which had been protected from the light for a long time. The fallen leaves and the leaves protected from light invariably contained more alkaloid than normal living leaves; hence the alkaloids must be regarded not as assimilation products, but as waste products formed in the leaves or other organs. The author also found that no migration of alkaloid from the leaves into the stem of the plant takes place.—A. S.

Pyrola [Pyrola rotundifolia, L.]; The glucoside of the round-leaved ——. A. Fichtenholz. J. Pharm. Chim., 1910, **2**, 193—203.

An alcoholic extract of the plant gave on evaporation a syrupy residue which, on being purified with basic lead acetate and extracted with ethyl acetate yielded crystallised arbutin which contained a small amount of methylarbutin. The quantity of the glucoside in the fresh plant probably does not exceed 1 per cent. The plant also contains sucrose, invertase, and emulsin, but the quantity of the enzymes is so small that even after slow and imperfect drying of the plant, the amount of arbutin and sucrose obtained was only slightly less than that obtained from the fresh and undried material. In winter the plant contains about three times as much sucrose as it does after growth has started, indicating the use of the sugar as a food reserve.
—J. A.

Cheiroline, the mustard oil of wallflower seeds, its decomposition and synthesis. W. Schneider. Annalen, 1910, **375**, 207—254. (See this J., 1909, 106 and 1161.)

A short summary of the medicinal uses of the wallflower (*Cheiranthus cheiri*) is given. The author finds that the cheiroline obtained from the seeds of this plant is a mustard oil, γ-thiocarbimidopropylmethylsulphone, $CH_3{\cdot}SO_2{\cdot}CH_2{\cdot}CH_2{\cdot}CH_2{\cdot}N:C:S$. The seeds are first extracted with ether in a Soxhlet apparatus to remove a fatty oil present to the extent of 25 per cent. Afterwards they are shaken with ether and 5 per cent. sodium hydroxide solution, and the ethereal portion concentrated, when a residue of crude cheiroline with some oil is obtained. The latter is separated by shaking the residue with 0·5 per cent. sulphuric acid at 50°—60° C., when the cheiroline dissolves, and filtering. The filtrate is treated with excess of ammonium sulphate and the cheiroline taken up with ether, the ethereal extract being dried by digestion with potassium carbonate. About 1·6 to 1·7 per cent. of pure cheiroline can be obtained from wallflower seeds by this method, and about 1·3 per cent. from the seeds of *Erysimum arkansanum*. The substance crystallises from ether or methyl alcohol in fine, colourless, odourless prisms, m. pt. 47°—48° C., and distils at 200° C., at 3 mm. without decomposition. One part will dissolve in 70 parts of water at 50° C. When hydrolysed with sodium hydroxide, it decomposes quantitatively into hydrogen sulphide, carbon dioxide, and γ-aminopropylmethylsulphone, $CH_3{\cdot}SO_2{\cdot}(CH_2)_3{\cdot}NH_2$. This hygroscopic base, m. pt. 44° C., is easily soluble in water, giving a strongly alkaline solution. The hydrochloride melts at 146° C. Under the action of methyl iodide, the base is converted into the methiodide of γ-dimethylaminopropylmethylsulphone, m. pt. 150°—152° C. The melting point of this methiodide was previously given, through an error, as 183° C. (this J., 1909, 106). The *N*-benzoyl derivative of the base crystallises from water in fine needles, m. pt. 102° C. When oxidised with boiling potassium permanganate solution, the hydrochloride of the base is converted into methylsulphonepropionic acid, $CH_3{\cdot}SO_2{\cdot}CH_2{\cdot}CH_2{\cdot}COOH$, m. pt. 105° C. Oxidation with fuming nitric acid produces methylsulphonic acid. The treatment of cheiroline with varying proportions of mercuric oxide gives rise to substituted ureas. Its reaction with alcoholic ammonia indicates the presence of an isothiocyanate grouping. Methylmercaptan dissolved in a solution of sodium ethoxide was treated with γ-bromopropylphthalimide, with the production of γ-phthaliminopropylmethylsulphide, m. pt. 59°—60° C. Under the successive action of caustic alkali and acid, this is hydrolysed to γ-aminopropylmethylsulphide, a strongly basic liquid, b. pt. 170° C. Several salts and methyl derivatives of this were prepared and are described, and a thio-urea was also made. Oxidation of this base converts it into γ-aminopropylmethylsulphone, which is also produced by the hydrolysis of cheiroline. The synthetic base was treated with carbon bisulphide, and mercuric chloride (Hofmann's mustard oil reaction), with the final formation of cheiroline.—F. Shdn.

Essential oils and plants producing odoriferous substances; Study of ——. Roure-Bertrand fils. Wiss. u. ind. Ber. von Roure-Bertrand fils, 1910, [3], **1**, 48—68. Chem. Zentr., 1910, **2**, 735—736.

The characters are given of various samples of orange-flower oil, Java patchouli oil, oil of *Mentha arvensis* var. *Javanica*, ylang-ylang oil from Mayotte, and oil of *Andropogon citratus* DC.—A. S.

Ylang-ylang oil from Réunion. E. Tassilly. Z. allgem. österr. Apoth.-Ver., 1910, **48**, 358—359.

Common adulterants of ylang-ylang oil are alcohol, turpentine, cocoanut oil and other non-volatile oils and petroleum. The leaves also are sometimes sprayed with turpentine and then the whole is distilled. By this process the oil acquires a sharp odour, and its density, rotatory power and refractive index are diminished. The presence of alcohol can be ascertained by shaking the oil with water and applying the iodoform test to the latter. Fats are detected in that the oil leaves a spot of fat when evaporated from paper. The residue, after distilling the oil in steam, should not be more than about 5 per cent. Petroleum is not acted on by sulphuric acid, which destroys the other constituents. The author also states that a synthetical ylang-ylang oil is found on the market which is equal to the natural product.—J. C. C.

Jasmine oil; Some new constituents of essential ——. F. Elze. Chem.-Zeit., 1910, **34**, 912.

Jasmine oil is found to contain *p*-cresol and geraniol. —J. C. C.

Essential oil; Determination of small quantities of —— *in spices, etc.* J. A. Brown. Analyst, 1910, **35**, 392—396.

The method described is an extension of that devised by Cripps and the author (Analyst, 1909, **34**, 519) for the determination of the volatile substances in spices. A weighed quantity of the spice is heated in a U-tube, which is connected with a combustion tube (containing copper oxide) heated in an ordinary combustion furnace. The products of combustion are collected in absorption tubes in the usual way, and from the amount of carbon dioxide (and thus carbon) obtained, the percentage of volatile oil in the spice may be calculated. The U-tube is made from tubing ¼ to ⅜ inch in diameter, and is supported in an air-bath, in which is a thermometer. From 1 to 2 grms. of carraway (No. 40 powder) or 4 to 5 grms. of cinnamon (No. 60 powder) are placed in the tube and kept in position by means of asbestos wool. When the combustion tube is hot enough, the air-bath is heated at 100° C. until all moisture has been expelled by the current of air (freed from carbon dioxide) which is aspirated through the apparatus. The temperature is then slowly raised to 130° to 140° C. in the case of carraway; or to 150° to 160° C. for cinnamon, and the air-bath kept at that temperature for 15 minutes after all signs of mistiness have disappeared from the part of the tube before the combustion tube. The percentage of oil in the spice is then found by multiplying the weight of carbon by 100 and dividing the result by a factor for the particular spice (80 for cinnamon and 81 for carraway). These factors represent a figure closely approximating the average percentage of carbon found in several samples of the two essential oils, the cinnamon giving values ranging from 79·0 to 80·7 per cent., average 79·98, and the carraway values of 79·9 to 82·6, average 80·9 per cent. Experiments showed that no decomposition of woody fibre or extractive substances took place during the expulsion of the volatile oil, but in the case of older samples of spices a slight amount of volatile matter apparently due to resinified oil was expelled. Thus, a sample of carraway a year old yielded, after being heated at 98° C. until odourless, 0·35 per cent. of volatile matter at 130° to 140° C., whilst another sample three years old yielded 1·87 per cent. The following results show the total amount of volatile matter taken as "essential oil" obtained by the combustion method and also the volatile products left after drying the samples at 98° C. in the analysis of representative commercial samples:—

Spice.	Total essential oil by combustion method.	"Essential oil" after drying at 98° C.	Essential oil by acetylene method.
	per cent.	per cent.	per cent.
Carraway, "Finest Dutch"	3·96, 3·84	0·08	3·97
,, "Dutch"	3·27	0·12, 0·18	3·56
,, "Finest Mogador"	1·17	0·16	1·23
Cinnamon, Old sample in quills	0·37	0·06	—
,, Old sample in chips	0·21	0·07	—
,, Ground	0·53	—	—

—C. A. M.

Camphor-production in China. Z. angew. Chem., 1910, **23**, 1676.

According to a customs return the camphor production in China was, in 1907, 27,198 pikuls i. w. (32,379 cwt.) of 2,168,047 Haikwan taels (£285,460), and in 1908 only 15,246 pikuls i.w. (18,150 cwt.) of 1,005,297 H. t. (£132,370). The export for the same two years was 25,798 P. i. w. (30,712 cwt.) of 2,057,475 H. t. (£273,540), and 13,072 P. i. w. (15,562 cwt.) of 850,135 H. t. (£114,540). Soil and climate in China are favourable to the growth of trees for camphor, and if systematic planting were adopted the industry might be considerably increased. In some of the inland provinces there are large quantities of camphor laurels, which yield nothing because the inhabitants are ignorant of their capabilities. Every rise in the price of camphor in Europe will bring more Chinese camphor into the market.—J. T. D.

Camphor and phenol; Freezing-point curve for mixtures of ——. J. K. Wood and J. D. Scott. Chem. Soc. Trans., 1910, **97**, 1573—1578.

It is known that mixtures of phenol with small proportions of camphor are liquid at the ordinary temperature, and remain liquid even on cooling to temperatures much below the freezing point of phenol. The authors have examined a large number of mixtures of the two substances in varying proportions, and from the results have constructed the complete freezing-point curve. The latter consists of three distinct branches; the middle portion of the curve passes through a maximum at − 18·6° C., corresponding to a compound containing equimolecular proportions of camphor and phenol. There are eutectic points at 40·35 per cent. of camphor (− 30° C.), and 70·12 per cent. of camphor (−32° C.). Some of the mixtures can often be greatly supercooled without freezing ensuing. Some of the experimental results are shown in the following table:—

Camphor	Freezing point.	Camphor	Freezing point.	Camphor	Freezing point.
per cent.	° C.	per cent.	° C.	per cent.	° C.
0·00	+40·3	34·50	− 3·0	70·12	− 32·0
4·53	+37·5	40·35	−30·5	76·58	+ 29·5
9·42	+34·2	44·90	−23·6	81·07	+ 67·5
14·86	+29·7	49·99	−20·4	84·72	+ 88·0
20·31	+25·0	55·80	−20·0	90·65	+128·0
25·40	+16·1	61·51	−20·1	94·06	+151·0
30·31	+ 5·0	64·12	−19·0	100·00	+174·5

—A. S.

Geraniol and linalool; Halogen derivatives of ——. J. Dupont and L. Labaune. Wiss. u. ind. Ber. von Roure-Bertrand fils, 1910, [3], 1, 42—48. Chem. Zentr., 1910, **2**, 734—735.

By the action of phosphorus trichloride on a benzene solution of geraniol or *l*-linalool, in presence of potassium carbonate, at 0°—5° C., in each case good yields of the chloride, $C_{10}H_{17}Cl$, b. pt. 94°—96° C. at 6 mm., are obtained; this chloride is also produced by the action of hydrochloric acid gas on the alcohols. A corresponding derivative of *d*-linalool could not be prepared by either method. Geraniol and *d*- and *l*-linalool when treated in warm toluene solution with hydrobromic acid gas, all yield the same bromide, $C_{10}H_{17}Br$, b. pt. 102°—103° C. at 6 mm., sp. gr. 1·1450 at 15° C., $n_D^{15}=1·507$, which is optically inactive, and decomposes when distilled at atmospheric pressure. The chloride derived from geraniol is converted into linalyl acetate when treated with potassium acetate in presence of toluene. The bromide from geraniol or *d*- or *l*-linalool yields geraniol ethyl ether by the action of sodium ethylate in presence of alcohol, whilst by the action of silver oxide in presence of petroleum spirit, it is converted into *i*-linalool. Geraniol ethyl ether prepared by the action of ethyl bromide on the sodium derivative of geraniol, boils at 218° C. Linalool ethyl ether obtained in an analogous manner from the sodium derivative of linalool (best prepared by the use of sodium amide) boils at 192° C. (See also this J., 1910, 716.)—A. S.

Triphenylstibine sulphide. L. Kaufmann. Ber., 1908, **41**, 2762—2766.

Ten grms. of triphenylstibine bromide, prepared by the method of Michaelis and Reese (Annalen, 1886, **233**, 44) are dissolved in 160 c.c. of a cold saturated solution of ammonia at the ordinary temperature. After filtering, the solution is treated with a current of hydrogen sulphide, with continual agitation, until it becomes coloured very faintly yellow; the coloration disappears on vigorously shaking the solution. The crystals which separate are drained with the aid of the pump, washed with alcohol, and dried on a porous plate. The yield is about 80 per cent. of the theoretical. Triphenylstibine sulphide, $(C_6H_5)_3SbS$, is a white substance melting at 119°—120° C., and decomposing at about 200° C. It is readily soluble in benzene, chloroform, and glacial acetic acid, less readily in alcohol (1 in 120 at the ordinary temperature, 1 in 100 on boiling), and with difficulty in ether and petroleum spirit. When the solutions are heated, decomposition gradually takes place, with liberation of sulphur. Decomposition is also caused by dilute acids, including acetic acid.—A. S.

Triphenylstibine sulphide ; Chemical and physiological properties of ——, and its behaviour in the animal organism. L. Kaufmann. Biochem. Zeits., 1910, **28**, 67—90.

As triphenylstibine sulphide (see preceding abstract) readily decomposes, with liberation of sulphur, a possible use of this compound as a substitute for sulphur as a therapeutic agent in dermatology suggested itself. According to Brisson the efficacy of a sulphur preparation for this purpose is proportional to the amount of sulphuric acid formed from it by oxidation. Comparative tests under similar conditions, using hydrogen peroxide solution as oxidising agent, showed that triphenylstibine sulphide is more than 100 times more effective than precipitated sulphur as an oxygen-fixing agent. Practical tests with the antimony compound incorporated *e.g.*, with lanoline and vaseline as an ointment, showed that it is superior to precipitated sulphur as a dermatological therapeutic agent, and moreover does not cause irritation as the latter does, probably owing to the fact that in the oxidation, triphenylstibine hydroxide is formed in addition to sulphuric acid, and these then unite to form the neutral triphenylstibine sulphate, $(C_6H_5)_3SbSO_4$. A few tests made on the possible use of triphenylstibine sulphide for subcutaneous injection, showed that when used in that manner it causes poisoning. —A. S.

Acrolein ; Preparation of ——. J. B. Senderens. Comptes rend., 1910, **151**, 530—532.

Aluminium sulphate which acts catalytically in the production of ethers and ethylenic hydrocarbons from saturated primary alcohols (see this J., 1910, 1081) has a similar effect in the production of acrolein from glycerol. (Alumina is not capable of acting as a catalyst in the formation of acrolein). Potassium bisulphate also, as used in the common method of preparing acrolein, acts as a catalyst as well as a dehydrating agent, and good yields of acrolein can be obtained with much smaller quantities of potassium bisulphate than are ordinarily employed. The method recommended by the author is as follows :—A mixture of 250 grms. of glycerin (200 c.c. of glycerin of 28°) and 10 grms. of crystallised potassium bisulphate is distilled in a flask the vapour-outlet tube from which leads to a U-tube cooled by melting ice. The temperature is not allowed to rise above 110° C. as indicated by a thermometer the bulb of which is opposite the vapour-outlet opening. The distillation is complete in about three hours, and 130—140 c.c. of distillate are obtained, from which 34—38 c.c. of acrolein can be recovered by distillation. The aqueous distillate can be kept for a long time without appreciable alteration, but the distilled acrolein is rapidly transformed into disacryl. The yield of acrolein is somewhat less than by the usual method, but the quantity of potassium bisulphate used is much smaller and distillation is effected at a lower temperature.—A. S.

Patents.

Formic acid from formates ; Manufacture of concentrated ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Eng. Pat. 20,893, Sept. 13, 1909.

It is stated that it is possible to obtain nearly theoretical yields of formic acid by adding a powdered formate at a low temperature to sulphuric acid of not greater strength than 66° B. (95 per cent. of H_2SO_4), mixing thoroughly, and allowing the temperature to rise spontaneously to complete the conversion, and then distilling off the formic acid, preferably in a vacuum. Formic acid of about 81 per cent. strength may be obtained by using sulphuric acid of 63° B., whilst 91 per cent. formic acid is obtained if 66° B. sulphuric acid is used. The use of more concentrated sulphuric acid is conducive to decomposition of the formic acid.—T. F. B.

Amide of β-β-methylpropylpropionic acid. L. Taub, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 961,385, June 14, 1910.

β-β-Methylpropylpropionic acid is converted, by means of phosphorus trichloride, into its chloride, which is then transformed into the amide by the action of ammonia. The new amide melts at 99° C., is soluble in alcohol and benzene, and possesses sedative properties.—T. F. B.

Pharmaceutical compounds ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,044, Dec. 1, 1909.

See U.S. Pat. 961,385 of 1910 ; preceding. The isomeric amide of β-β-diethylpropionic acid (m. pt. 127·5° C.), prepared in a similar manner, is also claimed. The amides may also be obtained by condensing the halogenides of the carbinols with alkali-cyano-acetic esters, saponifying, and heating the products.—T. F. B.

Pharmaceutical products ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,715, Dec. 8, 1909.

When phenolphthalein is treated with alcoholates of alkali metals or of calcium, or with alcoholic solutions of alkalis, new compounds are obtained, which are easily soluble in water and only slightly coloured, and therefore suited for use in medicine. A suspension of 317 parts of phenolphthalein in 600 parts of alcohol is added to a solution of 60 parts of sodium in 600 parts of alcohol ; after some time the new salt separates in the form of light "pink-red" crystals.—T. F. B

Pharmaceutical compounds ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,719, Dec. 8, 1909.

The ortho-oxymercuric compound of salicylic anhydride is converted into readily soluble compounds by treatment with salts of hydrocyanic acid. 350 parts of the mercury compound are stirred with a solution of 65 parts of sodium cyanide dissolved in 2500 parts of water until the solution is neutral to litmus ; it is then filtered and evaporated *in vacuo*. The new compounds are said to be valuable antisyphilitics, and especially suitable for subcutaneous injection.—T. F. B.

Mercury salicylate ; Process for preparing easily soluble compounds of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 224,864, May 19, 1909. Addition to Ger. Pat. 224,435, April 14, 1909 (see this J., 1910, 1037).

Compounds of mercury salicylate, similar to those described in the principal patent, are obtained by employing in the process there described, in place of amino-fatty acids, such compounds as have both a basic and acid character, and are neutral to litmus, *e.g.*, urea, dicyanodiamide, acid amides, polypeptides, urethanes, nuclein salts, albuminoids, albumoses, and xanthine bases. The new compounds are easily soluble in water, and are not affected by alkalis: acids precipitate insoluble mercury salicylate from their solutions.—T. F. B.

Camphene ; Process for preparing ——. Terpinwerk G. m. b. H. Fr. Pat. 413,282. May 21, 1909.

Camphene is prepared from pinene hydrochloride by treatment with alkali or alkaline-earth hydroxides in presence of compounds which will combine with water, such as alkali or alkaline-earth oxides. For example, a mixture of 10 parts of calcined soda, 10 parts of quicklime, 10 parts of slaked lime, and 20 or 30 parts of pinene hydrochloride is heated for some hours at 130°—150° C., until the camphene is free from chlorine, when it is distilled off under reduced pressure; the yield amounts to 95 per cent. of the theoretical yield.—T. F. B.

Terpene alcohols ; Process for preparing ——. Terpinwerk G. m. b. H. Fr. Pat. 413,289, May 22, 1909.

Terpenes are converted directly into terpene alcohols by treating with aqueous solutions of sulphonic acids, thus avoiding the saponification of the esters formed in the known process of treating terpenes with fatty acids. For example, one part of camphene is agitated for about 20 hours at 18°—20° C., with 6 parts of a 65 per cent. aqueous solution of toluenesulphonic acid: 15 parts of water are then mixed with the product, and the isoborneol is washed, neutralised, distilled with steam, and crystallised from benzene.—T. F. B.

Albumin-lecithin-saline preparation ; Process for obtaining a ——. L. Haensler. Ger. Pat. 223,876, Sept. 1, 1908.

Emulsions of albumin and lecithin are precipitated by means of several suitable electrolytes, which interact to form a precipitate, but which have no action on the colloids by themselves. The preparations may also be obtained by precipitating the colloids together from their emulsions by means of an alternating electric current, in conjunction with a suitable salt as electrolyte. For example, 100 grms. of casein and 2 grms. of sodium hydroxide are dissolved in water; 8 grms. of lecithin are emulsified with this solution, and the emulsion is treated successively with solutions of 5 grms. of sodium phosphate and 3 grms. of calcium chloride, the precipitate being separated and dried *in vacuo*.—T. F. B.

Monoiodosalicylic acid or its homologues ; Process for preparing ——. M. Haase. Ger. Pat. 224,536, Dec. 18, 1908.

Mono-iodo derivatives of salicylic acid or its homologues are prepared by the action of a solution of iodine in potassium iodide solution on an alkaline solution of the acid, the quantity of free iodine employed being less than that required for the complete conversion of the acid into the mono-iodo derivative. It is preferable to cool the mixture during the reaction, which occupies several hours. The mono-iodo-hydroxycarboxylic acids are precipitated by mineral acid, and purified by crystallisation from benzene. When salicylic acid is treated according to the above process, the *p*-iodosalicylic acid (COOH : OH : I=1 : 2 : 5), of m. pt. 196° C., is produced.—T. F. B.

Monoiodo-acetylsalicylic acid ; Process for preparing ——. M. Haase. Ger. Pat. 224,537, Dec. 18, 1908.

A mono-iodo-acetylsalicylic acid is obtained by acetylating by the usual methods the monoiodo-salicylic acid (COOH : OH : I=1 : 2 : 5) prepared according to Ger. Pat. 224,536 (preceding).—T. F. B.

Anhydrides of acidylsalicylic acids ; Process for preparing ——. A. Einhorn. Ger. Pat. 224,844, July 7. 1908.

The carbonic acid esters of acidylsalicylic acids of the formula, Acidyl.O.C_6H_4.COO.COOAlkyl, obtained by the action of chlorocarbonic esters on acidylsalicylic acids in presence of tertiary bases such as pyridine, are converted on warming into the anhydrides of the acidylsalicylic acids. Acetylsalicylic anhydride has a m. pt. of 85° C., benzoylsalicylic anhydride 109°—111° C., and cinnamoylsalicylic anhydride 110°—112° C.—T. F. B.

Mercury cholate ; Process for preparing ——. J. D. Riedel A.-G. Ger. Pat. 224,980, Jan. 22, 1910. Addition to Ger. Pat. 171,485, Jan. 1. 1905 (see Eng. Pat. 11,180 of 1905; this J., 1905. 939).

Pure mercury cholate may be prepared by the action of slightly acid solutions of mercuric nitrate on aqueous solutions of alkali salts of cholic acid. The product gives a clear, stable solution in a 1 per cent. solution of common salt, contains 19·6 per cent. of mercury, and corresponds to the formula $(C_{24}H_{39}O_5)_2Hg$.—T. F. B.

Theophylline and piperazine ; Process for preparing a double compound of —— *easily soluble in water.* Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 224,981, Dec. 18, 1908. Addition to Ger. Pat. 214,376, May 4, 1907.

The soluble double compound of theophylline and piperazine described in the principal patent (U.S. Pat. 919,161 of 1909; this J., 1909, 543) can also be obtained by the action of less than one molecular proportion (but not less than ¾ mol.) of piperazine on theophylline, either in the molten condition or in solution; in the latter case the resulting solution should be evaporated *in vacuo*. (See also Ger. Pat. 217,620; this J., 1910. 452.)—T. F. B.

Methylene ketones ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 19,088, Aug. 19, 1909.

See Fr. Pat. 409,403 of 1909; this J., 1910, 719.—T. F. B.

Thiosinamine ; Method for the preparation of concentrated solutions of ——. W., L., and E. A. Merck, Darmstadt, Germany. Eng. Pat. 29,247, Dec. 14, 1909. Under Int. Conv., Feb. 26, 1909. Addition to Eng. Pat. 22,533 of 1905, dated Dec. 12, 1904.

See Ger. Pat. 215,789 of 1909; this J., 1909, 1326.—T.F.B.

Diagnostic and curative preparation [for tuberculosis] ; Processes of obtaining a ——. W. Schultz, Charlottenburg, Germany. Eng. Pat. 1398, Jan. 19, 1910.

See Ger. Pats. 223,561 and 224,396; this J., 1910, 977 and 1037.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Cinematograph films ; Process for re-utilising the band supports of ——. R. W. James, London. From Comp. Générale de Phonographes, Cinématographes, et Appareils de Précision, Paris. Eng. Pat. 14,950, June 26. 1909.

Old or spoilt cinematograph films are treated by a process which will remove the gelatin without materially affecting the supports, such as is described in Eng. Pat. 14,407 of 1909 (this J., 1909, 1327); the band supports are then re-emulsified by any suitable process (see Eng. Pat. 14,039 of 1909; this J., 1910, 373).—T. F. B.

Films ; Non-inflammable ——, *especially for cinematographs.* W. Merckens and H. B. Manissadjian. Fr. Pat. 413,658. March 16, 1910.

Non-inflammable films may be prepared from mixtures of cellulose acetate with esters of phenol, cresols, naphthols, etc. For example, a film composition may consist of 5 kilos. of cellulose acetate and 1 kilo. of phenyl phosphate, dissolved in 12 litres of acetone, the mixture being worked up in the usual manner.—T. F. B.

Dyestuffs used in photography; Process for sensitising ——. J. H. Smith. Fr. Pat. 413,222, March 2, 1910. Under Int. Conv., March 3, 1909.

Thiosinamine (allyl thio-urea) is an efficient sensitiser for use with dyestuffs, in the bleaching-out process of photography: under certain conditions, its efficiency is twenty times as great as that of anethol. It may be used alone or in combination with other sensitisers, and may either be mixed with the emulsion or with the dyestuff solution, or it may be formed in the emulsion by the action of ammonia on allyl mustard oil. It is especially efficient as a sensitiser for Methylene Blue, Victoria Blue, Erythrosin, and Eosin.—T. F. B.

Developing photographic plates by means of thin layers of developer; Process for ——. H. Seemann. Ger. Pat. 221,404, Dec. 11, 1908.

This invention, the object of which is to apply only just sufficient solution to completely develop the plate and thus to avoid the possibility of over-development, consists in holding the edges of the film-side of the exposed plate tightly against the rim of a very shallow dish, the developer being introduced into the space thus formed through an opening in the side of the dish.—T. F. B.

Printing-plates; Process for producing ——. E. Albert, Munich, Germany. U.S. Pat. 967,875, Aug. 23, 1910.

See Eng. Pat. 25,934 of 1908; this J., 1909, 1063.—T.F.B.

Films for photography; Process for preparing sensitive positive or negative ——. E. Brandenberger. Fr. Pat. 413,900, June 5, 1909.

See Eng. Pat. 13,328 of 1909; this J., 1909, 1223.—T.F.B.

XXII.—EXPLOSIVES; MATCHES.

Black powder; Gaseous decomposition products of ——, *with special reference to the use of black powder in coal mines.* C. M. Young. Trans. Amer. Inst. Min. Eng., 1910, 637—662.

A number of samples of the black powder used in American coal mining were examined, particularly in reference to mine explosions. The powder differs from gunpowder in the use of sodium nitrate in place of potassium nitrate, with an accompanying change in the proportion of sulphur and charcoal. An average of five assays gave: moisture 0·7, sodium nitrate 72·0, sulphur 11·1, and charcoal 16·1 per cent. The powder was fired under high and low pressure and also with an admixture of coal dust. It was found that when fired alone no combustible gases were formed, but when fired in the presence of coal, especially of one rich in volatile matter, dangerous gases were sometimes produced. When an excess of powder is used, which is frequently the case, and when more than one shot is fired, the explosion of the last shot may cause a serious accident, by firing the gases produced from previous shots. In addition to the danger of explosion and to health from the combustion products, the free use of explosives tends to weaken the roof and cause falls and also to shatter the coal and render it less valuable.—F. R.

Patents.

Explosive. W. C. McLaughlin, Assignor to F. E. Whitney, Oakland, Cal. U.S. Pat. 968,389, Aug. 23, 1910.

A mixture of potassium chlorate, soot, sugar, alcohol, a cereal paste, sulphur, and aluminium.—F. R.

Explosive; A new compressed —— *containing chlorate and nitrocompounds.* Soc. Française des Explosifs "Prométhée." Fr. Pat. 413,224, March 2, 1910.

The explosive consists of non-explosive solid and liquid ingredients, which are intended to be mixed before use by miners, etc. The solid portion consists of potassium chlorate (85—95 parts), powdered aluminium (3—5) and manganese dioxide (0—12 parts). The liquid portion is composed of nitrobenzene (60—80 parts), petroleum (5—20), and turpentine (10—20 parts). The solid ingredients are finely powdered and intimately mixed and are then compressed into discs of varying diameter and thickness to meet special requirements. The discs (9 parts) are superimposed, and the liquid (1 part) poured over them. After drying in the air, the charge is ready to be placed in the borehole and fired with a No. 7 or 8 detonator.—G. W. McD.

Explosive; A new ——. Soc. Française des Explosifs "Prométhée." Fr. Pat. 413,259, March 4, 1910.

The solid portion consists of potassium chlorate (70—80 parts), ferric oxide (0—10) and powdered aluminium (5—10 parts). The liquid portion, forming 10 per cent. of the finished explosive, is composed of turpentine (7—9 parts) and carbolic acid (phenol) (1—3 parts).
—G. W. McD.

Explosives. M. Delvigne. Fr. Pat. 413,418, March 9, 1910. Under Int. Conv., April 2, 1909.

It is proposed to employ the silicides of the alkaline-earths as substitutes for aluminium, magnesium, silicon and ferrosilicon as ingredients of explosives. The following are given as examples. Ammonium nitrate (80 parts) and calcium silicide (20 parts), and ammonium nitrate (95 parts) and calcium silicide (5 parts). It is stated that 10 grms. of the former composition will give a Trauzl block expansion of 650 c.c., and that the latter is a safety explosive. Another composition given is ammonium nitrate (78·2 parts), trinitrotoluene (8), and calcium silicide (13·8 parts). This explosive is said to give a Trauzl block test of 750 c.c.—G. W. McD.

Smokeless powders and other nitrated explosives; Optical indicator of the decomposition of —— *especially applicable for packages containing old explosives.* J. C. E. Bouchaud-Praceiq. Fr. Pat. 413,821, June 3, 1909.

Where an explosive is contained in well sealed cases it is proposed to have a "sight-hole" of glass. The interior surface of the glass is covered with a film of any compound which by change of colour would indicate the presence of traces of oxides of nitrogen in the air of the case. Part of the film is protected from such action, and so serves as a standard of original colour. (See also this J., 1908, 961; 1909, 1007, 1105.)—G. W. McD.

XXIII.—ANALYTICAL PROCESSES.

Chromic acid, ferric salts, and nitrous acid; Pyrogallol-dimethylether, a delicate reagent for ——. J. Meyerfeld. Chem.-Zeit., 1910, **34**, 948.

A freshly-prepared 2 per cent. solution of pyrogallol-dimethylether acts as a very delicate reagent for the detection of chromic acid, ferric salts, nitrous acid, and other oxidising agents, with which it gives a red or yellow coloration; 0·001—0·002 mgrm. of chromic acid (in 10 c.c.) may be detected in this way, as compared with 0·04 mgrm. by means of hydrogen peroxide and ether: very dilute solutions are preferably extracted with a few drops of chloroform, to which the colour is imparted. The yellow colour is also given by a solution containing 0·016 mgrm. of potassium nitrite in 10 c.c. and with very dilute (colourless) solutions of chlorine, bromine, or potassium permanganate, but dilute solutions of nitric acid and hydrogen peroxide give no coloration, nor is the reagent affected by atmospheric oxygen.—F. Sodn.

Magnesium-ammonium phosphate. K. Bube. Z. anal. Chem., 1910, **49**, 525—596.

An investigation into the methods of determination of magnesium and of phosphoric acid dependent upon the precipitation of magnesium-ammonium phosphate. Of all the substances examined, with the view of having stable and definite compounds of magnesium and of phosphoric acid respectively, crystallised magnesium sulphate,

$MgSO_4.7H_2O$, and microcosmic salt, $NaNH_4HPO_4.4H_2O$, were the only ones the composition of which corresponded accurately with their formulæ. Magnesium-ammonium phosphate precipitates as mono- or hexahydrate according to the temperature; one changes into the other at 47°—48° C. in water, at a rather higher temperature in a liquid containing magnesium and ammonium chlorides and ammonia. The solubility of the salt varies according to the mixture of hydrates of which it consists; the solubilities of the two hydrates at different temperatures, in water and in a solution of ammonium chloride and ammonia were determined. The hexahydrate in solutions much above 48° C., and the monohydrate in solutions at lower temperatures, exhibit a tendency to decompose, with production of trimagnesium phosphate, and consequently with solution of a larger amount of phosphoric acid. The ions Mg'', OH', PO_4''' and HPO_4'' lessen the solubility of magnesium-ammonium phosphate, the ion H' increases it, whilst the ion NH_4' in low concentration lessens, in high concentration increases it. In Jörgensen's method of precipitation, or whenever the ratio of ammonium hydroxide to ammonium chloride in the solution is too high, there is the possibility of precipitating magnesium hydroxide along with the double phosphate. Moreover, under certain circumstances, ammonium phosphate may be precipitated, and, especially if mechanically enclosed in the double phosphate precipitate, not be completely converted afterwards into the double phosphate. The loss of phosphoric acid by volatilisation during ignition of the precipitate, which has been occasionally remarked by many observers from Neubauer onwards, is probably due to the presence in the precipitate of ammonium phosphate. In Schmitz's method, where the solution, containing magnesium and ammonium compounds and phosphoric acid, is made acid, and afterwards precipitated by adding ammonia, magnesium hydrogen phosphate may be formed; and as this is much more soluble than the double phosphate, and is not rapidly converted into it, low results may be given by this method if time be not given before filtration for the conversion to take place. If, too, according to Schmitz, a great excess of magnesia mixture and of ammonium chloride be added, the solubility-product of magnesium hydroxide may be exceeded, and this substance be precipitated. The author is working out a method for the accurate determination of phosphoric acid or of magnesium, based upon the results contained in this paper.—J. T. D.

Phosphoric acid and phosphates; Sensitive reagents for ——. G. Denigès. Bull. Soc. Pharm. Bordeaux, May, 1910, 195. Pharm. J., 1910, **85**, 321.

THE author has prepared a series of reagents for phosphoric acid and phosphates. 0·5 grm. of quinine sulphate is shaken with 50 c.c. of water, 10 c.c. of nitric acid of sp. gr. 1·39 are added and when solution is complete, 10 c.c. of ammonium nitromolybdate reagent are introduced and the whole made up to 100 c.c. (The nitro-molybdic reagent is made by dissolving 15 grms. of ammonium molybdate in lukewarm water, and making up the volume, after cooling, to 100 c.c. with water, then pouring this solution into a mixture of 50 c.c. of pure nitric acid, sp. gr. 1·390, and 50 c.c. of water.) Similar reagents may be prepared either with 0·5 grm. of antipyrine, or 0·5 grm. of strychnine sulphate, instead of quinine sulphate. That prepared with antipyrine becomes rose coloured, then red in about a day's time, tending to become yellow finally. That with strychnine becomes gradually of a picric yellow colour. These changes of colour, however, do not affect the delicacy of the two reagents. In preparing the antipyrine reagent, the antipyrine is dissolved in about 50 c.c. of water before adding the nitric acid and the solution of nitromolybdate, while in the case of strychnine sulphate, the salt (0·5 grm.) is dissolved in 20 c.c. of water by heat, adding, immediately after, 50 c.c. of cold water, then 10 c.c. of nitric acid and 10 c.c. of the nitro-molybdate solution, finally making up to 100 c.c. with water. A few c.c. of these reagents precipitate abundantly with a few drops of very dilute phosphoric acid, free or combined. A few hundredths of a milligram of phosphorus, in the state of phosphoric acid, per litre may thus be detected by the strychno-molybdic reagent, which is the most delicate of the three. In extreme dilutions only a turbidity occurs. These reagents are precipitated by tannin and salts of mercury, but the latter may be got rid of by calcination before testing for phosphates. Arsenic acid and the arsenates likewise precipitate the reagents, but in a less degree than phosphates, but the arsenical precipitate obtained with the quino-molybdic reagent is white, while that with phosphates becomes yellowish very quickly.

Colloid phenomenon: A new —— in analysis. Interaction of colloidal molybdic and tungstic acids. L. Wöhler and W. Engels. Z. Elektrochem., 1910, **16**, 693—697.

IN preparing the molybdic acid reagent for the determination of phosphoric acid by the addition of nitric acid to ammonium molybdate solution, a precipitate of polymolybdate is first formed, which redissolves on adding more acid. If the clear acid solution be heated to 70°—80 C., or in some cases, to boiling, a white crystalline precipitate of molybdic acid hydrate separates, a fact which is of importance in those methods of determining phosphoric acid where the phosphomolybdate precipitate is weighed or determined volumetrically by dissolving in potassium hydroxide and titrating with acid. The phenomenon appears to be due to the presence of tungstic acid (or ammonium tungstate) in the ammonium molybdate, the precipitate containing from 10 to 30 per cent. of tungstic acid according to the conditions, the proportion being smaller the higher the temperature at which precipitation took place; the precipitate contains only one-half or less of the tungstic acid present. Experiments showed also that a notable quantity of tungstate could be added gradually to an acid solution of ammonium molybdate without a precipitate being produced. By repeated sublimation it is possible to prepare molybdic acid practically free from tungstic acid and this gives a phosphoric acid reagent which only yields a slight turbidity when boiled for 5—10 mins. The phenomena observed are considered to be due to the formation of a colloidal compound of the unstable hydrosol of tungstic acid and the stable hydrosol of molybdic acid. The colloidal character of tungstic acid solution has long been recognised, and the authors show that though molybdic acid behaves as a crystalloid with respect to its definite solubility, its dissociation, its power of diffusing through parchment, and the acidity and electrical conductivity of its solution, yet it is characterised as a colloid by its high molecular weight, and its tendency to give a glassy mass on evaporation of its solutions; moreover the solutions exhibit the Tyndall effect and the acid forms colloidal compounds, *e.g.*, with gelatin. Molybdic acid may indeed be termed a semi-colloid, and its solution an intermediate form between true solutions and hydrophile or emulsion colloids. This recognition of the colloidal character of tungstic and molybdic acids affords an explanation of the fact that both acids can be retained in acid solution, and separate gradually on keeping, or "ageing," more rapidly on warming, the tungstic acid carrying down with it some molybdic acid (which alone forms a stable hydrosol), owing to the production of a colloidal compound of the two acids. It also affords an explanation of the invariable contamination of commercial tungstic acid by molybdic acid. The authors also point out the great probability that the phosphomolybdate precipitate is not a true chemical compound, but an adsorption compound of a crystalloid with a colloid of varying composition, which only under definite experimental conditions, attains a composition represented by the limiting formula, $(NH_4)_3PO_4.12MoO_3$.—A. S.

Ammonium phosphomolybdate: Precipitation of —— in presence of organic acids. G. Maderna. Atti R. Accad. dei Lincei, Roma, 1910, [5], **19**, I., 827—835. (Chem. Zentr., 1910, **2**, 761.

CONTRARY to the statements of Hundeshagen (Z. anal. Chem., **28**, 163) and Eggertz (J. prakt. Chem., **79**, 496), the author finds that organic acids do not prevent the precipitation of ammonium phosphomolybdate if the solution contains a sufficient quantity of nitric acid. In absence of nitric acid, a quantitative precipitation of ammonium phosphomolybdate can be effected by means of organic acids alone under certain conditions. Oxalic acid dissolves ammonium phosphomolybdate only when very concentrated solutions are used and then only with great difficulty and with the aid of heat. Tartaric acid in dilute solutions has no action on the phosphomolybdate precipitate; in concentrated solutions it exercises a reducing action. The compounds which are formed between molybdic acid, and possibly phosphoric acid, on the one hand, and organic acids on the other, are tolerably stable; they have higher solubility products than ammonium phosphomolybdate.—A. S.

Arsenic; Determination of ——. L. L. Kriekhaus. Eng. and Min. J., 1910, **90**, 357.

From 0·25 to 1 grm. of the material to be analysed, and 3 to 4 grms. of a mixture consisting of 75 per cent. of zinc oxide and 25 per cent. of sodium carbonate, are mixed, placed in a porcelain crucible and covered with ¼ in. of the zinc oxide mixture. The crucible is heated for 15 to 20 min. in a muffle, at a higher temperature than that required for cupelling. When cool, the mixture is stirred, and after crushing any large lumps, emptied into a beaker with 50 c.c. of hot water, and heated nearly to boiling to dissolve the sodium arsenate. The solution is filtered, the residue washed with hot water, the filtrate and washings evaporated to 50 c.c. and an equal bulk of strong hydrochloric acid added. When cool, 10 c.c. of a 20 per cent. solution of potassium iodide are added and stirred, followed after a minute by 100 c.c. of cold water. The solution is titrated with standard sodium thiosulphate, no indicator being required, the fading of the yellow colour being clear and sharp. No arsenic is lost by volatilisation but the concentration of the solution, above mentioned, is essential. The presence of antimony does not affect the result, but chromium and phosphorus probably interfere. Manganese should be removed by oxidising with hydrogen peroxide before filtering.—T. R.

Electro-analysis.—Report of Committee (Messrs. F. S. Kipping (*Chairman*), F. M. Perkin (*Sec.*), G. T. Beilby, T. M. Lowry, W. J. Pope, and H. J. S. Sand). Brit. Assoc. Sect. B. 1910, Sheffield.

The work on electro-analysis has been further elaborated during the year by the publication of papers by F. Mollwo Perkin and W. E. Hughes (this J., 1910, 159), and by H. J. S. Sand (this J., 1910, 47). The experiments referred to a year ago (see this J., 1909, 1067) by Sand with an anode made partly of glass and a cathode of metals, other than platinum, have been completed by him, and will be published shortly. Satisfactory results for copper were obtained with a cathode of silver, and for zinc with a cathode of nickel. In the former case the electrolyte deposit may be removed from the electrode by a solution of hydrogen peroxide in diluted sulphuric acid. Experiments on the separation of the four metals—copper, antimony, tin, and lead—have been continued. It has been shown that chlorides exert a retarding influence on the deposition of copper. This is due to the formation of derivatives of cuprous chloride during electrolysis from which copper is only deposited at a high potential. The conditions for the separation of copper from antimony have been fully elaborated, and mixtures of the three metals—copper, antimony, and tin—corresponding to industrial alloys have been successfully analysed. When lead is present in small quantity this may be deposited with the tin; the greater part of the tin may afterwards be removed by making the electrode the anode in a solution containing sodium polysulphides. The lead may then be separated from the small quantity of remaining tin by means of nitric acid, and can afterwards be deposited electrolytically.

Acrolein; A new colour reaction for ——. E. Voisenet. J. Pharm. Chim., 1910, 2, 214—215.

The author's protein-nitrous acid reagent (this J., 1910, 584 and 894) gives with solutions of acrolein of 1 in 2000 to 1 in 5000 strength, a green colour, but with weaker solutions the green colour which is at first obtained acquires a bluish tint. Solutions containing even less than 1 part of acrolein per million respond to the test. —I. A.

Comparison of Pfeiffer's and Dennis and McCarthy's method for determining benzene in illuminating gas. Harding and Taylor. *See* IIa.

Influence of aluminium salts on the determination of sulphates. [*Determination of sulphur in coal gas.*]. Creighton. *See* IIa.

Determining the ash of mineral oils. Hviid and Severin. *See* IIa.

German regulations for the standard supply and testing of Portland cement and "iron" Portland cement. *See* IX.

Analysis of white-metals. Heyn and Bauer. *See* X.

Assay of lead. Buskett. *See* X

Rapid determination of lead by electrolysis with stationary electrodes. Benner. *See* X.

Determining small amounts of lead in antimony-copper-tin alloys (bearing metals). Mann. *See* X.

Testing the capacity of a soil to decompose cellulose. Christensen. *See* XVI.

Determining the dry substance and marc content of the beet. Skärblom. *See* XVII.

Valuation of sugar-beets on the basis of their content of objectionable [melassigenic] nitrogen. Friedl. *See* XVII.

Colorimetric determination of objectionable [melassigenic] nitrogen in the beet. Friedl. *See* XVII.

Determining alkalinity of calcium sucrate. Taegener. *See* XVII.

Determining sucrose in cane molasses. Deerr. *See* XVII.

Detecting and determining cocoanut oil in butter and margarine. Shrewsbury and Knapp. *See* XIXa.

Determination of shell in cocoa. Filsinger and Botticher. *See* XIXa.

Determining small quantities of essential oil in spices. Brown. *See* XX.

Patents.

Lubricating products; Apparatus for testing ——. Soc. anon. Française Stern-Sonneborn. Fr. Pat. 413,996, March 24, 1910.

The testing machine has an axle carrying a disc which is made to revolve by turning the handle. Facing this disc and capable of being brought more or less closely against it by means of a screw is a second disc, to which is attached a lever balanced by a counterweight to compensate for friction. The lubricant to be tested is introduced between the two discs, and on turning the handle its relative value as compared with that of any product chosen as a standard is indicated upon a dial with an arbitrary scale, by means of a pointer attached to the second disc.—C. A. M.

Apparatus for the continuous automatic determination of the quantity of steam or pressure fluid delivered through a pipe. Eng. Pat. 17,354. *See* I.

Books Received.

Report on Gaseous Combustion. Brit. Assoc. Section B. Sheffield. 1910. By William A. Bone, D.Sc., Ph.D., F.R.S. Spottiswoode & Co., Ltd., London, Colchester and Eton, 1910, or The Secretary of the British Assoc.

Pamphlet, containing 32 pages of subject matter, a plate of illustrations, four ordinary illustrations, and several tables. The report as a whole aims at summarising the results of the principal researches upon the chemical aspects of gaseous combustion during the past thirty years.

Analytical Chemistry. By F. P. Treadwell, Ph.D., Professor of Analytical Chemistry in the Zürich Polytechnikum. Authorised translation from the German by William T. Hall, S.B. Volume II. Quantitative Analysis. Second Edition, thoroughly revised and enlarged. John Wiley and Sons, New York. Chapman and Hall, Limited, London. 1910. Price $4; 17s. net.

8vo volume, containing 777 pages of subject matter, and an alphabetical index. There are 110 illustrations, and an appendix includes a series of tables, numerical and otherwise, and one of logarithms. The classification of the subject-matter is as follows:—I. Introduction, with the chief mechanical operations. II. Gravimetric determinations of the metals. III. (*a*) Sulpho bases. (*b*) Sulpho acids. IV. Gravimetric determination of the metalloids. V. Volumetric analysis. A. Alkalimetry and acidimetry. B. Oxidation and reduction methods. C. Precipitation methods. VI. Gas analysis.

A Text-book of Organic Chemistry. By A. F. Holleman, Ph.D. Professor in the University of Amsterdam. Edited by A. Jamieson Walker, Ph.D., and Owen E. Mott, Ph.D. Third English Edition. John Wiley and Sons, New York. Chapman and Hall, Limited, London. 1910. Price $2.50.

8vo volume containing 570 pages of subject matter, and an alphabetical index. There are 83 illustrations in the text. Following the introduction, devoted to general theory, special methods, etc. Part I. deals with "The Fatty Compounds," and Part II. with the "Aromatic Compounds and substances related to them."

Traité Complet d'Analyse Chimique Appliquée aux Essais Industriels. Par J. Post et B. Neumann. Avec la collaboration de nombreaux chimistes et spécialistes. Deuxième édition française entièrement refondue. Traduite par G. Chenu et M. Pellet. Tome second. Libraire scientifique A. Hermann et fils, 6, rue de la Sorbonne, 6. Paris. 1910. Price 13 francs.

8vo volume containing 909 pages of subject matter, with 85 illustrations and a table of contents. The volume commences on page 497, and chapter XXV. which is devoted to the subject of beer; chapter XXVI to that of wine; XXVII to cider and perry; XXVIII to alcohol and pressed yeast; XXIX to vinegar, acetic acid, acetates, wood spirit, etc., and XXX, a supplement, to lime, cements, plasters, etc.

Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions. 1909. Volume II. [Cd. 5298]. Wyman and Sons, Fetter Lane, E.C. Price 3s. 2d.

This volume contains tables of imports from, and exports to, each country; tables of imports and exports at each port; tables showing the amount of Customs revenue received at each port or place; details of the transhipments under bond of certain articles; an account of the quantities of articles liable to Customs duties remaining in bond, and details of the transhipments of free goods on through bills of lading.

Statistical Abstract for the United Kingdom in each of the last fifteen years from 1895 to 1909. [Cd. 5296.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 8d.

This is the fifty-seventh number of a publication which is compiled annually in the Commercial Department of the Board of Trade. It embodies in a concise form the more important statistical data available from official sources in regard to the finances, trade, shipping, agriculture, fisheries, railways, tramways, banking operations, education, etc. of the United Kingdom during the past fifteen years.

East India. Statistical Abstract relating to British India from 1899—1900 to 1908—9. [Cd. 5,345.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 3d.

This abstract contains statistics of the area and population, finance, justice, education, railways, agriculture, industry, trade, shipping, etc. of British India.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

20,122. White. Drying machines. Aug. 29.

20,238. White. Drying machines. Aug. 30.

20,240. Ramén. Tunnel kilns or furnaces.* Aug. 30.

20,503. Ison and Watts. Furnaces. Sept. 2.

20,794. Bayer. Purifying and cooling gases. [Ger. Appl., Sept. 22, 1909.]* Sept. 6.

20,807. Epstein. Distillation or rectification. Sept. 6.

20,826. Billing. Producing crystals in a fine granular state. Sept. 7.

20,945. Paton. Centrifugal machines.* Sept. 8.

21,068. Dinckels. Evaporators.* Sept. 9.

21,127. Kruse. Separation of liquids and solids. Sept. 10.

Complete Specifications Accepted.

17,459 (1909). Lake (F. Krupp A.-G.). Separation of substances by the wet magnetic process. Sept. 7.

28,603 (1909). Méker. Furnaces or ovens. Sept. 7.

29,755 (1909). Caldecott. *See under* X.

4571 (1910). Kestner. Apparatus for concentrating liquids. Sept. 7.

5020 (1910). Kestner. Apparatus for concentrating liquids. Sept. 14.

9089 (1910). Maschinenbau-Anstalt Humboldt. Rotary drying drums. Sept. 14.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

20,245. Falding and Cathcart. Purifying gas and recovering values present as impurities. [Comprised in No. 11,364, May 7, 1910.]* Aug. 30.

20,409. Taylor. Purifying or decolorising crude petroleum, fatty substances, etc. Sept. 1.

20,571. Dickie. Incandescent gas mantles. Sept. 3.

20,794. Bayer. *See under* I.

20,857. Johnson, and Charbonite (1909), Ltd. Treating raw peat to render it applicable for use as fuel. Sept. 7.

20,898. Moeller (Billon-Daguerre). *See under* VIII.

20,976. Roesch. Treatment of oil and petrol for lighting, heating, etc. Sept. 8.

20,982. Roesch (Burchard). Treatment of oil for lighting, heating, etc. [Comprised in No. 24,216, Oct. 21, 1909.] Sept. 8.

Complete Specifications Accepted.

19,639 (1909). Cambridge. Apparatus for generating gas. Sept. 7.

20,237 (109). Simpson. Manufacture and purification of coke or other fuel. Sept. 14.

20,592 (1909). Tully. Retort furnaces for the destructive distillation of coal. Sept. 14.

26,858 (1909). Stewart and Stewart. Gas producers. Sept. 14.

27,714 (1909). Fabbri. Treatment of mineral and like oils for lighting, fuel, etc. Sept. 14.

27,960 (1909). Lake (Hite). Manufacture of coal briquettes. Sept. 14.

343 (1910). Reichel. Regenerators for coke ovens. Sept. 14.

3197 (1910). Summers. Coking process. Sept. 14.

4473 (1910). Fabry. *See under* VII.

III.—TAR AND TAR PRODUCTS.

Application.

20,109. Imray (Meister, Lucius, und Brüning). Manufacture of an oxidation product of β-aminoanthraquinone. Aug. 29.

Complete Specification Accepted.

29,139 (1909). Newton (Bayer und Co.). Manufacture of derivatives of the anthraquinone series. Sept. 14.

IV.—COLOURING MATTERS AND DYES.

Applications.

20,096. Newton (Bayer und Co.). Manufacture of oxazine dyestuffs and their leuco-compounds. Aug. 29.

20,110. Imray (Meister, Lucius, und Brüning). Manufacture of blue vat dyestuffs of the anthraquinone series. Aug. 29.

20,216 and 20,217. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of azo dyestuffs. Aug. 30.

20,324. Imray (Meister, Lucius, und Brüning). Manufacture of a new form of indigo. [Addition to No. 18,761 of 1910.] Aug. 31.

20,334. Bayer und Co. Manufacture of azo dyestuffs. [Ger. Appl., Sept. 3, 1909.]* Aug. 31.

20,338. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. Aug. 31.

20,430. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of disazo dyestuffs directly dyeing cotton. Sept. 1.

20,726. Footal. Dyes for domestic purposes. Sept. 6.

20,815. Levinstein, and Levinstein, Ltd. Azo dyestuffs and their production. Sept. 7.

20,970. Meister, Lucius, und Brüning. Manufacture of vat dyestuffs. [Ger. Appl., Sept. 28, 1909.]* Sept. 8.

Complete Specifications Accepted.

22,714 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of halogen derivatives of the indigo series. Sept. 14.

26,344 (1909). Newton (Bayer und Co.). Manufacture of acid wool dyestuffs. Sept. 14.

932 (1910). Newton (Bayer und Co.). *See under* XIII.

6351 (1910). Imray (Soc. Chem. Ind. in Basle). Manufacture of brominated vat dyestuffs. Sept. 14.

10,331 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of yellow disazo dyestuffs. Sept. 14.

12,715 (1910). Kubicek. *See under* XXIII.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

20,283. Thompson. Treatment of flax. Aug. 31.

20,333. Pearson and Stoneham. Manufacture of peat-board. Aug. 31.

20,560. Milne. Treatment of bamboo preparatory to making it into pulp. Sept. 3.

20,672. Mork. Cellulose esters and process of treating same. [U.S. Appl., Feb. 10, 1910.]* Sept. 5.

Complete Specification Accepted.

14,364 (1910). Bayer und Co. Production of pressed or shaped cellulose compounds from cellulose esters. Sept. 7.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

20,372. Sutherland. Bleaching or cleansing vegetable fibres. Sept. 1.

20,666. Morton. Machines for dyeing yarn.* Sept. 5.

21,052. Badische Anilin und Soda Fabrik. Production of discharge effects on vat colouring matters. [Addition to No. 30,505 of 1909. Ger. Appl., Jan. 31, 1910.]* Sept. 9.

Complete Specifications Accepted.

21,952 (1909). Hahn. Yarn mercerising machine. Sept. 14.

18,184 (1910). Mertens. Machine for printing lengths of fabric, etc. Sept. 14.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

20,127. Johnson (Badische Anilin und Soda Fabrik). Catalytic manufacture of ammonia. Aug. 29.

20,131. Salessky. Denitrating nitrose in the lead chamber process.* Aug. 29.

20,186. Wedekind und Co. Utilising the sulphur in sulphates, especially calcium sulphate. [Ger. Appl., April 12, 1910.]* Aug. 30.

20,325. Kaiser. Manufacture of nitrogen-oxygen compounds. [Ger. Appl., Aug. 31, 1909.]* Aug. 31.

20,332. Smith. Utilising the waste insoluble substances from solutions of bleaching powder.* Aug. 31.

20,386. Heys (Nitrogen Co.)* Production of alkali or alkaline-earth metals.* Sept. 1.

20,519. Johnson (McNitt). Electrolytic manufacture of alkali metals and their alloys.* Sept. 2.

20,777. Häusser. Manufacture of nitrogen oxides.* Sept. 6.

20,875. Henss. Manufacture of ammonium sulphate. [Ger. Appl., Sept. 8, 1909.]* Sept. 7.

20,989. Johnson (McNitt). Separation of alkali metals from alloys or combinations with other metals.* Sept. 8.

21,128. Westhausser. Making hydrochloric acid or hydrobromic acid from chlorine or bromine. Sept. 10.

Complete Specifications Accepted.

20,401 (1909). Chem. Fabr. Griesheim-Elektron. Manufacture of sulphuric acid. Sept. 14.

28,609 (1909). Glaser and Muller. Refining salt and recovering its impurities as by-products. Sept. 7.

4473 (1910). Fabry. Recovering ammonium sulphate direct from coke oven or retort gas. Sept. 14.

7079 (1910). Mackenzie (Reid). Method and apparatus for hydrating lime. Sept. 7.

8339 (1910). Marks (Blumberg and Rindskopf). Preparation of aldehyde-sulphoxylates. Sept. 14.

8734 (1910). Dieffenbach and Moldenhauer. Manufacture of hydrogen. Sept. 14.

9884 (1910). Salpetersäure Ind.-Ges., and Pauling. Manufacture of nitrites and nitrates. Sept. 7.

17,809 (1910). Zeiss. Mixtures disengaging oxygen when heated. Sept. 14.

VIII.—GLASS; CERAMICS.

Applications.

20,414. Demongeot. The baking of vitrifiable substances.* Sept. 1.

20,502. Burckhardt. Moulding fused quartz, etc.* Sept. 2.

20,897. Moeller (Billon-Daguerre). Manufacture of quartz goods. Sept. 8.

20,898. Moeller (Billon-Daguerre). Manufacture of quartz lamps. Sept. 8.

IX.—BUILDING MATERIALS.

Application.

20,782. Goddard. Concrete and like compounds. Sept. 6.

Complete Specification Accepted.

47 (1910). Coventry (Doherty). Apparatus for burning cement. Sept. 14.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

20,115. Berglof. Reduction of metal ores. [U.S. Appl., Sept. 3, 1909.]* Aug. 29.

20,133. Savelsberg. Sintering iron and other ores and metalliferous compounds. [Ger. Appl., Feb. 24, 1910.]* Aug. 29.

20,247. Ramén. Working tunnel kilns for burning ore bricks, etc.* Aug. 30.

20,337. Cowing. Producing alloys and separating metals.* Aug. 31.

20,339. McNitt. Reduction of metals from their compounds. [U.S. Appl., Sept. 9, 1909.]* Aug. 31.

20,386. Heys (Nitrogen Co.). *See under* VII.

20,519. Johnson (McNitt). *See under* VII.

20,594. Levoz. Production of steel by electrical methods. [Belg. Appl., Sept. 4, 1909.]* Sept. 3.

20,601. Jacquier. Alloy. Sept. 3.

20,669. Woud. Coating iron sheets, etc., with aluminium.* Sept. 5.

20,749. Bishop and Favero. Plating brass, steel, etc. Sept. 6.

20,754. Cowper-Coles. Electro-deposition of iron. Sept. 6.

20,764. Lehane. Spelter condensers. Sept. 6.

20,776. Consigliere. Process and apparatus for electro-deposition. [Ital. Appl., Sept. 7, 1909.]* Sept. 6.

20,896. Hardingham (Huntington). Means for use in separating volatile metals from ores or other metalliferous substances. Sept. 8.

21,122. Vautin. Treatment of zinc and copper. Sept. 10.

Complete Specifications Accepted.

20,057 (1909). Cowper-Coles. Apparatus for electroplating. Sept. 7.

20,471 (1909). Cobb (Cobb). Extraction of gold and silver from their ores. Sept. 7.

24,003 (1909). Lockwood. Treatment of auriferous or argentiferous minerals. Sept. 7.

29,365 (1909). Buderus'sche Eisenwerke. Apparatus for atomising liquid slag. Sept. 14.

29,755 (1909). Caldecott. Settling tanks for separating liquid from crushed ore products and other granular materials. Sept. 14.

5369 (1910). Roman. Electroplating apparatus. Sept. 14.

6485 (1910). Wilm. Process for improving alloys. Sept. 14.

9406 (1910). Richardson. Manufacture and treatment of steel. Sept. 14.

XI.—ELECTRO-CHEMISTRY.

Applications.

20,180. Beach. Anodes for electrolytic purposes. Aug. 30.

20,404. Ruthenburg. Electrical furnaces.* Sept. 1.

20,519. Johnson (McNitt). *See under* VII.

Complete Specifications Accepted.

20,129 and 22,715 (1909). Johnson (Badische Anilin und Soda Fabrik). Means for producing long electric arcs. Sept. 7.

XII.—FATS; OILS; WAXES.

Applications.

20,409. Taylor. *See under* II.

20,649. Richter und Richter, and Von Orth. Purifying and bleaching wax of all kinds. [Ger. Appl., Dec. 23, 1909.]* Sept. 5.

20,650. Richter und Richter, and Von Orth. Bleaching solid and semi-solid fats. [Ger. Appl., May 10, 1910.]* Sept. 5.

Complete Specification Accepted.

20,089 (1909). Macpherson and Heys. Soap and the manufacture thereof. Sept. 14.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Application.

20,655. Freymuth. Manufacture of lac.* Sept. 5.

Complete Specification Accepted.

932 (1910). Newton (Bayer und Co.). Manufacture of colouring matter lakes. Sept. 14.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

20,291. Killen. Manufacture of rubber, vulcanite, or other compounds. Aug. 31.

21,074. Tarver. Manufacture of articles from waste rubber, etc. Sept. 10.

21,118. Killen. Manufacture of rubber, vulcanite, and other compounds. Sept. 10.

Complete Specification Accepted.

19,701 (1909). Wallace. Production of isoprene. Sept. 7.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

20,874. Hart. Manufacture of artificial leather. Sept. 7.

Complete Specification Accepted.

26,040 (1909). Nance. Process of tanning. Sept. 14.

XVI.—SOILS; FERTILISERS.

Complete Specification Accepted.

9261 (1910). Coates. Production of fertilisers. Sept. 7.

XVII.—SUGARS; STARCHES; GUMS.

Complete Specifications Accepted.

19,768 (1909). Greenwood, Stocks, and White. Manufacture of gum tragasol. Sept. 7.

30,390 (1909). Holste. Bleaching-starch. Sept. 14.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

20,058. Fleming. Treatment of fermented liquids.* Aug. 29.

20,063. Lambert. Drying malt. Aug. 29.

20,521. Ransford (Soc. Franç. des Distilleries de l'Indo-Chine). Manufacture of fermented liquors of the saké type.* Sept. 2.

20,807. Epstein. *See under* I.

XIX.—FOODS. WATER PURIFICATION; SANITATION.

Applications.

20,176. Hogarth. Treatment of flour. Aug. 30.

20,489. Kuhn. Manufacture of beverages from grapes and raisins. [Addition to No. 27,831 of 1909.]* Sept. 2.

20,520. Ransford (Soc. Franç. des Distilleries de l'Indo-Chine). Manufacture of sauces or food products from soja and other leguminous matters.* Sept. 2.

Complete Specifications Accepted.

21,855 (1909). Edgeworth. Bacteriological treatment of sewage. Sept. 7.

28,371 (1909). Stohr. Manufacture of milk food preparations. Sept. 7.

754 (1910). Neumann. Manufacture of cocoa powder. Sept. 14.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Complete Specifications Accepted.

19,701 (1909). Wallace. *See under* XIV.

24,379 (1909). Wetter (Hoffmann-La Roche und Co.). Opium preparations suitable for pharmaceutical purposes. Sept. 7.

14,016 (1910). Sefton-Jones (Wülfing). Digestive remedy. Sept. 7.

15,392 (1910). Bloxam (Boehringer und Söhne). Manufacture of quinine compounds. Sept. 7.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

20,046 (1909). Albert. Manufacture of photographic printing paper. Sept. 7.

XXII.—EXPLOSIVES; MATCHES.

Applications.

20,494. Polster. Explosive for detonating pellets, etc.* Sept. 2.

21,071. Laufrey. Explosive. [Belg. Appl., Sept. 10, 1909.]* Sept. 10.

XXIII.—ANALYTICAL PROCESSES.

Application.

21,076. Hume. Method and means for use in chemical analysis. Sept. 10.

Complete Specification Accepted.

12,715 (1910). Kubicek. Method and means for analysing the composition of colours Sept. 7.

Journal of the Society of Chemical Industry.

No. 19, Vol. XXIX. OCTOBER 15, 1910. No. 19, Vol. XXIX.

New York Section.

ALKALOIDAL SALTS OF GUAIACOLSULPHONIC ACIDS AND CREOSOTE-SULPHONIC ACID.

BY DR. GEORGE L. SCHAEFER.

This Journal, August 15th, 1910, pp. 928—930.

ERRATUM.

Page 929, col. 1, line 9, *for* "less easily soluble" *read* "very easily soluble."

Sydney Section.

Meeting held at Sydney on Wednesday, 18th May, 1910.

MR. T. STEEL IN THE CHAIR.

CORROSION OF A CAST-IRON PIPE BY FRESH WATER.

BY THOMAS STEEL.

It is well-known that cast-iron pipes under the action of fresh water are frequently badly corroded, the iron becoming changed into a comparatively soft mass easily scraped away with a knife. A few years ago, a case came under my notice in the pipes of an ordinary Green's economiser, an arrangement of cast-iron pipes placed in a boiler flue for the purpose of heating water by means of the waste heat of the furnace gases. These pipes, within a moderate number of months of their installation, became greatly corroded, so much so that only a thin outer shell remained. The inner part of the metal had become transformed into a thick layer of plumbago-like material, easily separated from the unaltered iron. Originally the pipes were $\frac{1}{2}$ inch in thickness; when removed, owing to their giving way, the residual shell varied from $\frac{3}{16}$ to less than $\frac{1}{16}$ inch, while the layer of altered metal was about $\frac{3}{8}$ inch. The water while being heated was under boiler pressure, about 60 lb. per square inch, and its temperature would vary from about 60° F. at entrance to 300° F. at exit. There was no noticeable difference in the degree of corrosion of the pipes due to this range of temperature.

Analyses were made of a pipe which had never been used, of the thin shell of residual iron, and of the layer of altered metal.

The results are as under :—

	Original pipe.	Shell of residual iron.
Graphitic carbon	2·76	2·41
Combined carbon	0·34	0·19
Phosphorus	1·25	1·28
Sulphur	0·11	0·09
Silicon	2·08	1·90
Ratio, graphite to silicon	133 : 100	127 : 100
Ratio, phosphorus to silicon	60 : 100	67 : 100

	Altered metal.	
Ferrous oxide	37·86	= 45·8 iron.
Ferric oxide	16·75	
Graphitic carbon	8·69	
Combined carbon	0·00	
Phosphoric oxide	9·48	= 4·14 phosphorus.
Sulphur	0·00	
Silica	13·30	= 6·21 silicon.
Water	13·34	
	99·42	
Sp. gr.	2·698	
Ratio, graphite to silicon	140 : 100	
Ratio, phosphorus to silicon	67 : 100	

The altered metal is readily attracted by a magnet. From these figures it is evident that the affected iron has been oxidised to a mixture of the two oxides, while a large proportion of the metal has been dissolved away, leaving the other constituents, with the exception of combined carbon and sulphur, in a concentrated state. The phosphorus and silicon have both been oxidised along with the iron, while the combined carbon and sulphur have entirely disappeared. It is interesting to note that the ratios of graphite and phosphorus to silicon remain practically unchanged in the altered metal, showing that little or none of these elements has been washed away during the oxidation, and that the phosphorus has been able to withstand solution so completely, when, together with its combined iron, it was subjected to oxidation.

Taking the original cast-iron as containing 93·5 per cent. iron, which will be close to the truth, and calculating on the relative proportions of graphite and iron therein and in the altered metal, it is evident that of the iron originally present, about 84·5 per cent. has been dissolved away, and about 15·5 per cent. remains in an oxidised state, associated with the graphite and with the phosphoric oxide and silica resulting from the oxidation of the phosphorus and silicon that existed in the metal of the original pipes.

The water in use was the ordinary Sydney supply, a soft water of excellent quality, which, tested at the time, contained :—

	Parts per 100,000
Lime	0·24
Magnesia	0·24
Chlorine	3·89
Sulphuric anhydride	0·21
Alumina and ferric oxide	0·14
Organic matter, etc.	2·20
Total solids	8·80
Temporary hardness	0·3
Permanent "	2·1
Total "	2·4

Dr. Stokes, of the Department of Water and Sewerage, has kindly furnished me with a recent analysis of Sydney water, taken at the main reservoir, the figures for which are in close agreement with those given above. He finds the free carbon dioxide to average about 1 c.c. per litre, while the dissolved oxygen ranges from 50 to 80 per cent. of saturation. Doubtless these quantities of dissolved gases are somewhat reduced by the time the water reaches the city mains.

DISCUSSION.

Prof. C. E. Fawsitt said that though the corrosion of iron pipes by water was well-known, the phenomenon was of some interest at the present time in connection with the serious action of the water of Artesian bores on the iron casing. Owing to the great depth of the bores, cast-iron was too heavy, and wrought-iron, which was used on account of its lightness, corroded very quickly. Why cast-iron, which was more readily dissolved by acids than wrought-iron, should resist corrosion by water better had not been properly explained.

Dr. G. **Harker** also thought it strange that cast-iron should resist corrosion better than wrought-iron, because from a theoretical point of view the more impure cast-iron might be expected to be the more susceptible to chemical action. Though Moody had supplied some strong evidence in favour of the theory that carbonic acid was the cause of the rusting of iron, others had maintained that this was an electrolytic process in which the presence of carbonic acid was not essential, and Cumberland claimed that corrosion could be prevented by passing a weak electric current in such a direction as to reverse the polarity of iron exposed to water.

Dr. E. S. **Stokes** said that as the Sydney water supply seemed to be implicated in the paper that had been read, he would mention that when a 6-foot cast-iron main receiving this water from the canal was recently emptied, after being 18 years in use, and when a deposit of 2 inches of mud had been cleaned off, the iron was found to be sound, with almost no sign of pitting. Therefore, the water did not spoil that pipe. But this pipe had been full of water the whole time, whereas some flumes, made of wrought-iron plates, and kept only partly full of water, were nearly cut in two at the line of wind and water. The cast-iron main sometimes pitted on the outside, especially in clay soils, and on the under side, where drainage water gathered. Steel pipes were eaten through in about 10 years, mostly from the outside, the general action being a marked tuberculation, known as "oysters," consisting of ferric oxide on the outside and mostly ferrous oxide inside, and being attracted by a magnet. The water had no very marked action on the inside of the steel pipes. He thought the electric theory gave the most complete explanation of the observed facts. The mill scale coating new iron was electro-negative to iron; while this lasted, the iron stood; and when this went, the iron corroded.

Mr. T. U. **Walton** said that the pitting action of Sydney water on boiler plates was completely checked by keeping the water slightly alkaline with caustic soda.

Mr. T. **Steel**, referring to the fact that wrought-iron pipes gave way sooner than cast-iron, suggested that this might simply be because they were made so much thinner. The question might be asked whether any greater weight of wrought-iron corroded in a given time than with cast-iron.

THE OCCURRENCE OF A CRYSTALLINE ARSENIOUS SULPHATE IN A SULPHUR BURNER.

BY THOMAS STEEL.

References to compounds of arsenious oxide and sulphuric anhydride are but seldom met with in chemical literature, while in most current works of reference their existence is either ignored altogether or but briefly mentioned. The occurrence of crystalline arsenious sulphates in and about sulphur or pyrites burners has been occasionally noted, though few analyses of the crystals have been published. The first observer to call attention to the formation of a crystalline arsenious sulphate in such a situation, appears to have been Reich, who in 1863 (J. prakt. Chem., **90**, 176), examined a specimen found by Richter in the flues of a pyrites burner, and found it to contain 72·18 per cent. of arsenious oxide, a proportion somewhat in excess of the 71·22 per cent. required by the formula As_2O_3,SO_3.

Pearce (Chem. News, 1868, **17**, 144), describes similar crystals which were found associated with octahedra of arsenious oxide in the flue of a copper-ore calciner, and which, doubtless owing to this circumstance, contained, after deduction of a little extraneous matter, as much as 76·55 per cent. arsenious oxide, showing an admixture of about 5 per cent. in the free state. Weber (J. Chem. Soc., 1887, **52**, A., 212) mentions the preparation of $As_2O_3,6SO_3$, and $As_2O_3,3SO_3$, by dissolving arsenious oxide in sulphuric anhydride. Pearce (J. Chem. Soc., 1893, **64**, A., ii., 66), gives a second record of the occurrence in a pyrites hearth of crystals of $As_2O_3.SO_3$, which in this instance appear to have been contaminated with a small excess of sulphuric anhydride. Stavenhagen (J. Chem. Soc., 1893, **64**, A., ii., 459), examined crystals found during the repair of a pyrites furnace, and states that they had the composition corresponding to $As_2O_3.3SO_3$. In a comprehensive paper on the various arsenious sulphates, Adie (J. Chem. Soc., 1889, **55**, 157), gives references to earlier authors, and proceeds to show how six different arsenious sulphates, from $As_2O_3.6SO_3$ to As_2O_3,SO_3, are formed by crystallization from varying strengths of concentrated sulphuric acid.

My brother, Mr. F. W. Steel, works manager of the General Chemical Co., Clyde, N.S.W., recently drew my attention to a deposit of white crystals in the sight-tubes of a sulphur burner, and kindly furnished me with a sample put direct into a tightly stoppered bottle. On analysis I found the crystals to consist of a pure arsenious sulphate, As_2O_3,SO_3, with a slight accidental admixture of sand. The compound occurs in sublimed feathery plates of pearly-white lustre, deposited in the iron sight-tubes of the combustion chamber of a sulphur burner used for burning Japanese sulphur containing a somewhat variable amount of arsenic, but averaging 0·005 per cent., or about 0·35 grain per lb. The crystals are hygroscopic, and the solution in water has a strong acid reaction. Treatment with water causes decomposition into arsenious oxide and free sulphuric acid. A hot saturated solution on cooling deposits crystals of arsenious oxide. As is to be expected, the crystals produce a strong effervescence when dropped into sodium carbonate solution. On heating in a closed tube the substance is completely decomposed into its components, which sublime separately.

Discussion.

Mr. F. W. **Steel** said that the arsenious sulphate crystals, as well as being found in the sight tubes for observing temperature, also deposited at leaks in the brick work, when air leaked in and sulphurous acid leaked out. They formed beautiful fringes, and were quite stable in dry air; but in moist air they rapidly became reduced to a pasty mass. A deposit of them was also found under an iron plate, in a position usually too hot for sulphur to condense.

Communication.

THE USE OF PYRIDINE IN RUBBER ANALYSIS.

BY W. J. BRITLAND AND H. E. POTTS, M.SC.

In the analysis of rubber goods Weber recommended pyridine as a solvent for bituminous substances. He states: "I connect the extractor with a weighed flask containing about 60 c.c. of pyridine (b.pt. 109—111° C.). This flask I keep in an oil bath the temperature of which is kept between 116° and 120° C. In presence of tar, pitch, asphaltum, the paper at once assumes a more or less pronounced brown colour. I continue extraction until it has assumed its normal tint." The pyridine is distilled off at a low temperature and the residue weighed.* The table containing this method is quoted without comment in a recent book by Ditmar.†

On the other hand, in 1906, both Esch‡ and Ditmar§ published papers stating that the method was valueless. Ditmar, in particular, stated that at high temperatures practically all the rubber could be dissolved. Yet Torrey‖ states that "if the extraction is conducted in a Soxhlet extractor, and if care be taken to continue the operation just long enough to render the thimble free from the dark colour it takes on at first, the amount of pure rubber dissolved by the pyridine is insignificant. According to the Jahrbuch der Kautschuk-Industrie for 1907, the matter appears to have been left at this stage.

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* "Chemistry of India-Rubber," 1906, p. 243.

† "Analyse des Kautschuks," 1909, p. 216.

‡ Gummi-Zeitung, 1906, **20**, 324.

§ Gummi-Zeitung, 1906, **20**, 441 (this J., 1906, 224).

‖ India-Rubber Journal, April, 1906, 390.

Under these circumstances it seemed desirable to test the method.

Vulcanized rubber of known composition was used for all the experiments. This was finely "crumbed," extracted with acetone, and then extracted with pyridine[*] without delay. If the acetone-extracted rubber is left exposed to air it tends to oxidize. A mixing was taken containing 62 per cent. Pará, ½ per cent. carbon black, and nothing else beyond sulphur, zinc oxide, and French chalk. The acetone-extracted rubber was treated at two different temperatures for 3 hours with 90 c.c. of pyridine in 3 portions, and then with 40 c.c. for 3 hours, and let stand over night. 1·8 grms. were taken.

(1) At 60—65 first treatment (90 c.c.) dissolved 5 %.
second treatment (40 c.c.) „ 2½ %.
(2) At about 80°—85°—
first treatment (90 c.c.) „ 7½ %.
second treatment (40 c.c.) „ 4 %.

Although the solubility increases with rise of temperature, as seen above, it might still be possible to carry out the determination in the way suggested by Weber.

Accordingly two mixings were made :—

(1) Forty per cent. Pará, 3 per cent. ceresin wax, 1·8 per cent. sulphur; zinc oxide and French chalk.

(2) To a mixing made up as (1) 5 per cent. of refined bitumen was added.

These rubbers were sheeted and cured for 3½ hours (½ hour rise to 280°, 3 hours at 280°). They yielded acetone extracts as follows: (1) 5·1 per cent.; (2) bituminous, 7·3 per cent.

The 'crumbed' samples were extracted with acetone in an extractor, of the type recommended by Weber, for 5 hours, and then further extracted for 2½ hours with pyridine. The heating was done on a wire gauze, but the subsequent evaporation was carried out in an oil bath. The corks used gave an appreciable extract; two blank experiments yielded 0·018 and 0·026 grms. respectively. As the extractions were done on 5 grms., and as so much rubber is dissolved, the error is not serious. The bituminous sample gave a pyridine extract of 4·2 per cent.; the blank rubber gave 4·9 per cent.

This experiment was repeated using a Soxhlet extractor. The acetone extraction was continued for 10 hours, and the pyridine extraction for 2½ hours. At the end of this time both thimbles were brown, and the colours were nearly, but not quite, equal. The bituminous rubber gave 3·3 per cent., the non-bituminous one gave 4 3 per cent.

These two rubbers contained wax. It was shown by other experiments that rubber without wax behaved similarly to rubber with wax.

These experiments show that even with a carefully prepared blank at hand, the pyridine extraction affords no indication of the amount of bitumen present. Indeed, the non-bituminous sample actually gave a slightly higher extract.

The conclusion to be drawn is that pyridine is usually inadmissible as a solvent for bitumens.

If the bitumen would dissolve out in about ½ hour or less, some indication of the amount present might be obtained: in our case, however, the extract remained coloured for a much longer time.

Probably the best, and only safe, way to use hot pyridine is to extract for about 5 minutes in a Weber extractor, as a *qualitative* test only, when bitumens will give an intense brown stain. With a longer time we find the non-bituminous rubbers begin to colour the thimble a light brown.

Pyridine at room temperature is recommended by Martens[†] as a qualitative test for bitumens. In this case also there is little chance of making the test quantitative, as we found a bitumen-free vulcanized rubber, after extraction with acetone, dissolved to the extent of 3 per cent. quite readily.

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[*] B.pt. 115°. Weber states that he used pyridine of b.pt. 109—111° C.

[†] Chem. Zeit. 1910, 184; this J., 1910, 99.

Obituary.

HEINRICH CARO.

Heinrich Caro, one of the chief founders of the coal-tar colour industry, was born on February 13th, 1834, in Posen. After passing through the Gymnasium, he proceeded to the Berlin University for his training in pure science, which he afterwards supplemented by taking the technological course of the Berlin Gewerbeinstitut. At first inclined to devote himself to metallurgy, he became acquainted, shortly before the conclusion of his studies in that direction, with the subject of Turkey-red dyeing, and then at once turned his attention to cotton dyeing and calico printing. In 1855 he obtained a situation in that industry at Mühlheim a. d. Ruhr. In 1859, Caro came to England, and entered the service of John Dale, of the firm of Roberts, Dale and Co., of Manchester. Here he worked out, with great energy, problems in the then comparatively new subject of the aniline dyestuffs. During this period he discovered a new process for preparing mauveine, and at once received a share in the business. The personal acquaintance and intercourse with such men as A. W. Hofmann, Peter Griess, and W. H. Perkin, combined with unremitting theoretical and practical studies, doubtless furnished stimulus for the achievement of such results as the discovery of the blue spirit-soluble Indulines (1863), and the dyestuff known as "Manchester Yellow," patented by himself in conjunction with Dale and Martius in 1864.

In 1866 he returned to Germany. At first he intended to devote himself to pure science as a Privatdocent at Heidelberg University, but his relations, already contracted in England, with the Badische Anilin- und Soda Fabrik, led him, on November 1st, 1868, to accept a high position in that firm. He was a Director of the Company from 1884 to 1890, when he was made a member of the Aufsichtsrat, and invested with special supervisory functions. Quoting Bernthsen (Chem.-Zeit., 34 [113], 1001), "Caro's work in connection with this firm resulted in a continuous series of brilliant successes in the development of the chemistry of the coal-tar dyestuffs." This fact is well brought out in the Address "Ueber die Entwickelung der Theerfarben Industrie," which he delivered before the German Chemical Society in Berlin, on June 22nd, 1891.

The dyestuffs, Eosine, Alizarin Orange, Fast Red, Naphthol Yellow, Crystal Violet, Victoria Blue, Methylene Blue, and Auramine, and the sulphonic acid of Magenta, were either discovered or first prepared on the commercial scale by Caro. He published an investigation on artificial alizarin, undertaken conjointly with Graebe and Liebermann, one with Graebe on rosolic acid, and others on rosaniline and on acridine. With A. von Baeyer he also investigated the hydroxyanthraquinones, nitrosodimethylaniline, and nitrosophenol. Another notable address Caro delivered in 1877 at Munich before the "Naturforscherversammlung" Although at the close of the year 1890, he resigned all active duties in connection with the Badische Anilin u. Soda Fabrik, this only meant retirement to his own laboratory, where work and study went on apace. His discovery of monosulpho per-acid, now known universally as Caro's acid, is one example of the fruit of this private research.

Caro may be regarded as one of the principal founders both of the "Verein Deutscher Chemiker," and "Verein Deutscher Ingenieure." He was awarded the honorary Ph.D. degree by the Universities of of Munich, Heidelberg, and Darmstadt, and the D.Sc. by the University of Leeds. He was created Hofrat by the Grand Duke of Baden. Heinrich Caro was an original member of this Society, and wrote some letters to Sir Henry Roscoe in 1882, which were published in the journal (this J., 1882 258, 276). He died September 11th, 1910, at the ripe age of 76½ years.

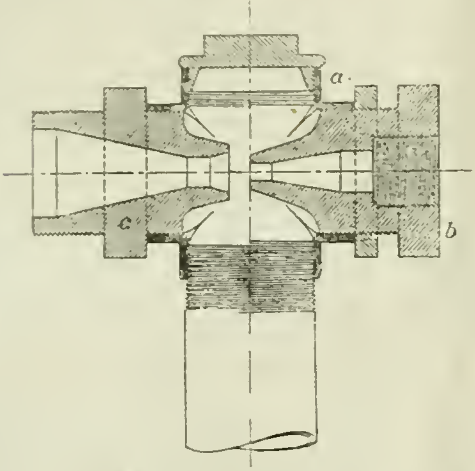
Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—
English.—8d. each, to the Comptroller of the Patent Office, W. Temple Franks, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1s. each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs Bourgeois, Paris (3e.).
German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Injector for chemical works; A simple ——. E. Asbrand. Z. angew. Chem., 1910, 23, 1763—1764.

The author describes a simple form of injector, the parts of which may be kept in stock and replaced in a few minutes. The body of the injector (see figure) consists of an ordinary 4-way pipe branch. Into one arm is screwed the steam nozzle, *b*, and into the opposite arm the delivery nozzle, *c*. The third arm carries the suction pipe, and the fourth a screwed plug, *a*, for cleaning and inspection purposes. All these removable fittings are constructed of whatever metal may be most suitable for the liquids to be dealt with.—J. F. B.



Heat-insulating materials; Testing of ——. F. Bacon. Brit. Assoc., Sept., 1910. Engineering, Sept. 16, 1910.

Slabs of the insulating material were clamped on either side of a flat heating net of resistance wire interwoven with asbestos, with thin sheets of asbestos millboard between to prevent direct contact of the heating net and the insulating material. The difference in temperature between the inner and outer faces of the insulating slabs was measured by means of flat resistance coils of fine double-silk covered wire in direct contact with the faces. The results obtained are given in curves and in the following table, where the figures represent kilo.-cals. passing per hour through a cross-section of 1 sq. m., when the temperature gradient is 1° C. per metre. These figures multiplied by 8·05 give the B.T.U. passing per hour per sq. ft. for a temperature gradient of 1° F. per inch.

Material.	Sp. gr.	Co-eff. of heat conductivity at 50°—75° C.
Yellow pine across grain	0·360	0·13
Teak across grain	0·515	0·23
*Expansit Schrot No. I.	0·051	0·055
" " No. II.	0·049	0·061
Compressed cork slabs	0·166	0·060
Silicate cotton (slag wool) ...	0·330 0·256 0·141 0·113	mean value, 0·07
Asbestos sheet ([illegible] in. thick)....	1·240	0·25
" millboard ([illegible] in. thick)	1·075	0·14—0·1
Air jacket in vertical plane, 1in. wide, walls of asbestos millboard	——	0·26—0·31

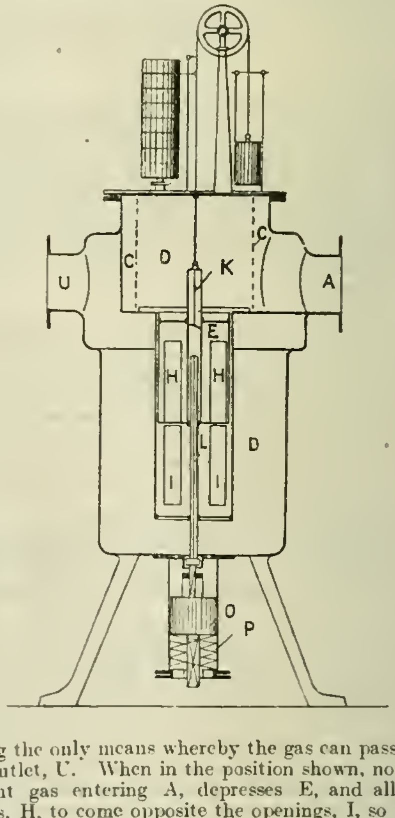
* A special cork preparation.

The author's results show that Expansit Schrot is a light and very efficient insulator. When silicate cotton is used, it is best to pack it as firmly as possible. The value of asbestos appears to be due rather to its fireproof qualities than to low heat conductivity. Attention is drawn to the deleterious effect of even small quantities of moisture on heat insulators.—A. S.

Patents.

Measuring gaseous fluids; Automatic recording apparatus for ——. C. F. Simon, Stolberg, Germany. Eng. Pat. 19,169, Aug. 20, 1909. Under Int. Conv., Nov. 2, 1908.

The gaseous fluid to be measured enters the apparatus through the inlet pipe, A, and passes into the chamber, C, provided with a projecting portion, E, which slides concentrically within D, the slots, H, H, in E, and I, I, in D, affording the only means whereby the gas can pass from C, to the outlet, U. When in the position shown, no gas can pass, but gas entering A, depresses E, and allows the openings, H, to come opposite the openings, I, so that gas can pass through. If the pressure of the gas alters, then, it acts on the plunger, O, against the tension of the spring, P, and by means of the rod and sleeve, L, K, rotates E, so that the width of the clear passage between the slots, H and I, is varied to suit the alteration in volume due to the alteration of the pressure. The result is that the height of the opening through which the gas passes is varied as the weight of gas passed per unit of time, any alteration in pressure being allowed for by the variation in the width of the opening which varies as the pressure only. The height changes are recorded on the drum placed above the apparatus and the quantity of gas or steam passed is calculated from the records on the drum.—W. H. C.



Cooling water or treating air or gases with water or other liquids; Apparatus for ——. H. N. Leask, Egremont, Cheshire. Eng. Pats. 20,880, Sept. 13, 1909, and 6315, Mar. 14, 1910.

The claim is for a "rotor" suitable for use with gas washing apparatus of the type described in Eng. Pats. 12,837 of 1907, and 6152 of 1909 (this J., 1910, 9). A central hub, mounted on the horizontal shaft of the washer, is provided with projecting parallel flanged arms, or Y- or T-shaped arms with flanged extremities, to which an outer concentric drum is attached. Sheet metal strips are wound either concentrically, helically or spirally between the faces of the drum. The layers are kept apart either by distance pieces introduced between each layer or by having indentations punched upon the sheets themselves.—W. H. C.

High vacua; Producing ——. W. Gaede, Freiburg, Germany. Eng. Pat. 27,457, Nov. 25, 1909. Under Int. Conv., Jan. 2, 1909.

The claim is for the use of a rotary pump having two grooved members which rotate in close proximity and which is provided with inlet and outlet orifices. In order to obtain a high vacuum with such a pump, the suction is connected to the apparatus it is desired to exhaust and the delivery to any form of vacuum pump capable of producing a vacuum of about 1 mm.—W. H. C.

Furnaces or ovens. G. A. H. Méker, Asnières, France. Eng. Pat. 28,603, Dec. 7, 1909. Under Int. Conv., Jan. 14, 1909.

The gas by which the oven is heated is completely burned at a series of jets which project horizontally into the ends of a row of horizontal or slightly inclined straight tubes which pass through the oven. The gas which enters the tubes being either completely burned, or at least mixed with enough air to secure complete combustion, passes through the tubes and gives up its heat completely to the oven.—W. H. C.

Gas-fired retort, oven and like furnaces. O. Benninghoff, Dortmund, Germany. Eng. Pat. 862, Jan. 12, 1910.

In gas-fired furnaces which are supplied with gas through a single conduit or flue, situated below the furnace, the gas outlets from the supply flue pass from the bottom of this flue, at first horizontally, then obliquely upwards, and then vertically upwards and finally again obliquely upwards to the combustion flues on either side of the retorts. This is done in order to avoid back firing when there is unequal draught on the opposite sides of the furnace. —W. H. C.

Furnace; Rotary [*roasting*] ——. D. Baker, Assignor to Ladd and Baker, Incorporated, Philadelphia, Pa. U.S. Pat. 968,313, Aug. 23, 1910.

In a rotary furnace the inclined tube is heated externally by means of longitudinal flues. A fixed annular combustion chamber surrounds the lower end of the tube. Means are provided for introducing and discharging the material to be roasted, and a hot blast may be introduced at the lower end of the roasting tube.—J. W. H.

Centrifugal separators with filtering apparatus. R. Haddan, London. From Aktiebolaget Separator, Stockholm, Sweden. Eng. Pat. 30,070, Dec. 23, 1909.

A number of circular filter-plates or elements are arranged one above the other, concentrically about the axis of the bowl of a separator of known type, and are enclosed in an outer case or drum, the bottom of which forms the top of the separator casing proper. The liquid, from which the coarser impurities have been separated by the centrifugal separator, passes upwards to a peripheral channel of the upper casing, and thence in an upward or downward direction through the filtering discs, in a sense opposed to the direction of the centrifugal force. The filtered liquid escapes into a vertical annular channel which surrounds the axis of the machine.—W. H. C.

Centrifugal separator. F. R. Abeel, Tacoma, Wash U.S. Pat. 969,591, Sept. 6, 1910.

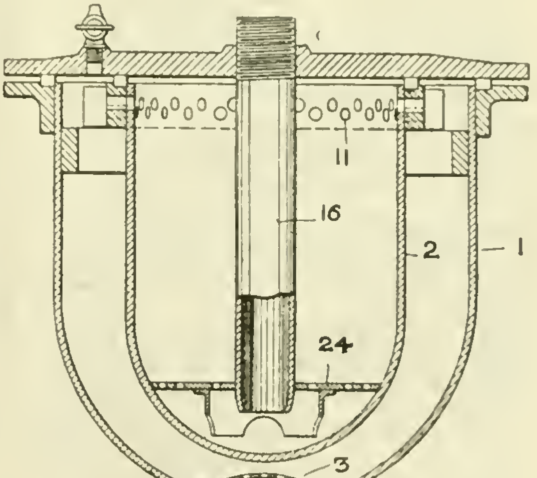
A hollow conical separator having an inwardly turned flange at its smaller end and an annular pocket with an inwardly turned flange at its larger end, is mounted by means of spiders upon a central horizontal shaft, so that it can be rotated. A number of parallel annular tubular receivers, capable of receiving and retaining mercury, are formed upon the shell of the separator, and are provided with annular openings into the separator. The width of these openings can be regulated by annular closing rings on the side of the receiver next the separator. The rings when in position are flush with the inner surface of the separator.—W. H. C.

Separating liquids and apparatus therefor; Art of ——. L. Strom, Los Angeles, Cal. U.S. Pat. 968,206, Aug. 23, 1910.

A process is claimed for separating by physical means mixed liquids, the constituents of which differ in adhesiveness and viscosity. The mixture is fed on to a rapidly rotating surface by which it is subdivided into a fine spray and projected against the knife edges of blades which retain the viscous constituent. This separated constituent runs down the blades and flows to a receiver. —J. W. H.

Filter; High pressure ——. A. Dondey and J. E. Testro, Melbourne, Australia. Eng. Pat. 4329, Feb. 21, 1910. Under Int. Conv., March 6, 1909.

The filter consists of two cylinders, 1 and 2, placed one within the other as shown, the space between them and that within the inner cylinder being filled with paper pulp or other suitable filtering material. The liquid to be filtered enters through the pipe, 16, passes through the strainer, 24, through the pulp in 2, and through the perforations, 11, into the space between the cylinders. This space is also filled with pulp, and the once-filtered liquid is again filtered by passing through the second layer of pulp between the cylinders, escaping finally through the grid, 3, to the outlet opening at the bottom. —W. H. C.



Concentrating liquids. P. Kestner, Lille, France. Eng. Pat. 4571, Feb. 23, 1910.

Improvements in the apparatus described in Eng. Pat. 6372 of 1903 (this J., 1904, 363) are claimed, consisting in arranging the separating chamber into which the vapour and liquid escape from the upper ends of the evaporator tubes, below their upper extremity and around their upper ends, instead of above them. In this way, not only is the apparatus reduced in length, but the tubes become more easily accessible, and condensation in the separating chamber is avoided, as the latter is directly heated by the upper ends of the evaporator tubes which pass through it.—W. H. C.

Still. J. Hoffbine and N. F. Harriman, Omaha, Nebr. U.S. Pat. 969,625, Sept. 6, 1910.

The still consists of two vertical cylinders, the first being divided by a horizontal partition into an upper boiling chamber and a lower storage chamber. The second cylinder is similarly divided into an upper condenser chamber and a lower storage chamber. The two lower storage chambers are connected together. The boiling chamber is provided with a steam heating coil, with a still head having a spray catcher, and with a relief valve, and is connected to the condenser chamber of the other cylinder so that it can be charged with the warm condensing water. The still head is connected to a condensing worm placed in the condenser chamber and connected to the storage chamber below, which acts as a receiver.—W. H. C.

Receptacle for acids and lyes. J. Michalowski. Ger. Pat. 223,407, Nov. 14, 1909.

The receptacle is constructed of any suitable material and inside it is fixed a lining made of wooden boards fitted together by means of tongues and grooves. The space between the receptacle and the lining is filled with water or any other liquid which has no action on the receptacle, and this liquid is maintained at a higher level than the acid or lye contained in the wooden lining. The lining may be attached to wooden joists fixed along the bottom and sides of the receptacle.—A. S.

Gas; Absorption of —— from a mixture of gases by means of hot liquor, and the apparatus employed therein. J. Y. Johnson, London. From R. Koepp und Co., Oestrich, Germany. Eng. Pat. 24,805, Oct. 28, 1909.

See Fr. Pat. 408,419 of 1909; this J., 1910, 615.—T. F. B.

Calcining-kiln. W. J. Willis, Ocker Hill. U.S. Pat. 969,931, Sept. 13, 1910.

See Eng. Pat. 5901 of 1909; this J., 1910, 496.—T. F. B.

Furnace; Annular rotating ——. W. B. Bary, St. Petersburg. U.S. Pat. 970,293, Sept. 13, 1910.

See Eng. Pat. 18,452 of 1909; this J., 1910, 996.—T. F. B.

Separation; Process of ——. H. A. Wentworth, Lynn, Assignor to Huff Electrostatic Separator Co., Boston, Mass. U.S. Pat. 970,002, Sept. 13, 1910.

See Fr. Pat. 411,116 of 1909; this J., 1910, 958.—T. F. B.

Air; Method of extracting moisture from ——. J. Gayley, New York. U.S. Pat. 970,453, Sept. 13, 1910.

See Eng. Pat. 865 of 1905; this J., 1905, 880.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

German petroleum; its treatment and application. P. Kessler. Z. angew. Chem., 1910, 23, 1697—1704.

In Germany, petroleum is found chiefly in the provinces of Alsace and Hanover, and first class lubricating oils are now made from the crude material; in fact, in the author's opinion, it should be possible to meet about 40 per cent. of the home (German) demand for lubricating oils from this source. An outline of the processes of distillation and refining, as carried out at one German factory, is given, but the method of treating the crude oil is said to vary generally with the local conditions; the coke prepared from the distillation residues is specially suitable for the manufacture of arc-lamp carbons and carbon-brushes for motors. The average yield, in volumes per cent., of the several fractions obtained by the distillation of different types of petroleum are shown in the following table.

Origin.	Sp. gr. at 15°C.	Crude benzine.	Crude burning oil	Middle oil.	Lubricating oil.	Paraffin content.
Pennsylvania	0·812	11·0	48·0	13	27	high
Galicia	0·856	12·0	34	22	31	medium
Roumania	0·852	15·0	41	19	24	,,
Sumatra	0·775	38	48	6	7	,,
Borneo	0·850	17	51	14	18	high
German Oils						
Wietze	0·900	0	24	31	41	low
do.	0·881	3	29	27	40	,,
Pechelbronn	0·890	3	23	26	46	,,
Ölheim	0·909	0	17	29	53	,,

In connection with the testing of lubricating oils, stress is laid on the insufficiency of the usual chemical and physical tests, since it is found that oils giving very similar data when examined by the ordinary methods, may behave quite differently under working conditions. The economic importance of a proper choice is shown by the results of a series of comparative experiments, in which a saving of power, amounting to 7—19 per cent., was registered by substituting a specially selected oil for an apparently similar oil previously used.—F. Sodn.

Petroleum; Diffusion of crude —— through fuller's earth. J. E. Gilpin and O. E. Bransky. Amer. Chem. J., 1910, 44, 251—303.

The well-known difference in character between Pennsylvanian petroleum, which is almost devoid of sulphur and nitrogenous bodies, and the oils of Ohio, which are rich in sulphur, or the heavy Californian oils containing much sulphur and nitrogen, has been explained by the assumption that Pennsylvanian oils are of vegetable origin whilst the other oils are of animal origin. The authors, however, point out that in the light of their experiments upon the diffusion of petroleum through fuller's earth on the lines previously described (this J., 1909, 831) it is unnecessary to make any such assumption, since when oils such as those from Ohio, California and Texas are made to diffuse through a porous medium such as fuller's earth, they yield products closely resembling Pennsylvanian oils. It was found that when a solution of benzene and paraffin oil diffuses upwards through a tube containing fuller's earth, there is a tendency for the benzene to collect at the bottom and the paraffin oil at the top, In like manner, a fractionation of crude petroleum may be effected by upward diffusion, and the oil subsequently displaced by water from the fuller's earth near the top of the tube has a lower specific gravity than that separated from the earth in the lower part of the tube. On continuing the fractionation the range in the specific gravity of the fractions becomes smaller, which indicates a tendency to the formation of mixtures which will eventually diffuse through the earth unaltered. The proportion of unsaturated hydrocarbons and sulphur compounds shows a gradual increase on passing from the lightest fractions at the top of the tube to the heaviest fractions at the bottom, and apparently there is a tendency for the fuller's earth to retain unsaturated hydrocarbons and sulphur compounds. Full details of the experiments are given. —C. A. M.

Grahamite, a solid native bitumen. C. Richardson. J. Amer. Chem. Soc., 1910, 32, 1032—1049.

The name grahamite was given to a solid native bitumen discovered in West Virginia in the early sixties of the last century, but since that date considerable confusion exists in the literature as to the character of grahamite and its distinction from albertite and gilsonite (uintaite) and, to a limited extent, from manjak. The author has been able to make a comparison between specimens of nearly all the well-known occurrences of native bitumens and a specimen of the original West Virginian grahamite and has come to the conclusion that many bitumens which have been given new names are really bitumens of the class of which grahamite is the type; he considers it would be preferable to term them grahamite, the name being prefixed by the place of origin. Native bitumens, in general, consist of a mixture of hydrocarbons with small amounts of their nitrogen, sulphur, and in some cases, oxygen derivatives. They are characterised by being soluble in carbon bisulphide, but are differentiated by their physical and chemical properties. The solid bitumens are all derived from petroleum, and their special characteristics are due to differences in the characters of the parent petroleums and in the environment to which these have been exposed during the period of change. Those products, derived from petroleum, which are not soluble in carbon bisulphide, such as albertite, are more correctly termed pyrobitumens. The extent of the metamorphism which, beginning with petroleum passes through maltha, asphaltum, and grahamite, to albertite, is indicated by the relative solubility in light petroleum distillates and in the heavy petroleum distillates known as fluxes, and by other characters, as shown in the following table:—

	Sp. gr.	M. pt.	Residual coke.	Solubility in:			
				Carbon bisulphide.	Light naphtha.	Heavy residuals.	
						Paraffin.	Asphaltic.
			per cent.	per cent.	per cent.		
Paraffin petroleum	0·83	liquid	0·0	100·0	100·0	—	—
Asphaltic petroleum	0·93	liquid	1·0	100·0	98·0	—	—
Maltha	0·99	viscous	3·0	98·0	94·0	—	—
Asphaltum, medium	1·03	60° C.	12·5	96·0	70·0	homogeneous	—
Asphaltum, hard	1·04	80° C.	14·5	—	63·0	,,	—
Gilsonite	1·04	130° C.	15·0	99·4	53·0	non-homog.	homogeneous
Glance pitch	1·10	130° C.	15·0	99·7	23·5	,,	,,
Manjak	1·10	200° C.	24·7	98·3	22·2	,,	,,
Grahamite, Trinidad	1·16	intumesces	35·0	98·8	14·5		,,
,, W Virginia	1·14	,,	41·0	97·8	3·3		,,
,, Oklahoma	1·18	,,	56·4	95·5	0·8	,,	,,
Albertite	1·08	,,	29·8	6·0	1·5	insoluble	insoluble

Grahamite may be described as a brittle, solid native bitumen, generally pure, but at times associated with adventitious mineral matter; characterised when pure by a peculiar schistose fracture, which has been termed "hackly." It does not melt, but merely intumesces; is soluble in carbon bisulphide, but only to a small extent in light naphtha; and yields a high percentage of coke. Different occurrences of grahamite may be divided into sub-classes according to whether the bitumen (1) contains 90 per cent. or more of matter soluble in carbon bisulphide, or is associated with a relatively large proportion of adventitious mineral matter; (2) contains less or more than 15 per cent. of matter soluble in light naphtha (malthenes); (3) contains less or more than 5 per cent. of sulphur. Grahamite closely resembles the "asphaltenes," *i.e.*, the portion of the bitumen of asphaltums which is soluble in carbon bisulphide, but insoluble in light naphtha.—A. S.

The Roumanian oil industry. U.S. Cons. Rept., through The Mining World (Chicago), Sept. 3, 1910. [T.R.]

Petroleum and its derivatives rank second in value among the products and exports of Roumania. The total amount of crude oil produced in 1909 was 1,430,351 tons, as against 1,270,074 in 1908, an increase of 160,277 tons. The production is mainly in the hands of large corporations whose capital is almost entirely owned outside of the country. The following table shows the capital investment of the four largest companies and their production in 1908 and 1909:—

Company.	Capital.	1908.	1909.
		Tons.	Tons.
Steana Romana	$9,500,000	364,032	482,753
Regalul Rouman	4,432,000	239,125	222,054
Romano-Americana	2,592,500	122,484	132,757
Concordia	4,625,000	184,919	125,576
Other concerns	....	359,514	467,311
Total		1,270,074	1,430,451

The Steana Romana has a bonded indebtedness of $3,599,781. The Romano-Americana is the Roumanian branch of the Standard Oil Co.

In 1908 a law was passed by the Roumanian Parliament with the avowed object of curtailing the competition of the Romano-Americana, which, by modern methods of distribution and by largely eliminating the middlemen, had been able to sell its product much more cheaply than any other producer, and which, it was feared, would get complete control of the local market. According to this law, the producers were divided into three classes: A, those producing more than 40,000 metric tons; B, those producing 10,000 to 40,000 metric tons; and C, those producing up to 10,000 metric tons. Class A was allowed to distribute in Roumania an amount of refined oil equal to the percentage its capacity (as fixed by the Government) forms of the total amount of refined oil produced in the country. Class B was allowed to distribute, in addition to this proportion, 200 per cent. more, and class C 400 per cent. more. Class A included the four companies previously named and a few others.

As a result of this law nearly all the companies in class A withdrew from the direct distributing business in Roumania, and turned over to a distributing company, which was formed for the purpose, the amount of refined oil each was allowed to distribute.

The small producers, however, most of whom were entirely dependent on the local market for their business (although 92½ per cent. of the total production of the Roumanian industry is exported) demanded further protection against the competition of this new distributing company, and in the spring of 1910 a new law was enacted, amending the law of 1908. The producers were divided into seven classes: Class A, those with a capacity of more than 100,000 metric tons; B, 50,000 to 100,000 tons; C, 30,000 to 50,000 metric tons; D, 10,000 to 30,000 tons; E, 2500 to 10,000 tons; F, 1000 to 2500 tons; G, up to 1000 tons.

Class A's distribution was limited, as under the old law, to the percentage which its production, as fixed by law, bore to the total production of the country. Class B was allowed to distribute 150 per cent. of its proportionate capacity; C, 300 per cent.; D, 350 per cent.; E, 550 per cent.; F, 750 per cent.; G, 1100 per cent. It is expected that under this law the large companies will be practically driven out of the local market. The idea is, while leaving to the large companies the large export business without restriction, that the local business shall be reserved to the small producers, who are nearly all Roumanians.

The law also fixes the maximum price that distributors are allowed for refined oil, by adding to the current market price of the crude production the estimated cost of refining and distributing.

Petroleum discovery in South Africa. Bd. of Tr. J., Sept. 22, 1910. [T.R.]

The "South African Mining Journal" (Johannesburg) of 27th August, reports the discovery of oil in the Barkly East district of Cape Colony, near the borders of Basutoland. The farm on which the property lies is known as Smiling

Vale, and is reached by a good road from Dordrecht on the Cape Government Railway. The formation is shales and sandstones, with layers of diabase rock. Asphaltic matter was found oozing out of a 2 in. quartz vein. A borehole put down struck an oil-bearing formation about 11 ft. thick at a depth of 81—92 ft. The bulk of the oil is more or less congealed, and it will be necessary to sink a shaft, as the oil is too thick to pump. An analysis of the deposit gave the following result :—Kerosine, 38·6 per cent., solid paraffin, 8·9 per cent., and heavy lubricating oils, 40 per cent. A railway in course of construction will come within nine miles of the farm, which is bounded on one side by the Kraai river.

Patents.

Briquette and process of making same ; Smokeless ——. R. A. Carter, jun., New York. U.S. Pat. 968,123, Aug. 23, 1910.

Coke screenings are mixed with a binder which can be partially volatilised (coal tar pitch substantially melting at 170° C.), and briquetted. The briquettes are finally heated to drive off the volatile matter and form uniformly coked blocks.—J. W. H.

Briquettes ; Manufacture of ——. E. Trainer, Langen, and W. Haage, Walsum, Germany. U.S. Pat. 969,504, Sept. 6, 1910.

Weather-proof briquettes are made by using as an agglomerating material, waste sulphite pulp liquor practically freed from soluble calcium compounds, and mixed with a chromium compound, with or without the addition of aluminium sulphate.—W. H. C.

Coke ovens. The Otto-Hilgenstock Coke-Oven Co., Ltd., London. From C. Otto und Co., Ges. m. b. H. Dahlhausen, Germany. Eng. Pat. 26,125, Nov. 11, 1909.

Horizontal coke ovens are constructed with the coking chambers in pairs, with one gas outlet and one or more charging openings common to each pair, the members of each pair being separated by a thin dividing wall through which the gases for heating the fuel can pass. The dividing walls are connected to the walls separating the pairs by small arches, the space formed above these arches by larger arches common to each pair serving as flues for the escaping gas. In cases where the discharging of the coke presents no difficulty, the small arches may be dispensed with, and the levelling rods, which are worked in pairs, may be attached together in front by a bar carrying a roller which runs along the top of the dividing wall.
—H. H.

Coke ovens ; Horizontal or inclined regenerative ——. R. Fabry, Sheffield. Eng. Pat. 6813, March 18, 1910.

The side walls of horizontal or inclined coke ovens are provided with an even number of vertical heating flues having gas nozzles so that the flues are uniformly heated and are independent of the reversals of draught. These gas nozzles are cleaned periodically by burning the deposit of soot by means of a reversed current of hot air from the regenerators. This reversal is obtained by chimney draught, a steam injector or a mechanical blower.—J. W. H.

Coking coals ; Process of ——. L. L. Summers, Chicago, Assignor to Continuous Process Coke Co., Maine. U.S. Pat. 968,499, Aug. 23, 1910.

The process consists in treating the carbonaceous material chemically or electrolytically, before coking in order to form volatile compounds of the sulphur, phosphorus, etc., present. After the treatment the material is dried and coked in a closed retort.—J. W. H.

Sulphur, phosphorus, and other impurities from coal, ore, etc. ; Method of extracting or eliminating ——. L. L. Summers, Chicago. U.S. Pat. 967,996, Aug. 23, 1910.

The material to be treated is subjected to electrolytic action in a bath with movable electrodes, by which it is subjected alternately to an acidifying and oxidising and a reducing and alkaline influence. An electrolyte is used in which the reaction products from the sulphur and phosphorus contained in the material are soluble.—J. W. H.

Gas-retort furnaces. O. Benninghoff and A. Klönne, Dortmund, Germany. Eng. Pat. 8369, April 7, 1910.

Gas-retort furnaces which are of considerable height and contain inclined retorts or chambers, are provided with supporting frames arranged around the furnace for the purpose of preventing the vertical supporting bars from bulging outwards. Springs may be fitted to enable the frames to yield during the expansion of the furnace.—H.H.

Gas manufacture. A. A. Johnston and F. W. Clark, London. Eng. Pat. 19,196, Aug. 20, 1909.

The coal is supplied continuously to long, narrow retorts, 5 ft. high, 20 ft. long, and 4 or 5 ins. wide at the mouth, which runs from end to end above the retort. The upper portions of the retorts are heated by gaseous fuel in which does not have to pass through any considerable heating chambers formed around them. The liberated gas, thickness of heated coke, escapes vertically through a superheated chamber, situated above the retort, through which the coal is dropped. The coke is continuously removed from beneath the retorts.—H. H.

Generating or producing gas ; Apparatus for ——. A. S. Cambridge, Christchurch, New Zealand. Eng. Pat. 19,639, Aug. 27, 1909.

In a vertical water-jacketed producer charged with fuel through the top, the air for combustion is forced into the space above the water in the jacket and after circulating over the surface of the water passes downwards through vertical pipes placed within the jacket and surrounded with water, to ports situated about half way down the producer, and thence into the mass of fuel. The zone of greatest heat is consequently at about half the height of the fuel, and the tarry matters which are given off in the upper part of the generator, pass down through the incandescent zone and are either burned or converted into fixed gas, which passes along with the gas generated by the partial combustion of the fuel, downwards, through the producer to the gas outlet pipe which is situated just above the water lute but below the central conical grate.
—W. H. C.

Gas producers. F. W. Sandmann, London. Eng. Pat. 6502, March 15, 1910.

In order to distribute the fuel from the hopper evenly over the entire area of the producer, a hollow cone or ring, inclined inwards, is attached to the cover plate beneath the usual hopper and cone distributor. When the latter is half lowered the fuel strikes the ring and is projected towards the centre of the producer, but when it is fully lowered the fuel misses the ring and is distributed towards the sides of the producer.—H. H.

Hydrogen and carbon dioxide ; Process for the manufacture of —— by the decomposition of coal, hydrocarbons, carbon monoxide, and other carbon compounds with excess of superheated steam. F. Sauer. Ger. Pat. 224,862, May 9, 1907.

In the production of a mixture of hydrogen and carbon dioxide by the action of steam on carbonaceous substances or on water-gas, the patentee proposes to use an excess of steam and to superheat this to such a degree that it suffices to maintain the proper reaction temperature, in order to ensure the production of a gas of uniform composition. For example in the action of steam on coal, the latter is not blown alternately with air and steam, but the steam is superheated to such a degree that when the process is once started, it can be carried on continuously by aid of the heat of the steam alone. The hydrogen and carbon dioxide may be separated from the other reaction products (steam, carbon monoxide, hydrocarbons) and the latter again brought into the process with a further quantity of superheated steam.—A. S.

Gas washers. G. K. Davis, Manchester. Eng. Pat. 4543, Feb. 23, 1910. Addition to Eng. Pat. 2113, Jan. 28, 1909 (this J., 1910, 79).

A spray arrester is fitted to the lateral aperture in each partition, comprising a pipe or cone of larger area than that of the aperture and having staggered baffles and a sealed pipe for discharging the collected spray.—H. H.

Stills [for producing pitch and coke from petroleum residuum]. J. Weiser, Schonberg, Austria. Eng. Pat. 14,251, June 17, 1909.

The claim is to heat stills by a fluid metal bath to produce pitch and coke from the residuum of crude petroleum distillation. The object is to prevent the deposition of crusts of carbon on the stills due to local overheating.—W. H. C.

Mineral oils and their distillates ; Process for treating ——. C. C. Denner-Meier, Zürich, Switzerland. Eng. Pat. 19,157, Aug. 20, 1909.

The mineral oil is treated in a still, which is not externally heated, with wet and saturated steam at about 100° C., and the resulting vapours, after being passed through a filter, are condensed. The products obtained in the order given below are:—benzine, turpentine substitute, and illuminating oil, and the residue contains lubricating and fuel oil. It is further stated that treatment with chemicals is dispensed with and that the products are obtained in a finished condition ready for immediate use. (Reference is directed to Eng. Pats. 48 of 1863, 3240 of 1874, 1928 of 1882, 15,899 of 1892 and 13,936 of 1902 ; this J., 1903, 692).—W. H. C.

Petroleum products ; Obtaining ——. H. Frasch, New York, Assignor to Standard Oil Co., Bayonne, N.J. U.S. Pat. 968,760, Aug. 30, 1910.

Coalinga or similar petroleum is distilled under a fractionating column so as to obtain a burning oil, solvent naphtha, and also a fraction which is treated with reagents for obtaining substitution derivatives of aromatic hydrocarbons.—A. T. L.

Combustion-engines ; Method of operating ——. P. Winand, Cologne, Germany. U.S. Pat. 970,152, Sept. 13, 1910.

See Eng. Pat. 3006 of 1906 ; this J., 1906, 582.—T. F. B.

Coke ovens. J. Kros, Essen-Ruhr, Germany. Eng. Pat. 4890, Feb. 26, 1910.

See Fr. Pat. 413,705 of 1910 ; this J., 1910, 1095.—T. F. B.

Gas-producer. E. Jones, Perry Barr, Assignor to Kynoch, Ltd., Birmingham. U.S. Pat. 969,375, Sept. 6, 1910.

See Eng. Pat. 6495 of 1908 : this J., 1909, 81.—T. F. B.

IIb.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Reflecting power of various metals [incandescence filaments, etc.] W. W. Coblentz. J. Franklin Inst., 1910, **170**, 169—193.

The present observations are the result of an attempt to obtain a more thorough knowledge of the optical properties of metals (and some other substances) used in incandescent lamps. A fluorite prism, a mirror spectrometer and a new vacuum bolometer were used ; and the unknown metal was compared with a new silvered glass mirror of which the reflecting power was known. Tungsten, molybdenum, graphite, tantalum, antimony, rhodium, iridium, iron, magnesium, chromium, vanadium, tellurium and silicon were examined, and the properties of tungsten, tantalum and molybdenum are summarised. The reflectivity curves of tungsten and of molybdenum are so nearly alike that from a consideration of their optical properties there is no great choice in the use of these two metals in incandescent lamps. The reflectivity curves show that the high efficiencies of the metal-filament lamps is due to their low reflectivity in the visible spectrum and to a high reflectivity in the infra-red. In tungsten this results in an emissivity of almost 50 per cent. in the visible spectrum, while in the infra-red the emissivity is less than 10 per cent. of an ideal radiator. The ideal solid illuminant giving a high luminous efficiency must fulfil the condition of a high operating temperature, a high reflectivity (hence low emissivity) in the infra-red, and a low reflectivity (high emissivity) in the visible spectrum. The pure metals, tungsten and molybdenum fulfil these conditions more exactly than any other known metals, excepting tantalum, which as a lamp filament, however, does not have the optical properties of the samples described in this paper.
—R. C. P.

Patent.

Ammonia from dry-distillation gases ; Process for removing ——. R. Barth. Ger. Pat. 222,407, Oct. 23, 1908.

In ammonia saturators in which a vacuum is maintained above the acid, a certain amount of ammonia is present with the steam in the gases from the outlet pipe ; it is proposed to mix these gases with the crude gas before it is cooled.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Nitrophenols ; Preparation of ortho- and para- ——. R. S. Hart. J. Amer. Chem. Soc., 1910, **32**. 1105—1106.

The author has observed that a yield of 18 per cent. of *p*-nitrophenol can be uniformly obtained, without any formation of tar, if the nitric acid is vigorously stirred during the addition to it of the phenol. A solution of 80 grms. of sodium nitrate and 100 grms. of strong sulphuric acid in 200 c.c. of water is kept at about 25° C. and vigorously agitated by means of a small motor. A solution of 50 grms. of phenol in 5 grms. of alcohol is then added gradually at the rate of 30—35 drops per minute. The agitation is continued for ½ hour after the addition of the phenol, and then after a further 1½ hours, the mixture is diluted with twice its volume of water. From the oily nitro-product nearly 30 grms. of ortho-, and about 13 grms. of *p*-nitrophenol can be isolated. Nitration cannot be effected below 4° C., and slightly lower yields of the para-compound are obtained at 4° C. and at 50° C. respectively than at 25° C.—A. S.

Patents.

Anthraquinone derivatives containing nitrogen ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 223,510, June 2, 1908. Addition to Ger. Pat. 210,019, May 1, 1908.

The products described in the principal patent and in Ger. Pat. 212,436 (this J., 1909, 650, 956), may be prepared by first condensing one mol. of succinic acid or a derivative with one mol. of an aminoanthraquinone, and then combining the intermediate product with one mol. of the same or another aminoanthraquinone.—T. F. B.

Azoxy- and azo-benzene ; Process for preparing ——. Chemikalienwerk Griesheim, G. m. b. H. Ger. Pat. 225,245, April 24, 1908.

Nitrobenzene is reduced to azoxybenzene, which is further reduced to azobenzene, by heating it, with or without application of pressure, with alkali and cellulose or a material containing cellulose (sawdust, etc.) ; it is sometimes advantageous also to add an organic solvent, such as solvent naphtha, to the mixture.—T. F. B

Condensation products containing iodine from wood tar or wood tar oils and aldehydes. Ger. Pat. 223,838. *See* XX.

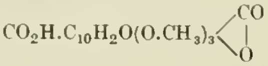
IV.—COLOURING MATTERS AND DYES.

Mordant dyestuffs. E. Noelting. Chem.-Zeit., 1910, **34**, 977—978.

The author finds that when a dyestuff, more particularly one belonging to the anthraquinone series, contains a hydroxyl and an amino-group in the ortho-position with respect to one another, the substance has mordant dyeing properties. In certain cases also mordant dyestuffs are formed when the two groups are in the para-position respectively, but here the affinity for the fibre is not so great as in the former case. A table is given which shows the shades produced by such anthraquinone derivatives on various mordants; it is remarkable that all amino-hydroxy-compounds give strong colours on a copper mordant.—J. C. C.

Lactone dyestuffs. VI. Galloflavin. J. Herzig. Monatsh. Chem. 1910, **31**, 799—818.

When tetramethylogalloflavin is heated to boiling with 8 per cent. potassium hydroxide solution and then hydrochloric acid added, a compound melting at 253°—256° C. is formed, which is called trimethyloisogalloflavin and to which the constitution,



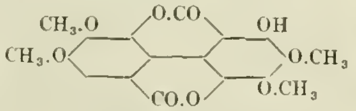
$$CO_2H.C_{10}H_2O(O.CH_3)_3\left\langle\begin{array}{l}CO\\ |\\ O\end{array}\right.$$

is ascribed. On treatment with diazomethane this forms tetramethyloisogalloflavin, $C_{12}H_2O_4(O.CH_3)_4$, melting at 232°—234° C. and isomeric with tetramethylogalloflavin. That trimethyloisogalloflavin is a carboxylic acid was shown by its conversion into the tetramethyl compound by means of alcohol and sulphuric acid. The lactone ring in these compounds is readily ruptured by means of alcoholic potash, and the corresponding ether-acid and ether-ester were prepared. By treatment with de-methylating agents the compounds of the isogalloflavin series yielded tarry products, but tetramethylogalloflavin, when heated with hydriodic acid, lost two methoxy-groups. Galloflavin itself, when fused with alkali, gives gallic acid. Purpurogallin is readily acetylated by means of acetic anhydride and sulphuric acid and the trimethyl ether is obtained in a quantitative yield by means of diazomethane. By further treatment with dimethyl sulphate the latter is readily converted into the tetramethyl derivative.

—J. C. C.

Lactone dyestuffs. VII. Condensation products of the di- and tri-methyl ethers of gallic acid. J. Herzig and F. Schmidinger. Monatsh. Chem. 1910, **31**, 819—826.

When the 3:4-dimethyl or the tri-methyl ether of gallic acid is treated with potassium persulphate in concentrated sulphuric acid solution, tetramethyloflavellagic acid,



is obtained. The substance, which is best purified through the acetyl derivative, melts at 270°—271° C. By treatment with dimethyl sulphate in alkaline solution the lactone ring is broken and the ether-ester of flavellagic acid is produced. Tetramethyloflavellagic acid is very resistant towards the action of diazomethane, but when de-methylated the product is readily converted, by this agent, into the corresponding pentamethyl ether.—J. C. C.

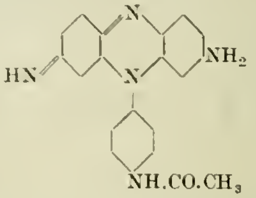
Patents.

Sulphide dyestuffs containing chlorine; Process for preparing red ——. A. Skita. Ger. Pat. 220,628, March 19, 1908.

When fluorescein is heated with sulphur chloride, or with a solution of sulphur in sulphur chloride, to 160°—190° C., compounds are obtained which, when oxidised either in substance or on the fibre, yield red sulphide dyestuffs containing chlorine. The dyestuffs contain more or less sulphur according to whether the melt is heated to a lower or higher temperature.—T. F. B.

Sulphide dyestuffs; Process for preparing blue-violet ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 222,418, Aug. 11, 1908.

p-Acetaminosafranine of the formula,



(obtained from *p*-phenylenediamine, aniline, and acetyl-*p*-phenylenediamine), or one of its homologues, is converted into a blue-violet dyestuff, dyeing fast shades, by treatment with an alkali polysulphide and a copper compound.—T. F. B.

Azo dyestuffs; Process for preparing basic ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 222,510, Feb. 11, 1909.

Basic azo dyestuffs, which dye artificial silk directly in shades fast to washing, are obtained (1) by diazotising aminodiphenylamine or 4.4′-diaminodiphenylamine or a homologue, and combining with an amine, diamine, aminophenol, aminonaphthol, or alkyl derivative of one of these; (2) tetrazotised 4.4′-diaminodiphenylamine is combined, in any order, with one mol. of one of the above amino-compounds and with one mol. of a phenol; (3) the above dyestuffs are combined with one or two mols. of a diazo compound; (4) the diazo or tetrazo compounds of these aminodiphenylamines are combined with an amine, which can subsequently be diazotised and then combined with an amine, diamine, aminophenol, or aminonaphthol, or one of their alkyl derivatives. The dyestuffs obtained are of various shades, from golden yellow, brown, bluish-red, and blue to black.—T. F. B.

o-Hydroxyazo dyestuffs; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 222,930, March 10, 1909.

The diazo compounds of *o*-aminophenols combine with 2.8-naphtholsulphonic acid and 2-naphthol-6.8-disulphonic acid, in presence of alkaline earth hydroxides, giving good yields of dyestuffs which dye wool directly in orange to red-violet, bluish red, and red-brown shades, altered by chroming to brownish-red to violet-black.—T. F. B.

[Azo] dyestuffs for wool; Process for preparing yellow ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 222,511, June 20, 1909.

The dyestuffs obtained by combining β-diazonaphthalene with 1-sulphoaryl-3-methyl-5-pyrazolones, though only containing one sulpho-group, are fairly readily soluble, and dye wool in level, reddish-yellow shades.—T. F. B.

Aminoazo compounds; Process for preparing sulphonic acids of aromatic ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 223,657, May 2, 1909. Addition to Ger. Pat. 217,935, Oct. 24, 1908.

Tetrazo derivatives of aromatic sulphonic acids are treated by the process described in the principal patent (this J., 1910, 343). When the tetrazo-derivative of diaminostilbene is combined with *p*-toluenesulphanilide, the product dyes wool yellow: on splitting off the toluenesulpho group, a dyestuff is obtained which dyes cotton orange; by diazotising and developing with β-naphthol, violet dyeings are produced.—T. F. B.

Dye; Greenish-yellow ——. P. Volkmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 969,428, Sept. 6, 1910.

SEE Fr. Pat. 411,192 of 1909; this J., 1910, 938.—T. F. B.

Anthracene vat dye. P. Thomaschewski and H. Raeder, Vohwinkel, and W. Mieg and P. Fischer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 970,278, Sept. 13, 1910.

SEE Fr. Pat. 409,407 of 1909; this J., 1910, 686.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Nitrocellulose artificial silks; Denitration of ——. A. Dulitz. Chem.-Zeit., 1910, 34, 989—990.

IT is impossible to obtain a product absolutely free from residual traces of nitrogen without the destruction of the threads. For practical purposes it is sufficient to prepare a denitrated silk containing 0·05 per cent. of nitrogen, provided the distribution of the denitrating action be absolutely uniform. Uniform denitration depends on uniformity in composition of the nitrocellulose threads and their uniform shrinkage; also on uniform moisture in the threads which are suspended in the denitrating bath. The quantity of denitrating liquid per kilo. of nitrocellulose must always be constant and the composition, the initial temperature and the changes in temperature of the bath during the process must be accurately controlled. The time of action of the denitrating bath is of the highest importance. The titration of the bath and the examination of the threads with the polarising microscope are not very satisfactory guides in judging the end-point of the denitration process. In order to be quite certain, the threads should be treated rather longer than appears to be strictly necessary. Nevertheless it must always be borne in mind that a prolongation of the treatment involves a loss of strength of the product. Any addition of substances, such as resins or oils, to the collodion has an unfavourable influence on the denitration and necessitates a longer treatment, with consequent loss of strength. The addition of acids with a view to reducing the viscosity of the collodion also detracts from the quality of the finished silk and appears to promote the formation of oxycellulose. The author points out that whereas fresh solutions of hydrosulphides attack the denitrated threads but slightly at 40° C., a solution which has already been used for denitration attacks them powerfully. He believes that the nitric acid groups split off from the cellulose during denitration are capable of inducing a secondary oxidation of the cellulose, part of which then enters into solution in the bath. The hydrosulphides alone are not sufficient to fix these nitric groups in such way as to avoid injury to the cellulose, and various other substances are generally added. The concentration of the denitrating bath should be fairly high.—J. F. B.

Cellulose and pure nitric acid; Reactions between —— *I.* C. Haeussermann. Z. angew. Chem., 1910, 23, 1761—1763.

THE first reaction between cellulose and nitric acid is an adsorption reaction, such as that described by Knecht (this J., 1904, 335), who obtained a compound unstable towards water, by a short immersion of cotton in nitric acid of sp. gr. 1·415 and drying over quicklime. But with longer periods of action with acid of this strength and even down to 1·36 sp. gr., esterification always takes place to a certain extent, the compounds produced being stable towards water. The tendency to esterification rises rapidly with increase in the concentration of the acid and becomes very pronounced with acids of 1·450 sp. gr. and upwards. At ordinary temperatures, the quantity of acid being 100—200 times that of the cotton, the fibres swell strongly in acids of sp. gr. 1·450—1·463, and break down into small particles, with the production of small quantities of products soluble in the acid but for the most part precipitated on dilution. The cellulose nitrates so obtained, after 48 hours' action, contain no more than 6·5—8 per cent. of nitrogen and are insoluble in ether-alcohol and acetone. Their microscopic appearance is partly fibrous and partly amorphous. Acids of 1·469—1·476 sp. gr. immediately dissolve loose cotton; the products are precipitated by water and contain 8—9 per cent. of nitrogen; they are insoluble in the usual solvents. These products are amorphous and belong to the xyloidin group; denser forms of cotton tissues are not dissolved but only parchmentised. Acids of 1·48—1·50 sp. gr. convert cotton into the ordinary pyroxylins, containing 9—12·5 per cent. of nitrogen without alteration of structure. More concentrated acids have a felting or parchmentising action, and uniform products are not obtainable. At higher temperatures, on the water-bath, nitric acid of 1·45 sp. gr. dissolves the cotton, and the modified nitrocellulose may be precipitated by dilution at the right moment; prolonged heating produces oxidation and decomposition. Dilute nitric acid of 1·3 sp. gr., on the water-bath, has an oxidising effect on cotton, yielding a gelatinous oxycellulose and soluble products. Acid of 1·2 sp. gr. also disintegrates cotton and yields soluble oxidation products. At the ordinary temperature dilute nitric acid has an action similar in the main to that of the non-oxidising mineral acids, and produces friable hydrocellulose. The vapours of nitric acid of 1·4 sp. gr. also produce hydrocellulose at the ordinary temperature, whilst those of highly concentrated acids have a pronounced esterifying effect.—J. F. B.

Cellulose, its materials and derivatives; Reducing properties of ——. L. Kollmann. Papierfabrikant, 1910, 8, 863—869, 890—893.

THE author has endeavoured to establish, as a quantitative method of investigation, the reducing property of cellulose towards permanganate, in a manner analogous to that standardised by Schwalbe in the case of Fehling's solution. About 5 grms. of the dried cellulose, raw cellulose material or modified derivative are weighed out and treated with 250 c.c. of a solution containing 20 c.c. of 10 per cent. (by volume) sulphuric acid and 5—20 c.c. of potassium permanganate (1 c.c. = 0·00392 grm. of the salt). The fibre is digested for a given time at a standard temperature and 100 c.c. of the clear liquid are drawn off for titration. 10 c.c. of sulphuric acid (1 : 9) are added to this portion, and oxalic acid exactly equivalent to the permanganate originally present in it; the volume of permanganate required then to restore the colour corresponds with that reduced by the aliquot portion of the cellulose. From the nature of the reaction the quantitative results depend on the strict observance of identical conditions, and they have only a comparative significance. They are calculated in terms of mgrms. of potassium permanganate reduced by 100 grms. of dry material. The results are influenced by the state of disintegration of the fibrous material, the concentration of the permanganate, the time of action and the temperature, but small variations in the weight of cellulose material taken have no effect on the percentage results. Reduction proceeds further in acid solutions than in neutral. The reducing power of a cellulose material under standard conditions is influenced by two factors: the presence of natural impurities, incrusting matters, lignin, etc., which have a very high reducing power, and the presence of aldehydic groups produced by the ulterior chemical modification of the pure normal cellulose. The author has therefore adopted two sets of conditions for his quantitative observations: (1) for impure raw cellulose materials he takes 20 c.c. of permanganate and allows 5 minutes for the reduction; (2) for pure cellulose and its chemically modified derivatives he takes 10 c.c. of permanganate and allows 1 hour. The action being to a great extent superficial, a textile fabric or yarn will show a lower result than the same fibre in the disintegrated condition. The following examples show the changes in the reducing power of a given sample of loose raw cotton in the course of the usual bleaching process. The results show mgrms. of permanganate reduced by 100 grms. of cotton in 1 hour, using 10 c.c. of permanganate solution: raw cotton 569; after the first (lime) boil 402;

after the second (soda) boil, 223; after bleach, 171. Mercerised cotton, hydrocellulose and oxycellulose all show higher results than the cellulose from which they are prepared, the results increasing in the order named and with the degree of modification. Mechanical wood pulp, unbleached chemical wood pulp, raw hemp, raw cotton and jute, when treated with 20 c.c. of permanganate for 5 minutes, reduce from 9 to 11 times as strongly as purified cotton wool under the same conditions.—J. F. B.

Patents.

Fabrics for use as belting or hose; Treatment of ——. P. L. Wooster, Yonkers, N.Y., U.S.A. Eng. Pat. 19,926, Aug. 31, 1909.

A closely woven cotton, jute or other textile fabric is saturated under pressure with a solution of asphaltum having a bituminous base in a suitable hydrocarbon, carbon bisulphide or other solvent. The impregnated fabric is then passed between rollers and dried at ordinary or increased temperature. The use of a fabric so impregnated with asphaltum for the manufacture of belting, or fire or garden hose is claimed. (Reference is directed to Eng. Pats. 1604 of 1885 and 10,543 of 1891.)—J. F. B.

Cyperus papyrus commonly known as papyrus and other tropical aquatic plants; Production of useful products from ——. W. Smith, Dublin. Eng. Pat. 19,150, Aug. 20, 1909.

The use of papyrus for the manufacture of paper stock or half-stuff is claimed. The major portion of the moisture is removed by passing the stems between rollers. If the material is to be exported, it is further dried, by exposure or by artificial heat. Otherwise the crushed stems are treated directly by the usual chemical processes for conversion into pulp. The crushed roots of the papyrus or other aquatic plants are utilised as fuel. (Reference is directed to Eng. Pats. 2190 of 1870, 2006 of 1872 and 607 of 1873.)—J. F. B.

Cellulose; Apparatus for producing —— *from fibrous materials.* G. H. Marshall, Roanoke Rapids, N.C. U.S. Pat. 968,864, Aug. 30, 1910.

The apparatus comprises two independently driven rotary digesters mounted on horizontal trunnions. One trunnion of each digester is hollow for the passage of a pipe which is bent so as to deliver near one end of the digester. These inlet pipes are connected to steam-pipes, to one another, to a blow-off pipe, to an agitating-tank, and to a water-heater in which is a heating coil connected to the blow-off pipe. The outlet of either digester can be connected when required to a swing-pipe connected with the blow-off pipe.—A. T. L.

Celluloid or celluloid substitute; Non-inflammable ——. W. C. Parkin and A. Williams, Sheffield. Eng. Pat. 26,657, Nov. 17, 1909.

100 parts of cellulose are mixed with 450 parts of glacial acetic acid, 280 parts of acetic anhydride and 10—15 parts of sulphuric acid and the mixture left at the ordinary temperature for about 13 hours. A mixture of 25 parts of nitric acid and 75 parts of water is next added, the whole is well mixed and allowed to stand for a further 13 hours. Water is then added and the precipitate is well washed and dried. In manufacturing a material from the product thus obtained, camphor and camphor substitutes may be employed with suitable solvents. It may also be worked with glycerin derivatives, together with oils, with solvents and with filling materials.—P. F. C.

Cellulose compounds from cellulose esters; Process for the production of pressed or shaped ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,364, June 14, 1910. Under Int. Conv., July 26, 1909.

Organic esters of cellulose are made into shaped compounds by the aid of pentachloro-ethylene as a liquefying agent, with addition of other dissolving or diluting agents. Pentachloro-ethylene alone has only a very slight solvent action on cellulose esters, but in presence of alcohol or other solvent it plays the part towards organic cellulose esters that camphor does towards nitrocellulose in celluloid, or acetylene tetrachloride towards acetylcellulose. For example, 200 parts of cellulose acetate are mixed with 100 parts of pentachloro-ethylene and 700 parts of acetone; when the solution is filtered and poured on plates, flexible films are obtained.—T. F. B.

Viscose and similar compositions; Process for manufacturing ——. C. C. Leclaire, Paris. Eng. Pat. 20,593, Sept. 8, 1909.

See Fr. Pat. 402,804 of 1908; this J., 1909, 1270.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Adsorption [*of dyestuffs*]; *Anomalous* ——. W. Biltz and H. Steiner. Z. Chem. Ind. Kolloide, 1910, 7, 113—122.

In adsorption experiments with Night Blue and cotton and charcoal, it has been observed that on increasing the concentration of the dyestuff solution beyond a certain limit, the amount of dyestuff adsorbed decreases considerably. The results of experiments with a number of dyestuffs are given. The basic dyestuffs, Night Blue and Victoria Blue, with cotton, showed this anomalous adsorption distinctly: for example at the boiling temperature a deeper shade was obtained with a 0·08 per cent. than with a 0·2 per cent. solution of Night Blue. In experiments with the salt dyestuffs, Congo Red, Benzopurpurin, and Chicago Blue 6 B, and cotton, and with the mordant dyestuffs, Alizarin Cyanine Green G extra and Acid Alizarin Blue, and ferric hydroxide gel, on the other hand, the results corresponded with the usual exponential adsorption formula. In the case of the basic dyestuffs, the basic constituent only is adsorbed and the anomalous results are probably due to the effect of hydrolysis of the dyestuff in solution. In the case of dialysed Night Blue, in which hydrolysis is probably already nearly complete, the adsorption curve approaches more nearly the normal form. Several other cases of anomalous adsorption which have been mentioned in the literature are referred to.—A. S.

Colour lakes in the fibre; Nature of ——. E. Grandmougin. Chem.-Zeit. 1910, 34, 990—991.

The nature of colour lakes in the fibre is very variable. Certain dyestuffs form simple lakes; to this class belong all the vat dyestuffs, the naphthol dyestuffs and the oxidation and condensation dyestuffs. In all these cases the lakes consist of the unchanged dyestuff deposited in or on the fibre; the dyestuff is extracted without chemical modification by treatment with suitable solvents: glacial acetic acid, xylene, nitrobenzene, cold concentrated sulphuric acid, etc., and the isolated extracts may be examined spectroscopically or otherwise for identification. The metallic lakes of the "mordant" dyestuffs include not only those dyed on a mordant previously fixed on the fibre, but also those which are dyed directly in an acid or saline bath and are subsequently converted into lakes by after-treatment with metallic salts, *e.g.*, potassium bichromate, chromium fluoride, copper sulphate, etc. Two tpyes of metallic lakes are met with (1) those from which the dyestuff can be isolated as such by chemical decomposition; (2) those which are not decomposed readily, and in so far as they are capable of extraction are obtained only in the form of solutions of the compound lake. A good example of the first type is alizarin lake, a complex mineral fatty acid soap in combination with alizarin. The soap is decomposed by heating with moderately concentrated acid, and the alizarin may be isolated in the free state for examination. The second group of mineral lakes includes certain chrome dyestuffs, *e.g*, Alizarin Blue, Cœrulein, Phenocyanin, etc., which are dyed on chrome-mordanted goods, and Chromotrope and acid-alizarin dyestuffs which are dyed direct and after-treated with bichromate. These lakes are not decomposed by acids, the metallic radical being very firmly combined with the organic radical. Chromotrope FB (naphthionic acid azo-1.4-naphtholsulphonic acid) is an interesting example. The aqueous or acetic acid solution of this substance has a red colour and a certain definite absorption spectrum; when dyed on wool and after-chromed it gives a fine Navy Blue. The colour may be extracted from the fibre by means of 90 per cent. acetic acid containing a few drops of strong hydrochloric acid; the solution has a violet to blue colour. A blue solution is also obtained when the fibre is treated with cold concentrated sulphuric acid. The form of the absorption spectrum shows that the same substance is in solution in both these cases, and this spectrum is quite different from that of the free dyestuff in the same solvents.—J. F. B.

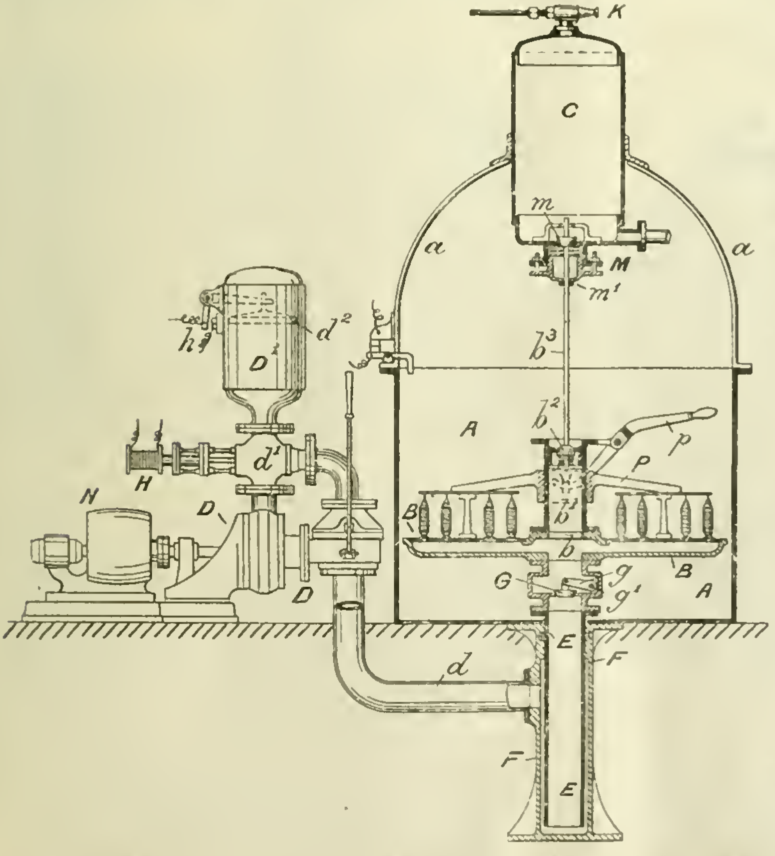
Glue; Viscosity tests of samples of Polish ——. E. Schmidt. Chem.-Zeit., 1910, 34, 993.

Glue and gelatin are largely used in the finishing of woollen and cotton textiles, and the commercial qualities are very variable. The characters desired are in the first place adhesive and thickening quality, secondly neutrality and freedom from undesirable adulterations. According to the author's experience the viscosity of the solution should be the sole factor in judging the value of glue for finishing purposes. He has examined a number of samples of Polish origin, using an Engler's viscosimeter and working with 15 per cent. solutions of the glues at a temperature of 30° C. All the samples were neutral and unadulterated; the price of the various samples was found to vary directly as the viscosity. The viscosity values found ranged from 1·2115 for a common glue and 1·3270 for a bone glue, up to 1·6730 for a high-grade gelatin.—J. F. B.

Patents.

Dyeing machine. J. H. Riley and Co., Ltd., and F. Riley, Bury. Eng. Pat. 3263, Feb. 10, 1910.

This cop dyeing machine, which is particularly constructed for indigo dyeing, comprises a cop-carrier, B, two vats, A, a pump, D, and an exhaust chamber C. The cop-carrier is provided with a hollow ram, E, working in a hydraulic cylinder, F, with which the pipe, *d*, of the pump, D, is connected. This ram opens into a chamber, *b*, the passage being controlled by a valve, G. When it is desired to raise the cop-carrier in the vat, this valve is closed and the dye-liquor on being pumped in, raises the cop-carrier. It can be lowered by either reversing the pump or opening the valve. The pump, D, is provided with a three-way valve, d^1, and a receiver, D^1, the latter being fitted with a float, d^2, and with an electrical device for automatically operating the valve, d^1, when the receiver is full, so as to turn the flow of the dye-liquor into another vat and to allow the liquor to flow from the receiver through a discharge pipe not shown. This receiver is used to draw the air out of the cops and to receive the dye-liquor first drawn through, which may have been oxidised by contact with the air. The cop-carrier, B, is fitted with an exhaust pipe, b^1, and valve, b^2, and above it is arranged the exhaust chamber, C, with an ejector, K. This exhaust chamber at its lower end is fitted with a spring stuffing-box, M, and a valve, *m*, through which passes a rod, b^3, fitted to the exhaust pipe, b^1. When the cop-carrier is raised, the upper end of the pipe, b^1, comes into contact with the spring stuffing-box, M, making a steam-tight joint. At the same time the projection, m^1, opens the valve, b^2, and thus connects the exhaust chamber, C, with the cop-carrier, B. The rod, b^3, also opens the valve of the ejector, K, and thus produces a partial vacuum in the chamber, C, opens the value, *m*, and draws air through the cops to oxidise the reduced indigo.—P. F. C.



Dyeing machine. J. H. Riley and Co., Ltd., and F. Riley, Bury. Eng. Pat. 3366, Feb. 11, 1910.

A dye-vat within which is placed a perforated yarn-carrier is constructed with a receiver surrounding it as a jacket, the vat and receiver being connected by a valved pipe at the bottom. This pipe is also connected to a pipe leading to a dye-liquor reservoir. The bottom of the vat is also connected directly with the pipe leading to the dye-liquor reservoir. The upper part of the dye-vat is connected by a branch pipe to a steam pressure pipe, and a partial vacuum can be formed inside the vat by an ejector fitted on to the exhaust pipe. The receiver is also connected with the steam pressure pipe so that steam can be alternately admitted to the dye-vat and to the receiver. The machine is provided with an exhaust chamber, having an ejector, the chamber being connected with the dye-vat and receiver in such a way that the liquor can be forced through the material by suction instead of by steam pressure.—P. F. C.

Washing, damping or dyeing cylindrical articles, especially bobbins or bobbins of yarns; Machine for ——. E. Herzog, Erlach, Lower Austria. Eng. Pat. 8086, Apr. 4, 1910. Under Int. Conv., Apr. 2, 1909.

The bobbins are taken up from the feed table by a revolving cylinder provided with longitudinal grooves which hold the bobbins until they are delivered to the washing device. This consists of two parallel endless bands which are travelling in the same direction at different speeds so that the bobbins, when placed between them, are caused to roll forward. The lower endless band, just before it takes the bobbins, passes through a washing liquor contained in a tank and carries some of it forward to wash the bobbins, If necessary, the bobbins, just before delivery from the machine, are further washed by discharging a jet of water on to them. The distance between the endless bands can be adjusted so as to enable them to be used for bobbins of different diameters and, if desired, the rotating feeding cylinder can be replaced by a creeping lattice, provided with tranverse grooves at intervals.—P. F. C.

Silk weighted with metallic salts; Process for rendering —— durable. O. Meister. Ger. Pat. 223,883, Oct. 17, 1909.

In order to render weighted silks more durable, without loss of their gloss or "feel," they are treated after dyeing with a solution of an aldehyde of a monohydric alcohol, or with its bisulphite compound. Thus the solution may contain 1 to 5 per cent. of formaldehyde-bisulphite. —T. F. B.

Dyeing and printing; Process for producing shades which can be graduated in ——. H. Schmid. Ger. Pat. 223,456, March 2, 1909. Addition to Ger. Pat. 218,474, March 2, 1909.

A padding mixture is prepared containing a phenylenediamine either alone or mixed with aromatic aminohydroxy compounds, an alkali chlorate, ammonium chloride, and an alkali ferrocyanide, and is used for the production of shaded effects in brown and black according to the process described in the principal patent (this J., 1910, 484). For instance, for brown shades, the mixture may consist of 12—15 grms. of *p*-phenylenediamine, 20 grms. of sodium chlorate, 20 grms. of ammonium chloride, and 10—20 grms. of potassium ferrocyanide in a litre of water.—T. F. B.

Silk; Process of preserving tin-weighted ——. O. Berg and M. Imhoff, Paterson, N.J. U.S. Pat. 969,446, Sept. 6, 1910.

See Eng. Pat. 6538 of 1910; this J., 1910, 1007.—T. F. B.

Erratum.

This J., Sept. 30, page 1102, col. 1, line 15 from bottom, *after* "London," *insert* "From E. Weichert."

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphur acids; Analysis of some inorganic ——. A. Casolari. Gaz. chim. ital., 1910, 40, II., 22—27.

Polythionates are determined by treating the neutral solution with hydrogen peroxide and a known volume of *N*/10 alkali, heating on the water-bath for ½ hour, and then titrating the excess of alkali. Each molecule of a polythionate with *m* atoms of sulphur forms *m*—1 mols. of sulphuric acid: $Na_2S_mO_6+(3m—5)H_2O_2+(m—1)H_2O=Na_2SO_4+(m—1)H_2SO_4+(3m—5)H_2O$. Thiocyanates can be determined in an analogous manner, but the alkaline solution is heated for about 1 hour, and then a quantity of *N*/10 acid equal to the alkali used is added, and the solution boiled for a few minutes to decompose the cyanate which would otherwise obscure the end point of the titration. The reaction is: $KSCN+4H_2O_2+2KOH=K_2SO_4+KOCN+5H_2O$. Thiosulphates may also be determined in this way, one mol. of thiosulphate yielding one mol. of sulphuric acid. Thiosulphate and thiocyanate when present together may be determined by first converting the thiosulphate into tetrathionate by titration with iodine, and then determining the combined tetrathionate and thiocyanate by oxidation with hydrogen peroxide in alkaline solution as described above.—A. S.

Ammonium perchlorate; Use of —— as a reagent. Metal-ammonium perchlorates. R. Salvadori. Gaz. chim. ital., 1910, 40, II., 19—21.

Metal-ammonium perchlorates are easily prepared by adding to a solution of a salt of the metal a 20 per cent. solution of ammonium perchlorate in ammonia of sp. gr. 0·9. The cobalt-, nickel-, manganese-, and cadmium-ammonium perchlorates are precipitated completely in this way even from dilute solutions, the filtrate from the precipitate giving no reaction with ammonium sulphide. Precipitation is incomplete with zinc salts, whilst with mercury salts the precipitate is soluble in excess of the reagent. With copper salts precipitation can only be effected in concentrated solutions and after long standing. The reaction may be utilised for detecting cadmium in presence of copper instead of using potassium cyanide. The sulphide precipitate obtained in the second group and containing copper, bismuth, and cadmium, is dissolved in nitric acid and the solution is first freed from bismuth by treatment with excess of ammonia, and then treated with the ammoniacal ammonium perchlorate solution. Cadmium-ammonium perchlorate, $Cd(ClO_4)_2.4NH_3$, is precipitated immediately; the white crystalline precipitate dissolves on heating, but separates again on cooling. Ammonium perchlorate may also be used for distinguishing cobalt salts from cobaltammines, the latter giving no precipitate. The metal-ammonium perchlorates are decomposed by water, with liberation of ammonia and formation of the hydroxide of the metal. They also decompose on heating, exploding when heated rapidly or when struck. The metal-ammonium perchlorates prepared by the author have the following composition: cadmium, $Cd(ClO_4)_2.4NH_3$; zinc, $Zn(ClO_4)_2.4NH_3$; cobalt, $Co(ClO_4)_2.6NH_3$.—A. S.

Permanganates and permanganic acid; Spontaneous decomposition of ——. A. Skrabal. Z. anorg. Chem., 1910, 68, 48—51.

The spontaneous decomposition of permanganates is considered to take place in three stages: (1) a slow incubation period, in which small quantities of manganous salts are formed, according to the scheme, $Mn^{vii}\rightarrow Mn^{ii}+O_2$: (2) a more rapid induction period, in which trivalent manganese, thought to be the primary product, gives rise partly to manganous salt and manganese peroxide and partly to manganous salt (which reacts with more permanganate) and oxygen, thus—$Mn^{ii}+Mn^{vii}\rightarrow Mn^{iii}<\begin{matrix}\rightarrow Mn^{ii}+Mn^{iv}\\ \rightarrow Mn^{ii}+O_2\end{matrix}$, and (3) the final period, in which the manganese peroxide reacts slowly to form manganous salt and oxygen, $Mn^{iv}\rightarrow Mn^{ii}+O_2$. If manganous salt be added to permanganate solution or produced in it by the reducing action of organic substances, the rapid induction period sets in immediately, with the liberation of oxygen and production of tetravalent manganese, and if more permanganate be then added, on account of the manganous salt formed by the slow final period reaction, the induction period sets in afresh, until manganese peroxide again remains; the peroxide appears, therefore, to act catalytically in the decomposition of the permanganate. This decomposition proceeds much more slowly in neutral than in acid solution, and, amongst other factors, light probably influences the rate of decomposition. The mechanism of the change, as explained by Sarkar and Dutta (this J., 1910, 843), is considered insufficient, because it only accounts for the liberation of oxygen after the permanganate has been reduced, whereas it is also evolved during the process of reduction.—F. Sodn.

Magnetic oxides of iron from aqueous solutions; Preparation of ——. S. Hilpert. Iron and Steel Inst., Sept., 1910. [Advance proof.]

Experiments on the production of magnetic iron oxide (Fe_3O_4) from aqueous solutions have led the author to the opinion that this is only possible through the precipitated ferrous oxide first dissolving in the ammonium salt solution and then combining with ferric oxide, Carulla's conclusions on the same subject (J. Iron and Steel Inst., 1909, 163) being called in question. For, when mixed solutions of ferrous and ferric salts are precipitated with ammonia, the bluish-white ferrous hydroxide and the brown ferric hydroxide, which are unmagnetic, are found to react on standing for a short time, or on boiling, to form one of the magnetic oxides, and the reaction proceeds more rapidly, the larger the excess of ammonium salt present; in fact, if the precipitation be made in a strong solution of ammonium chloride, so that only ferric hydroxide is precipitated, this immediately combines with the ferrous hydroxide present in solution, and with such vigour that the mixture becomes quite hot. Thus it is easy to produce the magnetic combination by adding a mixed ferrous-ferric solution to excess of ammonia or by precipitation of the mixed hydroxides and then heating or allowing to stand, with exclusion of air. So-called compounds to which formulae other than Fe_3O_4 have been ascribed, are considered by the author to be indefinite mixtures. The magnetic property of the oxide, Fe_3O_4, is held to depend upon the acid character of the group, Fe_2O_3, for, although salts in which ferric oxide is the base are unmagnetic, compounds of the oxides of copper, cobalt, calcium, barium, and potassium with ferric oxide have magnetic properties, the compound, CuO,Fe_2O_3, being as strongly magnetic as ferrous ferrate (Fe_3O_4) itself. It is also possible to produce a magnetic oxide, Fe_2O_3, by oxidising ferrous ferrate, when a red powder is obtained having this formula; this compound, which must be ferric ferrate, $(Fe_2O_3)^{+}(2Fe_2O_3)^{-}$, is regarded as the true magnetic iron oxide.—F. Sodn.

Silver nitrate formed by the action of nitric acid on silver sulphide. H. Gruener. J. Amer. Chem. Soc., 1910, **32**, 1030—1032.

The action of nitric acid of varying concentrations on precipitated silver sulphide under different conditions was studied. With very concentrated acid (94 per cent.) the sulphide is completely converted into sulphate. The maximum yield of silver nitrate (about 95 per cent.) is obtained with acid of 15—20 per cent. concentration. The relative yield of nitrate is increased by using cold nitric acid, but the absolute yield is frequently lower than with boiling acid, as the formation of nitrate appears to be hindered by prolonged contact of the reacting substances. Silver sulphide is attacked rapidly by nitric acid of all concentrations above 5 per cent.—A. S.

Strontium sulphate and sodium carbonate; Reaction between ——. W. Herz. Z. anorg. Chem., 1910, **68**, 69—72.

An examination of the reaction between strontium sulphate and sodium carbonate has shown that the final equilibrium reached is not affected by the surface-condition of the sulphate, for the same result was obtained whether freshly precipitated, gently heated, or ignited material was used; moreover, by varying the strength of the sodium carbonate solution, the reaction was proved to be in accordance with the law of mass-action.

—F. Sodn.

Manganifluorides; Preparation of —— and influence of fluorides in the titration of manganese by Volhard's method. E. Müller and P. Koppe. Z. anorg. Chem., 1910, **68**, 160—164.

When potassium permanganate reacts with a manganous salt in the presence of hydrogen fluoride, no manganese dioxide is precipitated, but a brown solution is produced which contains manganic fluoride. On the addition of potassium fluoride to this solution, the red manganifluoride, $2KF,MnF_3,H_2O$, separates. Manganese dioxide itself, although insoluble in hydrogen fluoride, also reacts with a manganous salt in presence of a fluoride to produce manganic fluoride. Further, in consequence of these reactions, only manganic fluoride is produced when a manganous salt is electrolysed in presence of a fluoride, and never permanganate or manganese dioxide. These reactions naturally have an effect in the Volhard titration of manganous salts with permanganate. It is certain that the ordinary results, corresponding to:

$$2KMnO_4 + 3MnSO_4 + 2H_2O = 5MnO_2 + 2H_2SO_4 + K_2SO_4,$$

are not obtained in presence of fluorides. It is not possible to get accurate results from the equation:

$$KMnO_4 + 4MnF_2 + 8HF = 5MnF_3 + 4H_2O + KF,$$

because the brown colour of the solution obscures the end point, and does not allow of deciding in the first place whether the reaction is reversible or complete. It is certain however that it is nearly complete in warm solutions with plenty of hydrogen fluoride, since a solution which should require 3·75 c.c. of permanganate takes about 3·65 (±0·3) c.c. Since ferrous salts will readily reduce manganic fluoride the presence of fluorides does not interfere with the titration of iron by permanganate.

—W. H. P.

Thorium salts; Some new ——. G. Karl. Z. anorg. Chem., 1910, **68**, 57—62.

The following salts have been prepared: *Picrate*, $Th(C_6H_2N_3O_7)_4 10H_2O$. Obtained as an oil by mixing a hot solution of thorium nitrate with ammonium picrate; solidifies, on cooling, to a yellow crystalline mass, melting at 52°—53° C., and explodes when suddenly heated; 100 c.c. of water, at 25° C., dissolve 0·3052 grm.; the anhydrous salt forms a yellow transparent glass. *Hippurate*, $(C_6H_5.CO.CH_2.NH.COO)_4Th$. Precipitated by mixing thorium nitrate solution with the calculated quantity of ammonium hippurate; white crystalline powder, readily soluble in alcohol; 100 c.c. of water, at 25° C., dissolve 0·0318 grm. *Basic monochloracetate*, $(Cl.CH_2.COO)_2Th(OH)_2,H_2O$. Precipitated by mixing the moist basic carbonate with a slight excess of monochloracetic acid; crystallises from hot 95 per cent. alcohol in minute white needles. *Basic dichloracetate*, $(Cl_2.CH.COO)_2Th(OH)_2$. Prepared in an analogous manner; crystallises from hot alcohol in microscopic crystals. *Basic trichloracetate*, $(Cl_3.C.COO)_2Th(OH)_2$. Similarly prepared; crystallises from 95 per cent. alcohol in small lustrous transparent octahedra, containing water of crystallisation, which is partially lost on exposure, the crystals becoming white and opaque. The mono- and tri-chloracetates are slightly soluble in hot alcohol: the dichloracetate is readily soluble. 100 c.c. of water, at 25° C., dissolve 0·0663 grm. of the mono-, 0·0887 grm. of the di-, and 0·0091 grm. of the tri-chloracetate.

—F. Sodn.

Barium nitride and its reaction with nitrogen in the presence of iron. D. Wolk. Bull. Soc. Chim., 1910, **7**, 830—832.

Practically pure barium nitride may be obtained in the following way:—Fifty grms. of barium-amalgam are placed in an iron boat and heated in a porcelain tube in an electric furnace. Pure nitrogen is led through the tube and the temperature is raised gradually so that it reaches 800° C. in 3 hours; the temperature is then raised to and maintained at 1000° C. until nitrogen is no longer absorbed by the amalgam. After cooling, the contents of the boat will be found to consist of barium nitride containing only traces of iron derived from the original amalgam. If the temperature be raised more rapidly, the product will contain more iron, and the amount of iron present in the barium nitride may be still further increased by mixing iron filings with the barium amalgam. The quantity of iron nitride formed, however, depends on the proportion of barium nitride present, and unless the latter be large the iron nitride appears to dissociate.—W. P. S.

Electrolytic chlorine; Utilisation of ——. F. Villani. L'Ind. Chimica, 1910, **10**, 228—231.

The author proposes the utilisation of electrolytic chlorine for the production of sodium chlorate. In the electrolytic manufacture of caustic soda in diaphragm cells, the formation of chlorate is usually suppressed so far as possible, but the author has observed that so long as the chlorate content does not exceed a certain limit, no evil effects on the anodes are to be feared. For instance in an experiment where the anode liquor attained the following composition: sodium chloride, 250; sodium chlorate, 142·2; hypochlorous acid, 5; and sodium sulphate, 17·8 grms. per litre, the gas evolved from the bath had practically the same composition as that from a bath free from chlorate. From a solution of the composition mentioned, the sodium chloride could be separated almost completely by concentration, and then the chlorate could be recovered by crystallising the residual liquor. The sodium chloride could be used again in the electrolytic bath, preferably after freeing it from sulphate by treatment with barium chloride. Instead of recovering the sodium chlorate directly, the solution, which contains chlorate and chloride in about the requisite proportions, could be treated in an absorption tower with sulphur dioxide, yielding sodium sulphate and hydrochloric acid: $NaClO_3 + 5NaCl + 3SO_2 + 3H_2O = 3Na_2SO_4 + 6HCl$. The sodium sulphate solution could then be used for the production of sodium chlorate from potassium chlorate, the latter having been prepared by the action of potassium sulphate on bleaching powder.—A. S.

Ammoniacal mercuric bromide compounds. R. Widman. Z. anorg. Chem., 1910, **68**, 1—25.

An investigation, based on the phase rule, of the compounds formed between mercuric bromide and ammonia (compare Gaudechon, this J., 1909, 814; 1910, 349) proves that, in the solid phase, in equilibrium with solutions containing varying proportions of ammonium bromide, ammonia, and mercuric bromide, the compounds, $HgBr_2.2NH_3$; H_2NHgBr; $NH(HgBr)_2$; $Hg_9N_4Br_6$, and NHg_2Br, and probably these only, may occur. Mercuric oxide and the compound, $HgBr_2.2NH_3$, are regarded as the limiting products, from which the others may be formed under appropriate conditions. The compound, $NH(HgBr)_2$, which is described for the first time, is obtained by treating the substance, H_2NHgBr, with mercuric bromide solution; it is white, and turns black on exposure to light.—F. Sodn.

Cyanogen; Hydrolysis of ——. R. Naumann. Z. Elektrochem., 1910, **16**, 772—777.

Electrical conductivity measurements lead to the conclusion that the primary reaction between cyanogen and aqueous potassium hydroxide proceeds completely according to the equation, $2KOH + C_2N_2 = KCN + KCNO + H_2O$. The subsequent reaction forming oxalic acid, azulmic acid, etc., proceeds much more rapidly as the concentration of the hydroxide is increased, so that for concentrations greater than normal the primary reaction can no longer be quantitatively recognised. The reaction of cyanogen with water is primarily $C_2N_2 + H_2O = HCN + HCNO$. The degree of hydrolysis of a saturated cyanogen solution at 0° C. is about 0·02 per cent., the corresponding value for chlorine being 0·16 per cent. Determination of the dissociation constants leads to the conclusion that cyanic acid ($K \times 10^9 = 120.000$) is many times stronger than hydrocyanic acid ($K \times 10^9 = 1{\cdot}3$). The mobility of the CNO' ion (56·5) at 18° C., calculated from conductivity measurements corresponds very closely with the previously determined mobility of the CNS' ion (56·6).—W. H. P.

Densities of solutions of concentrated superphosphates. De Sornay. *See* XVII.

Precipitation of arsenic acid with ammonium molybdate. Maderna. *See* XXIII.

Detecting arsenic acid in presence of phosphoric acid. Maderna. *See* XXIII.

Nitrate of soda. W. Montgomery and Co.'s Circular. October, 1910. [T.R.]

For some time past the statistical position of nitrate of soda has been steadily improving, not only by reason of smaller shipments to Europe, but by reason of larger deliveries and larger shipments to America. The European deliveries for September amounted to 68,000 tons against 53,000 in September, 1909, whilst shipments to Europe at 104,000 tons compare with 122,000 same month last year. Stocks at ports on September 30th were 208,000 tons, and afloat 267,000, as compared with 254,000 tons and 345,000 tons respectively at same date in 1909. Thus visible supply to-day at 475,000 tons compares with 596,000 tons twelve months ago, or 121,000 tons less.

Patents.

Lime; Apparatus and method of hydrating ——. J. W. Mackenzie, London. From T. Reid, Brooklyn, U.S.A. Eng. Pat. 7079, Mar. 21, 1910.

The apparatus consists of a closed rotatable cylinder or other vessel, into which, after a charge of lime has been introduced, moisture (preferably as water) is slowly admitted, in slight (10—20 per cent.) excess of that required for hydration; the heat is conserved within the vessel by a heat-insulating cover, which keeps the excess of moisture in the form of superheated steam, under high pressure (preferably about 100 lb. per sq. in.), and thereby facilitates thorough hydration and ensures a dry product, the still superheated steam being discharged when hydration is complete. Means are provided for subjecting the lime to a grinding action during the process; for instance, by means of a number of metal balls which pulverise the material. (Reference is directed to Eng. Pats. 12,182 of 1900; 2861 of 1901; 3210 of 1907; and 19,656 of 1908; this J., 1901, 717; 1907, 1279; 1909, 522.)—F. Sodn.

Radium salts or compounds and substances containing large proportions of radium; Manufacturing ——. F. Ulzer and R. Sommer, Vienna. Eng. Pat. 19,820, Aug. 30, 1909.

Material containing radium is first treated with concentrated sulphuric acid, for a longer time (some weeks) at normal temperature or a shorter time (several hours) at boiling temperature, or it is fused with acid sulphates, and the residue, remaining after repeated washing, is boiled, under pressure, with concentrated solutions of caustic alkalis or alkali carbonates, or is melted therewith; the melt is treated with water, and, after further repeated washing, the residue is boiled with dilute sulphuric acid. Or, the same effect may be obtained by treating first with alkaline agents and then with acid agents. In either case, a residue of only about half a per cent. remains, in which nearly all the radium is contained as sulphate, and the process can be carried out in a very short time, and with little difficulty. As an example:—100 kilos. of finely ground pitchblende residue are heated with about 400 kilos. of crude concentrated sulphuric acid for several hours, until the acid begins to fume; when the dark brown colour of the mixture has changed to light brown or grey, the mass is introduced into 10—20 times the quantity of water, boiled, left to stand, and the solution decanted. The residue is washed twice with water, collected on a filter, dried, and the dry mass, weighing 45—50 kilos., is heated with 130—150 kilos. of commercial sodium hydroxide in iron crucibles, until (generally in 1—2 hours) a uniform melt is obtained, and this is boiled several times with water (about 1000 litres each time), after which it is left to stand, decanted, and filtered. The moist residue is boiled with about 5 kilos. of dilute sulphuric acid (20 per cent.), and is then filtered and washed, about 0·5 kilo. of crude sulphates being obtained. Other examples are given. The crude sulphates may be converted quickly and almost completely into chlorides by fusing with alkali carbonates, washing, filtering, and dissolving the residue in pure hydrochloric acid. The crude chloride obtained by evaporating this solution may, for making bathing preparations, be left to stand alone, or with the addition of other known bath admixtures in solid or liquid form, in air-tight vessels, until the highest activity is reached.—F. Sodn.

Ammonium nitrate; Process for the manufacture of pure ——. O. Nydegger and R. Wedekind und Co., m. b. H., Verdingen-on-the-Rhine, Germany. Eng. Pat. 20,907, Sept. 13, 1909.

The double decomposition of ammonium sulphate and commercial calcium (or strontium or barium) nitrate, containing magnesium compounds, is effected in the presence of an excess of the latter salt, preferably 1—10 per cent. above the theoretical quantity; ammonium nitrate, free from magnesium, is thus obtained by concentrating the solution, and the mother liquor, containing the magnesium and excess of calcium salt, is added to fresh solutions of the decomposed salts before evaporation, until it becomes necessary to remove the accumulated magnesium salts; this is done by adding sufficient ammonium sulphate to convert the soluble calcium and magnesium salts into sulphates, and leave an excess, preferably 1—10 per cent. (of the ammonium nitrate present); the alkaline-earth sulphate and magnesium sulphate, or its double salt with ammonium sulphate, are thus in large measure precipitated, and, after adding a fresh excess of alkaline-earth nitrate, the solution is returned to the concentrating vessel.—F. Sodn.

Nitrogen oxides; Process of preparing ——. P. Presser, Berlin. Eng. Pat. 7319, Mar. 23, 1910. Under Int. Conv., June 1, 1909.

A mixture of nitrogen and oxygen is admitted into a cylindrical tube of refractory material, which is heated to a high temperature by means of an electric current. This tube is provided with a number of small apertures, through which the nitrogen oxides formed escape as jets under pressure into a space surrounding the tube, which is kept under diminished pressure, the consequent expansion of the gases causing a fall in temperature of about 500° C. —O. R.

Nitrites and nitrates; Manufacture of ——. Salpetersaüre Industrie-Ges., Ges. m. b. H., and H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 9884, April 22, 1910.

The process consists in causing a current of air containing oxides of nitrogen to meet an opposing stream of alkali (*e.g.*, in a series of towers); some of the resulting nitrite is, however, separated by evaporation of the lye at a given point (after it has traversed some of the towers, for instance) and nitrate is crystallised from the residual liquor (containing approximately equal proportions of nitrate and nitrite) after it has passed through the rest of the system, where nitric acid is mainly absorbed and nitrite is decomposed with the formation of nitrate. —F. Sodn.

Sodium cyanide; Process for preparing ——. Deutsche Gold- und Silber-Scheide Anstalt vorm. Rössler. Ger. Pat. 223,027, Aug. 19, 1909.

Excess of trimethylamine, alone or mixed with ammonia, is passed through molten sodium heated to about 700° C., The sodium cyanide is then separated from the carbon by filtration. The liberation of free carbon in the melt may be prevented by the addition of disodium cyanamide, which combines with the carbon forming cyanide.—T. F. B.

Oxygen; Method of generating ——. A. Beltzer, Bridgeport, Conn. U.S. Pat. 968,528, Aug. 30, 1910.

The method consists in heating to 300° C. a mixture of 2 parts of bleaching powder and 1 part of slaked lime. —A. T. L.

Salt; Process of refining —— and recovering its impurities as by-products. C. Glaser and G. J. Muller, Baltimore, Md., U.S.A. Eng. Pat. 28,609, Dec. 7, 1909.

See U.S. Pats. 957,416 and 957,417 of 1910; this J., 1910, 756.—T. F. B.

Cryolite; Process of making artificial ——. G. Loesekann, Hanover, Germany. U.S. Pat. 969,381, Sept. 6, 1910.

See Ger. Pat. 205,209 of 1907; this J, 1909, 140.—T. F. B.

Sodium cyanide; Process of making ——. O. Liebknecht, Frankfort, Germany, Assignor to Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 969,885, Sept. 13, 1910.

See Ger. Pat. 223,027 of 1909; preceding.—T. F. P.

VIII.—GLASS; CERAMICS.

Antique glass mirror. F. W. Dafert and R. Miklauz. Monatsh. Chem., 1910, 31, 781—784.

The mirror examined was found in the ancient Roman burial ground in Laibach, and is believed to date back to the second or third century A.D. it consisted of a slightly convex glass plate fitted into an indented leaden ring 3·5 to 4 mm. in thickness and 73 mm. in its greatest diameter. Chemical and microscopical examination showed that the mirror had probably been made by attaching lead foil to the thin glass, probably by means of some balsam, which in the course of centuries had become resinified and combined with the lead to form a resinate. A large proportion of the lead of the foil had been converted into red lead (Pb_3O_4), whereas the lead of the frame and on the back had been transformed into basic carbonate.—C. A. M.

Erratum.

This J., Sept. 15, 1910, page 1057, col. 2, line 18 from top (in table), *for* "8·50" *read* "0·50."

Patent.

Kiln for the firing of pottery enamel ware, glassware, enamelling, and the like. J. Dennis, Fenton, Staffs. Eng. Pat. 12,180, Aug. 24, 1909.

Claim is made for a continuous firing and cooling kiln, having a cooling portion made of a larger internal cross-sectional area than the heating portion, and possessing the following features, separately or in combination with each other, viz.: a floor sloping, or sides widening out, or roof ascending, towards the exit; this provides the heated ware with a gradually increasing cross-sectional area of cooling space, as it advances to the exit, thus preventing cracking or dunting, and, in the case of the sloping floor, facilitating also the transit of goods through the kiln. —F. Sodn.

IX.—BUILDING MATERIALS.

Brickmaking; Modern methods of ——. A. B. Searle. Cantor lectures. J. Roy. Soc. of Arts, 58, Nos. 3012, 3013, 3014, and 3015, Aug. 12 to Sept. 2, 1910.

This is the substance of four lectures, the subject being subdivided as follows:—I., Bricks as a building material. II., Dried, baked and burned bricks. III., Characteristics of bricks. IV., Clays and brick earths. V., Preparation of the clay. VI., Weathering. VII., Clay cleaning. VIII., Washing. IX., Pugging. X., Moulding. XI., Drying. XII., Burning. XIII., Wire-cut bricks. XIV., The stiff-plastic, semi-plastic and semi-dry processes. XV., Objections to the plastic process. XVI., Care of the plant. XVII., Machines compared. XVIII., Object of burning. XIX., Kilns. XX., Facing bricks. There are 28 illustrations.

Grog in firebrick manufacture; Application of the ——. G. Rigg. Met. and Chem. Eng., 1910, 8, 523—525.

The author deals at length with the chief properties and uses of the grog, the hard non-plastic basis of firebrick, which is cemented together with plastic bond-clay. It is essential that the grog should, as far as possible, neither shrink nor crack in the manufacture of the firebrick or in subsequent use. If, however, materials which tend to crack, are strongly heated before mixing, the fragments produced by their fracturing, frequently form a thoroughly satisfactory grog, owing to their angular shape. The value of sizing, in order to assist the close packing of the hard particles, is emphasised, as the strength, compactness and retention of shape of the firebrick is mainly dependent on the solidity of the grog.—F. R.

Fuel requirements of the rotary cement kiln. W. S. Landis. Met. and Chem. Eng., 1910, **8**, 520—522.

The theoretical fuel requirements of rotary calciners are discussed, particularly in reference to cement manufacture in the Lehigh district, U.S.A. As the argillaceous limestone used, is artificially dried and then finely ground before being burned, no calculation has to be made for water, the only reaction occurring being the driving off of carbon dioxide, and the chemical union of the silica, lime, and alumina, etc. The theoretical coal requirement for these reactions is 15·7 lb. of the long flame bituminous coal, used in the district, per barrel of cement clinker (380 lb.), but an additional 23·5 lb. of coal is required to provide for the loss of heat by radiation and conduction, and 13·5 for the waste heat in the chimney gases; the discharge of hot clinker from the kiln accounts for a further 10·5 lb., making a total of 63·2 lb. of coal actually used per barrel of clinker produced. It is considered that economies could be effected by reducing the radiation and conduction losses, and in utilising the waste heat for drying the raw material and preheating the air entering the kiln.—F. R.

Portland-cement industry of the United States and Canada. A. C. Davis. Proc. Inst. Civil Eng., 1909—1910, **180**, [ii].

From 1875 onwards a small quantity of Portland cement was produced annually in the United States, but for some years the output was small. The subsequent great increase in production has been realised by improved and cheaper methods of manufacture, chiefly by the introduction of the rotary kiln, and the adoption of ball and tube mills. The sizes and numbers of rotary kilns are given as:—

		In 1907.	Prepared for work in 1908.	
Length	60 ft. and less	362	—	
,,	70 to 78 ft.	43	—	
,,	80 ft.	85	—	
,,	85 to 95 ft.	68	—	
,,	96 to 100 ft.	76	100 ft.	20
,,	104 to 110 ft.	84	110 ft.	22
,,	120 ft.	41	120 ft.	9
,,	125 ft. and over	117	125 ft. and over	36
	Total	876		87

The following table gives an outline of the average results obtained with kilns 60 ft. long, and 6 ft. diameter:—

		On dry materials.		On wet materials, 30—70% water.
		In England.	In U.S.A.	
Output	Barrels per day	160—180	175	80—120
	Tons ,, week	200	208	95—142
Coal consumption	lb. per barrel	120—140	130	150—250
	per cent.	31—37	34·2	39—65

The standard size of kilns now being installed in America is 120 ft. in length and 8 ft. in diameter, and it is said that one 230 ft. by 12 ft. is being erected. The output of long kilns is much greater than that of short ones, and one attendant can look after the same number of kilns, but the fuel economy is not very considerable, the consumption being reduced from 30 per cent. with a 60-ft. kiln to, say, 26 per cent. with a 100-ft. kiln. In the United States the production of cement rose from 626,342 tons in 1898, to 8,651,843 tons in 1908. In 1907, in addition to about 8,200,000 tons produced, 350,000 tons were imported, and 150,000 tons exported. In 1900, the selling price per ton was 27s. and with some fluctuations fell to 16s. 1d. in 1909. The total cost per barrel of cement is estimated thus:—

	per barrel. s. d.
Repairs and renewals	6·62
Oils and greases	·78
Total coal for kilns, power, etc.	9·11
Sundries	1·29
Gypsum, etc.	1·28
Works salaries	·82
All labour	1 - 1·79
Monthly salaries, standing charges, and sales expenses	6·25
Total cost per barrel	3 – 3·94

This is equivalent to a total cost of 19s. 11·58d. per ton. The 23 works in operation in Canada produced 593,038 tons in 1908, the average selling price being 34s. per ton. The import duty is 11s. 8d. per ton. In winter the Canadian works have to shut down for lengthy periods owing to frost. At present there are 112 cement plants built in the United States, at a total cost of £29,193,196, and an annual capacity of 17,000,000 tons. This amounts to 34s. 6d. of capital per ton of capacity. At present there are 114 new plants in various stages of promotion, with a total capitalisation of £32,854,380, and a total capacity of 10,517,388 tons, or 62s. 6d. capital per ton capacity. In the case of 7 of the largest companies in the Lehigh district, only 17s. 9d. per ton of nominal capital is employed, or 23s. per ton of actual output, and in 15 companies in the East and Middle-West States 21s. 9d. per ton. These are considered to be in an absolutely sound technical and financial condition. The combinations of raw materials in both the United States and Canada may be grouped as follows: (1) Argillaceous limestone (cement rock), containing about 75 per cent. of calcium carbonate, and pure limestone. These are employed chiefly in Pennsylvania and New Jersey. (2) Pure hard limestone and clay or shale. (3) Soft chalk limestone and clay. (4) Fresh-water marls, containing about 90 per cent. of calcium carbonate, and clay. This is largely employed in Michigan. (5) Alkali waste and clay. (6) Slag and limestone. The relative importance of four kinds of fuel used for cement kilns in the United States is shown by the following table:—

Fuel used.	No. of plants.	No. of kilns.	Output in 1907.	Percentage of total.
			Barrels	
Powdered coal	79	753	43,151,461	88·5
Oil	8	64	2,229,004	4·5
Natural gas	6	58	3,404,925	7·0
Producer ,,	1	1		
	94	876	48,785,390	100·0

Powdered coal is used in all but one of the Canadian plants. Apart from the superior quality of American coal, it is calculated that there is a saving of 1s. 10·22d. per ton of cement by the American over the English maker. Oil fuel is used by all the cement plants in Arizona, California, Texas, and Washington. As kiln fuel it is estimated that 1 gallon of oil is equivalent to about 10 lb. of coal, and that 11 to 14 gallons are required per barrel of cement, but the kiln output is less than where coal is used. Natural gas is used in all the Kansas plants (and at Portcolborne, Canada). About 20,000 to 30,000 cb. ft. of gas are equivalent to 1 ton of coal, and would produce about 1 ton of cement, including rotary kiln firing and power, and would cost at least 5s. 9·6d. per ton of cement. The quality of cement manufactured in the United States and Canada is considered quite satisfactory. The tensile strengths are good, and the standard of fineness allows allows only a 10 per cent. residue on a 200-mesh sieve. For packing, brown paper bags have been replaced by cotton bags holding 100 lb. of cement, and a rather bigger charge is made for the hire than in England. There is little difference in the total cost of cement made in the United States and Canada, and in the best factories in this country. In the Lehigh Valley district it ranges from 18s. 9d. to 21s. 3d. per ton. The wages are 25 to 30 per cent. higher, but coal is of better quality and cheaper than in England. As a whole the American works are larger and more substantial than in England, but the latter are somewhat ahead of the former in using producer gas in place of steam for power generation. W. C. H.

Patents.

Artificial marble and floor and wall coverings ; Method of making ——. L. Pink. Berlin. Eng. Pat. 18,357. Aug. 9, 1909.

It is claimed that by the addition of oleic and phosphoric acids, or of oleic acid and phosphates, to the ordinary forms of magnesium oxychloride cements, the resulting product ceases to be deliquescent and maintains constant volume and composition.—O. R.

Glazed mortar coating on cement goods ; Production of ——. A. Weithaler, Karlsruhe, Germany. Eng. Pat. 3423. Feb. 11, 1910.

A mixture of cement and water, having about the consistence of oil paint, is sprayed over the objects to be coated, which have previously been well moistened, and are surrounded by damp air. (Reference is directed to Eng. Pats. 23,122 of 1892 and 1279 of 1908.)—O. R.

Mortar ; Process for the manufacture of dry ——. C. A. Kapferer. Ger. Pat. 225,206, March 27, 1909.

Ordinary quicklime is unsuitable for use in the preparation of coloured dry mortars as it affects the colouring matters. According to the present patent, quicklime is slaked and allowed to stand until it is converted into "calcium hydro-carbonate," which is used in the preparation of mortars, being first mixed, if necessary, with puzzuolana or other substance having hydraulic properties.—A. S.

Portland cement clinker ; Process of making ——. H. W. Lake, London. From Pine Street Patents Co., Jersey City, U.S.A. Eng. Pat. 19,459, Aug. 24, 1909.

A rotary kiln is divided into two sections, one above the other, the lower section being furnished with a burner and providing the clinkering space, whilst the current of hot gases issuing from the lower section passes in the reverse direction through the upper section, which constitutes the calcining portion of the kiln. Between the two sections is an appliance for pulverising and mixing. Roughly crushed cement raw materials are calcined in the upper portion of the kiln, pass into the pulveriser, where they are finely ground and intimately mixed, and thence into the lower portion of the kiln, where they are clinkered. It is claimed that by grinding cement materials after instead of before calcination, a considerable economy is effected, both owing to the softer nature of the calcines and to the lesser amount of material, which has to be pulverised. The resulting mixture is also claimed to be more homogeneous than any that can be prepared by grinding and mixing the raw materials before calcination. Reference is directed to Eng. Pat. 27,608 of 1898 (this J., 1899, 1021).—O. R.

Cement and other materials ; Process of burning ——. P. T. Lindhard, Assignor to F. L. Smidth and Co., New York. U.S. Pat. 969,169, Sept. 6, 1910.

A mixture of previously formed gas and air, which is surrounded by a mixture of powdered coal and air, which, in its turn, is surrounded by additional air, is introduced into a kiln or combustion chamber for burning cement, etc., to constitute the fuel of combustion.—F. Sodn.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron ores ; Briquetting of ——. C. De Schwarz. Iron and Steel Inst. Sept., 1910. [Advance proof.]

While the use of improved explosives for mining, and the transit of the ore over long distances, tend to increase the percentage of dust in iron ores, yet the modern blast-furnace more and more requires an ore free from dust, owing to its greater height, the high pressure of the blast, and the use of blast-furnace gas for gas engines. The conditions for successful briquetting are: (1) The briquettes must resist a pressure of 2000 lb. per sq. in., and when dropped from a height of 10 ft. on to an iron plate they must not fall into dust although they may break; (2) Heated to 900° C. they may begin to sinter but must not disintegrate; (3) They should not soften when placed in water; (4) They must resist the influence of steam at 150° C. without crumbling; (5) They must be sufficiently porous to absorb 15 per cent. of water in 25 mins. when placed in water after drying; (6) Binding material should not contain sulphur or arsenic so as to be deleterious to the pig-iron produced; (7) The cost of briquetting should not exceed the difference in price between lump ore and fine ore. *Briquetting without a binding medium :* At Kertsch, in Russia, bean ore is mixed with 8 per cent. of water and then pressed at 5600 lb. per sq. in. At Ilsede, in Germany, clay iron ore is mixed with the waste from the washing plant and rolling mills and pressed into briquettes at 4000 lb. per sq. in. In Sweden, the Gröndal process is producing 300,000 tons of briquettes per year at a cost of 4s. 8d. per ton. In this process the ore containing 27 to 58 per cent. of iron, and from 0·03 to 1·60 per cent. of sulphur, is broken up and then ground in a ball mill; from this powder, by means of magnetic separators, a concentrate of pure magnetic ore is obtained containing 70 per cent. of iron, and from 0·015 to 0·17 of sulphur. The concentrate is made into briquettes with round edges and heated with generator and blast-furnace gases, in a furnace supplied with hot compressed air by a Körner blower, whereby an oxidising flame is produced, which converts the magnetic ore (Fe_3O_4) into ferric oxide (Fe_2O_3) and reduces the percentage of sulphur. The finished briquettes contain from 65 to 69 per cent. of iron and 0·003 to 0·01 of sulphur and are more easily reduced and require less fuel in the blast-furnace than magnetic ore. *Briquetting by means of a binding medium :* Lime and basic slag are not extensively used owing to the diminution of the iron content, and the space and labour required for stacking the briquettes while the lime is being converted into calcium carbonate. Very good but expensive briquettes can be made from spathic ore by mixing with lime and subjecting to steam pressure, calcium carbonate and hydrated ferrous oxide being produced: the latter is gelatinous and becomes oxidised to hydrated ferric oxide. In the Schumacher process, blast-furnace flue dust has its hydraulic properties increased by the addition of magnesium chloride, the cost of briquetting being 1s. 9d. per ton without royalty. Waste sulphite cellulose lyes previously concentrated into a syrup, or cellulose pitch, have been used but are very costly. For use with the ferriferous residues of the aniline manufacture, containing 67 per cent. of iron, molasses has been tried, the cost being about 3s. 9d. per ton of briquettes. The Kertsch and Ilsede methods appear to be the cheapest, the cost amounting to only one shilling per ton of briquettes.—A. H. C.

Electric power in the iron and steel industry ; Utilisation of ——, *with special reference to the economical speed regulation of the motors.* J. J. E. Schuurman. Iron and Steel Inst., Sept., 1910. [Advance proof.]

After pointing out the importance of the centralisation of the power production and the electrical transmission of energy, in securing the most economical utilisation of blast-furnace gases, the author discusses the now solved problem of the speed regulation of alternating current motors (generally adopted), and describes the systems of Scherbius, Krämer, and Déri, discussing their application to the driving of rolling mills, blowers, etc.; he also explains how the inherently low power-factor of iron and steel works installations can be greatly improved, when one or more induction motors of the plant are arranged according to the Scherbius or Krämer systems. The single-phase commutator motor of the Déri type has the advantages of extreme simplicity and ease of regulation, and is very suitable for the drive of live rollers which require constant reversing, for the operation of blast-furnace hoists and travelling cranes, and, either as single or as double commutator motor, for most of the auxiliary drives in steel mills, which require regulation.—F. Sodn.

Electric steel refining. D. F. Campbell. Iron and Steel Inst., Sept., 1910. [Advance proof.]

The author describes the great possibilities of electrical refining in conjunction with the various steel processes. From the economic point of view the increase in the capacity of the Talbot and other open-hearth furnaces, is very important, since the expensive processes of desulphurisation and attaining a teeming heat can be most profitably carried out by transferring a portion of the charge to the electric furnace and making up again with raw material in the main furnace. A great reduction of capital expenditure is possible in works where the products are not sufficiently good to meet modern requirements. It will generally be cheaper to add an electric furnace to a Bessemer plant, than to replace the latter by open hearth furnaces. The author lays down the following features of design as being most desirable. (1) The best basic open-hearth design should be followed, with homogeneous solid bottom, and banks free from imbedded electrodes. (2) To avoid risk and complications all electrical mechanism, generators, transformers, etc., should be entirely separate from the furnace. (3) A high power factor must be maintained. (4) The roof should be protected from direct radiation by means of the electrodes themselves and the intensely heated area of slag should be as large as possible. (5) The heat should be applied to the slag, which must be kept very fluid, and much hotter than the steel. The high fluidity and dead melt obtained indicate the possibility of the extensive replacement of crucible plants by electric furnaces in this country, a change which is already taking place in Germany and America.—W. H. P.

Cast iron; Influence of silicon on pure ——. A. Hague and T. Turner. Iron and Steel Inst., Sept., 1910. [Advance proof.]

The chief object of the research was to examine the effect of varying proportions of silicon on the volume and temperature changes, during the cooling of a pure high-carbon iron alloy. The test pieces were cast in the form of round bars, 12 in. long, with a cross-section area of 1 sq. in., an extensometer being used to determine volume changes. The silicon content ranged from 0·03 to 4·83 per cent. and the total carbon from 2·26 to 2·95. The cooling curves were characterised by three general arrests and the indication of a fourth. The first, H_1, which indicated the commencement of solidification, was liable to inaccuracies due to supercooling, owing to the small amount of metal used, and was not always definitely shown. The second, H_2, indicating the solidification of the eutectic, was very definite, and the third, H_3, corresponding to the pearlitic or recalescence point, was also very definite. Another arrest was indicated slightly at a temperature between 800° and 900° C. In every case the test bars expanded during solidification, *i.e.* from H_1 to H_2, after which a uniform contraction took place until the arrest, H_3, when a temporary retardation occurred, after which the contraction proceeded at a uniform rate to the end. The tests showed that the addition of silicon to cast iron increased the range of stability of α-iron, the temperature of the arrest, H_3, being raised from 700° C. with no silicon to 795° C. with 5 per cent. The eutectic arrest, H_2, showed a very small but regular increase, from 1130° to 1160° C. over the same range, while the temperature of the first arrest, which indicated the commencement of solidification, was lowered. Hardness tests showed the hardening tendency of silicon up to 1 per cent., the limit of the white iron bars, then a sudden drop to 2 per cent., followed by a gradual rise. The paper is illustrated by curves and micro-photographs. —F. R.

Manganese in cast iron and the volume changes during cooling. H. I. Coe Iron and Steel Inst., Sept. 1910. [Advance proof.].

The author has investigated the effect of manganese on the properties of white and grey cast iron. The extensometer employed was similar to that used by Turner (see this J., 1906, 538) except that the cross-section of the pattern was ¾ inch square instead of ½ inch square to give a better record of the temperature changes. An excess of about 5 per cent. of manganese had to be used to produce a certain composition on account of the loss in the slag and by volatilisation. In the case of alloys rich in manganese, brown fumes due to that metal curled up from the surface of the molten metal contrary to the statement of Wraight (see this J., 1909, 603) that manganese is not volatile. In the case of white cast iron the curve of expansion during solidification shows four minima, *viz.*, 0 per cent. of manganese, corresponding to Fe_3C; 5 per cent., corresponding to $8Fe_3C,Mn_3C$; 15·3 per cent., corresponding to $2Fe_3C,Mn_3C$; and 19 per cent. of manganese, corresponding to $3Fe_3C,2Mn_3C$. There was also a depression at 10 per cent. of manganese, corresponding to $4Fe_3C,Mn_3C$. Manganese appears to lower the temperature at which the primary crystals separate out. The existence of a practically pure eutectic is indicated with an alloy of 4·05 per cent. of carbon, 26—28 per cent. of manganese and 68 per cent. of iron, corresponding to Fe_3C,Mn_3C, and a solution of this carbide in iron. With manganese over 30·5 per cent., excess carbide separates out in bands. The temperature of the arrest point Ar_1 is lowered by about 20° C. for each 1 per cent. of manganese but the intensity of the arrest diminishes and probably disappears at 10 per cent. of manganese. The pearlite becomes finer and more sorbitic up to 5 per cent. of manganese and across the solid solution canal-like bands of free carbide are formed. The hardness of the series increases up to 6·3 per cent. of manganese, then decreases with a sudden drop to 12 per cent. and again rises with a temporary decrease at 19 per cent. and remains uniform above 23 per cent. In the case of grey iron the expansion on solidification was very large. With a drop at 1·6 per cent., the expansion reached a maximum at 10 per cent., falling and again rising as the percentage of manganese reached 17·5 per cent. The temperature of solidification appears to rise with the addition of manganese up to 4 per cent. and then falls 50° C. to 1100° C., the freezing point of alloys containing from 7—17·8 per cent. of manganese. The pearlite point disappears with 3½—4 per cent. of manganese. With 5·8 per cent. of manganese free carbide is a constituent of an eutectic which increases until with 17·5 per cent. of manganese it forms the bulk of the section. Above 17·5 per cent. of manganese, free carbide separates out. The shrinkage of the grey irons increases with addition of manganese but is not so great as in the case of white iron. The hardness increases up to 2 per cent. and then falling to 2·65 per cent. rises first rapidly up to 4 per cent. and then uniformly. In the analysis of the specimens, combined carbon was obtained by difference on account of Eggertz' colour test being masked by the presence of manganese. Manganese was separated by the ammonium acetate method.—J. W. H.

Carbon steels; Theory of hardening ——. C. A. Edwards. Iron and Steel Inst., Sept., 1910. [Advance proof.]

The author discusses the available data on the hardening of carbon steels in the light of physico-chemical laws and seeks to combine the valuable points of the "carbonist" and "allotropist" theories. Microphotographs of the structure of steels are given in support of the views advanced. The conclusions arrived at are: (1). There is ample evidence for regarding the β-iron theory as applied to the explanation of the increased hardness of quenched carbon steels as untenable. (2). The physical interpretation of the first critical point, or range, which occurs in steels containing from 0·45 to 0·89 per cent. of carbon, is that it is the change from the γ-solid solution into α-iron. Therefore, strictly speaking, this is not the same point as the Ar_2 of pure iron. (3). The hardening of carbon-steel tools by quenching is due to the retention of the solid solution of carbide of iron in γ-iron. (4). Whilst the power of hardening depends upon the fact that iron exists in the γ state at high temperatures, and will dissolve carbon, it also depends upon the fact that this solid solution decomposes at slow rates of cooling into α-iron and carbide of iron, and that some force must be applied to prevent this inversion from taking place. (5). This force is brought to bear upon the steel by rapidly quenching from high temperatures. It is probably mechanical force exerted by the sudden contraction of the outer shell of the specimen. (6). The mechanical pressure exerted in this way and the pressure of solution are no doubt the principal factors in the hardening of carbide steels by quenching. (7). The suggestion is made that there is no constitutional difference between the so-called austenite and martensite, and that the apparent difference is due to the twinning of the γ solid solution crystals, caused by the mechanical pressure absorbed in suppressing the decomposition of this solution into α-iron and carbide of iron.—R. C. P.

Steel ; Influence of heat treatment on the corrosion, solubility, and solution pressures of ——. C. Chappell and F. Hodson. Brit. Assoc., Sheffield, Sept. 1910.

THE authors determined the influence of the previous heat treatment on the corrodibility in sea water of samples of commercial Bessemer steels containing ascending percentages of carbon. The simple corrosion tests, where the loss of weight was determined after the sample had been immersed by itself in sea water for definite intervals of time, showed that an annealed steel is least liable, and a hardened steel most liable, to corrosion, a general increase of corrodibility for an increasing carbon content being observed. On the other hand, the galvanic corrosion tests, where the steel was immersed in sea water in contact with pure iron, the electromotive force between the two metals being determined, showed exactly opposite results, the corrodibility increasing in the following order: hardened, rolled, normalised, annealed. The same effect was observed in the solubility tests (sulphuric acid 1 and 2 per cent.) and in the measurements of the solution pressures (in 1 per cent. sulphuric acid, sea water, or slightly acidified $N/10$ ferrous sulphate); the annealed and rolled steels showed the highest values and the hardened steels the lowest, the normalised samples occupying as before an intermediate position. It is therefore obvious that, with such directly opposed results, a dilute acid test is of no value as a guide to the corrodibility of steel in sea water.—C. A. W.

Alloys of nickel and copper with electrolytic iron ; Hardness tests on ——. G. A. Roush. Met. and Chem. Eng., 1910, **8**, 522—523.

IN continuation of the research on the effect of the addition of nickel and copper to electrolytic iron (see this J., 1910, 1060), the hardening effects of varying amounts of Monel metal (copper-nickel alloy) on iron, was determined by means of the scleroscope. In forged samples, the maximum hardness did not reach so high a value as would be the case if the effects of the contained nickel and copper were strictly additive, but the maximum hardness was reached at a much lower percentage of Monel metal, than the theoretical for copper and nickel. In the case of annealed alloys, however, the hardness was very much in excess of the calculated effect for the copper and nickel added separately. The maximum available hardness in both forged and annealed high-iron alloys was at 11 per cent. of Monel metal, compared with 16 per cent. of nickel in the absence of copper, showing that in regard to hardness a smaller quantity of the cheaper material was the more efficient. It is interesting to note that at 7·5 per cent. of Monel metal the hardness of both forged and annealed bars was identical.—F. R.

Sulphurous acid as a metallographic etching medium. S. Hilpert and E. Colver-Glauert. Iron and Steel Inst. Sept., 1910. [Advance proof.]

IRON and steel of almost every variety is readily etched by immersion in a 3 to 4 per cent. solution of concentrated aqueous sulphurous acid. The etching is complete in from 7 seconds to 1 minute. It is effected by a purely chemical process, the metal being dissolved with formation of ferric thiosulphate and ferrous sulphite, iron sulphide being deposited on the parts which are attacked. The different constituents of steels are acted upon with varying rapidity and are coated with films of iron sulphide of varying thickness, so that the structure is brought out in the same way as by "heat tinting." The process is not suited for steels composed of ferrite and pearlite, but these can be suitably etched with dilute nitric acid.—A. T. L.

Solubility of gold ; Effect on the —— when ore is crushed between iron surfaces. J. M. Tippett. Met. and Chem. Eng., 1910, **8**, 519—520.

THE author describes a series of comparative laboratory experiments on the chlorination and cyaniding of gold ores, which had been pulverised respectively in a grinding mill, on a bucking board, and in an improvised wooden tube mill with silicious pebbles. The assay results showed a higher gold extraction in the case of the tube mill, which the author considers is probably due to the fact that when the ore is crushed between iron surfacea the particles of gold become coated with a protective film of metallic iron. —F. R.

Silver-copper alloys ; Electrical conductivity and hardness of ——. N. Kurnakow, N. Puschin, and N. Senkowsky. Z. anorg. Chem., 1910, **68**, 123—140.

THE authors have carried out careful determinations of the electrical conductivity and hardness of a whole range of silver-copper alloys, with a view to determining the existence of solid solutions of these metals (*cf* this J., 1907, 51 and 826). Curves are given which show the variation of (1) the conductivity and (2) the temperature-coefficient of the resistance with the percentage composition of the alloy. Two curves are obtained in each case, one for the original wire, and another for the wire after heating to 550° C. for 8 hours. This treatment causes a rise in both the conductivity and the temperature-coefficient. The curves all show discontinuities indicating the existence of solid solutions which are not suggested on the thermal (melting-point) diagram. The limits of concentration are about 4 and 91—92 atoms of silver per cent. The curve of hardness is of the same type and gives the concentrations of 4 and 90·5 atoms of silver per cent. The conductivity and hardness curves give no indication of the eutectic point (60 atoms per cent. of silver) of the melting point diagram. Addition of more than about 6 per cent. by weight (9 atoms per cent.) of copper to silver coinage has no very marked effect on the hardness as the following figures show. The hardness measured by Brinell's method is for pure silver 24·8, with 5 per cent. of copper 46·0, 6 per cent. of copper 49·6 (about), 10 per cent. of copper 50·0, 20 per cent. of copper 51·0 and for pure copper, 40·0.—W. H. P.

Copper ; Behaviour of solid and liquid ——, towards gases. A. Sieverts and W. Krumbhaar. Z. physik. Chem., 1910, **84**, 277—307.

MELTED copper absorbs oxygen, which is converted into cuprous oxide; the dissociation-pressure of this oxide at lower temperatures is so low, that even in an oxygen free atmosphere no oxygen is given off on solidifying and cooling. Neither solid nor liquid copper absorbs nitrogen, carbon dioxide, or carbon monoxide; copper which solidifies in an atmosphere of carbon monoxide does not spit, has a high specific gravity on cooling, and is free from absorbed gas. Copper absorbs hydrogen at 650° C., and the rapidity of diffusion of hydrogen through the metal, and the amount absorbed, increase with rise of temperature. The rate of absorption and the amount absorbed by a given mass of copper are independent of its surface, so that there is no adsorption, but formation of a true solid solution. The amount absorbed increases considerably at the melting-point, and as the temperature of the melted metal rises to 1500° C., the amount absorbed increases more rapidly than for a similar temperature-change below the melting-point. At constant temperature, the amount of hydrogen absorbed by molten copper varies as the square root of the pressure. On solidifying in hydrogen the metal swells and spits, and on cooling retains a portion of the absorbed hydrogen. Solid copper does not absorb sulphur dioxide, but molten copper absorbs it readily, and the amount absorbed is doubled between the melting-point and 1500° C. At constant temperature the amount absorbed is proportional to the square root of the pressure, as in the case of hydrogen. Van't Hoff's explanation that hydrogen is absorbed as a monatomic molecule cannot apply to sulphur dioxide, and another explanation must be sought if the phenomenon is general for all solutions of gases in metals. Copper solidifying in sulphur dioxide spits violently, and when cold has a spongy texture and low specific gravity, and retains a sensible amount of the gas. As the absorption of hydrogen and sulphur dioxide increases with rise of temperature, it must occur with absorption of heat. —J. T. D.

Copper; Effect of silver, bismuth, and aluminium upon the mechanical properties of "tough-pitch"——, containing arsenic. F. Johnson. Inst. of Metals, September, 1910. [Advance proof.]

ELECTROLYTIC copper was melted in a crucible, and the desired quantity of arsenic added in the form of an alloy of arsenic and copper; then the pure metallic silver, bismuth, or arsenic was added, the metal well stirred, and samples poured from time to time till the flat surface of the solidified ingot showed that the metal was at "tough-pitch." An ingot 6½ by 1¼ by 1¼ inches was then cast in an open chill mould, reheated to a bright red heat, and rolled to a rod 4 feet long by ½ inch diameter. From these rods pieces were cut for the mechanical tests (bending, alternating stress, malleability, and tensile stress) and for chemical analysis. The chief results are as follows:—All the "tough-pitch" samples containing arsenic (0·26 to 0·52 per cent.) show improved mechanical properties over the "tough-pitch" pure copper similarly treated. The presence of arsenic lowers the percentage of oxygen needed to bring the copper to "tough-pitch." After hot-rolling, quenching confers greater toughness on the bars than slow cooling. Silver up to 0·175 per cent. in presence of arsenic, does not impair the hot-working properties. It increases tensile strength and raises the elastic limit. It does not seem to influence the "tough-pitch" stage. Bismuth is detrimental even in presence of arsenic, but as much as 0·05 per cent., with 0·3—0·4 per cent. of arsenic, is not ruinous. Hot-working improves the metal containing bismuth, for further mechanical treatment. The effect of bismuth is to raise the tensile strength and extensibility, but to lower the elastic limit and resistance to alternating stress. It causes more oxygen to be required to reach "tough-pitch.' '" Tough-pitch" pure copper with 0·02 per cent. of bismuth is much worse mechanically than "tough-pitch" arsenical copper with 0·05 per cent. Aluminium added to "tough-pitch" arsenical copper so as nearly to deoxidise it (0·014 per cent.) does not affect its hot-working properties, but lowers its tensile strength, whilst increasing its toughness and ductility. Excess of aluminium, however, (0·3 to 0·4 per cent.) is disastrous to the hot-working properties of the metal, and impairs its mechanical properties in the rolled condition. Microscopic examination shows that bismuth separates out from copper containing it, on solidification, in elongated plates or crystals, which separate the crystals of copper from one another. Excess of oxygen appears to cause the bismuth to separate either as metallic globules or as irregular masses of a bismuth oxide, which have not the same effect in weakening the structure as the long streaks of bismuth in copper containing no oxygen.—J. T. D.

Copper matte converting; Recent practice in ——. R. R. Moore. Eng. and Min. J., 1910, **90**, 460—465.

THE author briefly reviews the progress which has been made in copper matte converting during the last 30 years. Within this period the scale of operations has greatly increased, resulting in easier and more regular working, and the use of large blast-furnace settlers, which furnish a storage for matte, dispenses with the trouble and cost of remelting. The use of silicious gold, silver, and copper ores in place of barren quartz, for the converter lining, has made a market for ores that are too poor to pay for direct smelting, and clayey ores and tailing slimes have also been utilised for the necessary binding material of the same. Great improvements have been made in the mechanical appliances for tilting the converters, handling the matte, and also the shells for relining. The author discusses at length, the function of the air blast and the question of the allocation of costs.—F. R.

Copper; Temperature coefficient of resistance of ——. J. H. Dellinger. J. Franklin Inst., 1910, **170**, 213—216.

THE values in common use for the temperature-coefficient of copper vary from $a_0 = 0{\cdot}00398$ to 0·00445, or $a_{20} = 0{\cdot}00369$ to 0·00409; the differences in these values being due either to errors of measurement, or to differences in the temperature-coefficients of different samples of copper; hence accurate results cannot be expected when one of these values is taken as fixed and used for all samples. This investigation has shown that the variations of the temperature-coefficient are, to a fair degree of accuracy, in a simple proportional relation to the conductivity. Samples were investigated from 14 of the most important commercial sources, and the range of conductivity of the samples covered thoroughly the range of the copper furnished to the electrical industry. The effect of bending and winding wires was also investigated, whence it appeared that the temperature-coefficient was practically unchanged. The main results may be expressed in the form of the practical rule: "The 20° C. temperature-coefficient of a sample of copper is given by multiplying the number expressing the per cent. conductivity decimally by 0·00394"; or in another form: "The change of the resistivity per degree C. of a sample of copper is 0·000598 ohm per metre-grm. or 0·00681 micro-ohm per cm. cube." The measurement of temperature-coefficient has considerable advantage over a conductivity measurement in the following cases: (1) odd shapes; (2) short samples; (3) wires that have been distorted or bent; (4) estimation of chemical purity.—R. C. P.

Zinc; Polymorphism and electrical resistance of ——. C. Benedicks. Metallurgie, 1910, **7**, 531—537.

THE author has made a series of careful determinations of the electrical resistance of zinc at different temperatures, and, from the results obtained, deduces the existence of three allotropic forms of the metal. Three samples of the metal were employed, one of these being chemically pure, whilst the two others were of the ordinary commercial kind in rolled sheets. In the case of the first, a thin rod was cut almost in two down the centre, the two portions were insulated from one another by a sheet of mica, and copper wires were secured to the two upper extremities, thermo currents at the contacts being prevented by a wrapping of asbestos thread. The bifurcated rod was then heated in a small electric furnace and the resistance at various temperatures observed by noting the difference of potential between the two ends for a current of known intensity (0·6 ampère), the temperature being determined by means of a Le Chatelier pyrometer. If now a curve were drawn connecting the resistance with the temperature, a definite bend was observable at about 320° to 330° C., identical apparently with that obtained by Le Chatelier at 340°—350° C. A similar transition point, which has hitherto escaped observation, was obtained in the neighbourhood of 160°—175° C. The author therefore concludes that zinc is a polymorphous element and can exist in three different modifications, of which the temperature limits are as follows: α-zinc, up to 170°; β-zinc, from 170° to 330° and γ-zinc from 330° to 419·4° C., the last value being of course the melting point of the metal. In the case of the commercial samples, unexpected results were obtained; at about 220° C. an enormous increase in the resistance commenced, the curve ascending rapidly to a point between 300° and 310° C., where a maximum resistance was shown; after which the temperature-coefficient became negative. Although these abnormal results are evidently attributable to the impurities (lead, iron and arsenic) in the zinc, yet the author considers that they are in close connection with the allotropy of the metal. The observation that zinc increases in malleability up to 150° C. and subsequently becomes brittle again above 205° C., was probably made upon a commercial sample.—C. A. W.

Brass; Heat-treatment of ——. G. D. Bengough and O. F. Hudson. Inst of Metals, Sept. 1910. [Advance proof.]

The authors have studied in detail the effects of various annealing temperatures upon the mechanical properties in the cold of brass (copper 70, zinc 30) bars of commercial quality. They confirm the view that bars annealed between 600° and 700° C. have when cold the best mechanical properties, when both strength and ductility are considered. They determined the true elastic limit for one bar, which, however, had not a very definite yield-point. The duration of annealing is an even more important factor than the temperature. Whilst a bar may be maintained for half an hour at a temperature just below its melting point without becoming seriously "burnt," it will be "burnt" at a temperature 100° C. lower, if kept long enough at that temperature. Small quantities of impurity seriously heighten the tendency to burn. The properties of brass are not influenced by the reducing or oxidising character of the atmosphere of the annealing furnace. The loss of zinc during annealing is appreciable, but is chiefly a surface effect, and is not in itself the cause of "burning." In the case of brass wire, tests of mechanical properties at different temperatures were made. As temperature rises, maximum stress steadily decreases; but elongation and reduction of area fall to a very low value at 300°—400° C., beyond which to 590° C. the ductility again increases. Microscopically, annealing appears to cause the setting in of recrystallisation from a large number of centres, so that the structure is much finer than in the original rolled bar; over-annealing (and probably in a greater degree "burning") causes very rapid and coarse crystalline growth. Lead separates as small rounded particles scattered through the mass, and when the temperature has been too high it seems to segregate between the crystals of brass.—J. T. D.

Magnetic alloys formed from non-magnetic materials. A. D. Ross. Inst. of Metals, Sept. 1910. [Advance proof.] (See this J., 1904, 985; 1905, 850, 1237; 1906, 318; 1909, 246, 1041.)

Magnetic tests have been carried out by the author on the ternary magnetic alloys of copper-manganese with aluminium, tin, antimony, and bismuth, and on the binary alloys copper-manganese, copper-aluminium, manganese-antimony, and manganese-boron, more particularly as regards the effects produced by varying thermal treatment. The magnetic quality of the majority of these bronzes is improved if they are heated for some time at 150°—200° C. In the case of the aluminium and tin ternary alloys, cooling to −190° C. considerably increases the magnetic susceptibility. Quenching the copper-manganese-aluminium alloys renders them less magnetic, but greatly reduces hysteresis. In the case of an alloy containing 62 per cent. of copper, 25 of manganese, and 12·5 of aluminium, the coercive force is reduced to less than 0·3 C.G.S. units upon quenching at 550° C. (that of very soft iron being 1·7), with a permeability nearly equal to that of cobalt. This alloy would be an approximation to the ideal magnetic substance except that it is exceedingly hard and brittle and almost unworkable. Quenching also intensifies the magnetic effect of cooling to −190° C. Similar results are obtained with the antimony ternary alloy, but in the case of the bismuth alloy the effect of quenching is to increase both the susceptibility and the coercive force. As regards the binary alloys, comparisons are made between manganese-antimony and manganese-boron alloys, but no absolute values of permeability are given. The copper-manganese and copper-aluminium alloys are very feebly magnetic. The author does not support the theory that the ternary alloys contain magnetic compounds, Cu_3Al and Mn_3Al, but adheres to the view that the magnetic properties are due to the formation of solid solutions of which the compound, Cu_3Al, is a constituent. No explanation is offered at present as to why solid solutions of manganese or the compound, Mn_3Al, in the compound Cu_3Al, should add so greatly to the magnetic properties. A similar solid solution hypothesis seems applicable in the case of the copper-manganese-tin alloy, the magnetic compounds present being Mn_4Sn and Mn_2Sn.—H. H.

Antimony-lead alloys and aluminium-zinc alloys; Shrinkage of —— during and after solidification. D. Ewen and T. Turner. J. Inst. of Metals, Sept., 1910. [Advance proof.]

Experiments were made with an extensometer, to determine the variations in length of a cast bar during solidification and cooling. Pure lead showed no expansion but the addition of antimony up to the eutectic proportion of 13 per cent., caused an increasing expansion followed by a fall to a minimum at 35 per cent. of antimony, rising to a second maximum at about 50 per cent., and a second fall to 60 per cent., then a slow increase to pure antimony. No relation appeared to exist between the expansion curve and the distance of the solidus from the liquidus in the equilibrium diagram, such as exists in copper-zinc alloys, and it is suggested that this may be due to the entire absence of solid solution, as antimony-lead alloys containing less than the eutectic proportion of 13 per cent. of antimony, consist of lead crystals in a matrix of eutectic, while high antimony alloys consist of antimony crystals in a eutectic base. The variation in the expansion curve is probably due to a change in crystalline habit, as the crystals in the alloys containing 57·1 and 37·2 per cent. are coarsely crystalline and dendritic, while those in the 48·8 per cent. antimony alloy are quite small. Hardness tests were also made, the hardness increasing uniformly from pure lead up to the eutectic (13 per cent. of antimony), next rising rapidly to a maximum at about 80 per cent., then falling sharply to pure antimony. Similar tests were made on aluminium-zinc alloys, in which mutual solid solution occurs. The expansion curve very closely follows the shape of the liquidus, from nearly pure zinc to about 50 per cent. of aluminium, with the exception of the characteristic maximum at the eutectic proportion. With the disappearance of the eutectic, on exceeding 50 per cent. of aluminium, the expansion suddenly falls; the alloys, which now consist of a simple solid solution of zinc in aluminium, of varying degrees of concentration, show a fairly uniform expansion, until with more than 90 per cent. of aluminium, the high expansion of this metal predominates and the curve rises. Hardness tests showed, with the exception of a minimum at 30 per cent., a steady rise up to 50 per cent. of aluminium, which corresponds with an aluminium alloy containing the maximum amount of zinc in solid solution compatible with a homogeneous structure, after which the hardness falls uniformly to pure aluminium. The tensile strength of zinc-aluminium alloys rises rapidly to a maximum of 18 tons at 20 per cent. of aluminium, remaining about the same to 45 per cent., then dropping rapidly to pure aluminium. The paper is illustrated with curves and microphotographs.—F. R.

Alloys; Some common defects occurring in ——. C. H. Desch. Inst. of Metals, Sept., 1910. [Advance proof.]

The author classifies the common diseases of the non-ferrous alloys, which have been very little studied, and briefly discusses the causes and means of detection of these defects, and the conditions under which they occur. The defects referred to are—(1) sponginess, due to the enclosure of gas; (2) brittleness or weakness, due to the presence of (*a*) oxides or other drossy matter, (*b*) intercrystalline metal or eutectic alloy; (3) defects due to inequalities of composition caused by (*a*) imperfect mixing of the ingredients, (*b*) separation by gravity during solidification, (*c*) segregation in the mould; (4) excessively coarse structure, due to casting at too high a temperature; (5) defects due to wrong thermal treatment, viz. (*a*) quenching from a high temperature, (*b*) heating at too high a temperature or for too long a time during annealing, (*c*) "burning" in the case of alloys of copper and zinc, (*d*) unequal thermal treatment of different parts of the same casting or forging; (6) defects due to molecular change other than that produced by mechanical stress; (7) shrinkage cracks; (8) defects due to molecular change produced by mechanical deformation, viz. (*a*) brittleness of cold worked metals. (*b*) chilling-cracks. (*c*) cracking during hot-working; (9) corrosion; (10) erosion.—H. H.

Titanium and metallic sulphides. P. Müller. Metallurgie, 1910, 7, 537—539.

For the purpose, ultimately, of producing the pure metal, the author has attempted to obtain titanium alloys free from sulphur, together with volatile titanium sulphides, by smelting a mixture of carbon, rutile, and nickel matte or iron sulphide in the electric furnace. The furnace employed was of the arc type, its lining being composed of a mixture of retort carbon and tar. In the preliminary experiments, an attempt was made to mix the quantities according to the equations: $TiO_2 + FeS + 2C = TiS + Fe + 2CO$ or $5TiO_2 + 3FeS + 10C = Ti_2S_3 + 3(Fe.Ti) + 10CO$, but finally it was found only possible to obtain an iron-titanium alloy free from sulphur by employing a double quantity of rutile and so large an excess of carbon that the iron and a portion of the titanium could form carbides. Working in this way with a mixture containing rutile, 252; iron sulphide, 108; and retort carbon 106 grms., the heating being effected by a current of 500 ampères and 70 volts for one hour, a carbide melt, having the composition titanium, 59·09; iron, 9·31; silica, 0·17; carbon, 31·48 per cent. and sulphur, nil, was obtained. Similar results were obtained with nickel matte when a large excess of rutile was employed; in no case did the double carbide retain any appreciable amount of sulphur. The high current consumption however is opposed to the economical application of the method, and the chief result of the investigation is to show that titanium, like silicon, acts at high temperatures as a desulphurising agent.—C. A. W.

Settling fine dust at Copper Queen smeltery, U.S.A. G. B. Lee. Eng. and Min. J., 1910, 90, 504—506.

A series of diagrams and tables is given showing the results of large scale experiments on the settling of the flue dust from a copper smelter. It is shown that when the velocity of the flue gases was reduced to 150 ft. per min., a dust chamber 125 ft. long, having only one small baffle at the gas inlet, was adequate for the complete settling of the dust.—F. R.

World's metal production. U.S. Cons. Rept., through "Mining World," (Chicago), Sept. 10, 1910. [T.R.]

From the annual reports of three German joint stock metallurgical companies, the following statistics have been furnished by the U.S. Consul General at Frankfort, on metal production and consumption:—

The world's production of copper in 1909 aggregated 844,100 tons (metric ton=2204·6 lb.), which exceeds by about 100,000 tons that of the year before. The United States had the largest share, 498,200 tons, an increase of about 16 per cent. over the output in 1908. The world consumption of copper in 1909 reached 728,800 tons, exceeding that of the preceding year by 85,100 tons. The giant share in the consumption fell to the United States, and amounted to 318,900 tons (against 208,800 tons in 1908); Germany consumed 179,100 tons; England, 109,100 tons; France, 73,100 tons.

The world's production of lead last year aggregated 1,052,500 tons, divided thus: Europe, 505,800 tons; United States, 339,700 tons; Mexico, 118,000 tons; Australia, 77,200 tons. The United States consumed 365,200 tons of lead; Germany, 213,200 tons; Great Britain, 199,500 tons; France, 110,400 tons; Russia, 38,300 tons.

Of tin, 108,300 tons were produced in 1909, of which 61,500 tons came from the Straits Settlements ports; 35,600 tons from Bolivia; Germany produced (mainly from Bolivian ores) 8990 tons. The consumption of tin was distributed: United States, 42,800 tona; England, 17,500 tona; Germany. 17,100 tons; France, 8750 tons; and Belgium 1300 tons.

The zinc production in 1909 was 783,200 tons, of which the United States contributed 240,446 tons; Germany, 220,100 tons; and Belgium 167,100 tons.

In 1909 the world produced 16,100 tons of nickel, the chief contributors being United States, 9000 tons; Germany, 3100 tons; and England 2800 tons. Of aluminium, 24,200 tons were produced and 30,800 tons consumed throughout the world. The production of mercury amounted to 3200 tons, of which Great Britain took 1445 and Germany 723 tons.

Flue dust utilization at Pittsburg. Eng. and Min. J., Sept. 10, 1910. [T.R.]

The Carnegie Steel Company is erecting, near the Duquesne steel works and blast furnaces, a plant which is expected to briquette about 400 tons of flue-dust daily. The plant will work the Grondal process, which avoids the use of a binder, which has not proved effective, because the binder is dissipated by the heat in the upper part of the blast furnace or is attacked by the reducing gas. Instead of using a binder the process compresses the dust slightly when in a moist state, subsequently passing the briquettes on cars through a kiln, where they are exposed to an increasing temperature in an oxidizing atmosphere.

The Carnegie plant at Duquesne will work upon the current product of flue-dust from the Steel Corporation furnaces in the general Pittsburg district and probably also upon some accumulations. The process to be employed is expected to produce briquettes containing more than 60 per cent. iron. On account of its purity it is expected that at least a part of the product will be used in open-hearth steel practice.

It is stated that 75 Grondal briquetting kilns are in operation, chiefly in England, Spain, Italy, Sweden, Norway, and the United States, producing more than 1,000,000 tons of briquettes annually.

Patents.

Armour plates and other steel articles; Manufacture of ——. Vickers, Sons and Maxim, Ltd., and T. E. Vickers, Sheffield, and J. L. Benthall, Chesterfield. Eng. Pat. 12,055, May 21, 1909.

Chromium- and/or nickel-steel armour plates, with or without vanadium or tantalum, are rolled to the required size at a temperature of about 1900° to 1950° F. The plate is then heated to about 1100° to 1250° F. and cooled in air to remove internal stresses. It is next heated to between 1400° and 1500° F., bent to shape and allowed to cool to about 800° to 900° F.; after which it is reheated to between 1400° and 1560° F. and oil hardened, again reheated to 1150° to 1350° F. and allowed to cool in air. It is subsequently reheated to between 1150° and 1250° F., dipped in hot water or sprinkled with cold water, again heated to between 1050° and 1150° F. and again dipped or sprinkled, by which the fibrous structure required for the back of the plate is produced. The surface is then rapidly heated to between 1800° and 1970° F. and water hardened. For thick plates, 11 to 12 in., the heating and cooling in air, subsequent to the oil hardening, is omitted, and the two following reheatings and coolings reversed in order.—F. R.

Steel; Manufacture of ——. T. J. Heskett, Calcutta Eng. Pat. 16,940, July 20, 1909.

In order to produce a more uniform and purer steel by the Bessemer process, the cupola, in which the iron to be converted is melted, is provided with a well at its base into which the molten metal flows, and from which it continuously overflows into the converter. The well is provided with tuyères for the mixing and purifying of the iron by means of an air blast.—F. R.

Manganese steel; Manufacture of ——. W. S. Potter, New York. U.S. Pats. 968,601 and 968,602, Aug. 30, 1910.

In order to remove the objectionable "freezing structures" obtained in manganese steel during the production of the ingots and the subsequent heat treatment, it is proposed to cleanse and deoxidise the molten metal before casting, by intimately mixing it with silica. A portion of the oxides separate as silicates and are removed by flotation, surface oxidation being subsequently prevented by a protecting layer of acidic or non-basic slag maintained upon the top of the metal. Other portions of the oxides may be reduced by the introduction of a reducing agent into the molten metal. By this means the heat treatment, to which the alloy is afterwards subjected, may be considerably simplified, the metal being merely maintained at the reconstructing temperature until the objectionable "freezing structures" have been removed. Employing, for example, a manganese steel containing about 12 per cent. of manganese and 1 per cent. of carbon, the bath is cleansed and deoxidised in the manner indicated, the metal being cast at a temperature only slightly above its setting point. The ingot is then maintained at the reconstructing temperature until a uniform fine crystalline structure has been obtained, when, finally, the temperature of the outer portions is lowered so as to avoid the production of large and coarse grains. A wrought, tough, thick skin can then be produced over the surface of the ingot by lightly working it externally.—C. A. W.

Electroplating; Apparatus for ——. S. O. Cowper-Coles, London. Eng. Pat. 20,057, Sept. 1, 1909.

The apparatus comprises a drum containing the electrolyte, mounted at one end upon supporting rollers, and at the other end connected to an insulating sleeve mounted in a trunnion supported on a pedestal or bracket. A shaft extends through the sleeve and into the drum, and an anode is suspended from the shaft within the drum, with an insulating screen adjustably mounted on the shaft to prevent deposition of metal upon the inner surface of the drum. The latter and the insulating screen may be rotated by means of a driving belt or by suitable gearing.—B. N.

Furnaces; Electrical induction smelting ——. O. Mulacek and F. Hatlanek, Kladno, Bohemia. Eng. Pat. 672, Jan. 10, 1910. Under Int. Conv., March 1, 1909.

The fireproof part of the furnace, which is in direct contact with the molten metal forming the secondary of the furnace, rests wholly or partially upon a layer of sandy or granular fireproof material. This layer slopes in the direction in which the part of the furnace, which contains the melting channel, expands when heated.—B. N.

Smelting furnaces and the like; Means for heating ——. A. Wirtz, Mülheim-Ruhr, Germany. Eng. Pat. 21,652, Sept. 22, 1909.

Blast-furnace and coke-oven gases are conveyed to a mixer, consisting preferably of a vane wheel within a casing, and the mixed gases led to a gas storage vessel which supplies the smelting furnace.—F. R.

Sulphur dioxide; Method of and means for recovering gases rich in —— *separately from gases poor therein, in roasting and oxidising processes.* F. von Schlippenbach, Stolberg, Germany. Eng. Pat. 28,755, Dec. 8, 1909. Under Int. Conv., May 24, 1909.

The invention consists essentially in providing mechanical roasting furnaces with two gas chambers, one for gases rich in sulphur dioxide and the other poor therein. In the case of pot roasting, each roasting place is independently provided with separate means of communication with the two gas chambers, either of which, but not both, may be in use, according to the richness or otherwise, of the evolved gases. By having the roasting proceeding at different stages at each roasting place, continuous supplies of rich and poor gases flow to the respective gas chambers. In the case of revolving annular hearth furnaces, or the like, the space beneath the hearth is radially divided into compartments each of which is provided with gas outlets communicating respectively with a centrally situated conical vessel and an annular vessel concentrically arranged about the other, for the reception of rich or poor gases, as required, the vessels being suitably sealed to render them gas-tight.—F. R.

Granulation of metals or other substances. W. G. Wagner, London. Eng. Pat. 7315 of 1910; date of application, Aug. 23, 1909.

A circular or cylindrical body, having an irregular edge or surface (or a series of serrated discs), is caused to rapidly rotate partly submerged in a bath of molten metal, so that a continuous stream of particles of the metal is ejected. The particles are cooled by striking against a hard cold surface, by falling in water or merely by their passage through the air.—F. R.

Ores; Process of extracting metals from their ——. W. E. Greenawalt, Denver. U.S. Pats. 968,651 and 968,652, Aug. 30, 1910.

The ore, containing copper and possibly gold and silver, is treated with an acid solution of a chloride, such as the sodium salt, alone or mixed with other chlorides. A cupriferous solution is obtained, a certain amount of silver being dissolved at the same time. The solution is now saturated with sulphur dioxide in order to convert the cupric chloride into the cuprous salt, and afterwards passed into the cathode compartment of an electrolytic cell. The copper and silver having been deposited, the liquid as it issues from the compartment is again saturated with sulphur dioxide, when finally it is passed though the anode compartment, saturated with chlorine and returned to the ore. In the second and subsequent cycles, the gold, together with the remaining copper and silver, is dissolved by means of the regenerated acid solution. The process, in certain cases, is slightly modified, the preliminary saturation with sulphur dioxide before the precipitation of the copper and silver being omitted.—C. A. W.

Ores; Process of extracting metals from their ——. W. E. Greenawalt, Denver, Colo. U.S. Pat. 968,845, Aug. 30, 1910.

The ore containing copper and gold is treated with a mixture of chlorine and sulphur dioxide in the presence of water. The solution obtained is saturated with sulphur dioxide, when the metals are precipitated, any gold being subsequently redissolved and the excess of sulphur dioxide converted into acid by means of a current of chlorine passed through to saturation. The resulting solution, containing an excess of chlorine, may then be employed for a second extraction of the ore.—C. A. W.

Metals; Process and apparatus for the production of ——. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 19,764, Aug. 28, 1909. Under Int. Conv., Oct. 12, 1908.

See Fr. Pat. 406,434 of 1909; this J., 1910, 433.—T. F. B.

[Iron] ores; Treatment of —— *in blast furnaces.* F. A. Kjellin, Stockholm. Eng. Pat. 25,244, Nov. 2, 1909.

See Fr. Pat. 408,674 of 1909; this J., 1910, 637.—T. F. B.

Retorts of zinc and other analogous furnaces; Apparatus for charging the ——. E. Dor-Delattre, Liege, Belgium. U.S. Pat. 969,254, Sept. 6, 1910.

See Eng. Pat. 17,103 of 1909; this J., 1910, 360.—T. F. B.

Metallurgical furnace. S. Z. de Ferranti, Grindleford. U.S. Pat. 969,261, Sept. 6, 1910.

See Eng. Pat. 8255 of 1907; this J., 1908, 631.—T. F. B.

Extracting or eliminating sulphur, phosphorus and other impurities from coal, ore, etc. U.S. Pat. 967,996. *See* IIa.

XI. ELECTRO-CHEMISTRY.

Lead accumulator; Gas evolution and capacity of the ——. F. Streintz. Z. Elektrochem., 1910, 16, 747—754.

A complete investigation of the gas evolution (compared with a copper voltameter) and of the changes in potential at the electrodes in an accumulator leads to the conclusion that hydrogen may actually be occluded by the reduced

negative plate in charging. Oxygen absorption also takes place in the positive plate, but this is due to its penetration to the metal and formation of more peroxide. The discharge data show that the sharp fall in potential may be due to the exhaustion of the negative or of the positive plate. The former is the more usual case in actual practice but the latter may occur either (1) in an initial discharge when the positive plate is not completely formed, or (2) when the charging has been so carried out that the negative plate has been enabled to occlude considerable quantities of hydrogen. In the latter of these cases the capacity of the cell is of course found to be higher than usual.
—W. H. P.

Molybdenum, manganese, chromium and tantalum ; Anodic behaviour of ——. H. Kuessner. Z. Elektrochem., 1910, **16**, 754—772.

In $N/1$ potassium hydroxide at small current densities, molybdenum passes into solution at the anode in the hexavalent form. In the author's experiments two different specimens of metal were used from the same source, and containing the same impurities. In one case the effect of raising the current density to about 50 milliamps. per sq. cm. was to produce passivity and the solution of the metal was partly replaced by the evolution of oxygen. This effect became smaller as the temperature was raised, and near 100° C., even at high current densities, the solution of the molybdenum was almost quantitative. In the second specimen the passivity was not observed appreciably even at ordinary temperatures with 800 milliamps. per sq. cm. With a manganese anode there was always observed along with the solution of the metal simultaneous evolution of oxygen and hydrogen. It is not possible to explain the appearance of these gases by primary electrolysis, and by the action of the manganese on the water respectively. Consideration of the potential values leads to the conclusion that the oxygen is produced by the formation of trivalent manganese ions and their transformation into divalent ions, and the hydrogen by the disappearance of the directly formed monovalent manganese ions. In neutral electrolytes the manganese always appears finally entirely in the divalent form, but in alkaline solution the higher states of oxidation (peroxide and permanganate) are obtained, the amounts increasing with the alkali concentration. In the case of a chromium anode in potassium chloride solution there are apparently no conditions in which the chromium goes into solution in only one state of oxidation. Change of current density is without influence on the state of oxidation, while a rise in temperature favours the transition to the lower states of oxidation. The observations on the electrolysis of alcoholic zinc chloride solution do not confirm Hittorf's observation that chromium anodes dissolve quantitatively to form the chromic salt. In addition to solution of the metal the anodic reactions include in this case oxidation of the alcohol to aldehyde. When tantalum is made the anode of an electrolytic cell, it becomes covered in most electrolytes with an insoluble non-conducting layer of oxide, and a permanent current is possible only in strongly alkaline solutions at high temperatures. Even in the latter case the conductivity is not due to the solution of the primarily formed pentoxide, but to the disintegration and re-formation of the coating. In hydrofluoric acid tantalum goes regularly into solution, the purely chemical solution with evolution of hydrogen being an important contributor to this effect.—W. H. P.

Sparking at the electrodes during the electrolysis of fused salts. A. Kailan. Z. anorg. Chem., 1910, **68**, 141—159.

The anodic disturbances which are observed under certain conditions in the electrolysis of fused lithium chloride and other salts (see Arndt and Willner, this J., 1907, 877) have been further investigated by the author. His experiments do not support the view that the phenomenon is caused by the formation of a subchloride in the melt, or by the appearance of a film of silicic acid (from the containing vessel) on the cathode. The electrolysis resumes its normal course when the temperature is raised, and it is suggested that the cause of this is a change in the viscosity of the melt. This view is supported by the fact that under similar conditions the critical temperature is 100° C. higher for pure lithium chloride, than for a 50 per cent. mixture of lithium and potassium chlorides. The sparking is produced quite readily with a platinum (instead of carbon) anode, while the use of alternating current does not give rise to any disturbance at all. While the sparking persists it is noticed that the apparent resistance of the cell decreases with increasing E.M.F. A mixture of lithium bromide with lithium chloride (1 : 6) does not give rise to the phenomenon at all easily when compared with the pure chloride or with a mixture of lithium and potassium chlorides. This probably accounts for the great convenience of the former mixture for the production of metallic lithium. Oscillographic reproduction of the curve of current strength during the disturbance shows that when the anode is sufficiently deeply immersed, there are no great fluctuations with an E.M.F. of 110 volts. and a resistance of 19 ohms. From these facts the author prefers a purely mechanical explanation of the whole phenomenon.—W. H. P.

Electrolysis ; Investigation of —— *with the ultramicroscope.* J. J. Kossonogow. Z. Chem. Ind. Kolloide, 1910, **7**, 129—132.

The author has studied the electrolysis of solutions with the aid of the ultramicroscope. Before closing the current circuit, luminous points exhibiting Brownian motion could be seen in the solution, and frequently also a progressive movement of the luminous points, but this latter was due to convection and was entirely eliminated by first passing the light rays through a heat-filter. On closing the current circuit, the luminous particles travelled towards the cathode along the current lines ; the direction of the particles was reversed on reversing the direction of the current. There was a considerable increase in the number of the luminous particles after a current had passed for a few seconds. A number of observations are recorded which indicate that there is some close relationship between these luminous particles and the ions or carriers of electricity. For instance (with silver electrodes in silver nitrate solution) the luminous particles gradually deposited at the cathode and formed crystalline growths thereon. The direction of motion of the particles was altered by a magnetic field in accordance with Ampère's law. The velocity of the particles was of the same order of magnitude as found by Kohlrausch for electrolytic ions. On gradually increasing the potential difference between the electrodes (silver, in silver nitrate solution) a point was reached (corresponding to the decomposition potential) at which the number of luminous particles was suddenly enormously increased, and they accumulated in a dense layer at a distance of 0·05—0·08 mm. from and parallel to the surface of the cathode, the intervening strip of 0·05—0·08 mm. being entirely free from the particles and resembling thus the cathode dark space of a Giessler tube. Between the dense cathode layer and the anode the luminous particles, in much smaller number, appeared to be uniformly distributed, and moved, some towards the anode and some towards the cathode. With distilled water instead of silver nitrate solution, a dense layer of luminous particles was also formed, but in this case close up to the anode. Analogous results were obtained with copper electrodes in copper sulphate solution and in distilled water. Experiments with platinum electrodes in distilled water, using potentials higher than the decomposition potential are also described. In these a dense anode layer and a second dense layer distant from the anode by about $\frac{6}{17}$ of the total distance between the two electrodes, were observed.—A. S.

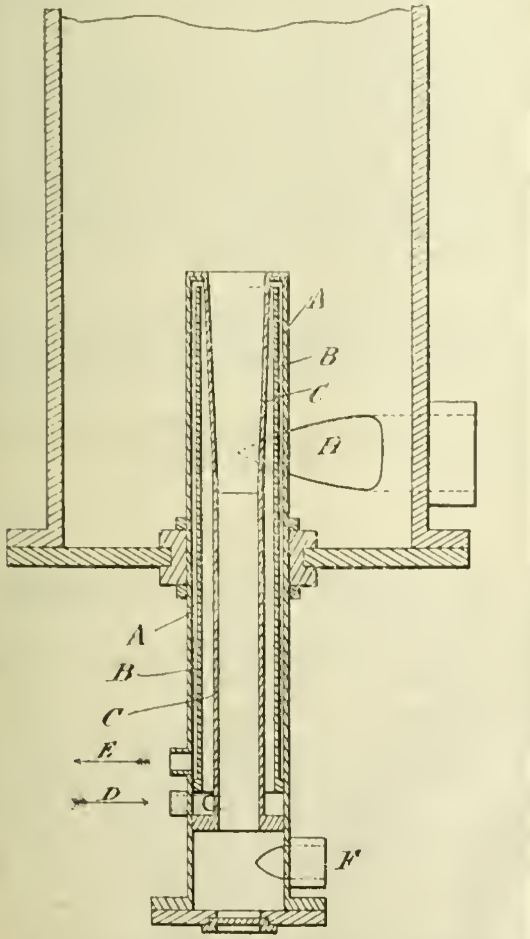
Electrolysis ; Investigation of —— *with the ultramicroscope.* Wo. Ostwald. Z. Chem. Ind. Kolloide, 1910, **7**, 132—155.

The author lays stress on the importance of Kossonogow's observations (see preceding abstract), but dissents from the conclusions drawn therefrom. It appears extremely improbable that electrolytic ions even if combined with the solvent to form solvates (hydrates, etc.) would be visible with the ultramicroscope. The phenomena observed are considered to be due to the electrical colloid-synthesis of metals and metallic hydroxides, together with electrophoretic (cataphoretic and anaphoretic) migration of the colloidal particles. The ease with which metals pass into colloidal solution, even without the use of the electric current, has been shown recently by Traube-Mengarini and Scala (this J., 1909, 857, 1171; 1910, 700), and these authors in their experiments also observed the "cathode dark space" in the case of lead. The great increase in the number of ultramicrons on passing the electric current is probably due to electrolytic disintegration of the electrodes, which, at higher potential differences, is well known. Indeed practically all of the phenomena described by Kossonogow have been previously described in connection with different branches of colloid chemistry, with the exception of the effect of a magnetic field on the motion of the ultramicrons, and even here, it is known that colloidal particles possess magnetic susceptibility. The author further discusses the present theories of the action of the electric current in the formation of colloids, and outlines a new electro-capillary theory, according to which the effects produced are due to the transformation of heat and chemical and electrical energy into surface energy of the second kind, *i.e.*, surface energy of which the outward characteristic is expansive surface tension as opposed to ordinary contractile surface tension, and the transformation of which into other forms of energy is accompanied by an increase of surface.—A. S.

Patents.

Electric arcs; Production of long stable ——. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik. Eng. Pat. 22,715, Oct. 5, 1909.

In the enclosed space between the tubes, A and C, is a third tube, B, so that water entering at D leaves at E. The gas is passed into the furnace through H, with a rotary motion, past the electrode, and may also pass through the electrode, entering at F. If the pressure at the opening, H, is greater than at F, a small portion of the gas will pass down the tube and out at the opening, F, thus causing the arc to move about on the inner surface of the electrode. If, however, the pressure at F be greater than at H, the arc will move about on the outer surface of the electrode. In an alternative form, the gas is not passed through the hollow electrode, which is made of thin heat-conducting material, nor is the electrode water-cooled, and the arc is caused to move about on the surface of the electrode by electro-magnetic means.—B. N.



Furnace; Electric ——. J. E. Hewes, Plattsburg, N.Y. U.S. Pat. 969,622, Sept. 6, 1910.

The body of the furnace is provided with two electrodes, directed towards each other from opposite sides over a travelling trough-shaped hearth made in separable sections and having a bottom and sides only. The sections of the hearth may be moved through the furnace in a straight line. The hearth is fed with material in the direction of its length, and the electrodes are adapted to strike an arc and "maintain a fusing zone in the hearth extending toward the hearth from opposite sides." Hollow water jackets on opposite sides of the furnace act as supports for the electrodes. Two sets of gearing are used for adjusting the water jackets to or from each other; these extend across the hearth and both jackets can be adjusted simultaneously in opposite directions by means of a common power shaft driving both sets of gearing and adapted to be operated from each side of the hearth. Means are provided for insulating the two sets of gearing from each other, and for maintaining a supply of water through the jackets during their adjustment.—B. N.

Insulating materials; Refractory ——. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, New York. Eng. Pat. 23,351, Oct. 12, 1909.

The insulating material is composed of a mixture of hydrated magnesium or aluminium silicate, such as talc or clay, a titanium compound, such as the dioxide, suboxide, carbide, or nitride, and a solution of sodium or potassium silicate as a binder, the mixture being compressed and fired at a temperature of from 900° to 1500° C.—B. N.

Electric arcs; Production of long continuous ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 20,129, Sept. 2, 1909.

See Fr. Pat. 410,710 of 1909; this J., 1910, 829.—T. F. B.

Electrolytic apparatus. W. Thum, Hammond, Ind. U.S. Pat. 969,921, Sept. 13, 1910.

See Eng. Pat. 14,660 of 1909; this J., 1910, 886.—T. F. B.

XII.—FATS; OILS; WAXES.

Wool grease oleines; Hydrocarbons of the ——. A. H. Gill and L. R. Forrest. J. Amer. Chem. Soc., 1910, 32, 1071—1073.

The unsaponifiable matter from distilled wool grease oleines was freed from cholesterol by treatment with acetic anhydride, and then repeatedly fractionated under a high vacuum (1 mm. pressure). The different fractions were purified by crystallisation from acetone, and then determinations of molecular weight and iodine absorption value were made. The results show that the hydrocarbons present in distilled wool grease oleines belong to the olefine series and range from $C_{20}H_{40}$ to $C_{30}H_{60}$.—A. S.

Cholesterol group; Investigations in the ——. VIII. Isocholesterol. A. Moreschi. Atti. R. Accad. dei Lincei, Roma, 1910 [5], **19**, II., 53—57. Chem. Zentr., 1910, 2, 872—873.

Wool grease was extracted repeatedly with boiling alcohol, then saponified, and the unsaponifiable matter was dried and fused for some hours with excess of benzoic anhydride. The product was extracted with boiling alcohol, dissolved in ether, and the ether solution treated with alcohol, which precipitated the benzoates of cholesterol and isocholesterol. The esters were separated by crystallisation from a mixture of benzene and ether. The cholesterol ester melts at 149° C. and has $[\alpha]_D^{15} = -15{\cdot}1°$ in chloroform solution; the isocholesterol ester forms small needles, m. pt. 199° C., and has $[\alpha]_D^{16} = +73{\cdot}33°$ in chloroform solution. Isocholesterol, liberated from the benzoate by means of alcoholic potassium hydroxide, crystallises in fine needles from a mixture of acetone and ether; it melts at 140°—141° C., and has $[\alpha]_D^{17} = +59{\cdot}1°$. Unlike cholesterol, it is not reduced in ethereal solution by hydrogen, even in presence of platinum black. When dissolved in a small quantity of ether and treated with excess of bromine, isocholesterol forms a readily fusible bromo-derivative, which dissolves to a yellow solution in alcoholic potassium hydroxide; the solution becomes green on boiling, but regains its yellow colour on cooling. Isocholesterol appears to belong to the group of hydrosterols. Isocholesteryl formate melts at 108°—110° C., and has $[\alpha]_D^{17} = +46{\cdot}47°$.—A. S.

Patents.

Bleaching oils, fats, waxes, resins, and their solutions by the action of rays of short wave-lengths and oxygen. A. Genthe. Ger. Pat. 223,419, Aug. 24, 1907.

The oil or fat is heated to 70°—90° C., and is then subjected to the action of rays from mercury vapour lamps immersed in it, being at the same time agitated by a stirrer provided with hollow arms, through which air is blown. It is stated that 1000 kilos. of linseed oil can be bleached with an expenditure of 60 kilowatt-hours for current, 30 h.p. hours, and 1500 cb. m. of compressed air, under a pressure of 0·3 atmosphere, the total cost being stated to be M.8.50 (8s. 4d.).—A. S.

Glycerin; Method of treating ——. S. H. Fleming, Camden, N.J., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 969,159, Sept. 6, 1910.

Glycerin is mixed with from one-half to one per cent. of an acetate, such as sodium acetate, and the mixture is subjected to heat.—E. W. L.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Resins, copals and balsams; The iodine and bromine values of ——. W. Vaubel. Chem.-Zeit., 1910, 34, 978.

The author gives a table containing his determinations of the iodine and bromine values of several resins, etc. The materials on which the determinations were made had not been previously heated. It is pointed out that in determining the iodine value by means of Hübl's solution, errors are easily made and the determination of the bromine value is therefore to be preferred. The values obtained differ considerably from those which have previously been recorded.—J. C. C.

Manufacture of turpentine in Japanese Sakhalin (Karafuto). Bd. of Tr. J., Sept. 22, 1910. [T.R.].

The British Acting Vice-Consul at Hakodate reports that, preliminary experiments having proved very successful, the manufacture of turpentine in Karafuto by the Government is shortly to be begun. Machinery for the purpose to the value of £15,300 has been ordered. The sources of supply are almost inexhaustible, and consequently more machinery will doubtless be required later.

The Acting Vice-Consul has forwarded samples of raw turpentine extracted from the tree "Larix dahurica Turcz," known in Karafuto as the "Rakuyōsho," of refined turpentine oil produced at the Government experimental laboratory, and of the rosin left after the extraction of the oil; these samples may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Patents.

Iron compounds [magnetic oxide pigment]; Preparation of ——. J. T. Carrick and B. S. Pattison, Johannesburg, Transvaal. Eng. Pat. 12,106, May 22, 1909.

Ammonium hydroxide or carbonate is added, in large excess, to an acid or neutral ferrous solution, other than that obtained by the digestion of nickeliferous matte, and the mixture is subjected to prolonged oxidation, for instance, by aspirating air through it for 24 hours, preferably in the cold and at normal pressure. A blue-black magnetic oxide or hydroxide of iron is thereby precipitated, the stability of which as a pigment is increased by boiling the ammoniacal solution, before removing the precipitate by means of an electro-magnet or by filtration; the precipitate is washed, and finally dried in the absence of air. In case the original liquor is a solution of iron chloride (*e.g.*, waste pickle liquor obtained in galvanising), the hydrochloric acid is recovered by adding lime, to set free the ammonia, and a slight excess of sulphuric acid, and then evaporating the mixture of calcium sulphate and hydrochloric acid at about 130° C. or under diminished pressure, at a temperature below that at which calcium sulphate is dehydrated, and above that at which hydrochloric acid evaporates, whilst drawing air over it; this removes the hydrochloric acid, leaving a marketable residue of hydrated calcium sulphate, and the acid distils over at substantially the strength required for pickling purposes. An advantage of the process is that the oxidation cannot be carried too far.—F. Sodn.

Basic sulphate of lead; Process for making ——. A. Hileman, Hollidaysburg, Pa., Assignor to Harrison Bros. and Co., Inc., Philadelphia, Pa., U.S. Pat. 969,474, Sept. 6, 1910.

Normal lead sulphate is combined with litharge by agitating the ingredients, in a substantially undissolved condition, in the presence of a hot liquid.—F. Sodn.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber planting in the Belgian Congo. R. Kindt. Bull. de l'Assoc. des Planteurs de Caoutchouc; through Gummi-Zeit., 1910, 24, 1794—1796.

Funtumia elastica is regarded as the only indigenous species suitable for planting. The great value of this species consists in its capacity for thriving and yielding well in regions where considerable periods of dryness are experienced. On the other hand, *Hevea braziliensis* and *Manihot Glaziovii* are much hardier, more productive, and less affected by variations of soil and climate than *Funtumia*. *Hevea* may be planted with advantage in localities where the length of the dry season does not exceed four months. *Manihot* may, however, be planted where the dry season is from four to six months long, and where *Hevea* would not flourish. As regards the yield of rubber in the case of *Manihot*, the following figures are given:

Locality.	No. of trees.	Age.	No. of tappings.	Dry rubber per tree.
Boma	8	11 years	55	340 grms.
,,	1	12 ,,	12	625 ,,
,,	10	12 ,,	43	564 ,,
Nere	10	6½ ,,	5	126 ,,
Kitobola	40	8 ,,	10	198 ,,
,,	190	8 ,,	39	90 ,, (in dry season)
,,	200	8 ,,	25	92 grms. (in rainy season)
,,	1000	8 ,,	7	42 grms. (tapped at 10 day intervals)

Manihot rubber from the Congo was valued at Antwerp at 23 Fr. per kilo. (8s. 3d. per lb.), Pará being 25 Fr. (8s. 11½d.) *M. Glaziovii* should be sheltered from winds, by which it is more readily damaged than *Hevea*.—E. W. L.

Cold vulcanisation. H. E. Potts. Z. Chem. Ind. Kolloide, 1907, 7, 111.

It is pointed out that Bysow's explanation of the adsorption of sulphur chloride by rubber (this J., 1910, 770) is insufficient. Bysow measured the surface tension air-solution: the determining factor in adsorption on Gibbs' theory, is the variation in the tension rubber-solution. This latter is unknown. In an editorial note Wo. Ostwald agrees, but suggests the two tensions may run in parallel series. He notes that Traube's theory of attraction pressures is open to the same objection.

Hot vulcanisation; Theory of ——. B. Bysow. Z. Chem. Ind. Kolloide, 1910, 7, 160—161.

The author has shown previously (this J., 1910, 770) that the absorption of sulphur in cold vulcanisation proceeds in accordance with the exponential adsorption formula. Preliminary experiments on hot vulcanisation showed that under constant conditions of vulcanisation, there is nearly a constant ratio of the amount of sulphur added to the amount left unabsorbed, independent of the former quantity, but in another series of experiments with smaller quantities of sulphur, this ratio increased with decreasing quantities of total sulphur. It was found that equilibrium was not attained until the samples were technically strongly over-vulcanised. Mixtures of rubber with 1, 1·2, 1·4, 1·6, 1·8, and 2 per cent. of sulphur respectively were then vulcanised for 2 hours under a steam pressure of 45 lb., and the free sulphur in the products determined by extraction with acetone. It was found that the results agreed satisfactorily with the exponential formula:—

$$\frac{(\text{total sulphur})^n}{(\text{free sulphur})} = \text{constant, where } n = 3{\cdot}1.$$

—A. S.

Rubber; Action of ultra-violet rays on ——. V. Henri. Caout. et Gutta-percha, 1910, 7, 4371—4376.

The author has studied the action of ultra-violet rays on vulcanised and unvulcanised samples of pure and compounded rubber. The source of radiation was a mercury vapour lamp with quartz tube, this being placed at a distance of about 20 cm. from the samples, which were in the form of sheet 0·5 mm. thick. The samples of rubber examined were fine Para cut-sheet, pale plantation Para cut-sheet, sheet rubber obtained by the evaporation of *Hevea* latex on glass, sheet rubber obtained by evaporating a petroleum spirit solution of rubber on glass, and samples of sheet rubber containing various mineral ingredients. In the case of unvulcanised rubber an exposure of 20 hours is sufficient to produce visible deterioration in the samples; the rubber darkens and becomes shiny, and the surface cracks when the sample is stretched. In the case of dark brown cut-sheet, the action is only superficial, but proceeds deep into the body of the rubber in the case of the paler samples. Vulcanised samples required a much longer period of exposure to bring about deterioration, as much as 48 and 72 hours being necessary. In the case of mineralised samples the action is, generally speaking, much slower than in the case of pure rubber, and deterioration is limited to the surface of the rubber. Certain ingredients, such as litharge, tend to restrict, others, like antimony sulphide, tend to facilitate the change. Rubber recovered from solution in petroleum spirit, is much more rapidly attacked than rubber which has not been in solution. Experiments carried out in the absence of oxygen showed that samples were not deteriorated by the rays under these conditions. The change is therefore one of oxidation promoted by the action of the ultra-violet rays. The most active rays are those of wave length less than 3000 Ångstrom units, which are not screened off by the interposition of a thin sheet of glass. The absorption of rays by a very pale sample of rubber was found to begin at about wave-length 3650, and it is these absorbed rays which bring about oxidation. As the rubber darkens in colour the absorption of the ultra-violet rays increases. The author applies the results obtained to the case of rubbered balloon fabrics which are exposed to the action of the more refrangible rays to a greater extent the greater the altitude they reach. Unvulcanised rubber should not be present in the manufactured fabrics; the cloth employed is, advisably, coloured with an ultra-violet screen, such as lead chromate or an aniline yellow; and a (yellow) colouring matter of some description, which would act as a screen towards the ultra-violet rays, might also be incorporated with the rubber itself.

—E. W. L.

Rubber cultivation in 1909 of the Federated Malay States. Board of Trade J., Sept. 22, 1910. [T.R.]

According to the report of the Director of Agriculture of the Federated Malay States for 1909, the number of rubber estates in the Colony in that year was returned as 377, with an acreage of 500,431 acres. Of this, 196,953 acres have been planted up, divided among the different States as follows:—Perak, 68,278 acres; Selangor, 93,853 acres; Negri Sembilan, 31,945 acres; Pahang, 2,877 acres. The output of rubber in 1909 is recorded as 6,083,493 lbs., as against 3,190,000 lbs. in 1908. The output in Perak increased by 177 per cent., in Selangor by 100 per cent., and in Negri Sembilan by 40 per cent.

Patent.

Production of isoprene. Eng. Pat. 19,701. *See* XX.

XV.—LEATHER; BONE; HORN; GLUE.

Sumachs; Varieties and analyses of Virginia ——. C. R. Delaney. J. Amer. Leather Chem. Assoc., 1910, 5, 404—405.

The author has analysed many samples of sumach from different districts in Virginia, and concludes that it is much cheaper for the American tanner to buy extracts made from domestic leaf (*Rhus Glabra*) rather than those made from foreign and Sicilian leaf. The percentage of tannin contained in domestic leaf extracts is equal to that of the best Sicilian, and the colour is not more than 20 per cent. higher. A table of analyses of samples of *R. Glabra*, *R. Typhina* and *R. Copallina* is given.—A. T. H.

Tanning extracts; Artificially coloured ——. G. Grasser. Collegium, 1910, 379—380.

A tanning extract was found to have been artificially coloured by the addition of an aniline dyestuff. From experiments with a chestnut extract to which a small quantity of auramine was added, the author proposes the following method for the detection of such artificial colouring. To 5 c.c. of the extract, 2 c.c. of dilute caustic soda solution (1 : 10) and 5 c.c. of benzene are added, and after shaking, the mixture is allowed to settle into layers. The benzene solution, which is scarcely coloured, is poured through a dry filter. When the solution has run through the filter, yellow zones on the paper are observed and the filtrate is only slightly yellowish. The colour of the filtrate is completely discharged by shaking with dilute sulphuric acid (1 : 20) which is, itself, rendered slightly yellow. By adding 1 c.c. of strong acetic acid to the benzene solution, and shaking vigorously, a fine yellow coloured acid solution is obtained which leaves a bright yellow stain on evaporation. Picric acid gives the same reactions to a slightly lesser extent, but the caustic soda solution should not be added before the extraction with benzene, as the sodium salt is not soluble in the latter. The method constitutes a conclusive test for the presence of auramine, which is the most likely aniline colouring matter to be used. Several other yellow dyestuffs were tried, but the method did not give satisfactory results in these cases. D. J. L.

Tannin analysis; Report of the chairman of the international commission (Internat. Assoc. Leather Trades Chem.) on ——. H. R. Procter. Collegium, 1910, 341—343, 354—361.

Following the Conference of 1908 a circular was sent to all members of the I.A.L.T.C. suggesting that they should collaborate in confirming, or improving upon the present official method of tannin analysis, and the general lines along which work was necessary were indicated.

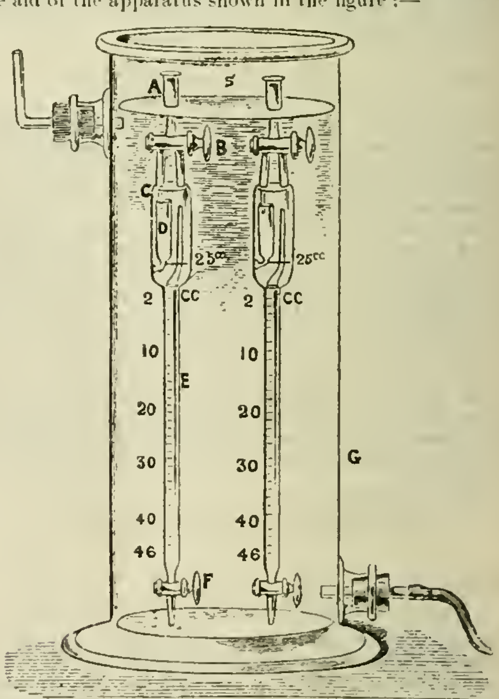
As a result of this circular, work has been returned by H. R. Procter, L. Meunier, and V. Boegh, which indicates that the official methods of washing, chroming and detannising give the best results, and are easiest to work, but that the Zeuthen method of washing (Collegium, 1908, 366) merits closer investigation, although Procter's experiments on washing in a Buchner funnel seem to show that the Zeuthen method can be improved upon. The use of dry chromed hide-powder is risky, and it offers no advantage over the preparation of the fresh reagent. In the extraction of tanning materials, the use of the Soxhlet apparatus gives a larger amount of tannin, and the results obtained by extracting 1 litre only in the Procter apparatus are too low by about 1·25 per cent. as indicated by the extraction of a second litre, but it is doubtful whether any other method would give better results; and the soxhleting, if prolonged, extracts matters which are not tannins, although absorbed by the hide-powder. Reed's asbestos-kaolin method of filtration (this J., 1907, 1247) is satisfactory, and might, with a slight correction, be substituted for the candle where this fails to give optically clear filtrates. Colour testing has been dealt with by Procter (this J., 1910, 663).—A. T. H.

Tannin determination; Tests for a method of —— without using hide-powder. R. Lepetit. Collegium, 1910, 375—379.

The author states that the new "shake method" of tannin analysis has not given results so nearly approaching those furnished by the old "filter-bell method" as, on its adoption as the official method, it was stated to do. A concordance to within 1—1½ per cent. of tannin between the two methods was claimed in the analysis of an extract containing 30—35 per cent. of tannin, while Paessler has found, in the analysis of certain tanning materials, differences of 4, 5, and 6 per cent. by the two methods. The method here proposed is to precipitate the tannin, after filtering the solution through S. and S. 605 hard filter paper, by means of ammoniacal acetate of zinc. The zinc is removed by precipitation with ammonium sulphide and the non-tannin residue estimated in the usual way. The ammoniacal acetate of zinc is prepared by dissolving 20 grms. of zinc acetate in 80 c.c. of warm water and adding 12 c.c. of ammonium acetate, prepared by neutralising glacial acetic acid with strong ammonia solution; 8 c.c. of strong ammonia are then added and a clear liquid is obtained which is not precipitated by a slight excess of ammonia but gives a precipitate on adding a drop to distilled water. To precipitate the tannin, 100 c.c. of the solution, containing 4—5 grms. of tannin per litre, are treated with 6 c.c. of the ammoniacal zinc acetate, 2 c.c. being added at a time, and the mixture shaken after each addition. After leaving for 5 minutes, the solution is filtered through S. and S. 605 hard filter paper, returning the first few c.c. to the filter if not absolutely clear. The zinc is then removed from the detannised liquid by treating 65 c.c. of the filtrate with 4 drops of acetic acid and 1·5 c.c. of colourless ammonium sulphide solution. The precipitate is filtered off and 50 c.c. of the filtrate evaporated to dryness and the residue dried at 102°—105° C. in a vacuum till the weight is constant. When drying is conducted at 105°—110° C. the weight is constant in 10—12 hours, while 20—30 hours are required at 95°—100° C. As the ammoniacal zinc acetate and ammonium sulphide leave a slight residue, a control determination must be made. The percentages of non-tans, as obtained by this method, are higher than those by the filter bell using lightly chromed Freiberg hide powder and so approach more closely those obtained by the official "shake" method. Tables of results of the analysis of various extracts by the method are given.—D. J. L.

Leather and skins; A new method for the determination of nitrogen in ——. U. J. Thuau and P. de Korsak. Collegium, 1910, 364—370.

About 0·25 grm. of leather and 5 c.c. of concentrated sulphuric acid are introduced into a flask and gently boiled. After a time, a few centigrams of manganese dioxide are added, and the mixture is boiled until clear and colourless, with the addition of more manganese dioxide if necessary, to accelerate oxidation of the organic matter. Having thus converted the nitrogen into ammonium sulphate, it may be directly estimated in the following manner, with the aid of the apparatus shown in the figure:—



The tap, F, being open, and the tap, B, turned to communicate with the small vessel, D, the ammonium sulphate solution, and the washings from the flask containing it, are poured into the funnel, A, and washed through with a jet of water. The tap, B, is now turned through 180° into communication with the larger vessel, C, into which is poured 25 c.c. of sodium hypobromite solution, and 10 c.c. of pure sodium hydroxide solution of 36° Bé., which is added to neutralise the excess of sulphuric acid. The measuring tube, E, is now filled to the extremity of the capillary tube with distilled water, through the tap, F, which is then closed, and the apparatus is placed in the cylinder, G, through which a constant stream of water is running. Having reached a constant temperature, which is noted, the volume of water in the measuring tube is readjusted, and the apparatus is inverted and shaken to mix the solutions in C and D. Nitrogen and heat are disengaged, and the apparatus is returned to the water to cool. When cool, F is opened, and when atmospheric pressure is established throughout the system, the volume of nitrogen in the measuring tube is read, taking the usual precautions. The weight of nitrogen disengaged is calculated by the following formula:

$$P = V \times \frac{1}{1+at} \times \frac{H-F}{760} \times 1{\cdot}256,$$

in which, V is the observed volume of gas, *a*, the coefficient of cubical expansion of nitrogen, *t*, the temperature noted, H, the atmospheric pressure, F, the tension of water vapour at temperature *t*, and 1·256 the weight of one litre of nitrogen. It is claimed that the method is rapid, easy to operate, and eliminates the personal factor; and also that the results are more accurate and concordant than those obtained by the Kjeldahl method.—A. T. H.

Viscosity tests of samples of Polish glue. Schmidt. *See* VI.

XVI.—SOILS; FERTILISERS.

Peat; The humic acids of ——. A. Stutzer. Z. angew. Chem., 1910, **23**, 1760—1761.

The author gives an account of the researches of Baumann and Gully (Mitt. Kgl. Bayr. Moorkulturanst., 1910, Heft 4) on the nature of the peaty soils of high moorlands. These authors deny the existence of the free humic acids, hitherto supposed to form the characteristic constituents of such soils. They contend that the apparent acid function of these soils is due to adsorption phenomena exerted by the colloids on the salts. These colloids behave in exactly the same manner as the colloids of the cell-membranes of the living sphagnum moss; they belong to the group of emulsion-colloids. The authors' views are supported by experiments on the electrical conductivity of the peat moss, which is extremely small. The adsorption of bases does not take place in stoïchiometrical proportions, but depends on the relative quantities of the reacting substances and water and on the valency of the base. The bases of divalent elements are adsorbed in higher molecular proportions than those of monovalent elements. Salts are dissociated, the bases being adsorbed and the acids liberated. From dilute equivalent solutions of salts of mono- and divalent bases with the same acid, the acid is liberated by the peat colloids, not in equal proportions, but in the ratio of the osmotic pressures, and the adsorption of the bases follows the same ratio. In applying potash salts to peat soils, the salt should be used in the relatively pure form (40 per cent. salt); if a correspondingly larger quantity of the poorer forms, such as kainite or carnallite, be used, containing the same absolute quantity of potash, the adsorption of the potash is hindered by that of the other bases (magnesia and soda) and the effect is not so good. Lime must be added, not to neutralise the humic acids, but to neutralise the mineral acids set free from the potash salts. An excess of lime is harmful because it is adsorbed by the colloids to the exclusion of the potash. Superphosphates are unsuitable because they are dissociated by the colloids, the lime being adsorbed and the phosphoric acid draining away. Thomas meal is the correct form of phosphate fertiliser, the base being available for the neutralisation of the free mineral acids and the phosphoric acid being utilised as required.—J. F. B.

Nitrogen; Fixation of —— *in soil by free living bacteria.* W. B. Bottomley. Brit. Assoc., Sept., 1910. Chem. News, 1910, **102**, 155; also Proc. Royal Soc., 1910, B. **82**, 627—629.

The discovery that species of Azotobacter and Pseudomonas are always found associated in the algal zone of the root-tubercles of Cycas, and results of inoculation experiments on clover with oats, suggested that a mixed culture of these organisms might be effective in fixing nitrogen in soil. Experiments with pure cultures showed that the two organisms fixed more nitrogen when grown together than when grown separately, this being the case not only with bacteria obtained from the Cycas but also with organisms from ordinary soil and leguminous nodules. Pure cultures grown in a solution consisting of mannitol 0·5 grm.; maltose 0·5 grm.; potassium phosphate 0·1 grm.; magnesium sulphate 0·02 grm. per 100 c.c. of water, at 24° C. for ten days, gave the following averages in mgrms. of nitrogen per 100 c.c.:—Control 0·53, Azotobacter 2·19, Pseudomonas 2·30, Azotobacter + Pseudomonas 4·51. In order to induce the pure cultures to accommodate themselves to soil conditions, ordinary garden soil was treated with lime and sterilised in the autoclave, wetted with the pure cultures and incubated at 24° C. for 21 days. Five grms. of this infected soil were mixed with 100 c.c. of water to which 1 grm. of glucose had been added, and incubated for 24 hours. A series of five earthenware plant dishes were filled with rich garden soil, and incubated for ten days after various treatments described, with results as follow:—1. Limed soil + distilled water yielded 324 mgrms. of nitrogen per grm. of soil. 2. Limed soil + autoclave culture 330 mgrms. Limed soil + living culture 359 mgrms. 4. Unlimed soil + distilled water 327 mgrms. 5. Unlimed soil + living culture 352 mgrms. Thus the mixed culture gave an increase of 35 mgrms. of nitrogen on the limed soil, and an increase of 25 mgrms. of nitrogen on the unlimed soil. To test further the effect of the mixed culture under ordinary conditions, experiments were made with different soils, with the result that in all cases a considerable increase in nitrogen was shown over the control where the bacteria were absent.
—R. C. P.

Calcium cyanamide; its analysis and the changes it undergoes when exposed to the atmosphere. C. Brioux. Ann. Chim. Analyt., 1910, **15**, 341—346.

Calcium cyanamide, when exposed to the air, gradually undergoes decomposition, with formation of calcium hydroxide and carbonate, a certain amount of cyanamide (CN_2H_2), and ammonia. The cyanamide slowly polymerises with the formation of dicyandiamide, $(CN_2H_2)_2$. These changes proceed much more rapidly in a moist atmosphere containing carbon dioxide than in a dry atmosphere; under the former conditions as much as 80 per cent. of the soluble (cyanamide) nitrogen may be converted into dicyandiamide. As dicyandiamide possesses toxic properties and is injurious to plants, the author recommends the following process for determining the relative proportions of cyanamide and dicyandiamide in calcium cyanamide. The method is based on the facts that calcium cyanamide or cyanamide yields a precipitate with ammoniacal silver nitrate solution, the precipitate containing the whole of the cyanamide-nitrogen, whilst dicyandiamide does not give a precipitate with this reagent. Further, silver nitrate in the presence of potassium hydroxide precipitates all three substances. One grm. of the calcium cyanamide under examination is mixed with 250 c.c. of water and shaken occasionally during a period of 3 hours; the solution is then filtered.

Determination of the cyanamide-nitrogen.—100 c.c. of the filtrate are treated with 20 c.c. of a 5 per cent. solution of silver nitrate and an excess of ammonia is added; the precipitate formed is collected on a filter, washed first with water containing a little ammonia, and then with water until all silver nitrate has been removed. The precipitate is now dissolved in dilute nitric acid (usually a small quantity of black residue remains insoluble) and the silver in the solution is titrated with a $N/10$ solution of ammonium thiocyanate; each c.c. of the latter solution used is equivalent to 0·0014 grm. of nitrogen. The reaction between the cyanamide and silver nitrate proceeds according to the equation:—

$$CaCN_2 + 2AgNO_3 = Ag_2CN_2 + Ca(NO_3)_2.$$

Determination of the cyanamide-nitrogen and dicyandiamide-nitrogen together.—A second quantity of 100 c.c. of the filtrate is treated with 20 c.c. of a 5 per cent. solution of silver nitrate and 20 c.c. of a 10 per cent. solution of potassium hydroxide solution are added. The precipitate is collected on a filter, washed with cold water until practically all the alkali has been removed, and the nitrogen then determined in it by Kjeldahl's process. The difference between the amount of nitrogen thus determined and that found in the first determination corresponds with the quantity of dicyandiamide present.—W. P. S.

Patents.

Manures. J. Milne. Inverurie, N.B. Eng. Pat. 5586, March 5, 1910.

A non-hygroscopic manure is prepared by mixing calcium nitrate with ammonium sulphate or potassium sulphate. —W. P. S.

Cyanamide fertilisers; Process of making stable ——. S. Peacock, Chicago, Ill., Assignor to American Cyanamide Co., Baltimore, Md. U.S. Pat. 968,399, Aug. 23, 1910.

A sufficient quantity of water is added to slake the lime present in the fertiliser (calcium cyanamide) after the latter has been mixed with such an amount of sodium nitrate as will prevent rise of temperature due to the slaking process.—W. P. S.

Fertilisers; Production of ——. L. R. Coates, Baltimore, U.S.A. Eng. Pat. 9261, April 16, 1910. Under Int. Conv., April 26, 1909.

See U.S. Pat. 947,795 of 1910; this J., 1910, 442.—T. F. B.

XVII.—SUGARS; STARCHES; GUMS.

[Sulphated] ash; Determination of the —— in raw sugars and other products, using quartz instead of platinum dishes, and quartz instead of fireclay muffles. K. Vorbuchner. Österr.-Ungar. Zeits. Zuckerind. Landw., 1910, 39, 423—432.

With the object of reporting upon the suitability of quartz dishes for the sugar laboratory, the author has made a large number of comparative determinations of the sulphated ash of refined sugars, first and after-product sugars, and molasses. It was found that the figures obtained by the use of the quartz dishes did not differ from those obtained with platinum dishes by more than + 0·04 per cent., and that no difficulty was experienced in carbonising with sulphuric acid in the quartz dishes, although incineration was less readily effected. The disadvantages observed were that the quartz dishes required a considerable time to cool, which necessitated changing from one desiccator to another; that both the accuracy and rapidity of weighing were diminished owing to the greater weight and to the fact that the tare of these dishes decreases with use comparatively rapidly. On account of the action of the alkalis on the silica, quartz dishes are useless for determining the ash of molasses, etc. when no sulphuric acid is used. Muffles made of quartz gave much satisfaction, since not only was red heat reached more rapidly with a quartz than with a fireclay muffle, but after many months' use the former material remained quite intact, whereas the latter generally cracked after a much shorter time.—J. P. O.

Erratum.

This J., Sept. 30, page 1123, col. 1, line 4 from bottom, *for* "9·881" *read* "9·551."

Patents.

Gum tragasol; Manufacture of ——. C. V. Greenwood, H. B. Stocks, and H. G. White, Hooton by Chester. Eng. Pat. 19,768, Aug. 28, 1909.

The process is an improvement on those described in Eng. Pats. 10,822 of 1905, and 569 of 1908 (this J., 1906, 944, and 1909, 153) for the extraction of gum tragasol from locust beans and other seeds. The kernels (*i.e.* the seeds) of the locust beans are subjected alternately to the action of steam and of water at a temperature of 90°—120° F.; the seeds are then decorticated and steeped and digested in steam-heated pans at a temperature of about 200° F. The temperature may then be raised to, and maintained at, 250° F. for 30 minutes, after which the mixture is filtered and cooled.—W. P. S.

Liquid adhesive substances; Manufacture of dry preparations for forming —— with cold water. J. Kantorowicz, Breslau, Germany. Eng. Pat. 3414, Feb. 11, 1910. Under Int. Conv., Mar. 10, 1909.

One hundred kilos. of starch (preferably soluble starch) are mixed with 300 litres of cold water and 3 kilos. of sodium hydroxide solution of 40° B.; the mixture is then dried on heated rollers, and the film thus obtained is ground. The product is soluble in cold water.—W. P. S.

Adhesive powder; Process for the preparation of an ——. F. Beckmann. Ger. Pat. 223,709, Oct. 14, 1908. Addition to Ger. Pat. 219,651, July 5, 1908.

Whilst the proportion of gum tragacanth prescribed in the principal patent (this J., 1910, 582) is sufficient when the gum arabic used is hard, larger quantities are required (up to 10 parts for 50 parts of gum arabic) when softer kinds of gum arabic are employed. Further, a product of greater porosity is obtained if the wheaten flour be replaced by buckwheat flour.—A. S.

Grape-sugar; Process for making ——. G. Ekström, Limhamn, Sweden. U.S. Pat. 970,029, Sept. 13, 1910.

See Fr. Pat. 380,358 of 1907; this J., 1908, 32.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Diastatic reactions and optically transparent liquids. H. van Laer. Brussels Congress of Brewing, July, 1910. Brewers J., 1910, 46, 535.

It has been shown by Spring that under certain conditions water and various solutions are optically transparent while colloidal solutions such as beer and wort are illuminated by a ray of light. The author has devised a means of measuring the relative illumination or "degree of limpidity," by comparing the intensity of the cone of light (from a projecting lens) in the liquid to be tested with that in a mixture of optically transparent water and a 1 per cent. solution of gelatin in various proportions; the degree of limpidity expressing the extent to which the gelatin solution has to be diluted to furnish a cone of the same intensity as that of the liquid being tested. A freshly prepared solution of starch after ultra-filtration through collodion has a limpidity of 60, but coagulates so rapidly that in 24 hours the limpidity is reduced to 12 and in 3 days to 5 by the increase in size of the coagulated particles. Unhopped wort, which contains the degradation products of the insoluble carbohydrates and proteins originally present in the barley, although perfectly bright under the microscope has only a limpidity of 2 degrees. After ultra-filtration, although this has only lowered its density by 2 per cent., the limpidity is found to have risen to 71 degrees. Wort thus contains large ultra-microscopic particles (P) which are retained by a collodion filter. On the other hand, a solution of pure maltose passed through the ultra-filter has a higher degree of optical transparency, its limpidity being 361. Hence what are illuminated in ultra-filtered wort are mainly particles (p) larger than the molecules of maltose, particles of dimensions varying from granules which will just pass through the pores of the filter down to corpuscles of the same magnitude as molecules of maltose. Now, an 8 per cent. solution of maltose is completely fermentable by yeast, whilst a wort of the same concentration never attains an attenuation of 98 per cent., so that, among the particles, p, there are some (p^1) that are too large to pass the cell membrane and come under the influence of

the protoplasmic enzymes, though the pores of the cell wall will admit molecules of maltose and some of the particles p. Invertase can pass out through the cell wall, whilst maltase and zymase cannot; from which it would appear that the former, or the colloidal corpuscles supporting it, is of the same order of magnitude as the smallest particles p, whereas zymase and maltase, or their supports, are larger. A bright Pilsen beer, with a limpidity of 11 is rendered more optically transparent (361) by ultra-filtration owing to the removal of the particles P, so that fermentation has eliminated some of the particles p, which produced illumination in the ultra-filtered wort.
—R. L. S.

Amylases. I. Examination of methods for the determination of diastatic power. H. C. Sherman, E. C. Kendall, and E. D. Clark. J. Amer. Chem. Soc., 1910, **32**, 1073—1086.

The authors' experiments were made with specimens of Taka-diastase and pancreatin. In the case of Taka-diastase results for diastatic power parallel with those given by the Lintner method were obtained by the following "iodine method." 250-grm. portions of a standard starch paste (=2·5 grms. of anhydrous starch) are placed in flasks of 350—400 c.c. capacity immersed in a water-bath kept at 40° C., and the desired amount of the enzyme preparation is then introduced together with 20 c.c. of water. The contents of the flasks are well mixed and digestion is continued at 40° C. until 0·25 c.c. of the mixture yields no coloration with 5 c.c. of a standard dilute iodine solution. Tests are made with varying amounts of the enzyme preparation until that amount is found which completes the conversion in 30 minutes (±1 min.). The diastatic power is represented as the weight of starch (2·5 grms.) divided by the weight of enzyme required to digest it under the prescribed conditions. For three specimens of Taka-diastase the values 66, 51, and 278 were found as compared with 24·5, 17·5, and 95·1 respectively by the Lintner method. The standard starch paste is prepared by suspending a quantity of air-dry potato starch, corresponding to 10 grms. of anhydrous starch, in 100 c.c. of cold water; a quantity of water sufficient to make up the total volume to 1 litre is then heated nearly to boiling under a reflux condenser, the starch suspension is added, and the whole boiled for 2 hours under the reflux condenser. The iodine solution is prepared by dissolving 2 grms. of iodine and 4 grms. of potassium iodide in 250 c.c. of water, and diluting 2 c.c. of the solution to 1 litre. This iodine method and also the Lintner method and the ordinary gravimetric copper method all failed to give concordant results with pancreatin, and a study of the action of pancreatin amylase (see following abstract) showed that it is necessary to add an electrolyte in order that the enzyme may exercise its full activity. The following gravimetric method is stated to be capable of much greater accuracy than the Lintner method. As applied to pancreatin the procedure is as follows. (For other enzymes different quantities of the enzyme preparation and different activating agents may be required). 100 c.c. of 2 per cent. soluble starch solution (see Ford, this J., 1904, 414) warmed to 40° C., are placed in each of four 200 c.c. flasks, into which have been introduced previously quantities of the enzyme solution (0·4—1 mgrm. per 1 c.c.) containing respectively 0·2, 0·5, 0·8, and 1 mgrm. of enzyme. For pancreatin the activating agents added are 300 mgrms. of sodium chloride and 7 c.c. of fiftieth-molar disodium phosphate per 100 c.c. (final volume) of reaction mixture. Digestion is continued for 30 mins. at 40° C., when 50 c.c. of Fehling's solution are added in each case, and the flasks immersed in boiling water for 15 mins., after which the contents are quickly filtered, and the reduced copper determined (the weight of cuprous oxide must not exceed 300 mgrms). The weight of reduced copper is corrected for the reducing power of the soluble starch. After calculating the corrected value in terms of cupric oxide, the corresponding weight of maltose may be ascertained from Defren's table. The weight of cuprous oxide, multiplied by 0·2415, divided by the time in hours and the weight of enzyme preparation in mgrms. gives values roughly comparable with those of Lintner's scale. The study of the action of pancreatin (see following abstract) has shown, however, that the velocity of the amylolytic action does not remain constant until a considerable percentage of the starch is converted, but decreases from the beginning, and hence the weights of cuprous oxide are not directly proportional to the diastatic power. For ascertaining the actual diastatic power, a velocity curve of the amylolytic action is plotted with times as abscissæ and yields of reducing sugar (weights of cuprous oxide) as ordinates, and on this scale, 300 mgrms. of cuprous oxide is taken as 100. For lesser weights of cuprous oxide the corresponding value (K) is obtained by expressing the abscissa corresponding to such weight as percentage of the abscissa for 300 mgrms. of cuprous oxide; the diastatic power is then found by dividing K by the weight of enzyme (in mgrms.) used to effect the conversion. The values of K for the action of pancreatin amylase on 2 per cent. starch solution at 40° C. are as follows:—

Cuprous oxide	K	Cuprous oxide.	K	Cuprous oxide	K	Cuprous oxide	K
mgrms.		mgrms		mgrms.		mgrms.	
30	9·1	100	31·2	170	54·1	240	78·3
40	12·2	110	34·4	180	57·5	250	81·8
50	15·3	120	37·6	190	60·9	260	85·4
60	18·4	130	40·9	200	64·3	270	89·0
70	21·6	140	44·2	210	67·8	280	92·6
80	24·8	150	47·5	220	71·3	290	96·3
90	28·0	160	50·8	230	74·8	300	100·0

The results given by this method with commercial pancreatins are about 200 times higher when the optimum activity is induced by addition of sodium chloride and disodium phosphate than when no electrolyte is added.
—A. S.

Amylases. II. A study of the action of pancreatic amylase. E. C. Kendall and H. C. Sherman. J. Amer. Chem. Soc., 1910, **32**, 1087—1105.

The results of the investigation are summarised as follows:—Pancreatic amylase in the form of high-grade commercial pancreatin is inactive towards soluble starch prepared by the Lintner method and purified by dialysis, but is rendered active by addition of a small quantity of a neutral electrolyte and still more active by addition of both sodium chloride (or potassium or ammonium chloride) and alkali. Until the activity of the enzyme attains a maximum, the optimum concentrations of salt and alkali appear to depend one upon the other, but beyond this point the optimum concentration of alkali appears to depend primarily upon the concentration of the starch. With a given quantity of enzyme, rendered fully active, the initial rate of hydrolysis does not depend upon the amount of starch; the rate diminishes as the reaction progresses, but less rapidly the greater the amount of starch present. With a 1 per cent. solution of starch, even under the most favourable conditions, the hydrolysis tends to come to equilibrium when the weight of maltose reaches about 85 per cent. of the initial weight of starch. Between 20° and 40° C. the action of pancreatic amylase rendered fully active by means of sodium chloride and disodium phosphate shows a temperature-coefficient approximating van't Hoff's rule for normal chemical reactions, being nearly double for a rise of 10° C. The effect of asparagine on the amylolytic activity of pancreatin in solutions of varying alkalinity containing sodium chloride and sodium phosphate can be explained by its influence on the alkalinity of the solution. The experimental data obtained in the investigation have been used for devising a method for determining diastatic power (see preceding abstract).—A. S.

Wine; Physico-chemical determination of the ash of ——. P. Dutoit and M. Duboux. Ann. Chim. Analyt., 1910, **15**, 333—338.

The electrical conductivity method described previously (this J., 1908, 912) for determining the acidity, etc., of wine also enables the quantity of mineral matters to be ascertained with a considerable degree of accuracy. For a given electrical conductivity and alcoholic strength of a sample of wine, the quantity of ash, a, is found from the equation :—

$$a = \frac{(x \cdot 10^5 + \beta)(A + 20)}{3340},$$

where x is the specific conductivity of the wine at 25° C. expressed in reciprocal ohms, A the percentage of alcohol by volume, and β a correcting factor. When $x \cdot 10^5$ lies between 125 and 149, β is equal to 3, and for every increase of 25 units in the value of $x \cdot 10^5$ up to 274, β increases by 3; above 274, β increases by 4 for every 25 units of conductivity so that when the latter lies between 450 and 474, β is equal to 50. The results obtained agree closely with those found gravimetrically, particularly if the residue obtained on charring the wine be extracted with water and the soluble and insoluble portions be ignited separately to a white ash. In the case of wines containing much extract, it is necessary to add a quantity to the amount of ash found by the above process; this quantity varies from 0·05 grm. when the extract lies between 30 and 35 grms. per litre, to 0·30 grm. when the extract is 55 to 60 grms. per litre.—W. P. S.

Wines; Detection of mineral acids in ——. A. Hubert and F. Alba. Monit. Scient., 1910, **24**, 578—595.

The authors discuss and criticise various methods which have been proposed for the detection of added mineral acids in wines; they also show how it is, to some extent, possible to deduce the presence or absence of these acids from the results obtained in the analysis of wines, namely, by comparing the amounts of sulphuric acid in the wine and in the ash, taking into consideration also the other constituents and the alkalinity of the ash.—W. P. S.

Inositol for the characterisation of wine vinegars; Detection of ——. P. Fleury. J. Pharm. Chim., 1910, **2**, 264—266.

As inositol is not decomposed during the acetous fermentation of wine, its detection can be used to determine whether or not a given vinegar has been prepared from wine. 100 c.c. of the vinegar are evaporated nearly to dryness. The residue is taken up with 50 c.c. of water, neutralised with sodium hydroxide and triturated with 3 grms. of barium hydroxide. The liquid is separated, and the precipitate washed with 20—30 c.c. of baryta water. The liquid and washings are freed from barium by means of carbon dioxide or sulphuric acid. The defecation is completed by the addition of 10 c.c. of normal lead acetate solution (1 : 3). The clear liquid is made up to 100 c.c., and 10 c.c. of official basic lead acetate solution and a solution of 2 grms. of neutral cadmium nitrate are then added. The precipitate which contains the inositol is decomposed by hydrogen sulphide, and the filtrate evaporated to a syrup. The residue is taken up with 20 c.c. of absolute alcohol and 5 c.c. of dry ether added. After one or two days standing the precipitate is tested for inositol by the usual methods. True wine vinegars give a decided reaction for inositol, and the absence of this substance indicates a vinegar prepared from dilute alcohol.—F. Shdn.

Butyl and amyl alcohols; Determination of —— *in alcoholic liquids.* A. Lasserre. Ann. Chim. Analyt., 1910, **15**, 338—341.

The method proposed resembles the well-known Allen-Marquardt process for determining the total quantity of higher alcohols in alcoholic liquids; carbon bisulphide is used in place of carbon tetrachloride for extracting the alcohols from their saline solution, the object of this modification being to prevent the simultaneous extraction of propyl alcohol. After oxidation with bichromate, the acid solution is extracted with benzene or toluene in order to separate butyric and valeric acids from any acetic acid present in the acid aqueous solution. The details of the method are as follow:—100 c.c. of the alcoholic solution are shaken for 5 minutes with 70 c.c. of carbon bisulphide, 450 c.c. of saturated sodium chloride solution, and sufficient water to re-dissolve the precipitated salt (50 c.c. of water are usually sufficient). The carbon bisulphide layer is then drawn off, the mixture is again shaken with carbon bisulphide and, after separation, the united carbon bisulphide extracts are shaken three times with moderately concentrated sulphuric acid, using 3 c.c., 1 c.c., and 1 c.c., of the latter successively. The sulphuric acid is drawn off into a 100 c.c. flask, and heated to about 60° C., while a current of air is blown into the flask in order to remove traces of carbon bisulphide. Twenty c.c. of boiling water are added cautiously, the mixture is cooled, 5 grms. of potassium bichromate and 1 c.c. of concentrated sulphuric acid are introduced, the stopper of the flask is at once inserted and firmly secured, and the flask is placed for 1 hour in a water-bath at a temperature of 60° C. At the end of this period, the contents of the flask are cooled, diluted to 100 c.c., and 25 c.c. of the solution are shaken for 3 minutes with 30 c.c. of benzene; the benzene layer is then separated, filtered through a small filter moistened previously with benzene, and the filtrate, after the addition of its own volume of neutral alcohol, is titrated with $N/20$ alcoholic potassium hydroxide solution, using phenolphthalein as indicator. If n be the volume of the latter solution required, the volume required to neutralise the total acids obtained from 100 c.c. of the wine will be :—$n \times 4 \times 2{\cdot}082$, this factor (2·082) representing the ratio between the total quantity of butyric and valeric acids and that quantity which is extracted by a single agitation with benzene, as described above. The result may be calculated in terma of amyl alcohol.—W. P. S.

Patents.

Brewing or distilling; Conversion of starch in ——, *and manufacture of a brewing material.* A. V. Board, Liverpool, and A. R. Ling, London. Eng. Pat. 19,391, Aug. 23, 1909.

While the starches of cereals, barley, wheat, rye, etc., are saccharified by ground malt when mashed with it at temperatures below their gelatinising point, the starches of maize and rice, and the root starches, such as the various kinds of cassava starches, are amongst those which are only partially dissolved and saccharified in similar circumstances. The claim is that such refractory starches are completely converted by malt in presence of yeast, yeast extracts, malt culm, digestion products of protein, or proteolytic enzymes preferably in conjunction with phosphoric or hydrochloric acid, phosphates or other electrolytes. The following mixtures have given good results :—malt grist 70—85 parts, cassava starch 25—10 parts, malt culm 5 parts and ammonium phosphate 0·5 part, or 75 parts of malt grist, 23 parts of refractory starch and 2 parts of pressed yeast. Both the brewing material and the method of preparing it are claimed.
—R. L. S.

Hops; Method of bleaching and fumigating ——. A. Boake, Roberts and Co., Ltd., Stratford, and A. E. Berry, Snaresbrook, Essex. Eng. Pat. 21,685, Sept. 23, 1909.

The hops while on the kiln are submitted to the bleaching action of pure cold sulphur dioxide which is liberated from previously prepared and liquefied gas.—R. L. S.

Beer; Manufacture of ——. H. Holzer, Frankfort-on-Maine, Germany. Eng. Pat. 7829, Mar. 31, 1910. Under Int. Conv., April 2, 1909.

A process for preparing beer characterised in that constituent parts of the Kawa plant (*Piper methysticum*) or extracts thereof are added to the beer for the purpose of preventing lactic fermentation and obtaining a great thirst-quenching, tonic and diuretic effect.—R. L. S.

Spirits; Process for manufacturing purified potable ——. P. A. Brangier, Agnews, Cal. U.S. Pat. 969,332, Sept. 6, 1910.

A mash is prepared and distilled in the usual way and impurities are removed from the distilled spirit. The waste mash or slop is then distilled separately and the flavoured distillate obtained is added to the purified spirit.—W. P. S.

XIXa.—FOODS.

Comparative toxicity of caffeine and theobromine. Veley and Waller. *See* XX.

Patents.

Milk and milk preparations; Desiccation of ——. M. Ekenberg, London. Eng. Pat. 16,375, July 13, 1909.

The milk, or fluid milk preparation, is sprayed into a drying chamber, entering the latter through a tubular extension where it mixes with a heated current of steam and carbon dioxide. The water in the spray is evaporated in the chamber and the dry powder falling to the bottom of the chamber is removed continuously by a conveyor or the like and discharged into a suitable receptacle. The mixture of steam and carbon dioxide is conducted from the chamber and passed through a condenser where it is cooled sufficiently to eliminate the moisture taken up from the spray; the gaseous mixture is then passed through a superheater and again delivered into the drying chamber. In desiccating skim milk the temperature in the drying chamber is kept at about 90° C. and the gaseous mixture may afterwards be cooled to about 85° C. to eliminate the moisture taken up from the spray; in this case the mixture may consist of 1 volume of steam and 1 volume of carbon dioxide. For use in desiccating whole milk and cream, the gaseous mixture should consist of 1 volume of steam and 5 or 6 volumes of carbon dioxide, and the temperature in the drying chamber should be maintained at about 61° C.—W. P. S.

Milk food [ferruginous] preparations; Manufacture of ——. F. Stohr, Vienna. Eng. Pat. 28,371, Dec. 4, 1909.

See Fr. Pat. 409,949 of 1909; this J., 1910, 837.—W. P. S.

XIXb.—WATER PURIFICATION; SANITATION.

Industrial diseases. Congress at Brussels. Times, Sept. 29th, 1910. [T.R.]

An International Congress, dealing with the subject of industrial diseases, was recently held in Brussels. The first Congress took place in June, 1906, in Milan, and since then a step has been taken by the establishment in Milan of an institution—the first of its kind—devoted to the study of diseases of occupation and industrial hygiene. The director of this institution is Dr. L. Devoto, who delivered a lecture describing the equipment and work carried out under his direction. Over 600 delegates from different countries were present at this Congress. A volume containing all the contributions to this discussion is to be issued. Roughly 20 per cent. of these papers were contributed by medical men and others in Great Britain. This is partly the result of the efforts made in this country by Dr. T. M. Legge, of the Factory Department of the Home Office, and Dr. F. W. Dearden, secretary of the Association of Certifying Factory Surgeons, in making the objects of the Congress known.

The matters dealt with were grouped under six main headings, as follows:—

(1) Is it possible to draw a distinction between maladies which are the result of certain occupations and accidents?

(2) What is the nature of the medical equipment and supervision in mines, workshops, factories, &c.?

(3) The present state of the campaign against ankylostomiasis.

(4) The eye and vision in their relation to industrial diseases.

(5) Work under compressed air.

(6) Poisoning caused by industrial processes.

The first of these questions, which, in view of its connexion with the Workmen's Compensation Act, is of significance just now, gave rise to a discussion on the difficulty in many cases of ascertaining if a disease is the direct result of the nature of employment. Dr. T. M. Legge gave a *résumé* of the procedure (very different from that in the case of an accident) under section 8, the industrial diseases section, of the Act of 1906. Dr. R. J. Collie urged that the law might be improved by giving facility to either party to have a medical assessor summoned to sit with the Judge; also that the County Court Judge should refer the matter to a medical referee on application being made by only one party instead of both parties as is now required. The justness of the principle of compensation for so-called industrial diseases was accepted, and the method of procedure by the aid of a schedule of diseases as adopted in the English law was regarded as the best example to follow. Dr. L. Teleky (Vienna) explained the Austrian system of differentiation and expressed his approval of the method adopted by the Home Office. Others had modifications of the British system to suggest; but the general opinion was that certain severe and clearly traceable diseases ought to be at once recognized. The sixth question before the Congress dealt with industrial poisoning. A number of instances of special causes of poisoning, through aniline, benzol, &c., were given, and several papers on lead poisoning were presented. All the speakers expressed their sense of the need for further investigations on industrial poisoning, and it was recommended that the introduction of any novel substance into industrial operation should be watched in order that any possible danger might be detected at an early stage. The next Congress is to take place in Vienna in 1914.

Patents.

Sewage; Apparatus for the purification of ——. M. J. Adams, Scotswood-on-Tyne. Eng. Pat. 13,488, June 9, 1909.

Sewage passes down an inclined conveying pipe into a cylindrical receiving tank, in which the heavy matter collects, the excess of liquid passing through a screen, near the top and at the side of the receiver, into a closed cylindrical vessel. The latter contains a tipping tray, which discharges the contents through a distributing pipe, fitted with a number of holes, on to a filter bed or into a system of land filtration pipes. Openings are provided at the end of the filter pipes for cleaning and inspection. —O. R.

Sewage; Bacteriological treatment of ——. K. E. Edgeworth, Cairo, Egypt. Eng. Pat. 21,855, Sept. 24, 1909.

The sewage is passed through a tank provided with two outlets at different levels; the upper serves for the separation of the floating solids which are conveyed to a disintegrator, in which they are reduced to a fine state of division. These solids are then re-mixed with the liquid portion of the sewage flowing from the lower outlet of the tank. The whole mixture is finally treated on contact beds or filters in the usual way. Gratings or screens of suitable mesh may be employed in place of the tank mentioned; when the tank is employed, means may be provided for the removal of heavy solids from the same. —W. P. S.

Bacteria filtering beds, for the prevention of subsequent putrefaction. J. Brightmore, Tideswell, Derbyshire. Eng. Pat. 24,741, Oct. 28, 1909.

The filter bed is constructed of a mixture of equal parts of hard basalt and calcspar, these minerals being broken up into cubes of about 2 inches. The filter bed may vary in depth from 4 to 6 feet, and is covered with a layer of calcspar from 6 to 12 inches in depth.—W. P. S.

Liquids; Apparatus for sterilising and oxidising —— *with ozone.* A. H. Twombly, Summit, N.J., Assignor to Gerard Ozone Process Co. U.S. Pat. 969,736, Sept. 6, 1910.

The apparatus consists of a tower divided into a number of sections by means of horizontal perforated diaphragms; the liquid and the ozone are passed through a number of injectors disposed above the tower and the mixture of liquid and gas falls down a pipe and enters the lower part of the tower; the injectors are operated by the fall of liquid, the action being similar to that of an ordinary water-pump. There is a "spreader" at the bottom of the tower and a drainage valve is fitted on the supply pipe. Means are provided for stopping the flow of liquid should the supply of ozone fail.—W. P. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Caffeine and theobromine; Comparative toxicity of ——, as measured by their direct effect on the contractility of isolated muscle. V. H. Veley and A. D. Waller. Proc. Roy. Soc., 1910, **B. 82**, 568—574.

The substances investigated were theobromine, caffeine, caffeotannic acid, an artificial mixture of caffeine and tannic acid, extracts of tea, coffee, and caffeine-free coffee. The results obtained were similar in type in all the cases. The toxic effect of theobromine is to that of caffeine as 1·7 : 1 for equimolecular quantities, or 1·8 : 1 for equal weights, so that the introduction of a methyl group into theobromine to form caffeine lowers the toxic action. Caffeotannic acid and the artificial mixture of caffeine and tannic acid both had a much smaller toxic action than caffeine. No very marked difference was found between tea and coffee extracts; this would be expected if the toxicity of both were due mainly to the caffeine present. Caffeine-free coffee showed much less toxic effect than ordinary coffee, thus affording a further argument for this view.—R. V. S.

Conicine, sparteine, and atropine; Silicotungstates of ——. M. Javillier. Bull. Sci. Pharmacol., 1910, **17**, 315—320. Chem. Zentr., 1910, **2**, 885.

In neutral or very faintly acid (0·05 per cent. of hydrochloric or sulphuric acid) solution, 1 part of conicine in 5000 can be precipitated by a 10 per cent. solution of silicotungstic acid or its potassium salt. Conicine silicotungstate dried at about 30° C. is a white amorphous substance of the composition,

$$SiO_2,12WO_3,2H_2O,4C_8H_{17}N+3H_2O,$$

which is appreciably soluble in boiling water; it loses 3 mols. of water at 120° C. In a neutral solution of sparteine sulphate, silicotungstic acid produces a precipitate at a dilution of 1 : 50,000, and a turbidity at a dilution of 1 : 500,000 in a solution containing 1 per cent. of hydrochloric acid. Sparteine silicotungstate is a white amorphous substance which when dried at 30° C. has the composition, $SiO_2,12WO_3.2H_2O.2C_{15}H_{26}N_2+7H_2O$; it loses 6 mols. of water at 120° C. Precipitation with silicotungstic acid may be used for the quantitative determination of sparteine. For the precipitation of atropine silicotungstate, also, it is best to use solutions containing 1 per cent. of free acid; in neutral solutions the sensitiveness of the reaction is limited to 1 : 40,000. The precipitates produced in solutions containing free acid usually contain somewhat more silicotungstic acid than corresponds with the formula of the atropine silicotungstate. By precipitating in a solution containing somewhat less acid than that required to ensure the complete precipitation of the alkaloid, a white amorphous substance is obtained, which when dried at 30° C. has the composition,

$$SiO_2.12WO_3.2H_2O,4C_{17}H_{23}O_3N+4H_2O;$$

it loses 4 mols. of water at 120° C.—A. S.

Narcotics and local anæsthetics. O. Gros. Arch. exp. Pathol. u. Pharmak., 1910, **63**, 80—106. Chem. Zentr., 1910, **2**, 904.

The theory of narcosis of H. Meyer and Overton is applicable also to local anæsthetics. The bases of local anæsthetics show a large distribution-coefficient oil: water. They act more powerfully than their salts. The anæsthetic power of a salt of an active base depends upon the anæsthetic power of the base and upon the degree of hydrolytic dissociation, being greater, the weaker the acid with which the base is combined. For instance the anæsthetic power of novocaine bicarbonate in aqueous solution is about five times greater than that of novocaine chloride. Cocaine, novocaine, eucaine, alypine, and stovaine all have about the same anæsthetic power as free bases, and the differences observed with their chlorides are due to the varying degrees of hydrolysis of these salts. The injurious effect of local anæsthetics on the tissues is due to a certain affinity they possess for proteins. Of the bases examined, eucaine and stovaine have the strongest, and novocaine the weakest affinity for proteins.—A. S.

Leaves; Action of alcohol vapours under low pressure on —— with respect to the activity of some enzymes. L. Aurousseau. Bull. Sci. Pharmacol., 1910, **17**, 320—327. Chem. Zentr., 1910, **2**, 905.

The author examined the process proposed by Perrot and Goris for sterilisation by means of alcohol vapour under pressure. In the case of fresh leaves containing enzymes, treatment with alcohol vapour under a pressure of ¼ atmosphere for 2 minutes is necessary, the temperature rising to 82° C. Invertase, rennet-enzyme, myrosin, oxydases, emulsin, and tyrosinase are destroyed by this treatment, but in order to destroy peroxydases a pressure of ½ atmosphere is sometimes required. Leaves freed from enzymes in this way dry rapidly and yield galenical preparations of unlimited stability.—A. S.

Hydrocyanic acid in plants; Occurrence of free ——. C. Ravenna and M. Tonegutti. Atti R. Accad. dei Lincei, Roma, 1910, [5], **19**, II., 19—25. Chem. Zentr., 1910, **2**, 892—893.

For the detection of free hydrocyanic acid the usual course is to pour boiling water on the material, and distil with steam, the distillate being collected over "milk of magnesia," and the Prussian blue reaction applied; for quantitative purposes titration with silver nitrate solution is employed. The authors have found in experiments with cherry-laurel leaves that the results differ according to whether boiling water is poured over the leaves or the latter are immersed in boiling water. Treating the leaves with boiling alcohol or boiling solutions of potassium acetate (110° C.) or potassium nitrate (106° C.), either by immersing the leaves in the liquid, or pouring the latter over them, also affects the results. In general the lowest results are obtained when the leaves are immersed in boiling water, but the figures are not concordant. The procedure recommended is to immerse 25—30 grms. of the leaves for 1 min. in a boiling, very dilute solution of potassium hydroxide, then neutralise the alkaline solution with tartaric acid, and distil with steam, the distillate being collected over potassium hydroxide solution. With this method, using the Prussian blue reaction for testing the distillate, no free hydrocyanic acid could be detected in cherry-laurel leaves.—A. S.

Determination of hydrocyanic acid in vegetable and animal tissues. Waller. *See* XXIII.

Lecithins; Non-existence of free or combined —— in yolk of egg. N. A. Barbieri. Comptes rend., 1910, **151**, 405—407.

According to the author the substance, usually termed lecithin, obtained from yolk of egg after removal of the stearin, oil, cholesterol, and ovin, consists mainly of a solution of nitrogenous substances, free from choline, and fatty matter. The phosphorus present is not combined with glycerol as in lecithin, but is in the form of dialysable compounds. By dialysis of an ethereal solution of so-called lecithin for 2—3 weeks, a water-soluble portion was obtained consisting of a yellowish, faintly acid paste, free from sulphates and chlorides, and containing 1·4 per cent. of phosphorus, 0·85 of sulphur, and 6·25 of ash (with 12·75 per cent. of phosphorus). After hydrolysis with 1 per cent. sulphuric acid, this substance yielded a chloroplatinate of a base containing sulphur; from the mother-liquor from the chloroplatinate, a yellowish substance also containing sulphur was separated. On allowing the ethereal solution, after dialysis, to stand at 0° C., a small quantity of a substance soluble in alcohol separated. This was obtained as a yellowish brown paste, which contained water-soluble substances similar to those described above, and after hydrolysis with 1 per cent. sulphuric acid, yielded also a substance, insoluble in water, which gave glycerol and margaric acid on saponification. The final ethereal mother-liquor contained the chief portion of the original "lecithin," which was obtained as an oily mass, almost free from nitrogen. From its solution in methyl alcohol, trimargarin gradually separated.—A. S.

Camphor series; Molecular rearrangements in the ——. IV. Synthesis of laurolene. W. A. Noyes and L. P. Kyriakides. J. Amer. Chem. Soc., 1910, **32**, 1064—1068.

The structure of laurolene as Δ^1-1.2.5-trimethylcyclopentene has been established by the following synthesis:—The mixture of "meso" and racemic α,α'-dimethyladipic acids obtained by the hydrolysis of dimethylketonetetracarboxylic acid was converted into 2.5-dimethylcyclopentanone (b. pt. 147°—148° C.) by distilling with lime, 70 per cent. of the theoretical yield being obtained. This ketone was converted by means of magnesium and methyl iodide in presence of ether (Barbier-Grignard reaction) into 1.2.5-trimethylcyclopentanol-1, which boils at 56°—60° C. at about 8 mm., sp. gr. 0·9121 at 15°/4° C., refractive index = 1·4554 at 16·7° C.; the yield was about 65 per cent. This hydroxy-compound was converted into laurolene by heating with anhydrous oxalic acid according to Zeuthen's method (this J., 1901, 1253), whereby it loses a molecule of water. The purified laurolene had the sp. gr. 0·8039 at 15°/4° C., refractive index, 1·4464 at 16·5° C., b. pt. 120°—122° C.—A. S.

Acetanilide and exalgin (methylacetanilide); Distinguishing ——. V. Zotier. L'Union Pharm., 1910, **51**, 255. Pharm. J., 1910, **85**, 391.

Antifebrin or acetanilide, and exalgin or methylacetanilide may be distinguished by the following reaction:—About 0·05 grm. is treated with ten drops of hydrochloric acid and boiled for two minutes. The liquid is then cooled, 5 more drops of hydrochloric acid are added, then 1 drop of 1 per cent. sodium nitrite solution; after allowing reaction to take place for ten minutes, 1 c.c. of phenol is added and then, gradually, enough strong sulphuric acid to give a homogeneous mixture. Of this, 0·5 c.c. is treated with sufficient caustic soda solution, sp. gr. 1·332, to give a clear solution. In the case of exalgin a blue colour will be obtained and with acetanilide a yellow tint. Mixtures will naturally vary from yellowish to green. The various details of the test must be rigorously observed.

Erratum.

This J., Sept. 30, page 1132, col. 2, line 8 from top, *for* "2,057,475" *read* "2,077,475."

Patents.

Isoprene; Production of ——. R. W. Wallace, London. Eng. Pat. 19,701, Aug. 27, 1909.

Isoprene is obtained by the destructive distillation of various raw materials, more particularly the bark and lamellæ of the various species of Xanthorrhœa or "blackboy" trees of Australia, and is absorbed in a suitable solvent such as acetic acid, alcohol, turpentine or any terpene oil. It may be recovered in a more or less pure condition by neutralising or otherwise separating the solvent from it. The distillation is conducted, preferably in vertical retorts, fired externally and provided with flues, at a temperature between 100° C. and 260° C. for three or four hours, after which the temperature is raised to about 800° C. From 10 to 15 per cent. of turpentine may be added to the charge, and, alternatively, heat may be applied by means of superheated steam. The vapours pass upwards through a tower containing baffle-plates over which the absorbent is flowing, and the solution of isoprene is collected at the bottom of the tower whilst the gaseous impurities escape at the top. The isoprene is recovered by *e.g.* neutralising the acetic acid by means of caustic soda or lime, and distilling through a reflux condenser or rectifier. The rectifier consists of a series of spherical, or other suitably shaped chambers, superposed, with intermediate connecting valves or cocks, and with an internally projecting pipe at the bottom of each to serve as a trap for liquid condensed therein. Air should be excluded from the apparatus, which should be tinned inside if acetic acid be employed as the solvent.

—E. W. L.

Opium preparations and products suitable for pharmaceutical purposes. J. Wetter, London. From F. Hoffmann-La Roche und Co., Basle, Switzerland. Eng. Pat. 24,379, Oct. 23, 1909.

Opium is extracted twice, for 24 hours each, with one per cent. hydrochloric acid, and the united extracts are neutralised with sodium carbonate solution. The precipitated alkaloids are mixed with asbestos flakes, wood shavings, etc., and extracted with 95 per cent. alcohol to separate them from the resinous matter; the alcohol is then distilled off, and the residue mixed with the acid solution obtained by extracting the neutralised solution (from which the precipitated alkaloids were removed) with a suitable organic solvent, and extracting the remaining alkaloids from this extract by shaking with dilute acid. The whole is then evaporated to dryness *in vacuo*. The product is light yellow in colour and readily soluble in water; it is said to contain the whole of the alkaloids of opium, and to be easily sterilised and therefore suitable for subcutaneous injection.—T. F. B.

Digestive remedy and process for preparing the same. H. Sefton-Jones, London. From J. A. Wülfing, Berlin. Eng. Pat. 14,016, June 9, 1910.

Stable products of proteolytic digestive ferments which act in acid solution (pepsin, papayotin, etc.), are obtained by mixing the ferments with solid acid-albumin: as an example is given the mixture of 80 to 90 parts of hydrochloric acid-albumin with 10 to 20 parts of fine pepsin. It is stated that the acid of the albumin is just as efficient for promoting the activity of the ferment as is free hydrochloric acid.—T. F. B.

Quinine compounds; Manufacture of ——. A. G. Bloxam, London. From C. F. Boehringer und Soehne, Mannheim-Waldhof, Germany. Eng. Pat. 15,392, June 27, 1910.

The diglycollic acid ester of quinine is a tasteless compound, of m. pt. about 70° C., which is readily split up, and therefore able to exercise the full therapeutic effect of its quinine content in the organism. It is prepared by the usual methods of esterification, *e.g.*, by allowing diglycollic acid chloride to act on quinine in chloroform solution, or by heating diglycollic acid phenyl ester with quinine in a vacuum to 120° C.—T. F. B.

Guanidine salts; Process for preparing ——. Stickstoffwerke G. m. b. H. Ger. Pat. 222,552, Oct. 30, 1908.

Salts of guanidine are obtained by heating a dry mixture of dicyanodiamide or melamine with an ammonium salt. For example, guanidine thiocyanate is obtained by heating equimolecular weights of dicyanodiamide and ammonium thiocyanate at about 125° C.—T. F. B.

Condensation products containing iodine from wood tar or wood tar oils and aldehydes; Process for preparing ——. J. Hertkorn. Ger. Pat. 223,838, Dec. 4, 1907.

Wood tar, wood tar oils, wood tar pitch, etc., with or without addition of free phenols, are condensed with aldehydes with the aid of feebly basic condensing agents (*e.g.*, alkali carbonates, acetates, or borates, or magnesium hydroxide), and the products are treated with iodine or substances which readily part with iodine.—T. F. B.

o-Dihydroxyphenylalkamines; Process for preparing optically inactive ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 223,839, Oct. 3, 1909. Addition to Ger. Pat. 220,355, April 3, 1909 (this J., 1910, 719).

Optically active *o*-dihydroxyphenylalkamines are converted into the inactive modification by heating with organic acids.—T. F. B.

Hydroxyarylarsinic acids and their reduction products; Process for preparing amino-derivatives of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 224,953, June 10, 1909.

Hydroxyarylarsinic acids are nitrated and the nitro-groups reduced to amino-groups; if powerful reducing agents are employed, derivatives of aminoarsenophenol are obtained, and these may be converted into the corresponding arsinic acid derivatives by oxidation with hydrogen peroxide in alkaline solution.—T. F. B.

C.C-Dialkylbarbituric acids; Process for preparing ——. A. Einhorn. Ger. Pat. 225,457, June 10, 1909.

Dialkylmalonamides react readily with oxalyl chloride in the warm (*e.g.*, at the temperature of the water-bath), hydrogen chloride and carbon monoxide being eliminated and the corresponding dialkylbarbituric acid produced in yields reaching 80 per cent. of the theoretical yield. —T. F. B.

Pharmaceutical compounds [from mercury salicylic anhydride]; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,045, Dec. 1, 1909.

See Ger. Pat. 224,864 of 1909; this J., 1910, 1133.—T. F. B.

Formaldehyde; Process of generating ——. H. Schneider, Hamburg, Germany. U.S. Pat. 969,661, Sept. 6, 1910.

See Eng. Pat. 4855 of 1908; this J., 1908, 915.—T. F. B.

Aminoacidylpyrocatechin and process of making same. Process of producing aminoacetylpyrocatechin. W. Grüttefien, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 970,042 and 970,217, Sept. 13, 1910.

See Eng. Pat. 23,143 of 1908; this J., 1909, 1104.—T. F. B.

Suprarenal glands; Process of making compounds of the active substance of ——, *and said compounds.* B. Reuter, Höchst on Maine, Germany, Assignor to H. A. Metz and Co., New York. U.S. Pat. 970,112, Sept. 13, 1910.

See Eng. Pat. 24,723 of 1903; this J., 1904, 910.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Drying [cinematograph] films; Method of and apparatus for ——. W. Fairweather, London. From the Selig Polyscope Co., Chicago, U.S.A. Eng. Pat. 2494, Feb. 1, 1910.

The wet film is passed between two suction orifices, with its uncoated side in contact with one of them, which is covered with absorbent fabric; the coated side of the film does not touch the other sucker. Both suckers are attached to the same pipe which connects them with a suitable pump. After having a certain portion of the moisture removed by this device, the film passes through a drying chamber and is finally wound off on reels. —T. F. B.

Polychrome screens for photography; Process for preparing ——. J. H. Powrie. Ger. Pat. 225,004, Oct. 24, 1907.

In the preparation of screens by successively printing and staining portions of a colloid surface, it is proposed to mordant the colloid, after each printing, with a direct cotton dyestuff, or other dyestuff which will give a precipitate with basic dyestuffs in solution, and which will not appreciably diminish the absorptive power of the colloid or its affinity for the basic dyestuffs, which are used for staining. After each staining, the colloid plate is hardened by treatment with a 20 per cent. solution of tannin.—T. F. B.

Photographic printing paper; Manufacture of ——. A. Albert, Planegg, Bavaria. Eng. Pat. 20,046, Sept. 1, 1909.

See Fr. Pat. 412,811 of 1910; this J., 1910, 1038.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Patents.

Safety explosive. E. Steele, London. Eng. Pat. 22,095, Sept. 28, 1909.

The use of liquid vaseline having a boiling point of not less than 369° C., and sp. gr. 0·885 to 0·89 is stated to have special properties as an ingredient in explosives containing either nitrate, chlorate, perchlorate, or permanganate of potassium, and also ammonium nitrate. The explosive mentioned in the claim consists of potassium chlorate 85 to 97·5 parts and liquid vaseline 2·5 to 15·0 parts.—G. W. McD.

Explosive compound. J. Burrows, Assignor to A. Ross, Port Arthur, Ontario. U.S. Pat. 968,919, Aug. 30, 1910.

The following composition is specified: barium nitrate, 32; toluene, 10 and aluminium, 8 parts, but these proportions may be varied. Of the aluminium, part is coarsely and part is finely powdered, and, if desired, paraffin wax and charcoal may be added to the mixture.—C. A. W.

Explosives. M. Delvigne, Namur, Belgium. Eng. Pat. 28,929, Dec. 10, 1909. Under Int. Conv., April 2, 1909.

See Fr. Pat. 413,418 of 1910; this J., 1910, 1135.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Indicator, a-naphtholphthalein; A new —— *which gives a colour change in the neighbourhood of the neutral point.* S. P. L. Sörensen and S. Palitzsch. Comptes rend. Trav. Lab. Carlsberg, 1910, **9**, 1—7.

The indicator is prepared from *a*-naphthol and phthalyl chloride and is purified by recrystallisation from benzene. The indicator solution is made by dissolving 0·1 grm. of the substance (dried at 100°—110° C.) in a mixture of 150 c.c. of alcohol and 100 c.c. of water. In distinctly acid solution the indicator is almost colourless, whilst in feebly acid solution it exhibits a red coloration; in feebly alkaline solution it has a green tint and in strongly alkaline solution a pure blue colour. The colour change is well marked between $p_{\mathrm{H}}^{+}=7{\cdot}26$ and $p_{\mathrm{H}}^{+}=8{\cdot}68$. This indicator cannot be used with solutions containing natural proteins.—W. P. S.

Spectrum analysis; Quantitative ——. W. Hempel and R. L. von Klemperer. Z. angew. Chem., 1910, **23**, 1756—1759.

The authors have devised an apparatus for the quantitative determination of salts in solution by means of their flame spectra. The solution to be examined is atomised by electrolysis under standard conditions in a current of hydrogen, and the latter is conducted to a burner in which it is burnt with a current of oxygen. By a comparison of the flame spectrum of the solution with that of a standard solution, it is possible to estimate at what dilution any particular line is just visible and thus to calculate the concentration of the solution. The atomising apparatus consists of a horizontal glass tube, 7 cm. long and 1·45 cm. in diameter. Branch tubes are fused on this: three on the upper side, for the introduction of the solution drop by drop, for the introduction of the hydrogen at one end, and for its passage to the burner at the other. On the lower side are two horizontal platinum electrodes, protected by glass on their lower surfaces, also an overflow tube for the exit of the liquid, and a tube passing straight up through the central axis of the burner-tube for the current of oxgyen. The burner, forming a vertical branch of the atomising tube, is constructed of two concentric glass tubes, fitted with elongations of platinum near the point of combustion. The electrodes are connected with a powerful battery and a large variable resistance, by which the current can be kept constant at exactly 1 ampère. Arrangements are described for the accurate control of constant supplies of hydrogen and oxygen. The flame is examined through a spectroscope, which can be adjusted to show only that portion of the spectrum under examination. In order to avoid variations of temperature it is desirable to prepare at least 1 litre of solution, to which 80 c.c. of 50 per cent. sulphuric acid are added in order to increase the conductivity. Standard solutions should contain 0·75 grm. of potassium chloride, 0·0177 grm. of lithium carbonate or 0·759 grm. of thallium alum per litre. A constant flow of the solution is maintained in drops through the atomising tube. The method gives good results in the determination of potassium and lithium in soils, 50 grms. of the ignited soil being decomposed with hydrofluoric and sulphuric acids and the extract made up to 1 litre.—J. F. B.

Copper; Separation of —— from cadmium and zinc by means of "cupferron" [ammonium nitrosophenylhydroxylamine]. J. Hanus and A. Soukup. Z. anorg. Chem., 1910, 68, 52—56.

Cadmium and zinc may be separated from copper by precipitating the latter in acid solution by means of "cupferron," as already ascertained by Biltz and Hödtke (this J., 1910, 721), but the excess of the reagent must be decomposed, before the determination of cadmium or zinc in the filtrate can be completed; the method is considered, therefore, to offer no special advantage. For the determination of copper, however, it is both rapid and accurate, but the precipitate must be filtered off without delay, since, on standing, part of the copper is redissolved.—F. Sodn.

Copper; Determination of —— as anhydrous cupric sulphate. A. Recoura. Bull. Soc. Chim., 1910, 7, 832—834.

Whilst cupric sulphate must be heated for many hours at a temperature of 190° C. in order to expel all the water of crystallisation, a completely anhydrous residue is obtained within 2 hours if a small quantity of sulphuric acid be added to the sulphate before the heating is commenced. The amount of copper in many copper compounds may be readily determined by treating the compound with sulphuric acid, evaporating the solution, heating the residue for 2 hours at 190° C., and weighing the resulting anhydrous cupric sulphate. If the compound be not directly soluble in dilute sulphuric acid, it may be treated first with nitric acid and then sulphated. When copper is separated from a mixture of metals as its sulphide, the latter may be dissolved in nitric acid and the solution treated with sulphuric acid, evaporated, and the residue of sulphate heated as described.—W. P. S.

Antimony and tin; Separation of —— by distillation. W. Plato. Z. anorg. Chem., 1910, 68, 26—47.

The method is based on the fact that antimony may be distilled as chloride, in a current of hydrochloric acid, from a sulphuric acid solution to which phosphoric acid has been added, whereas tin is retained in the solution as a complex acid, from which, however, it may be subsequently recovered by distilling at a higher temperature, in a current of hydrobromic acid. A convenient apparatus consists of a 100 c.c. round-bottom Jena flask, provided with thermometer, tap-funnel, and delivery tube, the last forming the inner tube of a condenser and passing directly into a closed receiver, from which the exit tube passes back through the condenser, to act as a reflux. The solution of tin and antimony, in 6 c.c. of strong sulphuric acid, is mixed with 7 c.c. of phosphoric acid (84 per cent., commercial) and 10 c.c. of hydrochloric acid, and is introduced into the flask; the tap-funnel is filled with fuming hydrochloric acid, and 50—75 c.c. of strong hydrochloric acid are placed in the receiver, sufficient to cover the end of the condenser tube. A current of carbon dioxide is passed through the apparatus, and the contents of the flask are heated to 155°—165° C., hydrochloric acid being allowed to drop in at the rate of 50—60 drops per minute. All the antimony distils over in an hour and a half, and the distillation is then interrupted, the tubes being rinsed and the distillate removed, after which the apparatus is arranged as before, the tap-funnel being filled with fuming hydrochloric acid almost saturated with bromine, and a further 6 c.c. of strong sulphuric acid added to the tin solution; the distillation is then resumed, in a current of sulphur dioxide (instead of carbon dioxide) and at 180°—190° C., the bromine solution being admitted, at about 40 drops per minute, when this temperature is reached; the distillation of the tin (as stannic chloride) is complete in about an hour. The determination of antimony and tin in the distillates is rendered easy by the absence of all other metals. The method may be applied to the separation of antimony, tin, and arsenic, and also to the separation of these from the heavy metals, especially copper and lead. When arsenic is present, it is preferably distilled over with the antimony and then separated by a second distillation (down to 70 c.c.) in a current of carbon dioxide, after adding 5 grms. of tartaric acid, to keep back the antimony. In the presence of copper and lead, antimony and tin are best distilled together and then separated.—F. Sodn.

Vanadium; Gravimetric determination of —— as silver vanadate. P. E. Browning and H. E. Palmer. Amer. J. Sci., 1910, 30, 220—222.

Whilst in an acid solution of vanadic acid or a vanadate, silver nitrate precipitates a substance of widely variable composition, the precipitate from a neutral solution is constant, and has the composition of silver metavanadate. The solution of the vanadate is acidified with nitric acid, then made alkaline by slight excess of ammonia, and boiled till the excess of ammonia is expelled (the yellow alkaline solution becomes colourless during the boiling, and begins to have a faint yellow tint again just as the ammonia is expelled). To the boiling solution silver nitrate is added in excess, the precipitate vigorously stirred to coagulate it, filtered through asbestos in a platinum Gooch crucible, washed, and ignited at a temperature below its melting-point.—J. T. D.

Arsenic acid; Precipitation of —— with ammonium molybdate. G. Maderna. Atti R. Accad. dei Lincei, Roma, 1910 [5], 19, II., 15—19. Chem. Zentr., 1910, 2, 912—913.

(*a*). *Precipitation in acid solutions by mineral acids of which the acidity is greater than* 0·03 *grm. H-ions per* 100. Nitric acid is the most suitable acid, and the best conditions for the precipitation are as follow:—10 c.c. of the solution containing 0·08 grm. of arsenic trioxide are treated with 15 c.c. of ammonium nitrate solution (370 grms. per litre), 60 c.c. of water, and 2·5 c.c. of nitric acid of sp. gr. 1·3, then heated to boiling, and after addition of about 1·6 grms. of solid ammonium molybdate, boiled for 3 minutes. The yellow precipitate is washed by decantation with a solution containing 200 grms. of ammonium nitrate and 160 c.c. of nitric acid per 4 litres. (*b*). *Precipitation in acid solutions by mineral acids of which the acidity is less than* 0·03 *grm. H-ions per* 100. Under these conditions a white precipitate is obtained which is insoluble in warm water and in water containing ammonium nitrate. 10—15 c.c. of the acid solution, containing about 0·1 grm. of arsenic trioxide, are treated with 15 c.c. of ammonium nitrate solution, heated to boiling, and after addition of about

1·5 grms. of ammonium molybdate, boiled for some time. The precipitate is washed by decantation with warm water containing ammonium nitrate, then dissolved in ammonia, and the arsenic re-precipitated as magnesium-ammonium arsenate. (*c*). *Precipitation of arsenomolybdate in acid solutions by organic acids.* Experiments indicate that in precipitation with organic acids—tartaric, oxalic, citric, acetic, succinic, and phthalic acids—with or without ammonium nitrate, the formation of the white or of the yellow precipitate depends upon the acidity of the solution. (*d*). *Precipitation of arsenomolybdate in neutral solutions.* Under the conditions described above in (*a*), the white precipitate is obtained. The ratio of arsenic anhydride to molybdenum trioxide in the yellow precipitate is given as 1 : 24, and in the white precipitate as 1 : 16.—A. S.

Arsenic acid in presence of phosphoric acid; Detection of ——. O. Maderna. Atti R. Accad. dei Lincei, Roma, 1910, [5], **19**, II., 68—69. Chem. Zentr., 1910, **2**, 913.

A small quantity of a solution containing the alkali salts of the two acids is rendered faintly acid with acetic acid, treated with 10—15 c.c. of a concentrated solution of ammonium nitrate, then heated to incipient boiling, and about 1 grm. of solid ammonium molybdate added. After the molybdate has dissolved, the solution is boiled for a further 1½ mins., the presence of arsenic acid being indicated by the formation of a white precipitate of arsenomolybdate. It is stated that 0·002 grm. of arsenic acid can be detected even in presence of large quantities of phosphoric acid. Calcium, strontium, and magnesium salts render the reaction less delicate, but do not prevent it.—A. S.

Hydrocyanic acid: New method for the quantitative determination of —— *in vegetable and animal tissues.* A. D. Waller. Proc. Roy. Soc., 1910, B, **82**, 574—587.

The method is based on the colour reaction between picric acid and hydrocyanic acid. The "picrate fluid" employed contains 0·05 per cent. of picric acid and 0·5 per cent. of sodium carbonate. Equal volumes of picrate fluid and 0·002 per cent. hydrocyanic acid are left for 24 hours in an incubator at 40° C., and the red colour obtained (corresponding to 1 mgrm. of hydrocyanic acid per litre) is used as a standard for colorimetric comparison. The coloration is unaffected by light or by boiling, and it is of such strength that the solution will bear dilution to 10 times its volume when very weak cyanide solutions are being investigated. The examination of tissues is effected by distillation with dilute acid, the distillate being received in a suitable quantity of picrate fluid, which is then allowed to stand for at least an hour in an incubator at 40° C. before the tint is compared with the standard. The errors of manipulation and reading are estimated not to exceed 10 per cent. of the minute quantities measured, and the method has been tested with excellent results on numerous animals poisoned with hydrocyanic acid, as well as in a case of hydrocyanic acid poisoning in man. It is found that the poison goes to some organs (heart and brain) rather than to others (the muscles). The method has also been used to show that the evolution of hydrocyanic acid from laurel leaves is a *post mortem* phenomenon.—R. V. S.

Reducing properties of cellulose, its raw materials and derivatives. Kollmann. *See* V.

Analysis of some inorganic sulphur acids. Casolari. *See* VII.

Ammonium perchlorate as a reagent. Metal-ammonium perchlorates. Salvadori. *See* VII.

Spontaneous decomposition of permanganates and permanganic acid. Skrabal. *See* VII.

Preparation of manganifluorides and the influence of fluorides in the titration of manganese by Volhard's method. Müller and Koppe. *See* VII.

Artificially coloured tanning extracts. Grasser. *See* XV.

Report of the chairman of the international commission on tannin analysis. Procter. *See* XV.

Tannin determination without hide powder. Lepetit. *See* XV.

Determination of nitrogen in leather and skins. Thuau and De Korsak. *See* XV.

Calcium cyanamide: its analysis and the changes it undergoes when exposed to the atmosphere. Brioux. *See* XVI.

Determination of the [sulphated] ash in raw sugars and other products, using quartz instead of platinum dishes and quartz instead of fireclay muffles. Vorbuchner. *See* XVII.

Physico-chemical determination of the ash of wine. Dutoit and Duboux. *See* XVIII.

Detection of mineral acids in wines. Hubert and Alba. *See* XVIII.

Detection of inositol for the characterisation of wine vinegars. Fleury. *See* XVIII.

Determining butyl and amyl alcohols in alcoholic liquids. Lasserre. *See* XVIII.

Silicotungstates of conicine, sparteine, and atropine. Javillier. *See* XX.

Distinguishing acetanilide and exalgin (methylacetanilide). Zotier. *See* XX.

Patent.

Colours; Method of and means for analysing the composition of ——. A. Kubicek, Prerov, Austria. Eng. Pat. 12,715, May 25, 1910. Under Int. Conv., May 25, 1909.

The composition of colours is determined, according to the process described, by the use of surfaces bearing the three primary and secondary colours and superposed perforated surfaces also bearing the three primary and secondary colours. The apparatus consists of three discs mounted so as to revolve freely upon a common axis; the central disc is larger than the two others and on one side of it are painted the three primary colours so as to form three sectors, whilst the other side is divided into two parts, one part showing the three primary colours and the other part the three secondary colours. The outer discs are smaller than the central one, are finely perforated, and bear the corresponding colours to those on the central disc. When the outer discs are moved, the colour exhibited by any one sector (outer covers may be provided having a piece cut out of them so that only one sector is visible at a time) is a combination of the colour on the outer disc and that on the central disc seen through the perforations; when viewed from a distance this combined colour has a uniform tint, but closer observation enables the component colours to be recognised. It is possible to make 36 combinations with 18 colours by the use of the apparatus.—W. P. S.

XXIV.—MISCELLANEOUS ABSTRACTS.

Enzyme decomposing aesculin, and a lipolytic enzyme; Occurrence of —— *in the horse chestnut.* W. Sigmund. Monatsh. Chem., 1910, 31, 657—670.

The epidermis of the kernels and shells of the seeds of the horse-chestnut, *Aesculus hippocastanum* L., contain an enzyme having the property of decomposing aesculin into aesculetin and dextrose. Experiments proved that bacteria played no part in the decomposition, and that the enzyme, for which the name *aesculase* is suggested, was neither an amygdalase nor a lipase. The cotyledons of the seeds contained a lipolytic enzyme, and the occurrence of aesculase therein was also regarded as extremely probable.—C. A. M.

Books Received.

DIE AETHERISCHEN OELE. Von E. GILDEMEISTER und FR. HOFFMANN. Zweite Auflage, von E. GILDEMEISTER. Band I. Verlag von Schimmel und Co., Miltitz bei Leipzig; also L. Staackmann, Leipzig. 1910. Price M. 17; bound M. 20.

8vo. volume containing 697 pages of subject matter, including an alphabetical index, also two maps and 75 illustrations. The text is divided under the following headings:—I. Historical. II. Recovery of perfumes from flowers by extraction, *enfleurage*, and maceration. III. Chief constituents of essential oils; natural and artificial perfumes: (1) hydrocarbons, (2) alcohols, (3) aldehydes, (4) ketones, (5) phenols and phenol ethers, (6) acids, (7) esters, (8) lactones, (9) oxides, (10) compounds containing nitrogen and those containing sulphur. IV. Examination of essential oils: (1) determination of physical properties, (2) chemical analysis, including detection of adulterants. Both in the book itself and in a separate pamphlet enclosed in a pocket on the cover, tables are given: (I.) for calculating the percentage of alcohols of the formula $C_{10}H_{18}O$, $C_{10}H_{20}O$, $C_{15}H_{24}O$, and $C_{15}H_{26}O$, or their esters, from the saponification values before and after acetylation; and (II.) for ascertaining the ester value (acid value, saponification value), and the percentage of alcohols and esters, directly from the number of c.c. of potassium hydroxide solution used for 1·50 grms. of oil.

THE FATS. By J. B. LEATHES, M.A., M.B., F.R.C.S., Professor of Pathological Chemistry in the University of Toronto. Longmans, Green and Co., 39, Paternoster Row, London. New York, Bombay, and Calcutta. 1910. Price 4s. net.

ROYAL 8vo. volume forming one of the series of Monographs on Biochemistry, edited by R. H. Aders Plimmer, D.Sc., and F. G. Hopkins, M.A., M.B., D.Sc., F.R.S. It contains 124 pages of subject matter, a bibliography, and an alphabetical index. The work is divided into the following chapters. I.: A. The fatty acids. B. Glycerol and the glycerides. C. Other alcohols and their fatty acid esters. D. Phospholipines, galactolipines, and lipines. II.: A. The extraction of fat. B. The estimation of fat in animal tissues. III.: A. Physical properties of fats. B. General chemical methods used in analysis of fats. C. Separation, identification and estimation of constituents of fats: (1) fatty acids; (2) alcohols; (3) phospholipines. IV. The physiology of fats: A. Biochemical synthesis of fats and higher fatty acids. B. Physiological oxidation of fats. C. Rôle of fats in vital phenomena.

COLONIAL REPORTS.—Miscellaneous. Nos. 63 and 71. Selected reports from the Scientific and Technical Department of the Imperial Institute. Edited by the Director (W. R. DUNSTAN, F.R.S.) II. Gums and Resins. III. Foodstuffs. [Cd. 4971] and [Cd. 5137]. Wyman and Sons, Ltd., Fetter Lane, E.C., and 32, Abingdon Street, Westminster, S.W.; Oliver and Boyd, Tweeddale Court, Edinburgh; E. Ponsonby, 116, Grafton Street, Dublin. Price 3½d. each.

No. 63 contains a report on numerous samples of gums and resins examined at the Imperial Institute during recent years and includes short chapters on the uses, chemistry, and analysis and valuation of gums, and the uses and methods of investigation of resins.

No. 71 deals with various foodstuffs which have been examined during the period 1903—1907 at the Imperial Institute, the results being given under the headings: I. Food grains; II. Miscellaneous foodstuffs; III. Tea, coffee, cocoa, etc. A short chapter on food constituents and their functions is also given.

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Garina Garibaldi: Estratti fluidi. Preparazione.—Conservazione—Saggi qualitativi e quantitativi delle principali farmacopee vigenti. Torino. 1910. 16°, p. 146. Lire 4.

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Koch's europäisches Tapeten-Adressbuch. 1. Tl.: Europäische Tapeten-Fabriken, Linoleum- u. Linkrustra-Fabriken, Tapeten- u. Linoleum-Fabriken u. Importeure v. Nord-Amerika u. Kanada. 2. Tl.: Europäische Tapetenhandlgn. 10. Aufl. (V, 320 S.) 8°. Darmstadt. 1910. Verlagsanstalt A. Koch. Cloth M. 6.

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*Dissertations.

[Prices vary, ranging from two to three shillings.]

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

21,191. Reyscher. Method of and means for drying. [Ger. Appl., Feb. 21, 1910.]* Sept. 12.

21,470. Berlin Anhalt. Maschinenbau A.-G. Tanks of large diameter. [Addition to No. 10,071 of 1909. Ger. Appl., June 8, 1910.]* Sept. 15.

21,472. Weiss. Drier. Sept. 15.

21,620. Broadbent and Sons, Ltd., and Broadbent. Centrifugal machines. Sept. 17.

21,644. Pryor and others. *See under* II.

21,657. Steuler und Co. *See under* VII.

21,721. Le Nitrogène Soc. Anon. Apparatus for producing endothermic chemical reactions in gases. [Swiss Appl., Sept. 20, 1909.]* Sept. 19.

21,746. Hessling. Compressing air or gases. [Ger. Appl., Sept. 18, 1909.]* Sept. 19.

21,789. Stettiner Chamotte-Fabrik. *See under* II.

21,820. Forsberg. Centrifugal liquid separators.* Sept 20.

21,835. Ward. Apparatus for recording the percentage of carbon dioxide in the combustion gases of furnace flues, etc.* Sept. 20.

21,849. Humphrey. Raising or forcing liquids. Sept. 20.

22,046. Rorke, Thame, Rorke, and Denson. Vacuum drying. Sept. 22.

Complete Specifications Accepted.

20,715 (1909). Petitpierre. Apparatus for raising liquids. Sept. 21.

21,421 (1909). Gee, and Hydraulic Separating and Grading Co. Centrifugal apparatus. Sept. 21.

21,582 (1909). Pritchard, and United Alkali Co. Apparatus for utilising heat from liquors discharged from stills and other apparatus. Sept. 28.

23,846 (1909). Ward. Apparatus for recording the percentage of carbon dioxide in the combustion gases of furnace flues, etc. Sept. 28.

2497 (1910). Leptien. Apparatus for producing low temperatures by expansion of compressed gases. Sept. 21.

9954 (1910). Evans (Biehler). Method of refrigerating liquids. Sept. 28.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

21,210. Muller. Treatment of and recovery of by-products from distillation gases.* Sept. 12.

21,644. Pryor, and London Vertical Retort Syndicate, Ltd. Means for utilising the waste heat of retort or other furnaces. Sept. 17.

21,737. Stewart and Bethell. Combination of gas producers and gas regenerative furnaces. Sept. 19.

21,789. Stettiner Chamotte-Fabrik. Method of constructing retort furnaces, etc. [Ger. Appl., Sept. 30, 1909.]* Sept. 20.

21,835. Ward. *See under* I.

22,126. Jaubert. *See under* VII.

22,127. Tessier. Apparatus for making gas for heating, lighting, and power. [Belg. Appl., Oct. 7, 1909.]* Sept. 23.

22,225. Wagener. Regenerative coke ovens. [Ger. Appl., Sept. 25, 1909.]* Sept. 24.

Complete Specifications Accepted.

17,017 and 22,219 (1909). Bedford and Williams. Catalytic synthesis of methane. Sept. 28.

20,975 (1909). Fritz. Purifying and increasing the heating power of fuel. Sept. 21.

21,153 (1909). Fabbri. Deodorising and treating mineral and like oils. Sept. 21.

21,661 (1909). Nicolas. *See under* XII.

22,418 (1909). Reeves. Fuel enriching compound. Sept. 21.

23,846 (1909). Ward. *See under* II.

27,116 (1909). Tanne and Oberländer. *See under* III.

27,344 (1909). Ges. f. Verwerthung Chem. Produkte. Bunsen burner. Sept. 28.

342 (1910). Merrick. Gas washers. Sept. 28.

2416 (1910). Wilson and Wilson. Gas producers. Sept. 28.

6282 (1910). Wagener. Separating tar from hot gases produced in the destructive distillation of coal and the like. Sept. 28.

III.—TAR AND TAR PRODUCTS.

Application.

22,097. Newton (Bayer und Co.). *See under* XX.

Complete Specifications Accepted.

21,007 (1909). Pichon and Truchelut. Utilising chlorides of carbon for rendering benzines, alcohol, ether, etc., non-inflammable, and for preparing rubber solution, etc. Sept. 21.

27,116 (1909). Tanne and Oberländer. Separating solid hydrocarbons from residues of mineral oil and tar. Sept. 28.

442 (1910). Sauvageot. Obtaining mineral fat or grease from coal tar. Sept. 28.

IV.—COLOURING MATTERS AND DYES.

Applications.

21,199 to 21,202. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Sept. 12.

21,473. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Sept. 15.

22,014. Meister, Lucius, und Brüning. Manufacture of green to black vat dyestuffs. [Ger. Appl., Oct. 4, 1909.]* Sept. 22.

22,138. Ransford (Cassella und Co.). Manufacture of indophenolic compounds and dyestuffs therefrom. Sept. 23.

Complete Specifications Accepted.

28,716 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Sept. 28.

133 (1910). Soc. pour l'Industrie Chimique à Bâle. Manufacture of vat dyestuffs of the anthracene series. Sept. 28.

3002 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the pyrazolone group. Sept. 21.

15,391 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of a substantive disazo dyestuff. Sept. 28.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

21,305. Calvert. Cellulose product. Sept. 13.

22,101. Crowther. Destroying cotton or other vegetable fibres and silk fibres in wool and woollen material. Sept. 23.

Complete Specifications Accepted.

24,556 (1909). Daniels. Web-coating machines. Sept. 21.

25,321 (1909). Chambers and Moffatt. Wool-scouring solution for extracting wool fat. Sept. 21.

15,700 (1910). Verein. Glanzstoff-Fabr. Utilising the refuse from the manufacture of artificial silk from cellulose. Sept. 21.

18,076 (1910). Eichengrün. Producing coatings from acetylcellulose. Sept. 28.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

21,411. Deutsche Solvay-Werke A.-G. Manufacture of bleaching liquids. [Ger. Appl., Dec. 31, 1909.]* Sept. 14.

21,471. Owen and Vassar. Fireproofing flannelette, muslin, linen, and other similar fabrics. Sept. 15.

21,802. Imrie (Anilinfarben- u. Extract-Fabr. vorm. J. R. Geigy). Process for shading indigo-dyeings. Sept. 20.

22,154. Young and Gass. Bleaching textile fabrics. Sept. 24.

Complete Specifications Accepted.

26,028 (1909). Daniell and Hebden. Supports for use in dyeing yarn or the like. Sept. 28.

30,555 (1909). Strecker-Aufermann. Preparation of printing plates. Sept. 21.

4557 (1910). Meunier. Treatment of animal substances such as wool, silk, and hair, to increase their resistance to water, heat, and chemicals. Sept. 21.

VII.—ACIDS ; ALKALIS ; SALTS ; NON-METALLIC ELEMENTS.

Applications.

21,237. Collett and Eckardt. Utilisation of sulphurous acid. [Appl. in Norway, Sept. 13, 1909.]* Sept. 12.

21,268. Weaver Refining Co., Ltd., and Neill. Production of acid calcium, ammonium, sodium, and potassium phosphates, phosphoric acid, and allied products from bones, bone char, etc. Sept. 13.

21,281. Williams. Production of ammonia. Sept. 13.

21,563. Bessler, Waechter, and Co., Ltd., and Rouse. Soluble ferrated silicate of soda with addition of borax. [Addition to No. 2440 of 1910.] Sept. 16.

21,628. Heys (Nitrogen Co.). Production of cyanogen compounds.* Sept. 17.

21,657. Steuler und Co. Glover and similar reaction towers. [Ger. Appl., May 19, 1910.]* Sept. 17.

21,879. Spence, and Spence and Sons, Ltd. Production of aluminous compounds. Sept. 21.

21,880. Spence, Llewellyn, and Spence and Sons, Ltd. Production of compounds of alumina. Sept. 21.

21,946. Hyatt. Production of oxygen. Sept. 21.

22,012. North Western Cyanamide Co., Ltd. (North Western Cyanamide Co.). Holders or retorts used in making calcium cyanamide from calcium carbide. Sept. 22.

22,029. Doerbecker. Production of calcium phosphide. Sept. 22.

22,126. Jaubert. Extraction of free hydrogen contained in industrial gases. [Fr. Appl., Sept. 23, 1909.]* Sept. 23.

Complete Specifications Accepted.

124 (1910). Marks (International Marine Signal Co.). Preserving calcium carbide in use and preventing overgeneration of gas. Sept. 28.

16,518 (1910). Saccharin-Fabr. A.-G. vorm. Fahlberg, List, und Co. Manufacture of chloro-sulphonic acid. Sept. 21.

16,540 (1910). Chem. Fabr. von Heyden. Manufacture of anhydrous alkali hydrosulphites. Sept. 21.

VIII.—GLASS ; CERAMICS.

Application.

21,687. Jones, Jones, and Jones. Continuous kilns for burning pottery, bricks, etc. Sept. 19.

Complete Specification Accepted.

14,897 (1910). Dor-Delattre. *See under* X.

IX.—BUILDING MATERIALS.

Applications.

21,315. Thorrand, Durandy, et Cie. Preparation of cement. [Fr. Appl., Oct. 15, 1909.]* Sept. 13.

21,687. Jones, Jones, and Jones. *See under* VIII.

Complete Specifications Accepted.

7645 (1910). Bocci and Lutz. Artificial stone or building block. Sept. 28.

7940 (1910). Bohn. Apparatus for separating granular admixtures from clay, etc. Sept. 21.

X.—METALS ; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

21,198. Edwards. Furnaces for calcining, roasting, and desulphurising ores.* Sept. 12.

21,206. Harden, and Electric Furnaces and Smelters, Ltd. Production of metals from their ores.* Sept. 12.

21,219. Cowper-Coles. Brassing metal tubes and rods. Sept. 12.

21,260. King's Norton Metal Co., Ltd., Bayliss, and Brownsdon. Coating metallic or non-metallic bodies with metals or alloys. Sept. 13.

21,332. Scott. Recovery of metals from ores. Sept. 13.

21,490. Vautin. Treatment of copper. Sept. 15.

21,603. Ampère-Ges., and Müller. Production of metals and alloys.* Sept. 16.

21,856 and 21,857. Greenway and Lavers. Concentration of ores. [Australian Applns., Oct. 5 and 20, 1909.]* Sept. 20.

22,010. Gutensohn. Fluxes for refining and extracting metals. Sept. 22.

22,016. Johnson (Chem. Fabr. Griesheim-Elektron). Purification of magnesium and magnesium alloys. [Addition to No. 23,440 of 1909.]* Sept. 22.

22,022. Herreshoff. Ore-roasting furnaces.* Sept. 22.

Complete Specifications Accepted.

18,817 (1909). Hommel and Durant. Treatment of complex zinc ores. Sept. 28.

21,638 (1909). Lang. Protecting iron from rust. Sept. 28.

27,600 (1909). Rousseau. Crucible furnaces. Sept. 21.

313 (1910). Rodman. Materials for case-hardening or cementation. Sept. 28.

3488 (1910). Arbuckle. Apparatus for recovering the metal contents from crushed ore products. Sept. 21.

4692 (1910). Warren. Apparatus for granulating blast-furnace slag. Sept. 28.

14,897 (1910). Dor-Delattre. Apparatus for making crucibles and retorts for zinc furnaces, coal distilling, etc., and for making other hollow earthenware articles. Sept. 28.

XII.—FATS; OILS; WAXES.

Application.

22,213. Grant. Manufacture of soap.* Sept. 24.

Complete Specifications Accepted.

18,468 (1909). Meiro. *See under* XV.

21,457 (1909). Bauer. Preparation of soft soap. Sept. 28.

21,661 (1909). Nicolas. Testing or analysing lubricating oils or the like. Sept. 28.

22,401 (1909). Barringer. Clarifying oils. Sept. 21.

25,321 (1909). Chambers and Moffatt. *See under* V.

29,113 (1909). Müller. Manufacture of soap. Sept. 28.

644 (1910). Peter. Cleansing and disinfecting fluid. Sept. 28.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

21,304. Calvert. Impregnating mass. Sept. 13.

21,401. Pollak. Manufacture of insoluble condensation products from phenols and formaldehyde.* Sept. 14.

21,662. Barton. Manufacture of white lead. Sept. 17.

21,710. McDougall and Stewart. Extraction of pigments from ferruginous sands. Sept. 19.

21,734. Waring (Uniacke). Vehicle for mixing paints. Sept. 19.

22,033. Moffatt. Pigments and process of making same. Sept. 22.

22,130. Munro and Ewart. Manufacture of paint, enamel, and the like.* Sept. 23.

Complete Specifications Accepted.

20,805 (1909). Meurant. Making oil colours having a magnesium base. Sept. 21.

27,135 (1909). Pauling. Anti-rust composition. Sept. 21.

28,490 (1909). Rehkop. Manufacture of ultramarine. Sept. 21.

3649 (1910). Farup. Manufacture of colouring matters from titaniferous iron minerals. Sept. 21.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

21,182. Higgins. Recovery of old or waste indiarubber. Sept. 12.

21,634. Da Costa and Bridge. Smoking and drying sheet rubber after coagulation. Sept. 17.

22,121. Lake (Danin & Mello). Manufacture of indiarubber. Sept. 23.

22,201. Norzagaray. Cleansing crude indiarubber. Sept. 24.

Complete Specifications Accepted.

21,007 (1909). Pichon and Truchelut. *See under* III.

22,606 (1909). Scholz. Obtaining pure caoutchouc, gutta, balata, etc. Sept. 28.

15,254 (1910) Bayer und Co. Manufacture of a substance similar to natural caoutchouc. Sept. 21.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

21,750. Bartels. Manufacture of horn substitute from casein.* Sept. 19.

Complete Specification Accepted.

18,468 (1909). Meiro. Extraction of grease and glue from bones. Sept. 21.

XVIII.—FERMENTATION INDUSTRIES.

Application.

21,251. Wethered. Manufacture of beer, ale, stout, and porter. Sept. 13.

Complete Specifications Accepted.

28,561 (1909). Berliner A.-G. f. Eisengiesserei u. Maschinenfabr. Malt drums. Sept. 21.

4956 (1910). Spencer. Production of malt liquors. Sept. 21.

13,108 (1910). Reinhardt. Production of malt grist for brewing purposes. Sept. 21.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Application.

21,283. Stiff. Bacterial filter beds, etc.* Sept. 13.

Complete Specifications Accepted.

20,766 (1909). Vasey. Soluble protein or albumin and its production from meat fibre or other insoluble protein matter. Sept. 21.

644 (1910). Peter. *See under* XII.

1459 and 1460 (1910). Hartman. Apparatus for purifying liquids by electricity. Sept. 28.

12,157 (1910). Zimmer. Disinfectants and emulsions having disinfecting properties. Sept. 28.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

APPLICATIONS.

21,414. Kalle und Co. Manufacture of therapeutic preparations. [Ger. Appl., Sept. 14, 1909.]* Sept. 14.

22,097. Newton (Bayer und Co.). Manufacture of sulphaminobenzoylaminonaphthols and their sulphonic acids. Sept. 23.

COMPLETE SPECIFICATIONS ACCEPTED.

27,030 and 28,166 (1909). Newton (Bayer und Co.). Manufacture of pharmaceutical preparations. Sept. 21.

27,650 (1909). Reese. Organic phosphates. Sept. 21.

5939 (1910). De Jahn. Manufacture of organic acid anhydrides. Sept. 21.

10,227 (1910). British and Continental Camphor Co. Conversion of pinene into camphene. Sept. 28.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

21,410. Ives. Coloured photographic print and process of making same. [U.S. Appl., Sept. 14, 1909.]* Sept. 14.

XXII.—EXPLOSIVES; MATCHES.

APPLICATION.

22,030. Himalaya. Manufacture of safety explosives. [Appln. in Portugal, Sept. 29, 1909.]* Sept. 22.

XXIII.—ANALYTICAL PROCESSES.

COMPLETE SPECIFICATION ACCEPTED.

21,369 (1909). Cambridge Scientific Instrument Co., and Whipple. Radiation pyrometers. Sept. 21.

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Communication.

THE ESTIMATION OF FORMIC ACID.

BY A. F. JOSEPH,
Ceylon Medical College, Colombo.

The methods usually described for the estimation of formic acid depend upon its oxidation by either potassium permanganate or mercuric chloride.

According to Lieben's method (Monatsh., **14**, 746), the liquid is made alkaline with sodium carbonate, heated and titrated with standard permanganate until a permanent reddish colour persists in the supernatant liquid. The precipitated oxide of manganese frequently takes some time to settle, and the end point is in consequence difficult to determine. This trouble is avoided in Jones's method (Amer. Chem. J., **17**, 539), in which the solution is made alkaline and treated with a measured excess of standard permanganate; it is then acidified with dilute sulphuric acid, and a measured volume of standard oxalic acid added more than sufficient to reduce the excess of permanganate and bring the precipitated oxide of manganese into solution. The oxalic acid remaining is then titrated with permanganate in the usual way. This method gives excellent results, but cannot be used in presence of a considerable quantity of chlorides.

With respect to mercuric chloride methods, gravimetric and volumetric applications of the equation,

$$\mathrm{H.COOH+2HgCl_2=Hg_2Cl_2+2HCl+CO_2},$$

have been worked out.

Auerbach and Plüddemann (Arb. Kais. Gesund. Amt., 1909, 178) add excess of standard mercuric chloride and estimate the excess (after filtration from the precipitated mercurous chloride) by titration with standard potassium iodide. The volumetric estimation of the mercury is far from satisfactory owing to secondary reactions. The gravimetric process proposed by Franzen and Greve, in which the precipitated mercurous chloride is weighed (J. Prakt. Chem., 1909, (ii). **80**, 368), is accurate but takes a long time, and should only be carried out in very dilute solution (up to 1 gram per litre, *i.e.*, about *N*/50). Having occasion to make a large number of formate determinations, sometimes in the presence of chlorides and sometimes of acetates, it occurred to me that the oxidising action of bromine might serve as a basis for a simple but accurate volumetric method.

As shown by Hell and Mulhausen (Ber., **11**, 245) and more recently and fully by Bognar (Z. physik. Chem., 1910, 529) bromine oxidises formic acid as follows:—

$\mathrm{H.CO_2H+Br_2=2HBr+CO_2}$; or with a formate,

$\mathrm{H.CO_2Na+Br_2=HBr+NaBr+CO_2}$.

There are three ways in which this reaction might be applied analytically:—Determination of the amount of carbon dioxide produced; determination of the amount of bromine used up; and determination of the amount of hydrobromic acid or bromide produced. It would be difficult to apply the first volumetrically owing to errors caused by the unknown solubility of carbon dioxide, and the high vapour pressure of bromine. Gravimetric estimations of carbon dioxide liberated from solution are tedious and not always accurate.

The second method (determination of the amount of bromine required for the oxidation) was attempted by adding a measured excess of standard bromine water and titrating the excess, after the oxidation was complete, by the addition of potassium iodide and standard thiosulphate. There are two serious drawbacks to this process, first that a standard solution of bromine changes strength each time the bottle is opened; secondly, that the reactions represented by the above equations, although proceeding rapidly at the start, soon become slow, owing to the inhibitory influence of the hydrobromic acid formed, and frequently take several hours for completion. This difficulty may be overcome either by reducing the acidity by the addition of a considerable excess of sodium acetate, or by heating the formate and bromine solution in a closed bottle to 100°. In either case the determination is finished by adding potassium iodide and standard thiosulphate. The method was, however, finally rejected on account of the instability of the standard bromine solution. This was greatly reduced by using bromine dissolved in 20 per cent. potassium bromide, such a solution losing bromine by evaporation at only about one-twentieth the rate that aqueous bromine does. Even then it was not found possible to get results which were nearer than 1–2 per cent. of theory, and the method was finally abandoned. The third method, that of estimating the amount of hydrobromic acid or of total bromidion formed, has proved satisfactory.

In this, the solution (previously exactly neutralised, if not already neutral) is boiled, and bromine water added until the colour no longer disappears. The boiling is then continued until the excess of bromine is completely expelled. In the absence of volatile acids such as acetic acid, the estimation is finished by titrating the liberated hydrobromic acid with standard alkali. Bromine water boiled alone leaves a small quantity of free acid, probably owing to hydrolysis. It is therefore advisable to boil a quantity of it roughly equal to that used in the estimation and titrate the acid left after the expulsion of the bromine. Only 1 or 2 drops of *N*/10 alkali are usually required for 50 c.c. of strong bromine water if the latter is fresh. On keeping the acidity becomes slightly increased, but not to any great extent, even after long exposure to bright sunlight.

Examples of the results obtained by this method:—

1. 2.322 grms. of pure calcium formate were dissolved to 200 c.c. 10 c.c. of this, after boiling with bromine water, required (*a*) 17.94, (*b*) 18.08 c.c. *N*/10 alkali: mean, 17.97. A similar quantity of bromine water boiled alone required 0·09 c.c. Therefore the hydrobromic acid liberated by the oxidation was equivalent to 17·88 c.c. of *N*/10 alkali (or 357·6 c.c. for the whole volume of solution). Since one mol. of calcium formate liberates two mols. of hydrobromic acid, this corresponds to a weight of 2·325 grms., *i.e.*, about 0·1 per cent. too high.

2. Pure (Kahlbaum) formic acid was diluted and its strength found by direct titration to be 6·573 grms. of formic acid per litre. 20 c.c. were then boiled with bromine water after exact neutralisation, the liberated hydrobromic acid requiring (*a*) 28·76, (*b*) 28·64 c.c. *N*/10 alkali. The blank experiment with bromine water showed that 0·18 c.c. must be subtracted, leaving 18·52 as a mean. This corresponds to 6·560 grms. of formic acid per litre, a result lower than that obtained by direct titration by 0·2 per cent.

This method may be therefore used with accuracy for formic acid and formates alone, or in the presence of inorganic salts. But in the presence of acetates considerable errors are produced owing to the hydrobromic acid liberating acetic acid which even in dilute solution is easily volatile at the boiling temperature; in this way part of the acid is lost by evaporation and the results may be several per cent. too low.

The difficulty is avoided by estimating the total combined bromine left after the expulsion of the free bromine, instead of the free acid, this being most satisfactorily accomplished by Volhard's method of titration with excess of standard silver nitrate followed by standard thiocyanate, after filtering off the precipitated silver bromide.

The following example will show the negligible influence of acetates on this method of working:

1 gram pure calcium formate was dissolved to 100 c.c. 10 c.c. were then boiled with bromine water and the remaining solution treated with silver nitrate and thiocyanate. The test was then repeated with the addition of different quantities of sodium acetate, and it will be seen that even a considerable excess of sodium acetate exercises very little influence on the titre.

Grams of sodium acetate added	0	0·1	0·2	0·5	1·0
c.c. *N*/10 silver nitrate used	30·85	30·76	30·91	31·11	30·96
0·09 subtracted for blank ...	30·76	30·69	30·82	31·02	30·87

These differences are hardly greater than would be allowed in the ordinary way for Volhard titration, the mean, 30·84, being almost exactly that required by theory for the pure calcium formate taken (30·78).

Note.—That the practice of keeping bromine water in amber coloured bottles appears to be quite unnecessary is shown by the following test :—

Bromine water ($N/5$) was put into a large colourless glass bottle, and exposed to bright sunlight. Every few days the acidity was estimated by boiling 50 c.c. and titrating the residue with $N/10$ alkali. The results were as follows :—

Days' exposure	1	4	16	36
c.c. of $N/10$ alkali	1·0	1·2	1·8	1·8

The amount of bromine present was capable of yielding sufficient acid to neutralise 100 c.c. of $N/10$ alkali; only about 2 per cent. of the bromine was thus converted into hydrobromic acid after more than a month.

Journal and Patent Literature.

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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Settling-tanks for separating liquid from crushed ore products and other granular materials. W. A. Caldecott, Johannesburg. Eng. Pat. 29,755, Dec. 20, 1909.

In settling tanks provided with overflow devices for the liquid, and outlets at the bottom for the settled solids, it is proposed to fix one or more diaphragms in the tank, below the normal level of the settled solids. These diaphragms have serrated edges or perforations, or both, through which the solids flow in a thick uniform mass to the outlet below.—A. S.

Concentrating liquids; Apparatus for ——. P. Kestner, Lille, France. Eng. Pat. 5020, Feb. 28, 1910.

Improvements in the apparatus described in Eng. Pat. 12,502 of 1906 (this J., 1907, 516; and also 1906, 874) are claimed, consisting in constructing the inlets to the tubes, through which the vapours and liquid descend, in such a manner that the mixture enters the tubes tangentially. The lower ends of these inlet openings are on a level with the upper ends of the tubes through which the liquid ascends.—W. H. C.

Evaporation; Method of —— *and apparatus therefor.* N. H. Hiller, Carbondale, Pa. U.S. Pat. 970,051, Sept. 13, 1910.

The liquid to be evaporated, is sprayed in a heated state into a chamber heated and maintained under pressure, and then the gaseous impurities are blown off. The liquid is then evaporated and the vapours condensed in a separate apparatus. The evaporation is effected by steam from an external source and the condensed water from this steam is collected and re-evaporated. The cooling water from the condensers which will have become heated, is used to charge the steam generator.—W. H. C.

Separating dust from gases. H. Howard, Boston, Mass. U.S. Pat. 970,053, Sept. 13, 1910.

The gas is caused to pass in a slow, regular, evenly divided stream between a series of horizontal, parallel, superposed dust-retaining surfaces and is kept during its passage in close proximity to these surfaces.—W. H. C.

Extracting apparatus. C. H. F. Lembke, Toledo, Ohio. U.S. Pat. 970,246, Sept. 13, 1910.

A jacketed extractor, provided with valved steam supply and liquid extract discharge pipes, is connected by valved pipes with an overhead store tank for the solvent and with the lower end of a condenser coil. The upper end of the condenser coil is connected with the vapour pipe of a steam-jacketed evaporator into which the extract flows from the extractor. A tank is provided at a lower level to receive the residue from the evaporator.—W. H. C.

Aeriform environments; Process of producing pure or mixed ——. H. J. R. Hemming, Washington, D.C. U.S. Pat. 970,623, Sept. 20, 1910.

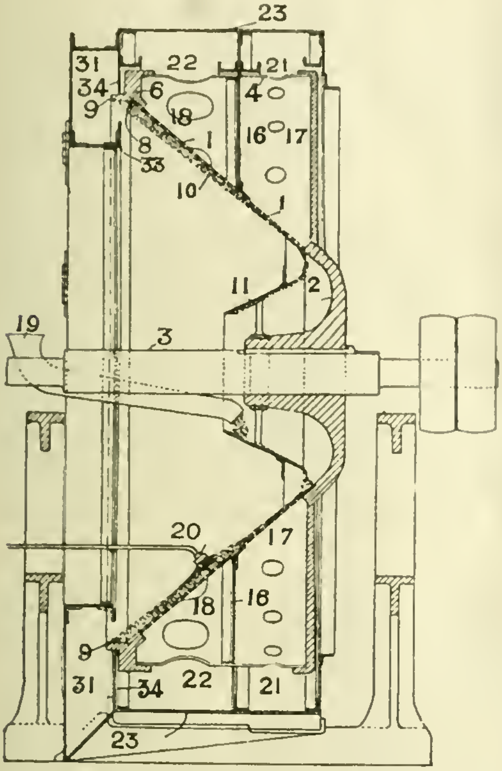
The patent relates to a method of obtaining an atmosphere of any desired gas or mixture of gases in a vessel, the original gaseous contents of the vessel being entirely displaced. The method consists in exhausting the vessel to about 1 in. of mercury, then admitting the displacing gas under a pressure of about 5 atmospheres, releasing the pressure and again exhausting, and repeating these steps until the amount of the original gas still remaining is negligible. The method may be used in order to protect organic liquids from bacterial action, the air in the vessel and the gases dissolved in the organic liquid being replaced by a suitable non-respirable or poisonous gas.—A. T. L.

Distilling volatile solid materials and heating and separating gases in vacuo; Apparatus for ——. W. S. Simpson. Fr. Pat. 414,634, March 15, 1910. Under Int. Conv., Oct. 25, 1909.

The apparatus consists of a hemispherical chamber having a flat or concave bottom which can be heated either by internal or external means. The chamber is provided with connections to one or more vacuum pumps, with means for withdrawing the gases given off, for introducing the materials to be treated into the crucible which stands on the bottom of the chamber, and for tilting this crucible and pouring the contents into receptacles within the chamber, and with air locks for withdrawing these receptacles without breaking the vacuum.—W. H. C.

Hydro-extractor. F. J. H. Bromham. Fr. Pat. 414,639, March 18, 1910.

A conical perforated bowl, 1, attached by the casting, 2, to the horizontal shaft, 3, by which it is rotated, is provided with an inner non-perforated distributing cone, 11, and an outer perforated collecting cage, 4, divided into compartments, 17, 18, by the partition, 16. The whole is surrounded by an outer casing, 23. The material to be dried is fed through the pipe, 19, on to the inner surface of the distributing cone, 11, from which it passes to the narrowest part of the perforated cone, 1. An annular piece, 6, joins the outer extremities of the two baskets, 1, 4, and has a projection, 9, inclined at such an angle that the material being dried takes the form of a wedge as shown at 10. The liquid passes through the lower part of the perforated cone into the chamber, 17, from which it passes into the chamber, 21, and is discharged through a suitable outlet. The dried material as it passes over the outer part of the cone, 1, is washed by a suitable liquid from the rose, 20. The wash water passes into the chamber, 18, and thence to the outer chamber, 22. The dried and washed material passes over the edge of the projection, 9, into the annular chamber, 31, provided with plates, 33, 34, to prevent any dried material from rebounding into the machine. It then passes round the channel, 34, and is discharged from the bottom. In order to prevent excess of pressure in the outer stationary chambers, 21, 22, they are provided with ventilating shafts fitted with baffles which allow the air to escape, but retain any projected liquid.—W. H. C.



Separator; Centrifugal ——. The International Clarifying Co. Fr. Pat. 414,841, April 15, 1910.

The bowl of the separator is mounted on a vertical shaft, upon which, but lower down, a motor turbine is also mounted. The whole is surrounded by a suitable casing having a movable top and a door at the side, so that when the bowl is full it can be removed by a pair of blocks suspended from an overhead rail, taken away for emptying and replaced by a spare basket.—W. H. C.

Liquids and gases; Apparatus for bringing —— *into intimate contact.* H. Lelarge. Fr. Pat. 414,720, April 11, 1910.

The claim is for a form of packing material to fill a vessel or tower in which the gases pass upwards and the liquids downwards. This packing material consists of cylinders or rods, round which a ribbon or wire is rolled spirally, or on which a spiral groove is cut, or of triangular prisms with grooved surfaces. The liquid is compelled by the form of the packing to drop from the lowest points of each turn of the wire or ribbon or point of the prism as a separate drop.—W. H. C.

Gases; Vessel for the absorption of —— *from gas mixtures.* Deutsche Ton- und Steinzeug-Werke A.-G. and R. Cellarius. Ger. Pat. 224,714, Aug. 1, 1908.

In apparatus wherein absorption of a constituent of a gaseous mixture is effected by a quiescent or moving body of liquid, fixed or movable guides are so disposed in the gas inlet that a whirling motion is imparted to the gaseous mixture before it enters the absorption vessel. —A. S.

Drying-drums; Rotary ——. Maschinenbau-Anstalt Humboldt, Kalk, Germany. Eng. Pat. 9089, April 14, 1910. Under Int. Conv., April 24, 1909.

See Fr. Pat. 412,569 of 1910; this J., 1910, 997.—T. F. B.

Filtering apparatus. P. C. C. Isherwood. Fr. Pat. 414,067, Feb. 18, 1910. Under Int. Conv., Feb. 22, 1909.

See Eng. Pat. 4358 of 1909; this J., 1910, 545.—T. F. B.

Separation of gaseous mixtures into their constituents. R. J. Lévy. Fr. Pat. 414,292, March 9, 1910. Under Int. Conv., March 11, 1909.

See Eng. Pat. 5931 of 1909; this J., 1910, 405.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal [Lignite] tests; Report on Canadian——. Eng. and Min. J., 1910, **90**, 617.

The Summary Report of the Mines Branch of the Canadian Department of Mines of 1909 contains a preliminary report by Dr. J. B. Porter, of the coal tests, undertaken by himself and Prof. Durley at McGill University, Montreal, begun in 1907. These tests have now been completed and a detailed report is in course of preparation. The coals examined, included samples from nearly all the Canadian mines already developed and in a condition to place their output upon the market; upwards of fifty samples of about 10 tons each being secured. These were subjected to coal-washing, boiler and gas-producer tests, as well as to coking trials. Chemical determinations were made as to the various constituents of each sample in addition to physical determinations of the fusion temperature of ashes, specific gravity, porosity and strength of cokes, and the calorific values of solid and gaseous fuels. Special investigations were also made on the determination of sulphur in coal, determination of volatile matter in coal and coke, solubility of coal in water, determination of physical values of coke, weathering of coal, etc. It has hitherto been difficult to answer the question as to whether a certain coal would make a good coke, without conducting a series of oven trials on a large and costly scale. An extended investigation undertaken at the works of the Dominion Iron and Steel Company, Sydney, N.S., has now led to a satisfactory method by which it is possible to test coal in lots of, say, 50 lb., the resulting cokes being in every way similar to those produced in commercial ovens and in most cases indistinguishable from them. The method is briefly as follows: The sample of coal, which should be as fresh as possible, is crushed, washed, if necessary, and slightly moistened in some cases, and is thus brought to the condition in which it would normally go to the ovens. It is then put into rectangular boxes of heavy sheet iron, each holding say 50 lb. These are freely perforated to permit the escape of gas, the perforations being covered with paper to prevent the egress or ingress of coal. The boxes are weighed and placed in an oven which is being charged, as a part of the regular charge, and are coked under normal conditions. On the withdrawal of the charge, the boxes are quenched, as promptly yet as lightly as possible, and are then dried and weighed, before opening. In addition to the trials to determine whether the coals would or would not coke, a series of tests was made to determine the effects of moistening, compressing, etc., also of different temperatures and the duration of the coking period.

The report presents some very general conclusions respecting the characteristics of the products of the great coalfields of Canada, which may be roughly grouped into four divisions, their respective coal contents being estimated as follows :—

1. Maritime provinces—bituminous coal, 10,000,000,000 tons.

2. Central Plains and Eastern Rocky Mountains, including Manitoba, Saskatchewan, Alberta, and a portion of British Columbia—anthracite, 400,000,000 tons; bituminous, 80,000,000,000 tons; lignite, 80,000,000,000 tons.

3. Pacific Coast and the Western Mountains, including most of British Columbia and the Yukon—anthracite, 10,000,000 tons; bituminous, 2,000,000,000 tons; lignite, 1,000,000,000 tons.

4. The Arctic-Mackenzie basin—lignite only, 500,000,000 tons.

The Nova Scotia coals are similar to the ordinary grades of English and Scotch, though on the average they may have a little more ash and considerably more sulphur than the British seams of the same thickness. Most of them make fair coke, and on the whole they may be taken as being fair to good steam coals and excellent for domestic use. The largest part of Canada's coal supply is from this source.

The coals of section 2 are enormous in quantity and many of them of excellent quality. Some of the best Crows Nest coals are excellent in every respect. These coals are all of comparatively recent age geologically (cretaceous) and, except the lignites, which occur chiefly in the plains, are found in the main uplift of the Rocky Mountains, in beds much tilted and often irregular. The coals are consequently less uniform in quality than they would otherwise be, and many of them carry large quantities of ash, either inherent, or as an unavoidable mixture from mining operations. The bituminous coals are quite variable, ranging from high-grade steam coals down. Some make good coke, others will do so if washed free from excessive impurities, and others, which do not coke well or will not coke at all, are useful for steam and domestic purposes. The greater part are still unexploited, lying to the north of present lines of traffic.

The Pacific Coast coal deposits are best developed in Vancouver Island where they have been mined for many years and also in Graham Island to the north where mining has not yet begun. Smaller but important fields have been found in many localities. The Vancouver Island coals are more or less normal bituminous and some of them coke well. Others are largely lignite, or lignitic bituminous, some of them coking well, but mostly unsuitable for metallurgical uses. They are in general well adapted for domestic purposes and for use as steam coal. Their impurities vary greatly, but on the whole they resemble the coals of the second division.

Peat; Utilisation of ——. N. Caro. Z. angew. Chem., 1910, **23**, 1844—1845.

By the process of Frank and Caro (this J., 1908, 796) it is now possible to utilise with success on the commercial scale, peat containing up to 60 per cent. of water and in a comparatively fine state of subdivision. Up to 85 per cent. of the nitrogen is obtained as ammonium sulphate together with power gas providing up to 900 horse power hours per 1000 kilos. of peat dry substance. A 4000 horse power station is now working the process at Dammer Moor, Hanover, and can supply power to the town of Osnabrück. The author points out how profitably the process can be worked in connection with the electrical production of nitrogenous manures. He also calculates that by cultivating for a renewal of the peat, a 4000 horse power station can be worked continuously on an area of 320 hectares (790 acres) of moorland, by removing the peat to a depth of 3 metres (3·3 yards) over an area of 16 hectares (39½ acres) each year, and then allowing 20 years for its renewal.—W. H. P.

Sulphur and sulphuretted hydrogen in illuminating gas; Process for the rapid determination of ——. C. W. Somerville. J. Gas Lighting, 1910, **112**, 28—29.

The determination of total sulphur is based upon the oxidation of sulphur dioxide by iodine, and is effected by passing the products of combustion of the gas through a known quantity of standard iodine solution, containing starch indicator, until decolorisation occurs. The gas is burned at the rate of ⅓ cb. ft. per hour in a Bunsen burner, suitably enclosed in a glass trumpet tube, the upper end of which is connected with the inlet of the absorption vessel The supply of air to the burner is maintained, and the circulation of the gaseous products effected, by means of an ordinary water-jet vacuum pump; and a three-way cock provides for diverting the gas from the meter when the decolorisation of the iodine solution is complete. In the determination of sulphuretted hydrogen, the gas is passed slowly through an absorption vessel containing a known quantity of standard iodine solution, together with a specially prepared starch indicator, until the liquid is decolorised; an aspirator is employed for this purpose, the volume of water displaced being noted as that of the gas used in the experiment. The decolorising effect of hydrocyanic acid, if present, is determined in a second experiment, in which the gas passes through a purifier containing lead carbonate before entering the absorption vessel. The process affords results agreeing closely with those obtained by the usual standard methods, and is primarily intended as a means of efficiently controlling the working of purifiers in gas works.—W. E. F. P.

Sulphur in illuminating gas; Comparison of Bolling's, Harding's, and Drehschmidt's methods for determining ——. E. P. Harding and C. Taylor. J. Ind. Eng. Chem., 1910, **2**, 385—386.

Attempts were made to determine the sulphur in Minneapolis illuminating gas (having a low sulphur content) by a wet oxidation method proposed by Bolling for analysing producer gas. In this method the gas is slowly drawn through absorption bottles containing a saturated solution of bromine in hydrochloric acid. The combined solutions, after addition of a little sodium carbonate, are concentrated by boiling and the sulphuric acid precipitated as barium sulphate. Considerable trouble was experienced in concentrating the solution and precipitating the barium sulphate. The last traces of bromine were expelled with difficulty, the bromine caused troublesome bumping, and it was found necessary to evaporate the solution nearly to dryness and to re-dilute in order to precipitate the barium sulphate. The method was found to give low results with the above gas. Drehschmidt's method (Chem.-Zeit., 1887, 2, 1382) is considered accurate, but the apparatus is complicated and difficulty is experienced in keeping the gas burning continuously with the Drehschmidt burner. In Harding's modification of this method (J. Amer. Chem. Soc., 28, 537) only very simple apparatus is required, with the exception of the specially constructed glass burner in which the gas is burned in the body of a large retort, in the presence of bromine vapour; the products of combustion are drawn through a 5 per cent. potassium carbonate solution, and the sulphur estimated as barium sulphate. The authors consider that purified coal gas contains more complex sulphur compounds than suction producer gas made from hard coal in a continuous automatic feed producer.—A. Sbld.

Petroleum oil of Surachany; Evidence of the production of —— *by natural filtration.* E. Pyhälä. Petroleum, 1910, **5**, 1525—1533.

The author describes filtration experiments in which heavy oils were passed through a medium of fuller's earth (see this J., 1910, 1146), and from these he concludes that the origin of the light petroleum oil of Surachany may be explained upon the filtration hypothesis. In the case of Surachany petroleum oil, the filtration must have taken place in an upward direction with the result that decolorisation and fractionation occurred. Gases that are present under tension undoubtedly play a part in the filtration process. Experiments showed that all minerals of the aluminium silicate group had a decolorising action upon petroleum oil, but that the property was most pronounced in the case of the so-called fuller's earths. In Herr's filtration experiments, which have been put forward as a proof against the filtration theory, the petroleum oil is fractionated into fractions of different shades of colour, but not into fractions as obtained in Day's method of filtration. The principle of the latter method of fractionation is that hydrocarbons of different degrees of viscosity differ in their speed of diffusion. Moreover the optical behaviour of Surachany petroleum oil is in favour of the filtration hypothesis, as Rakusin has shown in his investigations.—C. A. M.

PATENTS.

Coke or other fuel ; Manufacture and purification of ——, and apparatus therefor. W. S. Simpson, London. Eng. Pat. 20,237, Sept. 3, 1909.

Coal or other carbonaceous material is heated in a closed retort in which a vacuum is maintained, until the more volatile constituents have been expelled. The retort is then filled with a desulphurising gas such as carbon monoxide, and all connections are closed for 15 to 45 minutes, and finally the distillation in vacuum is completed, the products being drawn off through a separate exhauster and condenser. The coke may be allowed to cool in a separate vacuum chamber. The carbon monoxide may be generated in the retort from a mixture of 85 per cent. of chalk and 15 per cent. of charcoal.—A. T. L.

Fuel ; Method of purifying —— and increasing its heating power. F. Fritz, London. Eng. Pat. 20,975, Sept. 14, 1909.

Gases generated from fuel in a retort are led, at a temperature of 600° to 1000° C., through a separate chamber containing the fuel (coal, peat, wood, etc.) to be treated, until the temperature of the latter is raised to 300° C., the gases passing back into the retort or into another retort and being ultimately treated for the recovery of by-products. When the current of hot gases through the chamber is stopped, the chamber is closed, and gases are generated under pressure from the hot fuel. The fuel is thus rendered dry and nearly smokeless, and is enriched by the tarry constituents of the coal-gas. The fuel may be formed into briquettes.—A. T. L.

Retort coke-ovens ; Heating arrangement for ——. E. W. King, Assignor to Semet-Solvay Co., Syracuse, N.Y. U.S. Pat. 970,720, Sept. 20, 1910.

Horizontal heating flues are arranged in the dividing walls between adjacent coking chambers, the flues in each wall forming a continuous zig-zag path for the heating gases. Each end of a set of flues is connected to a regenerator arranged beneath the coking chamber and parallel with it, and the regenerators are connected to main flues running the length of the oven and serving for the introduction of air, and discharge of waste gases respectively. Burners are arranged at the ends of each of the horizontal flues, and means are provided for reversing the currents.—A. T. L.

Regenerators for coke-ovens. J. Reichel, Friedenshutte, Germany. Eng. Pat. 343, Jan. 6, 1910.

In order to obtain a uniform draught in the different ovens, each regenerator is composed of two adjacent chambers, which extend the whole length of the battery of ovens and communicate with each other through narrow openings. The chamber which is nearest the chimney has less chequer brickwork than the other.—A. T. L.

Vertical-retort coal-gas apparatus. J. H. Taussig, Assignor to The United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 969,996, Sept. 13, 1910.

The claim is for the combination of a furnace-chamber with a retort-chamber arranged behind the former. A combustion-chamber is arranged between the furnace and the retort-chamber and above the former. Regenerator chambers having their upper ends free to expand are built above the combustion chamber, the air flues being provided with dampers and so arranged that part of the heated air can be supplied to the combustion-chamber and part to the retort-chamber. W. H. C.

Retort-ovens [for the production of lighting gas]. P. Parsy. Fr. Pat. 414,776, April 13, 1910. Under Int. Conv., April 13 and July 29, 1909.

The oven comprises a central gas-producer with two sets of vertical retorts arranged at each side of it. One-half of the oven, or any individual retort can be shut off for repairs. The retorts have a rectangular cross-section and taper outwards from top to bottom. The lower part of the retort is shaped so as to guide the fuel towards a vertical sliding door at the front or back of the oven, the retorts being heated by flues in the transverse dividing walls. The gas is drawn from the retorts at about the middle of their height. The heating-chambers in the several dividing walls are independent of one another, and communicate with gas flues running the length of the oven. A separate regenerator is provided beneath each heating chamber. The producer has two outlets, one serving each half of the oven, and either outlet can be closed. The producer is charged with coke, and tar is admitted near the gas-outlet to enrich the producer gas. As the retorts are heated only at the two longer sides, the period of distillation is at least 24 hours. Water is admitted drop by drop at the top of the retorts, a mixture of water-gas and coal-gas being obtained.—A. T. L.

Gas producers, and method of working the same. J. Stewart, Alfreton, and W. Stewart, Motherwell, N.B. Eng. Pat. 26,858, Nov. 19, 1909.

The producer is divided into two chambers by a hollow metal wall depending from a flat tank which forms the cover of the producer and serves as a boiler for raising the steam required. The two producer chambers are in communication at the lower end, and each is provided with air-inlet and gas-outlet connections at the upper end. In operation, the chamber last charged with fuel is worked with a down-draught, and the other chamber is worked with an up-draught, an auxiliary supply of air being admitted at the bottom. The two chambers are charged with fresh fuel alternately, and the currents are reversed after charging. An eccentrically-rotating grate, as described in Eng. Pat. 15,074 of 1906 may be used. A.T.L.

Gas-producer. W. B. Chapman, Assignor to W. B. Hopping, New York. U.S. Pat. 970,017, Sept. 13, 1910.

A cylindrical producer having spaced concentric inner and outer walls has a hollow agitator beam fastened at each end to the inner wall and extending across the producer. The producer is also provided with cross stays and is arranged so that it can be rotated in a horizontal plane on a circular track supported above the water-sealed ash-pit.—W. H. C.

Gas-producer. P. E. L. Donay. First Addition, dated Mar. 31, 1910, to Fr. Pat. 413,114, Jan. 15, 1910.

The patent relates to apparatus of the kind in which a mixture of air, water-vapour, and coal-dust, is passed through a tube in which partial combustion takes place with formation of producer gas. The tube is arranged vertically so as to dip below water in a closed tank, the upper part of the tank being in communication with a gas-holder. The air supply is moistened by passing through water in a separate compartment of the tank, and the moist air, together with coal dust delivered from a hopper by an endless screw, passes through a mixing fan and into the upper end of the combustion tube. The draught of air is produced either by the mixing fan or by a suction fan in the pipe leading to the holder.—A. T. L.

Suction gas-producer. Soc. Franç. de Matériel Agricole et Industriel. Fr. Pat. 414,232, June 14, 1909.

The producer, which is suitable for lean coal, coke, peat, lignite, and fuels such as wood, sawdust, hay, straw, dry leaves, olive and grape marc, flax and hemp waste, is of the down-draught type. A primary supply of air is admitted above the fuel either from an orifice in the producer wall, or through a central tuyere which is directed downwards, and a number of secondary air inlets are provided at different levels throughout the height of the fuel column, these inlets being regulated according to the nature of the fuel. The fuel column rests upon a movable grate. The gas passes from the base of the producer, through a water seal, a coke scrubber and a sawdust scrubber.—A. T. L.

Gas producers; Process for improving the quality of the gas obtained in ——. V. Defays. Fr. Pat. 414,551, April 7, 1910. Under Int. Conv., April 16, 1909.

The hot gases leaving the producer are intimately mixed with very finely powdered coal or other carbonaceous substance, in quantity sufficient to reduce the carbon dioxide and steam in the gas to carbon monoxide and hydrogen, and to provide an excess of carbon so that the gas will burn with a luminous flame. The gas should be at a temperature of 700°—800° C. when the coal-dust is added, and must if necessary be heated to this temperature after leaving the producer. The combustion products from a gas-fired furnace may be used for this purpose. Flue gases may be treated in this way to form a combustible gas.—A. T. L.

Oils; Deodorization and treatment of mineral and like ——. S. Fabbri, London. Eng. Pat. 21,153, Sept. 16, 1909.

Naphtha of sp. gr. 0·750 is mixed with 2 per cent. of naphthalene and 0·5 to 3·0 per cent. of gas oil or tar oil, and treated with sulphuric acid of 66° B. After 24 hours the oil is decanted and washed with a soap solution containing 0·1 per cent. of oil of bergamot. After 30 mins. the oil is poured off, and the treatment may be repeated if necessary. A similar process is used to give shale oil of sp. gr. 0·795 to 0·810 the semblance of paraffin oil, but the naphthalene is dissolved in light oil and is added at the end of the process.—A. T. L.

Mineral and like oils; Treatment of —— for lighting, motor fuel, and similar purposes. S. Fabbri, London. Eng. Pat. 27,714, Nov. 29, 1909.

Burning oil of sp. gr. 0·810, obtained from petroleum or shale oil, is shaken with 1 per cent. of sulphuric acid of 66° B. and allowed to stand for 24 hours. The oil is then decanted, washed with milk of lime, again decanted, and shaken with 3 per cent. of lime, 2 per cent. of sodium chloride, and 9 per cent. of water. The oil is again decanted, and finally 0·5 to 1 per cent. of naphthalene, dissolved in 1 per cent. of toluene, is added. For motor spirit, the oil is mixed with an equal quantity of a light oil.—A. T. L.

Burner for consuming crude and other combustible oils. E. Nathan, Brussels. Eng. Pat. 24,503, Oct. 25, 1909. Under Int. Conv., Oct. 31, 1908.

The crude oil is conducted through a pipe, insulated in order to prevent premature decomposition, into a vaporising chamber. This chamber consists of a number of concentric, communicating, annular passages formed of badly conducting and refractory material and placed in the middle of the combustion space so that it is heated by the flame. The oil enters the centre of the vaporiser either from above or below and the vapour formed passes laterally to the jets.—W. H. C.

Coal briquettes; Manufacture of ——. W. E. Lake, London. From C. E. Hite, Burlington, N.J., U.S.A. Eng. Pat. 27,960, Nov. 30, 1909.

See U.S. Pat. 941,454 of 1909; this J., 1910, 11. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 935 of 1867 and 6738 of 1902.—T. F. B.

Coke furnace. W. Mueller, Düsseldorf, Germany. U.S. Pat. 971,137, Sept. 27, 1910.

See Fr. Pat. 407,835 of 1909; this J., 1910, 617.—T. F. B.

Coke-oven gases; Apparatus for removing tar from hot ——. Solvay et Cie. Fr. Pat. 414,035, March 25, 1910.

See U.S. Pat. 963,401 of 1910; this J., 1910, 936.—T. F. B.

Gases; Process for extracting tar and tar compounds from ——. W. Feld. Fr. Pat. 414,792, April 13, 1910. Under Int. Conv., April 14, 1909.

See U.S. Pat. 965,147 of 1910; this J., 1910, 999.—T. F. B.

Combustible gases containing carbon dioxide; Process and apparatus for enriching ——. H. L. Doherty. Fr. Pat. 414,164, March 26, 1910. Under Int. Conv., March 31, 1909.

See U.S. Pat. 964,901 of 1910; this J., 1910, 998.—T. F. B.

Gas washers. S. G. Merrick, Philadelphia, U.S.A. Eng. Pat. 342, Jan. 6, 1910.

See Fr. Pat. 411,449 of 1910; this J., 1910, 935.—T. F. B.

Blast-furnace and other gases; Process for purifying ——. F. Sepulchre, Liege, Belgium. U.S. Pat. 970,654, Sept. 20, 1910.

See Eng. Pat. 254 of 1908; this J., 1908, 677.—T. F. B.

Residues of mineral oil and tar; Process of separating solid hydrocarbons from ——. J. Tarne, Rozniatou, Galicia, and G. Oberländer, Berlin. Eng. Pat. 27,116, Nov. 22, 1909.

See Fr. Pat. 409,516 of 1909; this J., 1910, 747.—T. F. B.

Ammonium sulphate direct from coke-oven or retort gas. Eng. Pat. 4473. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Retort furnaces for the destructive distillation of coal. C. B. Tully, London. Eng. Pat. 20,592, Sept. 8, 1909.

In order to prevent overheating and to attain an even temperature in vertical retorts, the fire-gases from the combustion chamber, which is placed over the furnace, and, with the latter, between two rows of retorts, are caused to pass between walls of refractory material before reaching the retort chamber proper. The refractory walls absorb part of the heat of the gases and communicate it to the setting, and the partially cooled gas keeps the retorts at an even temperature. The regular and evenly distributed heating of the retorts is further assisted by dividing the vertical flues by horizontal cross walls.
—W. H. C.

Distilling coal. J. W. Aylsworth, East Orange, and F. L. Dyer, Montclair, N.J. U.S. Pat. 970,364, Sept. 13, 1910.

Smoke-producing constituents are removed from coal by causing it to pass at a definite rate through a distilling-chamber and at the same time passing a rapid current of inert gas from previously distilled coal through the apparatus in the same direction. Before entering the distilling zone of the apparatus, the gas is heated so that the temperature of the coal is raised to between 550° and 800° F. The gas and other volatile products given off from the coal are carried away by the stream of gas, and after separating the vapours by cooling, the gas is divided into two portions, one of which is used to pass through the apparatus and the other is used in any desired way.
—W. H. C.

Distillation gases from coal ; Process for recovering cyanogen and ammonia as a solid salt from —— by washing them directly with acids or acid liquors. K. Burkheiser. Ger. Pat. 225,461, Feb. 9, 1909.

In the usual process for the recovery of cyanogen from coal gas by means of iron compounds, the ammonium ferrocyanide solution from the cyanogen washers contains a considerable quantity of ammonia, and on the other hand, the condensed ammoniacal liquor contains a considerable quantity of cyanogen. According to the present process, the liquor from the cyanogen washers is mixed with excess of an iron salt and introduced into the distilling apparatus in which the ammoniacal liquor is heated with milk of lime. The iron salt fixes the cyanogen compounds, which are converted by the lime into calcium ferrocyanide. When the distillation gases or air are passed through the ammoniacal liquor, a column apparatus is used, the upper portion serving as a cyanogen washer, and the lower portion for driving off the ammonia (to be converted into ammonium salts by the " direct " process) and converting the cyanogen compounds into calcium ferrocyanide.—A. S.

Wood ; Process of separating the products of the destructive distillation of ——. T. H. Kennedy and F. J. Heckel, Bradford, Pa. U.S. Pat. 969,635, Sept. 6, 1910.

The residual tar and oils obtained in wood distillation, after the distillation of the pyroligneous acid liquor, are heated in presence of water (*e.g.*, live steam is blown into them under pressure), the aqueous liquor is distilled, and the oils are separated from the distillate, which is then added to the pyroligneous acid liquor ; the tarry residue obtained from the first distillation of the raw tars separated from the pyroligneous acid liquor, before the distillation of the liquor, is also treated with steam under pressure, the aqueous liquor is distilled, and the distillate freed from oils and added to the other mixed aqueous liquors, which are then treated in the usual manner to recover methyl alcohol and grey acetate.—T. F. B.

Thorium nitrate ; Preparation of pure —— for use in incandescence gas lighting. Dr. Kreidl und Heller. Fr. Pat. 414,463, April 4, 1910.

The thorium compound is converted into the salt of an organic derivative of sulphuric acid, for example, ethylsulphuric acid, and this salt is purified by fractional crystallisation. The differences in solubilities of the ethylsulphates of thorium and its impurities are greater than in the case of the sulphates. The pure ethyl-sulphate is converted into hydroxide, and finally into nitrate, and it is stated that a small admixture of the ethyl-sulphate with the nitrate is of advantage since it gives a bulky oxide on calcination.—A. T. L.

Incandescence mantles ; Manufacture of ——. L. Fontaine and L. Cossard. Fr. Pat. 414,700, June 24, 1909.

The fabric, impregnated with the usual solution of thorium and cerium nitrates, is dried rapidly at 50° C., and then treated in a closed vessel with a gas containing ozone, in order to convert the nitrates into oxides without the use of heat. The mantles are finally incinerated.—A. T. L.

Filaments for incandescence lamps ; Manufacture of ——. The Westinghouse Metal Filament Lamp Co., Ltd. Fr. Pat. 414,257, Mar. 30, 1910. Under Int. Conv., Mar. 31, 1909.

For the manufacture of continuous filaments of tungsten, a filament is squirted from an orifice in the usual way, but instead of being cut into lengths for further treatment, it is passed continuously through the apparatus, being dried, carbonised, heated to successively increasing temperatures in a non-oxidising atmosphere and finally wound on a drum. The squirting jet is at the apex of a conical hood, below which a gas jet is placed so that the filament is dried as it descends. The dried filament rests in a funnel from which it is drawn through a closed chamber filled with a suitable gas. On entering this chamber, the filament is carbonised by passing through the axis of an electrically heated coil. The carbonised filament passes downwards through a series of terminals connected separately to a source of current, so that the portions of the filament between successive pairs of terminals are heated to successively increasing temperatures. These terminals consist of horizontal copper plates, each having a small orifice in which a drop of mercury is held by its surface tension. The filament passes through the centres of these drops of mercury, and a similar arrangement is adopted for the passage of the filament into and out of the chamber.—A. T. L.

Arc lamp electrodes with light-increasing constituents. Gebr. Siemens und Co. Fr. Pat. 414,707, April 11, 1910. Under Int. Conv., May 14, 1909.

The substances added to the electrodes are compounds or mixtures of one or more of the oxides of the rare earth metals, cerium, lanthanum, didymium and zirconium, and one or more of the oxides of calcium, barium and strontium. For example, a mixture or compound of lime and cerium peroxide may be used, and the addition of a fluorine compound, such as flourspar, is recommended. —A. T. L.

Mantles for incandescence lighting ; Manufacture of ——. W. M. Still and A. G. Adamson. Fr. Pat. 414,080, Feb. 28, 1910.

See Eng. Pat. 25,549 of 1908 ; this J., 1910, 480.—T. F. B.

Condensing the products from the distillation of wood in blast-furnaces fed directly with wood. Fr. Pat. 414,514. *See* X.

Ammonia saturator and method of recovering ammonia from coal gases and the like. U.S. Pats. 969,906 and 969,907. *See* VII.

Pyrophoric alloys. Fr. Pat. 414,057. *See* X.

III.—TAR AND TAR PRODUCTS.

Coal tar ; Some constituents of ——. VI. Isopropylbenzene (cumene). G. Schultz and A. Székely. Ber., 1910, **43**, 2517—2521.

The mixture of sulphonic acids from the mesitylene fraction (see this J., 1909, 1188) was decomposed by means of superheated steam, and the hydrocarbons obtained were repeatedly fractionated ; about 30 per cent. of the total quantity distilled up to 161° C. In the portion distilling between 150° and 161° C., isopropylbenzene (cumene) was detected by the production of its liquid mononitro-derivative, from which the amino-derivative and *p*-nitrobenzoic acid were prepared. The same hydrocarbon was also detected in the portion distilling between 150° and 155° C. by converting it into its sulphamide.—A. S.

a-Pyrocresol ; Constitution of ——. F. Zmerzlikar. Monatsh. Chem., 1910, **31**, 897—902.

Of the three substances contained in the last fraction in the distillation of crude carbolic acid, viz. : *a*-, *β*-, and *γ*-pyrocresol, the author has investigated the first, and finds that on fusion of the " oxide " (obtained by the action of chromic acid) *m*-cresol and 3-hydroxy-1-methylbenzene-4-carboxylic acid are obtained. The conclusion is, therefore, that the " oxide " is 4 : 4′-dimethylxanthone and that the original *a*-pyrocresol is 4 : 4′-dimethylxanthane. —J. C. C.

Solubilities of organic substances in organic solvents : a contribution to the theory of solubility. D. Tyrer. Chem. Soc. Trans., 1910, **97**, 1778—1788.

In the course of an investigation as to the effect of the concentration of the solvent on the solubility of a substance, accurate determinations were made of the solubility of anthraquinone in benzene (I.) and in chloroform (II.), of anthracene in benzene (III.), and of phenanthraquinone in benzene (IV.) and in ethyl acetate (V.). The results are shown in the following table, the figures representing grms. of substance per 100 grms. of solvent.

Temp. °C.	I.	II.	III.	IV.	V.
0	0·110	0·340	0·605	—	—
10	0·173	0·457	0·975	0·412	0·518
15	—	—	—	0·471	—
20	0·256	0·605	1·43	0·538	0·626
30	0·350	0·780	2·03	0·738	0·770
40	0·495	0·994	2·78	1·032	0·995
50	0·700	1·256	3·75	1·354	1·292
55	—	1·415	—	—	1·457
60	0·974	1·577	5·14	1·760	1·640
65	—	—	—	—	1·902
70	1·355	—	7·00	2·687	2·215
75	—	—	8·35	—	2·515
80	1·775	—	—	3·770	—

—A. S.

Patents.

Coal tar ; Process for obtaining mineral fat or grease from ——. S. J. Sauvageot, Chaumont, France. Eng. Pat. 442, Jan. 7, 1910. Under Int. Conv., Jan. 20, 1909.

See Fr. Pat. 399,359 of 1909 ; this J., 1909, 932.—T. F. B.

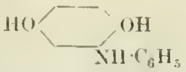
Derivatives [thio-ethers] of the anthraquinone series ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 29,139, Dec. 13, 1909.

See Fr. Pat. 410,152 of 1909 ; this J., 1910, 809.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Aniline ; Oxidation of ——. R. Willstätter and R. Majima. Ber., 1910, 43, 2588—2593.

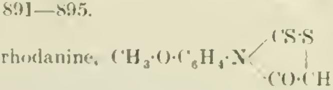
The authors have studied the ortho-condensation of aniline by means of oxidising agents in the absence of catalysts. With ferric chloride is produced a mixture of Aniline Black and dianilinoquinone which, on reduction, yields anilinoquinol,



and this, on oxidation furnishes anilinoquinone. The latter crystallises in bronze-brown rhombic plates. The powder has a dark Bordeaux colour. The solutions are intense red with a tinge of violet and brown and the solution in sulphuric acid is red violet. The substance melts at 117°—118° C. The product obtained by Caro by oxidising aniline with potassium persulphate is probably a dianilinoquinonemonoimine.—J. C. C.

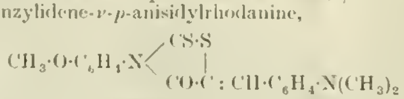
Rhodanines, Substituted ——, *and their aldehyde condensation products.* O. Antulich. Monatsh. Chem., 1910, 31, 891—895.

v-p-Anisidylrhodanine,



$$CH_3\cdot O\cdot C_6H_4\cdot N\begin{cases} CS\cdot S \\ CO\cdot CH_2 \end{cases}$$

is prepared by the action of ethyl monochloroacetate on ammonium *p*-anisidyldithiocarbamate. It forms leaflets of a Naples yellow colour and readily condenses with aldehydes in glacial acetic acid solution. Of the various aldehyde condensation products described, β-dimethyl-*p*-aminobenzylidene-*v-p*-anisidylrhodanine,



$$CH_3\cdot O\cdot C_6H_4\cdot N\begin{cases} CS\cdot S \\ CO\cdot C : CH\cdot C_6H_4\cdot N(CH_3)_2 \end{cases}$$

forms orange red platelets which have a strong affinity for animal fibres.—J. C. C.

Auxochromes. E. Noelting. Chem.-Zeit., 1910, 34, 1016—1017.

The author adduces examples showing that in addition to those groups which are usually recognised as auxochromes, the acid groups picrylamine, $C_6H_2(NO_2)_3\cdot NH\cdot$ dinitrophenylamine, $C_6H_3(NO_2)_2\cdot NH\cdot$, and probably also nitrophenylamine, $C_6H_4(NO_2)\cdot NH\cdot$ hydroxylamine, $\cdot NH\cdot OH$, and hydrazine, $\cdot NH\cdot NH_2$, act in this capacity. The suggestion is made that a compound containing a hydroxylamino-group in the ortho position with respect to a hydroxyl group might be a mordant dyestuff. The 1 : 3- and 1 : 4-hydrazines of tetramethyldiaminotriphenylmethane cannot be directly oxidised but their hydrazones, for example, $[(CH_3)_2N\cdot C_6H_4]_2.CH\cdot C_6H_4\cdot NH\cdot N : CH\cdot C_6H_5$, readily yield the corresponding carbinols, of which the salts of the para series dye blue and those of the meta series green.—J. C. C.

Patents.

Indigo series ; Manufacture of halogen derivatives of the ——, *and of intermediate products.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 22,714, Oct. 5, 1909.

See Fr. Pat. 412,642 of 1910 ; this J., 1910, 1003. The salts of the halogenated dehydro-indigos are converted into the corresponding halogen-indigos by treatment with alkaline or acid reducing agents ; 5.5′.7-tribromo-7′-chloro-indigo, obtained in this manner, is claimed as a new product.—T. F. B.

Indigoid colouring matters of the anthrocene series : Manufacture of ——. Kalle und Co., A.-G., Biebrich on Rhine, Germany. Eng. Pat. 3206, Feb. 9, 1910. Under Int. Conv., Feb. 17, 1909.

By condensing α-anthrol or a substitution product with an α-isatin derivative or a 2 dihalogen-3-oxy-(1)-thionaphthene, vat dyestuffs are obtained which are fast towards alkali and have good affinity for the fibre. The dyestuff from α-anthrol and α-isatinanilide dyes deep blue shades from the vat, which become somewhat redder on soaping. If the anthrol is replaced by 1.5- or 1.8-dihydroxyanthracene (using one mol. of this to two mols. of the isatin or oxythionaphthene), similar products are obtained.—T. F. B.

Azo dyestuffs containing a carbazole nucleus ; Process for making ——. Kalle und Co., A.-G. Fr. Pat. 414,523, April 6, 1910. Under Int. Conv., April 13, 1909, and Feb. 14, 1910.

See Eng. Pat. 8127 of 1910 ; this J., 1910, 1051. The 2.8.6-aminonaphtholsulphonic acid may be used in place of the 2.5.7-acid.—T. F. B.

Disazo dyestuff ; Manufacture of a substantive ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 15,391, June 27, 1910.

When tetrazotised toluylenediaminesulphonic acid ($CH_3 : NH_2 : SO_3H : NH_2 = 1 : 2 : 4 : 6$) is combined with two molecular proportions of 2.5.7-aminonaphtholsulphonic acid in acid solution, a disazo dyestuff is obtained, which dyes cotton orange shades ; these may be developed on the fibre, by means of diazotised *p*-nitraniline, producing vivid Bordeaux-red shades, very fast to washing, and which furnish good white discharges.—T. F. B.

Disazo dyestuffs ; Manufacture of yellow ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on the Maine, Germany. Eng. Pat. 10,331, April 27, 1910.

Disazo dyestuffs dyeing wool in yellow shades, which do not bleed on to white wool or cotton, are prepared by combining the tetrazo-compound of *m*-tolidine or of *m*-dichlorobenzidine with two molecular proportions of 1-sulphoaryl-3-methyl-5-pyrazolone (where "aryl" is limited to phenyl, its homologues and chlorine substitution products of phenyl or its homologues) or with one molecular proportion of this pyrazolone derivative and one of an ortho-hydroxycarboxylic acid of the benzene series, for example, salicylic acid.—J. C. C.

Anthracene compound [dye] and process of making same. F. Kacer, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 970,340, Sept. 13, 1910.

WHEN 2.2′-dimethyl-1.1′-dianthraquinonylamine is treated with a suitable reducing agent, such as alkaline hydrosulphite solution, it is converted into a leuco compound, which, when applied to the fibre and oxidised, produces fast, clear, pink shades unaffected by dilute caustic soda, sodium hypochlorite, or dilute hydrochloric or nitric acid. —T. F. B.

Anthracene series ; New products of condensation of the ——, new dyestuffs derived from them, and their application in dyeing and printing. Badische Anilin und Soda Fabrik. First Addition, dated April 2, 1910 (Under Int. Conv., Feb. 11, 1910), to Fr. Pat. 408,787, Nov. 9, 1909 (this J., 1910, 621).

THE dyestuffs described in the chief patent, when halogenated, particularly brominated, give new vat dyestuffs, the shades of which are brighter and redder than the original dyestuffs. The effect is the same if the condensation products prepared from anthraquinone halogen derivatives and thiosalicylic or anthranilic acid are brominated and the subsequent condensation afterwards carried out.—J. C. C.

Vat dyestuffs ; Production of red ——. Badische Anilin und Soda Fabrik. Fifth Addition, dated April 2, 1910 (Under Int. Conv., Oct. 9, 1909, and Jan. 26, 1910) to Fr. Pat. 365,920, May 4, 1906 (this J., 1906, 979 ; 1907, 960 ; 1908, 1015 ; 1910, 267).

DYESTUFFS similar to those described in the Fourth Addition (this J., 1910, 267) can be obtained by using, instead of the halogenated ketones therein mentioned, halogenated derivatives of fluorenone or of diphenylmethane. The substances given in the examples are mono- and di-bromo- and dichloro-fluorenone and 4 : 4′-dichlorodiphenylmethane.—J. C. C.

Vat dyestuffs ; Manufacture of brominated ——. O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 6351, Mar. 14, 1910.

IN continuing the study of the process described previously (this J., 1907, 1194 ; 1908, 71), it is found that bromination of the dyestuffs of the thioindigo or indirubin series can also advantageously be effected under pressure. The dyestuffs are heated with bromine in presence or absence of a diluent, and of a carrier of bromine. The product thus obtained from thioindigo (a mixture of tri- and tetrabromothioindigo) dyes cotton in violet red shades which are fast to washing, light and steam. The dyeings on wool are fast to fulling. The highly brominated derivatives of the condensation product of *a*-isatinanilide and 3-oxy-1-thionaphthene dye cotton in blue shades and the hexabromo-derivative of indirubin gives violet tints.—J. C. C.

Vat dyestuffs ; Halogenated —— dyeing like indigo. Soc. pour l'Ind. Chim. à Bâle. Seventh Addition, dated June 19, 1909, to Fr. Pat. 372,627, Dec. 17, 1906.

DYESTUFFS producing similar shades to those described in the First Addition (this J., 1907, 1135) are obtained by halogenating nitro-, amino- or acidylamino-derivatives of indirubin instead of the latter itself. Nitroindirubin is prepared by condensing nitroisatin with indoxyl ; on reduction it gives the corresponding amino-derivative. The halogenation (best by bromine) is effected as previously described.—J. C. C.

Vat dyestuffs ; Production of new ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 414,043, June 9, 1909.

NEW vat dyestuffs are obtained by condensing nitro-derivatives of *o*-carboxyphenylthioglycollic acid with isatin or its homologues, or substitution products, reducing the products, and, after acetylation if necessary, treating with halogens. The nitro-compounds may also be halogenated and subsequently reduced. The dyestuffs thus obtained dye both wool and cotton in brownish yellow to brownish violet shades.—J. C. C.

Anthracene series ; Production of dyestuffs of the ——. Farbenfabr. vorm. F. Bayer und Co. Third Addition, dated April 6, 1910 (Under Int. Conv., April 22, 1909) to Fr. Pat. 400,653, Mar. 10, 1909 (this J., 1909, 1029 ; 1910, 81, 412).

IF the aminoanthrimides are substituted for the aminoanthraquinones mentioned in the chief patent, the process of benzoylation gives rise to vat dyestuffs although the aminoanthrimides themselves do not, as a rule, dye from the vat. A table is given showing the shades produced by the benzoylated aminoanthrimides. The latter are produced by condensing an aminoanthraquinone with a chloroanthraquinone, nitrating, and reducing the product, or by condensing an aminonitroanthraquinone with a chloroanthraquinone and subsequent reduction.—J. C. C.

Gallocyanine series ; Production of dyestuffs of the —— and of their leuco-compounds. Fabr. de Couleurs d'Aniline et d'Extraits, ci-dev. J. R. Geigy. Fr. Pat. 414,305, June 15, 1909.

GALLOCYANINES are prepared by condensing nitrosomethylethylaniline (instead of nitrosodimethylaniline) with gallic acid, its methyl ether or with gallamic acid. The dyestuffs produced are bluer and more soluble than those prepared from nitrosodimethylaniline.—J. C. C.

Acid wool [azo] dyestuffs ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,344, Nov. 13, 1909. Addition to Eng. Pat. 7820, April 1, 1909.

SEE Addition of Nov. 22, 1909, to Fr. Pat. 402,546 of 1909 ; this J., 1910, 686.—T. F. B.

Azo dyestuffs ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,716, Dec. 8, 1909.

SEE Fr. Pat. 410,116 of 1909 ; this J., 1910, 809.—T. F. B.

Colouring matter lakes [from azo dyestuffs] : Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 932, Jan. 13, 1910.

SEE Fr. Pat. 411,938 of 1910 ; this J., 1910, 1002.—T. F. B.

Trisazo dye. A. Blank and W. Bergdolt, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 971,111, Sept. 27, 1910.

SEE Fr. Pat. 411,325 of 1910 ; this J., 1910, 938.—T. F. B.

Azo dyestuffs ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 414,294, March 11, 1910. Under Int. Conv., May 17, 1909.

SEE Eng. Pat. 12,205 of 1909 ; this J., 1910, 554.—T. F. B.

Vat dyestuffs of the anthracene series and intermediate products ; Manufacture of ——. Soc. pour l'Industrie Chimique à Bâle, Basle, Switzerland. Eng. Pat. 133, Jan. 3, 1910. Under Int. Conv., Jan. 4, 1909.

SEE Fr. Pat. 407,593 of 1909 ; this J., 1910, 482.—T. F. B.

Dyestuffs of the indigo series ; Production of brown ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 414,046, June 9, 1909.

SEE Eng. Pat. 14,314 of 1909 ; this J., 1910, 621.—T. F. B.

Colouring matters of the pyrazolone group : Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 3002, Feb. 7, 1910.

SEE Addition of Feb. 21, 1910, to Fr. Pat. 398,602 of 1909 ; this J., 1910, 1099.—T. F. B.

Vat [anthracene] dye and process of making same. R. Bohn. Mannheim. Assignor to Badische Anilin und Soda Fabrik. Ludwigshafen on Rhine. Germany. U.S. Pat. 970,878. Sept. 20. 1910.

SEE Fr. Pat. 409,381 of 1909; this J., 1910. 686.—T. F. B.

Sulphide dyestuffs; Process for producing brown ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 414,062. Feb. 12. 1910.

SEE Eng. Pat. 2627 of 1910; this J., 1910. 412.—T. F. B.

Dibromo-isatin; Process for making ——. Kalle und Co. A.-G. Fr. Pat. 414,820. April 14, 1910.

SEE Eng. Pat. 8239 of 1910; this J., 1910, 939.—T. F. B.

Monoazo dyestuffs; Process for producing chrome-mordant ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 414,701, June 24, 1909.

SEE Eng. Pat. 13,917 of 1909; this J., 1910. 267.—T. F. B.

Yellow lakes. U.S. Pats. 970,072 and 970,073. *See* XIII.

Red lakes [from azo dyestuffs]. Addition to Fr. Pat. 297,330. *See* XIII.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Silk; Comparative investigation of the composition and structure of different kinds of ——. *X. Mono-amino acids of the cocoon of the Italian silk-worm.* G. Roose. Z. physiol. Chem., 1910, 68, 273—274.

THE cocoons, which contained 28 per cent. of sericin, were examined in the usual way, the results of hydrolysis calculated upon the ash-free substance (ash = 1·9 per cent.) being as follows:—Glycocoll, 33·5; alanine, 20.0; leucine, 0·75; serine, 1·9; aspartic acid, 1·0; glutamic acid, 0·25; phenylalanine, 1·2; tyrosine, 9·0; and proline, 0·8 per cent.—C. A. M.

Silk; Comparative investigation of the composition and structure of different kinds of ——. *XI. Mono-amino-acids of the cocoon of the Japanese silkworm, "Haruko."* A. Suwa. Z. physiol. Chem., 1910, 68, 275—276.

THE cocoons, which were obtained from the Province of Mieken in Japan, yielded 18 per cent. of sericin and 0·4 per cent. of ash (calculated upon the substance dried at 120° C.). The following proportions of amino-acids were obtained on hydrolysis:—Glycocoll, 35·0; alanine, 22·6; leucine, 0·7; serine, 0·7; aspartic acid, 1·0; glutamic acid, 0·07; phenylalanine, 1·3; tyrosine, 9·7; and proline, 0·7 per cent.—C. A. M.

Indian fibres for paper-making. D. Hooper. Annual Report, Indian Museum, Industrial Section, 1909—1910, 35—36.

SAMPLES of different fibrous substances examined to ascertain their value for the manufacture of paper, gave the following results:—

Fibres.	Cellulose.	Water.	Ash.
	per cent.	per cent.	per cent.
Coir refuse (*Cocos nucifera*) from Malabar	27·9	10·7	32·9
Leaves of *Areca catechu* from the Dooars	31·9	—	—
Bark of tree (*Bauhinia*), Central Provinces............	48·4	10·5	6·6
Stem of grass ("Elkora"), Assam	50·4	7·8	3·3
Sacchi bark (*Aquilaria agallocha*), Assam	41·8	9·3	10·7
Sacchi bark, cleaned and peeled	53·1	10·2	5·2
Sacchi bark, polished	55·1	9·8	6·1
Rags, raw material	57·2	6·4	11·0
Rags, bleached and washed, 2nd stage	65·2	8·0	15·0
Rags, bleached and washed, 3rd stage	72·8	5·9	8·5
Rags, bleached and washed, 4th stage	78·7	6·4	2·3

The high proportion of ash and large amount of fibre of dark colour rendered the coir fibre useless for paper making. The bark fibre and grass stems were considered satisfactory. The sacchi bark is a natural paper of Assam, and is used in the polished state as a writing material. Twelve kinds of grass from Kathiawar were also examined, and found to contain from 31·8 to 43·9 per cent. of cellulose and 4·4 to 14·5 per cent. of ash.—C. A. M.

ω-Hydroxy-symm.-methylfurfural and its relation to cellulose. E. Erdmann. Ber., 1910, 43, 2391—2398.

THE author has prepared ω-hydroxy-*symm.*-methylfurfural from the corresponding bromo-derivative obtained from cellulose or lævulose by Fenton and Gostling's method (this J., 1899, 404; 1901. 757). The crude ω-bromomethylfurfural is dissolved in 50 per cent. alcohol and the solution is poured into aqueous silver acetate at 80° C. The product is extracted with ether and distilled under a pressure of 0·001 mm. Under this high vacuum the hydroxymethylfurfural distils as a colourless oil at 66°—72° C.; 150 grms. of cellulose yielded 5·5 grms. of the product. If the heating be too prolonged or severe, the substance is converted into an isomeride which distils at 110° C. *in vacuo*. ω-Hydroxymethylfurfural has an odour of camelia, and gives colour reactions with amines and many phenols. With a solution of 1 part of β-naphthylamine in 4 parts of glacial acetic acid, it gives a characteristic yellow colour; with an alcoholic solution of pyrocatechol and a few drops of strong sulphuric acid it gives a fine red coloration, changing to blue on dilution with alcohol. The ω-hydroxymethylfurfural gives no characteristic derivative with phenylhydrazine, but with an aqueous solution of semioxamazide it gives a semioxamazone crystallising in white needles, m. pt. 216° C. The isomeride mentioned above is obtained by heating ω-hydroxymethylfurfural with a solution of oxalic acid in a sealed tube at 134° C. The product gives the same colour reactions as the original, but it has a fainter odour, and yields a phenylhydrazone crystallising in yellow needles, m.pt. 137° C.; its semioxamazone does not melt, but chars at about 260° C. The production of ω-hydroxymethylfurfural from a group of the dextrose constitution may be formulated by the elimination of 3 mols. of water. The isomeride above described occurs in appreciable proportions among the products of the destructive distillation of cellulose (see next abstract); it may, however, be inferred that the ω-hydroxy-derivative is the primary product, the isomeride being formed by the migration of the hydroxyl from the methyl group to the ring.—J. F. B.

Cellulose; Products of destructive distillation of ——. E. Erdmann and C. Schaefer. Ber., 1910, 43, 2398—2406.

THE authors have submitted large quantities of pure filter paper to destructive distillation in a copper retort in charges of 1 kilo.; each distillation occupied 2 hours. The gases collected at the end of one hour contained 65·5 vol. per cent. of carbon monoxide, 19·0 of methane and 11·5 of hydrogen. By means of a condenser cooled by liquid air a small quantity (0·8 per cent.) of a liquid stable at the ordinary temperature and containing acetone was collected. The tar amounted to 4·7—5·0 per cent. of the cellulose, and the aqueous distillate to about 42 per cent. The present investigations were confined to the examination of this "water." The liquid, which was strongly acid, was nearly neutralised with sodium carbonate, whereby products of a humus nature were precipitated, and was then shaken with ether. The oily extract, representing about 4·5 per cent. of the cellulose, was fractionated under a pressure of 0·002 mm. The aqueous residue contained an appreciable quantity of formaldehyde. The first and second fractions of the ethereal extract consisted largely of furfural, which is formed in considerable quantities by the destructive distillation of cellulose. The third fraction deposited white crystals which were identified as maltol, melting at 160·5° C., which gives a deep violet coloration with ferric chloride and which was first discovered by Brand in roasted malt. 2·8 grms. of maltol were isolated from the "water" from 9 kilos. of cellulose, but further quantities might exist in the tar. The authors have also obtained maltol by the destructive distillation of starch. From the third fraction were also isolated considerable quantities of the semioxamazone of hydroxymethylfurfural. This body was identical with the higher boiling "isomeride" described in the preceding abstract. The same fraction also yielded γ-valerolactone which had previously been found by Grodski in pyroligneous acid. The fourth fraction and residue consisted of highly coloured syrupy and asphaltum-like products.—J. F. B.

Use of silk peptone in the detection of peptalytic enzymes. Abderhalden and Steinbeck. *See* XXIII.

Artificial silk in Canada: Customs decision. Board of Trade J., Oct. 13, 1910. [T.R.]

The duty on the yarn of artificial silk produced from cotton or wood pulp, on entry into Canada, is the same as that leviable on cotton (under Tariff items 520 and 522*) where the yarn is coarser than No. 40, but (under Tariff item 532) for No. 40 and finer yarns there is no duty, and this applies to silk yarn, as well as to cotton, on importation into the Dominion.

Patents.

Wool-scouring solution for cleansing wool for manufacture, etc. J. H. Chambers and W. Moffatt, London. Eng. Pat. 25,321, Nov. 3, 1909.

The solution is prepared by mixing 3 lb. of oatmeal with half a gallon of water, making up to 6 gallons, and then adding 2½ gallons of "lant," 2 gallons of benzine, 1 gallon of methylated spirit, 2 lb. of chloroform and 1 ounce of oil of citronella.—F. M.

Wool, hair and silk; Treatment of animal substances such as ——, to increase their resistance to water, heat and chemical changes. L. Meunier, Lyons, France. Eng. Pat. 4557, Feb. 23. 1910.

It is stated that an increased power of resistance to the action of the agents mentioned is obtained by subjecting the materials to the action of oxidation products of phenols. Wool, immersed for 24—48 hours in a 1 per cent. solution of quinone and dried, assumes a violet-rose colour; the tenacity and elasticity of the material are increased, as also its power of resistance to the destructive action of water, heat, etc., and its affinity for dyestuffs is also increased. —F. M.

Flax; Process of retting ——. P. Riva, Buenos Aires. U.S. Pat. 971,076, Sept. 27, 1910.

Flax is treated with a solution of sulphur dioxide, subjected to a vacuum, and then submitted to the action of steam under pressure.—T. F. B.

Fibre-yielding materials; Process for reducing ——. G. H. Marshall, Roanoke Rapids, N.C. U.S. Pat. 971,457, Sept. 27, 1910.

The materials are introduced into a digester together with an alkaline solution, and rotated and submitted to "mild" steam pressure; the air and gases are then removed from the digester, and the steam pressure is gradually increased and finally suddenly reduced. The liquid is now removed and the fibrous materials washed, freed from water by pressure, again washed, and dried.—T. F. B.

Artificial silk; Process for utilising the refuse from the manufacture of —— from cellulose. Vereinigte Glanzstoff Fabriken A. G., Elberfeld, Germany. Eng. Pat. 15,700, June 30, 1910. Under Int. Conv., Dec. 20, 1909.

Hydrated cellulose reacts with formic acid, in the presence of sulphuric acid or zinc chloride, yielding formic acid esters of cellulose. A suitable raw material is the "waste" which is produced in the manufacture of any of the artificial silks from cellulose. This waste is readily dissolved by gently warming with ordinary formic acid of 90—95 per cent. strength, and from solutions of suitable concentrations threads or films of formylcellulose may be obtained by the usual methods.—F. M.

Spinning artificial fibres; Apparatus for ——. C. C. Leclaire. Fr. Pat. 414,520, June 21, 1909.

The viscose or other composition is forced by means of a pump giving a constant flow along a flexible pipe and through the holes of a revolving nozzle into a coagulating bath. The nozzle, which is provided with a filtering device just before the point of delivery, is rotated by means of a water turbine which also drives the pump. The spinning nozzle is so mounted that it can be lifted out of the coagulating bath without stopping the machine. —P. F. C.

Acetylcellulose; Process for making solutions of —— and masses similar to celluloid therefrom. A. Eichengrün. First Addition, dated March 19, 1910, to Fr. Pat. 412,797, Jan. 20, 1910. Under Int. Conv., April 15, 1909.

The solutions of acetylcellulose prepared as described in the principal patent (this J., 1910, 1005), are utilised for coating paper, fabrics, leather, metals, and other materials; if the coated surfaces are brought into contact with polished or engraved surfaces, with or without the use of heat or pressure, products with a brilliant gloss or embossed surface may be produced.—T. F. B.

Plastic substances; Process for making non-inflammable ——, and substances made by its use. W. Merckens and H. B. Manissadjian. Fr. Pat. 414,679, April 9, 1910.

In preparing celluloid substitutes from cellulose acetate according to Fr. Pat. 413,657 (this J., 1910, 1101), there is difficulty in obtaining concentrated solutions of the cellulose acetate. It is now proposed to substitute for the acetate, mixed esters of cellulose, derived from cellulose acetate, which can be dissolved in acetone giving solutions of up to 75 per cent. strength. These esters are combined with the esters of phenol, cresols, or naphthols as previously described.—T. F. B.

Drying wool and other fibrous materials; Machine for ——. W. McNaught. Fr. Pat. 414,712, April 11, 1910.

See Eng. Pat. 7523 of 1909; this J., 1910, 559.—T. F. B.

Acetylcellulose; Method of producing coatings from ——. A. Eichengrün, Berlin. Eng. Pat. 18,076, Feb. 28, 1910. Under Int. Conv., April 15, 1909. Addition to Eng. Pat. 1441 of 1910, dated Jan. 25, 1909.

See Addition of March 19, 1910, to Fr. Pat. 412,797 of 1910; preceding.—T. F. B.

Cellulose; Manufacture of threads, filaments, strips, and films of ——. L. P. Wilson, Coventry, Assignor to S. Courtauld and Co., Ltd., London. U.S. Pat. 970,589, Sept. 20, 1910.

See Eng. Pats. 21,405 of 1907 and 5595 of 1908; this J., 1908, 1057.—T. F. B.

Cellulosic films; Process and apparatus for the continuous manufacture of ——. E. Brandenberger. Fr. Pat. 414,518, June 21, 1909.

See Eng. Pat. 15,199 of 1909; this J., 1910, 147.—T. F. B.

Cellulosic films; Machine for drying ——. E. Brandenberger. Fr. Pat. 414,594, June 22, 1909.

See Eng. Pat. 15,281 of 1909; this J., 1910, 83.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Rongalite [sodium sulphoxylate formaldehyde] and amine salts. A. Binz and T. Marx. Ber., 1910, **43**, 2344—2349.

The authors find that rongalite (this J. 1910, 690) gives crystalline precipitates with the hydrochlorides of *o*-toluidine and anthranilic acid even in the absence of formaldehyde. The reaction probably proceeds in two stages, the end-product being $R.NH.CH_2.O.S(OH).NH_2.R$. *o*-Toluidine yields a mass of white crystals melting at 101°—104° C. The compound reduces indigo carmine on warming. When β-naphthylamine is treated with rongalite, naphthacridine is formed. The product obtained from anthranilic acid consists of colourless crystals which melt and decompose at 143° C. When hydroxylamine hydrochloride is treated with rongalite, crystals of the hitherto unknown oxaminomethylsulphurous acid, $HO.NH.CH_2.O.SO_2H$, m. pt. 191° C. are obtained. This substance does not reduce indigo carmine.—J. C. C.

Aldehyde-sulphoxylates and potassium cyanide. A. Binz and T. Marx. Ber., 1910, **43**, 2350—2352.

It is shown that when an indigo vat is prepared with rongalite in the presence of potassium cyanide, the action of the former is very considerably increased. Potassium cyanide itself has no action in reducing indigo and it has also no accelerating action when the vat is prepared by means of benzaldehyde-sulphoxylate. Its action, in the case of rongalite, is considered to be a catalytic one. —J. C. C.

Patents.

Bleaching-starch. A. Holste, Bielefeld, Germany. Eng. Pat. 30,390, Dec. 29, 1909.

Claim is made for a mixture of starch and an oxidising agent, such as sodium perborate, or persulphate, to be used in laundry work. It is stated that the active oxygen is prevented from escaping by the glazing of the starch, and remains in contact with the fibre, which thus becomes thoroughly bleached.—F. M.

Bleaching by means of the oxygen of the air; Process of ——. R. Müller. Fr. Pat. 414,821, April 14, 1910. Under Int. Conv., April 16, 1909.

The material is treated, preferably at a high temperature and under pressure, with an aqueous solution of the hydroxide of an alkali or alkaline-earth metal, through which a current of air or oxygen is being forced. The bleaching is accelerated if a small quantity of some suitable salt such as manganese carbonate is added to the solution.—P. F. C.

Yarn in the hank; Apparatus for treating —— with a circulating liquor. Färberei- und Appreturges. vorm. A. Clavel und F. Lindenmeyer. Fr. Pat. 414,735, April 12, 1910.

The hanks are freely suspended from rotating yarn carriers which are arranged in the upper part of a dye-vat. Above them and parallel to the carriers are mounted a number of perforated pipes branching out from a larger pipe which is connected to a pump. This pump is also in connection with a large pipe which passes along the bottom of the vat, and is provided with a number of perforated branch pipes. The dye-liquor is discharged from the upper pipes on to the hanks and is aspirated through the lower pipes to be afterwards re-delivered into the vat from above. The currents set up in the vat by the aspiration of the liquor keep the hank under sufficient longitudinal tension to prevent them from entangling.—P. F. C.

Printing textile fabrics, paper, etc.; Machine for ——. E. Mertens, Freiburg, Germany. Eng. Pat. 18,184, July 30, 1910. Under Int. Conv., Aug. 2, 1909.

To obtain sharp impressions in printing, it is necessary to use rollers of small diameter for pressing the material against the printing roller. The rollers are arranged one above the other in a vertical frame; the printing roller takes up the colour (by contact) from the bottom one, which revolves in the colour trough, and the pressure roller which is of large diameter, presses a roller of small diameter upon the printing roller. The back grey is led between these two and forms the elastic bed necessary in printing.—F. M.

Wool, skins, textile and other materials; Process and apparatus for degreasing and treating ——. C. R. Mayo. Fr. Pat. 414,670, April 9, 1910.

See Eng. Pats. 8600, 17,125, and 22,615 of 1909; this J., 1910, 941.—T. F. B.

Yarn mercerising machine. P. Hahn, Neiderlahnstein a. Rhein, Germany. Eng. Pat. 21,952, Sept. 27, 1909.

See Fr. Pat. 405,551 of 1909; this J., 1910, 418.—T. F. B.

Washing, moistening, or dyeing cylindrical objects, especially thread on bobbins; Machine for ——. E. Herzog. Fr. Pat. 414,385, April 1, 1910. Under Int. Conv., April 2, 1909.

See Eng. Pat. 8086 of 1910; this J., 1910, 1153.—T. F. B.

Printing plates; Process for preparing ——. H. Strecker-Aufermann, Munich, Germany. Eng. Pat. 30,555, Dec. 31, 1909. Addition to Eng. Pat. 3699, Feb. 15, 1909.

See Addition to Dec. 28, 1909, to Fr. Pat. 408,259 of 1909; this J., 1910, 942.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Nitric acid; Test for ——. F. Klein. J. Ind. Eng. Chem., 1910, **2**, 389.

The reagent is made by adding a trace of powdered tellurium to 2—3 c.c. of fuming sulphuric acid, and then further adding 1—2 c.c. of 95 per cent. sulphuric acid. The eosine-red colour is immediately discharged on gently warming with a little of a nitrate or of strong nitric acid. Dilute nitric acid (less than 40 per. cent.) is neutralised and the solution evaporated to dryness before applying the test. The author finds that a solution of 0·1 grm. of tellurium in 10 c.c. of fuming sulphuric acid and 10 c.c. of 95 per cent. sulphuric acid is decolorised by 0·66 grm. of 66 per cent. nitric acid. A colorimetric determination can thus be made.—A. Sbld.

Acetic acid; Reaction for distinguishing acetic anhydride from glacial ——. F. Klein. J. Ind. Eng. Chem., 1910, **2**, 389.

The specimen is boiled with a small crystal of selenious oxide or preferably sodium selenite. A red precipitate of amorphous selenium is obtained with the anhydride, whilst with glacial acid an absolutely clear solution is produced.—A. Sbld.

Formic acid; Determination of —— in the presence of acetic acid. H. Delehaye. Ann. Falsif., 1910, **3**, 386—388. (See also Joseph, p. 1189.)

The method proposed depends on the reduction of mercuric sulphate by formic acid; the resulting precipitate of mercurous sulphate is collected and weighed. The mercuric sulphate used in the determination is prepared by mixing 10 grms. of yellow mercuric oxide with 20 c.c. of hot water and adding sulphuric acid drop by drop until the oxide has dissolved; the mixture is then diluted to a volume of 250 c.c. A quantity of the solution under examination, containing not more than 0·2 grm. of formic acid, is heated with 50 c.c. of the mercuric sulphate solution on the water-bath under a reflux condenser for 45 minutes. The mixture is then cooled rapidly, and the liquid decanted through a weighed filter, the volume of the filtrate being measured. The precipitate is washed on to the filter with a saturated mercurous sulphate solution, and, after being washed with 50 per cent. alcohol, the filter and precipitate are dried at 110° C., and weighed. To the weight obtained, is added a quantity in the proportion of 0·02 grm. for every 100 c.c. of the filtrate, and the corrected weight multiplied by 0·0927 gives the amount of formic acid present. The volume of the solution should not be less than 100 c.c., and the liquid should be decanted immediately the mixture is cold; otherwise, crystals of mercuric salts are liable to form and increase the weight of the precipitate. The quantity of mercuric sulphate (50 c.c.) mentioned is equivalent to 2 grms. of mercuric oxide, whilst 0·2 grm. of formic acid is capable of reducing 1·88 grm. of mercuric oxide, hence the necessity of taking not more than 0·2 grm. of the acid for the determination.—W. P. S.

Lactic acid; Causes of error in determining the strength of commercial solutions of ——. L. Monin. Rev. Gen. Mat. Col., 1910, **14**, 279—281.

The impurities contained in commercial lactic acid, viz., sugars and starchy substances, as well as adulterants such as dextrin, are stated to cause high results in determining the amount of lactic acid, both by the usual acidimetric method and the oxidation process with alkaline permanganate. Boiling the neutral liquid, obtained in the direct titration of the diluted acid with $N/1$ sodium hydroxide solution, with an excess of alkali, titrating back with $N/1$ acid, and calculating the additional quantity of alkali thus required as lactic anhydride (see this J., 1906, 339) is considered useless. As the anhydride is converted into lactic acid by boiling with water or even by prolonged exposure to moist air, the author concludes that it does not exist in the commercial acid. The author recommends the following process of determining the amount of lactic acid, as giving the most trustworthy results:—2 grms. of the acid are shaken in a stoppered tube with 30 c.c. of perfectly neutral absolute alcohol; on standing, the sugars and insoluble or little soluble starchy substances are deposited. The precipitate is filtered off and washed with ether. The filtrate and washings are evaporated *in vacuo*, the residue taken up with boiling water and the acidity determined by titration with $N/1$ sodium hydroxide, using phenolphthalein as indicator. (See also this J., 1900, 1152.)

—A. Sbld.

Iodine; Action of —— *on chlorate and bromate.* Klinger. Chem.-Zeit., 1910, **34**, 1023.

The author attacks the view that the affinity of the halogens for oxygen is in inverse order to their affinity for hydrogen. By the action of iodine on chlorate, iodate is ultimately produced, but the reaction does not proceed in one stage nor in the absence of acid. Chlorine is first liberated; this combines with the iodine to form iodine trichloride which then decomposes the chlorate. The change from chlorine and chlorate to chloride and hypochlorite is a reversible reaction dependent on the temperature. Bromates are acted upon in a similar manner.

—H. H. S.

Nitrate solutions; Action of crushed quartz upon ——. H. E. Patten. J. Phys. Chem., 1910, **14**, 612—619.

In the course of a study of the absorption of soluble salts from solution, it was observed that although sodium nitrate was apparently abstracted from aqueous solution by finely powdered quartz, the quartz after the experiment contained neither nitrate nor caustic soda. It would appear that the sodium nitrate is decomposed, and the decomposition products are not retained by the quartz. It is known that sodium nitrate is decomposed by bacteria, and the question arose as to what part, if any, was played by the quartz surface in that decomposition. Further experiments showed that when silver nitrate solution was allowed to percolate, under sterile conditions, through finely powdered quartz, there was a slight but distinct reduction to substances capable of decolorising permanganate, and a certain quantity of silver was retained by the quartz in such a form that it could not be removed by water but was dissolved by ammonia solution. The amounts of oxidisable compounds formed and of silver retained decreased as percolation proceeded, indicating that the effects were due to an absorption which decreased as the absorptive capacity of the quartz surface was satisfied. Sodium nitrate solution was not reduced to compounds capable of decolorising permanganates, in the course of its percolation through quartz powder under sterile conditions.—A. S.

Silica; Expansion and thermal hysteresis of fused ——. G. W. C. Kaye. Phil. Mag., 1910, **20**, 718—728.

From the results obtained by various workers on the coefficient of expansion of fused silica, which, as is well known, is smaller than that of any other known substance, good "invar" excepted, a curve has been constructed which is considered to represent with fair accuracy the expansion of clear, transparent, annealed silica from −190° to +1100° C.; it shows that the coefficient of expansion is negative below −80° C., zero at −80° C., slowly increases to a maximum at about 500° C., diminishes somewhat up to about 900° C., and afterwards rapidly increases. The following mean values for the coefficient of expansion, over various ranges of temperature, have been derived:—

Temperature range.	Expansion coefficient.	Temperature range.	Expansion coefficient.
−160° to −120° C.	$-0{\cdot}43\times10^{-6}$	30° to 100° C.	$0{\cdot}53\times10^{-6}$
−120° „ −80°	−0·11 „	100° „ 500°	0·58 „
−80° „ −40°	+0·14 „	500° „ 900	0·50 „
−40° „ 0°	0·31 „	900° „ 1100°	0·80 „
0° „ 30°	0·42 „		

It is found that, for temperatures below about 500° C. the translucent satin-like variety expands slightly more than the transparent silica, while, for temperatures above 500° C., the reverse is true; the difference is, however, very small. The change-point at about 1000° C. agrees with the observation of Day and Shepherd that, at all temperatures above about 1000° C., quartz and fused silica devitrify into crystalline tridymite, which is the stable phase above this temperature. Experiments on rods of fused silica (both clear and translucent) which were subjected, for periods of from 1—90 hours, to various temperatures over a range of from about −190° to 400° C., showed as a rule, as with "invar," a negative linear after-effect due to thermal hysteresis, the contraction, after heating and cooling to the original temperature, being greater than the preceding expansion; silica was found to compare very favourably, as regards this after-effect, with "invar" and with two special Jena thermometry glasses, there being practically nothing to choose between the clear kind and the cheaper translucent variety. Fused silica has been adopted for the construction of a standard metre at the National Physical Laboratory.—F. Sodn.

Lime-silica; Fusion and solution experiments in the series ——. H. Philippi. Tonind.-Zeit., 1910, **34**, 1318—1319.

Calcium trisilicate, $2CaO.3SiO_2$, bisilicate, $CaO.SiO_2$, sesquisilicate, $4CaO.3SiO_2$, singulosilicate, $2CaO.SiO_2$, and subsilicate, $3CaO.SiO_2$, have been prepared from corresponding mixtures of pure lime and silica; their respective melting points are 1450°, 1515°, 1495°, 2000°—2100°, and 2200°—2300° C.; on cooling, the last two fall to a fine white crystalline powder, but this may be prevented with the others by cooling suddenly. Quantitative experiments, the results of which are given, on the behaviour of the above compounds, when shaken for 15 hours with distilled water, $N/10$ hydrochloric acid, $N/10$ potassium hydroxide, saturated ammonium chloride solution, and a 10 per cent. solution of dextrose respectively, show that all are attacked by aqueous solvents, the amount decomposed depending on the proportion of solvent present; their stability increases with the silicic acid content, and they are least affected by pure water and $N/10$ potassium hydroxide.

For the detection of free lime, the author has used hydrogen sulphide (anhydrous), and, although no quantitative reaction has been established, the method is held to be suitable for qualitative purposes. Hart's method of detecting free lime by means of 10 per cent. alcoholic iodine solution is criticised on account of the strong oxidising action of iodine on alcohol in the presence of lime. —F. Sodn.

Compounds of nitric oxide with cupric salts. W. Manchot. Annalen, 1910, 375, 308—315.

A solution of copper sulphate in concentrated sulphuric acid absorbs nitric oxide, giving an intense bluish-violet solution which contains a molecule of nitric oxide for every molecule of copper sulphate; the compound is stable at 11° C., but is so readily decomposed by water, that it could not be isolated by the method used with the corresponding iron compound (this J., 1910, 563). Readily dissociable compounds, containing 1 molecule of cupric salt united to 1 molecule of nitric oxide, have also been obtained in other solvents (ethyl acetate, acetone, etc.). The dissociating influence of water is more or less compensated by the presence of sulphuric or hydrochloric acid in sufficient quantity, owing, probably, to the formation of a complex containing the respective acid molecule. By passing dry hydrochloric acid gas into liquid nitric oxide, or by passing nitric oxide into liquid hydrochloric acid, a dark red liquid, solidifying to a dark red crystalline mass, was obtained, but no evidence of the existence of a similar compound with sulphuric acid was obtained, and the faint red colour said by Raschig to be imparted to sulphuric acid by nitric oxide and ascribed by him to the formation of nitrosisulphonic acid (this J., 1905, 923) is thought to depend on the presence of iron in the acid used.—F. Sodn.

Cupricitrates. S. U. Pickering. Chem. Soc. Trans., 1910, 97, 1837—1851. (See also this J., 1910, 348.)

The following have been obtained:—*Potassiocupric citrate*, $(C_6H_5O_7)_2CuK_4$; *potassium β-cupricitrate*, $(C_6H_5O_7)_2K_4H_2CuO$; *potassium β-cupricitrate*, $(C_6H_5O_7)_2K_4HKCuO$; *potassium β-cupricitrate*, $(C_6H_5O_7)_2K_6Cu.6H_2O$; *potassium a-cupricitrate*, $[(C_6H_5O_7)_2CuK_4]_2K_2Cu(CO_3)_2$; *tetrapotassio-cupric β-cupricitrate*, $(C_6H_5O_7)_2K_4Cu.CuO$; *dipotassio-dicupric β-cupricitrate*, $(C_6H_5O_7)_2K_2Cu_2CuO$; *copper cupricitrate*, $(C_6H_5O_7)_2Cu_3.CuO$; *basic copper citrate*, $(C_6H_5O_7)_2Cu_34CuO$; *potassio-cupric β-cupricitrate*, $(C_6H_5O_7)_3K_5Cu_22CuO$; *potassium γ-cupricitrate*, and *potassio-cupric hydrogen citrate* $(C_6H_5O_7)_2K;Cu.C_6H_5O_7KH_2.H_2O$. With one exception, these cupricitrates are extremely soluble, unless the proportion of copper in them is very large; the solutions are of an intense blue colour, and can be concentrated by heat without decomposition; the crystals are microscopic and of a somewhat light blue colour, the anhydrous compounds being blue and hygroscopic. The cupricitrates have been found to contain a dark blue slow-moving electronegative ion. Copper in the electronegative condition does not, apparently, attack metallic iron or react immediately with ferrocyanide solution. Molecular weight determinations, so far, support the view, previously expressed, that copper is present in the molecule of cupri-salts as. :Cu:O, and that, for each atom of copper present, the molecule contains the elements, HHO, over and above those present according to the ordinary view. Further evidence on this point has been obtained by a study of the colour-intensity of these and other copper salts.—F. Sodn.

Adsorption of arsenic by iron hydroxide. G. Lockemann. Chem.-Zeit., 1910, 34, 1003.

The amounts of ferric hydroxide were determined which were necessary at different temperatures for the complete adsorption of dissolved arsenic as arsenite or arsenate, when the iron was precipitated by addition of ammonia. It was found that the results could be expressed by the hyperbolic equation, $E=\beta.A^p$, where E=mgrms. of ferric hydroxide per 100 c.c., A=mgrms. of arsenic per 100 c.c., β a constant, changing with the temperature, and p, a constant equal to 0·57 at all temperatures. The values of β were 70 at 0° C., 90 at 25° C., and 130 at 80° C. The results were found to be in agreement with this formula between concentrations of 0·1 and 500 mgrms. of arsenic per 100 c.c. In general the complete, or almost complete, adsorption of considerable quantities of arsenic requires relatively very much less iron hydroxide than that of very small quantities. Thus, at 0° C., 0·1 mgrm. of arsenic requires 150 times its weight of iron hydroxide, whereas a quantity of 500 mgrms. requires only 5·4 times its weight. With rising temperature the adsorptive power decreases. At 25° C. it is barely three-quarters of its value at 0° C., and at 80° C. has diminished to almost one-half of that value. Any excess of ammonia is disadvantageous; sodium and potassium hydroxides are still more so. The best results are therefore obtained by cooling with ice and in absence of any excess of ammonia. It is possible in the manner indicated to remove very small amounts of arsenic from very large quantities of liquids, a fact of importance both for the detection of arsenic and for the purification of chemicals.—E. F.

[*Hydrogen arsenide*] *Arseniuretted hydrogen; Synthesis of —— from its elements.* [*Detection of arsenic, and separation of arsenic and antimony.*] A. C. Vournasos. Ber., 1910, 43, 2264—2272.

The author extends his special reaction (this J., 1910, 351 and 563) to the case of arsenic, which readily yields the hydrogen arsenide when distilled with dry sodium formate. The yield depends on the temperature, which may cause more or less dissociation of the hydrogen arsenide. If sodium arsenite is used at 400° C., only 2—3 per cent. of hydrogen is present in the gas. The elimination of carbon monoxide from the residual sodium oxalate may be prevented by using an equimolecular mixture of sodium hydroxide and sodium formate. On account of its delicacy and wider applicability (*e.g.*, to sulphur compounds) the author recommends the use of his reaction as a substitute for Marsh's test in detecting minute quantities of arsenic. Since antimony compounds when heated with sodium formate produce only metallic antimony, except at such high temperatures as 800° C., it is suggested that a quantitative separation of antimony and arsenic may be made if the temperature is kept at about 400° C.—W. H. P.

Volatile hydrides; Direct synthesis of ——. A. C. Vournasos. Ber., 1910, 43, 2272—2274.

(See preceding abstract.) It is possible to prepare the hydride of an element by its action on sodium formate at a temperature at which the element is volatile. If compounds are used this temperature may be somewhat lowered. Selenium and tellurium react at 450°—500° C., though the hydride is largely dissociated at this temperature. Silicon gives some hydride at 1300° C. if the gases are quickly cooled, but the hydride is more easily obtained (at 750° C.) with a 3 per cent. solution of silicon in aluminium. In the same way a little boron hydride can be obtained.—W. H. P.

Hydrogen peroxide; Determination of free acid in solutions of ——. L. A. Brown. J. Ind. Eng. Chem., 1910, 2, 377—378.

The U.S. Pharmacopœia method for determining the free acid in hydrogen peroxide solutions is stated to be unreliable, the decomposition of the hydrogen peroxide on heating with alkali hydroxide being incomplete unless carried out in platinum vessels. Direct titration of the peroxide solution in the cold with $N/10$ potassium hydroxide, with phenolphthalein as indicator, is recommended as being expeditious and giving sufficiently accurate results. It has also the advantage of not being affected by any acetanilide added as a preservative. —A. Sbld.

Goldschmidt's ferrous and manganese borides, and the residue of the ignition of ferro-boron in the presence of hydrogen sulphide. J. Hoffmann. Chem.-Zeit., 1910, 34, 1045—1046.

The behaviour of Goldschmidt's borides of iron and manganese towards chemical reagents shows them to be heterogeneous in character, and this view is confirmed by the microscopic examination of these substances. By the action of *aqua regia*, for instance, definite compounds appear to be extracted, ferro-boron yielding the compound, Fe_3B_4, and manganese-boron, the compound, MnB, but an insoluble residue remains in each case. By heating in the presence of hydrogen sulphide, boron sulphide is formed and volatilised, but only part of the boron can be thus removed; the residue, which is mostly soluble in acid, is regarded as containing a large proportion of iron thioborides.—F. Sodn.

Platinum black; Action of —— on free nitrogen. O. Loew. J. Agric. Sci., 1910, **3**, 320—321.

In reply to Russell and Smith (J. Agric. Sci., 1906, **1**, 444) who were unable to confirm the formation of nitrous acid and ammonium nitrite by the action of platinum black on air in the presence of such bases as potash and baryta (this J., 1890, 979), the author refers to the necessity for using a large quantity of very pure finely-divided platinum, and to the fact that Wöhler was able to repeat his observation (Ber., 1903, **36**, 3479).—W. H. P.

Ozonometer. Jahn. *See* XXIII.

Nitrate production and exports of Chile. Board of Trade J., Oct. 13, 1910. [T.R.]

H.M. Consul-General at Valparaiso has furnished the following figures of the production and exports of Chilian nitrate during the year ended June, 1910, as compared with the corresponding years 1908-9 and 1907-8:—

Years ended 30th June.	Production.	Exports.
	tons.	tons.
1907-8	1,920,190	1,860,771
1908-9	1,861,353	1,827,879
1909-10	2,411,829	2,320,167

Chemical imports into India. Board of Trade J., Oct. 6, 1910. [T.R.]

The total value of chemicals imported into India in 1909-10 was 80·46 lacs of rupees (£536,400), as against 74·7 lacs (£498,000) in 1908-9. The increase was shared by sulphuric acid and soda compounds. A lower level of prices stimulated imports of the latter. The imports of sodium bicarbonate advanced from 3·99 lacs (£26,600) in 1908-9 to 4·84 lacs (£32,300) in 1909-10, and of caustic soda from 7·3 lacs (£48,700) to 7·9 lacs (£52,700). This trade is growing to meet the demands of soap and match factories. Imports of soda of other sorts showed an increase from 8·01 lacs (£53,400) to 10·99 lacs (£73,200). Sulphuric acid imports rose from 61,099 cwts., valued at 5·76 lacs (£38,400), to 74,440 cwts., valued at 7 lacs (£46,600).

Silica discovery in Canada. Oil, Paint, and Drug Rep., Oct. 3, 1910. [T.R.]

The discovery of an apparently unlimited quantity of silica free from iron has been made at St. Anne's, Manitoba. While digging a well the mineral was discovered at a depth of 194 feet, and came out while pumping water. The well was driven 14 feet through it without touching bottom. A neighbouring farm has also reported a similar discovery.

Patents.

Burner-gases; Process of treating——. J. B. F. Herreshoff, Assignor to General Chemical Co., New York. U.S. Pat. 969,868, Sept. 13, 1910.

The process consists in forming a continuous annular film or sheet containing sulphuric acid, and causing the gases to travel in the space surrounded by the film; the film may also be cooled by a cooling medium passed around it.—F. Sodn.

Burner gases; Purification of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 414,387, April 1, 1910. Under Int. Conv., Oct. 5, 1909.

Gaseous mixtures containing sulphur dioxide, such as those obtained by burning sulphur or pyrites, are, after removal of dust, deprived of sulphuric anhydride or sulphuric acid by heating to a high temperature, preferably in the presence of reducing substances (*e.g.*, coke, heated to 425° C.), so as to transform these impurities into sulphur dioxide. The process is intended specially for the treatment of gases to be used in the manufacture of sulphuric acid by the contact process. F. Sodn.

Sulphuric acid in lead chambers; Process for the manufacture of ——. H. Petersen. Ger. Pat. 225,197, June 18, 1908. Addition to Ger. Pat. 219,829, Dec. 16, 1906.

In the working of the process described in the chief patent (see Eng. Pat. 27,738 of 1907; this J. 1908, 981), space can be economised by using only one Glover tower, to which is led the nitrous vitriol from the two Gay-Lussac towers rinsed with weaker and stronger acid respectively. In the method of working now proposed, the mixed nitrous vitriol of 60° and 55° B. respectively from the Gay-Lussac towers are denitrated in the Glover tower, yielding acid of 60° B. Part of this acid is used for rinsing one of the Gay-Lussac towers, and the remainder is sold. The other Gay-Lussac tower is supplied with chamber acid, preferably that from the first chamber, which has a density of about 55° B.—A. S.

Chlorosulphonic acid; Manufacture of ——. Saccharin-Fabrik, Aktienges., vorm. Fahlberg, List und Co., Salbke-Westerhüsen on the Elbe, Germany. Eng. Pat. 16,518, July 11, 1910. Under Int. Conv., Sept. 4, 1909.

Hydrochloric acid gas is caused to react with sulphuric anhydride dissolved in chlorosulphonic acid, or, hydrochloric acid gas and sulphuric anhydride, also as gas, are introduced into chlorosulphonic acid. In either case, the gases may be mixed with air (the solution being cooled, if necessary), and pure chlorosulphonic acid is obtained directly.—F. Sodn.

Formic acid; Method of making ——. W. H. Walker, Boston, Mass. U.S. Pat. 970,145, Sept. 13, 1910.

A formate is allowed to react with a half or such other fraction of the molecular equivalent of sulphuric acid as will give a relatively mobile mass, and further quantities of formate and acid are added to the mixture to maintain the proper degree of fluidity while controlling the temperature; sufficient acid for completing the reaction is then added, and the formic acid is recovered by distillation.—F. Sodn.

Phosphoric acid technically and chemically pure; Manufacture of ——. M. Dittmar. Fr. Pat. 414,521, April 6, 1910. Under Int. Conv., Nov. 6, 1909.

Phosphates of the alkali or alkaline-earth metals, especially those of sodium and barium, are treated with an excess of gaseous or concentrated aqueous hydrochloric acid, which causes the base to be precipitated as chloride, leaving a solution of phosphoric acid, from which the excess of hydrochloric acid is eliminated by distillation; or, in the case of calcium or magnesium, for example, the phosphate may be treated with hydrofluoric acid, which gives a solution of phosphoric acid and a precipitate of calcium or magnesium fluoride, and of any iron and alumina present as impurities.—F. Sodn.

Ammonium sulphate direct from coke-oven or retort gas; Process to recover ——. R. Fabry, Sheffield. Eng. Pat. 4473, Feb. 23, 1910.

Crude coke-oven or retort gas (preferably hot, but deprived of tarry components) is washed by means of a neutral solution of zinc sulphate. There is obtained a solution of ammonium sulphate which is concentrated and crystallised, and a precipitate of zinc sulphide, which is dried and roasted to zinc sulphate and used again. Ammonia and as much sulphur (in the form of sulphuric acid) as is necessary to neutralise it are thus recovered from the gas, and ammonium sulphate is produced, without using an external supply of sulphuric acid. The proportion of hydrogen sulphide in the crude coal gas must be at least sufficient to combine with the ammonia present, and this is, if necessary, conveniently secured by running the requisite quantity of molten sulphur into the coke ovens or gas retorts. The ammonium sulphate produced is said to be of excellent colour and quality.—F. Sodn.

Ammonia saturator, and method of recovering ammonia from coal-gases and the like. J. A. Roelofsen, Middlesbrough, England, Assignor to the Actienges. für Kohlendestillation, Dusseldorf, Germany. U.S. Pats. 969,906 and 969,907, Sept. 13, 1910.

(1) The saturator, which is for the production of solid salts from gases, may be constructed with a pocket in the bottom and has a diaphragm depending from the upper wall into the contained liquid, thus dividing the vessel into two compartments which are united at the bottom; an inlet and an outlet pipe are provided for each compartment, and the former terminates below the surface of the liquid. (2) For recovering ammonium salts from gases of carbonisation, the gases are cooled, to deposit tarry matters, and the aqueous vapour, containing most of the combined ammoniacal products and a portion of the free ammonia, is condensed; the ammoniacal liquor is then distilled, and the gases and the vapours of distillation are independently introduced into an acid solution of ammonium salts (contained, for instance, in the apparatus described above), the gases of carbonisation and the noxious gaseous components of the vapours of distillation emerging from the solution being led off separately; the ammonia may be liberated from the ammoniacal liquor by mixing it with alkali and introducing hot neutral gases, so that the distillation vapours are superheated, and condensation in the saturator is prevented, the concentration of the acid solution being thereby maintained, so as to allow solid ammonium salts to separate.—F. Sodn.

Ammonium chloride from ammonium sulphate and common salt; Manufacture of ——. F. A. Freeth and H. E. Cocksedge. Fr. Pat. 414,682, April 9, 1910.

When equivalent quantities of ammonium sulphate and sodium chloride are agitated, at about 103° C., with a quantity of water just sufficient to give, after complete reaction, a saturated solution of ammonium chloride and of sodium sulphate, the sodium chloride is wholly decomposed, and, when the solution is cooled to about 30° C., ammonium chloride is deposited free from sodium sulphate, provided that, after the reaction, but before cooling, a small quantity of water or of a saturated or partially saturated solution of ammonium chloride (less than 4 per cent. of the total volume) be added. Brine may be used in the process if, after adding the equivalent quantity of ammonium sulphate, the solution be evaporated to the proper concentration.—F. Sodn.

Aldehyde sulphoxylates; Process for the preparation of ——. E. C. R. Marks, London. From Blumberg and Rindskopf, Zuckmantel, Bohemia. Eng. Pat. 8339, April 6, 1910.

Aldehyde sulphoxylates are prepared by allowing zinc dust, or other metallic reducing agent of equal value, aldehydes, and bisulphites to interact under pressure, without the application of external heat, in the presence of water and, preferably, of inert or reducing gases. For example, 100 parts of sodium bisulphite solution, at 38° B., are mixed in an autoclave (fitted with stirrer) with 25 parts of 40 per cent. formaldehyde and 50 parts of zinc dust; the air is displaced by means of carbon dioxide or the like, and the mixture is submitted to a pressure of 6—8 atmospheres, the reaction being effected, with stirring, in less than an hour; the product is subsequently treated in the usual manner.—F. Sodn.

Hydrosulphites of alkaline metals; Manufacture of anhydrous ——. Chem. Fabrik von Heyden Aktienges., Radebeul, Saxony. Eng. Pat. 16,540, July 11, 1910. Under Int. Conv., June 16, 1910.

Salts of acetonesulphoxylic acid are converted into anhydrous hydrosulphites by treatment with bisulphite, in the presence of concentrated solutions of suitable salts, at temperatures which are above the dehydration temperature of the particular hydrosulphite used. For instance, a pasty mass of sodium acetonesulphoxylate is introduced, with vigorous stirring, into an aqueous solution or suspension of sodium chloride and bisulphite, 2—3 molecular proportions of bisulphite being employed for each molecule of sulphoxylate, and the operation being conducted at about 65° C.—F. Sodn.

Ferric salts; Production of ——. A. G. Betts, Troy, N.Y. U.S. Pat. 969,833, Sept. 13, 1910.

Ferrous sulphate or other ferrous salt of a polybasic acid is oxidised to the corresponding ferric salt by electrolysing the solution with an insoluble anode, while keeping the solution at a temperature (*e.g.*, 50°—100° C.) high enough to substantially prevent the evolution of oxygen-containing gas at the anode.—F. Sodn.

Iron; Process of treating the waste liquors resulting from the pickling of ——. L. Hirt. Fr. Pat. 413,067, Feb. 26, 1910. Under Int. Conv., July 24, 1909.

The liquors, which contain iron salts in solution and a large excess of acid, are introduced into a preliminary heating chamber and pass through a series of tanks containing scrap-iron. The greater part of the acid is thereby neutralised, and the iron solutions flow through a pair of closed vacuum evaporating vessels into a receiver, and thence into crystallising pans. The vapours issuing from the evaporating vessels are led into and condensed in the first chamber, their heat being thus utilised for the preliminary heating. The liquor, which is still acid in the last scrap-iron tank, is drawn off from near the top of the tank and pumped back into the first chamber, the same being done with the mother liquor from the crystallising pans.—O. R.

Chemical compound [from potassium nitrate and hydrogen peroxide]. A. Eklund, Spokane, Wash. U.S. Pat. 970,898, Sept. 20, 1910.

The compound is formed by dissolving potassium nitrate in boiling water, allowing the mixture to cool to 80° C., and then adding hydrogen peroxide, suitable proportions being 96 grms. of nitrate, 100 c.c. of water, and 4 grms. of 10 per cent. hydrogen peroxide solution; the mixture crystallises on cooling. The new compound gives a blue colour when added to potassium iodide and starch, and decolorises permanganate, in presence of sulphuric acid, with evolution of oxygen; it gives a yellow precipitate with a solution of titanic acid in presence of sulphur dioxide, a blue coloration in an oil solution of guaiacum mixed with infusion of malt, a blue coloration with tincture of guaiacum in presence of ferrous sulphate, and a blue coloration also with chromic acid.—F. Sodn.

Radioactive products [tubes, vessels, etc.] possessing permanent activity; Preparation of ——. H. Farjas. First Addition, dated May 8, 1909, to Fr. Pat. 411,629, April 14, 1909 (this J., 1910, 951).

The raw material such as radioactive barium sulphate, is made into a paste with a solution of sodium silicate, shaped into tubes, vessels, etc., dried, and baked at a temperature of not less than 1000° C. The resulting "biscuit" is of a porous nature and eminently suitable for bringing liquids into intimate contact with radioactive emanations.—O. R.

Barium and strontium chlorides; Process of converting —— *into chlorine and the corresponding hydroxides.* A. Clemm. Fr. Pat. 413,553, Mar. 12, 1910.

Barium or strontium chloride solution is electrolysed, with the evolution of chlorine and formation of barium or strontium hydroxide. When the solution of hydroxide in the corresponding chloride is nearly saturated, it is strongly cooled and the hydroxide crystallises out. The solution of unchanged chloride is brought back to its original concentration, either by evaporation or by the addition of fresh raw material, and the electrolysis is resumed.—O. R.

Compounds containing nitrogen [nitrides, etc.]; Manufacture of ——. A. Sinding-Larsen and O. J. Storm. Fr. Pat. 414,837, April 15, 1910.

Claim is made for products obtained by vaporising certain minerals or rocks, such as felspar, quartz, kaolin, etc., in an atmosphere containing nitrogen and a hydrocarbon or other reducing agent, in sufficient quantity. An electric furnace may be used to vaporise the mineral, the lower portion of the upper electrode being enclosed in a bell, from which the gaseous products may be withdrawn as desired. The mixture of gases is introduced into the outer portion of the furnace, and, being forced through the charge, collects in the bell, where the nitrogen reacts with the vapours from the charge. The products (nitrides, cyanides, cyanamides, etc.) pass into a receiver in which the least volatile (*e.g.*, nitrides of aluminium and silicon) are condensed, and then through a condenser which retains the more volatile products, such as water and soluble gases (ammonia, hydrogen cyanide, etc.); uncondensed gases are next led into absorption chambers to be treated successively with alkali and acid, the residue (chiefly carbon monoxide and indifferent gases) being aspirated into a chamber, in which carbon monoxide is absorbed "by a suitable liquid" and volatile hydrocarbons are added, after which the gases are mixed with the necessary nitrogen and sent back to the furnace. The products, which may be applied as fertilisers and for other purposes, may, if desired, be treated with water, in order to separate soluble or decomposable portions.—F. Sodn.

Hydrogen; Manufacture of ——. O Dieffenbach and W Moldenhauer, Darmstadt, Germany. Eng. Pat. 8734, April 11, 1910. Under Int. Conv., Jan. 10, 1910.

Steam is allowed to act on carbon or carbonaceous matter to which both an alkali compound and lime have been added, the effect of the additions being to lower the temperature of decomposition and to give hydrogen free from compounds of carbon and oxygen. For example, 100 kilos. of charcoal or coke, impregnated with a 10 per cent. solution of potassium carbonate, are mixed with 500 kilos. of burnt lime, and the mixture is decomposed by steam at 550°—750° C.—F. Sodn.

Hydrogen; Process of producing ——. A. Messerschmitt, Assignor to Internationale "Wasserstoff" A.-G., Frankfort on Maine, Germany. U.S. Pat. 971,206, Sept. 27, 1910.

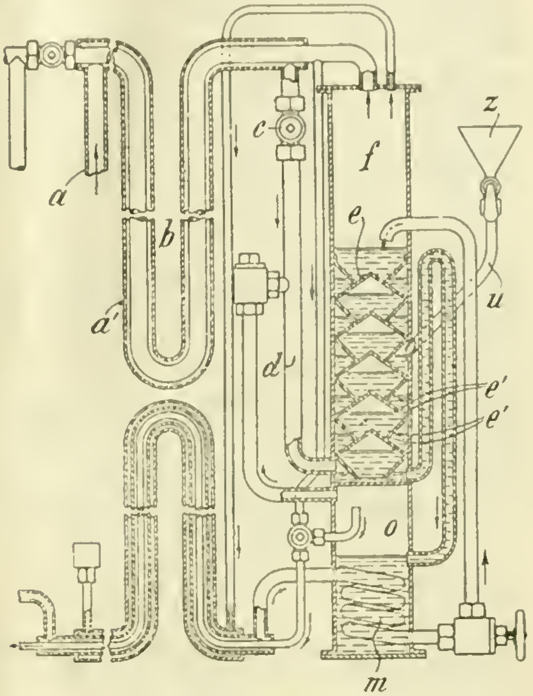
See Fr. Pat. 405,200 of 1909; this J., 1910, 212. The volume of steam used is not more than half the combined volumes of the carbon monoxide and hydrogen contained in the reducing gas, the ferric oxide being only partially reduced.—T. F. B.

Oxygen; Mixtures disengaging —— *when heated.* C. Zeiss, Jena, Germany. Eng. Pat. 17,809, July 27, 1910. Under Int. Conv., July 29, 1909.

The mixture contains, as principal component, a chlorate or similar oxygen vehicle, and, as by-components, compounds which cause the decomposition of the principal component, when started by local heating, to be transmitted spontaneously. Among the by-components is a small quantity of a substance (*e.g.*, iron or zinc oxalate) which decomposes, with the production of gas, when heated nearly to the fusion temperature of the principal component, thereby lowering the decomposition temperature of this component below its fusion point. The mixture may, for instance, be composed of potassium chlorate (75—90 parts), peroxide of iron or manganese (10—20 parts), powdered iron (5—10 parts), and iron oxalate (0·5—2 parts).—F. Sodn.

Atmospheric air; Process and apparatus for separating —— *into oxygen and nitrogen.* G. Röttger. Fr. Pat. 413,958, Mar. 23, 1910.

Air is introduced by way of the tube, *a* (see Fig.), into the tube, *a'*, of the refrigerator, *b*, and is there cooled to as low a temperature as possible by gaseous nitrogen issuing from the separator, *f*. The air then passes through the tap, *c*, and tube, *d*, into the bottom of a series of funnel-shaped vessels, *e*, having narrow perforations, *e'*, these vessels constituting the separator or fractionating appliance, *f*. The separating liquid consists originally of liquid air introduced through the funnel, *z*, and the tube, *u*, into the separator, *f*, and contains, as the separation proceeds, pure oxygen at the bottom, an increasing proportion of nitrogen in an upward direction, and pure nitrogen at the top. The vessel, *o*, serves to vaporise the oxygen, which has been separated in the liquid form, and contains the worm condenser, *m*, in which nitrogen is liquefied under suitable pressure.—O. R.



Sulphuric acid; Manufacture of ——. Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 20,401, Sept. 6, 1909. Under Int. Conv., Sept. 21, 1908.

See Fr. Pat. 406,641 of 1909; this J., 1910, 487.—T. F. B.

Catalytic body [for use in making nitric acid] and method of making same. K. Schick, Griesheim, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 971,149, Sept. 27, 1910.

See Fr. Pat. 380,884 of 1907; this J., 1908, 22.—T. F. B.

Caustic soda and caustic potash; Preparing ——. R. Reitz, Griesheim, Assignor to Chem. Fabrik Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pats. 971,144 and 971,145, Sept. 27, 1910.

See Eng. Pats. 29,491 and 29,494 of 1909; this J., 1910, 488 and 815.—T. F. B.

Ammonia; Process of obtaining ——. N. Caro, Berlin. U.S. Pat. 970,883, Sept. 20, 1910.

See Ger. Pat. 198,295 of 1905; this J., 1908, 932.—T. F. B.

Ammonia; Production of ——. F. Haber and R. Le Rossignol, Karlsruhe, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 971,501, Sept. 27, 1910.

See Fr. Pat. 411,446 of 1910; this J., 1910, 949.—T. F. B.

Ammonium chloride; Process of making ——. F. A. Freeth, Great Crosby, and H. E. Cocksedge, London. U.S. Pat. 970,909, Sept. 20, 1910.

See Fr. Pat. 414,682 of 1910; preceding.—T. F. B.

Dolomite; Process of treating ——. J. J. Gathy, Mons, Belgium. U.S. Pat. 971,368, Sept. 27, 1910.

See Eng. Pat. 779 of 1910; this J., 1910, 816.—T. F. B.

Aldehyde-sulphoxylates; Process for producing ——. Blumberg und Rindskopf. Fr. Pat. 414,013, Mar. 24, 1910.

See Eng. Pat. 8339 of 1910; preceding.—T. F. B.

Hydrosulphites free from water; Process for preparing ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 414,531, April 6, 1910. Under Int. Conv., Nov. 26, 1909.

See Eng. Pat. 9848 of 1910; this J., 1910, 878.—T. F. B.

Compounds of silicon and metals containing nitrogen; Process for making —— *from silicides.* A. Kolb. Fr. Pat. 414,625, March 5, 1910.

See Ger. Pat. 222,237 of 1908; this J., 1910, 757.—T. F. B.

Recovering cyanogen and ammonia from distillation gases from coal. Ger. Pat. 225,461. *See* IIb.

Production of compounds containing oxygen and nitrogen by electrical means. Addition to Fr. Pat. 402,012. *See* XI.

Electric arcs for formation of compounds of oxygen and nitrogen. Addition to Fr. Pat. 406,115. *See* XI.

VIII.—GLASS; CERAMICS.

Lead glazes; Contributions to the knowledge of the properties of ——. H. Pistorius. Sprechsaal, 1910, 43, 576—578.

The author criticises a paper on the same subject by Eisenlohr (this J., 1910, 950), who stated that a lead frit would be more soluble in acetic acid if cooled quickly by pouring into water than if allowed to cool naturally in the crucible. The author attributes this to the longer attack of the frit on the crucible in the latter case, the composition of the frit being thereby changed. He also states that Eisenlohr's method of allowing half-an-hour to elapse before titrating the dissolved lead induced further attack on the glaze and was not in accord with the official procedure (*loc. cit.*).

In reply to the above criticisms, Eisenlohr maintains that the greatest attack on the crucible is during the heating-up and full fire, and that the titration could not be affected by standing as the undissolved glaze had already been filtered off.—H. H. S.

Fusion and solution experiments in the lime-silica series. Philippi. *See* VII.

Patents.

Clay; Apparatus for cleaning ——. M. Bohn. Fr. Pat. 414,455, April 4, 1910.

The apparatus comprises two cleaning compartments, arranged one after the other; in the former impurities are continuously eliminated from the clay, and in the latter the impurities are freed from the remainder of the clay. A plain cylindrical portion may be arranged between the two compartments. The cleaning compartments are cylinders (or the second may be conical in shape) provided on the periphery with sieves, over which the material to be purified is carried by means of an endless screw, and through the meshes of which the clay escapes. The outer edges of the blades of the screw are provided with loosely-adjustable scrapers, which are kept in contact with the interior of the compartment, and consequently with the sieves, by the pressure of the material under treatment, and serve to keep the sieves clean, and to throw into a receiver the foreign bodies separated from the material. The scrapers may consist of angle irons which are attached in a flexible manner to the blades of the screw by rivets which slide in oblong holes in the blades. The scraper may also end in a sharp edge, over which the stones are removed from the sieve and thrown into a receiver. Instead of being convex, the blades may be flat on the side where they exert pressure, and the scrapers may have the form of a band.—W. C. H.

Magnesium silicates or other similar products: Process for the utilisation of —— *in the form of powder for moulding various articles.* L. M. Bullier. Fr. Pat. 414,843, April 15, 1910.

Naturally or artificially powdered magnesium silicates, such as steatite, talc, etc., are mixed with from 3 to 10 per cent. of some coagulating material, such as paraffin or wax, and then moulded in required shapes under pressure. The binding material merely increases the cohesion of the powder during the moulding, and is entirely removed when the articles are fired.—W. C. H.

Magnesia; Process for the manufacture of refractory articles of ——. E. Merck. Ger. Pat. 225,472, July 8, 1909.

Refractory articles which do not shrink to any considerable extent on heating to high temperatures can be obtained by the use of a mixture of powdered fused magnesia with ignited magnesia, the quantity of the latter being smaller the lower the temperature at which it has been ignited. A mixture of 20 parts of fused magnesia and 1 part of ordinary "magnesia usta" is suitable, and can be moulded into articles, without pressure, when mixed with the requisite quantity of water. —A. S.

Clay and like plastic substances; Apparatus for separating granular admixtures from ——. M. Bohn, Nagykikinda, Hungary. Eng. Pat. 7940, April 1, 1910.

See Fr. Pat. 414,455 of 1910; preceding.—T. F. B.

Ceramic transfer-pictures; Ink for ——. J. Kasseker, Assignor to Schmidt, Kasseker, und Co., Altwasser, Germany. U.S. Pat. 971,280, Sept. 27, 1910.

See Eng. Pat. 23,852 of 1909; this J., 1910, 278.—T. F. B.

IX.—BUILDING MATERIALS.

Fusion and solution experiments in the lime-silica series. Philippi. *See* VII.

Action of dust from tarred roads on the eyes. True and Fleig. *See* XIXb.

Cement production of the United States. Board of Trade J., Oct. 6, 1910. [T. R.]

According to a report issued by the United States Geological Survey the total production of cement in the United States in 1908 and 1909 was as follows:—

Class.	1908.		1909.	
	Quantity.	Value.	Quantity.	Value.
	Barrels.	Dollars.	Barrels.	Dollars.
Portland	51,072,612	43,547,679	62,508,461	50,510,385
Natural	1,686,862	834,509	1,527,279	623,141
Puzzolan	151,451	95,468	160,646	99,453
Total ..	52,910,925	44,477,656	64,196,386	51,232,979

PATENTS.

Kiln for burning bricks and tiles. H. Stephenson and C. Duerden, Accrington. Eng. Pat. 30,259, Dec. 28, 1909.

THE kiln is of the usual construction as regards the outer portion or shell, but has a central longitudinal wall built in the floor, and flues from each furnace, on each side, leading to this central wall, return flues being provided to communicate with spaces between the flash wall and the outer wall of the kiln: a series of outlets in the floor of the kiln lead into the main flue to the chimney, which outlets consist of moulded pipes of refractory material, capable of supporting a considerable weight, and having their upper portions detachable, so that they can be removed from time to time; the floor of the kiln is composed of bricks laid on the top of the flues, the bricks being preferably solid for a distance of 2 or 3 feet from the flash wall, and the remainder of the floor being of either perforated or solid square bricks. With this construction, a portion of the heated gases passes under the floor of the kiln, and the lower portion of its contents is thereby dried and burnt in advance of the upper portion, which is treated in the usual way.—F. SODN.

Wood or other similar materials; Process for the impregnation of ——. G. von Kardos. Fr. Pat. 414,141, Mar. 26, 1910.

THE previously dried wood is treated with highly heated and strongly compressed air, or strongly compressed gases, in order not only to open the cells, but to stretch them for the reception of the impregnating material which acts as a piston when the wood is subsequently subjected to suction.—W. C. H.

Abrasive compound, and process of manufacturing it. H. Arsandaux. Fr. Pat. 412,853, May 11, 1909.

BAUXITE, poor in silica and titanic acid, and containing alumina and ferric oxide roughly in the proportions of two molecules of the former to one of the latter, is heated in a reducing atmosphere to 1300°—1400° C. The ground material possesses a hardness of approximately 8, and may be moulded and re-calcined to form refractory bricks, grinding wheels, acid-proof plates, and the like.—O. R.

Magnesian cement. P. Comet and F. Coulon. Fr. Pat. 414,009, Mar. 24. 1910.

A SILICO-MAGNESIAN cement, practically insoluble in water, is obtained by the combination of magnesia, mixed with quicklime (*i.e.*, calcined dolomite) with gelatinous silica. When mixed with abrasive powders, or other materials, such as talc, sawdust, etc., before the addition of the gelatinous silica, this cement may be used for the production of grindstones, and other articles, such as insulators, flooring-tiles, etc., which resist the action of water.
—W. C. H.

[Rotary] Cement kilns. J. A. P. Lavocat. Fr. Pat. 414,845, April 15, 1910.

THE interior of the kiln is provided with a suitable number of discs of equal or of progressively increasing diameters, arranged perpendicularly to the axis, in order to give an annular form to the column of gases passing through, and to ensure that the gases impart their heat to the wall of the kiln. The discs may be replaced by a cylinder, or truncated cone, the axis of which coincides with that of the kiln.—W. C. H.

Wood-preserving solution. F. Hasselmann, Munich, Germany. U.S. Pat. 971,194, Sept. 27, 1910.

SEE Eng. Pat. 12,587 of 1909; this J., 1909, 1250.—T. F. B.

Cement; Apparatus for burning ——. C. Coventry, Liverpool. From H. L. Doherty, New York. Eng. Pat. 47, Jan. 1, 1910.

SEE U.S. Pat. 945,307 of 1910; this J., 1910, 153.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Steel; A fourth recalescence in ——. J. O. Arnold. Brit. Assoc., Sept., 1910.

ON cooling unsaturated steels containing about 0·2 per cent. of carbon there is some thermal evolution along the range of temperature between the critical points, Ar_3 and Ar_1 which not only prevents the cooling curve crossing the radiation line after recalescence but also keeps it well to the right of that line. Experiments show that the maximum heat of the fourth phase of recalescence is evolved from a semi-saturated steel, namely iron containing 0·45 per cent. of carbon and having in the cold a micrographic structure consisting of one-half ferrite and one-half pearlite. The combined total heat evolved at Ar_3, Ar_2, and by the fourth recalescence is in 0·38 per cent. carbon steel, equivalent to a rise of 32·7° C. and in 0·63 per cent. carbon steel equal to 21·9° C. Hence that evolved by the fourth recalescence is equivalent to 23·4° C. and 12·6° C. respectively in the two steels. The fourth recalescence is due to constitutional segregation, namely, the falling out between Ar_3 and Ar_1 of the ferrite and hardenite from their state of solid solution into microscopically visible masses. Microphotographs prepared from 0·2 per cent. carbon steel rapidly quenched at various temperatures along its cooling curve are given in the paper to show the course of segregation. This has obviously commenced in the section quenched at 995° C.; it is far advanced in that quenched just below Ar_3 in which the structure is somewhat indistinct. Just above Ar_1 segregation is practically complete. The critical range Ar_2 has no influence on the segregation of hardenite and ferrite.—E. F. A.

Iron-carbon system; Influence of sulphur on the ——. T. Liesching. Metallurgie. 1910, **7**, 565—571.

FIFTY alloys of iron containing from 0·08 to 4·78 per cent. of carbon, and from 0·01 to 1·11 per cent. of sulphur were prepared from a Swedish charcoal iron containing 3·8 per cent. of carbon, and 0·0076 per cent. of sulphur, a Swedish nail iron containing 0·06 per cent. of carbon, and 0·004 per cent. of sulphur, and a puddled iron containing 0·086 per cent. of carbon, and 0·023 per cent. of sulphur, by the suitable addition of a sulphide iron containing 28 per cent. of sulphur. Details of the furnace used, and of the method of applying the pyrometer are given, and after complete cooling curves had been obtained the alloys were analysed, polished and then etched by a first immersion in a four per cent. solution of picric acid in amyl alcohol and then in a four per cent. solution of nitric acid in amyl alcohol, followed by a hot concentrated solution of sodium hydroxide. By this means the sulphide was coloured brown without affecting the results produced by the picric and nitric acids. The author summarises the previous opinions on the influence of sulphur and finds no evidence that a chemical combination of iron, sulphur and carbon produces the whitening of cast iron, but attributes it solely to a physical or mechanical influence exerted by the iron sulphide. Sulphur lowers the freezing point of the iron, at which temperature austenite free from sulphur is separated, the sulphur being concentrated in a eutectic of austenite, cementite, and sulphide which solidifies at about 1130° C. In an iron free from sulphur, the cementite decomposes with the formation of a grey iron, but the presence of sulphur produces alternate layers of sulphide and cementite, the sulphide hindering the decomposition of the cementite with the production of a white iron. The pearlite point remains constant at 700° C. The paper is illustrated by eighteen microphotographs, and a summary of the literature of the subject is appended.—A. H. C.

Bullion: Electrolytic refining of —— *in the United States Mints.* H. J. Slaker. Eng. and Min. J., 1910, **90**, 214.

DURING the past 10 years the methods of refining gold and silver bullion in the United States Mints have been radically changed, and an economical and efficient electrolytic method is now in use, by which in the first stage fine silver is produced, and in the second stage fine gold. For the silver refining an electrolyte consisting of a 2 per cent.

solution of silver nitrate containing about 2 per cent. of free nitric acid is used. in stoneware tanks, sixteen of which are in series across the line voltage so that each cell takes somewhat less than 1 volt pressure. The anodes, consisting of ingots containing 40 per cent. of gold and about 47 per cent. of silver, are suspended in the electrolyte in a bag carried on a gold hook. The hooks are in electrical connection with thin silver strips fastened along a hard rubber tube, with a steel core, these strips carrying the current from one cell to the next. A current density of 5—7 ampères per sq. ft. is used, and it is stated that the deposited silver is rarely less than 99·9 per cent. fine and carries less than 1 oz. of gold per 100,000 oz. of silver. The silver content of the electrolyte is kept constant by addition of silver nitrate. From the spent electrolyte most of the silver is separated by electrolysis with iron anodes, and the remainder is precipitated as chloride. Lead peroxide is gradually deposited on the iron anodes, and from this small quantities of silver and palladium (present as peroxides) are subsequently recovered. The used anodes from the silver cells are employed next as anodes for the recovery of fine gold, being suspended in a solution containing 10 per cent. of hydrochloric acid and 3 per cent. of gold as chloride, in porcelain jars. The cells are placed in a steam-heated sand-bath, the electrolyte being kept at about 120° F., and agitated by means of hard rubber propellers driven at 700 revolutions per minute. A current density of 70 ampères per sq. ft. is used, and the deposited gold is usually of 99·95 per cent. purity, the greater part of the impurity being silver. From the spent electrolyte platinum is precipitated by ammonium chloride, spongy platinum being obtained by washing the precipitate and then heating it. Much smaller amounts of palladium are also recovered. The slimes are washed, treated with granulated zinc to reduce the silver chloride to metal, and after again washing, the whole is melted into bars, which are used for preparing anodes for the silver cells.
—A. S.

Gold ; Solubility of finely divided —— in potassium ferrocyanide solution. E. Beutel. Monats. Chem., 1910. **31**, 887—890.

Finely divided gold slowly dissolves in a solution of potassium ferrocyanide at the ordinary temperature, forming a distinctly alkaline solution ; even at the boiling point, solution is very slow. Potassium aurocyanide is apparently first formed, and the liberated ferrous ions become oxidised by atmospheric oxygen to ferric hydroxide (which is precipitated), in amount corresponding to the quantity of gold dissolved, but the prolonged action of a strong solution of potassium ferrocyanide would seem to give ultimately potassium auricyanide.—F. Sodn.

Zinc ; Electrolytic determination of —— in ores. G. Kemmerer. J. Ind. Eng. Chem., 1910, **2**, 375—377.

From about 0·5 grm. of the ore the zinc is separated as sulphide by one of the usual methods, and the latter is washed with hot water and dissolved on the filter in a little hot dilute hydrochloric acid ; 2 c.c. of sulphuric acid are added to the solution, which is then evaporated until nearly all the sulphuric acid is driven off. The zinc sulphate is rinsed into a 150 c.c. Jena glass beaker and diluted to about 100 c.c., 20—25 grms. of sodium hydroxide are added, and the liquid is electrolysed, with a cylindrical nickel gauze cathode of about 160 sq. cm. surface, fitting loosely into the beaker, and a revolving propeller-shaped anode driven at about 600 revolutions per min. A current of 6 ampères at a pressure of 4·4 volts is allowed to flow for 15 min. The cathode is then removed without opening the switch, and plunged into a large beaker of water ; it is then dried with absolute alcohol and ether which have been distilled over sodium, heated to 70°—100° C., cooled and weighed at once, as the deposits gain weight on keeping. All the zinc is deposited with a current of $N.D._{100}=3·1$ ampères. The method is expeditious and gives results fully as accurate as the usual gravimetric process. If, however, a much smaller quantity of sodium hydroxide be added to the electrolyte, the results are high and unreliable. (See also this J., 1905, 905 ; 1907, 830 ; 1910, 591, 595.)—A. Sbld.

Ores ; Notes on the roasting and sintering of ——. F. M. Smith. Mining World, Sept. 10, 1910, 459—460.

In the Dwight and Lloyd apparatus for roasting lead ores and concentrates, the ore rests in a thin layer on travelling grates. The grates pass over an air-tight windbox which is connected with an exhaust fan, so that air is sucked down through the charge. The ore, reduced to pieces of $\frac{1}{8}$ to $\frac{1}{4}$ inch in size, is fed on to the grates, and arranged as to thickness and compactness by a series of brushes, followed by a wooden roller. Just at the point where the grates begin to travel over the windbox, the charge is ignited by means of a gasoline jet under about 80 lb. pressure. After the sintering action is complete down to the grates, the product is automatically discharged into dump cars. The product is well sintered, with almost no fines, and the sulphur content varies from 3 to 4 per cent. To obtain the best results, the ore charge must contain approximately 4 to 5 per cent. of moisture. Machines are being designed to deal with 100 tons of ore and concentrates per day.
—T. St.

Ore treatment at Broken Hill. J. Plummer. Mining World, Sept. 10, 1910, 458.

The Amalgamated Zinc Co. at Broken Hill in 1909 purchased 98,670 tons of zinciferous tailings, and using the De Bavay system obtained 492 tons of lead concentrates, and 30,347 tons of zinc concentrates. The Minerals Separation Co., Ltd., at the Central mine using a small amount of oil and acid to agglomerate the mineral and depending on the rising bubbles for flotation effect, treated 193,842 tons of dump during 1909, obtaining 68,552 tons of zinc concentrates. It is intended to treat the slimes lost by these processes by the Howard process which consists in dividing the mixed concentrated sulphides of lead and zinc into two products by roasting them for three or four hours at a temperature of 300° to 400° C. in order to coat the lead sulphide particles with a layer of lead sulphate without oxidising the zinc sulphide, and then again submitting the roasted material to the flotation process. One of these products contains about 80 to 85 per cent. of the zinc in the slime, and assays at about 32 per cent. of zinc, while the other contains 80—90 per cent. of the lead in the slime and assays at from 45 to 55 per cent. At Block 14 preparations have been made for treating 1,600 tons of sulphide by the Murex process of using a finely powdered magnetic powder in conjunction with the oil and a minute quantity of a solution of alum.—A. H. C.

Fusion and solution experiments in the lime-silica series. Philippi. *See* VII.

Uranium ore in Mexico. L'Ind. Chimica, 1910, **10**, 270.

A new mineral discovered by an American named W. Niven in the Guerrero district of Mexico, proved on examination at the Geological Institute of Mexico City and the Smithsonian Institution of Washington, to be a hydrophosphate of uranium and copper. The mineral, to which the name *torbernite* has been given, has a slight action on a photographic plate in the dark. Further experiments are being undertaken with a view to ascertain the suitability of the mineral as raw material for the manufacture of radium salts.—A. S.

Tungsten ore deposit in Chile. Board of Trade J., Oct. 6, 1910. [T.R.]

H.M. Consul at Santiago reports that a rich tungsten ore deposit has been discovered in the north of Chile. A picked sample of the ore contained 77·5 per cent. of oxide of tungsten (=61·46 per cent. tungsten).

Patents.

Separation of substances by the wet magnetic process. W. E. Lake, London. From F. Krupp, A.-G. Grusonwerk, Magdeburg-Buckau, Germany, Eng. Pat. 17,459, July 27, 1909.

The liquid containing the material to be separated is made to flow along a channel beneath which a number of separate stationary magnets are arranged. At a certain distance above the channel, a horizontal magnetisable ring is rotated upon an upright shaft, the direction of motion of this ring as it passes over the channel being transverse to that of the liquid. The under side of the ring is tapered to a sharp annular edge, or, alternatively, a number of projections are arranged so as to depend from points around the circumference. As the liquid flows along the channel and passes under the ring, the magnetic particles are caused to flow upwards by means of the lines of force produced at these points. At the same time, a certain amount of liquid is carried upwards, a permanent column of constantly renewed liquid being produced and the lifting of the magnetisable particles thus assisted by the buoyancy which they retain. In order to form the liquid columns at the start, the ring may be lowered and afterwards raised, or the strength of the current in the windings of the lower magnets may be temporarily increased. Moreover, the formation of the columns may be facilitated and the space between the edge of the ring and the normal level of the liquid may be increased, by arranging a downward stream of liquid from the lower edge of the ring. When tapered projections beneath the lower side are employed, each of these may be provided with a hole at the apex through which the liquid is run from an annular trough above, so that a liquid column is obtained at each point. The separated magnetic material adhering to the rotating ring is carried away from the magnetic field and finally falls into vessels arranged between the lower magnets.—C. A. W.

Armour-plate. S. O. Cowper-Coles, London. Eng. Pat. 20,020, Sept. 1, 1909.

A number of steel bars or plates are arranged on edge in the casting box, vertically or at varying angles to one another, each piece being placed at right angles to the one below it. The pieces before introduction into the casting box may be coated with zinc by any convenient process, and each may be advantageously provided with a number of projections formed on the surface by punching or stamping, or, alternatively, perforated plates coated in the same manner may be employed. The box containing the pieces is then heated to a considerable temperature, when, finally, aluminium or aluminium alloy is poured into it and allowed to solidify. Subsequently, unless a self-hardening steel has been employed, the mass is quenched at a temperature which will ensure the hardening of the embedded metal.—C. A. W.

Steel; Manufacture and treatment of ——. H. A. Richardson, London. Eng. Pat. 9406 of 1910; date of application, June 5, 1909.

Steel plates with a hardened surface are produced by forming the plates from a steel containing 2·5 per cent. of tungsten and 0·2—0·5 per cent. of carbon, and subjecting them to cementation, whereby a glass hard surface is obtained without quenching. For the manufacture of armour plates, a steel containing 2·5 per cent. of tungsten, 4 per cent. of nickel, and 0·3 per cent. of carbon is used, and the plates are carburised on one side by a cementation process.—A. S.

Metal [steel] of high grade; Production of a —— *from a metal of low grade.* L. A. Leonard, New York, and J. P. Larrimer, Brooklyn, N.Y. U.S. Pat. 970,728, Sept. 20, 1910.

For the manufacture of a high-grade steel, a low-grade steel is baked in a closed holder in the presence of hydrated iron oxide, silica and possibly phosphorus, this preparatory treatment being necessary for the success of the subsequent carbonisation. The metal is then heated strongly in the presence of some carboniferous material and finally quenched in a bath which, if desired, may contain calcium sulphate, ferric oxide and carboniferous material.—C. A. W.

Iron; Manufacture of pure —— *intended to replace Swedish iron and its cast alloys.* N. A. Hélouis. First Addition, dated March 16, 1910, to Fr. Pat. 404,187, June 4, 1909 (this J., 1910, 96).

According to the original specification, a pure iron was manufactured by introducing scrap iron, previously heated to redness and sufficiently oxidised, into a cupola, the heat necessary for the fusion being obtained by means of the alumino-thermic reaction. The corundum slag was discharged, as fast as it was formed, through an aperture in the upper part of the cupola, being displaced by the molten iron which ultimately completely filled the vessel. It is now proposed to arrange the cupola upon trunnions so that it can be swung in either direction, and to stop the addition of scrap iron at the moment when the upper level of the corundum slag reaches the casting orifices. The vessel can then be inclined in one direction for the removal of the slag and subsequently in the other direction for the pouring of the metal.—C. A. W.

Condensing the products from the distillation of wood in blast-furnaces fed directly with wood; Process and apparatus for ——. A. E. Carbonel. Fr. Pat. 414,514, April 6, 1910.

The gases from the top of the blast-furnace are passed first into a dust catcher, and then through two parallel ranges of condensers, into a main to be conducted away for use. The condensers, which are protected against acid gases by an internal coating of cement, stand in a trough, into which the condensed liquids flow, each being closed at the top by a cover, the flange of which dips into water in an annular gutter. The cooling water flows from water tanks above the condensers, down through vertical pipes, and then up through outer concentric pipes, overflowing into the annular gutters. The inner cooling pipes can be removed bodily for cleaning, etc., by raising the water-tanks. Explosion doors are fitted to the dust catcher, the main, and to each of the washers. —W. H. C.

Casting metals; Method of ——. W. E. Lake, London. From European Brake Shoe Co., West Orange, N.J., U.S.A. Eng. Pat. 20,040, Sept. 1, 1909.

In the method of casting one metal around another, the piece of metal which is to form the core is first coated with an adhesive substance such as oil, fish-glue, etc., and then with a heat-insulating material such as powdered silica, before the other molten metal is poured around it. —A. S.

Gold and silver; Extraction and separation of —— *from their ores.* W. F. Cobb, London. From B. G. Cobb, Dawson, Canada. Eng. Pat. 20,471, Sept. 7, 1909.

The ore, finely crushed and screened, is fed into a tank to a depth of about six inches and covered with a solution composed of water, 1 ton; sodium chloride, 12 lb.; sodium (or potassium) bromide, 2 lb.; and potassium iodide, 6 oz. A continuous current of suitable strength (10 to 20 ampères) and voltage is then passed through the tank from a lead anode, formed by the lining combined with lead plates extending through the pulp, towards a lead cathode suspended in the solution above. At the same time, the contents are agitated by means of a rocker or mechanical stirrer. At the end of 12 to 20 hours, the whole of the gold will have been deposited in the amorphous form upon the cathode, which is subsequently removed and cupelled, whilst the chloride of silver, which has been simultaneously produced, may be recovered from the crushed residue at the bottom of the tank by a subsequent lixiviation with a solution of sodium thiosulphate. In some cases the operation may be accelerated by employing a sealed tank and raising the internal pressure to about two atmospheres.—C. A. W.

Minerals; Treatment of auriferous or argentiferous ——. A. A. Lockwood, Honor Oak. Eng. Pat. 24,003, Oct 19, 1909.

The ore, consisting, for example, mainly of iron pyrites, is finely crushed, mixed with about 1 per cent. of carbon and introduced into an iron retort connected with a vacuum apparatus. The mixture is then heated at a temperature of 700°—800° C. for about five hours, a partial vacuum being maintained within the retort; at the conclusion of the operation, the carbon remaining in the charge is burnt away by the admission of air. Any fumes evolved may be condensed by passing them through water and a larger proportion of carbon may be employed, or, possibly, with some carbonaceous ores, it may not be necessary to add carbon at all. With this preliminary treatment, it is stated to be possible to extract an increased amount of gold and silver from those ores of a basaltic blue, purple or pink appearance, which exist in the Croydon district of Queensland and in some parts of Rhodesia. Similarly, ores which, by other methods of assay, have shown no indications of gold or silver, have been proved to contain appreciable amounts of these metals. The process is employed more advantageously with ores containing a large proportion of gangue.—C. A. W.

Alloys ; Process for improving ——. A. Wilm, Berlin. Eng. Pat. 6485, March 15, 1910.

ALLOYS, especially those of aluminium and magnesium, after the last heating in the course of the usual mechanical treatment, are reheated to a temperature above 420° C., and then stored in order that they may undergo spontaneous improvement. After the reheating and before the storing, the alloys may, if necessary, be subjected to slight mechanical treatment.—A. S.

Metal ; Process for recovering ——. A. W. Diack, Detroit, Mich. U.S. Pat. 969,253, Sept. 6, 1910.

A MIXTURE of light metals and their oxides is fed by means of a hopper and worm attachment into a tube, the lower end of which is immersed in a molten metallic bath having a higher specific gravity than the metals to be recovered. The impurities are permitted to rise to the surface, the oxidation of the light metals being prevented by means of a non-oxidising gas which is passed in through the conveyor. —C. A. W.

Alloys ; Process of producing ——, and the separation of metals. P. F. Cowing, New York. U. S. Pat. 969,773, Sept. 13, 1910.

A NICKEL-COPPER alloy is dissolved electrolytically under such conditions that the solution obtained contains the copper as cuprous salts and any iron present as ferrous salts. The copper in the solution is then replaced by iron, and nickel and iron are deposited electrolytically from the resulting solution.—A. S.

Sodium amalgam ; Method of making liquid ——. H. P. Ewell, Detroit, Mich. U.S. Pat. 969,853, Sept. 13, 1910.

CLAIM is made for the preparation of a liquid amalgam, for use in the separation of gold and silver from their ores, by introducing a small quantity of sodium into a large quantity of mercury, with exclusion of air ; for example, the mercury may be covered with a suitable protecting layer and the sodium introduced through such layer.—A. S.

Ore-roaster. A. R. Wilfley, Denver, Colo., Assignor to J. Seep, Scranton, Pa. U.S. Pat. 969,927, Sept. 13, 1910.

A CIRCULAR hearth is mounted so as to rotate in a roasting chamber, and ore is fed on to it, means being provided at a predetermined point for regulating the temperature of the ore. An endless travelling brush, composed of hinged sections extending transversely across the hearth, removes the ore at a predetermined point, any fine particles left on the hearth being swept away by a blast of air.—A. S.

Ores ; Process of treating ——. E. B. Goodwin, Ward, Colo. U.S. Pat. 970,325, Sept. 13, 1910.

THE ore is ground to increasing degrees of fineness in successive grinders, and the metallic particles exposed by each grinding are subjected immediately to the action of the atmosphere and a heated solvent.—A. S.

Metals ; Elimination of —— [from copper alloys]. G. H. Clamer, Philadelphia, Pa. U.S. Pat. 970,686, Sept. 20, 1910.

THE alloy is melted with a flux and with a metallic compound of which the heat of formation is less than the heat of combination between its radical and the metal to be eliminated : and then after removing the slag, the fused mass is subjected to the action of the air.—C. A. W.

Quicksilver [Mercury] apparatus. I. Hageman, San Francisco. U.S. Pat. 970,705, Sept. 20, 1910.

THE ore mixture is heated in a slightly inclined revolving cylinder attached at either end to a fixed chamber. The material is fed continuously into the upper chamber, passes down the cylinder, and is discharged from the lower chamber. The escape of volatile products at the inlet and outlet points is prevented, the fumes being led into a condensing chamber. A burner, through which liquid fuel can be introduced, is arranged at the lower end of the furnace, above the discharge aperture, and means are provided for regulating the feed of the material at one end and the discharge of the waste products at the other. —C. A. W.

Air for use in metallurgical processes ; Art of treating ——. J. B. Miles, St. Davids, Pa. U.S. Pat. 971,297, Sept. 27, 1910.

IN apparatus where the air is required at varying pressures, it is compressed to the degree required, then cooled, and brought into contact with water which is maintained at a constant temperature, varying with the pressure at which the air is to be used, so that whatever the pressure the air carries substantially the same percentage of moisture.—A.S.

Detinning scrap ; Process of separating heterogeneous substances and ——. C. J. Reed, Philadelphia, Pa. U.S. Pat. 971,405, Sept. 27, 1910.

A MIXTURE of metals, for example tin scrap, is agitated with a magnetic material, preferably with the aid of heat, so as to pulverise one of the metals (tin) ; the magnetic material is then removed magnetically, and the pulverised metal is separated from the other metal or metals. (See also U.S. Pat. 950,115 of 1910 ; this J., 1910, 434.)—A. S.

Metals soluble in alkali : Process for the separation of —— from substances containing them. G. Spitz. Ger. Pat. 224,776, April 21, 1909. Addition to Ger. Pat. 224,283, Dec. 18, 1908.

THE process described in the main patent (see Eng. Pat. 28,551 of 1908 ; this J., 1910, 161) for the removal of metals soluble in alkali from scrap, alloys, etc., by heating under pressure with an alkali solution of sp. gr. 1·06—1·20, with or without addition of oxidising agents, can also be applied to substances such as ores, dyers' tin residues, etc., in which the metal is present in the form of oxide. In this new application of the process, the addition of oxidising agents is diminished considerably or even dispensed with.—A. S.

Alloys ; Pyrophoric metallic ——. H. Beck. Fr. Pat. 414,057, Feb. 1, 1910. Under Int. Conv., Feb. 5, 1909.

THE cerium-mercury alloys claimed contain between 40 and 80 per cent. of cerium. Even when the alloy contains only between 10 and 16 per cent. of cerium, it possesses the property of igniting spontaneously in the air ; with a content greater than 40 per cent., it ignites rapidly in these conditions and throws out intense sparks which give an exceedingly brilliant light. The intensity of production of the sparks increases with the proportion of cerium up to a content of 80 per cent., after which the pyrophoric force considerably decreases. The alloys can be obtained by heating the finely divided rare metal in a closed vessel in contact with mercury vapour at a temperature of 500°—600° C., the intensity and duration of the heating being adjusted according to the amount of mercury it is desired to absorb. The presence of other rare earth metals in the cerium employed may be neglected, since it has been found that the alloys of mercury with all these metals possess almost exactly similar pyrophoric properties. From such alloys, which are very brittle and can easily be powdered, an explosive, igniting spontaneously in the air, can be obtained. For this purpose, the finely divided substance is mixed with an oxidising agent, such as a chlorate.—C. A. W.

Ores; Apparatus for the treatment of crushed — with a view to recovering the metal contents. A. J. Arbuckle. Fr. Pat. 414,459, April 4, 1910.

The invention relates chiefly to means for transporting the solid material, which has been separated at the bottom of a depositing vat from a mixture of liquid and solid such as the mill pulp obtained in the treatment of gold ores. When these solids have to be treated again in another vat, it will be necessary to raise them from the bottom of the depositing vessel through a considerable height, which renders the employment of a continuous screw-transporter impracticable by reason of the difficulty of supporting and driving so long a shaft. It is therefore proposed to form the transporter in several sections, each section being composed of a parallel pair of screw-conveyors running upwards and communicating at the top with an adjacent pair arranged above it. A main shaft passing down the centre then serves to drive the screws in alternate pairs, commencing at the lowermost, by means of gear-wheels, the screws in the intermediate pairs being driven indirectly by gear-wheels arranged on the shafts of the others. At the lower end of each unitary screw, a tube is provided through which water can be admitted in order to prevent the solids from penetrating into the bearings. The depositing vessel itself does not differ essentially from that described in Fr. Pat. 413,417 (this J., 1910, 1115), the solids from the bottom of the conical vat being driven by means of a worm-conveyor into the lowermost section of the transporter.—C. A. W.

[Aluminium] alloy and process of manufacturing it. J. M. Belin. Fr. Pat. 414,591, June 22, 1909.

The alloy consists of aluminium with suitable proportions (which may be varied) of copper, nickel, cobalt, manganese, and magnesium, with or without addition of up to 10 per cent. of vanadium and tungsten. An alloy containing a small proportion of aluminium is first prepared by melting the aluminium, then adding in succession the copper, nickel, cobalt and manganese, tungsten, and vanadium, and after the whole is fused, the mass is allowed to cool somewhat and then the magnesium added. From this alloy the final product is obtained by fusing with the desired quantity of aluminium. Special mention is made of an alloy containing 94·30 per cent. of aluminium, 4·60 of copper, 1 of nickel, cobalt and manganese together, and 0·1 of magnesium. This is stated to have a tensile strength of 25 kilos. per sq. mm.; elastic limit, 18 kilos. per sq. mm.; and elongation, 7 per cent.—A. S.

Solder for aluminium alloys. J. M. Belin. Fr. Pat. 414,592, June 22, 1909.

A solder for aluminium alloys, especially those described in the preceding abstract is prepared by using as basis an alloy, fusible at 100° C., composed of 3 parts of tin, 8 of bismuth, and 5 of lead. This alloy is fused with variable proportions of zinc and aluminium, and in some cases, also tin, to obtain solders suited for different purposes. A specially strong solder is composed of 10 grms. of the fusible alloy, 300 grms. of zinc, and 5 grms. of aluminium; whilst a soft solder is composed of 160 grms. of the fusible alloy, 80 grms. of zinc, 25 grms. of aluminium, and 80 grms. of tin.—A. S.

Ores; Mechanico-chemical process for the separation of ——. Comp. d'Entreprises de Lavage de Minerais. Fr. Pat. 414,660, April 8, 1910.

The process is intended for the separation of sulphides from other minerals of approximately the same specific gravity. The ore is converted into a pulp containing particles of not more than 2 mm. diameter and is then treated with an acid solution, such as dilute sulphuric acid, at a temperature between 45° C. and the boiling point of the solution. The sulphide particles become coated with a film of hydrogen sulphide, and by reason of the buoyancy thus conferred on them, can be separated mechanically from the other constituents of the ore, by the aid of percussion tables, screens, or other suitable devices. The acid solution after separation from the ore can be brought to the requisite temperature and again used in the process.—A. S.

Metallic bodies [platinum-coated metals]; Composite — and process of manufacturing them. B. E. Eldred Fr. Pat. 414,721, April 11, 1910.

Solid pieces of a metal of the iron group and of platinum are placed in contact and then heated to nearly the fusing point of the former metal, or even a little above the fusing point, in order to obtain a firm union between the two metals. In most cases it is preferable to first give the metal of the iron group a thin coating of a metal such as copper of high melting point, before effecting the union with platinum; in this case the composite metal is heated to the melting point of the copper. The composite metals thus obtained can be rolled, drawn, stamped or worked in any other manner, and in this way the mechanical properties of the platinum coating are improved. By suitable choice of the metal which is united with the platinum, products suitable for electric lamp electrodes, leading-in wires, chemical apparatus, fittings for artificial teeth, etc., can be prepared. A. S.

Slag; Apparatus for atomising liquid ——. Buderus'sche Eisenwerke, Wetzlar, Germany. Eng. Pat. 29,365, Dec. 15, 1909. Under Int. Conv., Dec. 28, 1908.

See Fr. Pat. 410,377 of 1909; this J., 1910, 827.—T. F. B.

Case hardening or cementation purposes; Production of materials for ——. H. Rodman, Pittsburg, U.S.A. Eng. Pat. 313, Jan. 5, 1910.

See U.S. Pats. 949,446, 949,448, 949,449, and 949,549 of 1910; this J., 1910, 361.—T. F. B.

Electric furnace for transforming pig-iron into steel. G. Gin, Paris. U.S. Pat. 970,700, Sept. 20, 1910.

See Addition of Jan. 26, 1906, to Fr. Pat. 342,101 of 1904; this J., 1906, 993.—T. F. B.

Steel: Process for refining —— in the open-hearth furnace, using coal-dust for heating. G. Barbanson and M. Lepersonne. Fr. Pat. 414,092, March 5, 1910. Under Int. Conv., July 3, 1909.

See Eng. Pat. 5916 of 1910; this J., 1910, 1113.—T. F. B.

Ore products; Apparatus for the treatment of crushed —— for the recovery of the metal contents. A. J. Arbuckle, Belgravia, Transvaal. Eng. Pat. 3488, Feb. 12, 1910.

See Fr. Pat. 413,417 of 1910; this J., 1910, 1115.—T.F.B.

Electroplating: Process of and means for depositing metals. A. Rosenberg, London. U.S. Pats. 970,755 and 970,852, Sept. 20, 1910.

See Eng. Pat. 7227 of 1908; this J., 1909, 530.—T. F. B.

Sodium: Process for the manufacture of metallic ——. P. L. Hulin, Grenoble, Assignor to Soc. d'Electro-Chimie, Paris. U.S. Pat. 971,198, Sept. 27, 1910.

See Fr. Pat. 393,706 of 1907; this J., 1909, 149.—T. F. B.

Ores bearing precious metals: Treatment of ——. J. C. Clancy, New York. U.S. Pats. 971,251 and 971,252, Sept. 27, 1910.

See Fr. Pat. 400,770 of 1909; this J., 1909, 1044.—T.F.B.

Alloys; Process for improving metallic ——. A. Wilm. Fr. Pat. 414,108. March 18, 1910.

SEE Eng. Pat. 6485 of 1910; preceding.—T. F. B.

Settling tanks for separating liquid from crushed ore products and other granular materials. Eng. Pat. 29,755. *See* I.

Lubricant for metallurgy. Fr. Pat. 414,813. *See* XII.

XI.—ELECTRO-CHEMISTRY.

PATENTS.

Compounds containing oxygen and nitrogen; Production of —— by electrical means. P. Bunet and A. Badin. First Addition, dated June 26, 1909, to Fr. Pat. 402,012, Aug. 17, 1908 (this J., 1909, 1198).

THE present addition to the original patent described in this J. 1909, 1198, refers briefly to the extinction and cooling of the arcs, for which any fluid, not necessarily a liquid, is claimed, the fluid operating at the exit of the reaction chamber, through which it is not allowed to pass. Special mention is made of the use of steam for this purpose, the short-circuiting, liable to occur with water (in the form of spray) and other liquids, being thereby avoided.—F. SODN.

Electric arcs; Apparatus for the production of —— intended for the formation of compounds of oxygen and nitrogen. P. Bunet and A. Badin. First Addition, dated June 26, 1909, to Fr. Pat. 406,115, Nov. 30, 1908 (see Eng. Pat. 16,225 of 1909; this J., 1910, 98).

IN order to ensure the maximum number of arcs, each of the branches constituting either the lateral or central electrode is fed by an independent current, obtained preferably by transforming the potential of the single source of current supplying the apparatus. The central electrode, where this is single, may also be fitted with a toothed rotary part, intended to start the arcs as the teeth move opposite the branches of the lateral electrode, combined with an arrangement for producing an intermittent blast of air on the arcs as they are formed. —F. SODN.

Furnace; Electric resistance —— with great concentration of energy and continuous working. V. Popp. First Addition, dated March 11, 1910, to Fr. Pat. 409,244, Oct. 15, 1909 (this J., 1910, 766).

THE resistance of the furnace is combined with an arc, produced between two electrodes placed above the crucible, so that the heat radiates on to the surface of the treated material. A greater quantity of heat is thus concentrated at the interior of the crucible, ensuring complete reaction, a more perfect fusion, and also a superfusion or distillation of the treated material.—B. N.

Furnaces; Process and arrangement for the charging of electric resistance ——. A. Petersson. Fr. Pat. 414,296, March 12, 1910. Under Int. Conv., June 2, 1909.

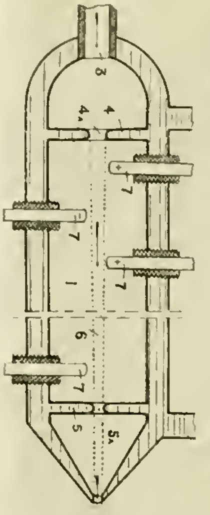
THE charging material, or a portion of this, is pushed, by the aid of mechanical feeding arrangements, towards the surfaces of the electrodes in contact with the charge, or towards a point situated below the point of the electrode. This ensures good contact between the electrode and the charging material, and prevents the formation of luminous arcs in the neighbourhood of the electrode. —B. N.

Iron; Process of preparation of a mass of active —— for the negative electrode of alkaline accumulators. Nya Ackumulator Aktiebolaget Jungner. Fr. Pat. 414,713, April 11, 1910. Under Int. Conv., May 13, 1909.

IRON and cadmium are simultaneously precipitated from their solutions by electrolytic means, the spongy alloy obtained being afterwards washed, dried, and reduced to a powder of convenient size of grain.—B. N.

Electric furnace; Process and arrangements for the treatment of gases by the —— particularly for the synthetic manufacture of nitrogen products. C. Sénez and L. Giniès. Fr. Pat. 414,726, April 11, 1910.

THE furnace comprises a cylindrical chamber, 1, provided with double metallic walls, 2, and with diaphragms, 4 and 5, having openings, 4a and 5a, of appropriate form and dimensions. Electrodes, 7, produce arcs which traverse the moving column of gas, 6, the latter being formed by the orifices in the diaphragms. This column of gas is surrounded by a stationary layer of gas, which protects the walls of the furnace. The heat radiated from the furnace is recovered by the water between the walls, 2, this forming a boiler-tube and vaporiser without circulation of water. The products of the action are absorbed in a number of tubes through which absorbing liquid is circulated, the middle part of one tube being connected to the lower part of the adjacent tube, so that each is partially filled with the absorbing liquid. The gas is circulated through the tubes, in the opposite direction to the absorbing liquid, entering the bottom of each tube and leaving at the top. The furnace and the absorption apparatus are combined with a turbine, and an appropriate compressor, so as to form a closed cycle for the treatment of the gases under pressure.—B. N.



Electro-plating apparatus. G. I. Roman, Charlottenburg, Germany. Eng. Pat. 5369, March 3, 1910.

SEE Fr. Pat. 413,239 of 1910; this J., 1910, 1115.—T. F. B.

XII.—FATS; OILS; WAXES.

Olive oils; Composition of Tunisian ——. R. Marcille. Ann. Falsif., 1910, 3, 372—379.

RESULTS are given of the analyses of 550 samples of Tunisian olive oil, the samples being representative of the whole of the oil exported from the country during the period Dec. 1, 1908, to Mar. 31, 1910. The iodine values (Wijs) obtained were:—Sfax oils, 82·1 to 86·7; Sahel oils, 81·2 to 84·5; Tunis oils, 87·0 to 92·8. The liquid fatty acids separated from the oils had iodine values varying from 104 to 108. Certain of the oils from the Sfax and Sahel districts yielded colour reactions similar to, but not identical with, those given by sesamé oil; no less than 70 per cent. of the oils from the Tunis district gave these reactions (see this J., 1909, 1208). The acidity of the oils was extremely low, 85 per cent. of the total number of samples showing an acidity of less than 1 per cent.—W. P. S.

Indian oils. D. Hooper. Annual Report, Indian Museum, Industrial Section, 1909—1910, 26—31.

Cottonseed oil.—When the oil expressed from American cottonseed grown in India is exposed to the winter temperature of Calcutta (22°—24° C.), very little "stearine" is deposited, but chemical methods yielded 29·5 and 32·4 per cent. of a solid white fat in the case of two samples of this oil. In the author's opinion Indian oil would yield as much "stearine" as American and Egyptian oils. The acid values of two samples of oil obtained from American seed grown at Dharwar were 7·5 and 9·5 respectively. By adding an amount of alkali corresponding to this acidity, and subsequently washing the oil, the whole of the colouring matter, "bloom" and acidity was removed, leaving a product having the light colour and other characteristics of Egyptian refined oil. Most of the edible cottonseed oil used in Britain is derived from Egyptian seed, for the Indian product is believed to have a disagreeable flavour. This is attributed to excess of fibre in the seed or to the bad condition of the seed on delivery. The process of refining is also stated to be more expensive. The experiments cited, however, show that careful screening of the seed before crushing, and thorough washing of the oil after the alkaline treatment would produce a perfectly edible oil for local use.

Soy beans.—The amount of oil in 91 samples received from the different districts where the seeds are grown ranged from 13·5 to 22·4 per cent., those from Poona yielding the most. The beans grown in India yield almost as much oil as those from Manchuria and Japan. Only certain districts, such as upland areas in Burma and Assam and the lower valleys of the Himalayas, are suitable for the cultivation of Glycine.

Malkanguni seeds (*Celastrus paniculatus*) contain a reddish coloured oil which deposits a white fat on standing. The oil is reputed to have medicinal properties and is employed by native students as a brain stimulant. Two samples of the seeds yielded 44·7 and 43·25 per cent. of a thick oil of bitter taste. Seven samples of the oil from different districts gave the following values:—Sp. gr. at 50° C., 0·942 to 0·956; acid value, 34·7 to 101·0; saponification value, 218·0 to 246·7; iodine value, 75·5 to 100·8; Reichert-Meissl value, 41 to 42; unsaponifiable matter, 3·5 per cent.; Hehner value, 70·2 to 86·2. *Fatty acids:*—M.pt., 35·5° to 38·5° C.; neutralisation value, 179·9 to 192·8; and iodine value, 103·1 to 109·3. The "solid" fatty acids (37 per cent.) melted at 54° C. The high saponification and Reichert-Meissl values are in accordance with the values obtained with oil of the staff tree (*Celastrus senegalensis*, and spindle tree (*Eronymus europæa*), which belong to the same natural order.

Pyinkado seeds (*Xylia dolabriformis*), obtained from a tree common in Burma, yielded, on extraction with ether, 21·1 per cent. of a yellow non-drying oil melting at 22° C. It gave the following results:—Acid value, 22·0; saponification value, 176·3; iodine value, 89·4; Hehner value, 93·3. *Fatty acids:*—M.pt., 54° C.; and neutralisation value, 179·4. The "solid" fatty acids (31·6 per cent.) melted at 69° C., and thus probably consisted of stearic acid.

Kirni seeds, which are derived from *Mimusops hexandra*, a plant cultivated in Northern India, yield a clear light yellow non-drying oil, which gives a deposit of "stearine" at 30° C. The oil gave the following results:—Sp. gr. at 40° C., 0·905; acid value, 25·5; saponification value, 195·4; iodine value, 72·5; Reichert-Meissl value, 0·17; Hehner value, 95·4; unsaponifiable matter, 1·3 per cent. *Fatty acids:*—M.pt., 38° C., neutralisation value, 200·5; and iodine value, 75·6.

Origanum vulgare.—A sample of the seeds from Ramnagar yielded, on extraction with ether, 27·3 per cent. of a drying oil with the following characteristics:—Acid value, 11·3; saponification value, 194·9 and iodine value, 190·5. In its high iodine value the oil resembles the oil of *Perilla ocimoides.*

Prunus puddum.—The seeds of this plant (bird cherry), which grows in the Himalayas, yield a rapidly drying oil when extracted with ether. Owing to the fact that a pellicle began to form upon the oil immediately after evaporation of the solvent it was difficult to ascertain its iodine value. In one experiment this value was 172. The oil formed a dry film on glass in 2 hours, whilst boiled linseed oil under the same conditions required 4 hours. The pressed cake and the seeds, when distilled with water yielded a considerable quantity of hydrocyanic acid and benzaldehyde.—C. A. M.

Propolis; Further contributions on ——. K. Dieterich. Chem.-Zeit., 1910, **34**, 1006.

A NUMBER of samples of propolis, both personally collected and commercial specimens, were examined. The crude propolis was extracted with petroleum ether, and the soluble portion, containing crude propolis wax, boiled with 70 per cent. alcohol thus separating it into propolis balsam (soluble) and propolis wax (insoluble). The residue from the treatment with petroleum ether was extracted with 96 per cent. alcohol which dissolved the propolis resin, leaving a residue of dirt, wood, fibres, etc. The amount of aqueous extract was fairly constant, usually light yellow in colour, or colourless, and strongly opalescent. On drying at 100° C. there was usually a loss of 5 to 6 per cent. The ash was about 8 to 12 per cent. in the commercial samples, but only about 2·5 per cent. in those personally collected. The insoluble residue amounted to 15 to 22 per cent. in the commercial samples, but did not exceed 12 to 13 per cent. in those personally collected; in the former samples it often contained small nails, screws, and other pieces of metal. The commercial samples contained in some cases as much as 60 per cent. and more of crude wax; in the personally collected samples this was less in amount, and never more than 45 per cent. The average amount of propolis balsam in the samples examined waa 3 per cent. Both commercial beeswax and fresh wax from the hive, free from resin, showed only traces of balsam after treatment with 70 per cent. alcohol. In some of the personally collected samples the amount of propolis resin amounted to almost 65 per cent., but waa never higher than 44 per cent. in the commercial samples. According to the author good propolis should comply with the following conditions:—The ash should not amount to more than 2 per cent.; the aqueous extract should amount to 5 to 6 per cent., should be strongly opalescent and of strongly aromatic smell; the amount of crude propolis wax should be as small as possible and the amounta of propolis resin and propolis balsam as high as possible. The insoluble residue should be as small as possible, not more than 13 to 14 per cent.; it should also contain no metallic particles or other heavy adulterants.—E. F.

Indian industrial vegetable products. Hooper. *See* XIXA.

Palm kernel and oil industry of Sierra Leone. Col. Off. Ann. Ser., No. 648. [T.R.]

THE exports last year of palm kernels, the staple product of the colony, exceeded by 9,176 tons, or 27·2 per cent., the exports in 1908. The hinterland of Sierra Leone is rich in palm kernels, but until the railway is extended, a great part of the resources will remain undeveloped. Palm kernels and palm oil represent more than 60 per cent. of the whole export trade of Sierra Leone. A few nut-cracking machines have been imported, but they all seem defective in one or other respect, and most of the kernels shipped from Sierra Leone are obtained by placing the nuts singly on a stone and cracking them with the aid of another stone; this work is done by women and children. The Agricultural Department of the Gold Coast Colony, experimenting with a nut-cracking machine, found that a saving in labour of 41·5 per cent. was effected in cracking 2,050 lb. of nuts. Another machine yielded 14·85 lb. of nuts in the depulper from 22 lb. of fruit, and from the pulp 2·2 lb. of palm oil were obtained—a yield of about five-sixths of the oil present.

PATENTS.

Bones; Extraction of grease and glue from ——. A. Meiro, Moscow. Eng. Pat. 18,468, Aug. 10, 1909.

THE bones are crushed to a paste which is then introduced into a vessel provided with a steam-jacket where it is mixed with water having a temperature above that of the melting point of the fat present. The vessel is provided with a stirring device and air is also blown into the lower part of the vessel in order to aid in mixing the mass. When all fatty matter has melted and risen to the surface of the mixture, more water is admitted so that the level of the fatty layer is raised to that of overflow pipes near the top of the vessel. After the removal of the fat, the water is run off through screened openings at the bottom of the vessel and the bone-paste is treated with water and steam under pressure, the glue solution thus obtained being drawn off from time to time through the screened openings already mentioned. The last quantities of glue

solution are removed from the bone-paste by admitting compressed air to the upper part of the vessel. Finally, the bone-paste may be dried by forcing a current of air into the lower part of the vessel while the stirrer is operated.
—W. P. S.

Oils; Clarifying ——. H. Barringer, London. Eng. Pat. 22,401, Oct. 1, 1909.

The clarifying apparatus described consists of a tank containing a heating coil formed in the shape of a cone; this coil is surrounded by a screen having openings at its lower part. The oil is introduced at the top of the tank and while it is heated in the latter, a current of hot air is blown through it, the perforated pipe through which the air is forced being situated inside the heating cone. Any water in the oil is thus converted into steam which escapes at the top of the tank, whilst the oil flows over the top of the screen, then downwards outside the latter and is drawn off at the bottom of the tank.—W. P. S.

Lubricant for metallurgy. R. Auché et Cie. Fr. Pat. 414,813, June 28, 1909.

To a mixture of 5 parts of castor oil and 1 part of sulphuric acid, water is added until the desired degree of fluidity has been attained. The resulting liquid is then incorporated with powdered sodium carbonate, or with soda lye, in the proportion of 100 parts of the liquid and 5 to 10 parts of the alkali.—C. A. W.

Soap, and manufacture thereof. R. Macpherson, London, and W. E. Heys, Bushey. Eng. Pat. 20,089, Sept. 2, 1909.

Casein, gluten, albumin, the germs of various cereals or other similar materials are treated in the cold with an excess of strong alkali and the excess of alkali is caused to combine, preferably, with fatty acids although glycerides may also be employed, the mixing being carried out in an edge-runner or similar mill. The soap thus obtained may be immediately passed through rolls and plodded. Heat is not required for the process but solid fatty acids may be melted before use.—J. A.

Soap; Machine for instantaneously converting liquid —— into solid soap to be sold in bars or as a powder. E. Savy. Fr. Pat. 414,252, Mar. 30, 1910.

The apparatus comprises a rotatable drum containing channels to receive and divide the soap paste into fine flakes, and provided with means for the introduction of a cooling gas or liquid. Fitting closely against the side of this drum there revolves in the opposite direction a smaller cylinder with double walls, which acts as a hopper for the liquid soap paste. Steam or hot water are introduced between the walls, whilst the sides of the cylinder are pierced with circular openings coinciding with the channels in the large drum. Means are also provided for discharging the solidified soap from the drum in the form of a bar or bars.—C. A. M.

Lubricating oils; Manufacture of ——. A. de Hemptinne, Ghent, Belgium. U.S. Pat. 970,473, Sept. 20, 1910.

See Fr. Pat. 440,843 of 1909; this J., 1910, 222.—T. F. B.

Soft soap; Preparation of ——. J. Bauer, Stuttgart, Germany. Eng. Pat. 21,457, Sept. 20, 1909.

See Fr. Pat. 406,917 of 1909; this J., 1910, 576.—T. F. B.

Soap; Manufacture of —— [*with basis of vaseline, etc.*]. P. Müller, St. Petersburg. Eng. Pat. 29,113, Dec. 13, 1909.

See Fr. Pat. 410,894 of 1909; this J., 1910, 830.—T. F. B.

Oleic acid derivative containing a phenyl group. U.S. Pat. 970,662. *See* XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Turpentine (oil of); Detection of small quantities of petroleum spirit in ——. F. Klein. J. Ind. Eng. Chem., 1910, **2**, 389.

3—4 c.c. of a 10 per cent. copper sulphate solution are added to 1—2 c.c. of the sample. With pure oil of turpentine a turbid liquid is obtained; on now adding a small crystal of potassium iodide, a purple-red coloration is obtained, which on shaking, gradually fades and changes to green. In the presence of petroleum spirit, the liquid remains clear and with the iodide a purple coloration is obtained, changing to yellowish-brown on shaking. If rosin be also present the odour is recognisable, and the solution is brownish in colour and more or less clear according to the proportion of petroleum spirit present.—A. Sbld.

Shellac; Analysis of ——. W. Vaubel. Chem.-Zeit., 1910, **34**, 991—992 and 1008—1009.

The composition of stick-lac is probably:—about 6·0 per cent. of wax; 6·5 of lac dye; 74·5 of pure gum (of which two-thirds are soluble in ether); 9·5 of wood, sand, etc.; and 3·5 of water. The composition of pure shellac is probably about 4·5 per cent. of myricyl alcohol; 8·8 of acid not condensed by hydrochloric acid; 27·0 of trihydroxypalmitic acid; and 65·0 of oily acids. Shellac is usually bleached with chlorine, which not only destroys the dyestuff but also effects other chemical changes. Sometimes bleached shellac contains chlorine (up to 1·26 per cent.). Shellac is often adulterated, more especially with colophonium and other similar resins soluble in alcohol. For the determination of resins in shellac the following methods are available:—(1) Extraction with organic solvents. (2) Extraction with borax solution. (3) Determination of the acid and saponification values. (4) Determination of the iodine value. (5) Determination of the bromine value. (1). *Extraction with organic solvents.*—Chloroform, carbon tetrachloride, and benzene are the most suitable solvents, colophonium being readily soluble in these, whilst shellac is almost insoluble. But other methods must also be used to identify both the residue and the soluble portion. (2). *Use of borax solution.*—Though both shellac and colophonium are soluble in alkalis, shellac alone is soluble in borax solution. 10 grms. of the finely divided substance are warmed and stirred on the water-bath with 200 c.c. of 10 per cent. borax solution and the residue washed and dried. In this case also it is advisable to further examine both residue and solution. Sometimes a condensation product of aldehyde and phenol is used for adulteration, and remains in the residue. (3). *The acid, saponification and iodine values* are of little value for detecting adulteration. (4). *Bromine value.*—By this means shellac can be analysed quickly and with fair accuracy, and it is the method recommended by the author. The bromine value of shellac varies from 5 to 8, and that of colophonium from 120 to 130 according to the author, whilst Lewkowitsch finds 190·6. The bromine value of Burgundy resin is stated to be 78·8 to 88. 5 grms. of the finely powdered material are vigorously shaken with 100 c.c. of chloroform or carbon tetrachloride in a stoppered bottle of 300 to 400 c.c. capacity. If much of the material is dissolved this fact points strongly to adulteration. After shaking for 30 minutes, 100 c.c. of water, 20 c.c. of concentrated hydrochloric acid and 10 grms. of potassium bromide are added and the whole well mixed. A solution containing 20 grms. of pure potassium bromate per litre is now added from a burette, 1 c.c. at a time, with shaking, until the supernatant aqueous layer is permanently coloured yellow. If the shellac is itself strongly coloured, excess of bromine is tested for with iodised starch paper. The reaction is finished when the yellow coloration remains for half an hour with frequent shaking. Under these conditions the bromination of the shellac itself is so slight that it can be neglected, owing to the fact that the shellac remains undissolved. For 5 grms. of material and a potassium bromate solution of exactly the above strength the percentage of colophonium is 0·975*n*, where *n* is the number of c.c. of bromate solution used, if the bromine value of the colophonium is 120, and 0·9*n* if it is 130. The insoluble portion may then be removed, washed with water and chloroform, dried and weighed as shellac; with the help of the bromine value an opinion as to the nature of the adulterating resin may then be formed.—E. F.

Copal amber mixtures; Detection of ——. F. Klein. J. Ind. Eng. Chem., 1910, **2**, 389.

A LITTLE of the finely powdered sample is added to about 4 c.c. of ethyl acetate containing 0·5 grm. (at most) of cobalt nitrate, then 2 c.c. of anhydrous acetic acid and 1—2 c.c. of chloroform are successively added, and the mixture heated. Copal will dissolve whilst amber will granulate. On adding the solution to strong methyl alcohol, a silky precipitate is obtained if copal be present, otherwise the solution will remain clear. Small quantities of copal can be detected by the opalescence produced on adding water to the methyl alcohol solution.—A. SHLD.

Indian industrial vegetable products. Hooper. *See* XIXA.

PATENTS.

Lakes; Yellow ——. E. Meckbach, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 970,072 and 970,073, Sept. 13, 1910.

THE lakes prepared from the symmetrical 1.8- and 1.5-dibenzoyldiaminoanthraquinones are yellow in colour, and fast to light, water, and oil.—T. F. B.

Lakes [from azo dyestuffs]; Production of red ——. Badische Anilin und Soda Fabrik. Second Addition, dated April 1, 1910 (Under Int. Conv., Dec. 13, 1909) to Fr. Pat. 297,330, Feb. 17, 1900 (see Eng. Pats. 25,511 of 1899, 2784 of 1900, and 82 of 1906; this J., 1901, 35, 240; 1906, 703).

METALLIC lakes of Lithol Red (1-sulphonaphthaleneazo-β-naphthol) can be prepared by boiling the dyestuff with suspensions of insoluble metallic salts other than carbonates, for example, heavy spar or lead sulphate.—J. C. C.

Paint vehicle; Process for manufacturing products suitable for use as a —— *and for the preparation of varnishes and impregnating and insulating materials.* S. Diesser. Chem. Lab. und Versuchsstat. f. Handel und Ind. Ger. Pat. 224,501, April 25, 1908.

IN Ger. Pat. 191,552 (this J., 1908, 235) the manufacture of a product suitable for the preparation of varnishes, etc., by heating keratin (horn, etc.) with fatty or resin acids, was described. In the present patent the preparation of similar products by using proteins of any kind instead of keratin is claimed.—A. S.

Oil colours having a magnesium base; Process of making ——. J. Meurant, Liege, Belgium. Eng. Pat. 20,805, Sept. 11, 1909.

SEE Fr. Pat. 406,927 of 1909; this J., 1910, 577. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 20,707 of 1889; 9291 and 17,581 of 1893; 3929 of 1899; and 11,803 and 20,379 of 1907.—T. F. B.

Anti-rust composition and process of manufacturing the same. W. P. B. C. Pauling, Leipzig-Lindenau, Germany. Eng. Pat. 27,135, Nov. 22, 1909.

SEE Fr. Pat. 409,569 of 1909; this J., 1910, 770.—T. F. B.

Ultramarine; Manufacture of ——. R. Rehkop, Linden-Hannover, Germany. Eng. Pat. 28,490, Dec. 6, 1909.

SEE Fr. Pat. 410,055 of 1909; this J., 1910, 831.—T. F. B.

Colouring matters of great covering power and polishing powders from titaniferous iron ores; Manufacture of ——. P. Farup, Christiania. Eng. Pat. 3649, Feb. 14, 1910.

SEE Fr. Pat. 412,563 of 1910; this J., 1910, 1023.—T. F. B.

Printing and lithographic inks; Manufacture of ——. R. C. Child and J. Johnston. Fr. Pat. 414,179, March 26, 1910. Under Int. Conv., April 8, 1909.

SEE Eng. Pat. 8532 of 1909; this J., 1910, 288.—T. F. B.

Pigments [lakes] from dibenzoyl-1.5- and 1.8-diaminoanthraquinones; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 414,351, March 31, 1910. Under Int. Conv., June 10, 1909.

SEE U.S. Pats. 970,072 and 970,073 of 1910; preceding. —T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Indiarubber; Cultivation of —— *in Mexico.* H. J. Ludewig. Tropenpflanzer, 1910, **14**, 510—521.

IN Mexico indiarubber is obtained from two different plants, Guayule in the North of the Republic, and *Castilloa elastica* in the South. The total export of rubber from Mexico in the fiscal year 1908—1909 amounted to 6,015,173 kilos. (13,261,000 lb.), with a declared value of £850,661, the respective proportions of Guayule and Castilloa being 5,601,858 kilos. (12,348,800 lb.), and 413,315 kilos. (911,200 lb.), or 93·12 and 6·88 per cent. It is stated that expectations with respect to the Castilloa tree are far from being fulfilled. In Palenque there are well developed 14 year old trees yielding no latex, whilst in the Isthmus 7 to 8 year old trees in normal condition give 90 to 100 grms. (3·2—3·5 oz.) per year. The most promising Castilloa plantation has an area of 500 hectares (1235 acres) with 350,000 trees 6 to 8 years old yielding 36,800 kilos. (81,130 lb.) of commercial raw rubber, which corresponds to 73·6 kilos. per hectare (65·7 lb. per acre), and 105 grms. (3·7 oz.) for each tree. It is difficult to estimate the extent of the Castilloa cultivated in Mexico, but the total area according to the most reliable estimates for the Palenque, Tabasco, Veracruz, and Soconusco districts amounts to 36,000 hectares (88,920 acres). Taking the yield for a 10 year old plant as 150 grms. (5·3 oz.), and assuming there are 500 trees per hectare (200 per acre), then the yield of plantation rubber in the year 1915, given favourable weather conditions, may be estimated at 2,700,000 kilos. (5,952,400 lb.). Appended to the article are reports of consuls on different plantations of Mexico, and also some particulars of experiments on the cultivation of the Guayule rubber plant.—J. P. O.

PATENTS.

Caoutchouc; Manufacture of a new substance similar in its properties to natural ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 15,254 June 25, 1910. Under Int. Conv., Sept. 29, 1909.

THE process consists in heating erythrene (divinyl) with or without the addition of agents which promote polymerisation. For instance, 500 parts of erythrene are dissolved in benzene and the solution is heated in an autoclave for 10 hours at a temperature of 150° C.; the solvent and other volatile substances are then removed by steam-distillation, leaving an elastic substance very similar to natural caoutchouc. Or, 200 parts of erythrene are liquefied by cooling with a mixture of ether and solid or liquid carbon dioxide, and the liquid is then heated in an autoclave for four days at from 90° to 100° C.; unchanged erythrene is now removed, and the residue is heated for some time *in vacuo* on a water-bath which is finally raised to boiling. A liquid distils over whilst the new product remains.—W. P. S.

Rubber; Regeneration of waste ——. L. C. A. de Clercq. Fr. Pat. 414,759, April 12, 1910.

WASTE vulcanised rubber is finely divided and heated with a solvent such as turpentine oil until it has swelled up as much as possible. It is next heated for several hours in an autoclave with an excess of turpentine oil containing a hydrocarbon such as naphthalene in the proportion of at least double the weight of sulphur in the rubber. After this treatment the rubber may be dissolved by the ordinary solvents and precipitated from the concentrated solution by the addition of alcohol or acetone. Or, if it is desired to recover the mixture of rubber and mineral matter without the sulphur, it is sufficient to wash the mass from the autoclave with alcohol. By this treatment the naphthalene is removed.—C. A. M.

Chlorides of carbon; Method and means for utilising —— for rendering benzines, alcohol, ether, and the like, non-inflammable and for the preparation of rubber solution and other products therewith. H. Pichon and T. Truchelut, Paris. Eng. Pat. 21,007, Sept. 14, 1909.

See Fr. Pat. 402,235 of 1909; this J., 1909, 1273.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Sampling for liquid [tanning] extracts; Rules of ——. R. Lepetit. Collegium, 1910, 382—384.

The rules for sampling liquid extracts formulated by the Internat. Assoc. of Leather Trades Chemists in London in 1897 and confirmed at Leeds in 1902 prescribed that a sample should be taken from at least 5 per cent. of a consignment. The head must be removed from the cask, the contents well mixed and the deposit removed from the sides before the sample is drawn. This method appears to be followed in Germany, but it has certain disadvantages and the author proposes an alternative one. The proportion of 5 per cent. is too little when the consignment consists of 20—50 casks only; also the removal of the head of the cask damages it. The proportion of the total number of casks to be sampled is proposed as the square root of the total number less one. The barrels are to be rolled for a distance of about 20 metres and left to stand for a few minutes first on one end and then on the other. The bung is then removed and two buckets-full of about 18 litres removed and the contents of the cask shaken again before taking the sample. By removing some of the contents a much more efficient mixing is possible than by the stirring with a stick as prescribed by the rules of the Internat. Assoc. of Leather Trades Chemists, and the whole operation takes only from one-seventh to one-sixth of the time required by the latter method.—D. J. L.

Hide-powder; Chroming of ——. C. R. Oberfell. J. Amer. Leather Chem. Assoc., 1910, 5, 419—426.

The report of a committee appointed to investigate the possibility of reducing the time of chroming the hide powder, used in tannin-analysis, from that prescribed by the official method of the Amer. Leather Chem. Assoc. The new method consists in wetting the hide-powder with 10 times its weight of water, adding 3 per cent. of chrome alum and agitating continuously for one hour. The chromed powder is then washed according to the official method. The results obtained in the analysis of samples of chestnut, blended, and quebracho extract, using the new method, were compared with those obtained by the official method. The mean results, obtained by all the investigators by the two methods show very close agreement, but the saving of time effected by the new method cannot be taken advantage of in extract analysis unless a rapid cooling of the analysis solution is permitted. —D. J. L.

Acidity of tan liquors; Determination of ——. W. K. Alsop. J. Amer. Leather Chem. Assoc., 1910, 5, 434—446.

The report of a committee appointed to test the method for determining the acidity of tan liquors, by precipitating the gallic acid with gum-arabic, proposed by Yocum, Faust and Rikker (this J., 1910, 832). Great diversity of opinion as to the accuracy of the method is expressed. Reed and Wisdom find that gum-arabic precipitates very little more gallic acid than gelatin alone and that the addition of further quantities of gum-arabic tends rather to a re-solution of gallic acid. The general opinion expressed was that the precipitation of gallic acid by gum-arabic was not complete.—D. J. L.

Analysis of leather; Report on methods for the ——. F. P. Veitch. J. Amer. Leather Chem. Assoc., 1910, 5, 426—433.

Two samples of leather containing grease were sent to each member of the committee with instructions for the estimation of moisture, fat, water-extract, and nitrogen. The results obtained show that probably the most accurate results are obtained by estimating the moisture, fat and water-soluble matter, each on the original sample. The error caused by estimating fat on a sample which has been dried for the moisture determination is small, but an appreciable variation in the percentage of water-soluble matter is noticeable, when this is determined on the dried and exhausted leather, from that obtained when the original sample is used. The processes of drying and fat-extraction hence produce changes of solubility in the matter extracted by water.—D. J. L.

Acid in chrome leather; Determination of free ——. G. Grasser. Collegium, 1910, 381—382.

The qualitative test for free acid in chrome leather by pressing test-paper against its cut surface is not always conclusive owing to the strong affinity which the acid has for the leather fibre. The following method for determining free acid in chrome leather is stated to be reliable and quick and also shows any excess of alkali in de-acidified leather. 20—30 grms. of the finely divided leather are made into a thick paste with distilled water in an Erlenmeyer flask. 30—40 c.c. of $N/1$ hydrochloric or sulphuric acid are added, the flask connected with a reflux condenser, and warmed with the naked flame until the leather particles are completely dissolved ($\frac{1}{2}$—1 hour). The interior of the condenser is then washed into the flask, which is cooled and the contents titrated with $N/1$ alkali using methyl orange as indicator. Any access of alkali required over that necessary for neutralisation of the $N/1$ acid used represents the free acid derived from the leather and in a similar way any access of alkali in the leather is shown. If the presence of green chromium salts renders the determination of the end-point difficult, litmus is used as an external indicator. Through the decomposition of the leather all chromium is brought into solution and chromic acid and chromates are reduced to chromium salts. The chromium originally present in the leather can therefore be determined in the solution, but a volumetric process must be used, since the presence of organic matter hinders the precipitation of chromium as hydroxide. —D. J. L.

Degree of impermeability conferred on films of gelatin by addition of various insolubilising substances. Lumière and Seyewetz. *See* XXI.

Patents.

Tanning; Process of ——. C. W. Nance, London. Eng. Pat. 26,040, Nov. 10, 1909.

The hides to be tanned, separated by wooden frames, or by other means, are placed in a closed pan and treated with thin milk of lime. A high vacuum is maintained in the pan, the liquid contained in it being occasionally boiled. After 24 hours the hides are taken out, scraped free from hair and washed in the usual way. They are then placed in a pan in which a high vacuum is created and weak tanning extract is sprayed over them until they are well covered, the liquid being occasionally boiled. As the liquor evaporates, further weak liquor is run in until the extract is fairly concentrated, after which it is not again boiled. From time to time a little of the liquor is withdrawn and fresh liquor passed in. In about two days the hides are tanned and may be withdrawn, washed, air-dried, and finished, or they may be washed and dried in the vacuum-pan in which they were tanned.—J. A.

Hides ; Apparatus for treating, dehairing, swelling, and tanning ——. A. Fay, Assignor to G. F. Seiser and W. J. Cogle, Louisville, Ky. U.S. Pat. 971,126, Sept. 27, 1910.

The apparatus consists of a closed tank in which the hides are suspended in the tanning or other liquor, the tank being connected with a pump so that the air can be exhausted therefrom. A limited quantity of air at a temperature above that of the liquor is introduced into the vessel below the surface of the liquor during the treatment. The air is heated by passing through coils in a steam-chest, and enters the closed vessel through a pipe terminating in a perforated cross-head near the bottom of the vessel. —A. S.

Hides ; Apparatus for treating ——. C. J. Glasel, Washington. U.S. Pat. 970,701, Sept. 20, 1910.

See Fr. Pat. 400,940 of 1909 ; this J., 1909, 1263.—T. F. B.

Leather ; Treatment of —— with india-rubber. A. McLennan, London. U.S. Pat. 970,734, Sept. 20, 1910.

See Eng. Pat. 9870 of 1909 ; this J., 1910, 289.—T. F. B.

Extraction of grease and glue from bones. Eng. Pat. 18,468. *See* XII.

XVI.—SOILS ; FERTILISERS.

Soils ; Physical analysis of ——. E. A. Mitscherlich. Z. angew. Chem., 1910, 23, 1840—1841.

The author criticises methods of determining the size of soil particles by the use of sieves and sedimentation processes, pointing out that differences in shape and form, in specific gravity, and in colloidal state, may lead to great differences in the final position of similar sized particles when separated by these methods. Such analyses are therefore not indicative of the fertility or ease of working of a soil. A better way is to determine the soil surface from the hygroscopicity. It is necessary to distinguish between the outer (visible) and the inner surfaces, the latter of which plays no part in the actual separation of the particles. Both these surfaces are wetted by water, but only the outer one by organic liquids of high molecular weight. To determine water hygroscopicity the air-dried soil is exposed to 10 per cent. sulphuric acid in a desiccator, and then thoroughly dried over phosphoric anhydride at 100° C. The loss in weight represents the water condensed on the total surface and is therefore a direct measure of the latter and of the soil fertility. The gain in weight caused by exposure to a benzene-oil mixture (20 per cent. of benzene, the result being interpolated from 15 per cent. and 25 per cent. mixtures) gives a measure of the outer surface only, which relates to the mechanical state of the soil and is indicative of the ease of working. Statistics are given from pot experiments with mustard, connecting the yield with the total surface determined by the author's method in mixtures of sand with varying quantities of peat. —W. H. P.

Soil-surfaces ; Significance and action of soil colloids in the determination of —— by the Rodewald-Mitscherlich method. P. Ehrenberg. Z. angew. Chem., 1910, 23, 1841.

See preceding abstract. The extent of surface and consequently the hygroscopicity of a soil are appreciably reduced by air drying, especially where the percentage of humus is high. The results of the Rodewald-Mitscherlich method appear therefore to depend on the initial state of the soil, and more information is given by the experiments in which the air drying is omitted. Opinions should be deduced with great care from results of the determinations, since soils of the same surface magnitude have often very different compositions and properties.—W. H. P.

Heated soils ; Changes in ——. S. U. Pickering. J. Agric. Sci., 1910, 3, 258—276.

The author has previously shown (this J., 1908, 867 and 1909, 212) that heating a soil produces a soluble, organic and probably nitrogenous body, which is toxic to germination. He now finds that the water extracts obtainable from soils are of constant composition as regards organic matter when the time allowed for extraction varies from 20 to 230 minutes, the temperature from 7° to 23° C., and the proportions of soil from 5 to 10 per 100 of water. The inorganic matter is not affected by time, but is by the temperature and relative proportions of soil and water. The increase in soluble matter and in toxic properties produced by heating a soil, is gradually reduced by exposing the soil in a moist condition to air, even under aseptic conditions. It is not reduced in the absence of air and the destruction of the toxic substance is therefore probably due to oxidation. Unheated soils, and those heated to only a low temperature show an increase in soluble matter on keeping, whether air is present or not, but the substance thus produced has no toxic effect on germination. This increase however is preceded by a preliminary diminution, due apparently to the disappearance of the toxic substance, which is presumably present in all soils, though only in a small proportion when the soil has not been heated. Air-dried soils, heated and unheated, show an appreciable reduction in soluble matter and in toxic properties on keeping for several months, which is closely similar to the behaviour of moist soils when kept in air for about ten days.—W. H. P.

Heated soils ; Plant growth in ——. S. U. Pickering. J. Agric. Sci., 1910, 3, 277—284.

Pot experiments have been conducted with various plants in previously heated soils, which illustrate the previous work of the author (see preceding abstract) and of Russell and others (this J., 1909, 1213). On heating a soil the soluble matter available for nutrition is increased, and changes in the bacterial condition are brought about, which conduce to increased fertility. The action of heat also induces the development of some substance both toxic in influence and arresting growth. At low temperatures the favourable action predominates, but as the temperature of heating is raised above 100° C., the toxic substance has a predominating effect. The experimental results vary considerably with conditions, and are difficult to interpret, owing to the instability and susceptibility to oxidation of the toxic body, whose effects are neutralised by cultivation, access of air and time, and so do not extend considerably to second crops. It is probably legitimate to assume that the body which retards growth is the same as that which retards the germination of seeds, so that the latter, the shorter process, is a better method of determining its presence in a soil. Different plants are susceptible to the toxin to different degrees. In the author's experiments grasses appeared to be much less susceptible than other plants, though the evidence is not sufficient for a general statement.—W. H. P.

Soils ; [Determination of] ammonia in ——. E. J. Russell. J. Agric. Sci., 1910, 3, 233—245.

When soils are distilled at low pressures with small quantities of alcoholic potassium hydroxide, a definite amount of ammonia is evolved and the reaction comes to an end. With larger quantities of potassium hydroxide or with a suspension of barium or magnesium oxide, the decomposition is not definite but continues further, owing to decomposition of material other than ammonium salts. With magnesium oxide, however, if the amount of organic matter is not too high, the continued decomposition is very slow and the first stage gives results agreeing with those obtained by use of alcoholic potassium hydroxide, which are considered to represent the ammonium salts in the soil. The quantity of ammonia in soils taken at different periods of the year is constant but small, usually about 1—2 parts per million, increasing with the amount of organic matter to about 5 or 6 parts per million in heavily dunged soils. Since the ammonia does not accumulate, the rate of nitrification must be greater than the rate of ammonia production, and in normal circumstances is therefore limited by this rate. When ammonium salts react with soil, a certain proportion is fixed and is not evolved on distilling with alcoholic potassium hydroxide or magnesium oxide. —W. H. P.

Barium in soils. G. H. Failyer. U. S. Dept. Agric., Bureau of Soils. Bull. No. 72, Aug. 27, 1910.

Experiments have shown that barium is present in most soils throughout the United States, the proportion found in soils where quantitative determinations were made, ranging from 0·01 to 0·11 per cent., with an average of 0·06 per cent. The barium is dissolved from the soil in appreciable quantities by water containing carbon dioxide.—A. S.

Soil fertility problems; Method for the study of ——. J. G. Lipman. J. Agric. Sci., 1910, **3**, 297—300.

By growing oats in the inner, and peas in the outer of two concentric pots, the inner pot being very porous in one case and glazed in the other, the author has shown the beneficial effect of the legume on the growth of the grain, when the inner pot was porous. No nitrogen was supplied, so that it was indicated that soluble nitrogen compounds were passing from the peas to the oats, through the unglazed partition. The author recommends this device for the study of other soil problems.—W. H. P.

Agricultural field trials; Error of experiment in ——. A. D. Hall and E. J. Russell. Brit. Assoc., Sept., 1910. Chem. News, 1910, **102**, 180.

Analysis of the causes of error shows that they fall under several heads :—(*a*) *Lack of uniformity in the soil.*—Even on a level field, analysis shows that there are certain differences in different parts of the field. The differences in the percentage of moisture in samples of soil collected to the same depth—6 or 9 inches—and as nearly as can be at the same time commonly amount to 5 (or in dry fields to 10) per cent. of the moisture present. Another factor greatly influenced by variations in the soil is the amount of nitrate present. Here, also, differences are found of the order of 5 or 10 per cent. of the amount present on fields that appear to be uniform. These differences may be accentuated where there is a dip in the field. (*b*) *Lack of uniformity in the conditions of growth.*—The conditions of the outside row of a plot differ from those obtaining inside the plot, and those on the outside of the field are much modified by the competition of hedges and trees. The unequal incidence of disease is sometimes very troublesome. (*c*) *Effect of season.*—In manurial trials it is possible after a number of years to allow for the effect of season in a general way, but in variety trials the problem is much more difficult, and cannot yet be said to be solved. *Total magnitude of the error of experiment.*—An examination of the Rothamsted records shows that the error is 10 per cent. on plots where the past treatment has for many years been uniform, where all weighing, measuring, and other operations are performed with the utmost care, and where the general conditions are favourable for experimental work. Having regard to these considerations and the difficulties often encountered in field trials, the authors would not be prepared, as a general rule, to lay stress on differences of less than 15 per cent.

Soil and plants; Influence of poisonous solutions of alkaloids on ——. R. Otto and W. D. Kooper. Landw. Jahrb., 1910, **39**, 397. Biedermann's Zentr., 1910, **39**, 639.

When small quantities of dilute solutions of strychnine or nicotine salts are added each day to a column of earth of relatively small surface area, the alkaloids are retained by the soil. The filtrates obtained each day contain no alkaloid, but the acid present in the salt—sulphuric acid in the case of strychnine sulphate—passes through the soil. After a longer or shorter period the alkaloids also pass through unaltered. The phenomenon is the same whether the soil is previously sterilised or ignited and it is obviously due to absorption effects and not to bacterial action. Soils covered with vegetation exhibit the effects of toxic influence more readily than soils not thus covered; nevertheless the presence of such alkaloids in solution, exerts a marked effect, retarding germination and growths, and leading to the development of abnormalities in the fruits, etc. Nicotine in 3 per cent. aqueous solution is adsorbed both by sandy and by humus soils. The alkaloid is not chemically changed, an additive compound being formed. Nicotine is to some slight extent decomposed and part is volatilised; moisture and heat facilitate these changes, which are retarded in dry soils. Nicotine solutions have a markedly favourable influence on the growth of *Nicotiana Tabacum* and a favourable influence on that of *Solanum tuberosum*. In the former case the alkaloid content of the plant was increased; sodium nitrate solutions produced a similar effect. The alkaloid was not observed to have any influence on the other components of the plant.—E. F. A.

Calcium cyanamide; Determination of the nitrogen contained in crude —— in the form of cyanamide and dicyandiamide. A. Stutzer and J. Söll. Z. angew. Chem., 1910, **23**, 1873—1874.

In the analysis of crude calcium cyanamide the whole of the nitrogen is brought into solution only with great difficulty. When 10 grms. of a Norwegian product (which had not been treated with tar oils), containing 19·69 per cent. of total nitrogen, was treated with 400—450 c.c. of water, 3·50 per cent. of the nitrogen remained undissolved after agitation for ½ hour. In carrying out the analysis, agitation is continued for 2½ hours; a small quantity of the nitrogen still remains undissolved, but concordant results are obtained. The total nitrogen is determined in an aliquot portion of the solution by the Kjeldahl method. Cyanamide may be determined volumetrically by means of silver nitrate in ammoniacal solution (see Ellis, this J., 1909, 1097), but the authors prefer to precipitate with silver acetate in accordance with an unpublished method of Caro, and to determine the nitrogen content of the silver precipitate. In an aliquot portion of the filtrate from the silver cyanamide, silver dicyandiamide is precipitated by treating with potassium hydroxide, and the nitrogen content of the precipitate is determined. In a number of samples examined, the amount of dicyandiamide nitrogen ranged from 0·07 to 0·14 per cent. It is frequently only necessary to determine the total and dicyandiamide nitrogen, and in such cases the latter is preferably determined directly. 10 grms. of the sample are agitated for 1 hour with 250 c.c. of 94 per cent. alcohol, 100 c.c. of the resulting solution are evaporated to dryness, and the residue extracted with warm water. (In the case of German products, which have been treated with petroleum residue, a small quantity of mineral oil separates.) The solution is treated with 10 c.c. of silver acetate solution, the small quantity of silver cyanamide which separates is filtered off, and the filtrate is treated with 10 c.c. of 10 per cent. potassium hydroxide solution, the nitrogen content of the precipitate being determined as before. The solubility of dicyandiamide at 13° C. is in water, 22.6, and in absolute alcohol, 12·6 grms. per litre.—A. S.

Potassium [*in fertilisers*]; *Volumetric determination of —— by the cobaltinitrite method.* O. M. Shedd. J. Ind. Eng. Chem., 1910, **2**, 379—384.

In determining potassium in fertilisers by Drushel's cobaltinitrite method (this J., 1907, 1256) a definite concentration of the potassium solution, before adding the nitrite reagent, is found necessary to ensure reliable results. Very accurate results are obtained by evaporating the potassium solution (from 0·1 grm. of commercial muriate, or 0·5 grm. of kainite, or 1 grm. of mixed fertiliser) to about 5 c.c., slightly acidifying with acetic acid and adding 15 c.c. of freshly prepared nitrite reagent. The mixture is then evaporated on the water-bath until the residue is a thick syrup becoming pasty on cooling; this is then treated as previously described. (See also this J., 1909, 163, 615).—A. Sbld.

Fertilisers; Duty-free admission of —— into Morocco. Board of Trade J., Oct. 6, 1910. [T.R.]

The Moorish Government has decided to admit the undermentioned fertilisers free of Customs duty, at all the ports of the Empire open to commerce :—Phosphates and superphosphates of lime; scoriae containing phosphates; metallurgical phosphates; sulphate of ammonia; Peruvian guano and poudrette. Duty-free admission will also be accorded to all other products which are generally regarded as suitable for the fertilisation of the soil, provided that they cannot be put to any other use.

Patents.

Manure; Treatment of ——. W. Hoskins, La Grange, Ill., Assignor to The Pulverised Manure Co., Chicago. U.S. Pat. 970,711, Sept. 20, 1910.

Farm-yard manure is steeped in water, the liquid is then passed through a screen, and the albuminous matters in solution are precipitated by the addition of a sulphate. The precipitate is separated and dried for use as a fertiliser. —W. P. S.

Fertilisers [superphosphates]; Process of manufacturing artificial ——. Chem. Düngerwerke Bahnhof Baalberge Ges.m.b.H. Fr. Pat. 413,061, Feb. 26, 1910.

The raw material is broken up in a crushing appliance fixed inside a pit, which is situated near a tower at least 35 metres high. The crushed material is conveyed into a chamber at the top of the tower together with the acid required for its decomposition, and the mixture is distributed into decomposing vessels immediately below. The gases evolved are partly allowed to escape and are partly diverted into the chimney or boiler flue. From the decomposing chambers the material is thrown down a central conduit provided with horizontal bars, which serve to subdivide the material. A fan forces hot air up the conduit and thereby dries the material as it falls.—O. R.

Vinasses; Process for manufacturing fertilisers by the use of distillery ——. F. and E. D. Verbièse. Fr. Pat. 414,517, June 21, 1909.

Claim has already been made for a process for treating distillery vinasses (Fr. Pat. 396,288 of 1908; see this J., 1909, 619). The present invention consists in adding a quantity of the precipitate (in the form of a mud or of moist or dry cakes) obtained in a previous identical operation, to the vinasse under treatment, this addition preferably being made prior to the treatment of the vinasse with the reagents. This procedure insures a practically instantaneous and more complete precipitation, and the proportion of reagents required is considerably decreased; moreover, filtration is facilitated and the filtrate is non-putrescible.—L. E.

[Calcium] cyanamide; Process of granulating ——. P. Mauricheau-Beaupré. Fr. Pat. 414,648, March 26, 1910.

Calcium cyanamide is thoroughly incorporated with an aqueous suspension of iron oxide (preferably obtained by the treatment of bauxite) or alumina, the mass being meanwhile cooled, and the product, during or after mixing, or after drying, is sifted, to secure a regular size of grain. 100 parts of calcium cyanamide, containing 18—25 per cent. of nitrogen, may, for example, be incorporated with a pulp made by suspending 5—10 parts of finely ground or precipitated iron oxide (more or less moist) in 25—35 parts of water.—F. Sodn.

Manufacture of compounds containing nitrogen. Fr. Pat. 414,837. *See* VII.

XVII.—SUGARS; STARCHES; GUMS.

Sugar cane cultivation and industry in Cuba. R. J. Holty. Tropenpflanzer, 1910, **14**, 495—510.

According to the most recent reports the total sugar production of Cuba for the present year is estimated at 1,765,000 tons, as compared with 1,545,000 tons for the preceding year. Attributing one-fifth of this increase to old cane, and four-fifths to newly-planted cane, it follows that with a yield of 25 tons per acre, and a sugar content of 11 per cent., 57,000 acres was the newly planted area, and that since there are 186 factories in existence on the island, the plantation area per factory was increased by 306 acres. Taking into account this increase of cane planted, and the present tariff system, the next crop will probably reach 2,000,000 tons of sugar with favourable weather conditions. Of the 186 factories, 76 are owned by English, French, and Spanish firms, 72 by Cuban, and 38 by American. The future outlook of Cuba as a sugar-producing country is very promising. Compared with Louisiana it has numerous advantages, the most important being the richness of the soil, the more favourable climatic conditions, and the fact that it is unnecessary to replant the cane each year. The opinion is expressed that the production of beet-sugar in Europe must in time decrease, since owing to the increase of population corn will eventually become a more profitable crop. The varieties of cane cultivated in Cuba are the Bourbon or Otaheite, the Salangore, and the Crystalina, the last-named giving the best sugar and being the most widely planted. Statements and figures relating to the general development of commerce in Cuba are also given.—J. P. O.

Sugar beet growing and beet sugar manufacture in England. S. Stein. Brit. Assoc., Sept. 1910. J. Roy. Soc. Arts, 1910, **58**, 956.

Raffinose in raw beet sugar. Deuts. Zuckerind. 1910, **35**, 757—761.

A conference of representative chemists appointed by the British and Continental Sugar Associations and the British Refiners met recently (Sept. 20—22, 1910) at the Institut für Zucker-Industrie, Berlin, to discuss:—(1) What indications shall be required in order that a given sample of raw beet sugar shall be tested for raffinose; (2) How the quantity of raffinose shall be determined; (3) What is the melassigenic effect and coefficient of raffinose. It was unanimously agreed (1) that under the name of raw beet sugar, sugars are sold that contain considerable quantities of raffinose, and that raffinose should be determined in such sugars; (2) that in those cases where in future the test for raffinose is required, the Herzfeld inversion method and formula shall be applied. The amount of raffinose found shall be stated only in those cases where the difference between sucrose and direct polarisation amounts to 0·5 per cent., or more. When the difference found is smaller than 0·5 per cent., the amount of raffinose shall not be given, but it may be stated on the certificate: "This sugar probably contains raffinose." The English chemists maintained that raffinose is probably present when the analysis shows a lower ratio than 1: 1·5 between the ash and organic matter, but the Continental chemists were of opinion that many normal beet sugars containing no measurable amount of raffinose show a lower ratio, therefore the Continental chemists agreed that measures should be taken to brand after-products originating entirely or partially from molasses desaccharification processes (by using the strontia method, osmose, separation) so as to distinguish them from pure after-products, originating from beets. The buyer and seller of these sugars can then decide if they should be tested for raffinose. The melassigenic effect of raffinose was not fully discussed.—L. J. de W.

Bagasse analysis: determination of sugar and moisture. R. S. Norris. Bull. No. 32, 1910, Agric. and Chem. Series. Expt. Station, Hawaiian Sugar Planters' Assoc.

In the course of an exhaustive study of this subject it is pointed out that one sample of bagasse taken every hour at the mills should even under the most variable conditions give a fair average, but that if the cane does not vary greatly, one sample in 3 hours will suffice. In collecting the sample at the mills, about one kilo. should be taken from the full length of the roller and the full depth of the bagasse blanket, mixed rapidly in a deep vessel, avoiding evaporation as much as possible, one-half discarded, and the rest taken in an air-tight vessel to the laboratory. The samples must be analysed immediately after being taken. The whole of the sample collected is chopped into pieces not greater than ¼ inch in diam.; whilst doing this a considerable loss of water (from 2 to 4 per cent.) takes place, allowance for which must be made when weighing out for analysis. To determine the moisture, an amount equal to 100 grms. of the sample before chopping is placed on a shallow tray, ¾ inch in depth, and heated in an air-bath at 125° C. for 3 hours. For the sucrose, an amount equal to 100 grms. of the original bagasse is weighed into the inner vessel of a digestion apparatus resembling a "double-cooker," 500 c.c. of hot water containing 5 c.c. of a 5 per cent. solution of sodium carbonate solution are added, the bagasse pressed down into the liquid, and the inner vessel placed in the outer one containing the boiling water for heating. Digestion is continued for an hour, and the bagasse is mixed every 15 minutes. At the end of this time the weight of bagasse + solution is taken, the liquid filtered through cheesecloth, and cooled to the laboratory temperature; 99 c.c. are then placed in a 100 c.c. flask, made up to the mark with lead subacetate solution, filtered, and polarised in a 400 mm. tube. An alternative method is to weigh out the equivalent of 100 grms. of the sample into a quart cup or pot with cover, add 500 c.c. of water containing 2 c.c. of 5 per cent. sodium carbonate solution, boil gently for an hour, stirring every 15 minutes, and then proceed as just described. Whichever method be used the polarisation of the bagasse is found from the following formula: $\frac{R(W-f)}{2\times 3{\cdot}8\times 100}$, in which R is the polarimetric reading observed in a 400 mm. tube; W, the weight of the bagasse + solution; and f the fibre content of the bagasse, generally taken as 50. Differing from Prinsen-Geerlig's experience (Int. Sugar J., 1909, 156) with Javan bagasse, the author has found that no other dextro-rotatory substances than sugar are extracted or produced during digestion from Hawaiian bagasse. This method of aqueous digestion when continued for an hour is said to give results agreeing with those obtained by alcoholic extraction lasting 1½ to 2 hours.—J. P. O.

Sucrose in the presence of certain reducing sugars; Polarimetric determination of ——. P. Lemeland. J. Pharm. Chim., 1910, 2, 298—302.

It has been found that certain reducing sugars (arabinose, dextrose, lævulose, galactose and lactose) lose their reducing power when their aqueous solutions are heated with manganese dioxide, whilst by the joint action of hydrogen peroxide solution and an alkali, the optical activity is destroyed. Sucrose is not affected by this treatment. A suitable quantity of the mixture of sugars is heated on the water bath with 100 c.c. of water and 0·50 grm. of manganese dioxide. For each grm. of sugar to be destroyed a mixture of 30 c.c. of official hydrogen peroxide solution and 2 c.c. of 36 per cent. sodium hydroxide solution are added to the hot liquid. After 35 to 45 minutes the liquid is cooled, neutralised with dilute nitric acid, decolorised with animal charcoal or lead acetate, and made up to 100 c.c. The amount of sucrose can then be determined by the polarimeter.—F. Shdn.

Phromnia sugar. D. Hooper. Annual Report, Indian Museum, Industrial Section, 1909—1910.

A white secretion with a sweet taste emanating from the *Phromnia marginella* is obtained by the insect from *Elæodendron glaucum*, *Euonymus spp.*, and other plants belonging to the *Celastrineæ*. It consists, in the main, of dulcitol, an isomeride of mannitol or mannite, found in commercial manna.—C. A. M.

Honey; Fermentation of —— *and a note on the composition of honey.* T. Nussbaumer. Z. Unters. Nahr. Genussm., 1910, 20, 272—277.

As the result of cultivations on wort, wort-gelatin, wort-agar, honey, and honey-gelatin media the author has isolated two different kinds, or two different species, of yeast from Canadian honey. Further investigation showed that the yeasts are extremely widely distributed, being found in honey from N. America, Chili, Honolulu, W. Indies, Mexico, etc. One of the yeasts was similar in some respects to the yeast, *Zygosaccharomyces Priorianus*, obtained by Klöcker from the bodies of bees. Both yeasts are capable of fermenting dilute honey solutions; they are destroyed, together with their spores, when exposed to a temperature of 70° C. for 30 minutes. The author finds that Fiehe's reaction (this J., 1908, 1127) is not given by the majority of samples of natural honey. When tested by Lund's albumin precipitation process, samples of Swiss honey gave precipitates varying in volume from 0·65 to 1·82 c.c., whilst imported honey yielded precipitates measuring from 0·28 to 1·05 c.c. —W. P. S.

Test for caramel [in flavouring extracts, etc.]. Lichthardt. *See* XX.

ERRATUM.

This Journal, 1910, p. 506, col. 1, line 6 from top, *for* "$C_{12}H_{22}O_{11},2H_2O$," *read* "$C_{12}H_{22}O_{11}-2H_2O$."

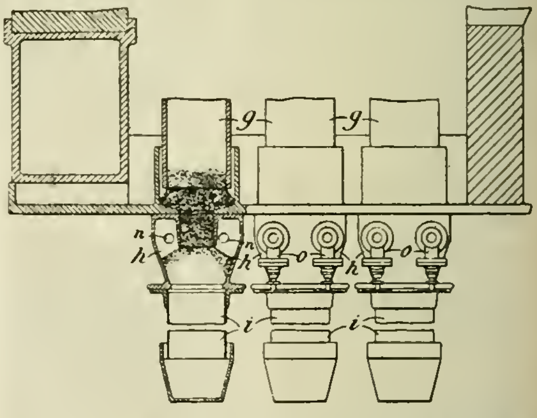
PATENTS.

Beetroot juice; Purification of ——. N. P. Owsjannikoff. Fr. Pat. 414,683, Apr. 9, 1910.

The treatment of the diffusion juice with lime is effected at a comparatively low temperature in order to insure a more complete purification; the temperature may be, say, 40°—50° C., and in any case lower than that at which albumin coagulates. The saturation is carried out at the same temperature as the defecation; when the alkalinity is diminished to about 0·1 per cent., the juice is heated to the temperature at which the albumin coagulates or a little higher, in order to facilitate filtration.—L. E.

Kilns for the decarbonising and revivifying of animal charcoal. M. Blake and R. H. Smart, Greenock. Eng. Pat. 262, Jan. 5, 1910.

In Scotch kilns for the revivification of animal charcoal which has been used for sugar refining, decarbonising chambers, *h*, are provided immediately below the "burning" pipes, *g*, and above the "cooling" pipes, *i*. Air is introduced into the chambers, *h*, through the openings, *n*, in order to burn off the inert carbon resulting from the organic matter taken up by the charcoal. When the amount of inert carbon to be burned off is high, the valves, *o*, controlling the openings, *n*, are of the three-way type, and are connected with an air pressure receiver, so that air can be introduced into the decarbonising chambers under atmospheric or increased pressure as desired. —J. W. H.



XVIII.—FERMENTATION INDUSTRIES.

Malt; Laboratory and brewhouse yields of extract from ——. J. Schmidt. Z. ges. Brauw., 1910, 33, 381—384, 393—395, 405—410.

The official "Congress" method of estimating the amount of extract obtainable from malt is well known not to give a value as high as can be obtained in modern brewhouse practice. The author gives figures, obtained by a variety of methods, which agree more nearly with practical results and points out that by the "Congress" method wort is obtained that has never been boiled, whereas in practice all worts are boiled before collection. The methods suggested are essentially reproductions on the small scale of digestion (three mash) brewery working.—R. L. S.

Invertase; The presence of —— in malt extract. A. J. J. Vandevelde. Biochem. Zeits., 1910, **28**, 131—133.

An aqueous extract of green malt was added to sucrose solutions of varying strengths and incubated for 200 days in presence of the author's iodoform and acetone mixture as antiseptic. At the end of the incubation period the optical activity and cupric-reducing power of the solutions were estimated and it was found that sucrose had been hydrolysed in every case in direct proportion to the amount originally present. The author concludes that the invertase of malt extract has much less hydrolytic activity than that of yeast, *Aspergillus niger*, or green leaves, and its presence can only be demonstrated by very protracted aseptic experiments.—R. L. S.

Invertase; Destruction of —— by acids, alkalis and hot water. C. S. Hudson and H. S. Paine. U.S. Dept. Agric., Bureau of Chem., Circular No. 59, 1910.

Measurements made in the manner previously described (this J., 1910, 711) show that as the temperature is raised, the rate of destruction of invertase by acids and alkalis increases until finally at about 60° C., distilled water itself slowly destroys invertase and at 65° C. the destruction by water is quite rapid. It is concluded that the destruction is caused by hydrolysis of the enzyme. The increase in the rate of destruction for 10° C. rise in temperature, is about 3·1, a coefficient showing "how many fold the rate increases for the 10°." The presence of lævulose protects invertase from destruction by acids, alkalis and hot water. The protective action approaches a limiting value which is reached in solutions containing not far from 2·7 per cent. of lævulose. The enzyme is supposed to form a combination with the sugar which is more resistant to destruction.—E. F. A.

Yeasts; The power of assimilating various carbohydrates exhibited by different ——. P. Lindner and Saito. Woch. f. Brau. 1910, **37**, 509—513.

It has been generally accepted as unquestioned that carbohydrates that are fermentable by yeasts can also be assimilated by them. The recent work of L. Rose (*Diss. inaug.*, Berlin, 1910) on *Endomyces Magnusii* proved that this organism was incapable of reproduction in nutritive solutions containing as carbohydrate only dextrose or lævulose, although these were actively fermented; in maltose solution it multiplied rapidly, but produced no fermentation. This discovery has led the authors to reopen the question and study the reproduction of many yeasts in solutions of different carbohydrates. The nutrient medium was tap water with addition of 0·025 per cent. of magnesium sulphate, 0·5 per cent. of potassium-dihydrogen phosphate, 0·5 per cent. of asparagin, and 5 per cent. of either dextrose, lævulose, sucrose, maltose, lactose, dextrin, raffinose or arabinose. The culture liquid was inoculated with as small a quantity of the organism as possible in order to prevent possible contamination of the solution by products of autolysis. Over a hundred yeasts were investigated and the authors found that maltose was the most generally assimilable of the carbohydrates; in isolated instances only was it indifferent. Lactose, on the contrary, was only assimilable in isolated cases. Dextrin was frequently slightly assimilable; by the group of film-forming yeasts, torulæ and pink yeasts it was readily assimilated. Sucrose, which is "very readily fermentable," played a very secondary part in assimilation, being less utilised than dextrose or lævulose except by the wild yeasts. Raffinose and arabinose were only made use of in isolated cases. Dextrose and lævulose were in the majority of cases, only slightly assimilable and in some instances were incapable of supporting growth. Some yeasts were able to assimilate one of these sugars, but not the other. The aerobic yeasts could assimilate almost all the sugars with facility. One yeast, *Schizosaccharomyces octosporus*, in the experimental conditions could assimilate none of the carbohydrates. From the experiments it is seen that it is typical of the aerobic yeasts to be able to assimilate carbohydrates which they cannot ferment. It is less usual for a non-assimilable carbohydrate to be fermented, though the top-fermentation beer yeasts ferment, but cannot assimilate, dextrose and lævulose. It is possible, and in the case of *Schizosacch. octosporus* certain, that with other forms of nitrogenous nutriment present, different results would be obtained.—R. L. S.

Yeast and yeast juice. The fermentation of galactose by ——. A. Harden and R. V. Norris. Proc. Royal Soc., 1910, B. **82**, 645—649.

It has been shown that many species of yeast which ordinarily cannot ferment galactose, readily acquire that power when cultivated in a medium containing the sugar. In these experiments pure cultures of S. Carlsberg I. have been used and trained by cultivation in yeast water to which was added 20 per cent. of hydrolysed lactose and 0·15 per cent. of secondary potassium hydrogen phosphate. The authors find this yeast can readily be trained to ferment galactose and that such a trained yeast yields a juice, by the ordinary methods, which is capable of fermenting galactose. A fermenting mixture of this yeast-juice and galactose reacts with phosphate in a similar manner to ordinary yeast-juice and glucose. The phosphate is similarly converted into an organic compound not precipitable by magnesium citrate mixture (this J., 1909, 1322). The fermentation of galactose by this yeast-juice is also accelerated by the addition of small quantities of sodium arsenate.—R. L. S.

Waste yeast. G. Graf. Allgem. Z. Bierbrau., 1910, **38**, 372—374, 385—388.

Superfluous brewery yeast is but rarely utilised and vast quantities of potentially valuable food material are annually wasted in this form. Yeast has been proved to be a suitable food adjunct for cattle when given in quantities of 1 kilo. per 100 kilos. of live weight. Cakes of compressed yeast and spent hops are readily eaten by cattle and should provide a cheap foodstuff of general utility. The writer develops a scheme for the preparation of such a food and shows that the cost of preparation is far from being prohibitive. The waste yeast is first washed, drained and pressed to remove the excess of moisture; it is then plasmolysed by addition of 1—2 per cent. of common salt and dried. The compressed cakes of yeast and spent hops have the following percentage composition:—water, 10; proteins, 55; non-nitrogenous extractives and cellulose, 24·2; ash, 7·8; and fat, 3 per cent., and should be worth M. 12 per zentner (11s. 10d. per cwt.) or more than dried brewers' grains.—R. L. S.

Protein precipitation in bottled beer. Z. ges. Brauw., 1910, **33**, 384—386, 395—400.

A series of 28 beers of Bavarian and Bohemian types both carbonated and "Kraüsened," has been studied exhaustively. It was found that pasteurisation tended to hasten the formation of a protein precipitate. During pasteurisation the pressure within the bottle rises to about 5 atmospheres and it is stated that when this pressure was not allowed to accumulate, the protein precipitate did not form. It is concluded that the precipitation is a purely physical phenomenon and quite independent of the chemical composition of the beer.—R. L. S.

Sucrose in wine; Rothenfusser's method for the detection of ——. F. Schaffer. Chem.-Zeit., 1910, **34**, 1040. (See this J., 1910, 584.)

It is found that this method depends on a reaction of hydroxymethylfurfural and that the preliminary precipitation with casein and lead acetate is not necessary in all cases, this procedure being replaceable by distillation with hydrochloric acid of 15 per cent. concentration.

The hydroxymethylfurfural can be detected in the distillate, and for this, orcinol may be used instead of diphenylamine. Orcinol, after addition of hydrochloric acid, gives on warming a blue colour with furfural and a yellow colour with hydroxymethylfurfural, or precipitates of corresponding colours. The method has no practical value, however, in the analysis of wines, since the reaction is obtained with pure, natural wines as well as with expressed grape-juice itself.—L. E.

Fusel oil: Determination of —— in distilled liquors. H. P. Bassett. J. Ind. Eng. Chem., 1910, 2, 389—390.

The following modification of Savelle's method for determining fusel oil is recommended:—25 c.c. of the sample are heated on the water-bath under a reflux condenser for 1 hour with 5 c.c. $N/1$ alkali hydroxide; 25 c.c. are then distilled over, 5 c.c. of water added to the residue and an additional 5 c.c. distilled. The distillate, after addition of 0·2 grm. of *m*-phenylenediamine hydrochloride, is boiled under a reflux condenser for 1 hour to remove aldehydes, and then re-distilled. 25 c.c. are collected, then 5 c.c. of water are added to the residue, and another 5 c.c. distilled over, bringing the distillate to the original volume. An equal volume of concentrated sulphuric acid is slowly added to the distillate, the mixture heated nearly to boiling, and whilst hot, 5—10 drops of a 1 : 1000 furfural solution are added. The pink or red coloration formed in the presence of higher alcohols is compared with that given by a standard solution of amyl alcohol similarly treated. Less than 0·01 per cent. of fusel oil can thus be determined and 1 part in 20,000 detected.—A. SBLD.

Ethyl alcohol: Distinguishing —— from methyl alcohol. F. Klein. J. Ind. Eng. Chem., 1910, 2, 389.

To a few c.c. of the alcohol (after distillation, if not concentrated) 1—2 drops of selenic acid and a trace of a silver halogen salt (preferably the bromide) are added. A white amorphous precipitate is obtained with ethyl alcohol. With methyl alcohol either no precipitate or a crystalline precipitate, with a clear liquid, is obtained. The reaction is applicable to esters.—A. SBLD.

Fermentation of honey. Nussbaumer. *See* XVII.

Test for caramel [*in flavouring extracts, etc.*] Lichthardt. *See* XX.

Use of silk peptone in the detection of peptolytic enzymes. Abderhalden and Steinbeck. *See* XXIII.

PATENTS.

Malt liquors, and process of producing same. E. S. Spencer, London. Eng. Pat. 4956, Feb. 28, 1910.

LACTOSE or whey powder is melted with another more soluble carbohydrate, such as cane or grape sugar, in proportions varying from 25—75 per cent. of the lactose to 75—25 per cent. of the more soluble carbohydrate. The ingredients are mixed in a boiling pan "and heat applied until the lactose is dissolved with the carbohydrate, the mixture being boiled"; preferably the heat is continued to the candying or caramelising point as the resulting product is more readily soluble in the later brewing processes in which it is used. Such a product is applied in the manufacture of beer in proportions of 5—30 per cent. of the solid extract in the beer.—R. L. S.

Malt grist; Process and apparatus for producing ——. W. Reinhardt, Bochum, Germany. Eng. Pat. 13,108, May 30, 1910. Under Int. Conv., May 29, 1909.

THIS process for the production of malt grist for brewery mashing is characterised by the feature that the fine meal is sifted out and removed after the first and second milling, whilst the grist is subjected to three consecutive millings and the husks only to two, being separated from the grist after the second pair of rolls. A mill with three or more pairs of rolls and suitable sifting and guiding devices to secure these separations is claimed.—R. L. S.

Malting; Process of —— and apparatus therefor. H. Dufour. Fr. Pat. 414,283, March 4, 1910.

THE steeped and washed grain is placed on a floor, preferably made of marble, at a known temperature. The temperature of the floor is regulated by a current of water (heating or cooling) beneath the floor. The latter may be supported on a lower floor by a series of partitions, so constructed that the current of water flows through a series of parallel channels formed by the partitions, and in opposite directions through successive channels. The water then passes to a vat in which the grain is steeped and washed prior to malting.—L. E.

Beetroot; Process for obtaining from the —— a dry, purified product of good keeping properties and friability, destined especially for the manufacture of beer, alcohol, and for a food in the form of bread, etc. L. Dautrebande. Fr. Pat. 414,329, March 25, 1910.

THE washed roots are drained from adhering water, and then suddenly subjected to the action of a strong current of hot air, the temperature of the latter being such that the rinds of the roots are inflated, crisped, and partly detached from the interior fleshy portions. The material is then passed through a slicing machine; the cossettes obtained are dried slowly at a temperature rising progressively from 50° to 110° C. The temperature is then raised to 130°—160° C. The material is then cooled suddenly; this last operation completes the detachment of the portions of rind from the interior parts of the root; it also renders the product much denser and thus imparts to it the properties of keeping indefinitely and of perfect friability. The portions of rind are removed from the product by a sorting process, and may be worked up for potash, cellulose, etc.—L. E.

Musts; Device for the automatic removal of residues in vacuum- and boiling apparatus, and in particular, in apparatus for distilling ——. R. Hübner. Fr. Pat. 414,715, April 11, 1910. Under Int. Conv., June 23, 1909.

THE apparatus includes a three-way device which permits of communication between a pipe for compressed steam and a pressure vessel, or between the latter and the boiling vessel (*e.g.*, the lower part of a distilling column). When the steam pipe is closed with relation to the pipes leading to the pressure- and boiling vessels, the must passes from the boiling vessel through a valved pipe to the pressure vessel. The latter contains a float connected with a system of levers and springs in such a manner that when the liquid in the pressure vessel rises to a certain height, a valve in the three-way device is operated so as to shut off communication between the pipes leading to the pressure- and boiling vessels respectively, and to make communication between the former pipe and the steam pipe. The steam then forces the must from the pressure vessel, through a valved pipe, into a back; the float descends with the level of the liquid, and, through the agency of the levers and springs, re-establishes communication between the pressure- and boiling vessels, whereby the steam in the pressure vessel is enabled to escape into the boiling vessel.—L. E.

Musts; Apparatus for desulphiting and concentrating ——. G. M. J. Cloppet. Fr. Pat. 414,849, April 15, 1910.

THE must falls from a distributing trough in a thin stream over the surface of a series of horizontal tubes which are heated by steam. The hot, desulphited, or concentrated must is then cooled by contact with a serpentine tube through which the liquid to be treated is passed.—L. E.

Malt drums. Berliner A.-G. f. Eisengiesserei u. Maschinenfabr., Charlottenburg, Germany. Eng. Pat. 28,561, Dec. 7, 1909. Under Int. Conv., Dec. 8, 1908.

SEE Fr. Pat. 409,923 of 1909; this J., 1910, 836.—T. F. B.

Fertilisers from distillery vinasses. Fr. Pat. 414,517. *See* XVI.

XIXa.—FOODS.

Milk; Catalase in —— and the use of its determination in the control of milk supplies. A. Faitelowitz. Milchw. Zentr., 1910, 299—427.

The results are recorded of an investigation undertaken with the object of ascertaining the conditions governing the activity of catalase in milk and also whether it is possible, from the activity of the enzyme, to form any opinion as to the freshness of milk. The decomposition of hydrogen peroxide by the enzyme is a monomolecular reaction when the enzyme is present in excess and the peroxide is not present in too great concentration; the determination of the catalase is best carried out by determining the velocity constant, K, from the formula :— $K = \frac{1}{t} \log. \left(\frac{a}{a-x}\right)$, in which t is the time, a the number of c.c. of oxygen in the hydrogen peroxide used, and x the number of c.c. of oxygen liberated. In the case of fresh, un-neutralised milk the value of this expression varies from 0·0025 to 0·0055; when the milk is kept at the ordinary temperature, the activity of the catalase remains constant for about 24 hours and then increases; at a temperature of 0° C. the activity shows no increase until after the lapse of from 3 to 4 days, but at blood-heat, the activity increases at the end of 6 hours. The addition of chloroform does not influence the activity of the catalase already present in fresh milk or the increased activity of the catalase in old milk. Chloroform, however, in the proportion of 2 : 100 prevents the formation of fresh catalase, and the addition of this proportion of chloroform to a milk at the time of milking allows the catalase present at such time to be determined. One is therefore enabled, by adding chloroform to the milk immediately after it has been obtained from the cow, to judge of the state of health of the cow, as far as the udder is concerned. One is also enabled, with the aid of the test for catalase, to control the statements of purveyors of milk, as regards time of milking, manner of keeping the milk (cooling by means of ice, or at the ordinary temperature). As soon as the milk of a cow shows an activity of $K=0·01$, then it must be considered as suspicious, and may either originate from sickness of the cows, or may be due to the fact that the milk is no longer fresh. Formaldehyde inhibits the action of catalase but the interference is not proportional to the concentration; the influence of formaldehyde is the greater if it be added to the hydrogen peroxide and the milk then treated with the mixture. Potassium cyanide and thiocyanate have an influence analogous to that of formaldehyde. Lactic and acetic acids also inhibit the catalytic action of the enzyme temporarily; when the milk is neutralised, the activity is restored. The acidity of fresh milk interferes with the activity of the catalase, the activity being approximately doubled when the milk is neutralised; in the case of old milk, only a fractional part of the catalytic activity is inhibited by the acidity, and, consequently, neutralisation does not increase the activity to any great extent. Curdled milk shows but little catalytic activity, but does so when neutralised; the curdling process does not appear to injure the enzyme permanently. The addition of alkali beyond the neutral point destroys the catalase. The maximum catalytic action is observed when milk is curdled and then neutralised, but milk which has been inoculated with lactic acid bacteria and allowed to curdle at blood-heat, exhibits less catalytic activity after neutralisation than does milk which has been allowed to curdle spontaneously at the ordinary temperature. Whilst the greater quantity of enzyme is found in the curd, that remaining in the serum eventually, but slowly, attains a high degree of activity, and the serum from boiled milk increases in catalytic activity still more rapidly. The dry solids of the serum are very rich in catalase.—W. P. S.

Egg albumin; Behaviour of commercial —— with hydriodic acid. T. Weyl. Z. physiol. Chem., 1910, **68**, 236—212.

By the action of hydriodic acid (sp. gr. 1·50) at 75° C. upon egg albumin there is produced, in addition to soluble products, a protein containing iodine. This body, termed *iodalbose*, is thus obtained in the form of its hydroiodide, which is soluble in 98 per cent. alcohol and in acetone. It may be separated from its alcoholic solution by the addition of water, ether or ethyl acetate, or it may be "salted out" by potassium acetate. Iodalbose is soluble in solutions of caustic alkalis or alkali carbonates. It is precipitated from its alkaline solutions by the addition of dilute acetic acid, whilst the resulting precipitate dissolves in strong acetic acid. From its solution in the latter reagent it is precipitated by potassium ferrocyanide. It does not give the biuret reaction, does not contain carbohydrate groups, and no longer gives the lead sulphide reaction. The preparations obtained by different methods were found to vary somewhat in composition and were therefore termed iodalbose A and iodalbose B, the former containing 5·2 to 5·3 and the latter 3·6 per cent. of iodine. These iodalboses are not identical with Hofmeister's iodalbumin, which contains less carbon (47·9 per cent.) and more iodine (8·9 per cent.). On introducing a current of dry ammonia into their alcoholic solution there is an immediate precipitation of a body which still contains iodine. As this contains less carbon than the original iodalbose it is termed *apoiodalbose*. It has all the characteristics of proteins, and the iodine (3·1 to 3·7 per cent.) is present in a state of firm combination, since it cannot be detected until after the substance has been heated for a short time with strong sulphuric acid. By the action of zinc dust upon an alcoholic solution of iodalbose the iodine may be eliminated, and a new substance *redalbose* is obtained. This differs from iodalbose and apoiodalbose in not being soluble in 25 per cent. acetic acid. When allowed to stand for some hours in contact with a solution of sodium hydroxide (about 20 per cent.) it is decomposed, with the liberation of a volatile base, the odour of which recalls that of impure scatole. Redalbose has a composition similar to that of its parent substance, egg albumin, from which, however, it differs in containing about 1 per cent. less nitrogen. Its reactions are also different. Thus, it is not coagulable, and does not yield the products of reduction formed in the hydrolysis of albumin.
—C. A. M.

Jams; Analysis of ——. A Beythien and P. Simmich. Z. Unters. Nahr. Genussm., 1910, **20**, 241—272.

In the analysis of jams it is recommended that the following data be determined :—Insoluble matter, sp. gr. of the soluble matters in a 10 per cent. solution of the sample, water, sp. gr. and polarisation of the inverted solution, total sugars, sugar-free extractives, "starch syrup," total acidity, pectinous matters, nitrogen, ash, alkalinity of ash, phosphoric acid, and tannin, and tests should be applied to detect the presence of gelatin and agar-agar. Numerous analyses of jams prepared with equal parts by weight of sugar and various fruits are given for the sake of comparison. As regards the determination of "starch syrup," the authors, as the result of an extended investigation, find that the specific rotation of the inverted solution of German "starch syrup" approximates very closely to the value given by Juckenack, namely, +134·1°. The ratio of dextrose to lævulose in different fruits varies to a not inconsiderable extent and the specific rotation of the total fruit sugars is not always that of invert sugar. As a rule, however, the variation does not have an appreciable effect on the specific rotation of the inverted sugars of the jam. It is almost impossible to ascertain whether exhausted pulp (*i.e.*, fruit which has been pressed and the juice used for other purposes) has been used in the preparation of jam; determinations of the "crude fibre" and insoluble matters are of little use as the quantities vary considerably in genuine jams.—W. P. S.

Caffeine; Determination of —— in roasted coffee. C. Virchow. Chem.-Zeit., 1910, **34**, 1037—1038.

The following method is stated to give concordant results: A mixture of 10 grms. of the finely ground coffee, 2·5 grms. of magnesium oxide and 10 grms. of water is allowed to stand for 2 hours, and is then shaken with three portions, of 100 c.c. each, of chloroform in succession, each shaking being continued for 1 minute. The extract is treated with

1 grm. of paraffin wax (cp. Lendrich and Nottbohm, this J., 1909, 379), and distilled, the last part of the chloroform being expelled from the still heated residue with a small hand bellows; 25 c.c. of hot water are added to the distilling flask, which remains in the hot water bath (70°—80° C.) and is occasionally shaken until the mixture of wax and fat is melted. The solution is then poured into a beaker, the extraction of the flask-contents with hot water being repeated three times. The contents of the beaker are heated and stirred until the fat and wax have melted to a clear liquid, then cooled and filtered, the filtrate being evaporated and the residue (crude caffeine) weighed. To purify the caffeine, the residue is warmed and rinsed with water into a porcelain dish, the solution being strongly concentrated on a fairly hot water-bath, with careful stirring, then treated with finely powdered magnesia in small portions, and evaporated to dryness. The residue is powdered as finely as possible and extracted three times with chloroform. The extract is decanted through a small filter into a weighed flask, the solvent and washings are distilled off, and the residue (practically pure caffeine) is weighed. The nitrogen-content of the residue is then determined.—L. E.

Indian industrial vegetable products. D. Hooper. Annual Report, Indian Museum, Industrial Section, 1909—1910, 31—34.

Myrobalan seeds and kernels :—Samples of these had the following percentage composition :—

	Moisture.	Fat.	Proteins.	Carbohydrates.	Fibre.	Ash.	Nitrogen.	Phosphoric acid (P_2O_5)
Seeds	11·4	3·40	2·81	31·84	49·00	1·55	0·45	0·29
Kernels	9·15	35·76	30·18	16·76	2·00	6·15	4·83	1·63

Vanguiera spinosa :—The fruit of this tree, known as *maina* in Assam, is reputed to have medicinal properties and to be toxic if taken in quantity. Samples were found to contain sugar, gum and a small quantity of tannin, but no cyanogenetic glucoside or alkaloid was found. The dried seeds yielded on extraction with ether 14·01 per cent. of a semi-drying oil, with an iodine value of 115·07.

Morhal resin :—A sample of this resin derived from *Vatica lanceæfolia*, Blume, which grows in Eastern Himalaya, Assam, E. Bengal, and Burma, was a light brown brittle substance. It was completely soluble in turpentine oil; and dissolved to the extent of 48 per cent. in alcohol and 84 per cent. in ether. Its acid value was 15·4 and its iodine value, 69·3. The resin does not appear to be produced in large quantities.

Pistacia galls :—Samples of leaf galls of *Pistacia mutica* Fisch. et Mey., var. *cabulica*, which are used in Baluchistan for dyeing, were separated from the leaves and separately examined. The following percentage results were obtained :—

	Moisture & volatile matter.	Resins and wax.	Tannin.	Soluble non-tannin.	Soluble in alkali.	Proteins.	Fibre.	Ash.
Leaves .	7·25	7·40	12·85	18·88	27·09	9·18	9·50	7·95
Galls . .	6·85	10·57	15·16	21·64	23·41	5·50	10·32	6·55

The increase in tannin produced by the gall insect is less than was to be expected from the composition of galls from other species of *Pistacia*.—C. A. M.

Manganese; Detection of small quantities of —— in foods. Dumitrescou and E. Nicolau. Ann. Falsif., 1910, 3, 370—372.

An aqueous solution of the ash of the substance to be tested, the said ash having been previously dissolved in nitric acid and the solution evaporated to dryness, is treated with its own volume of a 40 per cent. solution of ammonium persulphate and 1 drop of a 2 per cent. solution of cobalt nitrate. The mixture is then boiled and a pink coloration is obtained if only a trace of manganese be present. By the use of this method the authors have detected the presence of manganese in numerous animal and vegetable substances, namely, in muscular tissue, the heart, liver, bile, etc., and in peas, beans, lentils, cereal grains, plums, eggs, milk and wine.—W. P. S.

Patents.

Soluble protein or albumin and a process for the production of the same from meat fibre or other insoluble protein matter. S. A. Vasey, Bromley, Kent. Eng. Pat. 20,766, Sept. 10, 1909.

About 0·5 lb. of dry powdered meat fibre, or 2 lb. of fresh meat, is boiled with about 2 galls. of 0·25 per cent. sodium or potassium hydroxide solution. The turbid liquid is then saturated with slaked lime, strontia, or a calcium salt, again boiled, and filtered. The filtrate is now treated with carbon dioxide or ammonium carbonate, and, after the removal of the insoluble carbonates, the solution is mixed with phosphoric acid or soluble calcium phosphate, and the mixture is boiled. The amount of phosphoric acid added should be approximately equivalent to one-fourth of the weight of the alkali used originally. The liquid is again filtered, and the filtrate, containing practically the whole of the original protein in solution, may be evaporated to dryness, and the residue ground to a powder. The latter is readily soluble in cold water.
—W. P. S.

Milk; Method of treating ——. S. R. Kennedy, Philadelphia, Pa. U.S. Pats. 970,718 and 970,719, Sept. 20, 1910.

The milk is evaporated and cooled so as to crystallise the milk-sugar and salts, and is then agitated to reduce the viscosity. Finally, the sugar and the salts are separated by filtration, and the liquid portion is evaporated to dryness.—A. T. L.

Cocoa-powder; Method of manufacturing ——. F. E. F. Neumann, Wandsbek, Germany. Eng. Pat. 754, Jan. 11, 1910. Under Int. Conv., March 15, 1909.

See Fr. Pat. 411,208 of 1909; this J., 1910, 973.—T. F. B.

Flour; Process for making ——. C. Herendeen. Fr. Pat. 414,126, March 26, 1910.

See Eng. Pat. 1444 of 1909; this J., 1910, 293.—T. F. B.

Dry purified product from beetroot, of good keeping properties and friability, destined for the manufacture of beer and alcohol, and for a food. Fr. Pat. 414,329. *See* XVIII.

XIXb.—WATER PURIFICATION; SANITATION.

Dust from tarred roads; Action of —— on the eyes. H. Truc and C. Fleig. Comptes rend., 1910, 151, 593—596.

It has frequently been observed that the dust from tarred roads has appeared to be more irritating to the eyes than the dust from untarred roads, and an investigation of this point was made by means of experiments on animals. It was found that dust from untarred roads had only the slightest effect when sprinkled on the eye, and that dust from old tarred roads from which the coating had more or less disappeared gave effects little different. Dust from old tarred roads with a well preserved surface brought about conjunctivitis and other lesions, while dust artificially produced from such roads gave still more severe effects. Artificial mixtures of powdered stone and tar gave results corresponding to the proportion of tar therein. This noxious effect of the dust from tarred roads is due primarily to the chemical action of the constituents of the tar upon the mucous membrane of the eye; secondarily to the mechanical irritation produced by the dust; and thirdly to the germs present. It was noticed that the dust from tarred roads contained fewer germs than that from untarred roads. The authors consider that these experiments do not constitute an argument against the tarring of roads, which, when well done, diminishes the chance of injury to the eyes.—J. H. J.

Patents.

Cuprous oxychloride in powder intended for the treatment of cryptogamic diseases of plants; Preparation of ——. J. A. Cousin and A. Buisine. Fr. Pat. 414,341, June 16, 1909.

Cuprous oxychloride, obtained electrolytically as a paste, is dried, without heating, by adding certain anhydrous metallic salts or organic products, capable of being hydrated at the expense of the water present, such, for instance, as anhydrous sodium carbonate or sulphate, dried starch, etc. In this way, important properties of the moist product are retained.—F. Sodn.

Purifying liquids by electricity; Apparatus for ——. H. B. Hartman, Pittsburg, U.S.A. Eng. Pat. 1459, Jan. 19, 1910.

See U.S. Pats. 951,311 and 951,313 of 1910; this J., 1910, 514.—T. F. B.

Sterilising agent; Production of a ——, *and apparatus for sterilising and cleaning beer or wine casks and other receptacles.* A. E. Sherman and L. C. Lutyens. Fr. Pat. 414,024, March 25, 1910. Under Int. Conv., March 27, 1909.

See Eng. Pat. 7419 of 1909; this J., 1910, 510.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Morphine in opium and in opium preparations; Determination of ——. L. Debourdeaux. Bull. Sci. Pharmacol., 1910, **17**, 382—385. Chem. Zentr., 1910, **2**, 1097.

About 10 per cent. of the morphine in opium is present in a form insoluble in water and alcohol, becoming soluble only on addition of slaked lime. Different methods for the determination of morphine are hence required in the case of preparations containing respectively opium itself or an aqueous or alcoholic extract of opium. In the former case extraction must be effected with water in presence of slaked lime, whilst in the latter case water alone is sufficient.—A. S.

Cocaine and strychnine, and atropine and strychnine; Separation and determination of ——. H. C. Fuller. J. Ind. Eng. Chem., 1910, **2**, 378—379.

The author's method of separating cocaine and strychnine is based on the fact that coca bases are readily hydrolysed by acids and alcoholic potassium hydroxide (compare Garsed, this J., 1903, 1370) whilst the *Nux vomica* alkaloids are not affected. The mixed alkaloids are dissolved in *N*/5 alcoholic potassium hydroxide, using 15 c.c. for each decigram of cocaine supposed to be present; the solution is heated on a steam bath for an hour in a digestion flask, and the contents of the flask are then evaporated till nearly all the alcohol is driven off. The residue is extracted three times with chloroform, and the combined chloroform extracts are shaken three times with 10 c.c. of dilute sulphuric acid. The acid liquids are united, an excess of ammonia added, and the liquid shaken three times with chloroform. The chloroform extracts are collected and after washing with water, are filtered through cotton into a tared dish and the solvent evaporated. The dried residue consists of strychnine (and any brucine which may have been present in the alkaloidal mixture). The same procedure can be employed to separate atropine from the *Nux vomica* bases, the tropeines being readily hydrolysed.—A. Sbld.

Alkaloids; New reagent [sodium selenite] for ——. F. Klein. J. Ind. Eng. Chem., 1910, **2**, 389.

A trace of sodium selenite is added to a solution of the alkaloid in 94—95 per cent. sulphuric acid and the mixture heated. A very characteristic purple coloration is given by cantharidine. A purplish coloration is also given by veratrine and quinine. Digitaline, strychnine, brucine, aconitine, and atropine give a brown coloration; morphine and codeine give a black precipitate; caffeine and sparteine give no coloration.—A. Sbld.

Glucoside [rutin] from Tephrosia purpurea. G. Clarke, jun., and S. C. Banerjee. Chem. Soc. Trans., 1910, **97**, 1833—1837.

The sun-dried leaves of *Tephrosia purpurea* (Pers.)—nat. ord. *leguminosae*, a small woody annual which is found all over India and in Assam, were found, on extraction with 95 per cent. alcohol, to yield about 2·5 per cent. of a yellow crystalline glucoside, identical with rutin, $C_{27}H_{30}O_{16},3H_2O$.—F. Sodn.

Osyritrin, myrticolorin, violaquercitrin, and rutin; Identity of ——. A. G. Perkin. Chem. Soc. Trans., 1910, **97**, 1776—1777.

The author has shown previously (Chem. Soc. Trans., 1902, **81**, 477) that osyritrin (*Osyris compressa*), myrticolorin (*Eucalyptus macroryncha*, this J., 1898, 835, 913), and violaquercitrin (*Viola tricolor*) are identical. The formula, $C_{27}H_{28}O_{16}$, was ascribed to them and they were regarded as yielding 1 mol. of quercitin and 2 mols. of dextrose on hydrolysis. More recently, Schmidt (Arch. Pharm., 1908, **246**, 214) and Wunderlich (*ibid.*, **246**, 224) have shown that violaquercitrin and rutin (Chem. Soc. Trans., 1899, **75**, 440) are identical and that they yield rhamnose as well as dextrose on hydrolysis. Further experiments have now shown that myrticolorin and osyritrin also yield rhamnose as well as dextrose on hydrolysis, and the melting point of either of the compounds is not affected by admixture with rutin. The four compounds, osyritrin, myrticolorin, violaquercitrin, and rutin, are thus identical. They have the composition, $C_{27}H_{30}O_{16},3H_2O$, and yield 1 mol. each of quercitin, dextrose, and rhamnose on hydrolysis. In a footnote it is pointed out that myrticolorin which can readily be isolated in large quantity from *Eucalyptus macroryncha* (*loc. cit.*) forms an excellent source of quercitin.—A. S.

Chlorogenic acid; its occurrence and detection in plants. Extraction and yield of caffeic acid from several plants. C. Charaux. J. Pharm. Chim., 1910, **2**, 292—298.

It has been shown that chlorogenic acid (this J., 1910, 587) is present in the coffee plant, and that it hydrolyses into caffeic and quinic acids. Hence the extraction of caffeic acid from a plant would indicate the presence of chlorogenic acid. The dry plant is extracted with ten times its weight of 80 per cent. alcohol, and the extract filtered and distilled. The residue is taken up with a quantity of water equal in weight to that of the plant. The liquid whilst still slightly warm is extracted twice with ether, and the aqueous portion diluted with 5 or 10 times its weight of water. It is then treated with a solution of basic lead acetate, and the precipitate collected and decomposed with a slight excess of 10 per cent. sulphuric acid. The liquid is treated with 50 per cent. potassium hydroxide so that it contains one-tenth of its weight of free alkali, and is boiled for half-an-hour, in order to liberate the caffeic acid. The latter is obtained by adding a slight excess of 25 per cent. sulphuric acid, and extracting the liquid with ether. The residue from the ether is taken up with boiling water, decolorised with animal charcoal and allowed to crystallise. The caffeic acid thereby produced is weighed. A large number of plants were examined and the amounts of acid obtained are recorded. The underground portion of *Orobanche Rapum* yielded 10 per cent. of caffeic acid, corresponding to 20 per cent. of chlorogenic acid. The presence of the latter acid in a plant can be readily detected by boiling about a gram of the substance with 5 or 10 parts of 10 per cent. sulphuric acid for an hour.

The liquid is filtered and shaken out twice with ether, the ethereal liquid being washed once with water and evaporated. The residue is taken up with a little water and treated with two drops of 1 per cent. ferric chloride solution, when a faint greenish colour is produced. The further addition of two or three drops of 1 per cent. sodium carbonate solution produces a persistent blue coloration, characteristic of the decomposition products of chlorogenic acid.—F. Shdn.

Guarana. P. H. Marsden. Annals Trop. Med. and Parasit., 1910, 4, 105—113.

A historical and descriptive account of the Brazilian drug, guarana, together with illustrations of the plant, the seed, and the drug, and a bibliography. Guarana is obtained from the seeds of *Paullinia sorbilis*, Martius (*P. Cupana*, H. B. and K.), N. O., *Sapindaceæ*, a climbing plant which is abundant in the province of Amazonas and also in Guiana and Venezuela. It has an astringent, tonic, and analgesic action, and is used by the natives for the preparation of a beverage similar in its effects to tea and coffee. It is usually sold in stick form, the seeds being washed, gently heated, and beaten in bags in order to remove the seed coat, after which the kernels are crushed upon a heated stone and made into a paste with water to which is sometimes added cacao powder or manioc flour; the paste is moulded into cakes or cylinders which are dried in the sun or by aid of gentle heat. Under the microscope the drug is characterised by the presence of swollen starch granules, needle-shaped crystals, small polygonal cells, and characteristic sclerenchymatous cells. Most authorities consider caffeine (theine, guaranine) to be the most important constituent, the amount of caffeine stated to be present ranging from 2·5 up to 6 per cent. According to the Spanish Pharmacopœia, guarana should contain at least 3 per cent. of caffeine. The yield of ash is given variously as from 1·3 to 2 per cent. Other substances, which at different times have been said to be present in guarana are a tannin (catechin), a gum, starch, a resin, an acrid green fixed oil, and a concrete volatile oil scarcely soluble in water. (See also following abstract.)—A. S.

Guarana: Some of the chemical constituents of ——. M. Nierenstein. Annals Trop. Med. and Parasit., 1910, 4, 115—118. (See preceding abstract.)

The finely-powdered material was extracted with alcohol containing 1 per cent. of hydrochloric acid at 55°—60° C., and the solution was neutralised with ammonia. The substance precipitated was obtained, after purification, in the form of small needles, m. pt. 217°—219° C. After drying for 2 hours at 116° C., during which a loss of weight occurred corresponding to 2½ mols. of water of crystallisation, the substance had the composition, $C_{10}H_{47}O_{21}N_4$. Its acetyl, methiodide, $C_{40}H_{47}O_{21}N_1.CH_3I$, methyl-ammonium hydroxide, $C_{40}H_{47}O_{21}N_4.CH_3OH$, and bromine derivatives were prepared. The amount of tannic acid in the guarana as determined by Körner's and Nierenstein's casein method (Collegium, 1909, 337: this J., 1909, 1150) was 4·3 per cent. It was isolated by the acetone process (Nierenstein, "Darstellung u. Nachweis der Gerbstoffe," Abderhalden's "Handbuch. der biochem. Arbeitsmethoden," Bd. II., S. 996) and after purification was obtained as small colourless needles, m. pt. 199°—201° C. It appeared to resemble Gorter's chlorogenic acid (this J., 1908, 242, 464) rather than catechin, but was not identical with either of these substances, as shown by the melting points of its acetyl derivative (147°—149° C.) and aniline salt (203°—205° C.). Further investigation is needed to ascertain the exact nature of the alkaloid (*β-guaranine*) and tannic acid (*guarana-tannic acid*), but the author's results show clearly that these substances are not theine (caffeine) or theobromine and catechin respectively. The alkaloids of both *Paullinia sorbilis* (v. *cupana*) and *P. cambess* have been given by other authorities as either caffeine or theobromine, or a mixture of the two, but the guarana examined by the author was stated to be used as a remedy against diarrhœa in Brazil, and according to Dekker only *Paullinia trigonia* is used for this purpose.—A. S.

Ultra-violet rays; Action of —— *upon plants containing cumarin, and plants the odour of which arises from hydrolysable glucosides.* Pougnet. Comptes rend., 1910, 151, 566—569.

Certain plants containing coumarin, *Melilotus off.* Lam., *Asperula odorata* L. and others, were exposed to the ultra-violet rays emitted by a quartz mercury vapour lamp using 4 ampères at 110 volts. After a few minutes the odour of coumarin became perceptible. Other plants containing a hydrolysable glucoside, such as the cherry laurel, also developed an odour after a few minutes' exposure to the rays. It appears that the cell is killed, whilst the enzymes survive. The action of the rays on these plants resembles that of anæsthetics (see this J., 1909, 1324).
—F. Shdn.

a-Elaterin; Note on the constitution of ——. C. W. Moore. Chem. Soc. Trans., 1910, **97**, 1797—1805.

The source of the *a*-elaterin used in the investigation was *Citrullus Colocynthus* Schrader (this J., 1910, 371). The author confirms the formula of Berg, $C_{28}H_{38}O_7$. The molecule contains two phenolic groups, an acetyl and a lactone group. Ketonic groups are absent. It yields 1 : 4-dimethylnaphthalene on distilling with zinc dust. The iodine value is 53·3 (Hübl), that required for $C_{28}H_{38}O_7$ with one double linkage being 52·2. "Elateric acid" was prepared by the action of potassium hydroxide on *a*-elaterin. It had $[a]_D=23·9°$ in ethyl acetate. When oxidised with chromic acid it yielded a ketone, elaterone, $C_{24}H_{30}O_5$, which crystallises from alcohol in long colourless needles, m. pt. 300° C., and which has $[a]_D=+120·5°$ in chloroform. The monophenylhydrazone melts at 278° C., and the dioxime at 295° C. When subjected to milder oxidation, elaterin yields a compound, $C_{24}H_{32}O_4$, m. pt. 230° C.—F. Shdn.

Caramel [in flavouring extracts, etc.]; Test for ——. G. H. P. Lichthardt. J. Ind. Eng. Chem., 1910, 2, 389.

A solution of 1 grm. of tannic acid and 0·75 grm. of sulphuric acid (1·84 sp. gr.) in 50 c.c. of water is recommended as a reagent for detecting caramel in flavouring extracts, alcoholic liquids and vinegar. In testing vanilla extract 5 c.c. of the reagent are added to 5 c.c. of the extract, the mixture gently heated, until the precipitate at first formed is almost all dissolved, and allowed to stand for 12 hours. If caramel be present, a light or dark brown precipitate, according to the amount contained, is formed. The pure extract gives only a very slight precipitate quite different in character. In testing alcoholic liquids the greater part of the alcohol is evaporated, water added, and the liquid then tested as described.—A. Sbld.

Lavender oil; Occurrence of thymol and nerol in French ——. F. Elze. Chem.-Zeit., 1910, 34, 1029.

By fractionally distilling, *in vacuo*, a large quantity of French lavender oil a portion was obtained which boiled at 85°—100° C. under a pressure of 5 mm., had the sp. gr. 0·916 at 15° C., and saponification value, 216, corresponding with an ester-content of 75·6 per cent. (as linalyl acetate). In this fraction the presence of thymol and nerol was detected, the former being recognised by means of its phenylurethane (m. p. 107°—107·5° C.) and nitroso derivative (m. p. 160°—161·5° C.), and the latter by means of its tetrabromide (m. p. 118° C.) and diphenylurethane (m. p. 50° C.). The nerol is present in the oil in the free state.—W. P. S.

Otto of rose: a new adulterant. E. J. Parry. Chem. and Drug., 1910, 77, 65.

The common adulterant of otto of rose, geraniol mixed with more or less citronellol, raises the specific gravity and refractive index and lowers the so-called melting-point. To correct these defects alcohol containing 1—5 per cent. of an odoriferous substance (commonly phenyl-ethyl alcohol and vanillin) is usually added. A new substance used for this purpose has come into the hands of the author, who found that it consisted of a 5 per cent. solution of nonyl or decyl aldehyde in alcohol, containing suspended crystals of paraffin.—A. S.

Cyclohexane, its separation from, and its determination in, mixtures containing benzene. T. S. Patterson and A. Fleck. Chem. Soc. Trans., 1910, 97, 1773—1775.

The authors conceived the idea of determining the quantity of cyclohexane in a mixture of that substance and benzene by means of the difference in the effect on the optical rotation of ethyl tartrate of the two compounds when used as solvents. It was found on trial that cyclohexane and ethyl tartrate are practically immiscible, and a portion at any rate of the cyclohexane present in admixture with benzene can be recovered by shaking with ethyl tartrate. When the benzene forms about 50 per cent. or more of the mixture, however, too much ethyl tartrate must not be used, or a homogeneous mixture is produced. For the method depending upon the optical rotation, a mixture of 4 vols. of ethyl tartrate and 1 vol. of benzene is made up as a stock solution and 5 c.c. of this are mixed with 1 c.c. of the liquid under examination, the rotation being then determined in a 50 mm. tube at 25° C. With pure benzene the rotation is $+2{\cdot}81°$ and with pure cyclohexane, $+1{\cdot}76°$, whilst the intermediate values lie about the straight line joining these two values. It is stated that by this method of working, the results for the proportion of cyclohexane in a mixture with benzene are accurate to within about 3 per cent.—A. S.

Sicilian citrus industry. Board of Trade J., Sept. 29, 1910. [T.R.]

According to an Italian law, dated 17th July, providing for the regulation of the Sicilian citrus industry, the Government is obliged to present to Parliament, not later than 31st December next, a bill for the reconstruction of the administration of the "Camera Agrumaria" (the Chamber for the Sicilian citrus industry). The manufacture of citric acid is placed under the control of the Chamber. A tax is payable, on the sale of citrate of lime and concentrated lemon-juice, of 3 per cent. of the selling price if the goods are sold through the Chamber, and of 1 lira per 100 kilos. and per degree of citric acid if the goods are not entrusted to the Chamber. Not later than 15th September the Ministry of Agriculture was to fix the minimum price of valuation of deposit warrants of the Chamber for the season from 1st December, 1910, to 30th November, 1911. The sale price of citrate of lime and concentrated lemon-juice is to be fixed by the Royal Commissioner appointed in January last to administer the Chamber. The law also contains provisions for granting special privileges to co-operative societies formed for the purpose of manufacturing the products of the citrus industry or of exporting them.

The average annual lemon crop is estimated at 50,000,000,000 fruits (8000 citrus fruits = about 1 metric ton), of which 50 per cent. is exported as fruit, 40 per cent. is converted into citrate and essence, and 10 per cent. is consumed at home and pickled. It is estimated that the production of citrate of lime in 1910–11 will be 7000 metric tons, and the sales, 5800 tons.

Thymol; U.S. Customs decision. Oil, Paint, and Drug Rep., Oct. 3, 1910. [T.R.]

Thymol was assessed at the rate of 55 cents per pound under paragraph 3 of the tariff act of 1909, as a compound in the preparation of which alcohol was used, but it was claimed by the importer, the National Aniline and Chemical Co., to be dutiable under the same act and paragraph at 25 per cent. *ad valorem* as a chemical compound in the preparation of which alcohol was not used. The board found from an examination of the evidence that the thymol here in question was manufactured without the use of alcohol, and accordingly sustained the protest of the importer.

Saccharin; Importation of —— into Turkey. Board of Trade J., Sept. 29, 1910. [T.R.]

Saccharin may be imported into Turkey only by licensed chemists and in quantities of not more than 50 grms. at one time.

Patents.

Organic phosphates. L. C. Reese, London. Eng. Pat. 27,650, Nov. 27, 1909.

New compounds, termed "carbohydro-glycerophosphates," intended to be added to such foods as are deficient in organic phosphates, are obtained by combining a carbohydrate with a glycerophosphate or with glycerophosphoric acid. For example, potassium amylo-glycerophosphate is obtained by intimately mixing 3 parts of starch (containing 15 per cent. of moisture) with 4 parts of a 50 per cent. aqueous solution of potassium glycerophosphate, and heating to about 60° C. until the mass forms a homogeneous cake, which is then dried in a vacuum.—T. F. B.

Organic acid anhydrides; Manufacture of ——. F. W. de Jahn, New York City. Eng. Pat. 5939, March 9, 1910. Under Int. Conv., March 27, 1909.

In the preparation of anhydrides of organic acids (especially acetic and propionic acids) from the corresponding salts by treatment with halogen in presence of sulphur, the sulphur, sulphur dioxide, or sulphur chloride previously used, is replaced by substances containing oxidisable sulphur, such as iron, copper, or sodium sulphides, pyrrhotite or pyrites, or sodium hydrosulphite, thiosulphate, or metasulphite; the chlorine is introduced to the mixture of anhydrous salts at a temperature between 40° and 50° F., and the resulting anhydride is distilled off under reduced pressure. (Compare addition to Fr. Pat. 407,046; this J., 1910, 592.)—T. F. B.

Oleic acid derivative of bodies of the terpene group. N. Sulzberger, New York. U.S. Pat. 969,420, Sept. 6, 1910.

Esters of oleic acid with terpene alcohols (*e.g.*, menthol) are obtained by heating oleic acid chloride with the alcohol; they are oils of a yellowish colour, insoluble in water and alcohol, and are decomposed by sodium hydroxide and decolorise bromine water.—T. F. B.

Oleic acid derivative containing a phenyl group. N. Sulzberger, New York. U.S. Pat. 970,662, Sept. 20, 1910.

Esters of phenols with oleic acid are produced by combining oleic acid with "such monohydric phenols as will form an ester with stearic acid, having a m. pt. of about 40° C." Phenyl oleate is a yellowish, oily liquid, insoluble in water, which cannot be distilled under atmospheric pressure without decomposition.—T. F. B.

Perfume. C. O. Kleber, Clifton, N.J. U.S. Pat. 969,636, Sept. 6, 1910.

Neutral esters of *o*-phthalic acid are mixed with essential oils and also, if desired, with other synthetic perfumes. —T. F. B.

Eucalyptus oil solution and process for the manufacture thereof. A. M. Cox, Assignor to H. Metcalf, Los Angeles, Cal. U.S. Pat. 971,359, Sept. 27, 1910.

The oil-bearing portions of the eucalyptus are exposed and then treated with phenol dissolved in a volatile solvent, *e.g.*, a petroleum distillate of sp. gr. 0·7 to 0·8. —T. F. B.

Neutral esters of diglycollic acid with phenols; Process for preparing ——. C. F. Boehringer und Söhne. Ger. Pat. 223,305, May 22, 1908.

The dichloride of diglycollic acid reacts with two mols. of a phenol or salt of a phenol, forming esters of the composition, $O(CH_2.COOR)_2$. The phenols may be replaced by nitrophenols, halogen-phenols, phenolcarboxylic acids, etc. The products are said to be of therapeutic value.—T. F. B.

Tetramethylenediamine; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 414,461, April 4, 1910. Under Int. Conv., Nov. 9, 1909.

Adipic acid diamide is converted into tetramethylenediamine by treatment with a solution of a halogen in alkali solution.—T. F. B.

Mercury compounds; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 414,563, April 7, 1910. Under Int. Conv., April 13, May 18, Nov. 11, Dec. 6, 14, and 30, 1909.

See Ger. Pats. 224,435 and 224,864 of 1909; this J., 1910, 1037, 1133. Similar results are obtained by the use of barbituric acid or its homologues or their salts, or of succinimide or the imide of glutaric acid. On the other hand, the mercury salicylate may be replaced by other mercury derivatives of organic acids, *e.g.*, oxymercuribenzoic anhydride or its chloro, nitro, or amino derivatives.—T. F. B.

Tuberculosis immune-sera ; Process for the preparation of active ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger Pat., 223,758, July 23, 1909.

Normal animals are first rendered supersensitive to tuberculin by injection of living tubercle bacilli, non-pathogenic for the animal in question, and tuberculin or other preparation of tubercle bacilli is then injected until this supersensitiveness is destroyed. These two operations are repeated a number of times, using for the first injection mixtures of non-pathogenic with increasing quantities of pathogenic (for the animal in question) tubercle bacilli, and finally the pathogenic bacilli alone. By each pair of operations the blood serum of the animal is enriched in immune-substances and after the final treatment with tuberculin, a specially active immune-serum can be obtained from the animal.—A. S.

Pharmaceutical compounds ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,030, Nov. 20, 1909.

See Ger. Pat. 224,435 of 1909 ; this J., 1910, 1037.—T. F. B.

Pharmaceutical compounds ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,166, Dec. 2, 1909.

See Fr. Pat. 414,563 of 1910 ; preceding.—T. F. B.

Camphene ; Process for converting pinene into ——. British and Continental Camphor Co., Ltd., London. Eng. Pat. 10,227, April 26, 1910. Under Int. Conv., May 7, 1909.

See Fr. Pat. 412,668 of 1909 ; this J., 1910, 1036.—T. F. B.

Aliphatic hydrocarbons having more than one double bond ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 414,382, April 1, 1910. Under Int. Conv., April 8, 1909.

See Eng. Pat. 8100 of 1910 ; this J., 1910, 1036.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Gelatin : The degree of impermeability conferred on films of —— *by the addition of various insolubilising substances.* A. and L. Lumière and A. Seyewetz. Phot. J., 1910, **50**, New Series, Vol. **34**, 315—319.

As the result of a series of experiments on the action of five insolubilising agents on gelatin, it is concluded that substances which render gelatin insoluble also lessen its permeability (measured by the amount of water absorbed in a given time). The substances used are placed in the following order as regards their power of decreasing permeability :—Formalin, sodium quinonesulphonate, quinone, chrome alum, potash alum. The last, which is not a true insolubilising agent, as it only raises the melting point of gelatin, is considerably weaker in its action than the other four substances. Sodium quinonesulphonate and quinone, although they stain the gelatin and are not so powerful as formalin, are preferable for photographic purposes, since the contraction caused by formalin tends to separate the gelatin from the glass. Quinone and sodium quinonesulphonate can also be used in much greater quantity than formalin without lessening the fluidity of the resulting gelatin solutions.—T. F. B.

Photographic silver images ; Action of quinones and their sulphonic acids on ——. A. and L. Lumière and A. Seyewetz. Comptes rend., 1910, **151**, 616—618.

Quinone and its sulphonic acid (sodium salt), in acid solution, have a reducing action on silver images similar to that of ammonium persulphate. The following solution has given the best results :—Quinone, 5 grms. ; sulphuric acid, 20 c.c. ; water, 1000 c.c. ; when reduction is complete, the reaction is stopped by treating the negative or print with a 20 per cent. solution of sodium bisulphite. In presence of alkali chlorides or bromides, especially the latter, quinone and its sulphonic acid have a powerful intensifying action on the photographic image ; this action is greater with quinone than with its sulphonic acid. A suitable formula is :—Quinone, 5 grms. ; potassium bromide, 25 grms. ; water, 1000 c.c. The process gives very stable images, probably containing a silver oxybromide. At the same time as the intensification, a considerable modification in tone occurs, the images being reddish-brown with quinone and yellowish-brown with its sulphonic acid, so that these substances may also be used for toning silver prints on paper, glass, etc.—T. F. B.

Patents.

Web coating machines [for cinematograph films, etc.]. W. A. Daniels, Chicago, U.S.A. Eng. Pat. 24,556, Oct. 26, 1909.

Machines for coating with pyroxylin the gelatin surface of perforated cinematograph and like films, are provided with means for projecting an air blast on the side of the web opposite to that which receives the coating, the object being to prevent the pyroxylin from flowing through the apertures in the web and thus closing them.—T. F. B.

Picture films ; Method of coating ——. F. B. Thompson, Assignor to National Waterproof Film Co., Chicago. U.S. Pat. 970,972, Sept. 20, 1910.

A web consisting of a non-absorbent support (*e.g.*, celluloid) carrying an absorbent (gelatin) film, is immersed in water, and then after the moisture has caused the gelatin to swell, it is coated with a film of celluloid varnish. The above processes are applied progressively to the web from end to end.—T. F. B.

Non-inflammable films ; Process for making ——. W. Merckens and H. B. Manissadjian. Fr. Pat. 414,680, April 9, 1910.

Non-inflammable films are obtained by working up in the usual way, the solutions of mixtures of mixed cellulose esters (sulphacetate or phosphacetate) with esters or sulpho-esters of phenol, cresols, or naphthols, in acetone or other solvent.—T. F. B.

Cinematograph films ; Process for re-utilising the bond supports of ——. Comp. Gén. de Phonographes, Cinématographes, et Appareils de Précision. Fr. Pat. 414,050, June 10, 1909.

See Eng. Pat. 14,950 of 1909 ; this J., 1910, 1134.—T.F.B.

XXII.—EXPLOSIVES ; MATCHES.

Ammonium perchlorate in explosives. E. C. Carbonelli. L'Ind. Chimica, 1910, 10, 209—212, 225—228, 245—247.

Ammonium perchlorate can now be obtained of great purity at a reasonable price, and its use in the manufacture of explosives is considered to offer great advantages. The stability and safety of the salt are greater the purer it is, the resistance to shock of the pure product being nearly double that of one containing traces of ammonium chlorate. Its chief advantages, apart from the rapidity of decomposition and high velocity of the explosion wave, are a large evolution of gas and of heat, together with a large quantity of available oxygen, and its stability and non-hygroscopicity when pure. A comparison of ammonium perchlorate with the perchlorates and chlorates of sodium and potassium, and the nitrates of ammonium, sodium, and potassium, using aniline as combustible substance, showed that with respect to development of heat it is inferior only to sodium and potassium perchlorates and sodium chlorate, whilst it is much superior to these in regard to development of gas, in which respect only ammonium nitrate gives better results; it is superior to all of the other compounds mentioned when both qualities are taken into consideration. Nitroglycerin develops 1450 calories and 700 litres of gas per kilo. A mixture of ammonium perchlorate and aniline is inferior by about 13 per cent. in the development of heat and superior by about 10 per cent. in production of gas; it gives results comparable with those furnished by blasting gelatin (92 per cent. of nitroglycerin). Ammonium perchlorate tends to dissociate on keeping, slowly even when pure, and more rapidly when in presence of acid substances (rancid fats, etc.) Hence the only safe way of using it is in explosives of the "Promethus" type (see this J., 1903, 820), in which the oxidising agent alone is made into cartridges and is dipped in a liquid combustible substance immediately before use. By mixing the ammonium perchlorate with 18 per cent. of manganese dioxide it is rendered perfectly stable, the density is increased, and evolution of hydrochloric acid on explosion is prevented. The production of hydrochloric acid might also be prevented by addition of a nitrate, but the use of manganese dioxide presents many advantages as shown in the following table:—

	Mixtures of ammonium perchlorate with:	
	Manganese dioxide.	Sodium nitrate.
Preparation	Easy and safe.	Dangerous.
Preservation	Indefinite.	Impossible without alteration.
Agglomeration on keeping	*Nil.*	Rapid.
Explosive power ...	Constant.	Diminishes on keeping.
Charging density ..	High.	Low.
Hygroscopicity	*Nil.*	Great.
Fixation of chlorine	Complete with 18 per cent.	Complete with 42 per cent.
Nitrogen compounds in gas	Very little.	Much.
Sensitiveness to detonation	High and constant.	Low and diminishes on keeping.
Character of explosive	Chlorate.	Nitrate.

As combustible substances the most suitable appear to be anthracene oil, the middle, and heavy distillates from certain Roumanian petroleums, and oil of turpentine, and of these the turpentine is best, owing to the variable composition of the other two. Aniline oil would be quite suitable but for its content of nitrogen. (See also this J., 1909, 492).—A. S.

Coal dust; Explosibility of ——. Mining World, Sept. 10, 1910, 457.

A BULLETIN has been issued by the Bureau of Mines (U.S.A.) which summarises the experiments establishing the belief in the explosibility of coal dust, and gives an account of preventive measures tried up to date. Experiments at Pittsburg indicate that under ordinary conditions the dust must be from coal having at least ten per cent. of volatile matter, and the higher this percentage the more sensitive the dust becomes, ash, moisture, and size being constant. Where there is a large amount of dry coal dust a humid atmosphere has little effect on its ignition or on the propagation of an explosion. A long continuance of humid conditions renders the coal dust moist and inert, but the presence of moisture in the air at the moment is not sufficient to prevent an explosion, a fully saturated atmosphere at 65° F. containing a quantity of moisture equal to only 7·8 per cent. of the weight of the dust, when the latter is suspended in a cloud of moderate density, say, 200 grms. per cubic metre. In some experiments with wetted dust several times this percentage of moisture in the dust in addition to a nearly saturated vapour, was necessary to prevent the propagation of an explosion. The only purpose of moistening the air of a mine is that it may be the means of damping the dust. The characteristic features of the various remedies are reviewed in the bulletin. —A. H. C.

PATENTS.

Smokeless powders; Method for the manufacture of ——. C. Claessen. First Addition, dated April 2, 1910, to Fr. Pat. 410,239, Dec. 11, 1909 (this J., 1910, 812).

IN the manufacture of smokeless powder by the process previously described, the product may be rendered plastic by mixing the nitrocellulose with a quantity of nitroglycerin not exceeding 30 per cent., and subjecting the mixture to strong pressure at a high temperature (about 80° C.).
—C. A. M.

Pyrophoric alloys. Fr. Pat. 414,057. *See* X.

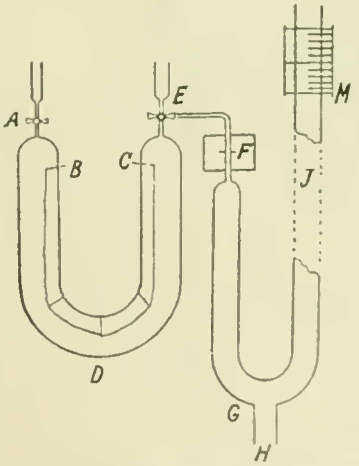
XXIII.—ANALYTICAL PROCESSES.

Iron and glass; Vacuum-tight seals between ——. H. J. S. Sand. Brit. Assoc., Sept. 1910. Chem. News, 1910, **102**, 166—167.

AN iron wire is sealed into the glass, and while the latter is still hot a small piece of heated steel tubing surrounding the wire is pushed a few mm. into the glass. After cooling, the steel tube is soldered to the wire. Tubes into which iron wires of 1 mm. diameter have been sealed in this manner have been pumped out to a cathode-ray vacuum, and the vacuum has kept unchanged for four months.
—R. C. P.

Ozonometer. S. Jahn. Ber., 1910, **43**, 2319—2321.

THE author recommends for the determination of ozone in gas mixtures the measurement of the pressure produced by the decomposition of the ozone into oxygen. The gas to be examined is passed through the U-tube, D, of 70 c.c. capacity, inside diam. 2 cm., entering through the cock, A, and leaving by the three-way tap, E, both of which have capillary bores. When 150—200 c.c. have passed through, the cock, A, is closed, and then the tap, E, and the thin platinum wire, B C, is heated to dark redness for 5—10 seconds by passage of an electric current. The tube, D, is immersed in water, and after stopping the current it is quickly brought to the room temperature, and the tap, E, then turned so as to place it in communication with the manometer, G. By means of a levelling tube connected with H, the manometer liquid (paraffin oil) is adjusted so



that the meniscus in the capillary stands at the level, F, and the pressure is then read off on the scale, M, on the tube, J. The percentage of ozone by volume (a) is then given by the expression $a = \frac{2\Delta p}{p}$, where Δp is the observed pressure difference and p the barometric pressure (both at 0° C.). For more accurate results the expression $a = \frac{2\Delta p}{p}(1-g)$ is used, where g is the ratio of the dead space between E and F to the total volume. The results are stated to be accurate to within 1 per 1000 for a concentration of 10 per cent., and to within 1 per 100 for a concentration of 1 per cent. of ozone.—A. S.

Potassium ; Determination of —— as potassium platinum chloride. H. Fresenius. Chem.-Zeit., 1910, 34, 1033—1034.

The conditions necessary for the accurate determination of potassium with platinum chloride are described and the influence of the presence of other chlorides is given. The precipitate of potassium platinum chloride obtained should be well subdivided in order that the last traces of moisture may be removed during the drying, which should be carried out at a temperature of 130° C. When sodium chloride is present, sufficient platinum chloride must be added to convert the whole of this salt, as well as the potassium chloride, into the double platinum salt. If the solution in which the potassium is to be determined contain calcium, barium, or magnesium, these must be removed previous to the determination of the potassium. Eighty per cent. alcohol should be employed for washing the potassium platinum chloride precipitate ; the use of 70 per cent. alcohol yields too low results, and 95 per cent. alcohol has a tendency to reduce any sodium platinum chloride present.—W. P. S.

Arsenic and certain metallic salts ; Detection and rapid separation of —— from solutions. C. E. Carlson. Z. physiol. Chem., 1910, 68, 243—262.

When a solution of an arsenious salt is treated with hydrogen sulphide a yellow coloration but no precipitate is at first obtained, and it is only after standing for some hours, or after the addition of hydrochloric acid, that the insoluble sulphide is formed. The author attributes the above-mentioned yellow coloration to the presence of a colloidal form of arsenic trisulphide. By shaking such a solution with ether the arsenic sulphide may be completely extracted, and will then be present in the ethereal layer, partly in solution and partly separated in fine particles. Benzene and petroleum spirit behave in the same way, whilst chloroform appears to dissolve the arsenic more completely than ether. The addition of alcohol renders the test more sensitive, so that as little as 0·001 mgrm. of arsenic may thus be detected with certainty. Thus in a test experiment, 1 c.c. of a solution of arsenious oxide (= 0·001275 mgrm. of arsenic) was mixed with 5 drops of 10 per cent. hydrochloric acid and 10 drops of hydrogen sulphide water, and, after the lapse of a few minutes, the mixture was thoroughly shaken for one minute, and then treated drop by drop with alcohol. The yellow particles of arsenious sulphide were plainly visible when the test-tube was held over a sheet of white paper. In the case of salts of arsenic acid a solution of thioacetic acid is a more sensitive reagent than hydrogen sulphide, but it is necessary to allow the mixture to stand for 10 to 20 minutes for the reaction to take place. The following details show the application of the method in quantitative work :—About 100 grms. of 10 per cent. hydrochloric acid were mixed with 5 c.c. of $N/500$ arsenious oxide solution and 10 c.c. of hydrogen sulphide water added. After standing for some minutes the mixture was shaken for one or two minutes with 10 c.c. of a mixture of equal volumes of ether and chloroform, and then allowed to stand. The lower layer, which was yellow from the separated arsenious sulphide, was now drawn off, and after the addition of 2 to 3 c.c. of 25 per cent. nitric acid, to prevent volatilisation of arsenic as arsenic chloride, was placed in a beaker on the water bath. The extraction of the original liquid was twice repeated with 10 c.c. of chloroform-ether, and finally with 5 c.c. of the solvent, and the extracts added to the first one in the beaker. In this way every trace of arsenic was removed from the acid liquid. The residue left on evaporating the contents of the beaker to dryness consisted of arsenic acid, and the amount of arsenic was determined by Mohr's iodometric method. The use of this test enables as little as 0·075 mgrm. of arsenic to be detected in 500 c.c. of urine. The method is also applicable to the separation of other metals which are precipitated as sulphides from an acid solution, and it is possible in this way to detect the slightest traces of lead, copper and mercury.—C. A. M.

Silk peptone ; Use of —— in the detection of peptolytic enzymes. E. Abderhalden and E. Steinbeck. Z. physiol. Chem., 1910, 68, 312—316.

When a solution of silk peptone is allowed to stand at incubating temperature in contact with organic tissue (previously washed with physiological salt solution) in the presence of toluene, the presence of peptolytic enzymes is indicated by the formation of crystals of tyrosine. The reagent may be prepared by treating dried silk refuse with five times its quantity of 70 per cent. sulphuric acid for 4 days at 25° C., then chilling the mixture in ice-water, and adding ten times the volume of cold water. The sulphuric acid is then removed by the addition of barium hydroxide, and, after separation of the excess of barium, the filtrate containing the silk peptone is concentrated to a syrup, and poured into absolute alcohol, from which the peptone separates in the form of a flocculent deposit. For tests it is best used in a 25 per cent. solution.—C. A. M.

Determination of sulphur and sulphuretted hydrogen in illuminating gas. Somerville. *See* IIa.

Comparison of Bolling's, Harding's, and Drehschmidt's methods for determining sulphur in illuminating gas. Harding and Taylor. *See* IIa.

Test for nitric acid. Klein. *See* VII.

Distinguishing anhydrous from glacial acetic acid. Klein. *See* VII.

Determination of formic acid in the presence of acetic acid. Delehaye. *See* VII.

Causes of error in determining the strength of commercial solutions of lactic acid. Monin. *See* VII.

Synthesis of arseniuretted hydrogen from its elements. [*Detection of arsenic, and separation of arsenic and antimony.*] Vournasos. *See* VII.

Determining free acid in hydrogen peroxide solutions. Brown. *See* VII.

Electrolytic determination of zinc in ores. Kemmerer. *See* X.

Detecting small quantities of petroleum spirit in turpentine. Klein. *See* XIII.

Analysis of shellac. Vaubel. *See* XIII.

Detection of copal-amber mixtures. Klein. *See* XIII.

Sampling liquid [tanning] extracts. Lepetit. *See* XV.

Determining free acid in chrome leather. Grasser. *See* XV.

Chroming of hide powder. Oberfell. *See* XV.

Determining acidity of tan liquors. Alsop. *See* XV.

Analysis of leather. Veitch. *See* XV.

Physical analysis of soils. Mitscherlich. *See* XVI.

Significance and action of soil colloids in determination of soil surfaces. Ehrenberg. *See* XVI.

[Determination of] ammonia in soils. Russell. *See* XVI.

Determination of the nitrogen contained in crude calcium cyanamide in the form of cyanamide and dicyandiamide. Stutzer and Söll. *See* XVI.

Volumetric determination of potassium [in fertilisers] by the cobaltinitrite method. Shedd. *See* XVI.

Bagasse analysis: determination of sugar and moisture. Norris. *See* XVII.

Determination of sucrose in the presence of certain reducing sugars. Lemeland. *See* XVII.

Rothenfusser's method for the detection of sucrose in wine. Schaffer. *See* XVIII.

Determining fusel oil in distilled liquors. Bassett. *See* XVIII.

Distinguishing ethyl alcohol from methyl alcohol. Klein. *See* XVIII.

Analysis of jams. Beythien and Simmich. *See* XIXa.

Determining caffeine in roasted coffee. Virchow. *See* XIXa.

Detecting small quantities of manganese in foods. Dumitrescou and Nicolau. *See* XIXa.

Determining morphine in opium and in opium preparations. Debourdeaux. *See* XX.

Separation and determination of cocaine and strychnine, and atropine and strychnine. Fuller. *See* XX.

New reagent for alkaloids [sodium selenite]. Klein. *See* XX.

Chlorogenic acid, its occurrence and detection in plants. Charaux. *See* XX.

Test for caramel [in flavouring extracts, etc.]. Lichthardt. *See* XX.

Patents.

Analysis; New method of —— and apparatus for its application. A. Houdayer. Fr. Pat. 414,317, Mar. 19, 1910.

Bulbs of glass are charged with measured quantities of the reagent, the filling being effected with the aid of a vacuum, and the bulbs then closed. Several of the charged bulbs may be kept in a stand, and if it is required to use a boiling reagent, fragments of caoutchouc or other porous substance which has previously been submitted to the action of compressed air, are introduced into the bulb before the heating.—C. A. M.

Gaseous mixtures; Means for measuring or analysing ——. B. C. Hinman, London. U.S. Pat. 970,923, Sept. 20, 1910.

See Eng. Pat. 26,561 of 1908; this J., 1910, 116.—T.F.B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Leaves; Aldehyde in ——. H. Franzen. Z. angew. Chem., 1910, 23, 1835.

After distilling the leaves of the hornbeam in steam, an aldehyde may be obtained from the distillate, the hydrazone of which melts at 167° C. The aldehyde has the formula, C_5H_9·CHO, and oxidation with silver oxide gives α-β-hexylenic acid, $CH_3·CH_2·CH_2·CH:CH·COOH$. The same aldehyde is obtained from the leaves of a large number of other trees, only the horse chestnut and the lime giving a hydrazone which melts at 234°—238° C. The hexylenic aldehyde is very similar in constitution to dextrose, and may play an important part in sugar synthesis in the plant.—W. H. P.

Trade Report.

Chemical industries; Present position of the —— in Germany. A. Binz. Oesterr. Chem.-Zeit., 1910, 13, 233—235.

The author deals with the influence of German scientific research on the chemical industries, on the effects of one branch of industry on another, and on the advantages of the German patent law. Since Wallach began his investigation of essential oils and terpenes in 1884, the manufacture of perfumes in Germany has grown continuously, the exports increasing from 1767 metric tons in 1890 to 2475 tons in 1900, and 3516 tons in 1909. In 1895, synthetic neroli oil was prepared; in 1896, oils of jasmine and hyacinth blossoms, and in 1908, the essential oil of lily of the valley. In the explosives industry the chief efforts have been directed to the manufacture of safe products. Whilst in 1890, 4938 tons of dynamite were produced and only an insignificant quantity of safety explosives; in 1909, the production of safety explosives amounted to 10,000 tons as compared with 8000 tons of dynamite. The great development of the German dyestuffs industry led to developments in many other branches, especially in the sulphuric acid, chlorine, tar oils, and nitric acid industries. The development of the cyanide process for the extraction of gold also led to the introduction of a new technical process of manufacturing synthetic indigo, based on the use of sodium amide in the alkali fusion of phenylglycin. At the present time the selling value of the synthetic indigo on the world market amounts to 70 million marks (nearly £490,000). The demand of the dyestuffs works for coal-tar products also led to the great development in recovery of by-products in coke manufacture. The recovery of ammonia as ammonium sulphate has grown rapidly in Germany. In 1890, the exports of ammonium sulphate were 1866 tons and the imports 33,873 tons; in 1900, the corresponding figures were 2431 and 23,105 tons; in 1909, the exports, 58,722 tons, were slightly more than the imports, 58,132 tons.—A. S.

Chemical industries of North West Germany; Position of the ——. Z. angew. Chem., 1910, 23, 1888—1889.

Owing to the increased competition from the large number of sulphuric acid works erected in the past few years, the price of sulphuric acid has fallen still further; moreover there has been only a moderate demand from superphosphate works. The nitric acid trade has remained satisfactory. Exports of the two acids to Austria-Hungary have been completely destroyed by increased duties, whilst the admission of the acids duty-free from Austria-Hungary into Germany has also tended to reduce prices in the latter country. In the incandescence mantle industry there will probably be no improvement until the accumulated stocks have been disposed of. Owing to depression in the building trade, there has been a decrease in the production of burnt magnesia, used chiefly for the preparation of jointless floors; the accumulated stocks have led to a considerable fall in prices, but an improvement has begun. The gradual development of electric iron and steel furnaces is leading to an increased demand for Greek magnesite, which as a furnace lining is superior to other kinds. In the superphosphate industry so many new works have been erected that it will be a considerable time before the producing power and the consumption are satisfactorily balanced. In some parts owing to over-production, the price on the home market has fallen below the export price. Notwithstanding the unfavourable conditions, new factories are still being built. The price of raw phosphate has again fallen to the figure prevailing before the recent rise, notwithstanding a limitation of the production. It has proved impossible also to maintain the price of ammonium sulphate. Crude calcium cyanamide is gradually being introduced, although not with the rapidity anticipated. The export of carbonic acid from Germany is becoming more and more difficult, since although the foreign consumption has increased, the demand is being met by the foreign countries themselves to the exclusion of the German product. The artificial horn product, "galalith," is stated to be making much headway, and the development of this new German industry would be still greater, it is believed, if the raw material for its production, casein, could be imported free of duty, as is the case with the raw materials for the competing products, ivory nut, horn, etc.—A. S.

Denmark. Customs decisions.

A CIRCULAR of the Danish Customs Department notifies various decisions as to the tariff classification of articles on importation into Denmark, including the following:—

(Krone = 100 öre = 1s. 1⅓d.)

Articles.	No. of the Tariff under which dutiable.	Rate of Duty.		
			Kr.	*öre.*
Castor meal, the waste product from the pressing out of castor oil	1	Free		
Turkey red oil, the chemical preparation produced by treating castor oil, olive oil, almond oil or other oil with concentrated sulphuric acid, after which the product so obtained is mixed with water and treated with ammonia until neutral	6	Kilog.	0	10
Siccative consisting of resinous soap and lead and manganese oxide, having the form of a very dark brown resin in small pieces	6	„	0	10
Liquid aniline dyes, solutions of the various kinds, red and yellow dyestuffs	38	„	0	01
Acetone, acetylene gas, and gas obtained by treatment of calcium carbide, and compressed into steel cylinders	301	7½% *ad. val.*		

The test for extracts and essences containing spirits or ether included under Tariff No. 32 is that the liquid gives off inflammable vapours (alcohol or ether), and this will be ascertained by heating a small portion (say 10 cubic centimetres) of the product in a reagent glass over a small gas flame, and applying a lighted match to the mouth of the tube.

Steel cylinders imported full of acetylene gas may be admitted free of duty as packing materials.

Books Received.

THE SOLUBILITIES OF THE PHARMACOPŒIAL ORGANIC ACIDS AND THEIR SALTS. BY ATHERTON SEIDELL. Bulletin No. 67. Hygienic Laboratory of the U.S. Public Health Service. June, 1910.

8vo volume of 93 pages, containing the results of a large number of solubility determinations on the following acids and salts:—Acetic acid and acetates (including ethyl acetate), benzoic acid and benzoates; camphoric acid; citric acid and citrates; gallic acid; lactic acid; oleic acid: sodium and zinc phenol-sulphonates; salicylic acid and salicylates; stearic acid; tannic acid; tartaric acid and tartrates; trichloracetic acid; ammonium and zinc valerate. Seven curves and 44 tables are included, giving the principal results obtained, and the figures calculated from these.

PROCEEDINGS OF THE TWENTY-SIXTH ANNUAL CONVENTION OF THE ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS, HELD AT DENVER, COLO., AUG. 26—28, 1909. Edited by H. W. WILEY. U.S. Dept. of Agriculture, Bureau of Chemistry. Bulletin No. 132.

THIS volume, which covers 162 8vo pages, contains a number of reports of referees on the analysis of chemicals, foodstuffs, soils, fertilisers, waters, etc., and a number of original papers, including the following:—"Determination of ammonia by the official magnesium oxide method," by T. C. Trescot. "Interpretation of soil analyses with respect to phosphoric acid," by G. S. Fraps. "Methods for determining the nitrifying and ammonifying powers of soils," by F. L. Stevens and W. A. Withers. "Rapid method for determining total potassium in soils," by O. M. Shedd. "Suggested modification of the Winton lead number," by S. H. Ross. "Varnishes on chocolate and confectionery," by B. H. Smith. "Keeping qualities of sugar sirups, fruit sirups, and crushed fruits," by H. E. Barnard. "Determination of glycerin in wine," by S. H. Ross. "Distinction of vanilla extract and its imitations," by A. L. Winton and C. I. Lott. "Determination of starch in cocoa products," by W. L. Dubois. "Phosphorus in flesh," by P. F. Trowbridge and L. M. Stanley. "Constants for creatinine determinations," by W. B. Smith and I. M. Myers. "Occurrence of methylpentosan in cattle foods," by F. W. Morse. "Dry lead defecation in raw sugar analysis," by W. D. Horne. "Comparison of methods for sucrose in sugar-house control," by H. P. Agee.

CHEMISCH-TECHNISCHE UNTERSUCHUNGSMETHODEN: Herausgegeben von Dr. G. LUNGE, emer. Prof. der techn. Chemie am Eidgenöss. Polytechnikum in Zürich, und Dr. E. BERL, Privatdozent, Chefchemiker der Fabr. de Soie artif. de Tubize, Belgium. Zweiter Band. Sechste, vollständig umgearb. und verm. Auflage. Verlag von J. Springer, Berlin. 1910. Price M. 20; bound, M. 22·5.

8vo volume, containing 842 pages of subject matter, 138 illustrations, alphabetical indexes of authors' names and of subjects, and an appendix consisting of a series of tables. The present volume contains the following chapters, the names of the authors responsible for the several parts being given in brackets. I. Cyanogen compounds (Dr. H. Freudenberg). II. Clay analysis (Ph. Kreiling). III. Examination of clay ware (K. Dümmler). IV. Alumina preparations (Dr. G. Lunge and Dr. E. Berl). V. Glass (Prof. E. Adam). VI. The mortar industry (Dr. K. Schoch). VII. Water (Dr. L. W. Winkler). VIII. Examination of water for boilers and for other technical purposes (Dr. G. Lunge and Dr. E. Berl). IX. Sewage and X. Soils (Dr. E. Haselhoff). XI. Air (Dr. K. B. Lehmann). XII. Iron (Dr. P. Aulich). XIII. Non-ferrous metals (Dr. O. Pufahl). XIV. Calcium carbide and acetylene (Dr. G. Lunge and Dr. E. Berl).

HANDBUCH DER CHEMIE UND TECHNOLOGIE DER OELE UND FETTE. Chemie, Analyse, Gewinnung und Verarbeitung der Oele, Fette, Wachse, und Harze. In vier Bänden. Herausgegeben von Dr. L. UBBELOHDE und Dr. F. GOLDSCHMIDT. III. Band, I. Abteilung. Verlag von S. Hirzel, Leipzig, 1910. Price M. 12.

8vo volume, containing 380 pages of subject matter with 130 illustrations. The text is classified as follows, the names of the authors responsible for the several sections being given in brackets. Part I. The hydrolysis of fats and production of pure glycerin: I. General (Dr. E. Benz); II. Hydrolysis of fats in autoclaves, and III. The Twitchell process (Dr. E. Benz and Dr. F. Goldschmidt). IV. Enzymatic hydrolysis of fats (Dr. W. Landsberger). V. The Krebitz glycerin recovery and saponification process (P. Krebitz). VI. Working up the soap lyes for crude glycerin, and VII. Comparison of the different processes (Dr. E. Benz). Part II. Technology and analysis of glycerin (Dr. W. Landsberger). Part III. The stearine industry. I. Historical (Dr. C. Deite). II. Modern stearine manufacture, and III. Candle manufacture (Dr. O. Rosauer). IV. Manufacture of drawn wax candles (Dr. B. Lach). V. Analytical control of the hydrolysis of fats and manufacture of stearine (Dr. F. Goldschmidt and Dr. O. Rosauer). VI. Technical examination of stearine, candles, oleine, and stearine-pitch (Dr. L. Ubbelohde). Part IV. Turkey-red oils. I. Action of concentrated sulphuric acid on fatty oils (Dr. A. Grün). II. Manufacture of Turkey-red oils and their substitutes, and III. Examination and valuation of Turkey-red oils and similar products (Dr. F. Erban).

HANDBUCH DER LACK- UND FIRNIS-INDUSTRIE. Lehrbuch der Fabrikation von Lacken und Firnissen sowie Beschreibung der dazu verwendeten Rohmaterialien. Von Dr.-Ing. F. SEELIGMANN und E. ZIEKE, unter Mitwirkung von Dr. E. Sachsel und Dr. F. Zimmer. Union Deutsche Verlagsges. Zweigniederlassung, Berlin. 1910. Price M. 28; bound, M. 30.

LARGE 8vo volume, containing 917 pages of subject matter, 252 illustrations, a bibliography and alphabetical indexes of authors' names and of subjects. The text is classified as follows:—Part I. Raw materials for lacquer and varnish manufacture. I. Solid constituents of lacquers and varnishes. II. Liquid non-volatile constituents: oils. III. Liquid volatile constituents: solvents and diluents. IV. Other additions: siccatives and scents. Part II. Technical working-up of the raw materials. I. Preparation of the raw materials. II. The chief process of manufacture. III. Improvement of the products and recovery of lost material. Part III. Technique of lacquer and varnish manufacture. I. Oil-lacquers. II. Varnishes. III. Spirit lacquers, Japan lacquer, and chemical colouring of metals. Part IV. Asphaltum and its use in lacquer manufacture.

DER KAUTSCHUK UND SEINE PRÜFUNG. Von Dr. F. W. HINRICHSEN und Dipl. Ing. K. MEMMLER, Ständige Mitarbeiter am Königl. Materialprüfungsamte zu Gross-Lichterfelde. Verlag von S. Hirzel, Leipzig. 1910. Price M. 8; bound, M. 9.

8vo volume, containing 255 pages of subject matter with 65 illustrations, and alphabetical indexes of authors' names and of subjects. The work is divided into three parts, the first two by Hinrichsen, and the third by Memmler. Part I. General: (A) Introductory. (B) Occurrence of rubber. (C) Properties of the latex. (D) Constitution of the caoutchouc hydrocarbon. (E) Substances accompanying the caoutchouc hydrocarbon in raw rubber. (F) Physical properties of raw rubber. (G) Chemical properties of rubber. (H) Theory of vulcanisation of rubber. (J) Technical manufacture of rubber goods. (K) Properties of vulcanised rubber. Part II. Chemical analysis of rubber. (A) Analysis of raw rubber. (B) Analysis of vulcanised rubber. (C) Examination of rubber goods as to their behaviour in use. Part III. Mechanical testing of rubber. (A) Determining the strength of samples of soft rubber. (B) Results obtained in the mechanical testing of soft rubber.

DRYING MACHINERY AND PRACTICE. A Handbook on the theory and practice of drying and desiccating, with classified description of installations, machinery, and apparatus. By THOMAS G. MARLOW. Crosby, Lockwood and Son, London. 1910. Price 12s. 6d. net.

4TO volume, containing 278 pages of subject matter with 174 illustrations, including 17 plates, and also a bibliography, a glossary of technical terms, and an alphabetical index. There are eleven chapters with the following headings:—I. Introductory. II. Drying by gravitation. absorption, and condensation. III. Mechanical drying, including centrifugal dryers. IV. Drying by evaporation. V. Methods of applying the heat. VI. Methods of removing the vapour. VII. Handling the material. VIII. to XI. Evaporative drying installations, including drying floors, gantries and racks, sheds, pans and troughs, kilns, stoves, cylinders, and tunnels, drying-rooms, drying ovens, desiccators, and autoclaves.

KONDENSATION. Ein Lehr- und Handbuch über Kondensation und alle damit zusammenhängenden Fragen, auch einschliesslich der Wasserrückkühlung. Von F. J. WEISS. Zweite ergänzte Auflage. Bearb. von E. WIKI. Verlag von J. Springer, Berlin. 1910. Price M. 12.

8vo volume, containing 429 pages of subject matter, 141 illustrations, and 10 plates. The text is classified as follows: Part I. (A) Mixed condensation. (B) Surface condensation. (C) Time required for the first exhaustion of the condensation chamber. (D) Power requirements. (E) Efficiency of the condensation. (F) Estimates for a large central condensing installation. (G) Size of pipes for the exhaust steam. (H) Control of the condensing apparatus. (J) Disc valve of Weiss. (K) Condensation with varying steam consumption. (L) Reflux cooling with water. (M) Steam tables. Part II. Weiss' cooling water accumulator. (A) Description of the accumulator. (B) Investigation of the accumulator and mathematical study of its action. (C) Appendix to the preceding chapters on accumulators for cooling water. Part III. Some installations, especially of Weiss' condensing apparatus, for different branches of industry.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

APPLICATIONS.

22,265. Paul, Lynch, and Meyer. Furnaces.* Sept. 26.

22,433. Theisen. Apparatus for purifying, cooling and mixing gases.* Sept. 27.

22,474. Morton. Machines for heating, mixing, or incorporating substances. Sept. 28.

22,675. Schuh. Apparatus for compressing vapours or gases. [Ger. Appl., Oct. 11, 1909.]* Sept. 30.

22,863. Still. *See under* III.

22,958. Schrey. Separating liquids or solids in solution in liquids. Oct. 4.

23,045. Phillips and Bulteel. Effecting catalytic reactions between gases or vapours. Oct. 5.

23,152. Normandy. Regulating the flow of liquid in evaporating or distilling apparatus. Oct. 6.

23,348. Hart. Apparatus for compressing gases. Oct. 8.

23,446. Richter und Richter, and Orth. Separating colloidal substances from pseudo-solutions. [Ger. Appl., Dec. 31, 1909.]* Oct. 10.

23,492. Bursall. Apparatus for washing and scrubbing gases. Oct. 10.

23,749. Jäger. Evaporating or concentrating under vacuum. Oct. 13.

23,856. Acetylene Illuminating Co. (Acetylène Dissous). Filling up with porous material receptacles for containing explosive gases, particularly dissolved acetylene containers.* Oct. 14.

23,910. Carmichael and Mansbridge. Evaporators. Oct. 15.

Complete Specifications Accepted.

25,084 (1909). Cooper. Non-heat-conducting compositions for covering steam generators, steam pipes, etc. Oct. 19.

27,048 and 27,050 (1909). Robertson. Centrifugal machines. Oct. 5.

27,413 (1909). Cleland. Centrifugal machines. Oct. 5.

28,302 (1909). Vialleix and Perrin. *See under* VII.

28,380 (1909). Siebert and Kühn. Apparatus for containing substances to be observed and capable of withstanding high temperatures. Oct. 5.

1224 (1910). Aumann. Circulation of liquid by gases. Oct. 12.

2439 (1910). Lee. Furnaces. Oct. 19.

2875 (1910). Michel. Settling and filtering apparatus. Oct. 5.

5161 (1910). Gebr. Siemens und Co. Protecting wall for apparatus subjected to a high temperature. Oct. 5.

8009 (1910). Johnson (Philadelphia Textile Machinery Co.). Drying machines. Oct. 19.

8443 (1910). Berger. Drying apparatus. Oct. 12.

8545 (1910). Malfitano. Apparatus for filtering liquids. Oct. 19.

8963 (1910). Lush. Centrifugal pumps. Oct. 12.

10,216 (1910). Haddan (Alpine Maschinenfabr. Ges.). Pneumatic separators for granular substances. Oct. 5.

10,903 (1910). Diver. Screening or filtering apparatus for drying wet materials. Oct. 5.

11,461 (1910). Schneider. Apparatus for liquefying gases for demonstration purposes. Oct. 19.

16,161 (1910). Robacher. *See under* X.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

22,231. Banner. Paraffin, petroleum, and other oils. Sept. 26.

22,313. Pyzel. Sweating crude paraffin or like mixtures.* Sept. 26.

22,335. Burkheiser. Separating sulphuretted hydrogen from gases. [Ger. Appl., Sept. 27, 1909.]* Sept. 27.

22,365. Siemens und Halske A.-G. Manufacture of incandescent electric lamp filaments. [Ger. Appl., Nov. 29, 1909.]* Sept. 27.

22,387. Booth. Manufacture of blocks or briquettes of peat. Sept. 27.

22,500. Wachs- u. Oel-Werke v. Boyen und Höpfner, and Von Boyen. Refining crude mineral wax.* Sept. 28.

22,546. Hopkins and Stansfield. Machines for manufacture and treatment of gases for heating, lighting, etc. Sept. 29.

22,730. Crossley and Rigby. Filtering and pressing wet carbonised peat. Oct. 1.

22,834 and 22,835. Zimmer and Forwood. Manufacture of fuel briquettes. Oct. 3.

22,907. Fabry. By-product coke ovens. Oct. 4.

22,908. Beilby. Apparatus for distilling coal or other carbonaceous materials. Oct. 4.

23,040. Van Marken. Production of gas and apparatus therefor. Oct. 5.

23,080. Verity and Lewis (Higgins). Increasing the calorific value of fuel. Oct. 5.

23,125. Tanne and Oberländer. Separating solid hydrocarbons from naphtha residues and tars. [Addition to No. 27,116 of 1909. Ger. Appl., Oct. 7, 1909.]* Oct. 6.

23,368. Van Tienen. *See under* III.

23,376. Moore. Treatment of carbonaceous materials and their by-products. Oct. 10.

23,418. Gehartz. *See under* VII.

23,459. Still. Coke ovens.* Oct. 10.

23,549. Hutchins. Gas producers. Oct. 11.

23,550. Aarts. Retorts or ovens for carbonising coal, etc. Oct. 11.

23,559. Främbs, and Bender und Främbs, G. m. b. H. Gas producers.* Oct. 11.

23,639. Schilling. Manufacture of metallic filaments for electric lamps. [Ger. Appl., Dec. 29, 1909.]* Oct. 12.

23,640. Schilling. Cementing process for the filaments of electric lamps. [Ger. Appl., April 6, 1910.]* Oct. 12.

23,855. Acetylene Illuminating Co. (Acetylène Dissous.) *See under* XXII.

23,856. Acetylene Illuminating Co. (Acetylène Dissous). *See under* I.

Complete Specifications Accepted.

19,395 (1909). Zohrab and Dunham-Massey. Treatment of peat. Oct. 5.

20,309 (1909). Glover and West. Distillation of coal in vertical retorts. Oct. 12.

22,514 (1909). Wyld and Green. Revivifying sulphuretted oxide from gas works. Oct. 12.

23,348 (1909). Wohle. Petroleum and other hydrocarbon oils. Oct. 19.

23,671 (1909). Muller. Manufacture of coke and gas. Oct. 19.

24,437 (1909). Ruhstrat. Manufacture of materials for metallic filaments of electric incandescent lamps. Oct 12.

2983 (1910). Westinghouse Metallfaden Glühlampenfabrik. Decarbonising metallic filaments for incandescent electric lamps. Oct. 12.

3610 (1910). Westinghouse Metallfaden Glühlampenfabrik. Manufacture of tungsten filaments for incandescent electric lamps. Oct. 12.

5262 (1910). Soc. Franç. de Chaleur et Lumière. Manufacture of incandescence mantles. Oct. 19.

6622 (1910). Diehl and Faber. Manufacture of coke. Oct. 12.

7766 (1910). Fabry. Purifying coal gas after extracting ammonia. Oct. 12.

11,364 (1910). Falding and Cathcart. *See under* X.

III.—TAR AND TAR PRODUCTS.

Applications.

22,862. Still. Apparatus for distilling hydrocarbons dissolved in tar oils.* Oct. 3.

22,863. Still. Coolers for condensing mixtures of hydrocarbon and steam.* Oct. 3.

23,125. Tanne and Oberländer. *See under* II.

23,368. Van Tienen. Treatment of acid tar.* Oct. 8.

23,467. Richter und Richter. Process of purifying hydrocarbons. [Ger. Appl., May 12, 1910.]* Oct. 10.

IV.—COLOURING MATTERS AND DYES.

Applications.

22,288. Meister, Lucius, und Brüning. Manufacture of isolated alkali salts of indoxyl. [Ger. Appl., Sept. 27, 1909.]* Sept. 26.

22,289. Meister, Lucius, und Brüning. Manufacture of a bluish-red azo dyestuff for preparing lakes. [Ger. Appl., Oct. 21, 1909.]* Sept. 26.

22,306. Ransford (Casella und Co.). Manufacture of vat dyestuffs. Sept. 26.

22,417. Ransford (Casella und Co.). Manufacture of dyestuffs. Sept. 27.

22,556. Levinstein, Wyler, and Levinstein, Ltd. New monoazo dyestuffs and their production. Sept. 29.

22,780. Act.-Ges. f. Anilinfabr. Manufacture of brominated anthraquinone derivatives applicable as vat dyestuffs. [Ger. Appl., Dec. 30, 1909.]* Oct. 1.

23,052. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Oct. 5.

23,893. Frank. Colouring matters. Oct. 15.

Complete Specifications Accepted.

22,555 (1909). Newton (Bayer und Co.). Manufacture of dyes. Oct. 12.

27,773 (1909). Newton (Bayer und Co.). Manufacture of vat dyestuffs. Oct. 12.

28,042 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of chlorine derivatives of indigo. Oct. 12.

29,459 (1909). Newton (Bayer und Co.). Manufacture of an azo dyestuff. Oct. 12.

30,297 (1909). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Oct. 5.

3601 (1910). Newton (Bayer und Co.). Manufacture of a leuco-derivative of the gallocyanine series. Oct. 19.

4537 (1910). Newton (Bayer und Co.). Manufacture of anthracene dyestuffs. Oct. 19.

7631 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. Oct. 12.

9744 (1910). Kalle und Co. Manufacture of azo colouring matters. Oct. 19.

15,523 (1910). Meister, Lucius, und Bruning. Manufacture of a salmon-coloured vat dyestuff of the anthraquinone series. Oct. 19.

22,289 (1910). Meister, Lucius, und Brüning. Manufacture of a bluish-red azo dyestuff suitable for preparing lakes fast to light. Oct. 19.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

22,309. Walker. Process for making new solvents for pyroxlin and the like.* Sept. 26.

22,869. McIlhenny (Penfaillit). Treating textile plants and vegetable matters to obtain vegetable fibres and paper pulp, also degreasing wool and other animal fibres. Oct. 3.

23,573. Cohoe. *See under* XVII.

23,709. Silberrad. Isolation of fibre from flax, straw, etc. Oct. 13.

23,944. Thompson. Decolouring and degumming decorticated flax and other vegetable fibres. Oct. 15.

Complete Specifications Accepted.

23,403 (1909) and 11,895 (1910). Carré. Teratment of straw, dried grasses, etc. Oct. 19.

27,597 (1909). McNaught. Wool washing and squeezing machines. Oct. 12.

4086 (1910). Metzeler und Co., and others. Manufacture of waterproof, lustrous fabric for balloons, etc. Oct. 12.

16,932 (1910). Bayer und Co. Production of solutions of cellulose esters. Oct. 19.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

22,549. Taylor. Process of calico printing. Sept. 29.

22,667. Watts. Fireproofing solutions for fabrics. Sept. 30.

22,876. Ransford (Cassella und Co.). Method of dry dyeing. Oct. 3.

22,993. Oliver. Waterproofing compositions. Oct. 3.

23,113. Bothwell-Jackson and Edge. Steam-heated kiers for bleaching and dyeing. Oct. 6.

Complete Specifications Accepted.

23,637 (1909). Bradford Dyers' Assoc., and others. Apparatus for printing textile fabrics. Oct. 19.

26,317 (1909). British Cotton and Wool Dyers' Assoc., and Robson. Machine for mercerising, dyeing, bleaching, etc., vegetable fibre. Sept. 12.

27,028 (1909). Newton (Bayer und Co.). Dyeing and printing. Oct. 5.

28,828 (1909). Mitchell. Manufacture of printed felts. Oct. 12.

900 (1910). Dean. Apparatus for treating cloth or yarn with liquors, hot air, etc. Oct. 5.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

23,319. Salpetersäure-Ind.-Ges., and Pauling. Production of nitric oxide from mixtures of nitrogen and oxygen.* Sept. 26.

22,320. Pauling. Treatment of aqueous nitric acid with sulphuric acid and other hygroscopic substances.* Sept. 26.

22,322. Pauling. Concentrating aqueous solutions of nitric acid.* Sept. 26.

22,506. Stock. Manufacture of pure tetraphosphortrisulphide. [Ger. Appl., Dec. 7, 1909.]* Sept. 28.

22,586. Bueb, and Deuts. Continental Gas.-Ges. Manufacture of ammonium carbonate. [Addition to No. 9177 of 1910.]* Sept. 29.

22,615. Hof and Rinck. *See under* XIII.

22,745. Heys (Nitrogen Co.). Production of nitrogen compounds.* Oct. 1.

23,046. Phillips and Bulteel. Causing nitrogen to react to form ammonia. Oct. 5.

23,157. Pietzsch and Adolph. Manufacture of potassium permanganate. [Ger. Appl., Oct. 9, 1909.]* Oct. 6.

23,158. Pietzsch and Adolph. Manufacture of hydrogen peroxide. [Ger. Appl., Oct. 9, 1909.]* Oct. 6.

23,252. Pietzsch and Adolph. Manufacture of persulphuric acid and its salts. [Ger. Appl., Oct. 11, 1909.]* Oct. 7.

23.333. Mathon. Lime kilns.* Oct. 8.

23,418. Gerhartz. Gaining hydrogen by decomposing steam by a metal.* Oct. 10.

23,548. Consortium f. Elektrochem. Industrie. Manufacture of persulphuric acid and its salts. [Ger. Appl., Nov. 4, 1909.]* Oct. 11.

23,551. Pietzsch and Adolph. Manufacture of potassium persulphate and sodium persulphate. [Addition to No. 23,157 of 1910. Ger. Appl., Feb. 16, 1910.]* Oct. 11.

23,660. Pietzsch and Adolph. Manufacture of hydrogen peroxide. [Addition to No. 23,158 of 1910. Ger. Appl., Jan. 8, 1910.]* Oct. 12.

23,745. Crowther and Gidden. Manufacture of salt suitable for use as table salt. Oct. 13.

23,923. Act.-Ges. f. Anilinfabr. Manufacture of sulphuryl chloride. [Ger. Appl., Oct. 18, 1909.]* Oct. 15.

Complete Specifications Accepted.

17,642 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia. Oct. 5.

22,672 (1909). Messel. Manufacture of sulphur dioxide, sulphuric anhydride, and sulphuric acid. Oct. 5.

23,107 (1909). Jäneeke. Continuous production of liquid air and its separation into its constituents. Oct. 19.

23,215 (1909). Kuzel and Wedekind. *See under* X.

23,442 (1909). Chem. Fabr. Griesheim Elektron. Manufacture of sulphuric acid. Oct. 19.

26,263 (1909). Freeth and Cocksedge. Manufacture of ammonium chloride. Oct. 5.

27,826 (1909). Häusser. Manufacture of nitrogen oxides. Oct. 12.

28,302 (1909). Vialleix and Perrin. Condensing acid vapours. Oct. 19.

1616 (1910). Foelsing. Production of a zinc salt of boro-disalicylic acid. Oct. 19.

7305 (1910). L'Air Liquide. Separating oxygen and nitrogen from air. Oct. 12.

8094 (1910). Dittmar. Manufacture of phosphoric acid. Oct. 12.

VIII.—GLASS: CERAMICS.

Application.

23,051. McMullin. Manufacture of window glass. [U.S. Appl., Nov. 8, 1909.]* Oct. 5.

Complete Specifications Accepted.

29,694 (1909). Westacott. Kilns for treating China clay. Oct. 5.

17,242 (1910). Benedictus. Manufacture of strengthened glass. Oct. 19.

IX.—BUILDING MATERIALS.

Applications.

22,308. Hohrath. Production of artificial granite from blast-furnace slag. [Ger. Appl., Oct. 28, 1909.]* Sept. 26.

22,399. Turnbull and others. Material for use in road making and building. Sept. 27.

22,434. Füredi. Production of artificial marble.* Sept. 27.

Complete Specification Accepted.

6384 (1910). Sundell. Composition for making artificial stone, and method of hardening the same. Oct. 5.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

22,246. Maccormack and Miller. Annealing or softening copper, brass, or bronze wire. Sept. 26.

22,569. Mackie and Forwood. Manufacture of steel. Sept. 29.

22,581. Gräf and Peschel. Case-hardening metals and alloys.* Sept. 29.

22,684. Pucillo. Treatment of aluminium. Sept. 30.

22,699. Claydor Synd., Ltd., and Andrew. Extraction of precious metals from ores by the cyanide process. Sept. 30.

22,777. Massip. Electric furnaces and the manufacture of steel. Ger. Appl., Oct. 2, 1909.]* Oct. 1.

22,792. Smith. Bessemerising copper matte. [U.S. Appl., Oct. 1, 1919.]* Oct. 1.

22,832. Hamilton. Nickel-silver plating powder. Oct. 3.

22,973. Greenway and Lavers. Concentration of ores. [Australian Appl., Dec. 1, 1909.]* Oct. 4.

23,171. Thompson. Utilisation of slag. Oct. 6.

23,177. MacIvor, and Metals Extraction Corporation. *See under* XIII.

23,250. Dick. Treatment of oxide ores or oxidised ores of copper. Oct. 7.

23,260. Mitchell. Treatment of ores.* Oct. 7.

23,331. Harris. Mechanical ore-roasting furnaces.* Oct. 8.

23,359. Rumpler. Forming galvanic metallic coatings on aluminium. [Ger. Appl., Oct. 9, 1909.]* Oct. 12.

23,430. Lockyer (Edwards). Tilting, calcining, or roasting furnaces.* Oct. 10.

23,565. Edwards. Ore-roasting furnaces.* Oct. 11.

23,664. Hill. Smelting furnaces. Oct. 12.

23,675. Küttner. Forming insulating layers of oxides or salts on metal wires, bands, etc. [Ger. Appl., Oct. 14, 1909.]* Oct. 12.

23,744. Cowper-Coles, and Metalloids, Ltd. Scaling and annealing metals. Oct. 13.

23,817. Herdman. Manufacture of slag wool. Oct. 14.

23,870. Minerals Separation, Ltd. (Lavers). Ore concentration. Oct. 14.

23,949. Nutter, Hoover, and Minerals Separation, Ltd. Ore concentration. Oct. 15.

Complete Specifications Accepted.

15,469 (1909). Wolf. Separating metalliferous material from ores. Oct. 12.

16,300 (1909). Bullock and Calcott. Treating iron or steel to prevent rusting. Oct. 19.

22,374 (1909). Cowper-Coles. Electro-deposition of metals. Oct. 5.

22,743 (1909). Coslett Anti-Rust Synd., and Coslett. Treatment of iron or steel to prevent oxidation or rusting. Oct. 19.

23,215 (1909). Kuzel and Wedekind. Production of zirconium and other rare metals. Oct. 5.

23,429 (1909). Johnson (Chem. Fabr. Griesheim-Elektron). Purifying magnesium and magnesium alloys. Oct. 12.

23,440 (1909). Johnson (Chem. Fabr. Griesheim-Elektron). Purification of magnesium and magnesium alloys. Oct 19.

23,441 (1909). Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of dense castings of magnesium or magnesium alloys. Oct. 19.

26,410 (1909). Witter. Separation of zinc and lead from mixed sulphides or ores. Oct. 19.

6977 (1910). Arbuckle. Apparatus for treating crushed ore products to recover the metal contents. Oct. 5.

11,364 (1910). Falding and Cathcart. Recovery of products from iron pickling liquor and gas liquor. Oct. 5.

16,161 (1910). Robacher. Filtering apparatus particularly for use in the cyanide process of extracting precious metals. Oct. 5.

XI.—ELECTRO-CHEMISTRY.

APPLICATIONS.

23,446. Rasmussen. Composition for electric insulating and other purposes.* Oct. 10.

23,671. Peterson. Manufacture of insulating material. [U.S. Appl., Oct. 20, 1909.]* Oct. 12.

XII.—FATS; OILS; WAXES.

APPLICATIONS.

22,369. Bamberg. Hydrolysis. Sept. 27.

22,605. Morgenstein. *See under* XVIII.

23,117. Janousek. Process for scenting soaps.* Oct. 6.

COMPLETE SPECIFICATION ACCEPTED.

418 (1909). Weiss. Cod liver oil preparations. Oct. 19.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

APPLICATIONS.

22,615. Hof and Rinck. Extraction of lead oxide or sulphate from impure lithage, lead ash, etc., and converting the pure lead-magnesium chloride into white lead or chrome yellow.* Sept. 29.

23,177. MacIvor, and Metals Extraction Corporation. Treatment of complex sulphide ores particularly to produce pigments. Oct. 6.

23,752. Fabr. de Vernis et Produits Chimiques. Manufacture of paint. [Fr. Appl., Oct. 14, 1909.]* Oct. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

22,218 (1909). Freymuth. Treatment of lac. Oct. 5.

23,010 (1909). Newton (Bayer und Co.). Preserving preparations. Oct. 12.

7926 (1910). Holtkott. Manufacture of lincrusta. Oct. 5.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

APPLICATIONS.

23,680 and 23,681. Perkin and others. Synthetic manufacture of isoprene and its homologues, and of caoutchouc and its homologues. Oct. 12.

23,727. Beaver and Claremont. Ageing rubber sheet. Oct. 13.

COMPLETE SPECIFICATION ACCEPTED.

9609 (1910). Plinatus. Production of elastic or resilient masses. Oct. 19.

XV.—LEATHER; BONE; HORN; GLUE.

APPLICATION.

23,878. Sorton. Hat leather or skin dyeing machine. Oct. 15.

COMPLETE SPECIFICATIONS ACCEPTED.

13,133 (1910). Kron. Tanning or production of leather. Oct. 12.

14,861 (1910). Justice (Nitritfabrik). Preparation of tannic extracts and tannic acid. Oct. 12.

XVI.—SOILS; FERTILISERS.

APPLICATION.

22,851. Coates. Fertilisers.* Oct. 3.

XVII.—SUGARS; STARCHES; GUMS.

APPLICATION.

23,573. Cohoe. Method of making a glucose-like product from cellulosic and ligneous materials.* Oct. 11.

COMPLETE SPECIFICATION ACCEPTED.

22,455 (1909). Fielding. Production of dextrine, British gums, etc. Oct. 5.

XVIII.—FERMENTATION INDUSTRIES.

APPLICATIONS.

22,605. Morgenstein. Production of alcohol or alcoholic matters from wool fat.* Sept. 29.

23,662. Braasch. Improving inferior pressed yeast. [Ger. Appl., Oct. 16, 1909.]* Oct. 12.

23,857. Stevenson. Treatment of barm or yeast produced in brewing beer and making vinegar. Oct. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

22,092 (1909). Le Petit. Manufacture of fermented liquids. Oct. 5.

22,093 (1909). Le Petit. Manufacture of temperance beer. Oct. 5.

27,713 (1909). Fabbri. Obtaining ethyl alcohol from maize, grain, vinaceous materials, molasses, coal, etc. Oct. 19.

27,831 (1909). Kuhn. Manufacture of beverages from grapes and raisins. Oct. 12.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

APPLICATIONS.

22,251. Waddington. Treatment of sewage. Sept. 26.

22,522. Neff and Brandes. Treatment of water. Sept. 28.

22,797. Rony. Manufacture and preservation of cheese. [Fr. Appl., Dec. 4, 1909.]* Oct. 1.

23,077 and 23,078. Henri, Helbronner, and Von Recklinghausen. Apparatus for sterilising liquids by ultra-violet rays. Oct. 5.

23,148. Anderson and Meikle. Obtaining extracts from vegetable substances.* Oct. 6.

23,293. Gillbanks. Foodstuff.* Oct. 8.

23,557. Banks. Treatment of cereals. Oct. 11.

23,564. Hülsmeyer. Purification of liquids.* Oct. 11.

23,676. Birney. Treatment of milk.* Oct. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

22,787 (1909). Bruun. Substitute for eggs in preparing foodstuffs. Oct. 19.

23,039 (1909). Boult (Electric Meat Curing Co.). Processes of preserving. Oct. 12.

23,127 (1909). Bond. Utilisation of whey for dietetic purposes. Oct. 19.

23,230 (1909). Gebr. Heyl und Co. Disinfectant and method of producing the same. Oct. 19.

24,278 (1909). Jones. Treatment of flour and meal. Oct. 12.

28,552 (1909). Hartman. Purification of liquids by electricity. Oct. 12.

6085 and 7549 (1910). Leask. Refuse destructors. Oct. 5.

10,089 (1910). Mackeson. Manufacture of aerated waters. Oct. 5.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

22,779. Act.-Ges. f. Anilinfabr. Manufacture of the allyl ester of salicylic acid. [Ger. Appl., Nov. 3, 1909.]* Oct. 1.

23,148. Anderson and Meikle. *See under* XIX.

23,680 and 23,681. Perkin and others. *See under* XIV.

23,924. Act.-Ges. f. Anilinfabr. Manufacture of acetic anhydride. [Ger. Appl., Oct. 19, 1909.]* Oct. 15.

Complete Specifications Accepted.

28,182 (1909). Neumann. Treatment of haemoglobin. Oct. 5.

531 (1910). Newton (Bayer und Co.). Manufacture of formyl derivatives of alcohol bases. Oct. 19.

2888 (1910). Newton (Bayer und Co.). Manufacture of a pharmaceutical product. Oct. 12.

4540 (1910). Newton (Bayer und Co.). Manufacture of diphenylenedioxide. Oct. 19.

8099 (1910). Newton (Bayer und Co.). Manufacture of tetramethylenediamine. Oct. 12.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

22,426. Fulton. Photographic sensitive surfaces. Sept. 27.

23,138. Späth. Manufacture of colour screens on celluloid films or coatings. [Ger. Appl., Oct. 29, 1909.]* Oct. 6.

Complete Specification Accepted.

16,273 (1910). Ruth. Manufacture of colour screens for colour photography. Oct. 5.

XXII.—EXPLOSIVES; MATCHES.

Applications.

22,309. Walker. *See under* V.

22,525. Boult (Stillwell). Machines for packing nitroglycerin compounds or similar explosives into shells.* Sept. 28.

23,145. Claessen. Manufacture of smokeless gunpowder.* Oct. 6.

23,855. Acetylene Illuminating Co., Ltd. (Acetylène Dissous). Porous material intended to prevent propagation of explosive waves, especially in dissolved acetylene and like containers.* Oct. 14.

23,871. Wharton, Shacklady, and Curtis's and Harvey, Ltd. Apparatus for purifying nitroglycerine. Oct. 14.

23,946. Bouchayer. Explosives.* Oct. 15.

Complete Specifications Accepted.

5335 (1909). Dart. Match compositions. Oct. 12.

14,396 (1910). Niditch. Compounds for railway-signal fusees. Oct. 19.

XXIII.—ANALYTICAL PROCESSES.

Application.

22,961. Baldus. Viscosity meters. [Ger. Appl., Oct. 5, 1909.]* Oct. 4.

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Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :
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German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Radiation pyrometers. The Cambridge Scientific Instrument Co., Ltd., Cambridge, and R. S. Whipple, Whittlesford. Eng. Pat. 21,369, Sept. 18, 1909.

The radiation pyrometer claimed consists of a closed tube in one end of which a sensitive element is arranged with a mirror, lens or diaphragm so that the radiation from the other end, which is exposed to the temperature to be measured, may be recorded. Focussing is thus avoided and, since true "black body" conditions are established, the readings are independent of the nature of the surface of the hot end of the tube.—J. W. H.

Centrifugal apparatus. W. J. Gee, and The Hydraulic Separating and Grading Co., Ltd., London. Eng. Pat. 21,421, Sept. 20, 1909.

The rotating basket or cylinder of a centrifugal machine is provided with an internal frame or cage supporting loose peripheral plates upon which the separated solids are deposited. After an operation the internal cage is withdrawn, and then returned to its old position as soon as the loose plates carrying the separated solids have been replaced by fresh ones. The invention is said to be particularly applicable to the machine described in Eng. Pat. 4155 of 1907 (this J., 1908, 227).—J. W. H.

Utilisation of heat from liquors discharged from stills and other apparatus. P. M. Pritchard, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 21,582, Sept. 21, 1909.

The heat from hot liquors may be most conveniently utilised by driving turbines with steam developed from the liquor. The liquors are discharged into a vessel in which a pressure is maintained less than the vapour pressure corresponding to the temperature of the liquor, the steam space being connected to the turbine. The load on the turbine may vary considerably, but it is necessary to maintain a constant pressure on the hot liquor discharge of the still. A baffle-plate is carried from the bottom of the reduced pressure vessel to near the surface of the liquid. Should the consumption of steam be reduced, the correct pressure may be maintained by providing an opening in the baffle-plate, controlled from outside, so as to short-circuit some of the hot liquor, or an automatic relief valve may be provided in the steam space to discharge some of the steam to the condenser should the pressure become too great.—J. W. H.

Drying plants; Hot air ——. B. Musgrave, Bolton. Eng. Pat. 23,751, Oct. 16, 1909.

The drying machine consists of a series of longitudinal chambers through which air is caused to circulate by a fan, while the goods are passed in the opposite direction. The hot air inlet and moist air outlet are at one end of the machine and the charging and discharging passages for the goods are at the opposite end. The moist air at the point of withdrawal is passed through a tubular cooler to deprive it of water, and after being forced through a tubular heater is returned to the drying chambers. The tubular heater and a fuel economiser are arranged in the boiler flues so as to admit of one, both, or neither being in operation. Chain devices for carrying hanks of material through the machine are also claimed.—J. W. H.

Heating and purifying boiler feed water, also applicable for cooling liquids; Apparatus for ——. J. Muchka, Vienna. Eng. Pat. 29,098, Dec. 13, 1909.

The apparatus consists of a scrubber down which the water flows against an upward current of steam. The bottoms of the trays in the upper part of the scrubber are alternately inclined inward and outward, the water overflowing at the deeper side whereby any precipitate may settle out. The area for the flow of steam is reduced where overflow of the water takes place, to bring about intimate contact between the water and steam.—J. W. H.

Low temperatures; Apparatus for producing —— *by expansion, with the performance of external work, of compressed gases.* F. Leptien, Neumünster, Germany. Eng. Pat. 2497, Feb. 1, 1910. Under Int. Conv., Feb. 1, 1909.

The cylinder in which the expansion of the compressed gas is allowed to take place is heat-insulated at the part which does not come into contact with the piston packing, by means of a vacuum chamber divided into compartments. The piston is provided with strong spring packing rings, which, pressing heavily on the cylinder walls, prevent leakage and generate sufficient heat to keep the lubricant in a fluid condition.—J. W. H.

Refrigerating liquids. W. E. Evans, London. From L. Bichler, Innsbruck, Austria. Eng. Pat. 9954, April 23, 1910.

An hermetically sealed apparatus consisting of two communicating vessels in which a high vacuum has been produced is used. Water containing a hygroscopic substance in solution (such as zinc chloride or caustic potash) is charged into one vessel and a small quantity is also placed in the second vessel. The first vessel is heated and the second vessel cooled, so that water distils over and is condensed in the second vessel. The first vessel is now cooled and the second vessel surrounded by the liquid to be frozen. The water in the second vessel re-evaporates and is re-absorbed rapidly by the salt in the first vessel, producing a low temperature in the second vessel. The small quantity of the salt in the second vessel prevents its contents freezing.—J. W. H.

Evaporator. J. E. Dunn, Assignor to American Evaporator Co., Philadelphia, Pa. U.S. Pat. 971,258, Sept. 27, 1910.

Each element of the evaporator consists of a group of vertical evaporator tubes which pass through a heating chamber. The lower ends of the tubes project into a pressure chamber and the upper ends extend into a separating chamber, provided with vanes, in which the liquid and vapour are separated, the vapour being conducted to the space surrounding the tubes and the liquid to the pressure chamber.—W. H. C.

Concentrating liquids; Apparatus for ——. P. Kestner, Lille, France, Assignor to Kestner Evaporator Co., Philadelphia, Pa. U.S. Pat. 971,383, Sept. 27, 1910.

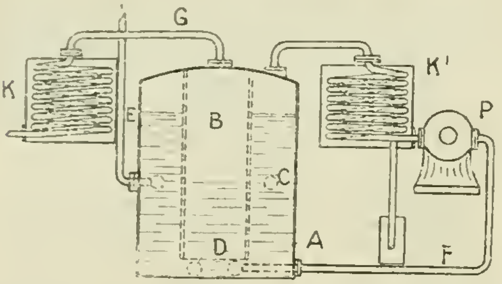
The lower ends of the vertical tubes of the evaporator extend beyond the lower tube-plate into an inner bowl contained within the feed chamber. The liquid accompanied by vapour enters the feed chamber and the former is obliged to flow over the upper edge of the inner bowl before it can enter the vertical tubes. This facilitates the separation of the vapour.—W. H. C.

Evaporators; Feeding device for ——. A. S. Morris, Haverford, Pa., Assignor to Kestner Evaporator Co., Philadelphia, Pa. U.S. Pats. 971,394 and 971,395, Sept. 27, 1910.

The claims are for the provision of a feed chamber at the bottom of the evaporator provided with annular baffle-plates to facilitate the separation of vapour from the liquid fed into the evaporator.—W. H. C.

Distilling apparatus. E. Mallmann. Ger. Pat. 222,330, July 25, 1909.

The apparatus is shown in the accompanying diagram. The hollow cylinder, B, divides the still, A, into two parts, the vapour space of the outer compartment being connected by a pipe passing through the condenser, K^1, with the suction side of the pump, P. The vacuum thus created causes air to be drawn in through the pipe, E, and ring, C. At the same time the pump forces air through the pipe, F, and ring, D, this air escaping through the pipe, G, passing through the condenser, K.—A. S.



Distilling apparatus; Column ——. E. Flick. Ger. Pat. 223,641, Feb. 24, 1909. Addition to Ger. Pat. 206,902, July 21, 1907.

The hoods or covers over the perforations in the plates of the column described in the chief patent (see Fr. Pat. 392,674 of 1908; this J., 1909, 15) are provided with annular, projecting, down-turned rims to ensure the formation of a thin film by the downflowing liquid as it flows down.—A. S.

Crystallisation of saline solutions by means of cooling surfaces; Process and apparatus for the ——. A. Johanson. Ger. Pat. 226,452, Aug. 13, 1909.

By means of a conical distributing plate, the saline solution is directed, in a thin stream, against the inner wall of a vertical cylinder provided with a cooling jacket. The crystals which separate flow downwards with the mother-liquor into a collecting hopper at the bottom of the cylinder. This hopper is furnished with a conveyor for removing the crystals and with an overflow for the mother-liquor. The cooling water is supplied to an annular trough at the upper end of the cylinder.—A. S.

Drying apparatus. L. Berger, Auf der Schanze, Germany. Eng. Pat. 8413, April 7, 1910. Under Int. Conv., Dec. 14, 1909.

See Fr. Pat. 412,321 of 1910; this J., 1910, 997.—T. F. B.

Dissociating and extracting steam from aqueous liquids; Method of ——. W. T. Hoofnagle. Fr. Pat. 414,921, April 19, 1910. Under Int. Conv., April 26, 1909.

See U.S. Pat. 956,097 of 1910; this J., 1910, 680.—T.F.B.

Filters; Manufacture of ——. F. Sehr, Blankenhain, Germany. U.S. Pat. 972,723, Oct. 11, 1910.

See Fr. Pat. 412,045 of 1910; this J., 1910, 1032.—T. F. B.

Crucibles. The Morgan Crucible Co., Ltd. Fr. Pat. 415,099, April 21, 1910. Under Int. Conv., May 6, 1909.

See Eng. Pat. 10,771 of 1909; this J., 1910, 742.—T. F. B.

Deflocculating insoluble substances; Process for ——. E. G. Acheson. Fr. Pat. 415,552, March 21, 1910.

See U.S. Pat. 964,478 of 1910; this J., 1910, 1047.—T. F. B.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Power gas and its development. J. S. S. Brame. (Lecture delivered at Sir John Cass Technical Institute.) Chem. Trade J., 1910, 47, 376.

The introduction of power gas has made possible considerable economy in the use of natural fuel resources. Apart from the use of blast-furnace and coke-oven gas, previously wasted, the replacement of steam-power by gas power would diminish the annual consumption of coal for power in this country by 9 million tons, or about 20 per cent. Power gas can also be generated from peat and other poor fuels not suitable for raising steam. There are 140 million acres of peat bog in Europe. For small powers, up to 30 B.H.P., the author recommends the use of coal-gas rather than a gas-plant; from 30 to 250 B.H.P. a suction gas-plant is recommended; and for greater power, a pressure gas-plant. The success of the suction gas-plant using bituminous fuel is now established. Recent developments are the use of the engine exhaust in place of steam in the producer, and, in Germany the abolition of the gas-holder in pressure gas-plants, the production being controlled by fans driven by the engine. —A. T. L.

Mixed gas [Coal gas and water-gas]; Production of ——. R. Terhaerst and H. Trautwein. J. Gasbeleucht, 1910, 53, 979—982.

The paper is mainly a defence of the practice of producing the water-gas in a separate generator for admixture with the coal-gas. The work of Debruck (this J., 1910, 680) apparently showed that it was cheaper merely to inject steam into the vertical retort. The present authors, discussing first alleged irregularities from imperfect mixing in the former process, assert that if the supply of water-gas is regular and continuous and is mixed with the coal-gas before reaching the holder, there is no difficulty in obtaining perfect homogeneity. As to cost they find Debruck's figures incomplete as leaving out many considerations, other than volume of gas produced. Where Debruck quoted M 26·69 per 1000 cb. m. (8·9d. per 1000 cb. ft.) by the mixing method they quote M 23·77 per 1000 cb. m. (7·9d. per 1000 cb. ft.) accepting his figure of M 24·07 per 1000 cb. m. (8d. per 1000 cb. ft.) for generation in the retort. This reverses the state of affairs, and it is further urged that a separate water-gas generator is greatly to be preferred for adaptability and emergency requirements.—W. H. P.

Water gas, suction gas, and other gases in factories; Memorandum as to the use of ——. Factory and Workshop Act, 1901. Form 827, April, 1910.

After mentioning the fact that the number of cases of carbon monoxide poisoning has increased in recent years, the memorandum gives some of the causes to which these casualties have been traced, and a few examples of necessary routine instructions which should be posted up in works. A number of preventive measures are suggested, and a specimen notice is given.

Petroleum output of California. Board of Trade J., Oct. 20, 1910.

The following are the particulars of the petroleum production of California in recent years:—

	Production.	Value.	Average price per barrel.
	Barrels.	Dollars.	Dollars.
1887	678,572	1,357,144	2·00
1897	1,911,569	1,918,269	1·00
1901	7,710,315	2,961,102	0·40
1907	40,311,171	16,783,913	0.41
1908	48,306,910	26,566,181	0·54
1909	55,400,000	27,700,000	0·50
1910 (first seven months)	43,992,000	21,996,000	0·50

Since the discovery of the "gushers," which have given a greater output than the market required, the large oil companies have announced that they will only pay 30 cents per barrel at the wells.

Hydrocarbon oils; Emulsification of —— by means of aqueous solutions of salts of fatty acids. F. G. Donnan and H. E. Potts. Z. Chem. Ind. Kolloide, 1910, 7, 208—214.

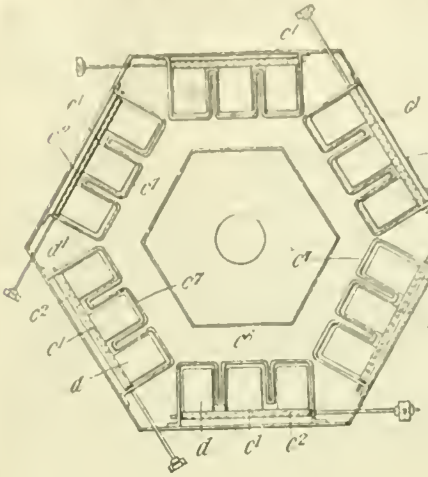
A series of measurements was made of the surface tension between solutions of sodium salts of fatty acids of various concentrations and a hydrocarbon lubricating oil containing about 0·1 per cent. of free acid (which had no influence on the results), by aid of Lewis' dropping pipette (Phil. Mag., April, 1908, 499). From acetic acid up to œnanthylic acid, the surface tension decreased only slightly as the concentration increased, but the sodium salts of caprylic acid and the higher acids gave a much greater decrease of surface-tension, the decrease varying with the molecular weight of the acid. The emulsification experiments were made by shaking a measured volume of the hydrocarbon oil with a measured volume of the fatty acid salt solution in a specially constructed quartz vessel, for sixteen hours, at a constant temperature; after standing for two hours, the mixture consisted of three layers—clear oil at the top, a thick, white "oil-cream" next, and a very dilute emulsion below. The vessel was then gently agitated for one minute, to cause the two lower layers to unite, and 10 c.c. of this emulsion were analysed. The results of this series of experiments showed that the sodium salts of the lower acids (up to and including caprylic acid) gave no emulsions; those of pelargonic and capric acids gave emulsions so dilute that the method employed gave no definite figures; the sodium salts of lauric and myristic acids emulsified increasing amounts of oil up to certain concentrations, and then the amounts emulsified decreased. This may be due to the positively-charged sodium-ions "salting-out" or coagulating the negatively charged oil particles after a certain concentration is reached, (a similar optimum concentration was observed by Spring in the case of lampblack suspensions stabilised by soaps; see this J., 1909, 430; also 1910, 99; 363). That the sodium salts of caprylic, pelargonic, and capric acids possess little or no emulsifying power, although lowering the surface-tension, is probably due to the fact that the decrease of surface tension, and consequent tendency to form emulsions, is not sufficient to destroy the coagulating action of the sodium-ions on the oil particles.—T. F. B.

Apparatus for distilling tars and mineral oils. Rosenthal *See* III.

Patents.

Peat; Treatment of ——. E. Zohrab, Caithness, and J. Dunham-Massey, London. Eng. Pat. 19,395, Aug. 23, 1909.

The patent relates to a process in which the peat is grounds mixed with added water or moisture, moulded into brick, or blocks, dried, and charred. A special drying apparatus and charring oven are used in order to obtain a denser charcoal which is suitable for use in metallurgical operations, as a fuel for boiler furnaces, and for other purposes to which wood charcoal is applied. The drying apparatus consists of an annular hexagonal drum, *c* (see fig.), divided by the six partitions, c^7, into a steam space, c^6, and six drying chambers, *d*, for the peat blocks. Dry air is passed through these chambers in the opposite direction to that in which the peat is travelling. The drum is mounted in end-bearings so that it can be rotated by hand-gear to bring each of the drying chambers in turn to the bottom for charging and discharging. The shape of the partitions, c^7, is such that as the drum is turned, fresh surfaces of the peat blocks are brought in contact with the hot casing, the other surfaces being exposed to the current of dry air. To facilitate charging and discharging, the peat-blocks, *d*, rest on endless bands, c^1, supported on rollers, c^2, and the end rollers can be driven by gearing when in the position for charging. The charring oven comprises a retort which is vertical at the upper and lower parts, the intermediate part being inclined. The retort is heated at first by gases from a furnace beneath it, which pass up through two heating flues in opposite walls of the retort. When sufficient gas is generated in the retort, this gas after being purified, is burned at tuyères arranged at intervals throughout the height of the two heating flues.—A. T. L.



Hard fuel; Method of realising in a furnace the full calorific value of ——. G. James, London. Eng. Pat. 21,779, Sept. 24, 1909.

The fuel is burnt in a closed furnace provided with an air inlet, an outlet flue, and a closed charging hopper. The air, which is supplied from a blower, is heated by passing through the hollow walls of the furnace and is then admitted to hollow baffles arranged in the space above the fuel, and, escaping through perforations in the under side of these baffles, is directed downwards on to the surface of the fuel. The smoke, carbon monoxide, and other combustible gases generated from the fuel are thus not passed through the fuel bed but are mixed, as soon as they are formed, with heated air or oxygen which ensures complete combustion.—A. T. L.

Carbon dioxide in combustion gases of furnace flues; Apparatus for automatically indicating and recording the percentage of ——. E. P. Ward, Ballyholme, Ireland. Eng. Pat. 23,846, Oct. 18, 1909.

The apparatus is of the type worked by water or a water motor, and in which the gas-measuring chamber and the water motor are comprised in a long cylindrical vessel (provided with a system of pipes and siphons) in such a way that the water rising in the vessel seals up and expels the gas in the measuring chamber. The measured quantity of flue gas is discharged into a bell float (contained in a solution of caustic potash) to the upper end of which the recording pen is attached.—W. E. F. P.

Coke-ovens; Process for keeping the ascension-pipes of —— clean. B. Rickers and E. Klinke. Ger. Pat. 223,259, June 8, 1909.

The interior of the pipe, after being cleaned mechanically, is sprayed with milk of lime or the like, in order to prevent subsequent deposits from caking on.—A. S.

Methane; Catalytic synthesis of ——. F. Bedford and C. E. Williams, Lincoln. Eng. Pats. 17,017, July 21, 1909, and 22,219, Sept. 29, 1909.

The process consists in separating carbon monoxide and hydrogen—either singly or together—from a commercial gas (such as Mond gas) and subjecting a mixture of the same to the action of finely divided nickel or other catalyser, whereby methane is produced in accordance with the equation, $CO+3H_2=CH_4+H_2O$. The commercial gas, after being freed from carbon dioxide by ordinary means, is cooled to such a degree that the constituents (including the sulphur impurities) assume the solid or liquid form, with the exception of the hydrogen which remains in the gaseous state and is collected in any convenient manner. On allowing the condensed residue to evaporate, carbon monoxide and nitrogen distil off first, and the former gas is separated "by known means," such, for example, as cuprous chloride solution, the carbon monoxide being subsequently recovered by evaporation. The purified hydrogen and carbon monoxide are then mixed in the required proportions and subjected to the action of the nickel. Alternatively, the cooling of the gas, after removal of the carbon dioxide, may be carried to such a point as to solidify the sulphur impurities and liquefy a portion of the carbon monoxide, leaving a gaseous residue containing carbon monoxide and hydrogen in the required proportions, together with nitrogen, the presence of the latter being immaterial.—W. E. F. P.

Gas generating apparatus. M. White, Luton. Eng. Pat. 26,459, Nov. 15, 1909.

In an apparatus for the manufacture of suction gas from wood refuse, a centrally arranged, vertical partition extends through the passage leading from the generator, through the dust collector, and through the passage leading to the scrubber. By means of suitably disposed valves, either half of the dust collector and adjacent passages may be put into communication with the generator and scrubber, so that one part of the apparatus may be cleaned out without interrupting the action of the other part.—W. E. F. P.

Gas producers. A. and L. Wilson, Stafford. Eng. Pat. 2416, Jan. 31, 1910.

In a producer for use with bituminous fuel, the generating chamber and the scrubbing chamber are contained in a common casing, or constitute one structure. The two chambers are on the same level, the scrubber being situated either at the side of the generator or co-axially within it. The scrubber is provided with a hopper at its upper end, the lower part being contracted and terminating in a water-sealed chamber, through which the removal of the fouled material is effected. The gas passes from the top of the generator to the bottom of the scrubber which effects the removal of dust, soot, etc., without condensing the tar—thus obviating the fouling caused by the semi-solid mixture of tar, dust and soot which deposits in apparatus of the ordinary type.—W. E. F. P.

Gas producer. W. B. Hughes, Cleveland, Ohio. U.S. Pats. 971,271 and 971,272, Sept. 27, 1910.

The producer has a rotating body-portion, and a rotating bottom, both sealed in a channel into which the ashes are forced by scrapers attached to the rotating bottom, or rotated independently of it. The ashes are delivered into a trough from which they are withdrawn by a conveyor.—A. T. L.

Gas; Apparatus for manufacturing ——. B. Loomis, Hartford, Conn., Assignor to Loomis Utilization Co. U.S. Pat. 971,858, Oct. 4, 1910.

The producer is formed with two fuel-chambers in the lower portion, separated by a partition rising from the base. Each chamber is curved outwards at its lower end towards a chamber or extension of the producer casing, and these extensions are fitted with doors at their outer ends. The base of each fuel chamber is fitted with a vertical tuyère connected with valved steam-inlet and gas-outlet connections, so that the blast can be admitted to either chamber and gas drawn off from the other. The gas-outlet pipes are connected to an air-heater, and the hot air is led to the top of the producer.—A. T. L.

Briquettes, blocks, or plates [of fuel, etc.]; Manufacture of ——. J. B. Ballantine, J. MacWilliams, and W. E. Windsor-Richards. Fr. Pat. 415,301, April 21, 1910.

See Eng. Pat. 1645 of 1909; this J., 1910, 683.—T. F. B.

Coking processes. L. L. Summers, Chicago, U.S.A. Eng. Pat. 3197, Feb. 9, 1910. Under Int. Conv., Feb. 9, 1909.

See U.S. Pat. 935,175 of 1909; this J., 1909, 1079.—T. F. B.

Coking processes. L. L. Summers. Fr. Pat. 414,174, March 26, 1910. Under Int. Conv., April 26, 1909.

See U.S. Pat. 951,786 of 1910; this J., 1910, 479.—T. F. B.

Coke; Treatment of ——. B. Ely and A. Rollason, Pye Bridge. U.S. Pat. 972,352, Oct. 11, 1910.

See Eng. Pat. 26,121 of 1908; this J., 1909, 876.—T. F. B.

Testing or analysing lubricating oils or the like. Eng. Pat. 21,661. *See* XII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Illuminating power of gas [in incandescence burners]; Determination of the —— from the heating value. M. Mayer. J. Gasbeleucht., 1910, **53**, 933—939.

Previous experiments have shown that when different gases are burned in the same incandescence burner with sufficient primary air in each case to give the hottest flame, the candle-power is proportional, within 10 or 12 per cent., to the heating value of the gas burnt in unit time. The condition mentioned requires the use of gas and air under pressure. Similar experiments have now been made with gas and air at the ordinary pressures. With the lighting-gases ordinarily met with, having a heating value from 4500—5600 cals. per cb. m. (lower value), the same relation holds between the candle-power and the heat consumed, provided the burner is regulated so that heat is consumed at the same rate with the different gases, and the volume of flame and distribution of temperature within it are the same. Under these conditions and with a wider range of gases it is found that with the weaker gases, which are richer in hydrogen, a smaller proportion of primary air is drawn into the burner, but these gases and also gases containing a smaller proportion of heavy hydrocarbons, give a higher candle-power for the same consumption of heat.—A. T. L.

Patents.

Distillation of coal or other carbonaceous material; Carriers for use in apparatus for the ——. R. S. Richards, Wraysbury, Bucks, and R. W. Pringle, Richmond, Surrey. Eng. Pat. 22,421, Oct. 1, 1909.

A carrier suitable for conveying fuel through a heated flue or chamber, in order to subject it to partial distillation, is formed of trays which are wide in proportion to their length in the direction of travel. The trays are divided by longitudinal partitions into a number of separate chambers which are tapered outwards from the bottom, so as to enable the heat to penetrate the mass.—A. T. L.

Separating tar from hot gas produced in the destructive distillation of coal or the like. E. Wagener, Dahlhausen a. d. Ruhr, Germany. Eng. Pat. 6282, Mar. 12, 1910. Under Int. Conv., Mar. 29, 1909.

The process consists in subjecting the hot gas to centrifugal action whilst injecting a large proportion of previously separated tar (or mixture of tar and ammonia liquor); or the gas and tar may be intimately mixed before being subjected to centrifugal action.—W. E. F. P.

Solid combustibles; Process for the destructive distillation of ——. A. Zorn. Ger. Pat. 224,069, March 13, 1909.

The process consists in subjecting a charge of the material to distillation in chambers disposed one alongside or one above the other, and in which the temperature increases progressively. For example a large distillation chamber may be divided into compartments by movable partitions, to allow of the transference of the charge from one compartment to the next. The partitions are provided with perforations, through which the distillation gases pass into the preceding compartment, and give up their heat to the charge therein.—A. S.

Metallic filament. I. Kitsee, Philadelphia, Pa. U.S. Pat. 971,385, Sept. 27, 1910.

The metal, in a finely-divided state, is converted into the phosphide, and the ingot of phosphide is then reconverted into the metallic state by electrolysis. The porous ingot thus obtained is hammered and rolled while hot, and is finally drawn into wire while at a lower temperature.—A. T. L.

Coal; Distillation of —— *in vertical retorts.* S. Glover, St. Helens, and J. West, Southport. Eng. Pat. 20,309, Sept. 4, 1909.

See Fr. Pat. 412,194 of 1909; this J., 1910, 1000.—T. F. B.

Metallic filaments for incandescent electric lamps; Process for decarbonising ——. Westinghouse Metallfaden-Glühlampenfabrik Ges. m. b. H., Vienna. Eng. Pat. 2983, Feb. 7, 1910. Under Int. Conv., Feb. 19, 1909.

See Fr. Pat. 412,443 of 1910; this J., 1910, 1001.—T. F. B.

Metallic filament for electric lamps. I. Kitsee. Fr. Pat. 415,875, May 11, 1910.

See U. S. Pat. 971,385 of 1910; preceding.—T. F. B.

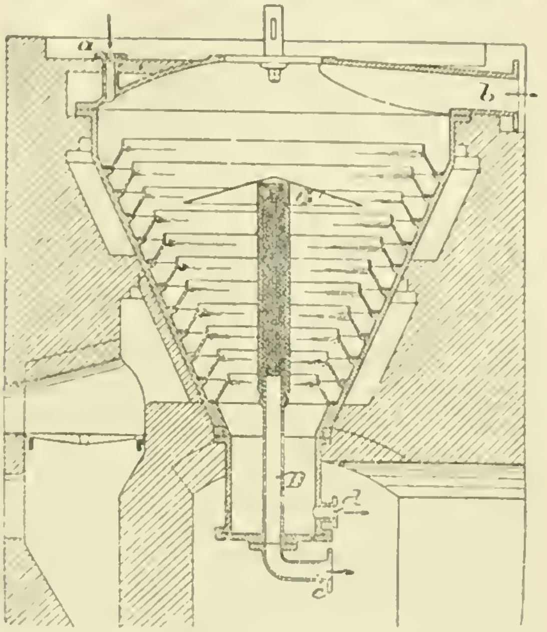
Obtaining gases such as sulphur dioxide and carbon dioxide, sufficiently pure for further use, together with ammonium salts. Ger. Pat. 226,107. *See* VII.

Producing crucibles and retorts for zinc furnaces and retorts for the distillation of coal. Eng. Pat. 14,897. *See* VIII.

III.—TAR AND TAR PRODUCTS.

Distilling tars and mineral oils; Apparatus for ——. T. Rosenthal. Z. angew. Chem., 1910, 23, 1969—1970.

The apparatus shown in the accompanying figure, invented by Wernecke (see this J., 1908, 1142), has been successfully employed for the distillation of lignite tars and lignite tar-oils, and has also given satisfactory results in the fractionation of German mineral oils; it is, moreover, equally suitable for treating other tars and oils. The feature of the apparatus is the series of troughs formed round the wall of the still by means of flanged annular projections. The tar, which may have been previously heated, is introduced through the orifice, *a*, in the crown of the still, and runs into the uppermost trough; when this is full, the tar overflows into the next, and so on until it reaches the lowest trough, the overflow from which is run off through the outlet, *d*. The lighter vapours pass out through *b*, but those of the heavier fractions are collected by the hood, G, and pass out through D and *c*, to a condenser, which is connected with a vacuum pump. The height of the hood, G, can be regulated according to the fractions which it is desired to separate. One of the great advantages of this apparatus is the very large surface of liquid which is exposed to heat; the total quantity of liquid treated at one time is not large (about 600 kilos.), but in addition to the large surface exposed in the troughs, there is a considerable layer of oil continuously running down the sides of the apparatus to the lower troughs. In one works where the apparatus is in use, from six to seven times more lignite tar has been distilled in 24 hours, than in a 2500 kilo. still of the ordinary pattern. The viscosity of the heavier oils produced has proved to be greater than that of the distillates from the old stills, and the decomposition of the tar constituents considerably reduced. Owing to the small amount of material treated at one time, the replacement of a trough or other slight repair is a much less serious operation than in the ordinary still.—T. F. B.



Patents.

Aromatic alkyl ethers; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 224,388, March 18, 1909. Addition to Ger. Pat. 189,843, April 5, 1906.

Alkylaryl ethers are obtained by the action of nitroso-compounds of alkylated acid amides (excepting nitroso-mono- or -dialkylureas and nitrosomethylurethanes) on componnds containing one or more phenol-hydroxyl groups, in presence of alkali or alkaline-earth hydroxides, ammonia, or organic bases. The nitroso-compounds are prepared by treating a suspension of the necessary alkyl amide in dilute acid with nitrite solution. (Compare Fr. Pat. 374,378; this J., 1907, 778.)—T. F. B.

β-Anthraquinonyl isocyanate from β-aminoanthraquinone; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 224,490, May 16, 1909.

β-Aminoanthraquinone is treated with phosgene in the cold, forming β-anthraquinonylurea chloride, which is converted into the corresponding isocyanate by treating with a suitable diluent; nearly quantitative yields are said to be obtained. The ordinary processes employed for the preparation of aromatic isocyanates are not applicable to β-aminoanthraquinone.—T. F. B.

Indole from products such as oils obtained by distilling coal tars; Process for extracting ——. Ges f. Teerverwerthung. Fr. Pat. 415,156, April 23, 1910. Under Int. Conv., July 8, 1909.

See Ger. Pat 223,304 of 1909; this J., 1910, 936.—T. F. B.

Diphenylene dioxide; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 415,774, May 10, 1910. Under Int. Conv., May 25, 1909.

See Ger. Pat. 223,367 of 1909; this J., 1910, 937.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

Indigo in India (1909–10). Indian Planters' Gazette, Sept. 10, 1910. [T.R.]

The final forecast for 1909–10 showed an increase of 2·3 per cent. in area and of 2 per cent. in estimated output of indigo as compared with the preceding season, but this should not be taken as an indication of any industrial revival, for the Bengal crop was 20 per cent. in defect, the deficiency of winter rain affecting the sowings in February, and the heavy rainfall at the end of August destroying the hopes of a good return from the second cuttings. The Behar output is the lowest on record. The official estimate of yield was 11,400 cwt. and the trade estimate 10,700 cwt. Research work still continues, and the results of Schrottky's experiments with a new ferment food and a second steeping have already been tested on a commercial scale. It is alleged that the price of synthetic indigo is very near the cost of production, and that, if an increased volume of indigotin is extracted from the plant by a process not proportionately more expensive than those at present employed, the natural product will be able to compete more successfully with the artificial. The introduction of the Java-Natal plant has reduced cultivation expenses, and in a good season the yield per acre shows material advance. The following statement shows the exports of indigo from India in 1909–10 and the five previous years, together with approximate quotations of average price per cwt. in London :—

	From Calcutta.	From Madras ports.	From other ports.	Total.	Value.	Average price per cwt. in London.		
	Cwt.	Cwt.	Cwt.	Cwt.	£	£	s.	d.
1904–05....	30,029	11,901	7,322	49,252	556,000	19	12	0
1905–06....	19,062	7,756	4,368	31,186	391,000	19	7	4
1906–07....	19,309	11,159	4,634	35,102	467,000	20	6	0
1907–08....	16,627	10,619	5,244	32,490	425,000	20	1	4
1908–09....	17,698	4,636	2,612	24,946	327,000	20	10	8
1909–10....	11,221	3,655	3,185	18,061	234,000	20	1	4

Fourteen years ago the total was 169,525 cwt., valued £2·91 millions. Although fine qualities were scarce, the level of prices in Calcutta in 1909–10 was slightly higher than in the previous year. The average price for the season works out at Rs. 157 (£10 9s. 4d.) per factory maund. In the distribution of exports the most striking decline is in the figures for the United Kingdom, which have fallen by 7,344 cwt. to 2,865 cwt., and the continent of Europe reduced its demand from 4,506 to 3,243 cwt. The general quality of the crop being poor and the Eastern demand considerable, business with Russia *via* the Black Sea fell short of the principal dealers' anticipations. Shipments to Egypt, chiefly "for orders," amounted to 2,586 cwt., against 3,351 cwt. in 1908–9, but the demand in Asiatic Turkey was stronger, the figures being 4,387 cwt. against 3,309 cwt. in the previous year. In Persia also, where the prohibition of the synthetic substitute is tending to become operative, the advance is from 1,170 to 2,730 cwt., and there is a small but steady Japanese demand. Japan took 1,012 cwt. against 804 cwt. in 1908–9, but the United States imports fell from 1,295 to 1,027 cwt.

Patents.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 30,297, Dec. 28, 1909.

The dyestuffs obtained by combining, in acid solution, diazotised 1.4-nitronaphthylamine sulphonic acids with N-aryl derivatives of 2-amino-8-naphthol-6-sulphonic acid dye wool from acid baths very level black shades, fast to light and milling. The products are very similar to those obtained from the diazotised ethers of 5-nitro-2-aminophenol according to Eng. Pat. 1397 of 1909 (this J., 1909, 1309).—T. F. B.

Vat [anthracene] dyes; Bluish-grey and brown ——. P. Thomaschewski and H. Raeder, Vohwinkel, and W. Mieg and P. Fischer, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 971,224 and 971,225, Sept. 27, 1910.

(1) 1-Benzoylamino-4-chloro-anthraquinone is condensed with 1-benzoylamino-4-amino-anthraquinone. (2) 1-Amino-4-benzoylamino-anthraquinone is condensed with 1-benzoylamino-5-chloro-anthraquinone and the product is treated with sulphuric acid. The dyestuffs obtained by the above methods dye cotton from the vat in bluish-grey and brown shades, respectively.—T. F. B.

Nitrated diazo compounds: Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 224,387, Dec. 5, 1908.

Aromatic amines, with the exception of *o*-aminonaphthols and their sulphonic acids, are diazotised in concentrated sulphuric acid, and then nitrated in the same solution at a low temperature. The nitro-diazo compounds thus produced possess greater coupling power than the non-nitrated compounds, and the aqueous solutions containing mineral acid can generally be utilised immediately for the preparation of dyestuffs.—T. F. B.

Dyes; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 22,555, Oct. 4, 1909.

See U.S. Pats. 951,046, 951,047, 951,048, and 951,049 of 1910; this J., 1910, 412.—T. F. B.

Azo dyestuff; Manufacture of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 29,459, Dec. 16, 1909.

See Fr. Pat. 411,192 of 1909; this J., 1910, 938.—T. F. B.

[Azo] dyestuffs; Black —— and process for producing them. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated May 3, 1910, to Fr. Pat. 405,928, Aug. 11, 1909. Under Int. Conv., July 5, 1909.

See Eng. Pat. 19,086 of 1909; this J., 1910, 685.—T. F. B.

Azo dyestuffs; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated April 12, 1910, to Fr. Pat. 414,294, March 11, 1910. Under Int. Conv., June 22, 1909.

See Eng. Pat. 15,847 of 1909; this J., 1910, 938.—T. F. B.

Azo dyestuffs for wool; Yellow ——. A. L. Laska, Offenbach. Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pats. 971,761 and 971,762, Oct. 4, 1910.

See Eng. Pat. 10,331 of 1910; this J., 1910, 1196.—T. F. B.

Disazo dyestuffs; Process for making yellow ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 415,632, May 4, 1910.

See Eng. Pat. 10,331 of 1910; this J., 1910, 1196.—T. F. B.

Disazo dyestuffs; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 415,967, May 13, 1910.

See Eng. Pat. 9173 of 1910; this J., 1910, 939.—T. F. B.

o-Hydroxyazo dyestuffs; Process for producing ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 415,912, May 12, 1910.

See Eng. Pat. 8722 of 1910; this J., 1910, 938.—T. F. B.

Monoazo dyestuff; Process for making a black, mordant ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 411,884, June 29, 1909.

See Eng. Pat. 15,089 of 1909; this J., 1910, 112.—T. F. B.

Disazo dyestuffs for cotton; Process for producing ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 415,286, July 8, 1909.

See Eng. Pat. 15,403 of 1909; this J., 1910, 413.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

American wood pulp imports. Papierfabrik., 1910, **8**, 996.

The paper industry in the United States has quite recently shown signs of increased activity and a more prosperous time is looked for in the near future. The production of wood pulp continues to fall behind the consumption, but the public is at last realising the importance of conserving what remains of the forest lands, the National Conservation Congress having done important service in this direction. The home production of wood pulp has suffered seriously in the past year owing to forest fires and a shortage of water, so that prices have risen and the statistics of imported materials show a considerable advance over the previous year. Below are the figures recorded for the last two fiscal years (July—June) for the imports of wood pulp into the United States:—

	1908–9	1909–10
Mechanical Pulp	£428,730	£529,740
Chemical pulp unbleached	£933,100	£1,214,770
,, ,, bleached	£435,930	£707,150
Total	£1,797,760	£2,451,660

The following table shows the participation of the various wood pulp-producing countries in the above importations:—

From	1908–9	1909–10
British North America	£709,730	£880,540
Germany	£378,550	£576,940
Norway	£325,810	£494,770
Other European Countries	£383,460	£499,430
Other Countries	£220	—

The bulk of the German imports into the United States consists of high-grade bleached chemical pulps, whereas the Canadian imports consist mainly of mechanical pulp and the cheaper sorts of chemical pulp.—J. F. B.

Paper; Limitation of the alteration of superficial dimensions of ——. P. Klemm. Wochenbl. Papierfab., 1910, **41**, 3569—3573.

Continuing his investigations on the stretching of papers on damping and their contraction on re-drying (this J., 1910, 874), the author now discusses the causes of these phenomena and the means to be adopted for limiting them. The primary cause of the alteration of the dimensions of paper on damping is the entrance of moisture into the fibres and the consequent swelling of the latter. The chief factor governing the access of moisture to the interior of the fibres is the degree of sizing of the paper. In addition to this, the condition of beating of the stuff and the structure of the paper are likewise factors which govern the stretching of the sheet. Cellulose beaten to a high degree of hydration absorbs water into its mass more readily than cellulose which has not been so severely treated, but the author has determined that the influence of this factor may be practically eliminated if the paper be sufficiently hard sized. The structure of the paper influences the alterations in dimensions first according to the dimensions of the interspaces between the fibres. A swelling of the latter only involves a stretching of the sheet of paper when the interspaces have first become filled up and the fibres press against one another. An open, spongy paper will therefore stretch less than a closely felted paper. Secondly, the majority of the fibres in machine-made papers are disposed longitudinally in the machine direction of the web, and since the swelling of the fibres relates only to their diameter, the greatest stretch on damping takes place at right angles to this direction. In limiting the stretching tendency of papers, the papermaker has at his disposal two means: the degree of sizing and the regulation of the tensions on the machine. By means of a tight tension during hot drying it is possible to make a paper which, when damped, will not stretch at all in the machine direction. But this effect is obtained at the expense of an increased stretching in the cross direction, since the unequal longitudinal disposition of the fibres is increased by tension.—J. F. B.

Paper; Destruction of the dyestuffs in —— by printers' ink. P. Klemm. Wochenbl. Papierfab., 1910, **41**, 3648—3649.

The author records a case of the destruction of the dyestuff in a coloured poster-paper by the printers' ink with which it was printed. The printed lettering was visible from the back of the poster in the form of white characters on the coloured ground, where the dyestuff in the body of the paper had been bleached. The phenomenon is attributed to the intense oxidation which takes place during the "drying" of the oily medium of the ink, which, as is known, may in special cases lead to spontaneous ignition. The oil and resin absorb oxygen most powerfully from whatever bodies may be in contact with them, and if the dyestuff be one which readily parts with oxygen giving a leuco-derivative stable in presence of air, the fading of the colour is a natural consequence. A number of dyestuffs correspond with this condition, for instance, Victoria Blue, and the author has proved experimentally, with paper coloured with this dyestuff, that printers' varnish may ultimately bring about the complete destruction of the colour.—J. F. B.

Production of alcohol from waste sulphite-cellulose lyes. Kiby. *See* XVIII.

Patents.

Chemical retting of fibrous plants, their conversion into paper pulp and the scouring of animal fibres; Process for the ——. L. Peufaillit and A. Leblanc. Fr. Pat. 415,188, April 25, 1910.

The material is treated with hot water to which a fatty substance or oil has been added, the operation being carried out in a closed vessel under pressure.—P. F. C.

Carbonised fabric. F. L. Horton, Bridgeport, Conn. U.S. Pat. 972,110, Oct. 4, 1910.

The claim refers to an asbestos fabric, impregnated with a coherent mass of carbon, derived from a mixture of sulphur and a carbohydrate.—F. M.

Cellulose ester and process of treating same. H. S. Mork, Assignor to Chemical Products Co., Boston, Mass. U.S. Pat. 972,464, Oct. 11, 1910.

The physical properties of the cellulose esters of fatty acids in solution can be altered by employing methyl formate with or without another solvent of the ester and then adding to the solution a liquid which is a non-solvent of the ester.—P. F. C.

Textile fibres; Process for obtaining ——. J. E. Pfiel. Vienna. U.S. Pat. 972.403, Oct. 11. 1910.

See Eng. Pat. 27.676 of 1908; this J., 1910, 147.—T. F. B.

Pulp fibres; Process and apparatus for separating —— from pigments or colouring matters, size, filling, and other impurities. B. W. Petsche. Fr. Pat. 415.231, April 26, 1910.

See U.S. Pats. 955.898 and 955,990 of 1910; this J., 1910, 689.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Indigo Blue: Peculiarities in the dyeings with —— upon natural and artificial fibres of cellulose. W. Minajeff. Z. Farben-Ind., 1910, 9, 297—300, 314—316.

A comparison under the microscope of sections of fibres of cotton, cellulose silk, and artificial horse-hair, dyed with indigo, shows that the cotton is homogeneously dyed throughout the fibre, that cellulose silk is evenly dyed but that there are also "specks" or aggregations of dyestuff here and there in the substance of the fibre, and that with "artificial horsehair" the outer layers are homogeneously and much more deeply coloured than the interior, in which there is a pronounced separation of particles of dyestuff as "specks." The conclusions drawn are that the cotton fibre is evenly dyed throughout owing to its physical structure, density and colloidal character. Whether a vat-dyestuff is developed homogeneously on the fibre, or shows "specks" or "aggregations" of dyestuff is undoubtedly dependent upon the thickness of the fibre, together with its density and internal structure: the thicker fibres of cellulose silk and artificial horsehair show a distinct aggregation of colour particles in the fibre substance, which otherwise is evenly dyed. The properties mentioned are dependent however upon the nature of the dyestuff employed, this being introduced into the fibre in dissolved form and precipitated therein by oxidation. The formation in artificial horsehair of a deeply dyed layer at the periphery of the fibre is due to the oxidation of the leuco-indigo from the solution, whilst the specks in the interior of the fibre are caused by the deposition of indigo white owing to a diminution in the amount of alkali (by which it is held in solution) and the subsequent oxidation of the precipitated indigo white to blue.—F. M.

Dyeing of animal fibres; Studies on the mechanism of the ——. II. The precipitability of dyestuffs by derivatives of guanidine. W. Suida. Z. physiol. Chem., 1910, 68, 381—390.

Guanidine hydrochloride gives a precipitate with many dyestuffs and the author suggests that this may be found a useful reagent in the recognition of acid and basic dyestuffs. A solution of 5 grms. of the hydrochloride in 100 c.c. of water to which 3 grms. of glacial acetic acid was added formed the standard solution and 1 c.c. was added to 2—3 c.c. of a dyestuff solution which itself gave no precipitate with acetic acid. It was found that all basic, non-sulphonated dyestuffs give a precipitate. Dyestuffs which are aminosulphonic acids behave differently, thus Archil substitute N extra, Toluylene Red, Acid Violet 6BN, Fast Acid Violet 10 B, Acid Violet 4B extra, Acid Violet 7B, and Red Violet 5RS give precipitates, whilst Quinoline Yellow, Guinea Green B, Patent Blue VN superfine, Light Green SF (blue shade and yellow shade), Fast Green, Navy Blue BW, Magenta S, and Pyramine Orange 3G give no precipitate. Nearly all the hydroxyazo-dyestuffs examined (with the exception of Eosamine B and Azofuchsine G), as well as picric acid and Alizarin Red, are more or less quantitatively precipitated. Hydroxyazo-dyestuffs, which contain free or alkylated amino-groups are only partly precipitated. Whilst carboxydisulphonic acids (Tartrazine) give no precipitate, dyestuffs which contain hydroxyl and carboxyl groups or these together with sulphoxyl groups give precipitates. If no hydroxyl groups are present but amino- or alkylamino- and carboxyl groups, no precipitate is formed. A soluble guanidine salt gives a white precipitate with phosphotungstic acid which is soluble in ammonia or ammonium carbonate; the white precipitate is not affected by contact with dyestuffs (free acid) but on adding ammonia or ammonium carbonate a coloured precipitate is formed. As phosphotungstic acid precipitates the basic decomposition products of proteins, the conclusion is drawn that it is the group, N.C.N, which precipitates the dye-acids both in the case of proteins and of guanidine. Hence the combinations of dye-acids with animal fibres are to be regarded as chemical compounds. In developing this idea the author finds that open chain or cyclic substances which contain the groups, :N.CO.N: or .N:C(OH).N:, do not give insoluble precipitates with dye-acids (*e.g.*, picric acid, Orange II, Crystal Ponceau, Orange GG, and Congo Red), but give precipitates with basic dyestuffs owing, no doubt, to their acidic character. Guanidine derivatives containing an open chain in which are contained no substituting acidic groups give insoluble precipitates with dye-acids. No such precipitates are obtained, however, with nitroguanidine, glycocyamine or creatine. All cyclic compounds examined, which contain the guanyl group or contain a carbon atom between two nitrogen atoms gave precipitates with dye-acids. The precipitability of these guanidine derivatives was also tested with phosphotungstic acid: in many cases the action is similar to that produced by dye-acids but several differences are described.—J. C. C.

Dye-acids with different organic bases; Combinations of ——. L. Radlberger. Z. physiol. Chem., 1910, 68, 391—394.

Diguanide sulphate gives a crystalline precipitate with the acid of Orange II (compare preceding abstract) which contains one mol. of the base to two mols. of the acid; with the acid of Crystal Ponceau the precipitate contains two mols. of the base and one of the acid. Acetoguanamine combines in equimolecular proportions with the acid of Orange II, forming an orange precipitate; and a rather more soluble, red precipitate, is produced with the acid of Crystal Ponceau.—J. C. C.

Dextrin in finishing; The effect of ——. E. Hastaden. Färber-Zeit., 1910, 21, 335—337.

The views held as to the behaviour of dextrin in the finishing of textile fabrics are rather divergent. Some users complain that it dulls the colours and imparts to the cloth a hard, stiff handle, whilst others deny this. It would be very expensive to fill a cloth heavily with dextrin alone, and to reduce the cost it has been usual to add salts such as sodium or magnesium sulphate or magnesium chloride, to increase the weighting effect. Epsom salts (magnesium sulphate) have been most largely used, with an addition of Turkey-red oil as a softener. Starch treated with "Diastafor" has been recently recommended as a substitute for dextrin, on the ground that it does not give such hard finishes as the latter, but the author does not agree with this and states that he uses it on account of the saving in cost. In his opinion there is no practical difference between dextrin and starch treated with Diastafor, a pure dextrin giving the same reactions as a completely converted starch, whilst an impure dextrin behaves more or less like a starch which has been acted upon by Diastafor only for a short time. With a pure dextrin a hard finish can only result from the use of too large a quantity in filling, whilst with an impure quality it is the unchanged starch which is responsible for the stiffness. Pure dextrin dissolves to a clear solution in cold water and such a solution cannot possibly dull the colours or whites; where this occurs it can only be that a poorly prepared product has been employed.—F. M.

Patents.

Dyeing yarn or the like; Supports for use in ——. F. H. Daniell, Franklin, N.H., and J. C. Hebden, Providence, R.I., U.S.A. Eng. Pat. 26,028, Nov. 10, 1909.

The support comprises a hollow, porous base, in the form of the frustum of a cone, attached to a tapered, porous, tubular barrel. The base and barrel are provided with perforations, in the form of narrow openings, extending in the direction of the axis of the support.—B. N.

Cloth or yarn; Apparatus for treating —— with liquors and hot air or the like. J. Dean, Bradford, Yorks. Eng. Pat. 900, Jan. 13, 1910.

The machine represents a combination of a dyeing, sizing and drying machine. The material on leaving the beams passes through a continuous dyeing machine and is then guided up and down a shaft in which it is subjected to the influence of hot air and dried. It is passed directly through the sizing machine and then up and down one or two drying shafts to dry.—F. M.

Discharges on vatted grounds and new sulphonated derivatives of organic ammonium bases. Badische Anilin und Soda-Fabrik. Fr. Pat. 414,937, Apr. 19, 1910. Under Int. Conv., Oct. 14, and Nov. 8, 1909 and Jan. 31, 1910.

Discharges on vatted grounds produced by reducing agents are very liable to re-oxidation by the air after the goods leave the steaming apparatus. This can be avoided by adding to the mixture of the reducing agent and a thickening agent, an organic ammonium base containing an alkaryl radical or its salts. According to the nature of the vatted ground the discharge obtained will be white or coloured. Thus thio-indigo gives a discharge which washes to a white, whilst indigo gives an intense chrome yellow discharge, the shade of which can be varied and rendered faster by the addition of metallic oxides or hydroxides to the discharge colour. The grounds which give coloured discharges by this process can be made to give permanent white discharges if the alkaryl nucleus of the organic ammonium base contains the sulphonic group, for the coloured discharge which is first formed can then be very readily removed by an alkaline treatment, leaving a perfect white. Dimethylphenylbenzylammonium is given as a typical organic ammonium base. Examples are given both of the preparation of the discharge colour and of the method of preparing the sulphonated bases.—P. F. C.

Finishing threads or yarns from warp-beams; Process of ——. G. A. Fredenburgh, Pawtucket, R. I., Assignor to Boston Braiding Co. U.S. Pat. 972,760, Oct. 11, 1910.

The threads are smoothed on all sides except the top, then passed through a cold-sizing mixture and are afterwards squeezed and polished. The yarn is next brushed and polished again, first on the upper side and then on the lower side and is afterwards partially stretched. All the processes are then repeated and the threads are finally wound, having been slowly dried during the length of travel towards the end of the process.—P. F. C.

Textile fibres, metallic or otherwise; Apparatus for the application of varnish or other similar coatings to ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 415,048, Apr. 20, 1910. Under Int. Conv., May 10 and Aug. 10, 1909.

The apparatus consists of a recipient (containing the varnish to be applied), which is provided near the bottom, on opposite sides, with two openings. These openings are covered by sheets of rubber or some similar material which in turn are provided with small perforations through which the thread to be varnished can be drawn. The thread enters the recipient at one opening, takes a coating of varnish, and is drawn out through the other opening. The nearness of the thread to the bottom of the recipient enables uniform results to be obtained even with metallic varnishes.—P. F. C.

Bleaching thread or yarn in bobbins, balls, or hanks; Apparatus for ——. E. Herzog. Fr. Pat. 415,157, April 23, 1910. Under Int. Conv., April 28, 1909.

See Eng. Pat. 9982 of 1910; this J., 1910, 1102.—T. F. B.

Dyeing and printing. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,028, Nov. 20, 1909.

See Fr. Pat. 409,748 of 1909; this J., 1910, 753.—T. F. B.

Dyeing; Process of —— and product thereof. J. Deinet. Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 972,065 and 972,066, Oct. 4, 1910.

See Ger. Pat. 213,473 of 1908; this J., 1909, 1195.—T. F. B.

Alizarin preparation soluble in water for use in dyeing; Process for making a concentrated, dry ——. Chem. Fabr. Grünau, Landshoff und Meyer. Fr. Pat. 414,952, June 30, 1909.

See Ger. Pat. 219,757 of 1907; this J., 1910, 484.—T. F. B.

Green shades on the fibre; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 415,047, April 20, 1910. Under Int. Conv., April 30, 1909.

See Eng. Pat. 11,355 of 1909; this J., 1910, 419.—T. F. B.

Dyeing half-woollen goods; Process for ——. M. Becke and A. Beil. Fr. Pat. 415,284, March 31, 1910. Under Int. Conv., April 8, 1909.

See Eng. Pat. 25,999 of 1909; this J., 1910, 1006.—T. F. B.

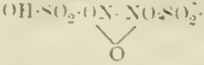
Sizing or finishing mediums; Manufacture of ——. G. Donauer. Assignor to Erste Triester Reisschäl-Fabriks-A.-G., Trieste, Austria-Hungary. U.S. Pat. 972,068, Oct. 4, 1910.

See Addition of June 19, 1909, to Fr. Pat. 349,074 of 1904; this J., 1910, 420.—T. F. B.

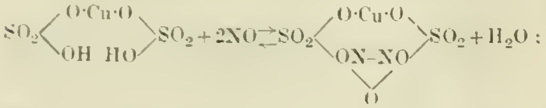
VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Lead chamber process [of making sulphuric acid]; Theory of the ——. O. Wentzki. Z. angew. Chem., 1910, 23, 1707—1714.

The results of experiments on the reactions involved in the lead chamber process of making sulphuric acid have led the author to challenge the conclusions arrived at by Raschig (this J., 1905, 923) and by Lunge and Berl (this J., 1906, 533). It is found (1) that dry sulphur dioxide readily reduces practically dry nitrous gases, (2) that, by denitrating weak nitrous vitriol (sp. gr. 1·5), "purple acid" is produced only towards the end of the process, whereas with nitrous vitriol of sp. gr. 1·71, containing no free nitrous acid, the blue colour appears at once, (3) that by passing dry sulphur dioxide and an almost dry mixture of nitrous gases and air, alternately, through a dry glass vessel, a film is produced which consists of a mixture of nitrosylsulphuric acid (chamber crystals) and sulphuric acid, and (4) that sulphur dioxide reduces, not only nitrosylsulphuric acid, but also the blue compound. The author concludes, therefore, (1) that sulphur trioxide and sulphuric acid may be produced directly from sulphur dioxide, nitrous gases, and water, without the formation of intermediate products, (2) that the blue compound is formed only by the reduction of nitrosylsulphuric acid, and not directly as held by Raschig and by Lunge (*loc. cit.*), (3) that nitrosylsulphuric acid is itself a secondary product, formed by the action of nitrous gases on sulphuric acid which is produced directly, and (4) that neither the blue acid nor nitrosylsulphuric acid can exist in the chamber when excess of sulphur dioxide is present. The only essential steps in the chamber process are considered to be the reactions, (*a*) $SO_2+NO_2+H_2O=H_2SO_4+NO$, and (*b*) $NO+O=NO_2$, and, in the Glover tower, besides these, the reactions, (*c*) $2HNO_2+SO_2=H_2SO_4+2NO$, and (*d*) $2HSNO_5+SO_2+2H_2O=3H_2SO_4+2NO$. For the blue compound, called by Raschig nitrosisulphonic acid ($OH{\cdot}NO{\cdot}SO_3H$), the name nitrosylous sulphuric acid is proposed, on the grounds that it is readily converted by oxidation into nitrosylsulphuric acid, and the constitution, $OH·SO_2·ON·NO·SO_2·OH$, is assigned to it, chiefly to explain the fact that the copper salt may be obtained by the interaction of nitric oxide, sulphuric acid, and copper sulphate, which, on Raschig's hypothesis, is considered to involve the displacement of sulphuric acid by the very labile blue acid. Assuming that acid copper sulphate is first formed, the reaction is expressed, with the new formula, thus:

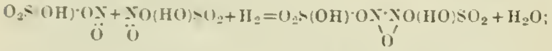


$OH·SO_2·ON·NO·SO_2·OH$ with O below bridging the two N



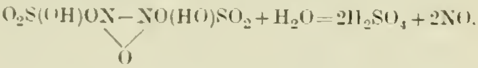
$$SO_2\left<\begin{matrix}O·Cu·O\\OH\ \ HO\end{matrix}\right>SO_2+2NO\rightleftarrows SO_2\left<\begin{matrix}O·Cu·O\\ON{-}NO\end{matrix}\right>SO_2+H_2O:$$

The formation of nitrosylous sulphuric acid is represented by the equation,



$$O_2S(OH)·O\underset{O}{N}+\underset{O}{N}O(HO)SO_2+H_2=O_2S(OH)·ON·NO(HO)SO_2+H_2O;$$

and its hydrolytic decomposition by the equation,



$$O_2S(OH)ON-NO(HO)SO_2+H_2O=2H_2SO_4+2NO.$$

There is reason to believe that the reduction of nitrosylous sulphuric acid leads to the production of nitrous oxide, and, since this gas is not found in appreciable quantities in the chamber process, an additional argument is provided against the introduction of the blue compound as an essential intermediate product; in fact its formation must be considered harmful, as leading to a probable ultimate loss of nitre as nitrous oxide.—F. SODN.

Weber's acid [chamber crystals]: Constitution of ——. K. W. Jurisch. Chem.-Zeit., 1910, **34**, 1065—1066.

THE author accepts Werner's co-ordination formula, $SO_3.H_2O$, for sulphuric acid, rather than the usual type formula, $SO_2(OH)_2$. He rejects, therefore, the formulæ for Weber's acid, $HO.SO_2.O_2N$ (Raschig), and, $HO.SO_2.ONO$ (Lunge), based upon the latter, contending that there can be no SO_2 group in the molecule and that nitro- and nitroso- groups are alike absent. In accordance with the co-ordination formula, Weber's acid is regarded as a double molecule of sulphuric acid in which an H_2O group is replaced by the group, N_2O_3, as represented by the formula, $H_2O.O_3S.SO_3.O_3N_2$.—F. SODN.

Sulphuric acid; Concentration of —— to 97—98 per cent. monohydrate. G. Stolzenwald. Z. angew. Chem., 1910, **23**, 1975—1978.

THE author discusses the relative advantages of the different methods for the concentration of sulphuric acid. Of the systems in which the concentration is effected in a single apparatus, only two are in use, viz., the Gaillard process (this J., 1910, 346) and the new Kessler system, in which volvic lava is used instead of pumice for the partitions. The statements as to the cost of the Gaillard process differ considerably, and the author considers that it will find considerable difficulty in displacing the Kessler system. Where the demands as to purity of the acid are not so stringent, and high capital cost is undesirable, the combined process is more useful, in which the acid is concentrated to a certain point in one apparatus, and the concentration completed in a second apparatus. There is a greater choice of systems of this kind, but the cheapest both as regards cost of installation and of working is concentration to 93—95 per cent. in cast iron boilers, and final concentration in cast iron pans. By this system, the cost of installation for a production of 5000 kilos. per 24 hours is M.10,000 (£490), whilst the consumption of coal is 1500 kilos. (compare this J., 1909, 520). It is pointed out that it is advisable not to run the acid direct from the boiler to the pan, but to have an intermediate receptacle, so that interruption of the working of one part of the system need not cause stoppage of the other part. —A. S.

Metaphosphoric acid; Hydration of ——. D. Balareff. Z. anorg. Chem., 1910, **68**, 266—268.

A STUDY of the hydration of metaphosphoric acid in solutions of different concentrations (from 1·3 per cent. up to the highest possible) at temperatures of from 23° to 65° C., showed that the meta-acid is converted directly into orthophosphoric acid without any intermediate formation of pyrophosphoric acid. For the detection of the latter acid, Arnold and Werner's method (this J., 1906, 92) was used, and a control experiment showed that 0·5 per cent. of pyrophosphoric acid can be readily detected in presence of much ortho- and meta-phosphoric acid by that method.—A. S.

Permanganates; Electrolytic conversion of manganates into ——. K. Brand and J. E. Ramsbottom. J. prakt. Chem., 1910, **82**, 336—396. (See also Askenasy and Klonowski, this J., 1910, 348.)

THE introduction to the paper contains an extensive resumé of the literature (chiefly patents) on the subject of the electrolytic production of permanganates. Working with the aqueous extract from a fusion of potassium hydroxide with manganese dioxide as anode liquid in a porous cell, and a potassium hydroxide solution as cathode electrolyte, the authors find that vigorous stirring and low anode current densities are favourable to high yields. Better yields are obtained with nickel anodes than with iron. The changes of current strength with varying E.M.F. and varying manganate and alkali concentrations, suggest that the oxygen discharging at the anode is the cause of the oxidation. The observations of the anode potential show, like the yields, that the oxidation takes place more easily at a nickel anode than at an iron one, the cause being probably the intervention of nickel peroxide as an oxygen carrier. The presence of potassium carbonate in the anode electrolyte leads to anomalous results, with poor yields and formation of a manganese compound which evolves oxygen spontaneously when electrolysis is interrupted. The spontaneous evolution of oxygen does not occur with a platinum anode. The oxidation of sodium manganate may be carried out under the same conditions with just as good yields as that of potassium manganate, sodium permanganate being very much more soluble. The paper also contains data as to the solubility of potassium permanganate in potassium hydroxide solutions at 18° C. These numbers have an important bearing on the separation of the solid permanganate at the anode. Another important point is that alkaline permanganate solution does not evolve oxygen at 100° C., except in the presence of dust particles or of small quantities of lower oxides of manganese (see Skrabal, this J., 1910, 1154). The relative effects of the different manganese oxides are tabulated. —W. H. P.

Metallic oxides; Action of chlorine in a solution of carbon tetrachloride and of carbon tetrachloride on ——. A. Michael and A. Murphy, jun. Amer. Chem. J., 1910, **44**, 365—384.

A SOLUTION of chlorine in carbon tetrachloride, which at the ordinary temperature may contain about 10 per cent., will keep indefinitely if the materials be pure and dry, and the chlorine is generally more reactive in this form than as gas. The solution reacts violently with ferrous oxide, giving ferric oxide and chloride, and also with manganous oxide; it reacts readily with nickelous oxide and, at 100° C., with cobaltous oxide; in the last three cases, the reaction proceeds according to the equation, $3MeO+Cl_2=Me_2O_3+MeCl_2$. Stannous oxide, obtained by heating the oxalate to redness, reacts violently with the solution, stannic chloride being formed and an insoluble light brown oxide. Cuprous oxide reacts at 250° C., giving a dark brown amorphous oxychloride, Cu_2OCl_2. Antimony trioxide, at 100° C., gives antimonic chloride and carbonyl chloride; with carbon tetrachloride alone, at 100° C., antimony trichloride and carbonyl chloride are formed. Silver oxide gives silver chloride and carbonyl chloride, and the same reaction is effected with carbon tetrachloride alone at about 250° C. Lead oxide, at 100° C., gives lead chloride and peroxide. Mercuric oxide reacts with gaseous chlorine, even at 0° C., forming chlorine monoxide and a basic chloride, the reaction being violent with the dry precipitated oxide, though the red oxide is comparatively inert; with a solution of chlorine in carbon tetrachloride, reaction occurs only at 100° C., when carbonyl chloride and basic chlorides are formed; carbon tetrachloride alone also reacts under the same conditions. Chromium trioxide reacts with chlorine in carbon tetrachloride, at 150° C., yielding chromyl chloride and carbonyl chloride, and, with the tetrachloride alone, the same products are formed at 170° C. Molybdenum dioxide reacts with carbon tetrachloride at 250° C., yielding the chloride, $MoCl_4$. Molybdenum trioxide reacts with the chlorine solution at 200° C., giving a yellowish green oxychloride, mixed with unchanged trioxide; at 240° C., the trioxide is converted completely into pure molybdenum pentachloride which crystallises from carbon tetrachloride in dark green hygroscopic needles; the same reaction is effected with the tetrachloride alone at about 280° C. The oxide, Mo_5O_8, with carbon tetrachloride, at 240° C., also gives the pentachloride. Tungsten dioxide, heated for several hours with carbon tetrachloride, at 250° C., is converted into tungsten tetrachloride. By heating tungsten trioxide with the chlorine solution, either the oxytetrachloride, $WOCl_4$, or the hexachloride is obtained, according to the temperature, the former at 240° C., and the latter at 280° C.; without chlorine, at 280° C., the hexachloride is formed. Uranium dioxide, with carbon tetrachloride at 250° C., gives uranium tetrachloride and carbonyl chloride. The oxides, UO_3 and U_3O_8, at the same temperature, with the chlorine solution or with carbon tetrachloride alone, each give the pentachloride. The above are considered to be the best methods for the preparation of molybdenum tetra- and penta-chlorides, the oxytetrachloride and hexachloride of tungsten, and the tetra- and penta-chlorides of uranium.—F. Sodn.

Calcium molybdate; Determination of molybdenum in ——. W. Trautmann. Z. angew. Chem., 1910, **23**, 1981.

One-half grm. of finely powdered calcium molybdate is boiled for a short time with 20 c.c. of hydrochloric acid (sp. gr. 1·19) and 1—2 c.c. of nitric acid (sp. gr. 1·4); the solution is diluted to 150 c.c. and added, without filtering off the silica, to a mixture of "concentrated" ammonia with a few c.c. of ammonium sulphide. The liquid is heated for a few minutes on the water-bath, and then filtered from the ferrous sulphide and silica, which is washed with a very dilute solution of ammonia to which a few drops of ammonium sulphide have been added. The hot filtrate is then treated with dilute hydrochloric acid, which causes the molybdenum to be precipitated as trisulphide; this can be converted into the trioxide or disulphide and weighed in the usual manner.—T. F. B.

Calcium metasilicate; Binary systems of —— with calcium fluoride and calcium chloride. B. Karandéeff. Z. anorg. Chem., 1910, **68**, 188—197.

The author has made a thermal and micrographic study of the binary systems: calcium metasilicate and fluoride and calcium metasilicate and chloride. The results are given in tables and curve-diagrams. Calcium metasilicate, pseudowollastonite (solidif. pt. 1501° C.), and calcium fluoride (solidif. pt. 1378° C.) form no compound. The eutectic (1130° C.) consists of the fluoride (38·2 per cent.) and wollastonite. The metasilicate and chloride (solidif. pt. 772° C.) also form no compound. The eutectic (about 764° C.) contains very little silicate. Between 30 and 40 mols. per cent. of fluoride (about 1200° C.) and between 50 and 60 mols. per cent. of chloride (about 1150° C.) there is a distinct change in the structure of the conglomerate, probably due to the transformation of pseudowollastonite into wollastonite.—A. S.

Lead silicates; Crystallisation of melted ——. S. Hilpert and R. Nacken. Ber., 1910, **43**, 2565—2573.

The authors have continued the investigations of the products formed by melting together lead oxide and silica in various proportions (this J., 1909, 1121). By taking the cooling curves, and by measuring the linear velocity of crystallisation and the capacity for spontaneous crystallisation of the products thus formed, they have shown the existence of the following silicates of lead:—$3PbO,SiO_2$; $2PbO,SiO_2$; $3PbO,2SiO_2$; and PbO,SiO_2. The orthosilicate has a sp. gr. of 7·08 in the amorphous state and 7·50 in the crystalline form. It has a much greater tendency to crystallise than the metasilicate. The compound, $3PbO,2SiO_2$, was found to correspond more nearly in its properties to the meta- than to the orthosilicate. The compound, $3PbO,SiO_2$, did not give very positive results, and its existence cannot yet be considered as completely demonstrated.—T. St.

Distribution in mixed solvents. W. Herz and A. Kurzer. Z. Elektrochem., 1910, **16**, 869—872.

A series of tables is given showing the results of the determination of the distribution of: (1) boric acid between water and mixtures of amyl alcohol and carbon bisulphide; (2) iodine between chloroform and glycerol or water or mixtures of the two; (3) bromine between water and carbon tetrachloride or carbon bisulphide or mixtures of the two; (4) picric acid between water and mixtures of toluene and chloroform; (5) iodine between aqueous barium iodide solution and a mixture of carbon bisulphide and carbon tetrachloride.—A. S.

Colloids; Purification of —— by dialysis. R. Zsigmondy and R. Heyer. Z. anorg. Chem., 1910, **68**, 169—187.

Comparative experiments with a colloidal silicic acid solution prepared by mixing together 1 vol. of sodium silicate solution and 2 vols. of 3·3*N*-hydrochloric acid showed that the chlorine ions can be removed practically completely in a few days by dialysis. Of the three membranes tried, fish-bladder gave the best and parchment the worst results, collodion being intermediate. The results were just as good when the water was renewed frequently as when a continuous flow of water was used. A new dialyser (the "star" dialyser) has been devised which is more efficient than the older forms. It consists of a circular vulcanite plate of 25 cm. diameter, with a rim 4 mm. high, and a central opening connected below with the water supply. In the plate are disposed eight radial partitions, 4 mm. high, extending from near the central hole to near the rim. The membrane is fixed on an ebonite ring, 40 mm. high and rests on the rim and partitions of the plate. Water is supplied continuously through the central hole and escapes through depressions in the rim of the plate, strips of filter-paper being hung over these depressions in order to obtain an even outflow. With this apparatus, colloidal silicic acid (200 c.c. of sodium silicate solution and 40 c.c. of concentrated hydrochloric acid) was obtained practically free from chlorine in 20 hours by dialysis with a collodion membrane; the consumption of water was about 10 litres per 24 hours. The paper also contains a description of the methods used for determining chlorine in the colloidal silicic acid, and a discussion of the purity and stability of the purified colloidal silicic acid.—A. S.

Nitric oxide formation in high-tension arcs. Haber and others. *See* XI.

Nitric oxide formation by alternating current discharges of very high frequency. Haber and Platou. *See* XI.

Yield of nitric oxide from air in cooled continuous current arcs. Holwech and Koenig. *See* XI.

Formation of nitric oxide in the arc flame under pressure. Haber and Holwech. *See* XI.

Formation of nitric oxide by the combustion of hydrogen. Wolokitin. *See* XI.

Patents.

Sulphuric acid; Process for increasing the efficiency of the Gay-Lussac apparatus in the manufacture of —— by the chamber process. H. Petersen. Ger. Pat. 226,793, Jan. 21, 1909.

The object of the invention is to overcome the difficulty experienced in completely removing nitrous compounds from the gases, especially in the last Gay-Lussac tower, where the proportion of nitrous compounds is small. This difficulty is due to the presence of ferrous sulphate in the acid. According to the present patent, therefore, the acid used in the last Gay-Lussac tower is first treated with gases containing oxides of nitrogen, in order to oxidise any ferrous sulphate present to ferric sulphate. For example, where at least three Gay-Lussac towers are used, the acid from the last tower but one is used to rinse the last tower, and the acid from the latter is passed to the first Gay-Lussac tower. The same result may be attained by passing the nitrous gases and the absorbing acid through the Gay-Lussac apparatus in the same direction; the nitrous compounds oxidise any ferrous sulphate present during the first part of the passage through the apparatus, and the acid is afterwards able to exercise its full absorptive power. In another modification of the process, the acid from the Glover tower is mixed with a portion of the nitrous vitriol from the Gay-Lussac apparatus before being used for absorbing nitrous compounds.—A. S.

Gases such as sulphur dioxide and carbon dioxide; Process for obtaining —— sufficiently pure for further use, together with ammonium salts. A. Rahtjen. Ger. Pat. 226,107, Oct. 28, 1908.

Gases containing ammonia, produced in the destructive distillation of organic substances, are neutralised by intimately mixing them with pyrites burner gases or the like, if necessary in the presence of steam, and are then treated in the usual manner for the production of ammonium salts (ammonium sulphate), whereby sulphur dioxide remains in a state of purity requisite for the manufacture of sulphuric acid by the contact process. By using combustion gases in place of burner gases, relatively pure carbon dioxide can be obtained in a similar manner.—A. S.

Sulphuryl chloride; Process for the preparation of —— from sulphur dioxide and chlorine. Actienges. f. Anilinfabr. Ger. Pat. 226,218, Oct. 19, 1909.

Sulphur dioxide and chlorine, in the required proportions, are passed into acetic anhydride, and the sulphuryl chloride formed is separated by fractional distillation. The yield is nearly quantitative.—A. S.

Nitrous oxide (N_2O) and nitric oxide (NO); Process for the preparotion of ——. R. P. Pictet. Ger. Pat. 226,867, Sept. 20, 1908.

It has been found that at a definite part of a nitrogen-oxygen flame, whether produced by electrical or other means, the combustion gases contain a considerable quantity of nitrous oxide, and by cooling strongly and rapidly the gases at this point, the reaction-product will contain most of the nitrogen in the form of nitrous oxide. The particular part of the flame at which the cooling should be applied must be determined by experiment; it varies with the working conditions, but is usually about the beginning of the last quarter of the length of the flame. Claim is also made for the production of nitric oxide by rapidly cooling a heated mixture of nitrous oxide and oxygen at the place where the maximum quantity of nitric oxide is present, as determined experimentally.—A.S.

Hydrogen; Process for obtaining —— by the decomposition of steam by means of a metal. W. Gerhartz. Ger. Pat. 226,453, June 23, 1909.

The process consists in blowing steam through a molten oxidisable metal, and subsequently reducing the oxidised metal for further use. Molten iron for example is introduced into a vessel lined with refractory material and provided with a perforated false bottom somewhat after the manner of the Bessemer converter. Steam under pressure is blown into the space below the false bottom and is decomposed whilst rising through the molten iron; the hydrogen produced is led off through a suitable pipe, and the heat carried by it is utilised for generating steam. The fluidity of the molten iron is gradually diminished, and after a time the supply of steam is stopped, coke is introduced, and the melt is blown with air in order to reduce the iron oxide which has been formed and thus restore the fluidity of the molten mass.—A. S.

Nitrous and nitric oxides; Manufacture of ——. R. P. Pictet. Fr. Pat. 415,594, April 19, 1910.

See Ger. Pat. 226,867, preceding abstract. In the apparatus described, a mixture of oxygen (about 55 per cent.) and nitrogen (45 per cent.) is forced into a suitable vessel, at one end, through a central tube, and this tube is surrounded by an inner and outer ring of concentrically flattened tubes, through which acetylene and pure oxygen respectively are admitted; a horizontal flame is thus produced, into which, at the previously determined zone, numerous jets of water or other liquid (for instance, one capable of reacting with nitrous oxide) are projected, the liquid and gases escaping from the farther end of the vessel; a yield of about 25 per cent. of nitrous oxide is said to be obtained. Similarly, the point chosen for cooling the flame may be that at which the maximum yield of nitric oxide is obtained, and the mixture to be heated may consist of oxygen and nitrous oxide. —F. Sodn.

Sulphur dioxide, sulphuric anhydride, and sulphuric acid; Manufacture of ——. R. Messel, London. Eng. Pat. 22,672, Oct. 5, 1909.

See the Fr. Pat. of this invention 414,387 of 1910; this J., 1910, 1203.—T. F. B.

Sulphur dioxide; Process and apparatus for recovering separately gases rich in, and gases poor in ——, in roasting or oxidising processes. F. von Schlippenbach. Fr. Pat. 415,920, Nov. 30, 1909. Under Int. Conv., May 24, 1909.

See Eng. Pat. 28,755 of 1909; this J., 1910, 1165.—T.F.B.

Phosphoric acid; Manufacture of ——. M. Dittmar, Wülfel, Germany. Eng. Pat. 8094, April 4, 1910. Under Int. Conv., Nov. 6, 1909.

See Fr. Pat. 414,521 of 1910; this J., 1910, 1203.—T.F.B.

Ammonia; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 17,642, July 29, 1909.

See Fr. Pat. 411,446 of 1910; this J., 1910, 949.—T. F. B.

Ammonium chloride; Manufacture of —— from ammonium sulphate and common salt. F. A. Freeth, Great Crosby, and H. E. Cocksedge, London. Eng. Pat. 26,263, Nov. 12, 1909.

See Fr. Pat. 414,682 of 1910; this J., 1910, 1204.—T.F.B.

Nitrogen oxides; Manufacture of ——. F. Häusser, Nurnberg, Germany. Eng. Pat. 27,826, Nov. 29, 1909.

See Ger. Pat. 216,518 of 1907; this J., 1910, 25.—T. F. B.

Nitrites [and nitrates]; Process for making pure —— by absorption of nitrous gases. Salpetersäure Ind.-Ges. Fr. Pat. 415,749, May 9, 1910.

See Eng. Pat. 9884 of 1910; this J., 1910, 1157.—T. F. B.

Iron pickling liquor and gas liquor; Recovery of valuable products [ammonium salts and iron compounds] from ——. F. J. Falding, New York, and W. R. Cathcart, Hackensack, N.J., U.S.A. Eng. Pat. 11,364, May 7, 1910.

See U.S. Pat. 961,764 of 1910; this J., 1910, 870.—T. F. B.

Aluminium-nitrogen compounds ; Process for making ——. O. Serpek. First Addition, dated July 6, 1909, to Fr. Pat. 367,124, June 13, 1906.

See Eng. Pat. 15,995 of 1909 ; this J., 1910, 25.—T. F. B.

Aluminium nitride ; Process of making ——. O. Serpek. Fr. Pat. 415,216, July 6, 1909.

See Eng. Pat. 15,996 of 1909 ; this J., 1909, 1198.—T.F.B.

Ammonia from aluminium nitride ; Process of making ——. O. Serpek. Fr. Pat. 415,252, July 7, 1909.

See Eng. Pat. 15,997 of 1909 ; this J., 1909, 1126.—T. F. B.

Silicon carbide ; Process for making ——. The Carborundum Co. Fr. Pat. 414,923, April 19, 1910.

See U.S. Pat. 965,142 of 1910 ; this J., 1910, 1057.—T. F.B.

Silicon carbide ; Manufacture of ——. The Carborundum Co. Fr. Pat. 414,946, April 20, 1910.

See U.S. Pat. 949,386 of 1910 ; this J., 1910, 353.—T. F. B.

Oxygen and nitrogen from the air ; Separation of ——. La Soc. l'Air Liquide, Paris. Eng. Pat. 7305, March 23, 1910. Under Int. Conv., March 24, 1909.

See Fr. Pat. 410,967 of 1909 ; this J., 1910, 949.—T. F. B.

VIII.—GLASS ; CERAMICS.

Metallic sulphides ; Mirrors of ——. O. Hauser and E. Biesalski. Chem.-Zeit., 1910, 34, 1079.

Thiourea in aqueous or alcoholic solution is decomposed by alkalis, with production of hydrogen sulphide ; and if metallic salts, especially lead salts, be present in solution, the sulphides formed are deposited on glass as closely adhering films. For example, a glass plate 9 by 12 cm. is supported on four paraffin blocks in a developing dish ; a solution of 1 grm. of thiourea in 50—75 c.c. of water is poured over it, then 50—75 c.c. of a dilute solution of lead acetate are added, and finally 25—50 c.c. of dilute sodium hydroxide solution or ammonia. In half an hour or more, the glass plate is coated on both sides with lead sulphide ; it is now washed with water and dried, and the upper coating rubbed away, leaving the other as a mirror under the glass.—J. T. D.

Enamel ; The stiffening of water-ground —— by chemical means. J. Grünwald. Sprechsaal, 1910, 43, 594—596.

The addition of 4—8 per cent. of clay to an enamel in slop increases its power of suspension by stiffening, and also renders the enamel more tenacious after firing. These properties may sometimes be further developed by the addition of electrolytes, whether acids, bases, or salts, such as hydrochloric acid, salt, magnesium sulphate, sodium sulphate, borax, calcined magnesia, ammonium chloride, sodium or ammonium carbonate. For the undercoat, cobalt chloride solution is useful. It is essential that clay should be present in the enamel, so that the colloids may be acted on by the electrolyte. The best agents are ammonium carbonate, burnt magnesia, and borax. Chlorides and sulphates tend to liberate free acid in the subsequent firing and this attacks the bases in the enamel forming rough spots. In fact, it is better, where possible, to avoid the use of chemical agents (*Stellmittel*) and to rely for good results on the addition of clay, the avoidance of too much water in the slop, and on the keeping of the ground enamel in tubs for a week or more.—H. H. S.

Greek vases ; Composition of ——. W. Foster. J. Amer. Chem. Soc., 1910, 32, 1259—1264.

The author quotes experiments to show that the black glaze of the Attic styles of vase is due to ferrous iron probably as silicate, while the red glaze of the Mycenaean style is possibly due to ferric iron. These opinions have been supported by independent synthetic experiments. Complete analyses of vase fragments show that the Mycenaean pottery is much poorer in silica and richer in lime and therefore more fusible than the Attic.—W. H. P.

Crystallisation of melted lead silicates. Hilpert and Nacken. See VII.

Patents.

Glass ; Method of and apparatus for drawing ——. R. L. Frink, Cleveland, Ohio. U.S. Pat. 972,613, Oct. 11, 1910.

The method of drawing glass articles from a bath of molten glass consists in regulating the speed of drawing to correspond with changes in the temperature of the bath. This is effected by including a thermo-sensitive device, such as an expansive fluid thermometer, in the mechanism governing the raising of the bait or drawing pot.—H. H. S.

Glass ; Method of drawing ——. R. L. Frink and F. J. Frink, Lancaster, Ohio. U.S. Pat. 972,616, Oct. 11, 1910.

A metallic bait member is raised from a bath of molten glass, the drawn glass being maintained at a desired temperature by an electric current through the bait member. If the member has a coefficient of expansion different from that of glass, the latter may be prevented from rupturing by maintaining it at a temperature above its point of setting. To make glass cylinders, a circular bait member is used, the temperature is kept up by a current until desired, when the cylinder is severed from the bait by interrupting the current.—H. H. S.

China clay ; Kilns for treatment of ——. P. Westacott, Plymouth. Eng. Pat. 29,694, Dec. 18, 1909.

To reduce ground area and to avoid waste of heat, silos and other receptacles for storing moist clay are arranged above the kiln floor, and means are provided for discharging the contents on to the floor. The kilns are built in pairs and may also be arranged in a circle to reduce the loss of heat.—H. H. S.

Crucibles and retorts for zinc furnaces, retorts for the distillation of coal and other products ; Hydraulic apparatus for producing —— and for producing other hollow earthenware articles. E. Dor-Delattre, Dorplein, Holland. Eng. Pat. 14,897, June 21, 1910. Addition to Eng. Pat. 7766, April 2, 1904.

The patent relates to modifications of the apparatus described in the chief patent (this J., 1904, 607). The draw-plate of the press is fixed instead of being movable and is made of greater height ; the paste or earthenware cylinder is movable vertically, being carried by the plungers of a hydraulic press. When the cylinder is in its highest position, a platform carried by it is on the same level as a track along which travel trolleys carrying the paste or material to be compressed. A trolley is moved on to the platform, and then the cylinder is lowered until the charge of material can be moved horizontally from the trolley into the space between the top of the cylinder and the draw-plate above, after which the cylinder is raised again.—A. S.

Refractory ceramic materials for the isolation of sound, cold, and heat, and for light constructions. A. Bigot. Fr. Pat. 414,913, April 18, 1910.

Instead of employing kieselguhr, diatomite, and other fossil earths, for the manufacture of light constructions, amorphous silicious materials such as vierzonite are used. They may be distinguished from fossil remains under the microscope ; they are less costly, absorb less water, and shrink less on drying and firing. Clay may be added, to the extent of 20 per cent., to induce plasticity. The articles are fired at a low red heat, wood and other combustible materials being added in the mixing to reduce the density of the product. A brick of this material, 2 inches in thickness and of density 0·4, would have a resistance of 200 lb. per square inch. The product may be employed as a light building material or as a jacket proof against the transmission of heat or sound.—H. H. S.

Refractory bricks for cupels, retorts, and converters; Manufacture of ——. Phönix Schamotte und Dinas-Werke, Ges. m. b. H. Fr. Pat. 415,251, April 27, 1910.

Clay, graphite and sand are used precisely as in the manufacture of graphite crucibles, in order to make durable linings for retorts, converters, and the like. —H. H. S.

Glass; Electric furnace for the continuous manufacture of ——. M. Sauvageon, Colombes, France. U.S. Pats. 972,778 and 972,779, Oct. 11, 1910.

See Fr. Pat. 401,744 of 1908; this J., 1909, 1130.—T.F.B.

IX.—BUILDING MATERIALS.

Mortar; The examination of ——. W. Vaubel. Chem.-Zeit., 1910, **34**, 1058—1061.

The author discusses the properties and composition of the various materials used in the manufacture of mortar, and refers particularly to the volume-weights of the materials in the form in which they are used. With regard to the preparation of mortar the author makes the following remarks:—(1) The lime and cement should fill the interstices between the grains of sand, and every sand-grain should be surrounded with a thin coat of lime. (2) A contraction takes place when the sand and lime are mixed. (3) Cement which has already begun to set cannot be rectified by the addition of water.—T. St.

Patents.

Wood; Impregnating ——. W. B. Chisolm, Charleston, S.C. U.S. Pat. 965,154, July 26, 1910.

The wood is treated so as to impregnate its pores with an aqueous solution, preferably boiling, containing an excess of alkali, such as calcium hydroxide, sufficient to hydrolyse the cellulose and partially gelatinise the lignin, the solution containing also free and combined sulphur.—B. N.

Bricks; Process of moulding ——. H. Schulte-Steinberg, Düren, Germany. U.S. Pat. 971,693, Oct. 4, 1910.

See Fr. Pat. 400,558 of 1909; this J., 1909, 1037.—T.F.B.

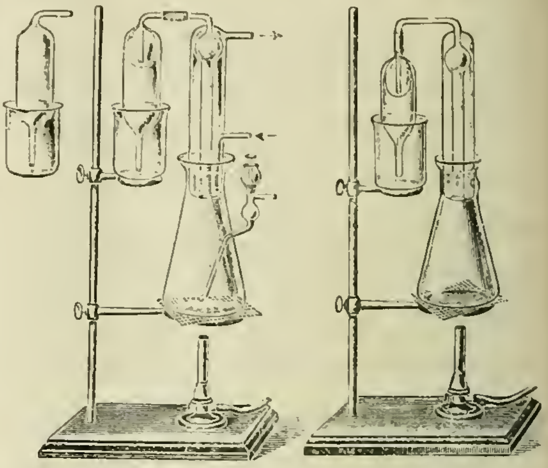
Testing cements, etc.; Apparatus for ——. T. Smith and G. T. Edwards. Fr. Pat. 415,501, May 3, 1910.

See Eng. Pat. 16,588 of 1909; this J., 1910, 820.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron and steel; Apparatus for determining carbon, arsenic, and sulphur in ——. G. Preuss. Z. angew. Chem., 1910, 23, 1980—1981.

The apparatus shown in Fig. 1 is suitable for the determination of sulphur, carbon, and arsenic in iron or steel. The complete apparatus is used for the sulphur determinations; the tube attached to the right side of the flask serves for the introduction of acid, whilst the small side-tube attached to it is connected with a carbon dioxide generator (in the case of carbon determinations, a potash tube to supply air free from carbon dioxide is connected with this tube). The condenser is ground into the neck of the flask, its water inlet passing down nearly to the bottom of the condenser. The gases generated pass up the wide condenser tube, which is enlarged to form a bulb at the top, so that all the steam is condensed. The pipette contains a bulb, near the top of which is a small round gas exit: this bulb is half filled with water, to absorb the greater part of the hydrochloric acid vapours. When the apparatus is to be used for the determination of arsenic, the simple pipette shown to the left of Fig. 1 is used in place of the absorber-pipette; this pipette has a capacity of about 250 c.c., and dips into a beaker containing about 200 c.c. of water. Fig. 2 shows a simplified form of apparatus for the determination of sulphur; the condenser is ground into the neck of the flask, and, instead of having side tubes, is provided with two holes in its casing which serve as inlet and outlet, the latter being normally closed by contact with the neck of the flask: the water is introduced into the condenser by means of a wash-bottle. To use the apparatus, the condenser is removed from the flask (the pipette-absorber having been half filled with water as before) and is replaced immediately after the decomposing solution is run into the flask: the vacuum produced in the flask will only cause the water from the pipette absorber to enter the flask, the absorbing liquid in the beaker not being sufficient to fill the pipette. If it is desired to drive the last traces of hydrogen sulphide into the pipette (where the cadmium-zinc acetate method has been used), the condenser casing is filled with sodium bicarbonate solution, which can be made to run into the decomposition flask by turning it until the enlarged part of the neck of the flask comes opposite the lower opening of the condenser, as shown in the figure.—T. F. B.



Ferro-vanadium; Determination of aluminium and chromium in ——. W. Trautmann. Stahl u. Eisen, 1910, **30**, 1802—1803.

After fusing about two grams of the finely powdered alloy in a nickel crucible with equal parts of sodium hydroxide and peroxide, the cooled crucible contents are extracted in a covered beaker with hot water, the melt dissolving in a few seconds. The solution is then diluted to about 500 c.c., treated with hydrochloric acid and filtered. The filtrate is neutralised by ammonia, a few drops of hydrogen peroxide added, and after boiling, filtered from the precipitated aluminium hydroxide which is washed with an ammoniacal solution of ammonium nitrate containing hydrogen peroxide. To remove the last traces of vanadium it is redissolved in hydrochloric acid, and reprecipitated by the ammoniacal ammonium nitrate containing hydrogen peroxide, and the precipitated aluminium hydroxide well washed with the same solution to remove chlorides. After ignition any traces of silica are removed by hydrogen fluoride. The chromium is estimated by acidifying the filtrate from the peroxide fusion with sulphuric acid, and after reducing the boiling solution with sulphur dioxide, the chromium hydroxide is precipitated by ammonia. This precipitate contains from two to three per cent. of vanadium which is removed

by redissolving in sulphuric acid and again precipitating by ammonia. The presence of chromium vitiates the titration of the vanadium and its removal is necessary.
A. H. C.

Iron; Rusting of different sorts of —— in moist air. K. Arndt. Chem.-Zeit., 1910, **34**, 1078—1079.

The analysis of the three metals used by the author (this J., 1910, 633) gave the following results:—

	Cast iron.	Mild steel.	Weldless tube.
Total carbon..	3·52	0·11	0·36
Graphite	3·01	—	—
Silicon	1·91	0·01	0·08
Manganese ...	0·57	0·34	0·39
Phosphorus ..	1·30	0·03	0·10
Sulphur	0·13	0·06	0·07

The author has made another set of measurements extending over 122 days, renewing the air every day at first, and every alternate day later, when the oxidation had become less rapid. The volumes of oxygen absorbed were:—

	Cast iron.	Mild steel.	Weldless tabe.
After 3 days	39	42	80
,, 5 ,,	58	82	143
,, 10 ,,	83	168	269
,, 20 ,,	128	327	441
,, 30 ,,	161	437	549
,, 40 ,,	195	525	642
,, 50 ,,	221	596	721
,, 70 ,,	286	731	870
,, 122 ,,	416	949	1132

When taken out, the cast-iron tube was covered both inside and out with little compact pimples of rust, but its general appearance was gray; the other two tubes were much more rusted on the outside than the inside, and the rust was in loose red patches, separated by patches on which the skin had protected the metal from rusting. The curves drawn from the experimental figures show a large number of maxima and minima, which the author attributes to the condensation of water on the metal and its subsequent evaporation, consequent on alternations of temperature.—J. T. D.

Copper; Influence of impurities on the properties of ——. F. Johnson. Met. and Chem. Eng., 1910, **8**, 570—575.

The author gives a brief account of the effects of traces of silver, bismuth, aluminium, nickel, cobalt, lead, antimony, tellurium, iron, tin, sulphur, and oxygen on the physical properties of copper and the modifying influence of small amounts of arsenic. The effects of silver, bismuth and aluminium, have been already described (see this J., 1910, 1162). Nickel is found to increase the strength, toughness, and resistance of copper to deformation at high temperatures, but where arsenic is present, as little as 0·1 per cent. of nickel seriously hardens copper that has to be subjected to severe working. Cobalt behaves similarly to nickel in its effect on copper, but is not so sensitive to the presence of arsenic. Antimony, up to 0·5 per cent., hardens and strengthens copper if a small percentage of oxygen is present, and other impurities are absent, but in the absence of oxygen the ductility of the copper is much impaired. The presence of 0·2 per cent. of tellurium reduces the tensile strength 25 per cent. and the elongation 50 per cent. Low percentages of tin improve the tensile strength, ductility, and resistance of copper to corrosion at high temperatures. Iron strengthens and toughens copper, and 1 per cent. causes it to be feebly magnetic, but renders it also less fluid. The effect of arsenic and oxygen is emphasised. The paper is illustrated by microphotographs.—F. R.

Zinc furnace; Condensation of the vapour from the ——. A. Roitzheim. Metallurgie, 1910, **7**, 607—610.

The main object in view when condensing the zinc vapour from the muffle is to avoid the formation of zinc dust, which because of the oxide contained in it cannot be melted down to a compact mass without loss. The various forms of condenser that have been employed are described, and it is pointed out that the condenser should be so shaped as to be a receptacle for the molten zinc, and should be so heated that its temperature falls gradually from that of the muffle at one end to a little above the temperature of molten zinc (500° C.) at the outlet. The dilution of the vapour by carbon monoxide does not affect the condensation although the gas is said to have an influence on the structure of the zinc obtained.—A. H. C.

Silver-cadmium alloys; Equilibrium diagram of ——. G. Bruni and E. Quercigh. Z. anorg. Chem., 1910, **68**, 198—206.

A thermal study of the silver-cadmium alloys indicate the existence of two compounds, AgCd (m. pt. 709—712° C.) and $AgCd_4$ (m.pt. 545° C.), both of which form continuous series of mixed crystals with silver (from 0 up to 80 atoms of cadmium per cent.). There is also a second series of mixed crystals from 87 to 100 atoms of cadmium per cent. The alloys between 80 and 87 atoms of cadmium per cent. consist, in the solid state, of a conglomerate of the compound, $AgCd_4$, and the end member of the series of mixed crystals rich in cadmium. (Compare this J., 1904, 1149.)—A. S.

Speiss and its utilisation. C. Guillemain. Metallurgie, 1910, **7**, 595—602.

Previous work by the author is referred to in detail, and it is shown that if the speiss be mixed with powdered limestone and roasted in a Bessemer roaster, the bulk of the arsenic and antimony is eliminated, thus concentrating the nickel and cobalt as well as the lead, copper, and other values. Slaked lime is not so efficacious as limestone, the evolution of the carbon dioxide helping to carry off the arsenic and antimony. The paper is largely a theoretical discussion, and short methods of analysis are given.
A. H. C.

Chromium; Alloys of nickel and cobalt with ——. E. Haynes. J. Ind. Eng. Chem., 1910, **2**, 397—401.

By heating a mixture of the oxides of nickel and chromium with powdered aluminium in a crucible lined with aluminium oxide, the author has obtained a nickel-chromium alloy which exhibits a fine lustre when polished. When the chromium-content much exceeds 10 per cent., the alloy is very resistant to chemical reagents, especially nitric acid. The author has obtained small quantities of a cobalt-chromium alloy by a similar method, and larger quantities of this alloy by fusing a mixture of cobalt and chromium (*e.g.*, 75 per cent. of cobalt and 25 per cent. of chromium). After numerous experiments with various purifying agents, a cobalt-chromium alloy was obtained which possessed an elastic limit of 79,000 lb., a tensile strength of 96,000 lb., an elongation of 3 per cent., and a modulus of elasticity about equal to that of steel. An alloy of 75 per cent. of cobalt and 25 per cent. of chromium, to which small quantities of other metals are added, is hard enough to be used for making edged tools, and is also quite tough. The cobalt-chromium alloy is attacked by hydrochloric and sulphuric acids, but not by nitric acid or caustic alkali, and it is quite indifferent to atmospheric influences. The alloy appears to be extremely suitable for the manufacture of cutlery, standard weights and measures, small tools, etc.—L. E.

Tin; Determination of —— in white-metals by electrolysis. E. Schürmann. Chem.-Zeit., 1910, **34**, 1117—1118.

The author finds it impossible to obtain accurate results with Czerwek's method for the determination of tin in white-metals (see this J., 1906, 829) because (1) the tin phosphate precipitate always contains antimony, and (2) the tin sulphide precipitate cannot be washed free from phosphoric acid. He has therefore modified the method to overcome these difficulties, the tin being finally estimated electrolytically (see this J., 1910, 1110). One grm. of the sample is treated in a beaker of about 800 c.c. capacity with 10 to 15 c.c. of a 50 per cent. solution of tartaric acid, and then 10 to 15 c.c. of nitric acid (sp. gr. 1·4) are slowly added. When the sample is dissolved, the solution is diluted to about 300 c.c., heated nearly to boiling and the tin precipitated by the addition of 10 c.c. of a 25 per cent. solution of disodium phosphate ($Na_2HPO_4+12aq.$) in dilute nitric acid. The volume is made up to 500—600 c.c. with boiling water, and the precipitate allowed to settle on the water-bath. The clear liquid is decanted and the precipitate stirred up with a large volume of a 1 per cent. solution of potassium nitrate in dilute nitric acid. The precipitate is allowed to settle on the water-bath and the clear liquid again decanted. The tin phosphate precipitate, which owing to its slimy nature cannot be washed on the filter paper, is thus almost entirely freed from other metals. The decanted solutions, after being allowed to stand on the water-bath until any precipitate has settled, are carefully filtered, and then the main precipitate is transferred to the filter. The precipitate is not washed, but brought back into the beaker as completely as possible with a spatula. The remaining precipitate is dissolved from the filter paper with 25 c.c. of a warm $N/1$ solution of potassium hydroxide, the same alkali serving to dissolve the main precipitate. The filter is well washed with hot weak alkali. The solution is neutralised with oxalic acid, of which an excess of 5 grms. is added. It is then made up to about 300 c.c., heated to boiling, and any antimony or copper present is precipitated by a brisk stream of sulphuretted hydrogen. The filtrate from the sulphides of copper and antimony is concentrated to about 150 c.c., neutralised with 80 per cent. potassium hydroxide solution, and 5 c.c. excess alkali added. The tin in the solution is then obtained by electrolysis in a Frary or other suitable apparatus. Where an ordinary form of apparatus is used, the beaker containing the electrolyte must be placed in a vessel of water, owing to the amount of heat developed. Tin in tin-metal can be determined directly by this method. The author gives figures to demonstrate the accuracy of the process.—T. St.

Tin antimony alloys ; Analysis of ——. L. W. McCay. J Amer. Chem. Soc., 1910, 32, 1241—1248.

The author has further developed his method of separating tin and antimony (this J., 1910, 376). He recommends preliminary heating with concentrated sulphuric acid which, unless there is more than 50 per cent. of lead, converts all the metals to sulphates. Dilute hydrofluoric acid is then added which converts the antimony and tin to soluble fluorides. The lead sulphate is filtered off (using a paraffined funnel), the filtrate is diluted further, and hydrogen sulphide passed for about an hour. The antimony sulphide is removed by filtration and tin estimated in the filtrate in the usual way. (See also this J., 1910, 952.)—W. H. P.

Iron ; Behaviour of —— *with solutions of stannous salts.* A. Thiel and K. Keller. Z. anorg. Chem., 1910, **68**, 220—235.

The supposed fact observed by N. W. Fischer in 1825 that tin is not precipitated by iron from a stannous solution, has been used for the separation of tin and antimony, the latter metal being precipitated, and has even been recommended for quantitative purposes. Since this supposed behaviour is quite at variance with the electrochemical properties of iron and tin, the authors have made a chemical and electrochemical study of the question. Their results indicate that in stannous solutions containing not too much free acid (less than $3N$ under the experimental conditions), iron, although apparently unaltered, becomes coated superficially with a thin, closely-adherent layer of a tin-iron alloy or pure tin, which prevents further solution of the iron. Under suitable conditions, using a large quantity of iron turnings, the deposited tin can be subsequently detected analytically.—A. S.

Strontium ; Metallic ——. B. L. Glascock. J. Amer. Chem. Soc., 1910, 32, 1222—1230.

The author describes a large number of experiments made under varying conditions with the object of obtaining metallic strontium by the electrolysis of molten strontium chloride. A simplified form of Goodwin's apparatus (this J., 1905, 1179), which worked admirably for calcium, did not produce any strontium, the metal generally burning or reacting with the electrolyte instead of adhering to the cathode. The final process consisted in fusing pure strontium chloride in a hemispherical iron cathode vessel 25 cm. diameter with walls 0·6 cm. thick, with a carbon anode 8 cm. × 8 cm. This allowed a low anode current density and avoided overheating. With a current of 125 amps. and 40 volts for 7 hours, as much as 76 grms. of metal could be removed in small lumps weighing up to 3 grms. and occasionally as much as 8 grms. each. The yield is decreased by passing the current longer than 6—8 hours, the best percentage yield being obtained with only two hours electrolysis (29·5 grms., 135 amps., 35 volts, 6·7 per cent. efficiency). The metal is best removed from the mixture by crushing on an iron plate and then sifting away the chloride, etc. Analysis of the product showed it to contain about 98 per cent. of metallic strontium, which is a light metal with a silvery lustre when cut, gradually becoming yellow and finally white and non-lustrous. It is softer than calcium and can be cut easily with a knife. It reacts with water, alcohol, ethyl malonate and acetoacetate, and with aniline, in each case evolving hydrogen. It alloys with iron and dissolves very readily in liquefied ammonia giving a deep blue solution. Strontium burns in an atmosphere of carbon dioxide and illuminating gas as readily as it does in air, but not so readily as calcium does. Hydrogen and nitrogen unite with the heated metal. The specific gravity is 2·55, and the specific heat 0·0742 (mean value), corresponding to an atomic heat of 6·5. The alloy with iron which can be obtained very readily without the application of pressure and far below the fusion point of iron, decomposes water readily and is rather hard. The author's alloy contained 23 per cent. of strontium.—W. H. P.

Crystallisation of melted lead silicates. Hilpert and Nacken. *Sec* VII.

Conditions affecting the electrolytic determination of copper. Blasdale and Cruess. *See* XXIII.

Non-ferrous metallurgy ; Department of —— *at Sheffield University.* Times, Eng. Suppl., Oct. 26, 1910. [T.R.]

In his inaugural presidential address to the Electro-metallurgical Society of Sheffield, Prof. J. O. Arnold stated that the University contemplated the establishment of a department for the study of non-ferrous metals, at a cost of £10,000. The University authorities had already provided a Kjellin non-ferrous crucible, with the aid of which a series of tests would be made as to the relative merits of coke and electric melting of base metal. The University was already in a position to experiment on the electric melting of brasses, bronzes, and German silver.

Monazite and zircon production of the United States. U.S. Geological Survey, 1910. [T.R.]

The production of crude monazite in the United States in 1909 amounted to 1,976,329 lb., averaging about 25 per cent. of monazite. The crude concentrates yielded 541,931 lb. of refined sand, valued before cleaning at $65,032 ; of this production, 391,068 lb. came from North Carolina, and the remainder from South Carolina. The imports of monazite and thorite were valued at $8324 in 1909, and those of thorium oxide and other salts (not nitrate) at $19,596, while the thorium nitrate was valued at $236,057. No exports of monazite were recorded. About 2,000 lb. of zircon, value $250, was produced in the United States in 1909, entirely from one mine in North Carolina.

Mineral output of Chile. Board of Trade J., Oct. 20, 1910. [T.R.]

The following are the particulars of the mineral production of Chile in 1909, as compared with 1908 and 1907:—

	1907.	1908.	1909.
Gold .... Grams	1,495,714	818,955	880,995
Silver .... „	18,736,188	43,568,726	35,907,227
Copper .... Kilos.	28,863,100	42,090,731	42,726,145
Coal .... Metric tons	832,612	939,836	898,971
Nitrate .... „	1,846,036	1,970,974	2,101,512
Natural borates .... Kilos.	28,374,098	35,039,038	32,218,042
Guano .... „	7,518,165	870,800	10,691,845

Patents.

Iron; Method of and coating for protecting —— from rust. A. Lang, Karlsruhe, Germany. Eng. Pat. 21,638, Sept. 22, 1909. Under Int. Conv., Sept. 23, 1908.

The surface of the iron or steel is first treated with substances which will give a coating of iron oxide, then with chromic acid, and finally with a mixture of aniline or other dye-producing substance and linseed oil; the aniline is oxidised by the chromic acid to "aniline black" which adheres firmly to the oxide coating. Or, the iron may be treated first with substances which will give a coating of iron sulphide, and then with aniline or the like; in this case a sulphide dyestuff is produced. The different substances may be applied together, and special claim is made for a coating mixture composed of an oxidising agent or a sulphurising agent and an organic dye-producing substance having a reducing action or an organic substance which is converted by sulphur into a dyestuff, together with a binding agent. Such a mixture may, for instance, consist of aluminium sulphide powder, aniline, an aniline salt dissolved in aniline, and linseed oil.—A. S.

Electro-deposition of metals [*iron*]. S. O. Cowper-Coles, London. Eng. Pat. 22,374, Oct. 1, 1909.

The process is for destroying the brittleness of electro-deposited iron or other metals. The iron is deposited preferably on a sleeve fixed on the cathode or mandrel (see Eng. Pat. 3160 of 1908); and the sleeve with the deposit is afterwards immersed partly or wholly, and/or rotated, in a bath of molten lead, in order to expel hydrogen from the deposit and render the latter sufficiently ductile to be removed from the sleeve without cracking or splitting.—A. S.

Zinc ores; Treatment of complex ——. W. Hommel and H. T. Durant, London. Eng. Pat. 18,817, Aug. 16, 1909.

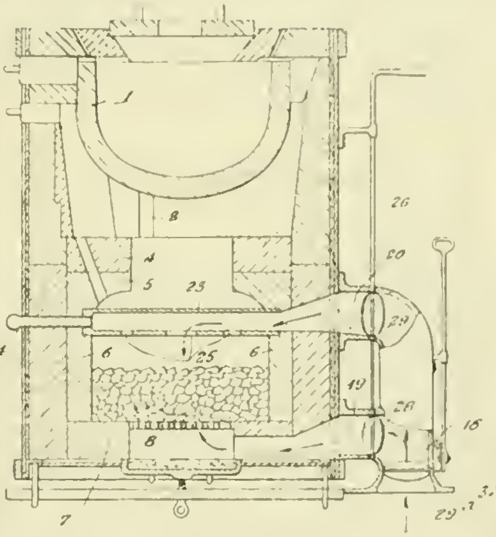
The roasted ore is mixed with water and treated with gases containing sulphur dioxide. The solution, containing the zinc as sulphate and bisulphite, is mixed with chalk or lime and violently agitated. The precipitate of zinc oxide and monosulphite and calcium sulphate and sulphite is separated, and dried, for example, by forming into blocks, with or without the addition of carbonaceous material and fluxes, and exposing to waste fire-gases. The dried material is then treated in a blast-furnace or other blowing furnace for the recovery of the zinc, the residual lime being used again in the process. The carbonaceous material may be added in the blast-furnace or it may be added to the zinc solution with the lime. When the zinc oxide recovered from the blowing furnace contains some monosulphite, it is either heated to expel sulphur dioxide, or the sulphite is oxidised to sulphate, and the latter dissolved out.—A. S.

Zirconium and other rare metals; Production of ——. H. Kuzel, Baden, Austria, and E. Wedekind, Strassburg, Germany. Eng. Pat. 23,215, Oct. 11, 1909.

The oxides of zirconium, thorium, titanium, cerium, vanadium, uranium, chromium, tungsten, and molybdenum, in a finely-divided condition, are mixed with metallic calcium, also in a finely-divided condition, and reaction is started by heating, or by means of a spark, etc., preferably *in vacuo*. When the reaction is complete, the product is cooled, and treated with water and then with dilute acid, and the residue is powdered, collected on a filter, and washed with water, alcohol, and ether. In the case of some of the metals, such as titanium, oxygen and nitrogen must be excluded throughout the process. It is stated that metallic zirconium of 97—98 per cent. purity is obtained by this process.—A. S.

Furnace; Crucible ——. L. Rousseau, Argenteuil, France. Eng. Pat. 27,600, Nov. 26, 1909. Addition to Eng. Pat. 6028 of 1908, dated March 20, 1907 (see Fr. Pat. 375,913 of 1907; this J., 1907, 1014).

The crucible, 1 (see fig.), is supported by radial members, 2, which are fixed upon the lining of the surface and upon an annular crown, 4, underneath. The crown rests upon an arch, 5, formed by a double lining, 6, of refractory material, the whole being supported upon the furnace-bottom, 7. The charging of the furnace is effected by means of an inclined shoot (not shown) arranged at the side and entering the furnace immediately below the arch, 5; this shoot is closed, when not in use, by a cover, the joint being rendered impermeable by means of a lining of asbestos. The air necessary for the combustion is introduced from a pipe, 18, which divides into two branches, one of which, 19, enters the furnace below the grate, 8. The other branch, 20, passing through the wall immediately below the arch, is extended across the furnace above the bed of fuel by means of a tube, 23, of refractory material, preferably plumbago, perforated underneath with holes, 25. The other end of this tube is connected at the opposite side of the furnace with a pipe, 24, which passes around the exterior and rejoins the air-admission pipe, 20. In this way, a current of hot air is admitted to the chamber in a direction opposed to the upward draught, so that a perfect mingling and combustion of the gases is obtained. The air-admission-pipe, 18, is provided with an adjustable damper, 29ª, and in the branches, 19 and 20, are dampers, 28 and 29, keyed on a single rod, 26, at right angles to one another so that when the aperture of one of the conduits is increased, the other is diminished. The furnace is provided with trunnions (not shown), on which it can be oscillated when necessary for the pouring of the metal, the flange, 37, at the lower end of the air-pipe, 18, being lifted away from the upper edge of the fixed air-conduit.—C.A.W.



Furnaces; Metallurgical ——. J. Härdén, London. Eng. Pat. 3739, Feb. 15, 1910.

One or more composite terminal plates or electrodes of the kind described in Eng. Pats. 26,251 and 26,266 of

1909 (this J., 1910, 763; 885) are built in the walls of an open-hearth or other gas-heated furnace, or a Bessemer converter for the manufacture of steel, in order that after decarburisation, dephosphorisation, and oxidation have been effected in the usual manner, electrical heating may be used to supplement or replace the ordinary method of heating in the subsequent desulphurisation and deoxidation, and expulsion of occluded gases from the molten metal.—A. S.

Granulating blast-furnace slag; Apparatus for ——. W. R. Warren, New York. Eng. Pat. 4692, Feb. 24, 1910.

The apparatus is of the type in which molten slag is fed on to the surface of a rotating drum provided with longitudinal corrugations, between which are perforations or slits. Liquid introduced into the interior of the drum is forced through the slits by centrifugal force and effects the granulation of the slag. In order to obtain more intimate contact between the liquid and the slag, the drum is provided at each end with a flange projecting from its surface, the two flanges being inclined in opposite directions and having annular outlet orifices through which liquid is discharged on to the particles of slag thrown from the surface of the drum.—A. S.

Filtering apparatus particularly adapted for use in the cyanide process of extracting precious metals from their ores. W. W. Robacher. Rochester, N.Y., U.S.A. Eng. Pat. 16,161, July 6, 1910. Under Int. Conv., May 13, 1910.

The patent relates to filtering apparatus for use in the process described in Eng. Pat. 1582 of 1908 (see U.S. Pats. 880,821 and 887,268 of 1908; this J., 1908, 340, 618). The apparatus consists of a hollow, rotating, slightly tapering drum, having a peripheral wall of rigid, porous, filtering material. At the larger end the drum is closed by a receiving chamber for the filtrate, this chamber being divided by radial partitions into a number of compartments. The drum is mounted on trunnions, that at the larger end being hollow and connected with the discharge pipe from the receiving chamber, which in turn is connected with a suction device. The drum is rotated slowly in the mixture of ore and cyanide solution; the liquid is drawn through the porous wall of the drum, and flows into the receiving chamber through openings near the periphery, and then through ports into the axial discharge pipe. The solid or semi-solid matter on the surface of the drum is removed by a scraper.—A. S.

Tin from tin scraps; Apparatus for extracting ——. E. C. Higgins, Bayonne, N.J., Assignor to A. D. Britton, Brooklyn, N.Y. U.S. Pat. 965,580, July 26, 1910.

The apparatus consists essentially of a basket mounted on a water-jacketed, vertical bearing so as to rotate within a double-walled receptacle, the space between the walls being preferably filled with a non-heat-conducting material. A combustion chamber is mounted centrally within the basket. The latter has a false bottom, the space below which acts as a heat-radiating chamber, whereby heat is supplied to the tin scrap in the basket from below as well as laterally from the walls of the combustion chamber. Fuel and air are supplied to the combustion chamber through concentric pipes passing upwards through the vertical bearing, and the basket is rotated at 650 revolutions per minute. The tin is melted and is thrown by the centrifugal force through the walls of the basket into the outer receptacle, from which it may be removed as desired. —A. S.

Detinning; Process of ——. F. von Kügelgen, Holcombs Rock, Va., and G. O. Seward, East Orange, N.J., Assignors to Tin Products Co., New York. U.S. Pat. 972,135, Oct. 4, 1910.

The scrap is treated in a closed vessel with dry chlorine, the temperature outside the vessel being kept at about 100° F. The iron is not attacked, but the tin forms stannic chloride which condenses to a liquid and is drained off. —A. S.

Flux for brass plating and for protecting a bath of copper or zinc. W. S. Rockey and H. Eldridge, New York. U.S. Pats. 971,563 and 971,564, Oct. 4, 1910.

Boric acid is melted in an iron pot lined internally with silver and is heated at a low temperature until no more steam is evolved. It is then transferred to a suitable crucible and heated at a white heat until it becomes placid, after which it is allowed to cool to a bright red heat, and a sufficient quantity of finely divided zinc, carbon, cadmium, antimony, bismuth, or other suitable element, added to decompose any remaining water of constitution, the mass being stirred until all reaction ceases. The product is suitable as a flux for brass-plating. To obtain a flux for protecting a bath of copper or zinc, silica is added to the fused boric acid just before the zinc or other element added to decompose the last traces of water, and the final product is heated to a high temperature so as to obtain a boro-zinc silicate.—A. S.

Alloy and method of making same. L. C. Dodd, Buffalo, N.Y. U.S. Pat. 971,669, Oct. 4, 1910.

The alloy is composed of copper and lead in nearly equal quantities, together with a quantity of iron not exceeding 3 per cent. of the whole. The alloy may also contain small quantities of manganese (up to 2 per cent.) and zinc (up to 8 per cent.).—A. S.

Autogenous welding, cutting, or soldering metals; Method of ——. B. Hoffmann, Griesheim, Assignor to Chem. Fabr. Griesheim Elektron, Frankfort, Germany. U.S. Pat. 972,079, Oct. 4, 1910.

Ethane is used as principal combustible substance.—A. S.

Autogenous welding, soldering, and cutting metals; Process for ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 416,001, May 14, 1910. Under Int. Conv., May 17, 1909.

See U.S. Pat. 972,079 of 1910; preceding. Propane may be used in place of ethane.—T. F. B.

Ores; Method of treating ——. C. E. Baker, Chicago, Ill. U.S. Pat. 972,149, Oct. 11, 1910.

Mixed sulphide and oxide ores are treated with a gaseous mixture containing hydrochloric acid, chlorine, and oxygen, the chlorine being present is sufficient quantity to convert the sulphides into chlorides. A method of carrying out the process is to treat the ore with an excess of chlorine, in presence of moisture, under such conditions that a portion of the chlorine is converted into hydrochloric acid.—A. S.

Metals; Art of hot-working ——. J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pat. 972,559, Oct. 11, 1910.

A process of hot-working ferrous metals susceptible to oxidation or other contamination or deterioration at high temperatures is described. A clean surface is produced on the metal, and this exposed surface is then provided with a cast-on coating of an unlike and less sensitive metal, for example copper (see following abstracts). The coated metal is heated and subjected to hot-working, then cooled, and the coating removed by means of a solvent. —A. S.

Coated metal objects; Method of and apparatus for producing ——. J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pats. 972,561 and 972,629, Oct. 11, 1910.

The process consists in heating a metal article while submerged in a bath of fused protective material, then transferring the article with some of the protective material into a mould, the article being kept submerged, and afterwards pouring a second metal in a molten condition into the mould into contact with the metal article, and allowing it to solidify. Two different forms of apparatus are described. In one, the hearth of a furnace is provided with two adjacent depressions containing the fused protective material, and in which the metal articles to be coated are heated. The lower of the two depressions has an inclined floor and its outlet registers with the mouth of a mould, which can be tilted. When the article and the protective material have been transferred to the mould, the latter is disconnected from the furnace by tilting, and the second molten metal poured in.—A. S.

Compound metal bodies; Process of making ——. J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pat. 972,630, Oct. 11, 1910.

The process is for "weld-uniting" ferrous metals to non-ferrous ("cupriferous") metals having a melting point above 900° F. The ferrous metal is heated to a temperature far above the melting point of the non-ferrous metal under such conditions that its surface remains clean, and is then immersed in a mass of the molten non-ferrous metal, and the latter allowed to solidify.—A. S.

Converter. W. J. Murphy and A. E. Culley, Butte, Mont. U.S. Pat. 972,564, Oct. 11, 1910.

Fluxing material is introduced through conduits so disposed that the material forms a protective lining on some of the walls of the converter. The charge in the converter is agitated as usual by a blast introduced through tuyères and is directed against the lining of fluxing material by a deflecting rib mounted on the wall of the converter opposite the tuyères.—A. S.

Antifriction alloy. J. R. Stratton, Assignor to R. A. Borden, Moncton, New Brunswick, Canada. U.S. Pat. 972,786, Oct. 11, 1910.

Claim is made for alloys consisting mainly of zinc with varying proportions of lead, tin, copper, and antimony. An alloy consisting of 82 per cent. of zinc, 1·7 of copper, 5·8 of tin, 9·8 of lead, and 0·7 of antimony is specially mentioned.—A. S.

Nickel- and cobalt-matte; Process for the preliminary treatment of —— before smelting. J. Savelsberg. Ger. Pat. 222,231, Jan. 21, 1908.

The matte, in a solid finely divided condition, is "blown" without the application of heat, so as to oxidise the iron, whilst leaving the sulphur content substantially unchanged. Sufficient heat is developed to sinter the charge, which is thus obtained in a suitable condition for the subsequent smelting.—A. S.

Ore products; Apparatus for treating crushed —— for the recovery of the metal contents thereof. A. J. Arbuckle, Belgravia, Transvaal. Eng. Pat. 6977, March 19, 1910.

See Fr. Pat. 414,459 of 1910; this J., 1910, 1211.—T. F. B.

Separation of ingredients of mixed solid materials [ores, etc.]; Process for ——. F. S. MacGregor, Hyde Park, Assignor to Huff Electrostatic Separator Co., Boston. U.S. Pat. 972,459, Oct. 11, 1910.

See Fr. Pat. 411,116 of 1909; this J., 1910, 958.—T. F. B.

Ores; Process for separating complex ——. W. M. Martin. First Addition, dated April 16, 1910, to Fr. Pat. 412,984, Feb. 23, 1910. Under Int. Conv., April 20, 1909.

See Eng. Pat. 9300 of 1909; this J., 1910, 825.—T. F. B.

Slags; Utilisation of heat contained in ——. C. Vautin, London. U.S. Pat. 972,418, Oct. 11, 1910.

See Eng. Pat. 3623 of 1909; this J., 1909, 987.—T. F. B.

Metals; Method of separating —— from wet-process liquors. J. H. Thwaites and S. J. Ralph, Peterborough. U.S. Pat. 972,584, Oct. 11, 1910.

See Eng. Pat. 4167 of 1909; this J., 1910, 432.—T. F. B.

Crucible furnace. W. Miller, Wellington. U.S. Pat. 972,703, Oct. 11, 1910.

See Eng. Pat. 12,534 of 1908; this J., 1909, 708.—T. F. B.

Aluminium silicate ores; Process of treating ——. The Carborundum Co. Fr. Pat. 414,903, April 18, 1910. Under Int. Conv., May 4, 1909.

See U.S. Pat. 920,518 of 1909; this J., 1909, 944.—T. F. B.

Metals or metalliferous substances; Process for separating non-volatile from volatile ——. T. Huntington. Fr. Pat. 415,519, May 4, 1910. Under Int. Conv., May 24, 1909.

See Eng. Pat. 12,198 of 1909; this J., 1910, 433.—T. F. B.

Induction furnace for metallurgical purposes, and process for working it. The Gröndal Kjellin Co., and J. Härdén. Fr. Pat. 415,563, April 5, 1910. Under Int. Conv., April 5, 1909.

See Eng. Pat. 8194 of 1909; this J., 1909, 1047.—T. F. B.

Producing crucibles and retorts for zinc furnaces and retorts for the distillation of coal. Eng. Pat. 14,897. *See* VIII.

XI.—ELECTRO-CHEMISTRY.

[Laboratory] Furnace for very high temperatures; Convenient and inexpensive ——. D. F. Calhane. Met. and Chem. Eng., 1910, 8, 581—582.

The furnace, which is of the electrical resistance type, consists of a small vertical fireclay muffle standing within an enclosure formed by four fireclay bricks, the space between the muffle and the bricks being filled with a mixture of Portland cement, magnesium oxide, and asbestos. At the bottom of the muffle is placed an alundum block on which rests a graphite crucible 2 in. high. The space between the crucible and the muffle is filled with carbon powder which forms the resistance. A ring of carbon, turned from an electrode end, fits flush at the bottom of the muffle and a second ring is provided just above the top of the crucible. The current enters at the bottom, where it is evenly distributed by the ring, and leaves at the top ring. In order to concentrate the heat on the walls of the crucible, an alundum insulating ring is placed at some distance between the graphite rings, practically dividing the mass of resistance carbon into two portions, thereby causing the current to flow along the sides of the crucible at this point. The crucible also is furnished with an alundum lining to prevent carbon contamination of the metals or alloys treated. The furnace, which has a capacity of one kilowatt, only weighs complete about 25 lb., and is capable of heating from 60 to 70 grms. of metal to temperatures up to 2500° C. The total cost of the furnace, it is stated, should not exceed £1.—F. R.

Nitric oxide formation in high tension arcs. F. Haber, A. Koenig, and E. Platou. Z. Elektrochem., 1910, **16**, 789—796. (See also this J., 1908, 27 and 1070.)

Two further series of experiments are described. The first series with a continuous current arc showed in the authors' apparatus a maximum percentage of nitric oxide (8·16) when the pressure was about 150 mm. At higher pressures the arc did not fill the quartz tube and the water cooling effect was thereby diminished. In the second series with alternating current, the power efficiency was determined. The power factor was ascertained with current of not too high frequency by means of a Dolezalek electrometer. The most favourable yield obtained with 0·7 kilowatt was 57 grms. of nitric acid per kilowatt-hour, the concentration of nitric oxide being 3·4 per cent. Apparently the application of a large amount of electrical energy does not allow of very great deviation from the thermal equilibrium of the reaction under the authors' conditions of pressure.—W. H. P.

Nitric oxide formation from air by alternating current discharges of very high frequency. F. Haber and E. Platou. Z. Elektrochem., 1910, **16**, 796—803. (See preceding abstract.)

For very high frequencies the nature of the discharge renders the usual methods of determining the phase difference and the power factor unreliable, hence the authors had recourse to a calorimetric method with suitably modified apparatus. The discharges used in the investigation had periods of 500 and about 50,000, and were passed through air at atmospheric pressure and at 387 mm. With properly manipulated arcs the yields were about the same both at high and at low frequencies, and although the yields were lower at the lower pressure, it is impossible, in view of the work described in the preceding abstract, to make any general statement as to the influence of pressure which shall be independent of the conditions of experiment.—W. H. P.

Nitric oxide; Yield of —— from air in cooled continuous current arcs. W. Holwech and A. Koenig. Z. Elektrochem., 1910, **16**, 803—810. (See this J., 1909, 520 and 1910, 754.)

By further modifications of the short arc apparatus the authors have shown the possibility of obtaining particularly favourable yields (80 grms. of nitric acid per kilowatt-hour and a concentration of 2·5 per cent. of nitric oxide) when the air is passed rapidly through a narrow (2 mm. wide, 2 cm. long) well-cooled capillary of copper. The heating of the cathode is discontinued and no previous heating of the air is resorted to as in the technical process. The results give further support to Haber and Koenig's view that the equilibrium is primarily electrical, and only becomes thermal at high temperatures.—W. H. P.

Nitric oxide; Formation of —— from air in the arc flame under pressure. F. Haber and W. Holwech. Z. Elektrochem., 1910, **16**, 810—813.

The discharge in air under pressures up to 12 atmospheres gave yields which were no higher than those of Holwech and Koenig with the cooled arc (see previous abstract), while the nitric oxide concentrations were much lower.
—W. H. P.

Nitric oxide; Formation of —— by the combustion of hydrogen. A. Wolokitin. Z. Elektrochem., 1910, **16**, 814—826.

The combustion of hydrogen, like that of carbon monoxide (Haber and Coates, this J., 1910, 20), at high pressures in an equimolecular mixture of oxygen and nitrogen, gives a considerable yield of oxides of nitrogen. Without previous heating about 3 molecules of nitric acid to 100 of water (10 per cent. acid) may be obtained. The effect of pressure only becomes appreciable above 3 atmospheres, and reaches its maximum at about 16 atmospheres. With air the yields are not so good though still appreciable. Mixtures with excess of oxygen behave similarly to the equimolecular mixture. The yields are very similar to those previously obtained by explosion methods (Fincke, this J., 1905, 693; and Pier, Z. Elektrochem., 1909, **15**, 536), though they are somewhat less than those calculated from the known equilibrium data. This may be due to the fact that the theoretical temperature is not attained.
—W. H. P.

Conditions affecting the electrolytic determination of copper. Blasdale and Cruess. *See* XXIII.

Rapid determination of copper, silver, cadmium, and bismuth with mercury cathode and stationary anode. Benner. *See* XXIII.

Patents.

Batteries; Regenerating storage ——. C. Luckow, Cologne, Germany. Eng. Pat. 29,706, Dec. 20, 1909.

The electrolyte is replaced by water, which takes up the residues of the electrolyte in the cell, and a current is passed through the battery in a direction opposite to that of charging until the electrodes are sufficiently transformed. The acidified water is then converted into a concentrated solution of a salt, such as sodium sulphate, and the current passed in the charging direction until the electrodes are re-transformed. A modified process is described in which the salt is added at the moment when the zero point is crossed, during the passage of the current in the charging direction.—B. N.

Thermo-electric couple. A. L. Marsh, Assignor to Hoskins Manufacturing Co., Detroit, Mich. U.S. Pat. 971,767, Oct. 4, 1910.

The negative element consists of a nickel-chromium alloy and the positive element of a nickel-aluminium alloy containing less than 10 per cent. (preferably about 2 per cent.) of aluminium. The couple is stated to have a high E.M.F., whilst the curve representing the relation between E.M.F. and temperature is a comparatively straight line.
—A. S.

Electric-resistance furnaces; Method of charging ——. A. Petersson, Odda, Norway. U.S. Pat. 971,782, Oct. 4, 1910.

See Fr. Pat. 408,397 of 1909; this J., 1910, 638.—T. F. B.

Electric induction and arc furnace. J. H. Reid. Fr. Pat. 415,116, April 22, 1910.

See U.S. Pat. 956,544 of 1910; this J., 1910, 704.—T. F. B.

Electricity; Method of and apparatus for generating ——. B. Schwerin, Frankfort on Maine, Germany. U.S. Pat. 972,029, Oct. 4, 1910.

See Eng. Pat. 10,793 of 1909; this J., 1910, 638.—T. F. B.

Electrolyte for primary batteries; Preparation suitable for making an ——. B. E. R. Newlands and R. M. Parkinson. Fr. Pat. 415,758, May 9, 1910. Under Int. Conv., May 20, 1909.

See Eng. Pat. 11,926 of 1909; this J., 1910, 362.—T. F. B.

Apparatus for purifying liquids by electricity ——. Eng. Pat. 1460. *See* XIXb.

XII.—FATS; OILS; WAXES.

Linolenic acid and linseed oil. E. Erdmann and F. Bedford. Z. physiol. Chem., 1910, **69**, 76—84.

In support of their views upon linolenic acid (this J., 1909, 530, 531), which have been called in question by Rollett (this J., 1909, 1210), the authors cite the results of the following experiment:—Linolenic acid (18·5 grms.) obtained by debrominating pure linolenic hexabromide with zinc and alcohol was again brominated. The yield of solid hexabromide (m. pt. 179° to 180° C.) obtained was 13·07 grms., corresponding to 25·93 per cent. of the original linolenic acid, whilst a fluid bromide, which did not separate on addition of petroleum spirit, remained in solution. When freed from bromine by treatment with zinc and glacial acetic acid, this soluble compound was obtained as an oil with an iodine value of 185·8 and molecular weight of 428. It was again brominated in acetic acid, and on adding petroleum spirit to the liquid, there separated (in addition to a little solid hexabromide, *viz.*, 3·2 per cent. of the oil) a bromide insoluble in petroleum spirit, which when freed from bromine was a viscid oil of an iodine value 109·3 and molecular weight 516; on re-bromination this no longer yielded any solid hexabromide. The explanation offered for these results is that on reducing the pure hexabromide, a mixture of 25 per cent. of α-linolenic and 75 per cent. of β-linolenic acid is obtained, and that the latter on re-bromination only absorbs 4 atoms of bromine. On reducing this fluid tetrabromide, partial polymerisation or formation of anhydride takes place, as is indicated by the decreasing iodine value and increasing molecular equivalent. The production of a small quantity of hexabromide on first re-brominating the oil separated from the soluble bromide is accounted for by the fact that the fluid bromide is able to dissolve a small proportion of solid hexabromide, and that the primary separation is therefore incomplete. The hypothesis of Rollett (*loc. cit.*) has, it is pointed out, no experimental support, whilst, on the other hand, the iodine value that he gives for the liquid fatty acids of linseed oil (234) is contrary to the experience of all previous observers, the highest recorded value being 209·8. The liquid fatty acids of linseed oil examined by the authors had an iodine value of 203·8, whilst the hydrogen value of the ethyl esters of the fatty acids (freed from the saturated fatty acids and bulk of the oleic acid) was 1·452, corresponding to 22 per cent. of fatty acids of the composition, $C_{18}H_{30}O_2$. The theoretical amount of linolenic acid in a mixture of linolic and linolenic acids with an iodine value of 203·8 is 24·4 per cent. Hence, in the authors' opinion, linseed oil fatty acids contain not more than 20 to 25 per cent. of acids of the formula, $C_{18}H_{30}O_2$, with 3 ethylene linkages, and these consist, in the main, if not exclusively of α-linolenic acid yielding, when brominated, the solid hexabromide melting at 179° to 180° C.—C. A. M.

Cocoanut oil; Determination of —— in admixture with butter fat. N. C. Cassal and B. H. Gerrans. Chem. News, 1910, **102**, 190—191.

The method is based upon the titration of the insoluble volatile acids of the fats and accentuates the difference in this respect between butter fat and cocoanut oil to a greater extent than do the methods of Wauters or Polenske. Three grms. of the filtered fat are saponified with 2 c.c. of sodium hydroxide solution (50 grms. in 100 c.c.) and 10 c.c. of absolute alcohol, the alcohol is expelled, and the soap dissolved in 50 c.c. of boiling water. The solution is treated with 10 c.c. of concentrated hydrochloric acid, followed by 50 grms. of anhydrous granulated calcium chloride, and the flask (300 c.c.) connected by means of a bent tube with a Liebig's condenser and by means of a second tube passing nearly to the bottom of the flask with a steam boiler. The end of this tube is slightly turned up and points away from the condenser. The flask is immersed to the level of its contents in a calcium chloride bath which is maintained at 141° to 146° C., and steam is passed through it until 500 c.c. of distillate have passed over. As the distillate leaves the condenser it falls through a filter into a 500 c.c. flask, and when this is filled, the apparatus is disconnected, and the inner tube of the condenser washed with cold water on to the filter, and then washed out with hot methylated spirit. The insoluble fatty acids upon the filter are also washed with cold water, and then dissolved in hot methylated spirit, the solution added to the alcoholic washings from the condenser, and the whole titrated with $N/10$ baryta solution. The mean value for pure butter fat thus obtained was 14·67 c.c., whilst that of cocoanut oil was 66 c.c. Since certain butters gave a result somewhat above 15, the value 16 was chosen as the "titration standard" for genuine butter. In the case of mixtures the percentage of cocoanut oil in the fat taken is calculated from the formula, $(A-16)\times 2=x$, where A represents the titration figure obtained. The results (quoted) obtained with experimental mixtures of butter fat with 10 to 35 per cent. of cocoanut oil were in close agreement with the theoretical amounts, and very concordant in duplicate determinations.—C. A. M.

Fat determination by the Kumagawa-Suto method. Y. Shimidzu. Biochem. Zeits., 1910, **28**. 237—273.

From the results of a long series of experiments which are recorded in the paper, the author is of opinion that the Kumagawa-Suto method (this J., 1908, 455) gives reliable results when applied to the estimation of fat in fresh animal tissues and organs. If the fresh tissues or organs are dried on the water bath prior to the fat estimation, low results are obtained and even if drying is assisted by the addition of alcohol, the loss, when dealing with large quantities (over 400 grms.), may amount to 10 per cent. With small quantities and rapid drying, assisted by alcohol, the loss may be reduced to below 1 per cent. The loss of fat is attributed to oxidation of the fatty acids and if it is desired to obtain the tissues, etc., in the form of a dry powder they should be desiccated in a high vacuum without any application of heat. The Kumagawa-Suto method gives a correct statement of the fat contained in a powder prepared in this way. In the case of blood and its constituents the method does not give good results, it being better to fully extract the fatty materials with cold and hot alcohol followed by saponification of the alcohol residue. The reason for this difference in behaviour is not yet established. —J. A.

Hydrolysis of fats; The action of acids in the enzymic ——. Y. Tanaka. J. Coll. Eng., Imperial University of Tokyo, 1910, **5**, 25—42.

The author's experiments upon the extent of the hydrolysis of soya-bean oil when treated with the lipase obtained from the pressed cake of decorticated castor seeds have led him to the following conclusions:—1. The addition of the proper quantity of acid to the castor seeds is necessary in hydrolysing fats by the latter. The absolute quantity of the added acid is the main factor of the lipolytic activity of castor seeds and its concentration has no marked influence. 2. The amount of acid required for a definite amount of castor seeds is constant and is not affected by the amount of oil with which they are mixed. In the case of mineral and comparatively strong organic acids, the amount of acid which exerts a maximum effect upon the hydrolysis is proportional to their reacting equivalents. Of the less dissociable organic acids, larger quantities are required. 3. An excess of acid exerts a retarding action on the hydrolysis. 4. Castor seeds contain lipase in the form of an insoluble zymogen which can be readily converted by dilute acids into the insoluble enzyme. The acid at the same time combines with certain basic constituents in the seeds, especially nitrogenous matters, to produce soluble neutral compounds. 5. A neutral lipase preparation obtained by treating castor seeds with acid and subsequently washing out the soluble matters with water has a strong power of hydrolysing fats without the use of any acid. Such a preparation is most active in a neutral medium, is less active in the presence of free acid and is inactive in an alkaline medium. 6. Lipase is less stable towards dilute alkalis than is its zymogen.—J. A.

Lipase reactions; Some ——. H. C. Bradley. J. Biol. Chem., 1910, **8**, 251—264.

The author obtained corresponding results when digesting ethyl butyrate and triolein respectively with pancreatic lipase and concludes that such processes are not affected if the zymolyte is only emulsified and not in solution. On digesting triolein with lipase there is no evidence that the loss of enzyme is due to a combination of the two occurring; nor would it appear that the oleic acid produced has any destructive effect upon the lipase. A regular increase in the amount of enzyme present results in an equally regular effect upon the final equilibrium of the reaction. The results do not exhibit a linear relationship, nor can they be expressed by a simple logarithmic function, though both may approximate to the truth in certain limited stages of the reaction. Hamsěk's results with regard to the reversibility of the reaction with lipase in mixtures containing small proportions of water have been confirmed. Experiments showed that synthesis ceased when the amount of water in the mixture amounted to about 50 per cent. and was most complete when the mixture was made as nearly as possible anhydrous.—J. A.

Iron soaps. K. Feist and W. Auernhammer. Arch. Pharm., 1910, **248**, 520—524.

Attempts have been made to form with certain liquid fatty acids an iron salt (soap) which is stable in a solution of cod-liver oil. A ferric stearate was prepared by adding a solution of ferric chloride to stearic acid dissolved in sodium hydroxide solution, the precipitate being filtered off and washed. The salt contains 7·65 per cent. of iron dissolves in fatty oils and chloroform on warming, but separates on cooling. It melts at 103° C. Ferric oleate was prepared in a similar manner from pure oleic acid, but the salt was obtained by extraction with ether instead of by precipitation. It has the composition, $Fe(C_{17}H_{33}COO)_3$, and is soluble in fatty oils, ether, and chloroform in the cold. Commercial oleic acid is unsuitable on account of its taste. Satisfactory iron soaps can be made by first preparing a potassium soap from linseed, sesamé, or almond oil, and then treating this with ferric chloride solution. A formula is given for the preparation of a cod-liver oil containing 1 per cent. of iron as a soap.—F. SHDN.

Wax oil [*Oleum Ceràe*]. T. Ekecrantz and E. Lundström. Arch. Pharm., 1910, 248, 500—513.

IN the production of wax oil by distilling beeswax with lime, variation of the amount of the latter notably influences the breaking down of the constituents having a high carbon content. Increased quantities of lime decrease the formation of substances with a low carbon content. The liquid portion of the oil, whether volatile with steam or not, is a mixture of saturated and unsaturated hydrocarbons. In the portions of the liquid part volatile with steam, the hydrocarbons contain at most 16 carbon atoms in the molecule, whilst the non-volatile portion contains hydrocarbons with 16—27 carbon atoms. The principal constituent of the solid obtained by distilling beeswax with lime is nonocosane, $C_{29}H_{60}$. Part of this solid distillate is soluble in ether, and is a mixture of saturated, and of a small amount of unsaturated hydrocarbons, the number of carbon atoms in the molecule varying between 25 and 29. The sp. gr. of a genuine wax oil should lie between 0·790 and 0·792, the acid value between 8 and 12, and the iodine value between 80 and 90.—F. SHDN.

Emulsification of hydrocarbon oils by means of aqueous solutions of salts of fatty acids. Donnan and Potts. *See* IIA.

Palm oil and gum copal in Sierra Leone. Col. Off. Ann. Ser. No. 648 (see this J., 1910, 1213). [T. R.]

THE exports of palm oil from Sierra Leone during 1909 amounted to 851,999 gallons, of the value of £64,273. This is an increase over the quantity exported in 1908 of 362,362 gallons, to the value of £27,822. The proportion of oil to kernels continues to grow, but not as quickly as might be expected. For every 100 tons of kernels shipped from Sierra Leone in 1909 there were exported 1,986 gallons of oil.

Germany easily maintains her position as chief importer of palm kernels, having taken 36,767 tons, or 85·7 per cent. of the total quantity exported during the year. A comparatively small quantity of palm oil, viz., 41,720 gallons, found its way to the German market. The United Kingdom took 761,156 gallons of palm oil, or 89·3 per cent. of the total shipment. The remainder was distributed between various places in West Africa—British and foreign.

Forty-six tons of gum copal were exported to the value of £5,036 in 1909, as compared with 45 tons, to the value of £4,948, exported in 1908. The gum copal industry has remained practically stationary for the past two years. Sierra Leone at one time used to export large quantities of gum copal. The government have, in the various nurseries, half a million seedlings which will be ready for planting out in 1911. It will, of course, be many years before the seedlings will be gum-producing trees; but efforts are being made to bring the value of the existing gum trees to the knowledge of the chiefs and headmen, and it is anticipated that such action will have a beneficial effect on the industry. In the Ronietta District the gum copal trade has considerably revived owing to the adoption of more careful methods in cutting. The natives have been encouraged to make new plantations of new trees. The seedlings planted under government supervision in 1907 are doing well. There is plenty of gum copal of very good quality in Tambakka north of the 9° 30′ parallel. The traders are prepared to give a good price for it, but labour is scarce in that part of the Protectorate, and the people are fully occupied growing produce for their own consumption.

PATENTS.

Lubricating oils or the like; Method and apparatus for testing or analysing ——. F. Nicolas, Brussels. Eng. Pat. 21,661, Sept. 22, 1909.

THE apparatus consists of a boiler for the generation of steam, a superheater, consisting of a coiled pipe heated by means of Bunsen burners; a cylindrical vessel, tapering towards a tap at the lower end, and provided, at the upper end, with holes to admit the steam pipe from the superheater and a thermometer graduated to 450° C. This vessel is also fitted with a side-tube near the top, leading to a condenser. The oil to be examined passes at a definite rate through a capillary tube into the steam pipe, just before it enters the cylindrical separating vessel, where it is separated into a less volatile portion which settles to the conical bottom of the separator and is run off through the tap, and a portion volatile in steam which passes out through the side-tube and is condensed, together with the steam, in the condenser, and collected in a graduated siphon tube. A steady feed of oil is obtained by allowing mercury to run into a flask, filled with oil, through a thistle-funnel arrangement; the rate of flow is regulated by means of a cock in the capillary tube. Steady steam pressure is obtained by setting the safety-valve of the boiler to such a pressure as will ensure sufficiency of steam for the required degree of superheating, and arranging the heating of the boiler so that steam constantly escapes through the safety valve during the test. A steady temperature is obtained by regulating the pressure of the gas supplied to the burners heating the superheater. As soon as a steady temperature of, *e.g.*, 300° C. has been attained, 50 c.c. of the oil are allowed to flow into the steam pipe (the amount of oil being determined by the amount of mercury added) during 50 minutes, and the two portions are then collected and measured. The volatile portion represents that portion of the oil which is non-effective as a lubricant in (*e.g.*) the cylinder of an engine supplied with steam at the temperature employed in the test, in the above instance 300° C.—E.W.L.

Fat-like substance from the bodies of bacteria; Preparation of a ——. G. Deycke, Constantinople, Assignor to Kalle und Co. A.-G., Biebrich, Germany. U.S. Pat. 972,345, Oct. 11, 1910.

SEE Eng. Pat. 26,077 of 1906; this J., 1907, 934.—T. F. B.

Soap; Manufacture of ——. R. Macpherson and W. E. Heys. Fr. Pat. 415,974, May 14, 1910.

SEE Eng. Pat. 20,089 of 1909; this J., 1910, 1214.—T.F.B.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead blackened by sulphuretted hydrogen; Influence of light on ——. E. Täuber. Chem.-Zeit., 1910, 34, 1126.

IN view of Sacher's statement that hermetically sealed specimens of the products of the action of sulphuretted hydrogen on white lead showed no trace of bleaching after exposure to sunlight for three years (this J., 1910, 831), the author repeated his own experiments on the action of light on white lead oil paints, blackened by sulphuretted hydrogen (Chem.-Zeit. Rep., 1906, 267). It is found that light bleaches even old painted surfaces, though very slowly compared with those freshly painted. Bleaching takes place even under a coating of resin or under glass. The bleaching is, therefore, ascribed to the action of the peroxides resulting from the oxidation of the drying oils. A six-year old coat of white lead paint was exposed to an atmosphere containing sulphuretted hydrogen and a portion then thinly coated with poppy seed oil; after a few days exposure to sunlight, the oiled portion showed signs of bleaching, the remainder being quite unaltered. With freshly painted surfaces, bleaching takes place even in the dark, but much more slowly than in sunlight. It is stated that white lead oil paints can be used by artists without risk from sulphuretted hydrogen in practice, as the varnishing usually given before the painting is perfectly dry is an effective protection. The bleaching of white lead or zinc white oil paints tinted with indigo or "thioindigo red" (see this J., 1908, 1073; 1909, 373, 482) is found not to take place in an atmosphere of hydrogen or carbon dioxide; it is regarded as an oxidation process.—A. Sbld.

Patents.

Pigments with basis of calcium cyanamide or other cyanamide salts. R. Fulloni. Fr. Pat. 415,543, March 4, 1910.

See U.S. Pat. 957,153 of 1910; this J., 1910, 706. Salts of cyanamide other than the calcium salt may also be used. —T. F. B.

Pigment colour [*from azo dye*]. F. Runkel and M. Herzberg, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 972,130, Oct. 4, 1910.

See Fr. Pat. 411,938 of 1910; this J., 1910, 1002.—T. F. B.

Lac; Treatment of ——. W. A. Freymuth, London. Eng. Pat. 22,218, Sept. 29, 1909.

See Fr. Pat. 409,794 of 1909; this J., 1910, 770.—T. F. B.

Varnish; Manufacture of ——. E. H. Strange and E. R. Burrell. Fr. Pat. 415,818, Feb. 26, 1910. Under Int. Conv., Feb. 27, 1909.

See Eng. Pat. 4878 of 1909; this J., 1910, 501.—T. F. B.

Method of and coating for protecting iron from rust. Eng. Pat. 21,638. *See* X.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Patents.

Caoutchouc, gutta, balata and the like; Process for obtaining pure ——. V. Scholz, Hamburg, Germany. Eng. Pat. 22,606, Oct. 4, 1909.

Crude caoutchouc, *e.g.*, partly decomposed by improper storing (or crude gutta-percha or balata), is separated into prime caoutchouc and viscous, inelastic "degenerate" by treatment with aniline, phenol, the homologues or alkyl derivatives of these substances, amyl acetate, ethyl acetate or a mixture of these substances, which dissolve the resins and the "γ-rubber" leaving the "α and β rubber" undissolved. For example, by boiling 500 kilos. of partly decomposed crude caoutchouc with 1000 litres of toluidine, for two hours, filtering the solution, and precipitating the resins and "degenerate" from the filtrate by means of alcohol, a product consisting of a hard, "nervy" rubber melting at 145°—150° C., and a viscous mass melting at 50°—70° C. are obtained. (Reference is directed to Eng. Pat. 4692 of 1906; this J., 1906, 940).—E. W. L.

Indiarubber; Manufacture of —— *and apparatus therefor.* H. S. Smith, Caledonia, Tobago. U.S. Pat. 972,030, Oct. 4, 1910.

See Eng. Pat. 7433 of 1909; this J., 1910, 225.—T. F. B.

Filling material [*for tyres, etc.*]; *Process for making a* ——. R. J. Caldwell, F. Pfleumer, and Pfleumatic Synd., Ltd. Fr. Pat. 415,829, April 13, 1910. Under Int. Conv., May 12, 1909.

See Eng. Pat. 11,300 of 1909; this J., 1909, 1052.—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning liquors; Determination of acids in ——. G. Grasser. Collegium, 1910, 406—410.

The author describes an apparatus by means of which the different acids in a tan-liquor can be determined separately. It consists of a flask fitted with several tubes, each connected with an absorption apparatus and each capable of being shut off from the rest by clips. The carbonic acid is estimated by aspirating air free from carbon dioxide through the liquor and then through a potash apparatus. Acetic and the other volatile acids are then estimated by boiling the liquor and collecting the distillate and titrating with $N/10$ alkali. The residual liquor which contains the lactic and other non-volatile acids is de-tannised by gelatin solution (Koch's method) and then titrated with baryta and phenolphthalein.

Determination of gallic acid in presence of tannic and other organic acids. The author makes use of the fact that sulphuric acid prevents the combination of iodine with gallic acid but not with tannic acids. The tan liquor is divided into two portions, of which one is acidified with sulphuric acid and the other not. Both are then titrated with $N/50$ iodine solution until a drop of the liquor gives a violet colour with starch, the difference between the two amounts of iodine absorbed corresponding with the amount of gallic acid. If lactic acid also be present, it is determined, together with gallic acid, in a third portion of the liquor by Koch's method.—J. R. B.

Tanning process; Study of the ——. R. O. Herzog and G. Rosenberg. Z. Chem. Ind. Kolloide, 1910, 7, 222—227.

In continuation of earlier work (see this J., 1908, 347), experiments have been made on the absorption of different substances by hide powder (unchromed and lightly chromed) and by the "fibrous alumina" of Wislicenus (this J., 1904, 765; 1905, 294). No considerable difference could be detected between the behaviour of the unchromed and chromed hide powder. The absorption of silver nitrate and of some dyestuffs (Crystal Violet, Patent Blue, New Magenta) by hide powder appeared to be a typical adsorption process. The absorption of phenol, however, was not so simple, and other factors besides adsorption evidently play a part in this case. In the case of sodium picrate solutions, the percentage of the salt absorbed by unchromed hide powder was practically constant for solutions of different concentrations. Fibrous alumina gave essentially similar results to hide powder with Crystal Violet, but showed practically no absorptive power for sodium picrate or phenol.—A. S.

Ethyl tannate. R. J. Manning. J. Amer. Chem. Soc., 1910, **32**, 1312—1319.

The author has isolated two crystalline hydrates of an ethyl ester of gallotannic acid. Gallotannic acid, as free as possible from gallic acid, when dissolved in alcohol, and treated with dry hydrogen chloride is esterified, and from the product crystalline nodules may be obtained melting at 157° C. corresponding to $C_{41}H_{27}O_{21}(OC_2H_5)_5.5H_2O$ in elementary analysis, water, ethoxy, glucose and gallic acid contents. An ester with 15 mols. of water was also obtained by re-crystallising from water, and a 5 per cent. yield of the same hydrate was synthesised from glucose and ethyl gallate. The above formulæ support the formula, $C_{41}H_{32}O_{26}$ (five molecules of gallic acid to one of glucose) for gallotannic acid.—W. H. P.

Corsican chestnut extract industry; The ——. Oil, Paint, and Drug Rep., Oct. 17, 1910. [T.R.]

By far the most important export of Corsica is that of chestnut wood extract for tanning; the quantity, however, does not seem to have any tendency to augment to any extent. The figures for the last three years were:—1907, 18,275 tons; 1908, 17,459; 1909, 18,435. The amount shipped to the United Kingdom during this period was:—1907, 6,710 tons; 1908, 8,365; 1909, 7,344. There are four factories engaged in the manufacture of the extract, capable of producing between them 25,000 tons annually. This industry has from the commencement flourished: unfortunately, however, it is only during the last few years that new trees have been planted to replace the old ones as they are cut down. The industry has been heavily handicapped latterly by the constantly increased demands of the workmen. The prolonged railway strike during the year, which necessitated all the transport being done by carts, had also a serious effect. The United Kingdom is still the biggest market for the extract, taking 7,344 tons in 1909, followed by Germany with 5,738 tons. The shipments to the United Kingdom were all made to the ports of London, Liverpool, and Manchester. All the extract shipped during 1909 left from the port of Bastia. A large number of empty extract barrels are returned from the United Kingdom every year to be refilled. The various extract manufactories are, however, now making their own barrels, so this importation will gradually disappear.

XVI.—SOILS; FERTILISERS.

Soils; Methods for the determination of the nitrifying and ammonifying powers of ——. F. L. Stevens and W. A. Withers. U.S. Dept. of Agric., Bull. No. 132, 1910, 34—38.

The following processes are given for determining the nitrifying efficiency, nitrification inoculating power, and nitrifying capacity of soils. Nitrifying efficiency denotes the efficiency of the soil as a whole to produce nitrates as a final product; the nitrification inoculating power represents only the effects due to the living organisms present, taking no account of the fitness or unfitness of the soil for their activity; by nitrifying capacity is meant the capacity of the soil to support nitrification provided proper organisms be present. *Nitrifying efficiency.*—The soil is screened through a sieve having a mesh of from 3 to 4 mm. (aperture); the moisture is determined in a portion of the soil and in another portion the saturation capacity is ascertained. For this purpose 50 grms. of the soil are placed on a porcelain filter plate and a measured quantity of water is added; the filtrate is again poured on the soil and the operation is twice repeated. The amount of water taken up by the soil is ascertained by measuring the final filtrate, allowance being made for the moisture present originally. A quantity of the soil equivalent to 400 grms. of the dry sample is then placed in a flask, 0·240 grm. of nitrogen in the form of sterilised ammonium sulphate solution is added and sterilised water is introduced in quantity sufficient, together with that already in the soil and in the ammonium sulphate solution, to make the saturation approximately two-thirds. The flask is now closed with a plug of cotton wool, and its contents are maintained at a temperature of 30°—35° C. for 4 weeks. A duplicate test is started at the same time and also two control tests, *i.e.*, 400 grms. of the same soil under the same conditions but without added nitrogen. At the end of the incubation period, the amounts of nitrate and nitrite are determined in each flask, the results being expressed in terms of nitrogen; the average of the quantities found in the two control flasks is subtracted from the average quantities obtained in the case of the other two flasks in order to find the net amount of nitrite and nitrate nitrogen produced by the organisms in the soil. The nitrifying efficiency may be expressed as a coefficient equal to the percentage of the added nitrogen that is represented by the net nitrite and nitrate nitrogen found. *Nitrification inoculating power.*—Four hundred grms. of dry, sterilised, standard soil are placed in a flask, 0·240 grm. of nitrogen (as ammonium sulphate) is added together with sufficient water to two-thirds saturate the soil; this mixture is then inoculated with 75 c.c. of a liquid prepared by shaking 100 grms. of the soil under examination with 200 grms. of water for 3 minutes and allowing 5 minutes for sedimentation. The experiment is made in duplicate and the nitrite and nitrate present are determined at the end of 4 weeks. Any quantities of nitrite and nitrate originally present in the soil are subtracted from the results obtained and the nitrification inoculating power is expressed as a coefficient equal to the percentage of original nitrogen changed to nitrite and nitrate nitrogen under these standard conditions. *Nitrifying capacity.*—The soil to be tested is prepared as for the determination of the nitrifying efficiency, then sterilised, and treated subsequently as described for the determination of nitrification inoculating power, using the same inoculating medium at the same time in parallel cultures in standard soil. The coefficient given by the soil is divided by the coefficient of the standard soil in order to obtain the nitrifying capacity.

The ammonifying properties of the soil may be ascertained in a somewhat similar manner, the processes being as follows:—*Ammonification efficiency.*—The method is the same as that used for determining the nitrifying efficiency with the exception that 200 grms. of soil are employed, 0·120 grm. of nitrogen is added in the form of cottonseed meal, the incubation lasts 7 days, and the ammonia is determined. *Ammonifying inoculating power.*—As for the nitrification test, but nitrogen is added in the form of cottonseed meal, 200 grms. of standard soil are used in the medium, 25 c.c. of the inoculating liquid are added, and the ammonia is determined at the end of 7 days' incubation. *Ammonifying capacity.*—The sample is prepared as in the determination of the nitrifying capacity, 200 grms. of medium are used, and the inoculating medium consists of 1 c.c. of a pure culture of *B. subtilis* 24 hours old in standard beef bouillon at incubator temperature, which culture is inoculated with 1 oese from another culture. This inoculating medium must be standardised frequently against standard soil.—W. P. S.

Moorland water; Acidity of ——. K. Endell. J. prakt. Chem., 1910, 82, 414—422.

The acid content of peaty water is best determined by direct titration with *N*/100 potassium hydroxide in the cold. Addition of excess of standard baryta and titration of the excess is not advisable, as the apparent acid content then increases with time owing to hydrolysis of the humus colloids present. The results obtained with different samples of two moorland waters, are given in the paper. A third sample more thoroughly studied was submitted to dialysis after a titration which showed the water to be equivalent to 0·0063 *N* hydrochloric acid. The results show that all the acid is dialysable and can be driven off by boiling. In this sample therefore all the acidity is due to carbonic acid, and the humus colloid is not acid at all. —W. H. P.

Patents.

Superphosphate chambers; Apparatus for emptying ——. N. K. E. Malmsten and C. T. Thorssell, Malmo, Sweden. Eng. Pat. 14,842, June 20, 1910.

The block of superphosphate on the floor of the chamber, is pushed forward by a vertical shield through a door at the opposite side of the chamber, an inclined or horizontal plate being attached to the shield near its lower edge so that the pressure of the superphosphate on this plate prevents the shield from rising.—L. E.

Fertiliser; Manufacture of ——. L. R. Coates, Baltimore, Md. U.S. Pat. 971,830, Oct. 4, 1910.

The material—a mineral consisting of carbonate and phosphate of lime chemically combined, and the same mechanically mixed with carbonate of lime and phosphatic fossils—is burnt and slaked. The fossil phosphate which is now in a friable condition, is separated by screening, and may be ground and mixed again with the remainder of the product.—L. E.

Fertiliser and process of making the same. S. B. Newberry, Baybridge, Ohio, Assignor to G. R. Fishburne, Charleston, S.C. U.S. Pat. 972,567, Oct. 11, 1910.

Natural insoluble calcium phosphate is converted into a citrate-soluble form by calcination with a salt of phosphoric acid soluble in water, *e.g.*; an alkali phosphate.—A. S.

Calcium cyanamide; Process for converting crude —— into a product having little caustic action and free from dust when used as a fertiliser. A. Stutzer. Ger. Pat. 226,340, July 22, 1909.

The crude calcium cyanamide is moistened with a solution containing such carbohydrates as combine with lime to form saccharates or similar compounds, and the crumbly moist mass is either used directly or is dried at a moderate heat. Suitable liquids are molasses or concentrated waste lyes from cellulose factories.—A. S.

Fertilisers; Production of ——. L. R. Coates. Fr. Pats. 415,121, April 22, 1910, and 415,161, April 23, 1910. Under Int. Conv., April 26, 1909.

See U.S. Pats. 947,795 and 947,796 of 1910; this J., 1910, 442.—T. F. B.

Fertilisers; Production of ——. L. R. Coates. Fr. Pat. 415,812, May 11, 1910. Under Int. Conv., May 14, 1909.

See U.S. Pat. 947,798 of 1910; this J., 1910, 442.—T. F. B.

Fertiliser [calcium nitrote]; Process for making a ——. E. Collett and M. Eckardt. Fr. Pat. 415,445, May 2, 1910. Under Int. Conv., May 3, 1909.

See Eng. Pat. 10,815 of 1910; this J., 1910, 1010.—T. F. B.

Nitrogen-fixing organisms; Utilisation of —— in agriculture or horticulture. W. B. Bottomley. Fr. Pat. 415,502, May 3, 1910. Under Int. Conv., May 13, 1909.

See Eng. Pat. 11,365 of 1909; this J., 1910, 581.—T. F. B

XVII.—SUGARS; STARCHES; GUMS.

Analytical control of raw sugar factories; Directions for the uniform ——. Published in accordance with the resolution of the Commission appointed by the Association of the German Sugar Industry. Z. Ver. Deuts. Zucker-Ind., 1910, 1004—1028.

Methods are given for the sampling and examination of fresh and exhausted beet slices, diffusion liquors, thin juices (unsaturated and saturated), thick juice, saturation mud, massecuites, raw sugars, molasses, waters and saturation-gas. A table of densities (20° C. /4° C.) of aqueous solutions of pure sucrose is appended, also one giving temperature corrections to be applied to Balling (Brix) degrees.—J. H. L.

Beet sugar factories; Methods of sampling, analysis and calculation for use in Russian ——. Z. Ver. Deuts. Zucker-Ind., 1910, 1028—1054.

This summary of methods, published under the direction of the Russian Association of Sugar Manufacturers, contains similar matter to that in the corresponding German one (see preceding notice), and in addition the interpretation of the analytical results is treated at considerable length.—J. H. L.

Sugar factory products; The exact comparison of the apparent purity of —— from diffusion juice to molasses. J. Weisberg. Bull. Assoc. Chim. Sucr., 1910, **27**, 1145—1158; and **28**, 132—136.

In the determination of the "apparent-purity" of juices and products in sugar factories it is essential, in order to avoid the disturbing influence of the non-sugars present, and of varying dilutions, that the densities of the solutions employed should lie within very narrow limits. The author proposes a scheme which would effect this by varying the weight of material taken according to their densities. Full details are given with numerous and full tables for converting the results so obtained from the diluted solutions to the original products.

Concentrated superphosphates; Densities of solutions of —— [for the decolorisation of sugar juices and syrups]. P. de Sornay. Bull. Assoc. Chim. Sucr., 1910, **28**, 147—149.

In the use of superphosphates for decolorisation of sugar juices it is of importance to know the percentage of available phosphoric acid. With superphosphates of closely similar type this may be approximately ascertained by the densities of their solutions. In making up the solutions for testing, the superphosphate should be kept in contact with cold water, with frequent stirring for 24 hours before filtration. If the solution is made quickly and filtered at once, some calcium phosphate invariably separates. The solution should not be of more than about 10 per cent. strength. The author gives a table for superphosphate of 43·5 to 44·5 strength (*superphosphate riche*, Packard), showing the soluble phosphoric acid and insoluble residue.

Vacuum pans [sugar]; Modern heating and circulating devices for ——. G. Stade. Int. Sugar J., 1910, **12**, 493—498.

The author strongly recommends the short, inclined tube system in preference to coils or vertical tubes or combinations of these, for heating vacuum pans. The water formed by condensation of the heating steam collects on a very narrow strip on the inclined side of the tubes, from which it runs away rapidly, thus leaving almost 95 per cent. of the heating surface fully effective. Moreover, the work of W. Nusselt (Z. Ver. deuts. Ing., 1910, 1158), has shown that this arrangement insures a high coefficient of transmission of heat in comparison with that obtained with a steam coil. The best heating surface will be inefficient, however, if no extensive circulation of the liquid under treatment takes place. The modern circulation system now generally used in combination with short inclined tubes, consists of a set of double or false shells fixed at certain intervals over the calandria. The shells divide up the interior of the pan in such a way that a "forced but natural circulation" takes place from inside upwards, the massecuite rising upwards through the inclined tube system inside the shell, and downwards between the shell and the wall of the pan.—L. E.

Evaporators; Sulphate scale in [cane sugar factory] ——. S. S. Peck. Bull. No. 33, 1910, Agric. and Chem. Series. Expt. Station, Hawaiian Sugar Planters' Assoc. pp. 5—30.

In the cane sugar factory three kinds of scale are met with: phosphate, silicate, and sulphate, the first two of which are of a loose, friable nature, whilst the last-named is hard and dense, and capable when only 1 mm. thick of inhibiting the efficiency of the evaporators. For the purpose of remedying sulphate scale formation, the author suggests the addition of sodium carbonate to the juice after neutralising with lime to neutrality or faint acidity, so that the phosphoric acid, the lime, and to some extent also the magnesium salts are precipitated and thus prevented from passing into the evaporators. The disadvantage of such a method of treatment is that since the amount of sediment would be much greater than ordinarily, the work of the filter-presses would be increased, and also that the cost of clarification would be materially greater. Whether, however, this increased cost would be compensated by economy of labour, of time, and of the wear caused by incrustation formation is a question only to be answered by further practical experiments in factories concerned with the problem. Other advantages of the treatment would be that owing to the lesser amount of lime in the syrups the working of low-grade products would be facilitated; that "froth fermentation" of molasses would be prevented; and that there would be no increase in the acidity of the molasses due to the decomposition of calcium glucinate, etc., during boiling.
—J. P. O.

Sugar group; Dissociation in the ——. Part II. The behaviour of sugars towards caustic alkalis. J. U. Nef. Annalen, 1910, **376**, 1—119.

In alkaline solution an aldose or ketose exists partly in the enolic form, the grouping $-CHOH\cdot CO-$ being changed to $-C(OH):C(OH)-$. Owing to the symmetry of this dienol group, reconversion into the ketonic form may occur in two ways, producing isomeric sugars. A series of such transformations accounts for the interconversion of all structurally isomeric aldoses and ketoses. The dienol group may moreover undergo dissociation, with severance of the double bond; the products are hydroxymethylenes, *i.e.* ionic forms assumed by aldoses (and formaldehyde) in presence of alkali. Conversely, similar or dissimilar aldoses (or formaldehyde), in the form of hydroxymethylene ions, may unite to produce the dienol form of a higher sugar. The author thus accounts for the synthesis, interconversion and degradation of sugars in alkaline solution. In the formation of saccharinic acids the group $-CHOH\cdot CHOH\cdot CO-$ of the sugar is first changed into $-CH_2\cdot CO\cdot CO-$ by several stages, and then the alkali effects a transformation similar to that of benzil into benzilic acid. From aldoses, metasaccharinic acids containing the group $-CH_2\cdot CHOH\cdot COOH$ are produced. Isosaccharinic acids, from 2-ketoses, contain the group $-CH_2\cdot(OH)C(CH_2OH)\cdot COOH$, whilst from 3-ketoses, normal saccharinic acids containing the characteristic grouping $-(CH_3)C(OH)\cdot COOH$ are produced. The so-called parasaccharinic acids, formerly supposed by the author to be formed, together with the normal acids, from 3-ketoses (this J., 1908, 31) do not exist or are not so formed.

The author has succeeded in isolating the main products arising from the action of 8*N*-caustic soda solution on *l*-arabinose, glycollic aldehyde, *l*-xylose, *d*-galactose and *d*-glucose. These sugars were heated with the alkali for 5—8 hours in a bath of boiling water. Glycollic aldehyde gave as main product $(d+l)$ 1.3-dihydroxybutyric acid, but the products from all the other sugars contained in addition, lactic acid and C_5- or C_6-saccharinic acids corresponding to the particular sugars. Varying quantities of resin and traces of optically inactive products were also formed. The general conclusions arrived at as to the behaviour of sugars under these conditions are as follows:—Pentoses and hexoses produce large quantities of the corresponding saccharinic acids, but also undergo considerable decomposition into lower sugars; only traces of optically inactive pentoses and hexoses are re-synthesised from these decomposition products. The chief mode of breaking-down of the hexoses is by dissociation of 3.4-dienols into two molecules of glyceric aldehyde which is then rapidly converted into lactic acid. Dissociation of 2.3-dienols of hexoses occurs to a smaller extent, the products being diose and tetroses which appear finally as 1.3-dihydroxybutyric acid. No dissociation of hexoses into pentoses and formaldehyde occurs. Pentoses break down into tetroses and formaldehyde, and into diose and triose; they do not form hexoses by combining with formaldehyde. Tetroses are converted into 1.3-dihydroxybutyric acid and also undergo some dissociation into diose, but not into triose and formaldehyde; they may form pentoses or hexoses by union with formaldehyde or glycollic aldehyde. Glyceric aldehyde appears mainly as lactic acid, but it may take part in the synthesis of tetroses, pentoses or hexoses, or be dissociated into formaldehyde and diose; it is formed in considerable amount by decomposition of pentoses and hexoses, and in larger quantity from *d*-glucose than from *d*-galactose. Glycollic aldehyde polymerises to tetrose exclusively, the greater part of which appears as 1.3-dihydroxybutyric acid. The concentration of the alkali employed is of importance in determining the composition of the product, and the so-called specific actions of the various metallic hydroxides may be imitated by caustic soda solution of appropriate concentration.

The following C_5 and C_6 saccharinic acids were isolated. From *l*-arabinose, *d*-threo- and *l*-erythro-1.3.4-trihydroxyvaleric acids were obtained, and their optical antipodes from *l*-xylose. *d*-Galactose produced *α*- and *β*-*d*-galactometasaccharins, of which the former, melting at 144° C., has been studied by Kiliani, whilst the latter is now found to be identical with the "parasaccharin" of that worker and Sanda. α- and β-Isosaccharinic acids, $CH_2OH\cdot CHOH\cdot CH_2\cdot(OH)C(CH_2OH)\cdot COOH$, were formed both by *d*-galactose and *d*-glucose. From *d*-glucose, *α*- and *β*-*d*-dextrometasaccharins were also obtained. The spacial configurations of all these acids and lactones have been determined and many derivatives prepared. Experiments are being carried out with formose, produced from formaldehyde by means of lead hydroxide; this appears to give a much more complex mixture of saccharins than any with which the author has yet dealt.—J. H. L.

Hexose phosphoric acid ester. A. v. Lebedew. Biochem. Zeits., 1910, **28**, 213—229.

Iwanoff and, almost simultaneously, Young recognised the presence of an organic compound of phosphoric acid in sugar solutions fermenting with zymase. Young later isolated the compound as lead salt and identified it as a combination of one molecule of a hexose with two molecules of phosphoric acid (this J., 1909, 1322). The author has studied the behaviour of this compound and its phenylosazone and confirms Young's view that it is a hexose combination but shows that the molecule only contains one phosphoric acid residue. The author shows that during fermentation of sucrose by yeast in presence of sodium phosphate, there is produced a colloidal phosphoric acid ester which is afterwards decomposed as fermentation proceeds; this ester appears to be a compound of a polysaccharide with phosphoric acid. The author has prepared the glucosephosphoric acid synthesised by Neuberg and Pollak (this J., 1910, 967) and finds it is not identical with the compound formed during fermentation.—R. L. S.

Carbonyl acids of the carbohydrate series; A new mode of formation of ——. C. Neuberg. Biochem. Zeits., 1910, **28**, 355—358.

The oxidation of dextrose, maltose or starch by means of nitric acid (sp. gr. 1·15), produces, besides saccharic acid, a considerable quantity of a carbonyl acid of which the normal barium salt has the formula $(C_6H_9O_7)_2Ba$. The acid reduces Fehling's solution in the cold, gives a positive naphtho-resorcinol reaction and forms insoluble basic salts of barium and lead. Its relationship to glycuronic acid is being investigated.—J. H. L.

Patents.

Diffusion waste-waters; Process for the utilisation of ——. H. Claassen. Ger. Pat. 226,855, Nov. 27, 1909. Addition to Ger. Pat. 194,046, Dec. 13, 1905.

In working the process described in the chief patent and previous additions thereto, there is obtained, after the clarification of the diffusion waste-waters, a relatively small quantity of a muddy liquid in which the particles of pulp have accumulated. This liquid will not filter, as the filter-cloths become clogged. It is proposed to use it for washing the cakes of saturation-mud in the filter-presses. When the two halves of the cake of mud in the press nearly meet, the supply of saturation juice is stopped, and the muddy liquid mentioned is passed in. The pulp particles are retained by the cakes of saturation-mud and thus do not clog the filter-cloths, whilst the liquid filters through, displacing the saturation juice.—A. S.

Kiln for revivifying char. R. S. Kent, Brooklyn, N.Y. U.S. Pat. 972,002, Oct. 4, 1910.

The kiln comprises two sets of vertical retorts which are filled with char, and a fire-box arranged between them. The fire-box is separated from the retorts by vertical walls at each side, so that the combustion products are caused to pass over these walls, and downwards between the retorts, to outlets at the bottom of the kiln. The walls of the retorts are thicker at the top than at the bottom.—A. T. L.

Starch free from salts, which forms a paste with cold water; Process for preparing a ——. H. Wulkan. Ger. Pat. 223,301, July 16, 1908.

Starch is mixed with an aqueous solution of ammonia, and dried in thin layers by means of hot plates or rollers;

the mixture may be boiled before drying. The product, which is free from alkali salts, forms an adhesive paste when mixed with cold water. T. F. B.

Dextrine, British gums, and the like; Production of ——. A. Fielding, Salford. Eng. Pat. 22,455, Oct. 2, 1909.

Starch is heated at a temperature high enough to drive off practically all the water without causing any torrefaction. Thus, the starch may be heated at 160—180° F., and drying is continued until a sample retains a practically constant weight when exposed to a temperature of 212° F. The dried starch is converted into dextrine, British gum, and the like, at a comparatively low temperature such as 160° F., by the action of expediting agents such as acid, in a suitable apparatus, *e.g.*, that described in Eng. Pat. 20,488 of 1906 (this J., 1907, 980).
L. E.

XVIII.—FERMENTATION INDUSTRIES.

Top-fermentation beer yeast. F. Schönfeld, Hinrichs and Rossmann. Woch. f. Brau., 1910, **27**, 493—498, 515—518, 532—536.

It is well known that among the yeasts classed as top-fermentation there are some which, so far from forming decided heads after fermentation, deposit and thus simulate bottom-yeasts. The authors have found 40 per cent. of a top-fermentation brewery's yeast to consist of such a transition type. The behaviour towards melitriose was that of a top-fermentation yeast, but on diffusion through water instead of yielding a milk it formed flecks though not decided flocks; in vaseline-sealed cultures the growth was that of a top-fermentation yeast, but in open cylinders of wort it could not be induced to form a head. The authors have endeavoured to induce this head formation; they have carried out hundreds of fermentations with the yeast, using both young cultures and yeast that had lain for six weeks in beer at 1° C., and always failed although the other properties of the yeast were those associated with top-fermentations. The effect of washing the yeast with hot water, which is said by some brewers to improve the head formation, and addition of lactic acid bacteria to the wort, which in distillery practice is found to be one of the best stimulants of yeast, were tried unsuccessfully. The lactates of iron, ammonium, potassium and calcium were tried as well as various other salts of iron added alone or with powdered pumice to the wort and of these they found that only pumice powder with ferrous tartrate or lactate produced a head. This property was manifested in further generations propagated in the same manner, but did not appear to be permanently preserved by the yeast when afterwards grown without the iron salt and pumice. The pumice appeared to act mechanically by its porosity and lightness, as it could not be replaced by sand or kieselguhr.—R. L. S.

Invertase; Theory of the influence of acids and alkalis on the activity of ——. C. S. Hudson. U. S. Dept. Agric. Bureau of Chem. Circular No. 60. (See also this J., 1910, 711.)

The author explains the variation in the activity of the enzyme by assuming that it is an amphoteric electrolyte which may undergo both basic and acidic dissociation. If the activity depends on the undissociated invertase, and is proportional to its concentration, it is possible to determine this concentration in solutions of varying acidity from an equation with three unknown quantities. Using three of the experimental results with hydrochloric acid to evaluate these unknowns, the values calculated from the now simple equation, agree very satisfactorily with the remainder of the experimental figures. From the numerical equation the optimum concentration of hydrogen ions is calculated to be $0{\cdot}8 \times 10^{-3}$ at 30° C., while it has been experimentally determined by Sörensen at 52° C. to be about 10^{-4}.—W. H. P.

Wine; Alteration in the relation of alcohol to glycerol in the after fermentation of ——. W. Seifert and R. Haid. Zentr. Bakt. u. Parasitenk., 1910, 2 Abt., **28**, 37—45. Chem. Zentr., 1910, **2**, 1152.

In the after fermentation of wine, not only the alcohol and glycerol, but also the total acid, and consequently, the sugar-free extract, are increased in amount. Hence, it is possible, that by an after-fermentation of a weak wine ("Halbwein") with a large quantity of sugar, the wine may gain so much in extract as to be proof against analytical control; this is not likely to occur often, however, since the use of large quantities of sugar for after-fermentation renders the method very costly. The authors show that by an after-fermentation alone, *i.e.*, without direct addition of spirit, a wine, possessing initially a low glycerol-alcohol ratio, may have this ratio lowered to say 5 : 100, which is considerably below the limit 7 : 100. Hence, in judging a wine that has a glycerol-alcohol ratio of 5 or 6 to 100, it should first be ascertained if the wine haa been submitted to an after-fermentation with large quantities of sugar; if the wine has not been so treated it must have been fortified. The above results were obtained by experiments made with four different races of yeast. In the artificial after-fermentation of wine by addition of sugar and pure yeast cultures, the absolute quantity of glycerol formed is considerably smaller than that formed in the normal fermentation of must, and the number of parts of glycerol per 100 parts of alcohol may decrease by three or more as a result of after-fermentation. This is a further proof that the glycerol is a product, not of fermentation in the strict sense, but of yeast metabolism, and is formed in smaller quantity during the alcoholic fermentation the less favourable the nutrient is to the development and vital activity of the yeast cells. As the alcohol-content of the wine increases, the normal vital process, and with it, the metabolism, is diminished. This enfeebling effect of the alcohol is especially in evidence when, as in the case of after-fermentation, the yeast is suddenly introduced into a liquid of higher alcohol-content than it has previously been accustomed to. An alcohol-content of about 11 per cent. by volume is about the limiting concentration at which an after-fermentation can be set up. If this concentration is exceeded, the yeast gradually dies, and the quantity of yeast added must be much increased in order to set up fermentation.
—L. E.

Alcohol from waste sulphite cellulose lyes; The production of ——. W. Kiby. Chem.-Zeit., 1910, **34**, 1077—1078, 1091—1093.

The author discusses the economic aspects of the newly established industry of the manufacture of spirit from the waste lyes of sulphite wood-pulp mills, taking as a basis the average yield of 60 litres of absolute alcohol per ton of cellulose produced. The prospects of the industry depend on the cost of production, the capacity of the market and the conditions of taxation. In Sweden all the conditions are more favourable than in Germany. The total production of alcohol in Sweden for the financial year 1908—9 was about 22 million litres (absolute), whilst imports amounted to 1·17 million litres. The sulphite pulp mill at Lärkudden is now producing spirit at the rate of 600,000 litres per annum, and will soon be in a position to produce 1·2 million litres, so that the whole of the imports would be equal to the product of this single mill. The pulp mills of Sweden are capable of producing about 25 million litres of absolute alcohol, and since the manufacture of spirit from the ordinary raw materials is intimately bound up with other branches of agricultural industries, it is hardly conceivable that the new sulphite spirit will be allowed to displace any considerable proportion of the present production. Further, since the sulphite spitit is of the nature of denatured spirit, owing to its impurities, it must be conceded that the future of the industry depends on the opening up of new industrial sources of consumption. The author details the probable cost of production of spirit at a mill producing 60 tons of cellulose per day. Such a mill could produce 1·3 million litres of absolute alcohol per annum at a cost of 10 pfennige

(1·2d.) per litre, allowing 10 per cent. for depreciation of capital. In Sweden the larger distilleries suffer a heavier tax the larger their production, so that, including this tax, 1·3 million litres per annum could be produced for about 17 shillings per 100 litres, and 3 million litres per annum at a cost of 18s. 6d. per 100 litres. With the increasing consumption of industrial alcohol it is possible that even the full production of Swedish sulphite spirit could gradually be absorbed. Turning to Germany, the author estimates that the maximum annual production of sulphite spirit might be about 33 million litres, which would be added to the present total production. The excise regulations in Germany are particularly severe and expressly penalise new distilleries, so that in addition to the production cost of 10—11 shillings per 100 litres, the sulphite spirit would be subject to an excise charge of 19 shillings per 100 litres. German wood pulp manufacturers could therefore only produce the spirit at a loss, which they would not consent to bear unless the production of spirit would offer a solution of the problem of the ultimate disposal of the waste lyes. This, however, is hardly likely to be the case, since the spent wash would in all probability be just as obnoxious as the original waste lyes.—J. F. B.

Distillation and rectification of binary liquid mixtures; Differential condensation in ——. A. Hirsch. J. Ind. Eng. Chem., 1910, 2, 409—419.

The author discusses the theory of partial condensation of binary liquid mixtures, with special reference to the case of mixtures of alcohol and water, and has investigated the efficiency of differential condensers. Differential condensation may be regarded as an infinite series of infinitesimal simple condensations. The two extremes of partial condensation are, a simple condensation (least efficient) and a differential one (most efficient). To insure the high efficiency of a differential condenser, the rate of the passage of vapour must not be too low, and the change in temperature of the vapour, from its entrance to its exit must be uniform. To prevent a material and sudden difference in temperature between the surface of the cooling coil and the vapour entering the condenser, the cooling water should be heated to a suitable temperature. The efficiency of differential condensers is less with alcohol of high concentration than with weak alcohol. The author describes an arrangement for increasing the efficiency of commercial rectifying columns. It includes a lower, rather short, plate column, separated from an upper, longer, plate column by a solid metal sheet; the vapours from the top plate of the lower column pass to the differential condenser, and, after being properly enriched, pass into the upper plate column for rectification for proof.—L. E.

Methyl alcohol in ethyl alcohol; Detection of ——. H. Engelhardt and H. W. Jones. Amer. Pharm. Assoc., May, 1910. Z. Riech- und Geschmackst., 1910, 2, 225—228.

Many different methods for the detection of methyl alcohol in ethyl alcohol have been examined and compared by the authors. The most reliable is that of Hinkel (this J., 1908, 1175), by means of which as little as 0·5 per cent. of methyl alcohol can be detected.—F. Shdn.

Hexose phosphoric acid ester. v. Lebedew. *See* XVII.

Spirit industry of Germany. Chem. and Drug., Oct. 22, 1910. [T.R.]

The total output of spirit in Germany since October, 1909, and inclusive of September, 1910 (61,357 hectolitres), amounted to 3,649,670 hl. In the same period the consumption for industrial purposes amounted to 1,888,128 hl., of which 1,497,120 hl. was fully denatured. The exports for the whole season were 10,232 hl., and the stocks at the end of September stood at 484,660 hl. The total production of spirit in the corresponding period of 1908–9 amounted to 4,265,231 hl., the output of spirit for industrial purposes amounting to 1,485,145 hl., of which 991,008 hl. was denatured. The consumption of spirit for drinking purposes fell to 1,800,422 hl. since October, 1909, compared with 2,602,121 hl. for the 1908–9 period. The first year of the new taxes has not been satisfactory for the spirit industry in general, consumers having previously covered their needs to a large extent, in view of the enormous rise in prices due to the spirit-taxes. The consumption of spirit for drinking purposes fell to the extent of about 400,000 hl., or about 20 per cent. The output of 3,649,670 hl., compared with 4,265,231 hl. in the previous period, has not entirely met the requirements of consumption, as the season opened with dutiable stocks amounting to 578,665 hl. and closed with stocks amounting to 484,660 hl. only. This is, however, largely accounted for by the conversion of visible into invisible stocks, as the season opened with practically no surplus stocks of duty-free spirit and closed on September 30th with considerable stocks of manufacturing spirit, and especially of denatured spirit. The production of denatured spirit was 50 per cent. in excess of last year's output, which is partly to be accounted for by the fact that the "Centrale" has introduced the system of sale in bottles, which necessitates a huge distribution to the various depots over Germany, but does not necessarily indicate an increase in consumption.

Patents.

Fermented liquids; Manufacture of ——. C. J. M. M. Le Petit, London. Eng. Pat. 22,092, Sept. 28, 1909.

The object of this invention is to produce fermented liquids containing in solution and in compression, in any desired proportion, the gaseous products of fermentation in their "initial" chemical and physical state. The fermentation is effected at an ordinary temperature in an insulated vessel. The carbon dioxide evolved is conducted into an "insulated" condenser containing carbon which absorbs the gas. A vacuum is produced in this condenser prior to the absorption of the carbon dioxide, and the latter process is carried out at the ordinary temperature. After fermentation, the carbon dioxide is liberated (*e.g.* by heating the condenser very slowly to 100° C.) and returned to the fermentation vessel, wherein the liquid is kept at the temperature at which the coefficient of solubility of the carbon dioxide is a maximum. If desired, the gas may be returned into the liquid under excess pressure by introducing additional carbon dioxide under pressure into the condenser. The fermented liquid, having dissolved the fermentation gases in any proportion, is then filtered and withdrawn, still under pressure, at the temperature which gives the most favourable conditions.—L. E.

Beer; Manufacture of temperance ——. C. J. M. M. Le Petit, London. Eng. Pat. 22,093, Sept. 28, 1909.

Claim is made for a process of manufacturing temperance beer, *i.e.*, beer containing less than two degrees of proof spirit. A solution of dextrin and soluble starch is prepared by boiling malt with water (30—50 grms. of malt per litre of water) for 1—2 hours. The solution is treated with a solution of tannin in such proportion that the resulting wort shall contain 0·25 to 1 grm. per litre of tannin; the purpose being to precipitate albuminoids, and then with a sugar solution in the form of brewery wort corresponding to the type of beer desired. Boiling is continued until the liquid is sufficiently fluid, hops are added, and the whole is boiled, filtered and cooled. The liquid is then treated with diastase, or preferably, "dextrinase," which may be obtained by boiling a solution of diastase *in vacuo* at 66° C. Isinglass is added either before or after fermentation which is effected with top fermentation yeasts (added about half-an-hour after the addition of the diastase or "dextrinase"). After fermentation for about 24 hours, the liquid is cooled to 0° C., and submitted to a pressure of carbon dioxide gas for a few hours before filtering and drawing off.—L. E.

Fermentation; Process of —— based on the symbiosis of saccharomycetes and lactic acid bacteria. D. Forster and P. Finitzer. Fr. Pat. 415,022, April, 9, 1910. Under Int. Conv., April 10, 1909.

The saccharine solution is submitted to acidification by lactic bacteria till 20 c.c. require for neutralisation 0·8—1·3 c.c. of *N*/1 alkali. The further formation of lactic acid is checked by addition of sulphuric or other mineral acid. The formation of alcohol by yeast in the solution is favoured by the vegetative action of the lactic acid bacteria. —R. L. S.

Alcohol; Preparation of —— and of a food for cattle from potatoes. C. Steffen, jun. Fr. Pat. 415,160, April 23, 1910. Under Int. Conv., April 26, 1909.

The potatoes in slices are systematically exhausted, at the temperature of gelatinisation of the starch, with a diastase solution prepared from green malt. The exhausted slices are pressed and dried. The saccharine solutions are fermented in the usual manner.—R. L. S.

Rice wine (saké) and other fermented beverages from cereals; Preparation of ——. Soc. franç. des Distilleries de l'Indo-Chine. Fr. Pat. 415,074, July 3, 1909.

The rice starch is saccharified by the usual methods and the sterile solution is fermented with pure cultures of suitable *mucors* and yeasts. When the desired attenuation is attained, fermentation is arrested by heating the liquid. The wine is then decanted or filtered, under aseptic precautions, and bottled, if necessary being again pasteurised when it has sufficiently matured.—R. L. S.

Soya; Preparation of condiments and particularly sauces from ——. Soc. franç. des Distilleries de l'Indo-Chine, Fr. Pat. 415,026, July 1, 1909.

The soya or other leguminous seeds, with or without addition of cereals, are suitably cooked and after being cooled aseptically are seeded with pure cultures of the organisms necessary to produce the desired results. The sauces or condiments produced are sterilised or pasteurised in the trade packages.—R. L. S.

Beverages from grapes and raisins; Manufacture of ——. E. W. Kuhn, London. Eng. Pat. 27,831, Nov. 29, 1909. Under Int. Conv., Dec. 2, 1908.

See Fr. Pat. 406,224 of 1908; this J., 1910, 416.—T. F. B.

Extract of malt from undried malt; Preparation of aromatised ——. P. H. Elmassian. Fr. Pat. 415,346, April 28, 1910.

See Eng. Pat. 14,266 of 1909; this J., 1910, 895.—T. F. B.

Cleansing and disinfecting fluid. Eng. Pat. 644. *See* XIXb.

XIXa.—FOODS.

Starch in cocoa products; Determination of ——. W. L. Dubois. U.S. Dept. of Agric., Bull. No. 132, 1910, 136—138.

The starch in cocoa may be determined by means of the following process without previously removing the fat from the portion of the sample employed. Two grms. of the cocoa are mixed in a flask with 20 c.c. of water, and 12 c.c. of concentrated sulphuric acid are added slowly. The mixture is heated over a small flame until the colour changes from brown to reddish-black (the time required is usually about 75 seconds), 30 c.c. of water are then added, and the whole is boiled for 15 seconds. After the addition of a small quantity of cold water, the mixture is cooled rapidly, nearly neutralised by the addition of a saturated solution of potassium hydroxide, diluted to a volume of 250 c.c., and filtered. The cupric-reducing power is then determined, using 50 c.c. of the filtrate. Clarification with basic lead acetate is unnecessary. At present the method can only be used in the case of unsweetened cocoa products. In the process described previously by the author (this J., 1909, 1160) for the determination of starch in chocolate, the separation of the fat by centrifugal action in the presence of a solvent may be carried out in cylindrical tubes instead of the flasks mentioned.—W. P. S.

Determination of cocoanut oil in admixture with butter-fat. Cassal and Gerrans. *See* XII.

Capsaicin, the pungent principle of capsicum, and the detection of capsicum. Nelson. *See* XX.

Patents.

Lemon juice; Preparation of concentrated sterile ——. A. Fernbach. Fr. Pat. 415,067, July 3, 1909.

The fresh, filtered, juice is concentrated to a syrup at a low temperature under reduced pressure in a stream of pure carbonic acid. The syrup is sterile and gives on dilution a liquid having the flavour of fresh juice.—R. L. S.

Waters; Manufacture of aerated ——. H. Mackeson, Hythe, Kent. Eng. Pat. 10,089, April 25, 1910.

Lactose, *e.g.*, in the form of pure dry powder, pure crystals, or pure crystals in solution, or in the form of the preparation described in Eng. Pat. 9083 of 1910 (this J., 1910, 1127), is added in the manufacture of aerated waters or in the bottling of natural mineral waters.—L. E.

Preserving [meat, fruit, etc.]; Processes of ——. A. J. Boult, London. From The Electric Meat Curing Co., Cleveland, U.S.A. Eng. Pat. 23,039, Oct. 8, 1909.

See Fr. Pat. 409,255 of 1909; this J., 1910, 779.—T. F. B.

Bran; Process of grinding ——. D. Finkler, Bonn, Germany. U.S. Pat. 972,103, Oct. 4, 1910.

See Fr. Pat. 382,686 of 1907; this J., 1908, 243.—T. F. B.

Preparation of alcohol and of a food for cattle from potatoes. Fr. Pat. 415,160. *See* XVIII.

XIXb—WATER PURIFICATION; SANITATION.

Putrescibility [of sewage effluents]; The Hamburg test for ——. F. Guth. Gesundh.-Ing., 1910, **33**, 586—588. Chem. Zentr., 1910, 2, 1162—1163.

The author's experiments show that the putrescibility of an effluent cannot be determined with certainty by the test of Korn and Kamman (this J., 1907, 888), depending upon the conversion of the organic sulphur into potassium sulphide, and detection of the latter by the formation of "methylene blue" on treatment with *p*-aminodimethylaniline. With a given sample of effluent the tints obtained vary from dark blue to pale bluish-green; the depth of the tint is influenced by the quantity of *p*-aminodimethylaniline added. A greenish colour is produced by nitrites in absence of sulphide. In some cases, even with ordinary tap-water, a positive reaction is obtained. This is attributed to the presence of small quantities of sulphates in the water, in some cases possibly derived from the glass vessels used.—A. S.

Patents.

Refuse destructors. H. N. Leask, Egremont, Cheshire. Eng. Pats. 6085 of 1910, dated Sept. 29, 1909, and 7549, March 26, 1910.

Means are claimed for discharging the clinker bodily from a fixed grate of a refuse destructor furnace.—L. E.

Refuse destructors. H. N. Leask, Egremont, Cheshire. Eng. Pats. 22,137, Sept. 29, 1909, and 7458, March 26, 1910.

The chief feature in the improvements is the provision of a trough-shaped grate, which may be mounted on rollers, formed with a hollow metal jacket which is divided by ribs into passages. Air passed into the jacket travels through the passages and then through holes in the walls of the grate into the fire, thus keeping the grate cool. Other provision for cooling is also made by means of water chambers connected with the upper and lower edges of the grate. The grate has a door extending its whole width, and has bars provided with arms projecting upwards, by which the whole of the clinker can be discharged in a mass. —J. H. J.

Liquids; Apparatus for purifying —— by electricity. H. B. Hartman, Pittsburg, U.S.A. Eng. Pat. 1460, Jan. 19, 1910.

The patent is for an improved tank or electrode box for purifying liquids by the electric current. The walls of the tank are lined with a non-conductor and there is an air-tight cover. Each set of electrodes is supported in grooves in special plates set in recesses at intervals along the walls. Plates containing different numbers of grooves can be inserted, so that the number of electrodes in each set and the space between them can be varied as required. Each set of electrodes has a wide space between it and the next set, to allow for a slow flow of the liquid through this space, giving time for coagulation of impurities. This wide space is provided with a baffle-plate extending from the top nearly to the bottom. The liquid to be purified passes between the electrodes in each set from top to bottom alternately, and then passes into the wide space and underneath the baffle-plate therein, and up to the next set of electrodes through which it passes from top to bottom as before, and so on. Openings are provided below the electrodes and at the bottom of the wide space for withdrawing the coagulated matter.—J. H. J.

Water distillation system. A. Faget, San Francisco, Cal. U.S. Pat. 971,183, Sept. 27, 1910.

In an arrangement for the distillation of water, the exhaust steam from an engine is passed through a heating coil in an evaporator before admitting it to the condenser. Steam which has been circulated through the cylinder jackets of the engine is passed through a heating coil in the feed-water heater for the main boiler, and then through a heating coil in a "vacuum re-boiler" which is also connected with the condenser.—A. T. L.

Cleansing and disinfecting fluid and method of using same. A. H. Peter, Hastings-on-Hudson, N.Y., U.S.A. Eng. Pat. 644, Jan. 10, 1910.

A disinfectant consisting of an alkaline solution of an alkali hypobromite to be used as a cleansing and disinfecting liquid in breweries, jam factories, etc., may be prepared by adding to 100 parts of a 10 per cent. caustic soda solution at 5° C., 2—4 parts by weight of bromine, and agitating until solution is complete. The excess of caustic soda is sufficient to render the solution stable for several weeks in its original, or in a diluted, condition. The limits of strength are not exceeding 15 per cent. of free alkali and 3 per cent. of active bromine. The disinfectant is especially useful in removing "beer-stone" in pipes in breweries.—J. H. J.

Disinfectants and emulsions having disinfecting properties. K. L. V. Zimmer, Hamburg, Germany. Eng. Pat. 12,157, May 17, 1910.

To prepare the disinfectant two solutions are required; firstly, castor oil or a similar oil is sulphonated, the sulpho-acid nearly neutralised with alkali, and concentrated; secondly, a solution of casein in borax is prepared and saturated with formaldehyde. These two solutions are then mixed in equal volumes, and the product retains the formaldehyde unaltered and is a disinfectant. This product is used to emulsify mineral, tar, and other oils. About 95 parts of the oil are gradually added to about 5 parts of the formaldehyde product in an agitator, a homogeneous mixture being obtained, which dissolves in water in all proportions.—J. H. J.

Formaldehyde disinfectant; Industrial preparation of a ——. Sindacato Chimico Italiano. Fr. Pat. 415,441, May 2, 1910.

Sulphuric acid, 40—50 parts, is stirred into a vegetable oil, 100 parts, at a temperature below 60° C. The mass is washed repeatedly with water, treated with a concentrated solution of common salt, decanted and neutralised with alkali. The compact mass thus obtained can be diluted to any desired extent with water and mixes to a clear solution with 40 per cent. formaldehyde.—R. L. S.

Feed-water for steam boilers; Apparatus for treating ——. C. Neff and A. Brandes, Hanover, Germany. Eng. Pat. 14,740, June 23, 1909.

See Addition of Aug. 14, 1909, to Fr. Pat. 378,877 of 1907: this J., 1910, 449.—T. F. B.

Liquids; Purification of —— by electricity. H. B. Hartman, Pittsburg, U.S.A. Eng. Pat. 28,552, Dec. 7, 1909.

See U.S. Pat. 943,187 of 1909; this J., 1910, 171.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cocaine; Volatility of ——. H. C. Fuller. J. Ind. Eng. Chem., 1910, 2, 426.

It is shown that when cocaine residues are heated at 100° C., appreciable loss occurs owing to volatilisation, but that no loss occurs at 60°—90° C. It is concluded that in determining cocaine, the last part of the solvent should be evaporated from the cocaine residue as rapidly as possible, a blast being used, and that the residue should be dried cautiously at a temperature not exceeding 90° C., and brought to constant weight by drying over sulphuric acid. —L. E.

Alkaloid of pituri from Duboisia Hopwoodii. A. C. H. Rothera. Bio.-Chem. J., 1910, 5, 193—206.

The alkaloid of pituri is nicotine. Non-volatile alkaloids are absent, and no evidence was forthcoming of the presence of other volatile alkaloids. The material, *Duboisia Hopwoodii*, when dried at 60° C., yielded 2·67 per cent. of the base.—F. Shdn.

Vanilla extract; Distinction of —— from its imitations. A. L. Winton and C. I. Lott. U.S. Dept. of Agric., Bull. No. 132, 1910, 109—111.

A determination of the lead number of the extract, using normal lead acetate for the purpose, is recommended as a means of distinguishing between genuine and imitation vanilla extracts. The use of normal lead acetate also permits of the determination of the vanillin in the same portion of the sample, which is not the case when basic lead acetate is employed. Fifty grms. of the extract are placed in a weighed beaker provided with marks showing volumes of 50 c.c. and 80 c.c.; after diluting the extract to a volume of 80 c.c., the solution is evaporated at a temperature of 70° C. to a volume of 50 c.c. Water is again added and the evaporation repeated. The residual 50 c.c. of solution are transferred to a 100 c.c. flask, 25 c.c. of an 8 per cent. solution of normal lead acetate are added, the mixture is diluted to the mark, shaken, and allowed to settle for at least 3 hours, preferably overnight. The supernatant liquid is then decanted through a dry filter. The vanillin and coumarin are determined in 50 c.c. of the filtrate by the Hess and Prescott method (this J., 1899, 397, 525). In another 10 c.c. of the filtrate the lead number is determined, by adding 25 c.c. of water, a slight excess of sulphuric acid, and 100 c.c. of 95 per cent. alcohol. After the lapse of some hours, the lead sulphate is collected on a filter, washed with alcohol, dried, and weighed. The lead number is then calculated by the formula:—

$$P=\frac{100\times 0{\cdot}6831}{5}(S-W)=13{\cdot}662\ (S-W),$$

where P is the lead number, S = grms. of lead sulphate obtained from 2·5 c.c. of the lead acetate solution (determined separately), and W = grms. of lead sulphate obtained from 10 c.c. of the filtrate from the lead acetate precipitate. In the following table are given the results of analyses of authentic vanilla extracts prepared from different kinds of beans. To avoid confusion, the words "normal" and "basic" are suggested as suitable for distinguishing the lead numbers obtained, respectively, with normal and basic lead acetate.

Kind of bean.	Vanillin.			Lead number.	
	Usual Hess and Prescott method.	Combined method. Normal acetate.	Combined method. Basic acetate.	Normal.	Basic.
Mexican (cut)* ..	0·14	0·16	0·12	0·81	1·08
Seychelles	0·15	0·17	0·09	0·35	1·00
S. American	0·18	0·18	0·14	0·50	1·13
Comores (Mayotte)	0·24	0·24	0·12	0·37	1·01
Tahiti	0·09	0·09	0·03	0·29	0·99
Vanillon*	0·09	0·09	0·08	0·64	1·09
Bourbon........	—	0·20	—	0·61	—

*12 per cent. extract, all other samples are 10 per cent.

Three samples of commercial extract stated to be pure yielded lead numbers varying from 0·29 to 0·34, whilst various artificial extracts had normal lead numbers of from 0·03 to 0·17. The amounts of vanillin obtained by the use of the above method agree closely with those found by the Hess and Prescott method (*loc. cit.*) but when basic lead acetate is used the vanillin results are worthless.—W. P. S.

Capsicum; Capsaicin, the pungent principle of ——, and the detection of capsicum. E. K. Nelson. J. Ind. Eng. Chem., 1910, **2**, 419—421 (cp. Micko, this J., 1900, 168).

Employing Micko's method of extraction, the author has extracted pure crystalline capsaicin from *Capsicum fastigiatum*, in quantity representing 0·14 per cent. of the original material; he concludes, from his investigations, that capsaicin is the only active principle of capsicum. One drop of a solution containing 1 part of capsaicin per 100,000, causes a persistent burning on the tongue, and the only method for detecting small quantities of capsicum appears to be that which depends on the physiological action of the capsaicin. The author proposes the following method, which is a modification of that proposed by Garnett and Grier (Pharm. J., [3], 12, 721), for the detection of capsicum in ginger preparations:—Ten c.c. of a tincture, or the ethereal extract from 100 c.c. of a beverage (from which any alcohol present has been evaporated prior to extraction), are evaporated on the steam-bath with 2*N* alcoholic solution of potassium hydroxide. The residue is treated with about 0·006—0·007 grm. of powdered manganese dioxide and 5—10 c.c. of water, the heating on the bath being continued for about 20 minutes or until volatile oils are expelled. The mixture is cooled, acidified with dilute sulphuric acid, and extracted at once with petroleum ether. The solvent is evaporated in a small crucible, the residue being kept within as small an area as possible and heated on the steam-bath for about five minutes. The residue is tested with the tip of the tongue: the burning sensation will soon be felt if capsicum is present in the sample examined, or in the course of a few minutes if the amount of capsicum is very small.—L. E.

Adrenine [*adrenaline*] *and allied bases; Some colour reactions of ——.* A. J. Ewins. J. Physiol., 1910, **40**, [4]. Pharm. J., 1910, **85**, 517.

This is an investigation into the more characteristic colour reactions which from time to time have been suggested for the identification or estimation of adrenine, and the following have been described:—(1) The production of a rose-red colour on the addition of iodine (Vulpian). (2) The formation of a red colour on addition of mercuric chloride (Comessatti). (3) The production of a reddish-violet colour by the action of potassium bi-iodate ($KIO_3.HIO_3$) and phosphoric acid (Fränkel and Allers), or by the action of iodic acid (Krauss). With solutions of the pure base, the delicacy of Vulpian's reaction is very great; a distinct reaction is obtainable with solutions of 1 part of the hydrochloride (or other salt) of adrenine in 1,000,000. The colour is apparently due to oxidation under the influence of iodine, the same colour being produced by the action of other oxidising agents, or when dilute neutral solutions of adrenine are allowed to stand exposed to light and air. The Comessatti reaction is considered by the author to be a particular instance of a general reaction. The following details are given to ensure the reaction being obtained with certainty: To 1 c.c. of a dilute solution (1:100,000) of adrenine in distilled water is added an equal volume of a solution of sodium acetate (1 per cent.), followed by 4 or 5 drops (approx. 0·25 c.c.) of a solution of mercuric chloride in distilled water (1:1,000). If the solution now be warmed to 40°—50° C. a rose-red colour is immediately obtained. At the laboratory temperature (15° C.) a pale rose tint is obtained after four or five minutes. The use of sodium acetate ensures uniform results. In the Fränkel-Aller's reaction it appears that free iodine plays an important part, but it is modified to some extent by the conditions under which it is made. It is a very delicate reaction; a distinct reaction may be obtained with a solution of one of adrenine in one million. The reaction has been modified and intensified by G. Bayer, who adds sulphanilic acid to the solution as prepared by Fränkel and Allers; a yellow colour instead of the normal rose tint is produced, and is seen in a solution of one of adrenine in five millions. Potassium persulphate, like the reagents referred to, oxidises adrenine, giving a characteristic red colour. It has advantages over those mentioned both in sensitiveness and in being readily obtained with crude extracts of the glands, etc. The characteristic colour reactions of adrenine are given by other closely related bases, namely, by (*a*) the amino base corresponding to adrenine, (*b*) dihydroxyphenylethylamine and the corresponding methyl, ethyl and propylamino bases (*c*) aminoacetopyrogallol. The bases of the type aminoacetocatechol do not give these reactions.

Amygdalin; The hydrolysis of —— by emulsin. L. Rosenthaler. Arch. Pharm., 1910, **248**, 534—535. (See this J., 1910, 450.)

Any *d*-benzaldehydecyanohydrin which can be isolated from the product of the action of emulsin upon amygdalin, is the result of a primary hydrolysis and a secondary synthetic reaction. The complete hydrolysis of amygdalin by this enzyme takes place in three stages: (1) The amygdalin is hydrolysed by amygdalase to mandelonitrile-glucoside and *a*-dextrose. (2) Mandelonitrile-glucoside is hydrolysed to *d*-benzaldehydecyanohydrin and *β*-dextrose by a *β*-dextrosidase. (3) *d*-Benzaldehydecyanohydrin decomposes into benzaldehyde and hydrocyanic acid under the influence of *δ*-*d*-oxynitrilase. If a 5 per cent. solution of emulsin be heated to 60°—65° C. for 10 hours, the resulting liquid has no action upon amygdalin, but hydrolyses *d*-benzaldehydecyanohydrin. A solution of emulsin saturated with magnesium sulphate and filtered, hydrolyses amygdalin but not *d*-benzaldehydecyanohydrin. The precipitate produces the latter substance when allowed to act upon amygdalin. Prulaurasin gives rise to *d*-benzaldehydecyanohydrin under the action of emulsin.—F. Shdn.

Hydrocyanic acid; Volumetric determination of —— particularly in and together with benzaldehydecyanohydrin. L. Rosenthaler. Arch. Pharm., 1910, **248**, 529—533.

The determination of hydrocyanic acid depends on the fact that the addition of mercuric chloride to this acid causes the liberation of hydrochloric acid, which can be titrated using iodeosin as indicator. *N*/10 solutions of acid and alkali are used, and a 0·2 per cent. solution of iodeosin in alcohol, also a solution of 27·1 grms. of mercuric chloride and 11·7 grms. of sodium chloride in 500 grms. of water. The liquid containing the hydrocyanic acid is neutralised with acid or alkali after the addition of iodeosin and ether when the aqueous portion is rose-coloured. Excess of mercuric chloride is added, the liquid shaken, and titrated with the alkali till the rose colour is restored. A further addition of mercuric chloride should not destroy the colour. To determine the total hydrocyanic acid in a mixture of the acid and benzaldehydecyanohydrin, excess of the standard alkali is added to the liquid which has previously been rendered neutral in the presence of iodeosin. After shaking, mercuric chloride solution is added, and the liquid again shaken. Standard acid is now added till the colour is removed. In order to determine the free hydrocyanic acid in such mixtures, the liquid to be titrated is mixed with 20 c.c. of saturated sodium sulphate solution and neutralised after the addition of about 50 c.c. of ether and 10 drops of the iodeosin solution. Mercuric chloride solution is now added, the mixture shaken, and the aqueous part drawn off. The ethereal solution is washed with sodium sulphate solution, which is added to the portion first drawn off. The whole is then titrated with alkali. The decomposition of the benzaldehydecyanohydrin is thus avoided.—F. SHDN.

Methylchrysophanic acid; The so-called ——. O. A. Oesterle and U. Johann. Arch. Pharm., 1910, **248**, 476—491.

THE substance containing methoxyl groups in the commercial chrysophanic acid obtained from chrysarobin is not methylchrysophanic acid, as has been supposed hitherto. It is identical with the emodin monomethyl ether obtained from Frangula (Rheum). The same substance is obtained by the partial removal of the methyl groups from the trimethyl ether of emodin from the same source. The authors conclude that chrysarobin contains neither the methylchrysarobin of Hesse (Annalen, 1899, **309**, 35) nor the dichrysarobin methyl ether of Jowett and Potter (this J., 1904, 797). Emodin methyl ether is also identical with rheochrysidin found in the chrysophanic acid of rhubarb and lichen.—F. SHDN.

Chrysophanic acid. O. A. Oesterle and U. Johann. Arch. Pharm., 1910, **248**, 492—500.

IN view of the differences of opinion respecting the constitution of chrysophanic acid, the authors are making a series of experiments on this substance. They consider that the two hydroxyl groups differ in their susceptibility to methylation. When the dimethyl ether of this acid is heated with strong sulphuric acid, a small amount of the monomethyl ether is produced. Similar results are obtained when the hydrolysis is carried out by means of aluminium chloride. The monomethyl ether of chrysophanic acid was heated in water saturated with ammonia to 140° C., producing the monomethyl ether of monoaminochrysophanic acid, $C_{14}H_5O_2CH_3(OCH_3)(NH_2)$. This forms glistening brownish-red needles, m. pt. 237°—239° C. It is soluble in hot alcohol, benzene and ethyl acetate, and in hydrochloric and sulphuric acids. It dissolves slowly in hot potassium hydroxide solution forming a brownish-red solution. Under the action of nitrous acid the monomethyl ether of chrysophanic acid is formed.—F. SHDN.

Peppermint oil; The physical and chemical characters of Hungarian ——. K. Irk. Z. Riech- und Geschmackst., 1910, **2**, 222—224.

A NUMBER of samples of Hungarian peppermint oil have been examined, including commercial specimens, and others prepared in the laboratory. The average yield of the oil was 1·17 per cent. varying from 0·862 to 1·4306 per cent. The sp. gr. at 20° C. lies between 0·89705 and 0·92, and the optical rotation, a_D, between −26·51° and −32·40°. As a rule the oil is soluble in 2—4 parts of 70 per cent. alcohol, 1—2 parts of 80 per cent. alcohol, and 0·5 part of 90 per cent. alcohol. The other characters are: saponification value 19·6 to 45·99; percentage of ester 6·93 to 16·26; menthol ester 5·46 to 12·82 per cent.; saponification value after acetylating 173·0 to 199·6; free menthol 42·815 to 55·90 per cent.; total menthol 55·38 to 65·19 per cent.; menthone 7·38 to 13·21 per cent.—F. SHDN.

Organic acids and their salts; Solubilities of the Pharmacopœial ——. A. Seidell. Bull. No. 67, June, 1910. Hygienic Lab., Treasury Dept., Publ. Health and Marine-Hospital Service, U.S.A.

CAREFUL determinations have been made of the solubilities of the organic acids and salts of the U.S. Pharmacopœia in water, and mixtures of water and alcohol, and in some cases, in various organic solvents. The results obtained with the different mixtures of alcohol and water are given in curves. These curves are of various shapes, showing that it is not possible to calculate the solubility in a given alcohol-water mixture from the solubilities in the two solvents separately. Solubility determinations cannot be relied upon as tests for purity, since comparatively large quantities of impurities do not, in some cases, materially affect the solubility. The author's results for the solubilities of organic acids and salts in water and in 92·3 per cent. (official, U.S.P.) alcohol are given in the following table, together with the values given in the eighth edition of the U.S. Pharmacopœia :—

Compound.		Grams of compound per 100 grams of solvent at 25° C.			
		In water.		In 92·3 weight per cent. alcohol.	
		Author.	U.S.P.	Author.	U.S.P.
Ethyl Acetate	$CH_3CO_2C_2H_5$	8·6	11·1	∞	∞
Lead acetate	$(CH_3CO_2)_2Pb + 3H_2O$	72·5	50·0	(*a*) 1·1	3·33
Potassium acetate	CH_3CO_2K	219·6	250·0	43·9	50·0
Sodium acetate	$CH_3CO_2Na + 3H_2O$	125·7	100·0	6·6	4·30
Zinc acetate	$(CH_3CO_2)_2Zn + 2H_2O$	44·5	40·0	4·3	2·77
Benzoic acid	$C_6H_5CO_2H$	0·37	0·35	56·74	55·50
Ammonium benzoate	$C_6H_5CO_2NH_4$	22·8	9·5	3·5	3·50
Lithium benzoate	$C_6H_5CO_2Li$	38·2	33·3	5·8	7·7
Sodium benzoate	$C_6H_5CO_2Na$	56·24	62·5	2·04	2·3
Camphoric acid	$C_8H_{14}(CO_2H)_2$	0·76	0·8	104·5	(*b*)
Citric acid	$C_3H_5O(CO_2H)_3 + H_2O$	207·70	185·2	116·0	61·5
Bismuth citrate	$C_3H_5O(CO_2)_3Bi$	0·011	(*c*)	0·07	(*c*)
Bismuth-ammonium citrate	Variable composition	22·25	(*d*)	0·0	(*e*)
Lithium citrate	$C_3H_5O(CO_2Li)_3 + 4H_2O$	74·5	50·0	0·04	(*f*)
Potassium citrate	$C_3H_5O(CO_2K)_3 + H_2O$	181·8	200·0	0·01 +	(*e*)
Sodium citrate	$C_3H_5O(CO_2Na)_3 + 5\frac{1}{2}H_2O$	92·7	90·9	0·0	(*g*)
Gallic acid	$C_6H_2(OH)_3(CO_2H) + H_2O$	1·16	1·18	27·23	24·1
Sodium phenolsulphonate	$C_6H_4(OH)SO_3Na + 2H_2O$	24·1	20·8	0·9	0·77
Zinc phenolsulphonate	$(C_6H_4OHSO_3)_2Zn + 8H_2O$	66·1	59·0	72·1	59·0
Salicylic acid	$C_6H_4(OH)CO_2H$	0·22	0·32	40·85	50·0
Ammonium salicylate	$C_6H_4(OH)CO_2NH_4$	103·2	111·0	42·86	43·4
Bismuth subsalicylate	$C_6H_4(OH)CO_2.OBi$	0·01	(*f*)	0·105	—
Lithium salicylate	$C_6H_4(OH)CO_2Li + \frac{1}{2}H_2O$	127·3	(*d*)	83·8	(*d*)
Methyl salicylate	$C_6H_4(OH)CO_2CH_3$	0·1	(*e*)	∞	∞
Phenyl salicylate	$C_6H_4(OH)CO_2C_6H_5$	0·01 +	0·043	21·51	20·0
Quinine salicylate	$C_6H_4(OH)CO_2H,C_{20}H_{24}N_2O_2 + \frac{1}{2}H_2O$	0·06 +	1·3	4·84	9·0
Sodium salicylate	$C_6H_4(OH)CO_2Na$	115·3	125·0	13·6	18·2
Strontium salicylate	$(C_6H_4OHCO_2)_2Sr + 2H_2O$	5·31	5·5	2·06	1·5
Stearic acid	$C_{17}H_{35}CO_2H$	0·03 +	(*c*)	4·33	6·0
Tartaric acid	$C_2H_4O_2(CO_2H)_2$	137·5	140·8	37·4	60·0
Antimony-potassium tartrate	$C_2H_4O_2(CO_2K)(CO_2SbO) + \frac{1}{2}H_2O$	8·52	6·45	Trace	(*c*)
Potassium bitartrate	$C_2H_4O_2(CO_2H)(CO_2K)$	0·654	0·5	0·014	(*h*)
Potassium-sodium tartrate	$C_2H_4O_2(CO_2Na)(CO_2K) + 4H_2O$	114·2	83·3	Trace	(*f*)
Trichloracetic acid	CCl_3CO_2H	1201·0	(*d*)	Decomp.	(*d*)
Zinc valerate	$(C_4H_9CO_2)_2Zn + 2H_2O$	1·46	2·0	5·82	2·8

a. Solid phase anhydrous.
b. Readily soluble.
c. Insoluble.
d. Very soluble.
e. Sparingly soluble.
f. Almost insoluble.
g. Slightly soluble.
h. Very sparingly soluble.

The chief results of the determinations of solubility in organic solvents are given in the following table:—

Grms. of compound per 100 grms. of solvent at 25° C.

Solvent.	Benzoic acid.	Camphoric acid.	Citric acid.		Gallic acid.	Salicylic acid.	Stearic acid	Tartaric acid.
			cryst.	anhyd.				
Acetone	—	—	—	—	35·120		4·97	—
Amyl alcohol, iso	32·37	50·000	18·210	—	5·700	25·73	10·41	3·50
Amyl acetate	22·00	—	6·300	4·11	2·800	20·00	12·60	—
Alcohol, absolute	58·40	100·400	99·200	62·20	28·54	47·50	9·05	27·6
Benzene	12·23	0·008	Trace	—	0·022	0·86	—	0·0086
Chloroform	15·14	0·153	0·007	None	Trace	1·67	18·40	Trace
Carbon tetrachloride	4·18	—	Trace	—	Trace	0·25	11·42	0·0189
Carbon bisulphide	4·82	0·020	Trace	—	0·042	0·23	23·76	—
Cumene (sp. gr. 0·862 at 20° C.)	8·59	0·197	—	—	—	0·87	—	—
Ether, absolute	46·74	91·400	2·223	1·06	1·390	47·68	25·06	0·0131
Ligroin (sp. gr. 0·714 at 25° C.)	1·75	0·007	—	—	—	0·13	—	—
Naphtha (sp. gr. about 0·720)	2·65	—	—	—	—	—	—	—
Nitrobenzene	10·05	0·500	—	—	—	2·23	1·26	—
Toluene	10·69	0·150	Trace	—	Trace	0·85	15·75	Trace
Spirits of turpentine (sp. gr. 0·865 at 20° C.)	5·09	1·740	—	—	—	2·27	—	—
Xylene (sp. gr. 0·861 at 25° C.)	9·71	0·230	—	—	—	0·91	—	—

—A. S.

Liquor aluminii acetici. K. Feist and M. Hochstätter. Arch. Pharm., 1910, **248**, 525—528.

A satisfactory preparation containing aluminium acetate in solution can be prepared in the following way. 30 parts of aluminium sulphate are dissolved in 80 parts of water, and a mixture of 20 parts of water and 26 parts of barium carbonate added, care being taken that the latter is not in excess of that required by the sulphate radical present. 36 parts of dilute acetic acid are added, and the whole allowed to stand for 8 days. The clear liquid is drawn off and diluted till it has the sp. gr. 1·044. This preparation contains a small amount of aluminium sulphate, but is free from other impurities. 20 grms. should be neutralised by 18·5—19·7 c.c. of $N/_1$ potassium hydroxide, using phenolphthalein. It should leave 7·5 to 9·0 per cent. of residue on evaporation, and 2·9 to 3·5 per cent. on ignition. The liquid is stable at the ordinary temperature.—F. Shdn.

Mercury in galenicals; Determination of ——. R. Grüter. Pharm. Zeit., 1910, 427. Pharm. J., 1910, **85**, 492.

The volumetric methods proposed by E. Rupp (this J., 1908, 1179), for determining mercury in galenical preparations are by far the best yet proposed; for preparations containing large quantities of colloids the iodine method is to be preferred, but Rupp's directions required to be modified. The Neisser-Siebert dressing, containing 0·3 per cent. of corrosive sublimate, with gelatin, starch, tragacanth, and glycerin, presents some difficulty, and if Rupp's directions are exactly followed, only about half the mercury will be found. Good results were obtained by using the following modification:—About 50 grms. of the compound are mixed with about 250 c.c. of water in a ¾-litre flask and well shaken for a few minutes; 5 grms. of potassium iodide in solution are then added, and the whole shaken for ten minutes; next, 50 c.c. of 10 per cent. caustic soda solution and 25 c.c. of 40 per cent. formaldehyde solution are added, and after shaking again for ten minutes the liquid is acidified by adding 12 c.c. of glacial acetic acid and 15 c.c. of $N/10$ iodine solution are added. After shaking for a further ten minutes the excess of iodine is determined by titration with $N/10$ thiosulphate solution. Smaller quantities of the original compound may be employed, down to one-tenth of the above; in that case the times of shaking may be reduced to three to five minutes; and $N/100$ iodine and thiosulphate are used.

Tincture of iodine of the French Codex, 1908; Influence of temperature and light on ——*, and means of preserving it.* C. Courtot. J. Pharm. Chim., 1910, 2, 344—350.

The tincture of iodine of the French Codex, 1908, is simply a 10 per cent. (by weight) solution of iodine in 95 per cent. alcohol. Like the tincture of the previous Codex, from which it differs only in containing slightly more iodine, this solution is unstable when stored under the ordinary conditions of variation of temperature and exposure to light, considerable quantities of free hydriodic acid being formed, as well as of ethyl acetate and aldehyde. It is found that by adding sodium iodide in the proportion of 35 grms. per kilo. of tincture, or an equivalent amount of potassium iodide, this decomposition of the alcohol may be entirely prevented.—J. O. B.

Iron soaps. Feist and Auernhammer. *See* XII.

Patents.

Hæmoglobin; Method of treating ——. F. Neumann, Wandsbek, Germany. Eng. Pat. 28,182, Dec. 2, 1909.

When hæmoglobin obtained from blood, and freed from fibre and then submitted to centrifugal action, is concentrated, considerable frothing takes place. This is prevented by mixing with the hæmoglobin, before concentrating, about 15 per cent. of a finely powdered, neutral substance, and preferably one having nutritive properties; the following are mentioned as suitable:—Common salt, starch, corn, coffee, sugar, cocoa, groats, rice, mucilage, leguminous plants.—T. F. B.

Anisaldehyde from anethol and anise oil; Process for preparing ——. Dr. Genthe und Co. Ger. Pat. 225,265, Sept. 4, 1908.

Anethol (or anise oil) is quantitatively oxidised to anisaldehyde by treating it with air and at the same time subjecting it to the influence of rays of light of short wavelength (ultraviolet rays). The advantage of this method of oxidation over that by bichromate and acid, is stated to be that no anisic acid is formed. The anisaldehyde is separated in the form of its bisulphite compound, and isolated in the usual manner.—T. F. B.

Mercury cholate; Process for preparing ——. J. D. Riedel Akt.-Ges. Ger. Pat. 225,711, Feb. 10, 1910. Addition to Ger. Pat. 171,485, Jan. 1, 1905. (See Eng. Pat. 11,180 of 1905; this J., 1905, 939.)

When a solution of mercuric chloride is added to a solution of an alkali cholate, a milky liquid is obtained, which contains the mercury cholate in colloidal form; in order to obtain it in the form of a precipitate, the solution is either heated or allowed to stand at the ordinary temperature for several days. One kilo. of cholic acid is dissolved by heating with 40 kilos. of water and the necessary quantity of sodium carbonate; 6750 kilos. of a 5 per cent. solution of mercuric chloride are added, and the mixture is heated on the water-bath until the mercury cholate is precipitated and the supernatant liquid has become clear; the precipitate is then filtered off, washed with water, and dried.—T. F. B.

Collodion ointments containing medicaments; Process for preparing ——. P. Eyer. Ger. Pat. 225,736, Feb. 1, 1910.

Homogeneous ointments containing collodion and suitable medicaments are obtained by agitating the collodion solution in which the medicament is dissolved, with a suitable fat or mineral grease, until a product of the desired consistency is obtained. The alcohol-ether mixture should consist of about 80 per cent. of alcohol and 20 per cent. of ether. For example, 28 grms. of nitrocellulose and 140 grms. of salicylic acid are dissolved in 1000 grms. of ether-alcohol, and 400 grms. of vaseline are incorporated with the solution.—T. F. B.

Vegetable juices containing resins; Process for the preparation of active solutions of —— free from irritant substances. E. Schreiber. Ger. Pat. 226,354, Dec. 10, 1908.

The resinous juice (balsams, empyreumatic turpentine oil, juniper oil, etc.) is dissolved in alcohol or other suitable solvent and the solution treated with water. The resinous and other substances which separate, are removed by filtration or otherwise. It is stated that the solutions thus obtained possess the valuable therapeutic qualities of the original substances, whilst not producing any injurious effects, and are suitable for both internal and external use —A. S.

Hypnotics; Process for the preparation of ——. C. F. Boehringer und Söhne. Ger. Pat. 226,454, Aug. 27, 1908.

Glycerol mono- or di-alkyl ethers are converted into trialkyl ethers by the usual methods, at least one of the new alkyl groups introduced being different to the alkyl group or groups already present. Whilst the tri-ethyl ether of glycerol exerts no hypnotic action, the alkyl ethers in which at least two of the alkyl groups are different are surprisingly active in this respect.—A. S.

Tetramethylene-diamine; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8099, April 4, 1910.

See Fr. Pat. 414,461 of 1910; this J., 1910, 1227.—T. F. B.

Ointment-bases; Process of making artificial ——. S. Knopf, Vienna. U.S. Pat. 971,681, Oct. 4, 1910.

See Eng. Pat. 17,523 of 1907; this J., 1908, 693.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Dyestuffs; The acceleration of the bleaching-out of —— by aromatic compounds. G. Kümmell. Z. wiss. Phot., 1910, 9, 54—60. Chem. Zentr., 1910, 2, 1184.

In order to obtain some indication as to the influence of the constitution of the "sensitiser" on the sensitiveness to light of fugitive dyestuffs, a set of experiments was made with Erythrosin, Methylene Blue, and Cyanine on the one hand, and anethol, eugenol, *iso*-eugenol, safrol, *iso*-safrol, anisol, and vinylanisol on the other hand; a specially prepared chromate paper was used for the tests. The influence of constitution was very marked; for example, anethol sensitises Methylene Blue and Erythrosin strongly, but has no effect on Cyanine, whilst safrol and *iso*-safrol make all three dyestuffs faster to light. In general the effect of the sensitisers decreases with increasing molecular weight. The bleaching-out process appears always to be an oxidising process, the sensitisers probably acting as oxygen carriers, by being converted into peroxides. —T. F. B.

Colloidal silver as intensifying and toning agent in photography. A. Neugschwender. Z. Chem. Ind. Kolloide, 1910, 7, 214—219.

When silver ferrocyanide is treated with stannous chloride solution and then with ammonia solution, a dark brown solution is obtained, from which a precipitate of colloidal silver separates after some time. This reaction may be utilised for the intensification or toning of photographic images, the silver being first converted into ferrocyanide by treatment with an alkali ferricyanide. The intensification produced is greater than that obtained with mercury and ammonia, but less than when uranium is used. Dark brown tones are obtained on bromide paper by the above means; they can be converted into bright brown and red-brown tones by subsequent treatment with dilute hydrochloric acid or ammonium chloride solution. When stannous nitrate and sodium carbonate are used in place of stannous chloride and ammonia, the intensification is stronger, but still somewhat less than that produced by uranium. Other amorphous silver compounds (the chloride and carbonate) are converted into colloidal silver by stannous salts and alkalis and also by certain other reducing agents, but the ferrocyanide process appears to be the only one which can be used in photography. —T. F. B.

Photographic silver images; Fixation of gold and platinum on ——. R. Namias. Internat. Cong. Phot., Brussels, 1910. Through Bull Soc. Franç. Phot., 1910, 1, 311—312.

In order to determine the amounts of gold and platinum taken up by silver images during toning, the prints were treated with dilute cupric chloride solution and then with sodium thiosulphate to eliminate the silver, and the residual images were examined. It was found that, with printing-out papers, the quantity of gold deposited was generally proportional to that of the silver in the print, but was very small, and varied according to the nature of the emulsifier. Toning with gold after fixation gives much deeper images, when the acid toning bath containing thiocyanate is used. In the case of platinum toning, the deposits are always greater than with gold, and are generally proportional to the amount of silver present. As regards the toning of bromide and chlorobromide papers, gold produces very heavy deposits, especially with the latter paper, but platinum gives very feeble deposits in both cases.—T. F. B.

Patents.

Colour screens for colour photography; Manufacture of ——. R. Ruth, Charlottenburg, Germany. Eng. Pat. 16,273, July 7, 1910. Under Int. Conv., July 10, 1909.

This invention relates to the preparation of the coloured particles for use in making screens for colour photography. A suitable coloured solution of a resin or a colloid, which will easily dry or solidify in air, is distributed in the form of minute drops in a chamber heated to a suitable temperature; the height from which the drops fall and the temperature are so adjusted that the drops solidify in the form of fine powder before they reach the bottom of the chamber.—T. F. B.

Toning agent for photographic images on paper. Gekawerke Offenbach Dr. G. Krebs. Ger. Pat. 226,293, April 11, 1908.

Pure black tones and clear whites are obtained on printing-out papers by the use of certain complex salts of palladium and iridium, such as pallado- or irido-oxalates; the oxalic acid radical may be replaced by that of formic acid, tartaric acid, citric acid, etc. It is preferable to use these salts in presence of an alkali chloride; if a sufficient excess of this be added, the bath serves as a combined toning and fixing bath. It is not necessary to isolate the complex salt first; it is more easily formed in making up the bath. For example, for separate toning and fixing, the bath may consist of :—1 grm. of potassium-palladium chloride, 40 grms. of oxalic acid, 5 grms. of ammonium chloride, and 1 litre of water; for combined toning and fixing, 300 grms. of ammonium chloride are used instead of 5 grms.—T. F. B.

Colour photography: Device for production of three-colour screens for ——. R. Krayn, Berlin. Eng. Pat. 26,911, Nov. 19, 1909. Under Int. Conv., Nov. 20, 1908.

See Fr. Pat. 409,397 of 1909; this J., 1910, 720. —T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives; The temperature of explosion and decomposition of ——. H. Kast. Z. ges. Schiess- und Sprengstoffw., 1910, 5, 376—380, 399—402.

The author criticises the views and conclusions of Poppenberg and Stephan (this J., 1910, 1083), and considers it is inaccurate to draw conclusions from the figures obtained for propellants, as to the results of detonation of high explosives. The formation of methane is considered to depend greatly on the pressure and temperature and the nature of the catalyser present, such as the walls of the explosion vessel. Poppenberg and Stephan consider that the formation of methane is comparatively slow, even at high temperatures and, in any case, far slower than the formation of carbon monoxide and water. The author considers that the high pressure which accompanies the decomposition of explosives causes reactions, which are normally slow, to take place with extreme rapidity. He does not agree with Poppenberg and Stephan as to the effect produced by the addition of sodium carbonate, as, from the results of his own experiments, in which he used up to 5 per cent. of sodium carbonate, no material decrease in the calories developed was shown. The higher bursting effect of picric acid compared with trinitrotoluene is explained on the basis of its higher speed of detonation (7100 metres per second against 6700 metres per second) and its higher density (1·65 as compared with 1·57). The author differs from Poppenberg and Stephan as regards secondary reactions taking place. They may be of importance from the ballistics point of view as heat may be evolved during the decrease of pressure and thus retard the rate of cooling. It is considered that temperature and pressure influence the molecular attraction in the same direction, that small changes of the co-volume are of great importance, and that this depends at low temperatures upon the qualitative nature of the gas. Mention is also made of the difference between the ballistic and chemical energy of an explosive, and that the denser a high explosive is the quicker the maximum pressure is reached, but that the reverse is the case with propellants. —G. W. McD.

Explosion; Circumstances attending an —— *which occurred in the mixing shed of the ammunition factory of the Birmingham Metal and Munitions Company, Limited, at Streetly, near Birmingham, in the County of Stafford, on the 5th August*, 1910. Major H. Coningham, H.M. Inspector of Explosives. [Cd. 5383.]

There were two explosions, the second being caused by projected *débris*. One man was killed and one injured by the explosions. The first explosion occurred in the mixing house, and an opening about 1 to 2 inches deep and about 2½ feet in diameter was formed at the place where the mixer stood. The furthest distance *débris* was projected was 85 yards. This was a piece of timber 9 inches by 4 inches by 6 feet long, which weighed about 65 lb. About 10 lb. of fulminate explosive and 3 lb. of potassium chlorate were in the building at the time of the explosion. The method of work employed was as follows:—Fulminate of mercury was brought into the building in sateen bags and placed on the table, or on the floor under it. Some 24 ounces of fulminate were weighed by means of a counterpoised balance, no loose weights being used. The fulminate was put into a soft leather bag and 6 ounces of potassium chlorate placed on the top of it. The bag containing the composition was taken to one of the mixers behind a wrought iron shield and then the contents carefully emptied into a "jelly" bag, which was made of soft material, and had india-rubber balls lying loose in it. After charging the mixer the bag was agitated by means of a system of levers and ropes from a motor which stood outside the building. When mixing was completed the contents were automatically emptied into wash-leather bags, and the operator entered the mixing house, went inside one of the semi-circular shields, removed the wash-leather bags and placed them inside a solid leather bag fitted with a handle and having a leather lid. This was then placed in a cage of an overhead transporter which carried it to the second building. Major Coningham comes to the conclusion that the workman was in the act of removing the solid leather bag to the cage, when he slipped, or in some way accidentally knocked the bag against the inside of the shield with sufficient force to explode its contents. In view of the effects of the explosion he considered that on re-erecting this particular building it should be mounded or otherwise effectively screened, and the building, especially the roof, should be of even lighter construction than it was prior to the explosion. He also suggests that the switch for starting the motor and the actuating lever should not be in the motor house, but in another building some distance away. The second explosion occurred in a building 26 yards away, and was undoubtedly due to projected *débris*. The total amount of explosive involved was about 4½ lb. and was contained chiefly in detonator capsules.

—G. W. McD.

Explosion of fireworks; Circumstances attending an —— *which occurred at Roundhay Park, Leeds, in the County of York, on the 25th June*, 1910. Major A. Cooper-Key, H.M. Chief Inspector of Explosives. [Cd. 5381.]

By this explosion, during a fireworks display, three people were killed and seven injured. On firing an 8 inch "shell" from a cast steel mortar weighing 4 cwt., and with walls about 1 inch thick, it detonated violently in the mortar, burst it, and scattered heavy fragments to all parts of the ground. The shell was made of two hemispheres of paper about ¼ inch thick, butted together and glued. The case was filled with about 1000 small coloured "stars" or cylinders about ⅜ inch diameter. These stars contained combustible bodies, potassium chlorate, salts of barium and potassium, and arsenic sulphide. They were coated with shellac, and, in order to burst the shell in the air, a small quantity of a composition consisting of a mixture of mealed gunpowder (2 parts), sulphur (1 part), and potassium nitrate (1 part) was poured into the shell. The "propelling" charge consisted of 10 ounces of fine grain powder. Major Cooper-Key considers that the detonation of the shell in the mortar was primarily due to ultra-sensitiveness of the contents of the shell, combined with an excessive propelling charge. If an inferior quality of shellac is used, the stars are very liable to crumble and form fine dust. The shell was only about two-thirds full, and this condition would tend to the creation of dust on handling, which would largely increase the risk of detonation and shock due to the discharge from the mortar. In large shells chlorate stars are usually diluted with lampblack or similar material and enclosed in cardboard cases. Care should be taken that the shell is quite full so as to prevent internal movement, and, at the same time, support the head and base, and prevent either collapsing on discharge. In a shell, similar to that which caused the accident, Messrs. Dupré found 100 grms. of a fine powder consisting of saltpetre (48 per cent.), charcoal (12 per cent.), sulphur (24 per cent.), and potassium chlorate (15 per cent.). Major Cooper-Key considers that it would require a very liberal interpretation of the provisions of the Order in Council to maintain that this did not constitute a distinct, even though unintentional, breach of the law. To prevent accidents of a similar nature the following recommendations are made:—(1) Sulphides of arsenic, antimony and copper should not be used in the composition of chlorate stars.

(2) When chlorate stars are used in shells above 5 inches in diameter, they should invariably be of the kind known as "pill-box." No "pumped" or 'cubic" stars should be employed. (3) In shells of 8 inches diameter or more, chlorate stars should never be used alone: they should always be mixed with small fireworks protected by paper cases, or with lampblack or similar material. (4) Shells should be completely filled. (5) Care should be taken that the binding agent used for chlorate stars, whether shellac, starch, or gum, is perfectly soluble in the solvent employed, in order that the stars should be hard and not crumble and form dust during handling and transit. (6) The mortars should be of mild steel, of a sufficient strength to withstand the explosion of the lifting charge, with an ample working margin, and should be "pitted" before use to as great a depth as reasonably practicable. (7) An exhibitor should decline to carry out a display unless a roped enclosure is provided for the fireworks.—G. W. McD.

PATENTS.

Trinitrotoluene mixture for explosives. J. G. Nathurst, Kingston, N.Y. U.S. Pat. 971,211, Sept. 27, 1910.

LIQUID dinitrotoluene is agitated with concentrated sulphuric and nitric acids, the temperature being kept below 90° F.; the product is separated from the acids, and washed. A mixture of dinitrotoluene and trinitrotoluene is thus obtained, of a brick red colour, melting below 50° F., and of a sp. gr. 1·50 at 60° F. It is non-volatile and "substantially" odourless, and is intended for use in high explosives.—T. F. B.

Smokeless powders; Manufacture of ——. C. Claessen. Fr. Pat. 415,737, May 9, 1910.

SEE Eng. Pat. 11,365 of 1910; this J., 1910, 1084.—T.F.B.

XXIII.—ANALYTICAL PROCESSES.

6-Sulpho-β-naphtholazo-m-hydroxybenzoic acid. A new indicator for alkalimetry. R. Mellet. Chem.-Zeit, 1910, **34**, 1073—1074.

THE sodium salt of this acid forms a deep purple solution in water, whilst the solution of the acid itself is bright red. The change in colour in a 1 per cent. solution is exceedingly sharp: so much so that the substance can be used as an indicator with *N*/100 solutions of acid and alkali. It is more delicate than any other indicator except phenolphthalein, for which it can be substituted, giving exactly the same results. Titrations can be made with it in either direction, and give the same results, if the change of colour be always pushed to its completion.—J. T. D.

Permanganate titrations; Source of error in ——. W. C. Bray. J. Amer. Chem. Soc., 1910, **32**, 1204—1207.

THE author gives the details of experiments which show the possibility of error in titrating oxalic acid with permanganate probably owing to the comparative slowness of the final stage in which the manganese is reduced from the trivalent to the bivalent state. The error is comparatively small but becomes of considerable importance where an accuracy of 0·1 per cent. is desired. In the case of the oxalate titration a careful study of the magnitude of the error shows the importance of avoiding low temperatures, high acid concentrations and large volumes. —W. H. P.

Ammonia; Determination of —— by the official [American] magnesium oxide method. T. C. Trescot. U.S. Dept. of Agric., Bull. No. 132, 1910, 20.

IN the determination of ammonia by distillation with magnesium oxide, the distillate being received in an excess of standard acid, there is frequently some difficulty in detecting the end-point of the titration when cochineal is used as the indicator; this is due to the presence of carbon dioxide liberated from the magnesium carbonate which is nearly always present in magnesium oxide. The difficulty may be overcome by igniting the magnesium oxide immediately before using, or by substituting Congo-red for the cochineal. A second, and more serious, difficulty found in using the method arises from the fact that many substances, such as cottonseed meal, meat, eggs, and wheat, continue to yield small quantities of ammonia as long as the distillation is continued, provided that fresh quantities of water are added from time to time; in some cases, a second distillation with a fresh quantity of water will yield as much ammonia as the first distillation. It is evident that all the ammonia existing as free ammonia or ammonium compounds would be obtained in the first distillation and that the quantities obtained subsequently are derived from the decomposition of other nitrogen compounds. In analyses of fertilisers these differences have little, if any, significance, but with other materials, notably in physiological work, they are of considerable importance.—W. P. S.

Copper; Conditions affecting the electrolytic determination of ——. W. C. Blasdale and W. Cruess. J. Amer. Chem. Soc., 1910, **32**, 1264—1277.

WITH a view to overcoming the difficulties offered by the electrolytic determination of copper in ores, etc., the authors have investigated separately the influence of the following factors on the rate of deposition and nature of the deposit. (I). *Form of electrodes.* A gauze cathode of comparatively fine mesh, and a cylindrically coiled spiral of platinum wire as anode are most efficient and economical. This stationary arrangement promotes most completely the agitation of the electrolyte by gas evolution. (II). *Variation in amperage.*—The available area of the cathode gauze being 93 sq. cm., a current of 0·75 amp. is chosen as the best practical value. (III). *Variation in concentration.*—The greater the concentration the more rapidly is the deposition made, and with 2 grms. of copper in 70—140 c.c. it is accomplished satisfactorily within an hour. (IV). *Amount and nature of acid present.*—If the temperature is kept below 30° C., as much as 4 c.c. of nitric or of sulphuric acid in 140 c.c. of electrolyte has little effect. Larger amounts would affect the nature of the deposit or tend to dissolve it. (V). *Effect of iron salts.*—This depends largely on the presence or absence of nitrates. Ferrous sulphate has little effect, while ferric sulphate causes a delay in deposition owing to its reduction. In the presence of much iron and much nitrate ion, especially the latter, the copper deposits normally up to a certain point, and then rapidly redissolves. This is generally accompanied by the darkening of the solution and is attributed to nitrous acid. This could be destroyed by the use of urea, but the deposition is retarded, and it is therefore better to avoid nitric acid when much iron is present. (VI). *Effect of arsenic.*—Arsenic if present deposits in traces with the copper and in larger quantities after the copper has been precipitated. Its deposition is prevented by sufficient nitric acid, or it can be removed by dissolving the copper in nitric acid and reprecipitating. (VII). Zinc and aluminium have little disturbing effect, but lead, if present, is deposited as sulphate in a sulphuric acid electrolyte. It is better to remove it completely before electrolysis. From these results it is suggested that the solution from a 1 grm.-sample of pyritiferous ore may be electrolysed with 0·75 amp. in about 90 mins., if the volume is not more than 100 c.c., containing not more than 5 c.c. of sulphuric acid and no nitric acid or arsenic. If arsenic is present in quantity, a reprecipitation will be necessary, but if it is only in traces, a little nitric acid and urea will enable the copper to be separated in one electrolysis.—W. H. P.

Copper, silver, cadmium, and bismuth; Rapid determination of —— with mercury cathode and stationary anode. R. C. Benner. J. Amer. Chem. Soc., 1910, **32**, 1231—1237.

WHEN the mercury cathode is used in electrolysis, the gas evolution stirs the liquid so considerably that the rotating anode may be dispensed with. The apparatus is thus greatly simplified, and the speed of deposition and accuracy of results are not appreciably diminished. It is necessary to use high current densities (35—40 amps. per sq. dm.) and fairly tall electrodes (to avoid splashing), while the anode must always be examined for, and freed from any globules of mercury which may have been carried to it.—W. H. P.

Tin; *Determination of —— in the presence of antimony.* J. A. Sanchez. Bull. Soc. Chim., 1910, 7, 890—894.

In a solution containing only stannous and antimonious chlorides, the former may be titrated directly with a standardised solution of ferric chloride. When the two metals have been separated as their sulphides in the usual course of analysis, the following procedure may be adopted for the determination of the tin by titration:—The mixed sulphides are dissolved by boiling with concentrated hydrochloric acid, small quantities of potassium chlorate being added from time to time, and the solution is then diluted and filtered to remove a few particles of sulphur which usually remain undissolved. The filtrate is next heated to boiling and fragments of aluminium are added; the stannic chloride is thus reduced to stannous chloride, whilst the antimony is precipitated in the metallic state. After filtering off the antimony, the stannous chloride in the filtrate is titrated with the standardised solution of ferric chloride. The antimony may be converted into its sulphide or oxide and weighed as such.—W. P. S.

Determination of molybdenum in calcium molybdate. Trautmann. *See* VII.

Apparatus for determining carbon, arsenic, and sulphur in iron and steel. Preuss. *See* X.

Determining aluminium and chromium in ferro-vanadium. Trautmann. *See* X.

Behaviour of iron with solutions of stannous salts. Thiel and Keller. *See* X.

Determining tin in white-metals by electrolysis. Schürmann. *See* X.

Analysis of tin-antimony alloys. McCay. *See* X.

Determination of cocoanut oil in admixture with butter-fat. Cassal and Gerrans. *See* XII.

Fat determination by the Kumagawa-Suto method. Shimidzu. *See* XII.

Determining acids in tanning liquors. Grasser. *See* XV.

Determining the nitrifying and ammonifying powers of soils. Stevens and Withers. *See* XVI.

Uniform analytical control of raw sugar factories. *See* XVII.

Methods of sampling, analysis, and calculation for use in Russian beet sugar factories. *See* XVII.

Detection of methyl alcohol in ethyl alcohol. Engelhardt and Jones. *See* XVIII.

Determining starch in cocoa products. Dubois. *See* XIXA.

Hamburg test for putrescibility [of sewage effluents]. Guth. *See* XIXB.

Volatility of cocaine. Fuller. *See* XX.

Distinction of vanilla extract from its imitations. Winton and Lott. *See* XX.

Capsaicin, the pungent principle of capsicum, and the detection of capsicum. Nelson. *See* XX.

Some colour reactions of adrenine [adrenaline] and allied bases. Ewins. *See* XX.

Determining hydrocyanic acid in and together with benzaldehydecyanhydrin. Rosenthaler. *See* XX.

Determination of mercury in galenicals. Grüter. *See* XX.

Patents.

Physical and for chemical apparatus for containing substances to be observed and capable of withstanding high temperatures, specially applicable to thermometers. C. Siebert and A. Kühn, Cassel, Germany. Eng. Pat. 28,380, Dec. 4, 1909.

See Fr. Pat. 410,023 of 1909; this J., 1910, 844.—T. F. B.

Colours; Apparatus for estimating the intensity of ——. J. W. Lovibond. Fr. Pat. 415,624, May 4, 1910. Under Int. Conv., Oct. 16, 1909.

See Eng. Pat. 23,746 of 1909; this J., 1910, 652.—T. F. B.

Apparatus for indicating and recording the percentage of carbon dioxide in combustion gases. Eng. Pat. 23,846. *See* IIA.

Testing or analysing lubricating oils or the like. Eng. Pat. 21,661. *See* XII.

Trade Report.

Austria. Report of Industrial Inspectors for 1909. Z. angew. Chem., 1910, 23, 1935—1936.

Reference is made in the report to the prohibition of the use of white or yellow phosphorus in the preparation of matches, etc.; the restriction of the importation and sale of colours, cements, etc., containing lead; the monopolisation of the match industry and of the storage and transport of petroleum; the use of acetylene generators for autogenous welding (compare this J., 1909, 786); and the safety regulations for electrical high-tension current installations (compare this J., 1910, 677). In the year covered by the report 27,532 visits were made to 25,704 works, in which 668,949 men, 285,075 women, 40,575 boys, and 24,414 girls were employed; of these 900 were chemical works employing 39,098 persons. A considerable number of new works were erected during the year, viz., blast furnace (1), cement (3), cement wares (5), kaolin (3), glass (2), accumulators (2), wood impregnation (2), rubber (1), xyloline spinning (1), finishes (6), bleaching and dyeing (3), starch (1), sugar (2), distilleries (2), chemical products (6), oxides of rare metals (1), wood distillation (1), gas (4), compressed gases (1), petroleum refining (1), tar products (3), colours (5), resin products (1), soap (4), glue (1), and crude petroleum storage (3). The number of cases of enlargement and reconstruction of factories was more than twice as large as in the preceding year. The provision of "sprinkler" installations in factories is stated to be largely increasing, and these have proved very efficient in the case of fires, notably in an artificial silk works in the Trautenau district. The use of electrical power and of suction gas plants is spreading. Among new methods of working are mentioned the manufacture of steel in electric furnaces (Héroult-Lindenberg system); briquetting of iron and metal cuttings by hydraulic pressure; electrical welding; cutting of steel plates by the oxyhydrogen blast flame, etc. During the year there were 86,132 accidents, of which 651 ended fatally; in the chemical works, the accidents were 3175, of which 25 were fatal.—A. S.

Chemical industry of Italy in 1909. Chem. Ind., Oct. 15, 1910, 648—649.

The chemical industry of Italy made no substantial progress during 1909, yet suffered less from the prevailing bad conditions than other branches of industry. There is a wide field for the installation of chemical works in Italy, Whilst the demand for acids, sulphates, and artificial fertilisers is covered by the home production, and in the case of calcium carbide, sodium sulphide, and barium salts, the imported products meet with vigorous competition from the home-manufactured substances, the demand for salts of tin, copper, and nickel, collodion, bleaching powder, chlorates, and perchlorates is met almost entirely by foreign products. It is probable, however, that this condition of affairs may soon be altered by the utilisation of some of the large supplies of water power available in Italy for hydro-electric installations.—A. S.

Books Received.

The Vapour-pressures, Specific Volumes, Heats of Vaporisation, and Critical Constants of Thirty Pure Substances. By Sydney Young, D.Sc., F.R.S. Scientific proceedings of the Royal Dublin Society, Vol. XII (N.S.), No. 31. Williams and Norgate, 14, Henrietta Street, London, W.C. Price 3s.

8vo volume of 70 pages, describing the methods employed and the results obtained in determining the above constants of the following substances:—Normal pentane, hexane, heptane, and octane, isopentane, di-isopropyl, di-isobutyl, hexamethylene, benzene, fluorobenzene, chlorobenzene, bromobenzene, iodobenzene, carbon tetrachloride, stannic chloride, ether, methyl, ethyl and propyl formates, methyl-, ethyl-, and propyl acetates, methyl and ethyl propionates, methyl butyrate and isobutyrate, methyl, ethyl, and propyl alcohols, and acetic acid.

Government Laboratories, Johannesburg. Report for the Year 1908-09. Government Printing Office, Pretoria.

Contains 16 f'cap. pages of matter. 2039 chemical tests were carried out during the year, including 690 water analyses, 389 of milk, 150 of wines, and 103 of medicines.

A Research on the Pines of Australia. By Richard T. Baker and Henry G. Smith. Technological Museum of New South Wales. Department of Public Instruction. Published by Authority of the Government of the State of New South Wales. William Applegate Gullick, Government printer, Sydney. 1910.

Quarto volume, containing 448 pages of subject-matter, 4 additional pages (appendixes), 3 maps, and the alphabetical index of subjects; in all, 459 pages. The work opens with a statement of acknowledgments, a preface by the authors, a table of contents, and an introduction by the Minister of Public Instruction, J. A. Hogue. The work has a frontispiece, and is illustrated throughout the text with 400 fine engravings and photolithographs, some coloured. The subject-matter is classified as follows:—I. Natural Order Coniferæ, with summary of the results of this research. II. Genera; A. Callitris, including arrangement of the species; giving also details and data as to the leaf oils; timbers; chemistry of the oil of the timber; (*a*) the phenol; (*b*) the occurrence of guaiol. Data are also given as to the tanning value of callitris barks, and concerning the Sandarac resins of the callitris. Then follow names of 18 individual species of callitris. B. Actinostrobus; two species. C. Diselma; one species (*archeri*). D. Microcachrys; one species (*tetragona*). E. Athrotaxis; three species. F. Araucaria; three species. G. Agathis; two species. H. Dacrydium; one species (*Franklini*). I. Pherosphæra; two species. J. Phyllocladus; one species (*rhomboidalis*). K. Podocarpus; five species. The treatment of the preceding genera, like that of the callitris group, is classified as to History; Anatomy; Sequence; Chemistry; and Economics, with, occasionally, details as to timber, leaves and bark (tanning value); chemistry of latex; volatile oil; free acids; gum; resin. Appendix A. refers to the "Systematic value of the chemical products of naturally growing plants as an aid to their botanical study." Appendix B. Table showing distribution of pines in New South Wales. Appendix C. Names of correspondents who assisted in collecting data for the pine survey of New South Wales. Maps (1) Of Australia, showing extreme distances from which material obtained: (2) Showing pine distribution in New South Wales; (3) County map with numbers corresponding to table.

E. Merck's Annual Report of Recent Advances in Pharmaceutical Chemistry and Therapeutics. 1909. Volume XXIII. E. Merck, Darmstadt and London. 1910. Price 1s. 6d.

8vo. volume, containing 347 pages of subject matter, with bibliographical index; alphabetical index of authors, alphabetical index of subjects, and alphabetical index of diseases, symptoms, and indications for treatment. The subject matter is classified as follows:—I. Serum therapy and bacterio-therapeutic agents. II. Preparations and drugs.

Kapillaranalyse beruhend auf Kapillaritäts- und Adsorptionserscheinungen. Auszug aus Fr. Goppelsroeder's seit 1861 bis 1909 über dieses Gebiet erschienene Publikationen. Von Friedrich Goppelsroeder. Separatabdruck aus Dr. Wolfgang Ostwald's Kolloid-Zeitschrift vom Januarheft 1909 an bis und mit Aprilheft 1910. Bd. IV., V. und VI. Theodor Steinkopff's Verlag. Dresden. 1910.

Large 8vo. volume, contains 162 pages of subject matter, with four illustrations. The text is classified as follows:—I. Introduction, with index of author's published articles on capillary analysis from 1861 to 1909. II. Experiments with organic dyestuffs. III. Capillary experiments with different series of organic bodies other than dyestuffs. IV. Capillary experiments with different series of inorganic bodies. V. Use of capillary analysis for the investigation of foodstuffs and the like. VI. Employment of capillary analysis in connection with physiological chemistry.

Tests for Coal-tar Colours in Aniline Lakes. A review of the coal-tar colouring matters generally used in the lake industry and their behaviour with distinct chemical reagents. By George Zerr. Authorised English edition by Dr. Charles Mayer. Chas. Griffin and Company, Limited, Exeter Street, Strand. 1910. Price 10s. 6d. net.

8vo. volume, containing 227 pages of subject matter, and an alphabetical index of subjects. The subject matter is classified as follows:—I. (*a*) Introductory: giving the outlines for preparation and definition, rationale, etc. (*b*) Reactions of aniline lakes—yellow and brown, orange, red, violet, blue, green, and a table by the translator, giving a clear definition as to dyestuff; carrier; precipitating agent; shade; solubility; reactions, etc. The bulk of the work is composed of tables, some giving the reactions of lakes with hot water, alcohol, and acetic acid: others classifying the precipitated coal-tar colours, as I., those soluble in hot water, alcohol, and acetic acid; II., those soluble in hot water and alcohol, but insoluble in acetic acid; III., those soluble in hot water, and acetic acid, but insoluble in alcohol; IV., those soluble in hot water, but insoluble in alcohol and acetic acid; V., those soluble in alcohol and acetic acid, but insoluble in hot water; VI., those soluble in alcohol, but insoluble in hot water and acetic acid. VII., those soluble in acetic acid, but insoluble in hot water and alcohol, and VIII., those insoluble in all three reagents. Next follow tables of reactions of the lakes with sulphuric acid of 66° Bé., and sodium hydroxide (12° and 40° Bé). An example is given (pp. 212—213) of the analysis of a lake containing only one dyestuff. Details follow as to the preparation, stocking, and application of standard lakes. Table XIV., furnishes the reactions of the coal-tar colour lakes with a tin salt solution. Examples are next given (pp. 222—226) of analysis of combined coal-tar colour lakes. Table XV. illustrates a series of coal-tar colour lakes specially fast to light.

Elektrische Doppelbrechung der Kohlenstoffverbindungen. Von Dr. Phil. Richard Leiser. [Abhandlungen der deutschen Bunsen-Gesellschaft für angewandte physikalische Chemie, Nr. 4.] Wilhelm Knapp's Verlag. Halle a. S. 1910. Price M. 3.60.

8vo. volume, containing 71 pages of subject matter, and twenty-six illustrations. The classification of the text is as follows:—I. Principles of measurement. II. Optical. III. Electrical. IV. Adjustment and calibration. V. The measurements. V. Discussion of the results. VI. Theoretical considerations. VII. Summary. VII. Bibliographic index. IX. Tables.

Elementary Course on Food-Testing. By B. A. Burrell, Lecturer on Food and its Adulterations, Central School of Commerce, Leeds, etc. Baillière, Tindall and Cox, 8, Henrietta Street, Covent Garden, London. 1910. Price 2s. 6d.

Crown 8vo. volume containing 85 pages of subject matter, with 21 illustrations, a glossary of chemical terms, and other tables, and 7 pages of microscopic diagrams. The text deals with the following themes: I. Adulteration in the early 19th century. II. Proximate composition of foodstuffs. III. Testing for organic matter and mineral matter. IV. Coffee and chicory—points of difference. V. Determination of the mineral matter or ash and silicious matter in chicory, coffee, and tea. VI. Sugar. VII. Detection of cottonseed oil in olive oil, lard, or lard substitutes. VIII. Examination of sausages for boric preservative compounds and starch; of tinned peas, for copper; of jam for salicylic acid. IX. Determination of water in butter, margarine, lard, etc., etc.

Handbook of the Commercial Intelligence Branch of the Board of Trade. Wyman and Sons, Fetter Lane, E.C. Price 2d.

The Board of Trade have just issued a new edition of the Handbook to their Commercial Intelligence Branch, the first edition of which was published in December, 1906. The Handbook explains the object for which the Commercial Intelligence Branch was originally formed, and enumerates under general headings, the subjects on which the Branch is prepared to supply information to British manufacturers and traders. Particulars will be found in it of the sundry samples on view at the Branch, of manufactured articles and raw products likely to be of interest to British manufacturers. It also contains lists of the principal official returns, trade directories, etc., which may be consulted at the Branch; and lists of the British Chambers of Commerce established in Foreign Countries, and of the Colonial Trade Enquiry Offices in the United Kingdom. The Handbook further contains a statement as to the duties of the Trade Commissioners who have been appointed by the Board of Trade in Canada, Australia, New Zealand, and the Union of South Africa, and a list of the local Trade Correspondents in British Colonies, together with information as to the work of His Majesty's Commercial Attachés and Consular Officers and their relation to the Branch.

*New Books.

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Patent List.

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Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT: MACHINERY.

Applications.

24,030. Marks (Jira). Filters. Oct. 17.

24,144. Cross (Borsari et Cie.). Tanks for acid liquors.* Oct. 18.

24,473. Lillie. Evaporating apparatus. Oct. 21

24,491. Veeckmans. Regenerative furnaces.* Oct. 21

24,508. Hiltruper Terrazo und Cementwaaren-Werke. *See under* IX.

24,543. Podmore and Bailey. Filter presses. Oct. 22.

24,577. Nesfield. *See under* XIX.

24,750. Smallwood. Furnaces for heating, roasting, smelting, drying, distilling, etc. Oct. 25.

24,885. Phillips and Bulteel. Method of oxidising vapours or gases. Oct. 26.

24,924. Schwarz. Gas-fired kilns. Oct. 27.

24,941. Phillips and Phillips. *See under* V.

Complete Specifications Accepted.

17,088 (1909). Johnson. Filtering apparatus. Nov. 2.

21,862 (1909). Pedersen. Centrifugal separators. Nov. 2.

24,074 (1909). Morison. Apparatus for heating and evaporating liquids by means of steam. Oct. 26.

24,458 (1909). Simpson. Apparatus for distilling volatilisable solids and for drawing-off gases *in vacuo*. Nov. 2.

24,825 (1909). Freymuth. *See under* XIII.

9493 (1910). Foster. Composition for attaching insulation to steam boilers, etc. Oct. 26.

11,720 (1910). Thomson and Fitzgerald. Rotary furnaces. Nov. 2.

12,858 (1910). British Thomson-Houston Co. (General Electric Co.). Centrifugal compressors. Oct. 26.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

24,018. Westphal. Retort furnaces.* Oct. 17.

24,035. Wilton. Treatment of gas obtained by distilling or carbonising coal, etc. Oct. 17.

24,046. Griffin. Treating liquid fuels. Oct. 18.

24,256. Pictet. Continuous manufacture of hydrogen and soot from acetylene. [Ger. Appl., Oct. 21, 1909.]* Oct. 19.

24,283. Ernst. Gas producers. [Appl. in Denmark, Nov. 2, 1909.]* Oct. 19.

24,319. Ledoux, Lloyd, and Simon Carves Bye-Product Coke Oven Co. Purification of coke oven gases. Oct. 20.

24,606. Jones. Coke ovens. Oct. 24.

24,637. Westinghouse Metallfaden Glühlampenfabrik. Decarbonising metal filaments for electric lamps. [Addition to No. 2983 of 1910. Austrian Appl., Nov. 12, 1909.]* Oct. 24.

24,667. Richter und Richter. *See under* III.

24,684. Fleischer. Gas producers. Oct. 24.

24,879. Jones. Coke ovens. Oct. 26.

Complete Specifications Accepted.

16,908 and 19,081 (1909). Davies and Richards. Treatment of liquid hydrocarbons. Nov. 2.

23,555 (1909). Graigola Merthyr Co., and others. Manufacture of artificial or patent fuel. Oct. 26.

23,624 (1909). Williams. Removal of cyanogen from coal and like gas. Oct. 26.

23,977 (1909). Phillips and Bulteel. Production of light oils from heavier mineral oils. Oct. 26.

III.—TAR AND TAR PRODUCTS.

Applications.

24,652. Ransford (Cassella und Co.). *See under* IV.

24,667. Richter und Richter. Purifying liquid hydrocarbons and alcoholic liquids by carbon, and manufacture of carbon therefor. [Ger. Appl., March 4, 1910.]* Oct. 24.

24,872. Soc. Chim. des Usines du Rhône. Manufacture of *o*-nitrobenzaldehyde. [Ger. Appl., Oct. 30, 1909.]* Oct. 26.

25,183. Ullmann. Manufacture of anthraquinone derivatives containing nitrogen. [Ger. Appl., Nov. 12, 1909.]* Oct. 29.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

Complete Specifications Accepted.

3752 (1910). Bedford and Williams. Catalytic reduction of organic substances. Nov. 2.

19,341 (1910). Kalle und Co. Manufacture of an oxidation product of acenaphthene. Oct. 26.

IV.—COLOURING MATTERS AND DYES.

Applications.

24,486. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. Oct. 21.

24,569. Imray (Meister, Lucius, und Brüning). Manufacture of violet blue vat dyestuffs. Oct. 22.

24,571. Rahtjen. Preparation of indoxyls and indigo colouring matters.* Oct. 22.

24,652. Ransford (Cassella und Co.). Manufacture of 3.6-diaminoacridine and its derivatives. Oct. 24.

24,682. Johnson (Badische Anilin und Soda Fabrik). Manufacture of condensation products of gallocyanines. Oct. 24.

24,690. Meister, Lucius, und Brüning. Process of isolating alkali salts of leuco-indigo. [Addition to No. 22,288 of 1910. Ger. Appl., Oct. 25, 1909.]* Oct. 24.

24,820. Meister, Lucius, und Brüning. Manufacture of indigo. [Ger. Appl., Oct. 25, 1909.]* Oct. 25.

24,871. Soc. Chim. des Usines du Rhône. Manufacture of indigo, its homologues and substitution products. [Ger. Appl., Oct. 30, 1909.]* Oct. 26.

24,883. Johnson (Badische Anilin und Soda Fabrik.) Manufacture of compounds and colouring matters of the anthracene series. Oct. 26.

24,886. Meister, Lucius, und Brüning. Manufacture of reddish-blue vat dyestuffs. [Ger. Appl., Jan. 24, 1910.]* Oct. 26.

25,184. Meister, Lucius, und Brüning. Manufacture of vat dyestuffs of the anthraquinone series. [Ger. Appl., Nov. 1, 1909.]* Oct. 29.

Complete Specifications Accepted.

23,992 (1909). Levinstein, and Levinstein, Ltd. Manufacture of azo dyestuffs. Oct. 26.

370 (1910). Newton (Bayer und Co.). Manufacture of an azo dyestuff. Oct. 26.

2394 (1910). Newton (Bayer und Co.). Manufacture of mordant dyestuffs. Oct. 26.

4536 (1910). Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. Nov. 2.

12,130 (1910). Meister, Lucius, und Brüning. Manufacture of violet to blue triphenylmethane dyestuffs. Oct. 26.

17,088 and 17,614 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of disazo dyestuffs. Oct. 26.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

24,382. Ellis (Chem. Fabr. von Heyden). Manufacture of cellulose esters of fatty acids. Oct. 20.

24,575. Butterfield and MacCallum. Treatment of fibres for the production of paper pulp or paper. Oct. 22.

24,707. Morane. Machines for spinning artificial silks. [Fr. Appl., Oct. 28, 1909.]* Oct. 24.

24,941. Phillips and Phillips. Simultaneous desiccation and consolidation of pulps. Oct. 27.

24,980. Newton (Bayer und Co.). Manufacture of cellulose formates. Oct. 27.

25,051. Jackson. Manufacture of pulp for paper making. Oct. 28.

Complete Specifications Accepted.

24,111 (1909). Kuldkepp and Graf. Sizing and impregnating paper, wood, etc. Nov. 2.

10,229 (1910). Petsche. Separating pulp fibres from pigments and other impurities present in waste papers. Nov. 2.

11,056 (1910). Landau und Co., and Kreidl. Loading silk. Nov. 2.

19,142 (1910). Schwalbe. Obtaining cellulose from vegetable fibres. Oct. 26.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

24,434. Ashworth. Dyeing indigo and other vat colours. Oct. 21.

24,593. Stevenson and Hamilton. Composition for cleaning and waterproofing fabrics, etc. Oct. 22.

24,821. Lisboa. Rendering fabrics impervious to climatic influences. Oct. 25.

24,841. Shaw and McGregor. Apparatus for use in bleaching and dye-works. Oct. 26.

24,951. Sutcliffe. Machines for printing calico, etc. Oct. 27.

25,007. Act.-Ges. f. Anilinfabr. Production of fast dyeings on the fibre. [Ger. Appl., Jan. 12, 1910.]* Oct. 27.

Complete Specifications Accepted.

23,437 (1909). Malard. Treatment by liquid processes of textile and other materials. Oct. 26.

18,921 (1910). Act.-Ges. f. Anilinfabr. Dyeing hairs, furs, and the like. Oct. 26.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

24,048. Perkin. Producing hydrochloric acid free from chlorine. Oct. 18.

24,138. Drehschmidt. Apparatus for making ammonium sulphate with impure acids.* Oct. 18.

24,379. Hale and Scott. Treatment of nitric acid. Oct. 20.

24,413. Heys (Nitrogen Co.). Separation of nitrogen from air.* Oct. 21.

24,501. Friedrich und Co., and Hirsch. Manufacture of sulphurous acid salts. [Austrian Appl., Nov. 29, 1909.]* Oct. 21.

24,607. Nobel's Explosives Co., and Cross. Production of oxides of nitrogen. Oct. 24.

24,742. Webster, and International Salt Co. Manufacture of salt. Oct. 25.

24,791. Hale and Scott. Treatment of nitric or other acid. Oct. 25.

24,817. Bolls and Cadenaccio. Production of peroxides or hydrated oxides of barium, strontium, potassium, and sodium from the carbonates. [Ital. Appl., Oct. 27, 1909.]* Oct. 25.

24,847. Lane. Synthetic production of ammonia. Oct. 26.

25,033. Weintraub. Reduction of chemical compounds. [U.S. Appl., Oct. 27, 1909.]* Oct. 27.

25,099. Swan and Kendall. Manufacture of barium oxide. Oct. 28.

25,100. Swan and Kendall. Manufacture of sodium and potassium. Oct. 28.

Complete Specifications Accepted.

24,716 (1909). Eycken, Le Roy, and Moritz. Electrolytic apparatus for producing pure oxygen and hydrogen. Nov. 2.

27,576 (1909). Read. Apparatus for forming solidified carbon dioxide. Nov. 2.

30,196 (1909). Raschen, Imison, and United Alkali Co. Purification of arsenical sulphuric acid. Oct. 26.

30,379 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable anhydrous hydrosulphites. Oct. 26.

86 (1910). Freeth and Cocksedge. Manufacture of ammonium chloride. Nov. 2.

9177 (1910). Bueb, and Deutsche-Continental Gas-Ges. Manufacture of ammonium carbonate. Oct. 26.

9375 (1910). Johnson (Deutsche Gold und Silber Scheide Anstalt). Manufacture of sodium cyanide. Nov. 2.

12,229 (1910). Kaiser. Oxidising nitrogen by means of electric discharges. Nov. 2.

16,193 (1910). Collin. Manufacture of ammonium sulphate from moist gases. Oct. 26.

20,325 (1910). Kaiser. Manufacture of nitrogen-oxygen compounds. Oct. 26.

VIII.—GLASS; CERAMICS.

Complete Specifications Accepted.

24,213 (1909). Osman and Co., and Fidler. *See under* IX.

10,930 (1910). Kent and Lacell. Production of silica glass. Nov. 2.

19,233 (1910). Sonntag and Sonntag. Process for enamelling metal. Nov. 2.

IX.—BUILDING MATERIALS.

Applications.

24,483. Haltenberger and Berdenich. Impregnation of timber.* Oct. 21.

24,508. Hiltruper Terrazo und Cementwaaren-Werke. Lining shafts with concrete. [Ger. Appl., Oct. 22, 1909.]* Oct. 21.

24,896. Thorougood. Manufacture of bricks and tiles. Oct. 26.

Complete Specifications Accepted.

24,213 (1909). Osman and Co., and Fidler. Continuous kilns for burning bricks, terracotta goods, lime, etc. Oct. 26.

7155 (1910). Cecchi. Manufacture of artificial stone or plates, etc. Oct. 26.

8724 (1910). Siemens. Rotary cement kilns. Nov. 2.

12,177 (1910). Siegmann. Composition for building, etc. Oct. 26.

21,315 (1910). Thorrand, Durandy, et Cie. Preparation of cement. Nov. 2.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

24,009. Dedolph. Smelting process. [U.S. Appl., Nov. 4, 1909.]* Oct. 17.

24,011. Lockwood. Extraction of precious metals. Oct. 17.

24,052. Martin. Extraction of iron from its ores.* Oct. 18.

24,197. Beauchamp. Extraction of zinc from tailings. Oct. 19.

24,550. Cowper-Coles. Coating iron and steel with zinc. Oct. 22.

24,551. Cowper-Coles. Hot galvanising. Oct. 22.

24,750. Smallwood. *See under* I.

24,825. Sefton-Jones (McGhie). Separation of nickel and cobalt. Oct. 27.

24,873. Duke. Alloys. Oct. 26.

25,030. Schwabacher. Treatment of calcareous ores. Oct. 27.

25,031. Weintraub. Purifying and casting of metal. [U.S. Appl., Oct. 27, 1909.]* Oct. 27.

25,092. Langbein-Pfanhauser-Werke. Manufacture of detachable electrolytic iron deposits. [Ger. Appl., Nov. 12, 1909.]* Oct. 28.

Complete Specifications Accepted.

21,584 (1909). Isherwood. Treatment of refractory zinc-lead ores. Nov. 2.

24,839 (1909). Reid. Recovery of precious metals from ores. Nov. 2.

29,287 (1909). McKechnie and Beasley. Extraction of metallic compounds from ores, mattes, etc. Nov. 2.

29,597 (1909). Girod. Hardening projectiles or other steel articles. Oct. 26.

29,779 (1909). Von Schlippenbach. Apparatus for continuous oxidation, reduction, etc., of ores and the like. Nov. 2.

2130 (1910). Baillot. Cupola furnaces. Nov. 2.

2876 (1910). Beck. Pyrophoric metal alloys. Oct. 26.

3375 (1910). De Back. Recovery of iron and steel from waste enamelled articles. Nov. 2.

5667 (1910). Niedringhaus. Finishing galvanised sheet metal. Oct. 26.

5668 (1910). Niedringhaus. Galvanising apparatus. Oct. 26.

15,507 (1910). Beck. Pyrophoric metal alloys. Nov. 2.

XI.—ELECTRO-CHEMISTRY.

Applications.

24,564. Mosley and Wagstaff. Insulating compound. Oct. 22.

24,869. Solomon. Electric induction furnaces. Oct. 26.

Complete Specifications Accepted.

24,716 (1909). Eycken and others. *See under* VII.

3631 (1910). Schneider. Manufacture of accumulators and positive electrodes therefor. Nov. 2.

6597 (1910). Schott und Gen. Electrolytic apparatus having a liquid anode. Nov. 2.

XII.—FATS; OILS; WAXES.

Applications.

24,516. Henderson. Apparatus for reducing vegetable fats, fatty materials, semi-soft substances, &c. Oct. 22.

24,608. Nobel's Explosives Co., Ltd., Rintoul, and Innes. Production of polymerised glycerine. Oct. 24.

24,981. Newton (Bayer und Co.). Manufacture of medicinal soaps. Oct. 27.

Complete Specification Accepted.

27,899 (1909). Higgins and Spensley. Drying or stoving of soap. Nov. 2.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

24,317. Pybus and Pybus. Paint vehicle or varnish. Oct. 20.

24,565. Mosley and Wagstaff. Paint. Oct. 22.

Complete Specifications Accepted.

23,668 (1909). Turcat and Nuth. Preparation of elastic products and substitutes for natural lacquers or varnishes. Oct. 26.

24,119 (1909). Perry. Manufacture of paints, varnishes, and stains. Nov. 2.

24,825 (1909). Freymuth. Centrifugal separators for treating lac. Nov. 2.

6365 (1910). Newton (Bayer und Co.). Manufacture of pigments or lakes. Nov. 2.

8017 (1910). Eckford. Purification or treatment of red or orange lead. Oct. 26

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

24,236. Heinemann. Production of isoprene. Oct. 19.

24,237. Heinemann. Polymerisation of isoprene. Oct. 19.

24,786 to 24,788. Perkin, Weizmann, Matthews, and Strange. Manufacture of isoprene, caoutchouc, and their homologues and derivatives. Oct. 25.

24,790. Matthews and Strange. Manufacture of synthetic caoutchouc. Oct. 25.

25,087. Reynaud. Manufacture of india-rubber. [Fr. Appl., Nov. 6, 1909.]* Oct. 28.

25,201. Reynaud. Manufacture of india-rubber. [Fr. Appl., April 23, 1910.]* Oct. 29.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

24,982. Becker. Puering or bating hides and skins. Oct. 27.

Complete Specification Accepted.

27,573 (1909). Greaves. Tanning hides or skins Oct. 26.

XVI.—SOILS; FERTILISERS.

Applications.

24,249. Thorsell and Malmsten. Apparatus for emptying superphosphate chambers, etc.* Oct. 19.

24,500. Freudenthal. Arrangement and working of superphosphate chambers. Oct. 21.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

24,667. Richer und Richter. *See under* III.

25,108. Dickson. Treating and utilising distillery wash and waste.* Oct. 28.

Complete Specifications Accepted.

12,046 (1910). Finlay. Manufacture of beer, stout, and the like. Nov. 2.

12,581 (1910). Schneible. Preparation of brewer's mash and wort. Nov. 2.

XIX.—FOODS. WATER PURIFICATION; SANITATION.

Applications.

24,025. Billon-Daguerre. Producing and utilising hyperultra-violet radiations for sterilising liquids. [Fr. Appl., Oct. 18, 1909.]* Oct. 17.

24,162. Mollinger. Preservative treatment of milk.* Oct. 18.

24,577. Nesfield. Apparatus for distilling water or other liquid. Oct. 22.

24,905. Richter und Richter. Manufacture of filter carbon and utilising filter carbons permeated with organic waste matter. [Ger. Appl., Nov. 29, 1909.]* Oct. 26.

24,992. Erith. Apparatus for purifying and softening water.* Oct. 27.

25,091. Tildesley, Ritchie, and Watkins. Improving flour. Oct. 28.

Complete Specifications Accepted.

25,665 (1909). Paul. Hardening abnormally soft water Oct. 26.

1117 (1910). Piestrak. Apparatus for sterilising liquids by ozonisation. Oct. 26.

7757 (1910). Hölldampf and Hallmeyer. Beverages. Nov. 2.

9372 (1910). Daime. Apparatus for the continuous purification of water. Nov. 2.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

24,236 and 24,237. Heinemann. *See under* XIV.

24,240. Von Arlt. Manufacture of a pharmaceutical preparation. [Austrian Appl., Nov. 10, 1909.]* Oct. 19.

24,480. Meister, Lucius, und Brüning. Manufacturing amino-oxyarylarsenoxides. [Addition to No. 9855 of 1908. Ger. Appl., Nov. 2, 1909.]* Oct. 21.

24,786 to 24,788. Perkin and others. *See under* XIV.

24,789. Perkin and others. Manufacture of methylene ketones. Oct. 25.

24,865. Heinrici. Production of alkaloids from the poppy and related plants. [Ger. Appl., April 9, 1910.]* Oct. 26.

Complete Specifications Accepted.

3752 (1910). Bedford and Williams. *See under* XX.

22,779 (1910). Act.-Ges. f. Anilinfabr. Manufacture of the alkyl ester of salicylic acid. Oct. 26.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

24,378. Triepel. Method of toning photographic prints Oct. 20.

Complete Specification Accepted.

25,998 (1909). Ruth. Colour photography. Oct. 26.

XXII.—EXPLOSIVES; MATCHES.

Applications.

24,274. Pierce and Stewart. Explosives. Oct. 19.

24,587. Tulloch. Propulsive explosives. Oct. 22.

Complete Specification Accepted.

20,494 (1910). Polster. Explosive for detonating pellets, etc. Oct. 26.

XXIII.—ANALYTICAL PROCESSES.

Application.

24,036. Baillet. Registering automatic apparatus for analysing furnace gases. [Fr. Appl., Oct. 15, 1909.]* Oct. 17.

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Official Notice.

THE TURIN EXHIBITION.

The laudatory notices of the British chemical exhibits at the Brussels Exhibition which have appeared in the technical press, especially in Germany, should afford gratification to the manufacturers who took part in the display as well as to the Chemical Industries Committee of the Royal Commission.

Other countries must now fully recognise the position occupied by Great Britain in industrial chemistry, and the action of leading firms has conclusively demonstrated that in many branches of this important department of applied science our position is maintained.

The verdict of the International Jury of Awards has fully confirmed views which were generally expressed, and it is satisfactory to find that at Brussels the number of the highest awards in relation to the number of the exhibitors was unprecedentedly large in the case of Great Britain, and in no group was this more conspicuous than in that of chemical and pharmaceutical products. This was doubtless in no small measure due to the care taken in securing the co-operation of representative exhibitors of the highest rank, but it may also be ascribed to the experience and ability of the British representatives on the juries, and as regards the chemical exhibits to the special descriptive catalogue which conveyed much information for the guidance of the jurors.

Those who are not familiar with the manner in which the work of judging exhibits is always carried out at great international exhibitions cannot appreciate the value which attaches to the awards, but those who are will fully recognise that it is a critical test of true merit, since the verdict is that of a jury of representatives of all nationalities, in which the British members are necessarily largely in a minority.

Not only has the German press commented in eulogistic terms on the British chemical exhibits and on the descriptive chemical catalogue, a new departure which attracted much attention at the St. Louis Exhibition, but has strongly emphasized the remarkable circumstance that there was no similar German display at Brussels, and has deplored the loss by Germany of an opportunity which has been so effectively made use of by Great Britain.

If Great Britain is to retain the advantage she has thus gained it is necessary that British chemical manufacturers should strive to make at Turin an even more effective display than was afforded in the Chemical Court at Brussels.

A statement showing the rates of Customs Duty levied on certain articles of chemical interest, on importation into Italy, is given on pages 1336—1338 of the current number Journal.

The address of the Exhibitions Branch of the Board of Trade is Queen Anne's Chambers, Broadway, Westminster, S.W., where full information may be obtained by intending exhibitors.

Canadian Section.

Meeting held at Toronto on November 6th, 1909.

GUAYULE RUBBER.

BY HAROLD VAN DER LINDE.

Recently a new source of revenue has been found in Northern Mexico in the shape of the guayule plant. This plant belongs to the order of *Compositae* and is a small shrub, weighing about two pounds and standing about two feet high when full grown. It has a dwarfed and gnarled appearance which is very characteristic, with a sparse olive-green, lanceolate leaf. It bears a small yellow composite flower of an agreeable odour. The guayule shrub contains an extraordinarily small amount of moisture, and indeed might be mistaken for a piece of dead wood during a large portion of the year were it not for the fact that on cutting into it the bark shows a greenish and somewhat moist section. The wood of this shrub is very hard and dense, and has a high specific gravity. The shrub grows on the northern part of the Central Mexico Plateau in enormous quantities. This district is nearly rainless and is very sparsely populated by a partly Indian, partly Spanish, race. The region is practically grassless and contains no large trees, being a typical desert country. The alkali dirt which is found over most of the plateau is in reality a very rich soil needing only sufficient water to make of the region one of the most fertile in the world.

Geologically, this region, which has been described with some minuteness by Humboldt, consists of rings of denuded mountains with flat plains at their base. These flat plains of dry soil have the appearance of dried-up lakes and this impression is heightened by the fact that they communicate with one another by gaps or canyons in the mountains, which might have been the beds of former rivers. On the beaches of these ancient lakes—that is to say, on a strip of land running around each ring of mountains somewhat above their bases, the guayule abounds. As a rule the soil selected by the guayule shrub appears to be most unpromising, as the so-called beaches are usually covered with flinty pebbles, many of which have not proceeded very far in becoming regular and oviform. A considerable variety of plants grows in the neighbourhood of these old beaches. In the month of August, 1909, in the course of an hour I picked thirteen varieties of flowers within a very short distance. The soil under the pebbles in the guayule districts is usually gravelly and less tightly packed than the soil of the plains below, which is really largely a dried-out heavy clay. The sub-soil of those beaches on which guayule flourishes is said to be universally composed of white magnesian marl called "Caliche."

The droughts of this plateau region are sometimes very prolonged, and in the guayule lands (which range from about four thousand to eight thousand feet above the sea), it is not uncommon to have a whole year practically without rain. On one hacienda in the heart of the rubber district, there was recently a drought of over two years and yet the desert plants managed to cling to life. That this should be possible is accounted for by the fact that each one of the plants has some kind of protective apparatus which either enables it to lie dormant without evaporation, or to store up water in a large quantity, or to get more than its ordinary share of water. In this way the "maguey," or American aloe, the "nopal" or prickly pear, the yucca or palma, and many others, store up the water to an enormous extent in the occasional wet seasons; and as all of these have glazed leaves from which evaporation is extremely slow, they are able to resist prolonged drought. The mesquite bush and some other plants show little but their branches above the ground, the greater part of their trunks being buried, and their roots extending far down into the earth seeking for water. In North-Western Mexico it is stated that mesquite rootlets can be seen in copper mine workings at a distance of from 120 to 130 feet below the surface. The fact that the trunks of this tree are so deeply buried and that so many of the rare springs of Northern Mexico are situated on the precipitous sides of the denuded mountains, gives rise to the paradoxical saying that in this country one has to climb for water and dig for wood.

A third class of plants depends for its preservation on the fact that it possesses a waterproof cover which almost entirely prevents evaporation during the dry seasons. Amongst these are the gobernadora, or greasewood, which secretes an enormous proportion of a very curious and complex resin; the candelilla, which is completely covered with a coating of very hard, impervious wax; and the guayule, which possesses a very thick bark, in the cells of which solid rubber is secreted, forming a more or less complete coating for the plant. In this last case the waterproof coat is the only defence that the plant possesses, as the roots are not long and do not sink deeply. As the guayule shrub does not take up a very large quantity of water even in the wet season, it is necessary for its cells to become dormant during the rest of the year.

Most of our sources of rubber, of which there are probably at least two hundred commercial kinds, consist in the milky juices of tropical plants. The guayule plant is exceptional in that it yields no milky latex; the rubber exists in the solid state, partially filling the cells of the bark, the cells themselves being lined by a resin which consists probably partly of incipient rubber and partly of degraded oxidized rubber. The plant also contains a considerable amount of two or more essential oils, which give it a very characteristic and not disagreeable odour; Rubber is contained in other parts of the plant besides the bark but in a smaller quantity, although it is abundant in the roots. It was, of course, not possible to gather the rubber from this kind of plant in the usual way—that is, by tapping—and special methods had to be devised in order to extract it. These methods in the past were both chemical and mechanical, but the mechanical method has now superseded the chemical, which latter is but little used.

The guayule plant probably lives to the age of forty or fifty years in favourable cases. It is said to be mature in from five to ten years; but very little is known on this subject, and since much of its growth depends upon the rainfall, in some districts it may mature much earlier than in others. The amount of rubber borne by the plant is generally taken as being about ten per cent. There is a very great variation, however, in the yield of plants gathered in different districts. Some of the worst grades of guayule shrub will not yield as much as 10 per cent. of rubber, while some of the better grades will yield more. Guayule shrub appears to have the power of hybridizing with other plants. The hybrids, if such they be, have the power of secreting rubber, but only in very small quantity and usually of poor quality. Reproduction occurs in this plant by budding from rootlets and by seed, but the seed seems to be the usual vehicle through which new plants appear. Each plant bears an enormous number of seeds but a large proportion of them is infertile.

The history of the guayule industry is very brief. The plant was used for many years in the back country of Northern Mexico as a fuel for smelting silver ores, and it is said that the Indians for centuries have made rubber balls by chewing the bark of the plant. In 1886 an English engineer reported that, on a ranch where he was prospecting for minerals, there was an enormous quantity of a plant which yielded about ten per cent of rubber. He recommended the investigation of this matter as he believed it possible that commercial rubber could be extracted in quantity. No action was taken, and the matter lapsed until attention was attracted to it again a few years ago through the rising price of rubber. Attempts were made to extract the rubber from the plant by means of solvents. Other attempts were made to destroy the woody and barky matters by chemical means and leave the rubber untouched. Many patents have been taken out for all sorts of processes but the mechanical method has practically superseded them all.

The extent of the industry to-day may be judged by the fact that in 1910 guayule rubber will form about 20 per cent. of the total world's production of all kinds—one large company in Northern Mexico alone producing more than 10 per cent. of the world's total product. Unless the rains of the rubber district are more than usually plentiful, it is not likely that this rate of production can be kept up, but there is no doubt that ordinary re-growth of the shrub will allow a large production for many years to come.

The plant is pulled from the soil and laden on the backs of burros. It is then carried to a central station where it is baled by ordinary hay balers. These bales are placed upon large wagons which are drawn across the desert by huge teams of mules—often 12 or 14 to the team—to the railroad station.

At the factory the process in principle is very simple, whilst the technical details have presented many difficulties, the conquering of which has resulted in a better and better grade of rubber. The plant is crushed to a very fine state of division in the presence of water and in the crushing the small grains of rubber adhere to one another, forming minute worms. These worms are capable of floating while the major portion of the woody and barky matters sink in the water. The rubber is skimmed off and further cleaned by purely mechanical means. It is then packed or baled and is ready for market.

This process is used for the bulk of commercial guayule rubber. Special brands are also prepared for specific purposes. These brands are usually more or less de-resinated. The resin in the commercial rubber is a highly complex body, and ranges from 19 to 21 per cent. of the crude dry rubber. There seems to be little doubt but that the presence of the resin acts to some degree as a preservative in vulcanized rubber goods. The so-called resin comprises all the "acetone-solubles" that the rubber contains. For some purposes from 5 to 10 per cent., or 15 per cent., or even all the resin is extracted, although many manufacturers believe that this process does not appreciably influence the quality of the product. Guayule rubber is classed among the soft inferior rubbers. It is undoubtedly a true rubber, and is almost paradoxical in its nature from the fact that the process of vulcanization enhances its quality to an extent which brings it into direct competition with other rubbers which sell for higher prices. In other words, it seems likely that the future will see guayule rubber at a price which will be higher relatively to that of other rubber than the price which at present obtains. In rubber goods, when properly vulcanized, guayule rubber does not readily deteriorate. An extended experience indicates that its life or resistance to cracking, etc., is as great as that of rubbers of a very high grade.

Nottingham Section.

Meeting held at Nottingham, on Monday, November 28th, 1910.

MR. S. J. PENTECOST IN THE CHAIR.

WATER OF CRYSTALLISATION OF MAGNESIUM, ALUMINIUM AND SODIUM SULPHATES WHEN PRESENT IN LEATHER.

BY DR. J. GORDON PARKER AND M. PAUL.

Nowadays sole leathers are frequently treated with various salts, including magnesium sulphate, sodium sulphate, and aluminium sulphate. These salts are used because of their cheapness; they are non-hygroscopic and contain a large proportion of water. When their amount does not exceed 6 or 7 per cent. of the weight of the leather, no crystalisation takes place on the grain, and it is quite impossible by simple examination to see if the goods are adulterated. Moreover, in the analyses, the percentage of ash is very low, due to the fact that dissociation takes place during the burning. Epsom salt especially is completely dissociated into magnesia, in such a way that one part of magnesia corresponds to 6·16 of $MgSO_4,7H_2O$.

These sulphates are determined in the ash, magnesium sulphate as phosphate[*], aluminium sulphate as alumina, and sodium sulphate by estimation of sulphuric acid. The percentages which are obtained from the ash are calculated as hydrated salts. Generally, magnesium sulphate is reckoned with seven mols. of water, because it crystallises in the air in this state.

Chemists do not agree concerning sodium and aluminium sulphates. This uncertainty sometimes causes big differences in proportion to the high percentage of water with which the salts may crystallise. For instance, the proportions of hydrated salt corresponding to one part of anhydrous salt are, according to the number of molecules of water of crystallisation, as follows:—

Magnesium sulphate.—One part of anhydrous salt corresponds to 2·04 parts of $MgSO_4.7H_2O$, 1·74 parts of $MgSO_4.5H_2O$, and to 1·11 parts of $MgSO_4.H_2O$.

Sodium sulphate.—One part of anhydrous salt corresponds to 2·26 parts of $Na_2SO_4.10H_2O$, 1·63 parts of $Na_2SO_4.5H_2O$, and to 1·35 parts of $Na_2SO_4.3H_2O$.

Aluminium sulphate.—One part of anhydrous salt corresponds to 1·95 parts of $Al_2(SO_4)_3.18H_2O$, 1·63 parts of $Al_2(SO_4)_3.12H_2O$, and to 1·31 parts of $Al_2(SO_4)_3.6H_2O$.

The chemist knows that the method of calculation is somewhat optional, therefore this does not matter, but for the practical tanner who examines the analyses and sees only the percentages which are given to him[†], it makes a great difference in his appreciation of the results.

This uncertainty is further increased, because the average moisture of ordinary sole leathers after some weeks of exposure to the air of a laboratory is between 16 and 18 per cent.; in determining the moisture of leathers containing 3 to 4 per cent. of sulphates (calculated as anhydrous salts by heating in the air oven at 100° — 105° C. for three hours) we have frequently been surprised at not finding the corresponding increase of the amount of water coming from the water of crystallisation, that is to say, about 3 or 4 per cent. This might be due to the difficulty of dehydrating the salt, but by heating in a vacuum for a long time till constant weight, we have only recovered this difference for magnesium and aluminium sulphates whereas with sodium sulphate the moisture was not very much increased.

We have therefore investigated the possibility of determining and verifying the amount of water of crystallisation for the three above-mentioned salts in leather. For the other non-hygroscopic heavy salts, such as barium chloride, the ratio of water to salt is very low, and therefore the question is not an important one.

Curried leathers and leathers treated with various percentages of glucose have been tried, but we unfortunately got discordant results; with fatty leathers because the oxidation of the greases and oils is too variable, and with the leathers treated with glucose because very small variations in the moisture of the air produce great differences in weight, due to the hygroscopic nature of the glucose.

Therefore we give only the method and the results for sole leathers.

The microscopic examination does not reveal very much because these salts produce some non-crystalline precipitates with the soluble matters from the leather.

The principle of the process was as follows:—We took 12 pieces of leather, 4 in. square, from the same belly portion of the hide, before rolling, to get two sufficiently homogeneous series of six pieces each; after six days the moisture of each series was determined under the same conditions, taking one piece of 1 in. by 4 in. from each sample. For the two portions the difference in moisture was about 0·02 per cent.

The remaining two portions were left together in the air and weighed every day. The daily variations were the same, and for one month the greatest difference was 0·04 per cent. (average 0·009 per cent.).

This point has been verified three times, once in operating as above, and twice with samples moistened with 25 per cent. of water.

Now, if one of the series is impregnated with a solution containing a known weight of anhydrous salt and the other one moistened with the same volume of pure water, and the two series allowed to dry in the air under the same conditions, it will be possible to find out the amount of water which has been fixed by the salt. As the two portions are similar, the comparison between the weights of the two samples taken from time to time will show the relative increase of weight produced by the salt; the weight of anhydrous salt being known, the water from this salt and therefore the number of molecules of fixed water can be calculated.

This suggestion may be criticised from a theoretical point of view, but it answers sufficiently for practical purposes, because the interesting point is to see the relative increase in weight produced by a certain amount of salt.

We have made several experiments with each salt, using various proportions of anhydrous salts on the weight of the leather, varying the conditions of drying with various leathers containing different amounts of water soluble matters.

Sampling.—To allow of an easy impregnation we took porous ox hide bellies; after ordinary scouring and setting out, mineral oil was used for oiling instead of cod oil to produce a more porous grain. The drying was done at the ordinary temperature for three weeks, the experiments being carried out with samples of 3 in. square, six pieces for each group; all the pieces put together for eight days to arrive at an average moisture-content, and the weights taken every day to see the concordance of the variations.

The weights of the various groups were about 100 grms.

Impregnation with solutions of sulphates.—The salts used were pure recrystallised products. Solutions were made containing 16 per cent. of anhydrous salt at 20° C. The strength was determined by estimation of sulphuric acid for each salt, and estimation of magnesium as phosphate, and aluminium as alumina.

With these three standard solutions, three new series of solutions were made containing in 25 c.c. of liquid 4 grms., 2 grms. and 1 grm. respectively of anhydrous salt in such a way that by using 25 c.c. of the solutions for 100 grms. of leather, the percentages of salts were respectively 4, 2 and 1 per cent. as anhydrous salt on the weight of the leather. With more than 4 per cent. the salt crystallises on the outside. Each group of six pieces was impregnated with the 25 c.c. of the corresponding solution. When the liquid is carefully run from a burette drop by drop on the grain and on the flesh side, it is quite possible to put 25 per cent. of liquid in a porous leather without any loss. Immediately after impregnation the leather was weighed to verify that no loss had occurred.

The groups with water were moistened with 25 c.c. of pure water. The drying of the various groups was done exactly in the same way. The first at ordinary temperature of the laboratory (15 — 18° C.), the second in the drying room at 22 — 24° C., and the third at 28 —30° C. The second and the third groups were removed from the drying room as soon as the drying was normal to prevent the alteration which accompanies a more complete drying. All the samples put together were weighed three times a week for two months.

The variations of weight were in concordance six days after the impregnation for the drying at ordinary temperature, and after ten days for the other groups. Each group compared with the corresponding one treated with water gave the relative increase of weight produced by the amount of anhydrous salt, therefore the fixed quantity of water, and the number of molecules of fixed water could be calculated.

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[*] Levy & Manuel (Tanners' and Chemists' Handbook, p. 32), say that magnesium sulphate is found as the anhydrous salt in the ash. But when the burning to ash is done in a muffle furnace, magnesia is always found.

[†] The percentage of magnesium sulphate with 7 molecules of water calculated from the ash is always too great, because the magnesia from the water and from the lime used in the tanyard are counted in the same way.

The numbers in the following table give the average of these determinations which were in concordance at each weighing.

Molecules of water fixed by—

Perceatage of Anhydrous salt.	Magnesium Sulphate. Drying at 15°–18°C.	Magnesium Sulphate. Drying at 22°–24°C.	Magnesium Sulphate. Drying at 28°–30°C.	Sodium Sulphate. Drying at 15°–18°C.	Sodium Sulphate. Drying at 22°–24°C.	Sodium Sulphate. Drying at 28°–30°C.	Aluminium Sulphate. Drying at 15°–18°C.	Aluminium Sulphate. Drying at 22°–24°C.	Aluminium Sulphate. Drying at 28°–30°C.
4% on the weight of the leather									
Leathers with 20% of soluble matter.	6·1	5·4	3·1*	2·3	2·6	2·9	11·2	9·9	9·6
Leathers with 10% of soluble matter.	7·1	6·0	5·2	2·9	2·8	2·2	11·8	10·2	10·4
Leathers with 5% of soluble matter.	6·4	5·7	4·8	2·6	2·7	3·2	11·4	9·8	10·8
2% on the weight of the leather									
Leathers with 20% of soluble matter.	6·7	6·1	5·4	2·7	2·2	2·5	11·5	10·1	10·0
Leathers with 10% of soluble matter.	6·5	5·3	3·3*	2·4	2·9	2·7	12·2	9·7	10·6
Leathers with 5% of soluble matter.	6·8	5·0	5·1	3·0	2·4	2·3	10·1	12·3	11·3
1% on the weight of the leather									
Leathers with 20% of soluble matter.	6·9	6·0	5·2	3·1	2·4	2·2	12·8	10·9	10·7
Leathers with 10% of soluble matter.	7·2	6·2	4·9	2·7	2·7	2·8	10·7	11·1	11·2
Leathers with 5% of soluble matter.	7·0	5·1	5·2	3·2	2·6	3·1	11·0	10·2	9·8

The samples marked * showed crystallisation outside.

On examination of the table we see that magnesium sulphate has taken about seven mols. of water for the leathers which are dried at ordinary temperature. This quantity decreases to five mols. for leathers dried at high temperatures. For aluminium and sodium sulphates, the difference is smaller, depending on the temperature of drying, the amounts being 10—12 mols. of water for aluminium sulphate and three for sodium sulphate.

The results also show that the percentage of soluble matter varying between 5 and 20 per cent. of the leather does not affect the quantity of water fixed by the salt.

In addition we have made some determinations with 100 grms. of small pieces of leather about 1 in. square, put in basins to facilitate the impregnation with the solutions, but the results were not satisfactory, because crystallisation takes place on the surface of the samples and on the bottom of the basins; the number of molecules of water was always smaller than the number given in the above table.

Finally, we have made a determination with larger pieces of leather, with three groups of samples (500 grms. each); the first group with 3·5 per cent. of anhydrous magnesium sulphate on the weight of leather, the second with 3·5 per cent. of anhydrous sodium sulphate, and the third with the same volume of water, doing the drying at ordinary temperature. The results were for magnesium sulphate, 6·8 mols. of water, and for sodium sulphate 3·1 mols.

Sydney Section.

Meeting held at Sydney, on Wednesday, September 21st, 1910.

MR. T. STEEL IN THE CHAIR.

ELECTROLYSIS AS A MEANS OF PREVENTING THE CORROSION OF IRON AND STEEL.

BY G. HARKER, D.SC., AND J. McNAMARA.

The galvanic effect set up between two different metals placed in a solution capable of conducting the electric current is well known and accounts for the rapid corrosion of iron in contact with copper or brass. The current can be considered as flowing from the iron as anode, to the copper or brass as cathode, while positively charged iron ions pass into solution and hydrogen ions are simultaneously forced out.

A method has been recently patented by Cumberland of Melbourne, which aims at the prevention of the corrosion of iron and steel by passing a current of electricity sufficiently strong to reverse the direction given above and so make the iron the cathode. It is put forward as being of special service in preventing the corrosion of boilers. In actual practice a bar of wrought iron is suspended in the boiler to act as the anode and a current of electricity of 1 to 2 amperes at 4 to 8 volts pressure is passed from this through the water to the shell of the boiler. Several marine boilers have been working now for some months under these conditions, and the results are stated to be eminently satisfactory.

The Colonial Sugar Refining Company, Ltd., of Sydney, to whose scientific staff the authors belong, maintains a very large number of boilers at its various mills and refineries, and at times trouble has arisen through bad feed water. The method was consequently of interest to the Company, and in this paper are given the results of some experiments carried out with the object of determining if possible the probable practical value of the process.

In Table I. are set forth the results of some preliminary experiments carried out with small iron and steel plates $1\frac{1}{2}$ in. × $1\frac{1}{2}$ in. × $\frac{1}{8}$ in. A small storage battery was employed for the supply of the current, which during the series described in Table I. was delivered at a pressure of 3·3 volts. The resistance of the circuit given in the second column of the Table was made up of that of the solution plus that purposely supplied from a "Standard" resistance box. The anode and cathode plates were placed 5 cms. apart in a beaker with about 115 c.c. of solution, and the resistance between the plates was found to be about 3.22. and 370 ohms for sea-water, acid solution and ordinary tap water respectively. The alteration of resistance during the progress of the experiments, owing to change in composition of the solution, was only of moment in the case of the two experiments in acid solution using iron anodes and no account was taken of it in these preliminary trials.

For purposes of comparison it should be stated that the corrosion of the steel and iron when placed in a beaker for 24 hours with about 115 c.c. of solution was found to be:—

	Steel.	Wrought Iron.
Acid solution	0·08 gram	0·01 gram
Sea-water	0·0033 „	0·0032 „
Ordinary water	—	0·0028 „

Different pieces of steel made from the same plate gave very varying results but the figures are sufficiently representative for purposes of comparison.

The results given in Table I. show that the corrosion of wrought iron and steel in ordinary water or in sea-water can be prevented—as judged by constancy of weight of the cathode piece—by even small currents when iron is used as the anode. In acid solution no loss of weight took place with a current of 0·15 ampere with iron as anode, but with platinum as anode the current did not wholly protect the cathode and reference will be made to this later. In the sea-water experiments a green coating of ferrous hydroxide nearly always formed on the cathode and the difficulty of removing this no doubt accounts for the slight gain of weight observed in some cases.

The results of these preliminary experiments were so interesting that it was decided to conduct further experiments using larger plates and also with the object of determining more exactly the size of current which would be sufficient to prevent corrosion under a given condition.

A plate $\frac{1}{16}$ in. thick was bent into circular shape, the dimensions of the cylinder thus formed being 6 in. in depth and 5 in. diameter. The surface area of this cylinder was 70 times that of one of the small plates used previously. By placing a rod of iron in the centre of the cylinder to serve as the anode, conditions were obtained approaching more nearly to those that would be met with in the practical application of Cumberland's method to boilers.

The steel cylinder weighed about 660 grams and it was found that it could be washed with water, dried and re-weighed with an error not exceeding 0·015 gram.

Two experiments were first made with acid solutions, as information was wanted as to whether the electrolytic process would be of use in protecting boilers if fed with sour waters from sugar factories. The results appear in Table II., and although the acid solution used was of much greater strength than would ever be met with in practice, it was quite clear that the steel cylinder could be protected by using currents of quite moderate strength.

In the first experiment 400 ohms resistance were added to the circuit from the resistance box in order to reduce the strength of the current to about 0·01 ampere, in the second the resistance of the cell only was employed.

The alteration in the resistance of the cell owing to solution of iron is shown by the second resistance figure.

An interesting point brought out by these experiments was, that the quantity of current actually used, calculated from the voltage of the battery and the resistance of the circuit, was approximately equivalent to the current calculated from the amount of iron removed from the anode. The electrochemical equivalent of iron is ·00029 gram per sec. per ampere, in other words 1·044 grms. of iron is carried by a current of one ampere per hour, and hence from the loss of iron from the anode it is possible to calculate the current flowing. This suggested that, in applying Cumberland's process, it might be possible to determine the strength of current for any given case by finding the rate of corrosion of the steel in the given solution, and then calculating from the electrochemical equivalent of iron the opposing current required. The method was tested in some experiments carried out with sea-water.

The cylinder was first immersed in sea-water for 72 hours and was found at the end of that time to have lost 0·3 grm. Assuming that, in order to keep the iron from dissolving, an amount of electricity has to be passed through the circuit equivalent to that produced by the dissolution of 0·3 grm. we find that 0·288 amp. is required, necessitating a current of 0·004 amp. per hour for 72 hours.

Three experiments with sea-water were performed using currents of 0·01, 0·004, and 0·0027 amp. respectively. According to the above theory the first current should be larger than necessary to prevent corrosion of the steel, the second about correct, and the third too small: and this proved to be the case.

In the first experiment the steel was completely protected, but the current employed was much larger than necessary and the excess of iron removed from the anode formed a greenish mud of ferrous hydroxide which partly remained on the cylinder. In the second experiment the strength of the current seemed to have been judged very correctly. The plate was quite protected and very little ferrous hydroxide was formed. In the third experiment the current was weak. No ferrous hydroxide but only ferric hydroxide was produced and the cylinder lost slightly in weight. In the last two experiments (D and E Table II.) the cylinder remained perfectly bright and clean during the whole time it was immersed. It therefore seems likely that in employing the electrolytic process the current required to prevent corrosion can be obtained by calculation from the rate of corrosion of the iron or steel vessel under the given conditions. A current somewhat in excess of that calculated should be employed so as to make certain of protecting the vessel. In the case of a boiler it would, of course, not be possible to determine the loss directly, but if a sample of the steel of which it was made were obtainable the rate of corrosion of this sample in the given liquid under somewhat similar conditions could be obtained. From the ratio of the area of boiling surface exposed to the area of the sample the current required to prevent the corrosion of the larger vessel could be determined. Assuming that the steel of a boiler would corrode at a rate equal to the rate of corrosion of the experimental steel cylinder in sea-water, and that the surface exposed to the water was 2500 square feet, then the surface of the cylinder being 1·25 sq. ft., the current required would be $\frac{0{\cdot}004 \times 2500}{1{\cdot}25} = 8$ amperes. This figure is somewhat higher than Cumberland's estimate of 1 to 2 amp. at 4 to 8 volts pressure, but it must not be forgotten that in determining the rate of corrosion of the experimental cylinder there was free access of air to the sea-water and this effect might possibly outweigh the influence of the higher temperature of the water in a boiler. Sea-water is also more corrosive than ordinary boiler water and it is quite probable that the estimate of 1 to 2 amperes is not too low. A good deal would depend on the nature of the feed water and the material of the boiler itself.

Up to this time Cumberland's explanation that, by making the plate to be protected the cathode, positive ions of iron are prevented from entering the solution, was accepted as satisfactory. The only disturbing experiments were those in which platinum was used as the anode, in which, although the current employed was far in excess of that required to protect the plate, corrosion still took place to a slight extent. To obtain further information on this point some experiments were conducted with zinc. A rod of zinc was placed in a small beaker filled with $N/5$ sulphuric acid and its rate of solution determined by immersing it for one hour and then re-weighing it. It was then connected to the negative pole of the battery through a suitable resistance and a strip of platinum was connected to the positive pole. The two were then immersed and left for one hour. Even when a current was used 3 or 4 times as strong as that calculated to be sufficient to prevent corrosion the rate of corrosion was only diminished to about half its previous value. Thus a rod of zinc was found to behave as follows:—

	Loss in weight. grms.
Immersed one hour without current	0·012
,, ,, using ,,	0·0064
,, ,, without ,,	0·015
,, ,, using ,,	0·0092

The temperature only varied from 15° C. to 15·5° C. The electrochemical equivalent of zinc being 1·22 grm. per hour, the current required for 0·015 grm. would be about 0·012 amp., while that actually employed was nearly three times as great. When a zinc rod was substituted for the strip of platinum as the anode a gain of 0·002 grm. was obtained in one hour, and this gain would have been much greater if the effectiveness of the current had not been reduced by the solution of zinc from the anode itself.

In another experiment in which the zinc dissolved more rapidly the rate of solution was determined in two successive experiments to be 0·2774 and 0·2786 grm. in 30 minutes. The current required was calculated, the resistance, about 8 ohms in this case, adjusted so as to give a current just slightly in excess of that calculated, and a zinc anode was used presenting a much smaller surface than the cathode. The anode lost 0·3412 grm. in 30 minutes, while the cathode lost only 0·0264 grm. and would doubtless have been completely protected but for the solution of some zinc from the anode by the action of the acid.

It was thus clear that in the case of zinc, as in that of iron, the weight of the cathode can be maintained by a current calculated from the actual corrosion of the cathode in the given solution, provided that the ions of the anode are carried through the solution. If a larger current than that calculated be employed the deposition from the anode will increase the weight of the cathode. In the experiments with iron and zinc anodes the cathode metal was dissolving, but its weight was being made up, at any rate in the acid solutions, by deposition from the anode, and this was clearly demonstrated in the last zinc experiment described, in which the deposit of zinc on the cathode derived from the anode could be plainly seen. During the progress of the experiment the cathode appeared to dissolve in the solution and to give off hydrogen gas just as freely as when it was immersed in the acid solution without any current passing. That the iron or zinc should be dissolving from the cathode while simultaneously deposition of the same metal was taking place seems rather strange at first sight, but is not so when we consider the action which takes place when a piece of iron is immersed in a solution of copper salt. Here the ions of iron pass into solution, and the copper ions take their place.

That the passage of a current is in itself not sufficient to keep the cathode protected is shown by the experiments with iron and zinc in which platinum was used as the anode. At the same time the connection of the iron or zinc to the negative pole of the battery does diminish the solution of the metals, but the diminution is much more marked in the case of iron than zinc. If we take it that the piece of steel used in the first experiment described in Table I. would have lost 0·08 grm. in the acid solution if left to itself, then since only 0·0036 grm. was lost when a current of 0·15 amp. was employed, the loss of metal was under 5 per cent. of what it would have been in the absence of the protecting current. Probably it would be possible in the case of both iron and zinc by sufficiently increasing the voltage to prevent the solution of the metal completely, but the process would be too expensive to apply on a large scale. The deposition of hydrogen ions from the platinum anode would undoubtedly tend to protect the cathode from the action of the acid, and, furthermore, after the iron or zinc had reached a certain concentration in the solution there would probably be a tendency for the current to re-deposit them on the cathode.

During the progress of the first experiment described in Table I., 5 c.c. of solution was taken from the beaker at intervals and tested with potassium ferrocyanide in order to determine whether the quantity of iron in solution continuously increased or whether it reached a certain concentration and then remained stationary. The first test was taken a few hours from the beginning of the experiment and showed the same amount of iron as in all the subsequent tests, proving that only a certain quantity of iron passed into solution. In the experiments with the steel cylinder in sea-water it was found impossible to weigh the cylinder with certainty with an accuracy greater than 0·015 grm. Furthermore, the passage of a current through sea-water generates sodium hydrate, which would not only tend to reduce the corrosion of the cylinder itself, but would also precipitate iron ions passing from the anode. It is therefore doubtful in these experiments whether any iron was deposited on the cylinder itself, but, even making allowance for the occurrence of experimental errors in the weighing, the loss from the cylinder could only have been very slight.

Although the experiments described have shown that the electrolytic process does not actually prevent metal from entering the solution from the cathode, for, where the weight remains constant, deposition is taking place from the anode, yet the tendency of the metal to pass into solution is much diminished. Whether or not the deposition of fresh metal from the anode takes place evenly over the surface of the cathode, forming a coating which may continually be removed and so protect the main body of the metal, is a matter which could only be decided by further investigation.

In conclusion, the authors with to express their thanks to the management of the Colonial Sugar Refining Co., Ltd., for permission to publish the results of their investigation.

TABLE I.

	Solution.	Resistance of circuit.	Current in amperes.	Anode.	Cathode.	Loss of weight of Anode. grms.	Loss of weight of Cathode. grms.	Time in hours.
A	N/25 Sulphuric acid ..	22 ohms	0·15	Platinum	Steel	—	0·0036	24
B	Do.	do.	do.	do.	Wrought iron	—	0·0060	21
C	do.	do.	do.	Wrought iron	do.	0·662	0·0107 (gain)	5
D	Water from tap	370 ohms	0·009	do.	do.	0·1537	0·0008	20
E	Sea-water	3 ,,	1·0	do.	do.	7·5721	0·0010 (gain)	6
F	do.	30 ,,	0·1	do.	do.	1·3967	0·0	17
G	Dilute acid	22 ,,	0·15	do.	Steel	0·5921	0·0155 (gain)	Not taken

TABLE II.

	Solution.	Resistance of circuit.	Voltage of Battery.	Current in amperes calculated from 2 and 3.	Time in hours.	Loss of iron from anode grms.	Current calculated from 5 and 6 amperes.	Loss on Cathode (steel cylinder). grms.	Remarks.
A	N/100 Sulphuric acid	414–454	3·8	·00918 to ·00837	72	0·7218	0·0096	0·52	In both experiments C and D a deposit of greenish ferrous hydroxide had to be removed from the cylinder. In "D" it was very slight.
B	do.	14–60	3·8	·27 to ·063	18	1·2663	0·067	0·25 (gain)	
C	Sea-water	40	4·0	·01	72	0·8328	0·0111	—	
D	do.	1000	4·0	·004	72	0·3058	0·0041	—	
E	do.	1500	4·0	·0027	72	0·2094	0·0028	0·03	

DISCUSSION.

Dr. E. S. STOKES thought that this paper afforded proof of the electrolytic theory of the corrosion of iron. He had prepared a number of specimens illustrative of the same action, which he now exhibited. Bright untinned iron nails were imbedded in a 12 per cent. solution of gelatin containing phenolphthalein and potassium ferrocyanide. One nail was in contact with a small piece of copper, another with tin, and others with zinc. The blue colour showed the positive polar areas, and the red colour the negative polar areas. Where the nail was cut or wounded a positive polar area was shown.

Mr. R. J. N. Franki said that in electric light stations a good deal of pitting occurred in the condenser tubes, and Mr. Cumberland was asked to instal his appliance at the Sydney Municipal Power House. He used a 7 inch plate on each condenser door, and, though corrosion had not been absolutely stopped, it was greatly diminished. There was also a further advantage, that the condensers were kept perfectly clean by the treatment. The same thing was done at the Balmain Power House with the same result.

The Chairman said that it was well known that an electric current was produced when iron was under strain, the strained part being the anode and the unstrained the cathode; thus the strained part of a boiler would set up an electric couple, and he asked how this couple would be affected by the application of an electric current to the boiler as a whole. He mentioned the case of a salt water pump, lubricated with sea water, in which corrosion was considerable. On one occasion a large piece of steel was accidentally left inside the pump, and on again opening up the pump after the lapse of one month the steel was found to be badly corroded, but the pump had been protected.

Prof. J. A. Schofield said that if the mass of iron of a boiler went into solution as a whole, he could understand that a counter current might protect it; but when one part of the iron was electro-positive to another that was electro-negative, he thought the method must fail, as the local action would still continue.

Dr. Harker, in reply, said that local action occurred all over a boiler, but the application of an external current inhibited that action. In the experiments in which platinum was used as the anode, it was found that, even in acid water, there was no appreciable decrease in the weight of the iron cathode.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Freezing mixtures. J. Duclaux. Comptes rend., 1910, **151**, 715—716.

The principle of regenerative cooling is applied to the production of low temperatures by the mixing of appropriate pairs of liquids, each portion mixed serving for the cooling of successive portions to be mixed. Carbon bisulphide and acetone have been found the most suitable liquids, allowing a temperature of −48° C. to be rapidly reached; they are introduced into the mixing apparatus by two long tubes (say 1 mm. in diameter), and the mixed liquids are made to flow back over the exterior of the tubes; the temperature is thus easily kept constant for hours, and the liquids are readily recovered by separating with water. In an example given, the use of 100 c.c. of carbon bisulphide and 70 c.c. of acetone per hour was necessary, to maintain a temperature of −43·5° C. in a volume of 20 c.c.—F. Sodn.

Colloidal solutions; Filtration of ——. A. Schoep. Bull. Soc. Chim. Belg., 1910, **24**, 354—367.

In the preparation of the collodion filters previously described (this J., 1910, 1041) the following proportions of the ingredients have given the best results:—(1) Pyroxylin, 4; castor oil, 3·5; and ether-alcohol, 92·5 parts; and (2) Pyroxylin, 4; castor oil, 4; and ether-alcohol, 92 parts. The solvent consisted of 10 parts of alcohol and 80 parts of ether. By adding to either of these elastic collodions variable quantities of glycerin, mixtures were obtained, which after evaporation of the solvent, left membranes through which certain colloidal emulsions and solutions could be filtered without external pressure. A filtering membrane prepared from collodion No. 1 with the addition of 4 parts of glycerin enabled a mixture of Prussian blue and of hæmoglobin to be separated; and water containing 500 micro-organisms per c.c. was rendered sterile by passage through a membrane of this composition. The rate of filtration was 100 c.c. in 10 minutes with a height of liquid in the filter-membrane of 27 c.c. It was proved that there was no adsorption of colloidal bodies by the substance of the membrane during the filtration.—C. A. M.

Patents.

Measuring the flow of liquids in closed conduits; Apparatus for ——. F. Simpson and A. R. T. Woods, Liverpool. Eng. Pat. 21,769, Sept. 24, 1909.

In apparatus for measuring the flow of liquids through closed conduits, in which the quantity of liquid passing is indicated by a liquid gauge showing the difference of pressure on the opposite sides of a constriction in the circuit, the claim is for an "obstruent" to form the constriction which consists of a tapered plug in a plug-cock so arranged that by closing the cock, the "obstruent" can be removed for inspection without loss of liquid. —W. H. C.

Pyrometers and the like; Indicating and recording apparatus for electric ——. W. Armour, Irvine, N.B. Eng. Pat. 22,764, Oct. 6, 1909.

The claim is for a method of recording the temperatures of several different points on one recording instrument by having a suitable arrangement of connections.—W. H. C.

Settling and filtering apparatus. W. Michel, Suhl, Germany. Eng. Pat. 2875, Feb. 5, 1910.

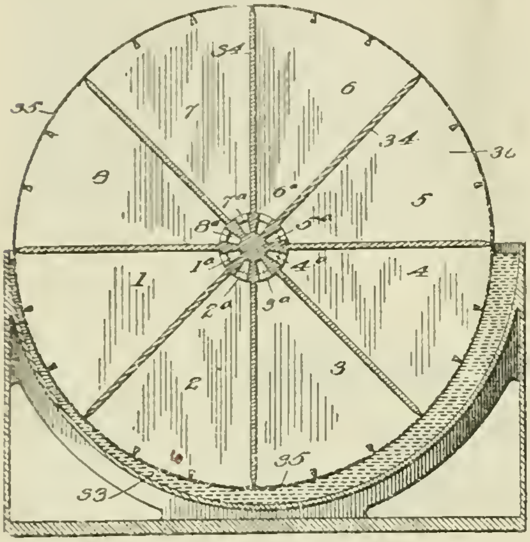
A series of filtering tanks constructed on the spring system is so arranged that the liquid passes in an upward direction through filtering media of progressively increasing fineness supported on trays suspended below the upper edges of the tanks. Overflows and baffle-walls are provided to guide the flow of the liquid. The solids are removed in trucks which run on rails laid along the floor of the tanks and passing through sluice-doors in the lower parts of the division walls between the tanks. —W. H. C.

Filtering liquids; Apparatus for ——. J. Malfitano, Paris. Eng. Pat. 8545, April 8, 1910. Under Int. Conv., April 9, 1909.

A porous membrane or bag formed of collodion, viscose, or gelatin hardened by formaldehyde is arranged within a cylinder or tube provided on its inner side with parallel grooves or with a network, the liquid being forced or sucked through under pressure. In the laboratory filter described, the vessel is preferably made of glass.—H. H.

Screening and filtering apparatus for drying wet materials. D. Divers, Deerfield, Mich., U.S.A. Eng. Pat. 10,903, May 3, 1910. Under Int. Conv., May 4, 1909.

A drum, 30, having a perforated peripheral surface, 35, divided into compartments, 1, to 8, by radial partitions, 34, is rotated about an axis in a trough, 33, into which the material to be filtered is fed. By means of channels, 1*a*, to 7*a*, in the axis, the compartments are subjected to an increasing vacuum, and material picked up in the trough is dried as the compartments come into the positions, 5, 6, 7, and then discharged from the surface when it arrives in the position, 8, by an air blast introduced through the channel, 8*a*, in the axis.—W. H. C.



Filter; Continuous ——. A. L. Viguier and E. B. Morac. Fr. Pat. 415,917, May 13, 1910.

The liquid to be filtered is fed into a trough in which a perforated drum rotates. The drum is put into communication with a vacuum pump through its hollow trunnions and an endless band of filtering material passes round the drum and also round a series of rollers, outside the trough. The liquid passes through the cloth into the drum and the solids collect on the cloth and are carried out of the trough as the endless band moves, being scraped off before each portion of the cloth re-enters the trough. —W. H. C.

Protecting wall for apparatus which are subjected to a high temperature. Gebr. Siemens und Co., Berlin. Eng. Pat. 5161, March 1, 1910. Under Int. Conv., March 17, 1909.

The protecting wall is formed of a material consisting principally of silicon, carbon, and nitrogen, manufactured according to the process described in Eng. Pat. 26,384 of 1905 (this J., 1906, 428) and coated with a refractory glazing film to render the wall impervious to the passage of gas.—W. H. C.

Liquefaction of gases for demonstration purposes; Apparatus for the ——. W. P. Schneider, Hamburg. Eng. Pat. 11,461, May 9, 1910. Under Int. Conv., June 8, 1909.

The cooling coil is divided into two concentric coils of which the outer is made from a single tube, while the inner coil is made from several thin plaited tubes. The latter are bent considerably more than in the usual spiral coil, so that the air passing through them is brought into thorough contact with the walls and is thereby cooled more efficiently. The upper part of the vacuum vessel is introduced into the annular space between the two coils, so that it is cooled slowly and liability to fracture at the junction of the inner and outer walls is minimised. No means are provided to free the compressed gas from carbon dioxide or moisture, but a preliminary cooling may be effected by a coil immersed in a freezing mixture.—H. H.

Evaporator. A. S. Morris, Haverford, Pa., Assignor to Kestner Evaporator Co., Philadelphia, Pa. U.S. Pat. 965,395, July 26, 1910.

An intermediate horizontal plate is provided in evaporators of the vertical tube type for the purpose of steadying the tubes, when these are of great length, and also for catching the water of condensation from the tubes and diverting it to the wall of the casing, thus checking the flow of condensation water down the tubes and permitting free access of steam thereto.—H. H.

Evaporating apparatus. S. M. Lillie, Philadelphia, Pa. U.S. Pat. 972,880, Oct. 18, 1910.

Each unit or " effect " of a series of evaporating chambers of a multiple effect system is provided with a liquor heater, consisting of a coil placed in the steam or vapour space of each " effect." The liquor is circulated first through the heaters in succession, and then delivered to the evaporating chamber of each " effect."—W. H. C.

Concentrating solutions; Apparatus for ——. E. Monti, Turin, Italy. U.S. Pat. 973,290, Oct. 18, 1910.

The claim is for a method of concentrating solutions by the combined use of a refrigerating and evaporating plant. The warm cooling liquid from the refrigerant gas condensers is passed through the coils of the evaporator to effect the evaporation of the liquid previously partly concentrated by refrigeration, the evaporation being conducted under reduced pressure. The ice water from the refrigerators is passed through the condensers.—W. H. C.

Evaporation of liquids: Removal of substances which are deposited as sediment or scale during the ——. E. Efran. Fr. Pat. 415,257, Feb. 14, 1910.

In order to prevent the deposition of mud or scale in steam boilers, or in any evaporating process, the water or other liquid is first passed through a special apparatus for the removal of the substances which would be deposited. This apparatus may be arranged in the steam-space of the boiler. The arrangement is such that the water is heated whilst flowing in a wide and shallow stream over inclined surfaces with frequent changes of direction. In one form, the apparatus comprises a series of superposed sloping plates or shallow open channels, inclined in opposite directions, and extending between two open-topped vessels. These vessels are divided by vertical partitions into a series of sumps of different heights, so that the water flows from the highest sump in one vessel, down one of the open channels, into the highest sump in the other vessel, back down the next channel to the next sump in the first vessel and so on. The sediment is deposited in the sumps. —A. T. L.

Distilling system. E. H. De Lany, Cleveland, Tenn., Assignor to De Lany Separator Co., New York. U.S. Pat. 971,668, Oct. 4, 1910.

The claim is for a system of feed-water heaters arranged in series, the second heater being heated by steam from a secondary evaporator.—W. H. C.

Desiccator. Maschinenfabrik Imperial Ges. m. b. H. Fr. Pat. 415,684, May 6, 1910. Under Int. Conv., June 9, 1909.

The apparatus consists of a horizontal perforated drum which is rotated within a casing. The material to be dried is fed upon the exterior surface of the drum and is agitated and spread out by a rotating agitating device provided with projecting blades which pass between similar blades attached to the outer surface of the drum. The desiccation is effected by hot air or gas, which is transmitted through the interior of the drum.—W. H. C.

Drying apparatus. A. Delpon. Fr. Pat. 415,854, April 21, 1910.

The materials to be dried are placed on suitable supports in a chamber through which the drying medium (air) is drawn by a fan. The air is first cooled by passing it over a series of pipes through which cold brine is circulated and then after it has deposited the moisture, it is heated by passing it over steam coils. The deposited frost may be collected by a system of scrapers and utilised as artificial snow. —W. H. C.

Clarification and separation of liquids. G. E. Sandford. Fr. Pat. 415,858, April 23, 1910. Under Int. Conv., July 27, 1909.

Two concentric rotating drums are provided with series of discs between the drums and within the inner drum. On rotating the apparatus, into which the materials to be separated are fed, the centrifugal force developed causes the solid bodies that are specifically heavier than the liquid to collect between the discs and against the peripheral portion of the drums, and the lighter solids to accumulate around the exterior of the inner drum and the central axis. The liquid portion takes an intermediate position and the three separated products are drawn off separately. —W. H. C.

Drying machines. J. Y. Johnson, London. From Philadelphia Textile Machinery Co., Philadelphia, U.S.A. Eng. Pat. 8009, April 2, 1910.

See U.S. Pat. 962,865 of 1910; this J., 1910, 932. —T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; The volatile constituents of ——. M. J. Burgess and R. V. Wheeler. Trans. Chem. Soc., 1910, 1917. Proc. Chem. Soc. 1910, **26**, 210.

It is shown that with all coals, whether bituminous, semi-bituminous, or anthracitic, there is a well-defined decomposition-point at a temperature lying between 700° and 800°, which corresponds with a marked increase in the quantity of hydrogen evolved. With bituminous coals, the increase in the quantity of hydrogen evolved falls off at temperatures above 900°, but with anthracitic coals it is maintained up to 1100°. It is further shown that ethane, propane, and butane, and, probably, higher members of the paraffin series of hydrocarbons, form a large percentage of the gases evolved at low temperatures, but that at temperatures above 700° the evolution of such hydrocarbons practically ceases. The suggestion is advanced that coal of whatever geological age contains a compound which undergoes decomposition at temperatures above 700° (under the atmospheric pressure), and yields hydrogen as its principal gaseous product. It seems probable, also, that the same compound is responsible for the hydrocarbons of the paraffin series that make their appearance at low temperatures.

Coke oven fumes; Suction device for drawing off ——. A. Gradenwitz. Eng. and Min. J., 1910, **90**, 825—826.

In order to eliminate the dense fumes evolved during the charging of coke ovens, without the risk of explosions in gas conduits, a covered channel is provided in the thickness of the oven lids and extends the whole length of the battery, terminating in a stack. When an oven is about to be charged, the gas main is closed by a valve, and communication is made between the uptake and the special channel, by means of a light iron elbow. The radiation from the oven maintains the channel at a temperature which ensures instantaneous combustion of the gas and air mixture drawn in, so that explosion traps are unnecessary. —F. R.

Carbonising in by-product coke-ovens and experiences in utilising the surplus gas for lighting purposes. J. S. Lacking. J. Gas Lighting, 1910, **112**, 326.

The surplus gas from a coke-oven plant, which is usually blown into the air, was mixed with lighting gas from gas retorts at the inlet to the purifiers. The naphthalene was deposited at the outlet of the purifiers and in the meter inlet and outlet but never beyond. In order to produce a gas of 16-candle power when mixing the gases in equal proportions, the temperature of the gas retorts was lowered to produce a richer mixture. The coke-oven gas rarely fell below 14-candle power. The advantages of the system were counterbalanced by the disadvantage of the unequal supply of gas from the coke-ovens, which necessitated keeping as many gas retorts heated up as would make the full quantity of gas required. Thus when the coke-ovens were stopped for three or four hours it was often thirty-six hours or more before there was any surplus gas. The coke-oven gas also contained more sulphuretted hydrogen than retort gas. —H. H.

Petroleum in the Argentine. W. Mecklenburg. Chem.-Zeit. (The author gives an abstract of a monograph entitled "Algunas investigaciones sobra los petróleos Argentinos," published by E. Longobardi in Buenos Ayres in 1909.) 1910, **34**, 1150—1152.

Petroleum in the Argentine has as yet only been found in the provinces and districts to the east of the Andes, notably at Jujuy, Salta, Mendoza, Los Buitres, Neuquén, and Chubut, but it probably occurs in many other places within the limits of this huge area. Argentine oils are viscous and of dark colour, that from Chubut being quite black. The oils from Yacuiva have the best appearance, whilst those of Salta come next. They are reddish-brown and have a strong greenish fluorescence. The oils of Salta, Jujuy and San Rafael (Mendoza) have an odour of lamp oil, whilst the oils of Cacheuta and Comodoro Rivadavia, which are derived from deep strata, have an odour of benzine. The following results were given by samples of the different oils :—

Oil from	Sp. gr. at 15° C.	Viscosity, Engler		Flashing point.	Ignition point.	Heat of Combustion.	Asphaltum	Sulphur.
		at 35° C.	at 70° C.					
				° C.	° C.	Cals.	Per cent.	Per cent.
Yacuiva	0·8980	4·20	1·70	70	—	10,864	trace	0·070
Laguna de la Brea	0·9290–0·9320	—	—	—	—	—	—	—
Salta (Tartagal)	0·9088	9·60	2·40	85	160	10,716	0·20	—
Salta (Aguaray)	0·9270	9·72	2·36	90	165	10,525	trace	0·1598
Cacheuta	0·9032 (17° C.)	11·00	—	45	90	—	—	—
Sierra Lotena	0·9282–0·9450	—	—	—	—	—	—	0·0960
Neuquén	0·9150	15·70	3·00	85	150	10,510	2·18	0·8492
Comodoro Rivadavia	0·9570	not determinable.	13·20	40	80	10,519	2·25	—

The results of fractional distillation showed that Argentine petroleums resemble Baku oils much more closely than Pennsylvanian oils. Only the oil of Comodoro Rivadavia approximates more nearly to the American oils in the properties of its fractions of lower boiling point, but it too resembles the Baku oils in the behaviour of the fractions of higher boiling point. Speaking generally, the values of the fractions of higher boiling point of Argentine oils are higher than those of the corresponding fractions of Russian oils. The composition of Argentine oils must also approximate closely to that of Caucasian oils, and, in fact, Englier and Otten (Dinglers' polyt. J., 1888, **268**, 375) found that cyclic hydrocarbons of the formula C_nH_{2n} (naphthenes) predominated in Cacheuta oil.—C. A. M.

Petroleum industry; Applications of cold in the ——. A Guiselin. Petroleum, 1910, 6, 133—135.

Hitherto the application of cold in the petroleum industry has been restricted to the separation of paraffin wax from the heavy oils obtained in the distillation of crude American petroleum oils. Even this use, however, is neglected, and in France the business of the refiner has practically disappeared, for the wholesale merchant is taking his place. In consequence of this a yearly loss of nearly 4,500,000 francs (£178,590) is suffered through the neglect to separate the paraffin wax, since the American crude oils imported into France contain on the average 1½ per cent. of paraffin wax, upon which product, when imported separately, a duty of 30 francs per 100 kilos. (12s. 1d. per cwt.), minimum tariff, or 45 francs per 100 kilos. (18s. 2d. per cwt.), general tariff, would have to be paid. The amount of paraffin oil imported into France is about 150,000 metric tons per annum, most of it being Pennsylvanian oil, containing paraffin wax. In the few refineries that still remain in France, the paraffin wax is not extracted, because attempts are made to decompose it by the cracking process. This results in many oils being placed upon the market the quality of which is inferior, owing to incomplete destruction of the paraffin wax, and this at an expenditure of coal, etc., and a tariff loss of 19·75 francs per 100 kilos. (7s. 11½d. per cwt.) of the destroyed wax. Another direction in which the use of artificial cold is neglected by the French refiners is in the condensation of the petroleum spirit. No attempt is made to recover the 2 to 3 per cent. of light petroleum fractions thus lost, although their value far exceeds the cost of labour, etc. Thus in one refinery the loss in rectifying 10,000 metric tons of petroleum spirit per annum is 3 per cent., which at the average price of 40 francs per 100 kilos (16s. 1½d. per cwt.) amounts to 120,000 francs (£4,760). By the introduction of a cooling plant this loss could be reduced to ½ per cent., or a total saving of 100,000 francs (£3,970). An artificial cold plant might also be advantageously introduced into the distilleries at the oil-fields, where owing to the scarcity of water the condensation is very slow and losses of petroleum spirit, occasionally reaching 6 to 10 per cent. of the original material, are inevitable. In place of water in the condensers the residues or heavy oils from which the light fractions had been separated might be used as the cooling agent. Moreover, in the process of refining the oils with sulphuric acid the requisite low temperature could be more effectively and economically attained by the use of artificial cold, than by means of water which in summer is often itself only a little below the atmospheric temperature. —C. A. M.

Oil—Water; The system ——. E. Groschuff. Chem. Weekblad, 1910, 7, 687. Chem. Zentr., 1910, 2, 1342.

Refined petroleum at 15° C. dissolves about 0·005 per cent. of water, and paraffin oil about 0·003 per cent. The solubility increases with rise of temperature, and to a greater extent with petroleum than with paraffin oil.—A. S.

Oil—Water; The system ——. A. Vosmaer. Chem. Weekblad, 1910, 7, 731—732. Chem. Zentr., 1910, 2, 1343.

See preceding abstract. The author points out that Tobey has shown that "an excess" of 0·01 per cent. or more water has an injurious effect on the insulating properties of transformer oils.—A. S.

Propagation of explosions in mixtures of petroleum vapour with air in tubes. Munroe. *See* XXII.

Mineral oils and gases, and potassium nitrate in Hungary; Bills for creating State monopolies in ——. Board of Trade J., Nov. 3, 1910. [T.R.]

Two Bills were introduced into the Hungarian Parliament on 5th October for creating State monopolies in the production (1) of petroleum and natural mineral gases and (2) of nitrate of potash. By these measures, the right of prospecting for and extracting (1) fluid bitumen, mineral oil, semi-solid bitumen, ozokerite, and gaseous bitumen, and (2) nitrate of potash, is reserved to the State. The Minister of Finance may transfer the above rights for a fixed period of time to others. The transferee may not sell or mortgage the right of extraction, however, without the consent of the Minister. In the Bill dealing with petroleum and natural mineral gases, it is provided that licences to prospect for fluid bitumen granted previously to the coming into force of the proposed law shall remain in force with certain restrictions; but such licences shall give no right as regards "gaseous bitumen," the search for and production of which shall be reserved to the State. After the coming into force of the law, mining rights for fluid bitumen shall only be granted to private persons if mining operations have been begun within a certain period of time on the ground of a prospecting licence. As regards wells of gaseous bitumen bored and in operation before the coming into force of the law, the Mining Authorities shall upon request grant a "reserved claim" of 200 metres radius. The text (in German) and an abstract in English of the two Bills may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Patents.

Briquette; Smokeless ——, *and process of making the same.* R. A. Carter, jun., New York. U.S. Pat. 972,333, Oct. 11, 1910.

Finely-divided carbonaceous matter such as coke or breeze is briquetted with 7 to 10 per cent. of a binder made from the oil residues obtained in the manufacture of carburetted water-gas.—A. T. L.

Briquettes; Manufacture of ——. T. Franke. Fr. Pat. 414,911, April 18, 1910. Under Int. Conv., Dec. 24, 1909.

In briquetting or compressing substances such as corn, seeds, fodder, leaves, wood, peat, etc., a suitable quantity of a granular substance such as gravel, clinker, iron turnings, dry peat, coal-dust or coke-breeze is added, the quantity varying from one-tenth to one-sixth, in order to facilitate the removal of liquid from the cells. In briquetting carbonaceous substances such as wood, coke and coal, moist peat is added as a binder in quantities varying from one-fifth to an equal amount.—A. T. L.

Briquettes agglomerated by waste sulphite-cellulose lyes; Increasing the resistance of —— *to atmospheric influences.* Gewerkschaft Pionier. Fr. Pat. 415,566, April 7, 1910.

See U.S. Pat. 969,504 of 1910; this J., 1910, 1148.—W.H.C.

Coke; Manufacture of ——. L. H. Diehl, London, and P. Faber, Berlin-Suedende. Eng. Pat. 6622, March 16, 1910.

The coal is mixed with basic substances, such as lime, in sufficient quantity to convert the constituents of the ash into a monosilicate, such as $SiO_2(CaO)_2$, or a slightly more basic silicate, and the coking is effected at a temperature sufficiently high to cause the ash and the lime to combine and form a fluid slag. This slag acts upon the iron sulphide which is present and transforms it to calcium sulphide. In this way, a hard coke suitable for metallurgical purposes is obtained, the sulphur being in a form which is insoluble in molten metals.—A. T. L.

Coke-ovens; Art of operating retort ——. A. F. Hilleke, Ensley, Ala., Assignor to Semet-Solvay Co., Syracuse, N.Y. U.S. Pat. 973,044, Oct. 18, 1910.

The ovens are heated by the combustion of tar in the heating flues. The heat given off by the combustion of the tar is distributed through the flues by an inert gas introduced independently.—W. H. C.

Cake-oven. A. Meister. Ger. Pat. 224,904, Sept. 5, 1909.

The patent relates to an oven having horizontal coking chambers and vertical heating flues, arranged in pairs, each flue being provided with independent supplies of heating gas and air. Each pair of flues communicates at the upper end, with an intermediate vertical waste gas flue, the lower part of which has a zig-zag, or other similar form. On either side of this zig-zag portion of the flue, are conduits, of similar shape, for preheating the air. A. S.

Gas; Method of producing ——. E. G. Jewett, Bellingham, Wash. U.S. Pat. 972,864, Oct. 18, 1910.

Raw coal, or other suitable fuel is distilled in the upper part of the generator by the heat from the combustion of the fixed portion of the fuel lower down in the producer, where it is partially burned in a blast of air. The volatile products of distillation are mixed with oxygen or air and burnt and then injected by a jet of steam into the body of incandescent fuel in the lower part of the producer.—W. H. C.

Gas producers. Tait Producer Co. Fr. Pat. 415,193, April 25, 1910.

The grate consists of an upper set of hollow water-cooled fire-bars arranged with spaces between them, and a lower set of bars arranged beneath the spaces. Poking holes are provided in the casing of the producer at the level of the lower set of fire-bars.—A. T. L.

Combustible gas; Manufacture of —— from peat, refuse, and other poor fuel. H. Riché and C. Birault. Fr. Pat. 415,413, April 30, 1910.

The peat, etc., is fed into the upper part of a producer chamber which contains a bed of incandescent coke or other fuel in the lower part, and air is admitted in regulated quantities below the bed of coke and also at the bottom of the bed of poor fuel. The hot gases liberated in the producer chamber are enriched by passing up through a bed of raw peat, etc., in an adjacent chamber, and the peat, etc., which has been treated in this latter chamber is used in the producer chamber. The two chambers are separated by a partition which is formed of two firebrick walls united by an impervious cement in order to render it gas-tight.—A. T. L.

Revivifying sulphuretted oxide from gas works. W. Wyld, Leeds, and H. E. Green, Yardley, Worcester. Eng. Pat. 22,514, Oct. 4, 1909.

The oxide is heated just sufficiently to ignite the sulphur, and as soon as the sulphur has been consumed, the oxide is brought into contact with a cooler atmosphere so as to prevent excessive heating which would decompose the hydrate originally present. In carrying out the process, the oxide is distributed on a moving band which passes through a heated flue, connected, near the end at which the band enters, with a Glover tower or the like. A current of air is drawn in at the other end of the flue in the opposite direction to the travel of the band.—A. T. L.

Coal gas; Purifying —— after extraction of ammonia. R. Fabry, Sheffield. Eng. Pat. 7766, March 31, 1910.

The gas from retorts or from coke-ovens, after passing through the condensers, the tar separator and the saturator in which it is treated with acid for the removal of ammonia, is washed with spent ammoniacal liquor containing an excess of lime, or with fresh milk of lime, in order to neutralise all acids.—A. T. L.

Refining petroleum. C. I. Robinson, West New Brighton, N.Y., Assignor to Standard Oil Co., Bayonne, N.J. U.S. Pat. 968,692, Aug. 30, 1910.

Petroleum obtained from oil fields near Beaumont, Texas, when refined in the usual manner, smokes badly when burned in ordinary lamps. This defect is removed by treatment of the oil with sulphuric acid containing 98 per cent. or more of monohydrate (H_2SO_4), which attacks the hydrocarbons that produce the smoke, whereas ordinary concentrated acid of 66° B., containing 93 per cent. of monohydrate, has no action on them. The oil is fractionated and "cracked," and the lighter portion treated with ordinary sulphuric acid in the usual way. The portions of the heavier fractions which can be satisfactorily treated with a moderate amount of 98 per cent. acid are collected and treated with about 2 lb. of such acid for each gallon of oil. After separation from the acid sludge, from which the acid is subsequently recovered, the oil is partially distilled, the greater portion being available as burning oil. Fuming sulphuric acid may be used instead of the 98 per cent. acid, and is preferable in some cases. An economy of 98 per cent. acid can in some cases be secured by a preliminary treatment with a weaker acid. The large volume of sulphuretted hydrogen given off in the distillation of the crude oil is converted into sulphuric acid for use in the process.—H. H.

Refining petroleum. J. C. Black, Assignor to Standard Oil Co., Richmond, Cal. U.S. Pat. 968,640, Aug. 30, 1910.

The treatment of "burning petroleum oil" which smokes, with fuming or anhydrous sulphuric acid for the purpose of removing the higher hydrocarbons which produce smoke, is modified by introducing the sulphuric anhydride in the gaseous condition in admixture with diluent gas. The acid sludge produced in this process contains far less free acid than that obtained in the treatment with liquid acid, and it is suggested that in the latter method particles of acid are surrounded by tarry bodies and so prevented from acting on the hydrocarbons. The petroleum is first distilled and treated with ordinary sulphuric acid of 66° B., and after separating the acid sludge, it is run into an iron agitator into which a mixture of sulphuric anhydride, freshly prepared by the catalytic method, and diluent gas containing about 3½ per cent. by volume of the anhydride, is passed. The diluent gas consists of nitrogen, oxygen, and unconverted sulphur dioxide. The temperature is maintained at 40° to 60° F. In an example the gas was passed for 32 hours into 40,000 gallons of oil, 18,000 lb. of sulphuric anhydride being absorbed. After settling, the sludge is run off, and the oil again treated with ordinary sulphuric acid. It is finally washed and treated with alkali in the usual manner.—H. H.

Petroleum and other hydrocarbons; Treatment of ——. S. Wohle. Fr. Pat. 414,928, April 19, 1910. Under Int. Conv., Oct. 12, 1909.

The oil is treated with an alkaline solution containing saline substances and iodine and also a soapy substance, and then sulphuric acid is added, and finally the oil is decanted. For example, the alkaline solution may be prepared by boiling seaweed with a strong lye containing two parts of sodium carbonate to one part of lime. Oxide of iron may be added to the solution thus obtained. A detergent solution is prepared by treating certain barks or nuts with a similar lye and a small quantity of iron sulphate is added to this solution. Three parts of the former solution are added to one part of the detergent solution, and the oil is intimately mixed with 5 to 10 per cent. of the mixed solutions. Finally 1 to 2 per cent. of sulphuric acid is added, the oil allowed to separate, and the purified oil is drawn off.—A. T. L.

Coke and gas; Manufacture of —— and apparatus therefor. W. Muller, Dusseldorf, Germany. Eng. Pat. 23,671, Oct. 15, 1909.

See Fr. Pat. 407,835 of 1909; this J., 1910, 617.—T. F. B.

Petroleum and other hydrocarbon oils. S. Wohle, London. Eng. Pat. 23,348, Oct. 12, 1909.

See Fr. Pat. 414,928 of 1910; preceding.—T. F. B.

Erratum.

This J., August 15, 1910, p. 934, column 2, title of fourth abstract. Insert "of 1910; date of Appl." *before* "May 27, 1909."

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Manufacture of hydrogen. See VII.

Patents.

Mantle for incandescence lighting by gas, alcohol, petroleum, etc. E. Crumière. Fr. Pat. 415,003, March 31, 1910.

In forming mantles from cellulose, instead of preparing a fibre of artificial silk and weaving it into a fabric of the desired form, the cellulose is precipitated from its solution upon a glass mould. After washing, the cellulose mantle is dried, then impregnated and finished in the usual manner. In place of cellulose, solutions of nitrocellulose, or of collodion may be used.—A. T. L.

Incandescence mantles for gas lighting. A. H. Williams. Fr. Pat. 415,980, May 14, 1910.

In order to increase the lighting power and to render the mantles less liable to fracture, they are treated after incineration in the following manner:—The mantles are dipped for 2 minutes in a bath of petroleum oil (burning oil, naphtha or benzine), dried for 5 minutes in a stove at about 26° C., and then dipped for 5 secs. in a solution consisting of 72·6 grms. of alcohol, 14·18 grms. of olive oil, 3·6 grms of "camphorated alcohol," and 141·75 grms. of collodion. The mantles are then dried for 10 mins. at 26° C., and dipped for 5 secs. in a solution of 7·1 grms. of gelatin in 311·84 grms. of water.—A. T. L.

Metallic filaments of electric incandescent lamps; Manufacture of materials for ——. E. Rubstrat, Goettingen, Germany. Eng. Pat. 24,437, Oct. 25, 1909.

Powdered tungsten is allowed to fall through a rotating arc which is struck between electrodes of tungsten and nickel in a water-cooled chamber through which a current of hydrogen is passed. In this manner the metal is heated to over 3000° C. in the arc and then suddenly cooled. The metal thus treated can be ground to an extremely fine state of division in which it becomes colloidal and even "oily." The metal in this state is mixed with water and squirted into filaments without the use of any binder.
—A. T. L.

Tungsten filaments for incandescent electric lamps; Manufacture of ——. Westinghouse Metallfaden Glühlampenfabrik, Ges. m. b. H., Vienna. Eng. Pat. 3610, Feb. 14, 1910. Under Int. Conv., Feb. 15, 1909.

In the process described in Eng. Pat. 9020 of 1906 (this J., 1907, 42), it is necessary to heat the filaments at a temperature much higher than that necessary for reduction of the oxide, in order to render them strong enough for further manipulation. The present invention consists in adding 40—50 per cent. of tungsten powder to the paste used for squirting the filaments, whereby it becomes unnecessary to heat the filaments above 1000° C.—A. T. L.

Filament for electric incandescence lamps, and manufacture of same. R. R. Graf. Fr. Pat. 415,273, March 19, 1910.

A "metal" for use instead of platinum in incandescence lamps is obtained as follows. Black antimony sulphide is heated with sodium chloride in a closed vessel for 8 hours at 149° C. 42 grms. of the product are mixed with 28 grms. of a liquid obtained by distilling together 2 parts of powdered "vitriol" and 1 part of alcohol. 112 grms. each of copper, brass and German silver are added and the whole is fused, and finally 112 grms. of molten steel is introduced. The substance obtained can be formed into filaments, or used instead of platinum for other purposes.
—A. T. L.

Incandescence mantles: Manufacture of ——. Soc. Franç. de Chaleur et Lumière, Levallois-Perret, France. Eng. Pat. 5262, March 2, 1910. Under Int. Conv., March 5, 1909.

See Fr. Pat. 400,378 of 1909; this J., 1909, 973.—T. F. B.

Incandescent mantles; Method of producing ——. C. R. Böhm, Assignor to Cerofirm-Ges., Berlin. U.S. Pat. 973,253, Oct. 18, 1910.

See Fr. Pat. 386,549 of 1908; this J., 1908, 742.—T. F. B.

Filaments for illuminating and heating purposes; Manufacture of ——. G. Michaud and E. Delasson, Montreuil, France. U.S. Pat. 972,893, Oct. 18, 1910.

See Additions of Dec. 21, 1907, and Jan. 16, 1908, to Fr. Pat. 387,665 of 1907; this J., 1908, 677 and 742.—T. F. B.

Filaments; Process of manufacturing —— *and the filament produced thereby.* G. Michaud and E. Delasson, Montreuil-sous-Bois, France. U.S. Pat. 973,535, Oct. 25, 1910.

See Fr. Pat. 378,665 of 1907; this J., 1907, 1131.—T. F. B.

Tungsten or molybdenum filaments for incandescence electric lamps; Process for making ——. The Westinghouse Metal Filament Lamp, Co., Ltd. First Addition, dated Feb. 14, 1910, to Fr. Pat. 374,543, April 19, 1906. Under Int. Conv., Feb. 15, 1909.

See Eng. Pat. 3610 of 1910; preceding.—T. F. B.

III.—TAR AND TAR PRODUCTS.

Reduction of nitro-derivatives by spongy copper. Mailhe and Murat. *See* XX.

Patents.

Compounds of the anthracene series [o-nitroanthraquinone carboxylic acids]; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7631, March 29, 1910.

o-Nitromethylanthraquinones are converted into the corresponding nitroanthraquinonecarboxylic acids by treatment with an oxidising agent in presence of nitric acid. For example, a mixture of 2 parts of 1-nitro-2-methylanthraquinone with 200 parts of 62 per cent. nitric acid is boiled until a solution is obtained, 10 parts of chromic acid are gradually added to the boiling solution, and the temperature is maintained until oxidation is complete; the product which separates on cooling may be purified by dissolving in alkali and reprecipitating; the 1-nitroanthraquinone-2-carboxylic acid thus produced forms yellow needles melting at 285°—287° C., with slight decomposition.—T. F. B.

β-Anthraquinonylurea chloride; Process for making pure ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 415,789, May 10, 1910. Under Int. Conv., May 12, 1909.

When β-aminoanthraquinone, suspended in toluene, is treated with phosgene, either alone, or dissolved in benzene or toluene, in the cold, a mixture of β-aminoanthraquinone hydrochloride and β-anthraquinonylurea chloride is obtained, which is very difficult to separate. If, however, the action of the phosgene is prolonged considerably in the cold (especially when using excess of phosgene), or if phosgene is allowed to act on a suspension of β-aminoanthraquinone hydrochloride in nitrobenzene, the temperature being raised to between 40° and 120° C., the aminoanthraquinone is completely converted into the anthraquinonylurea chloride. If toluene is used in place of nitrobenzene, the reaction is much slower. The solution of β-anthraquinonylurea chloride can be freed from phosgene and hydrochloric acid by means of a current of dry air, and can then be worked up in any desired manner.—T. F. B.

Acetylchloramino-anthraquinones ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 224,073, July 16, 1909.

When acetamino-anthraquinones are treated with aqueous solutions of hypochlorous acid, the chlorine enters the side chain, and can be eliminated by treatment with sodium bisulphite. The acetylchloramino-anthraquinones prepared in this way are converted into products substituted in the benzene nucleus by means of glacial acetic acid. No reaction occurs when acetaminoanthraquinones are treated with hypochlorites in acetic acid solution (compare Ger. Pat. 199,758 of 1907 ; this J., 1908, 976).—T. F. B.

Acenaphthene ; Manufacture of an oxidation product of ——. Kalle und Co. A.-G., Biebrich on Rhine, Germany. Eng. Pat. 19,341, Aug. 17, 1910. Under Int. Conv., Aug. 17, 1909.

A new derivative of acenaphthene, which is probably acenaphthene-quinone oxime, is obtained by treating it with an ester of nitrous acid (*e.g.*, amyl nitrite) in presence of a condensing agent, and preferably also of a solvent. It is a yellow substance, melting at about 220° C., and is converted into acenaphthene-quinone by hydrolysing agents, such as strong mineral acids. It can be used directly for the preparation of dyestuffs, for example, by condensing with indoxyl or with thionaphthene derivatives.—T. F. B.

Aromatic sulphinic acids from the corresponding sulphochlorides ; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 224,019, Aug. 27, 1908.

Aromatic sulphochlorides are converted into the sulphinic acids by treatment with alkali sulphides in presence of water, good yields being obtained of the products, which may be used for the preparation of mercaptans.—T. F. B.

Diphenylene dioxide ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4540, Feb. 23, 1910.

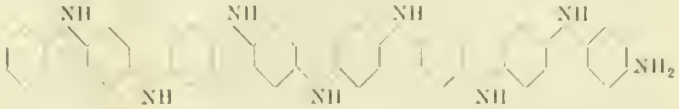
See Ger. Pat. 223,367 of 1909 ; this J., 1910, 937.—T. F. B.

IV.—COLOURING MATTERS AND DYES.

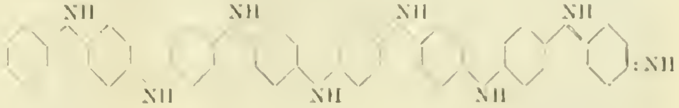
Aniline Black and allied compounds. Part I. A. G. Green and A. E. Woodhead. Proc. Chem. Soc., 1910, 26, 223.

The authors, after reviewing and criticising the recent work of Willstätter and Dorogi on Aniline Black, give an account of the preparation of certain intermediate substances obtained in the conversion of aniline hydrochloride into Aniline Black. The first product is emeraldine, and from it four other substances have been prepared, namely, two by oxidation, nigraniline and pernigraniline, and two by reduction, protoemeraldine and leucoemeraldine. All these compounds form a series, any member of which can be converted into any other by the use of a suitable oxidising or reducing agent. With the view of finding their molecular weight and probable constitution, these compounds have been analysed by determining the amount of hydrogen necessary to convert the more highly oxidised substances into less highly oxidised ones, and, conversely, the amount of oxygen required to oxidise the latter. From the results obtained, the following formulæ are assigned :

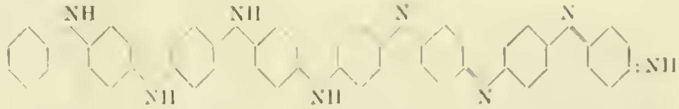
Leucoemeraldine :



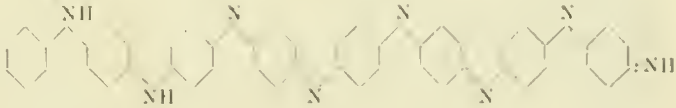
Protoemeraldine :



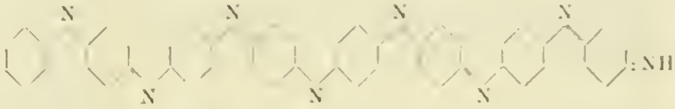
Emeraldine :



Nigraniline :



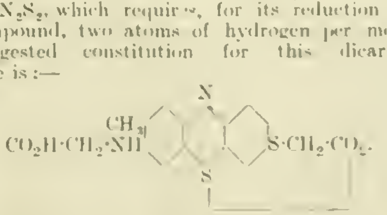
Pernigraniline :



The question as to whether the chain is open or closed is, for the present, to be regarded as unsettled. An attempt has been made to clear up the present extremely involved nomenclature relating to Aniline Black and allied substances, and, further, it has been shown that the so-called "Aniline Blacks" of Kayser, Nietzki, Willstätter, etc., consist essentially of emeraldine and nigraniline mixed with higher condensation products of at present unknown constitution.

Sulphide dyestuffs ; Contributions to our knowledge of the ——. *Part I.* G. H. Frank. Proc. Chem. Soc., 1910, 26, 218.

It has been found that many colouring matters belonging to the "sulphide" class readily combine with chloroacetic acid, giving carboxylic derivatives which are readily soluble in alkalis. The colouring matter known as Immedial-Indone gives a di-carboxylic derivative, $C_{17}H_{14}O_4N_2S_2$, which requires, for its reduction to the leuco-compound, two atoms of hydrogen per molecule. The suggested constitution for this dicarboxylic derivative is :—



Azomethineazo-dyes. A. G. Green and R. N. Sen. Chem. Soc. Proc., 1910, 26, 243–244.

In order to investigate the effect on the colour and dyeing properties brought about by the simultaneous presence in a compound of the azomethine and azo-groups, the authors have prepared and examined a number of dyes obtained by condensing phenetoleazobenzaldehydesulphonic acid, $OC_2H_5{\cdot}C_6H_4{\cdot}N_2{\cdot}C_6H_3(SO_3H){\cdot}CHO$, with various amines and diamines. These compounds, of various complexity, are all yellow, crystalline products, which dye wool readily in fast shades. Affinity for cotton is only manifested when the compound is derived from a para-diamine. The introduction of an auxochromic group, *e.g.*, OH or $N(CH_3)_2$, has practically no effect on the dyeing properties, and does not increase the tinctorial power, augment the affinity, or change the shade. Moreover, the colour is almost independent of the number of azomethine groups in the molecule. The members of the series which do not contain an auxochromic group possess, like the azo-dyes of the stilbene class, to which they have some structural analogy, a considerable degree of fastness to alkalis, light, and chlorine.

In discussion, A. G. Green said, in reply to J. C. Cain, that the colour of the azomethineazo-dyes was uninfluenced by the introduction of naphthalene nuclei into the molecule. The ethoxy-group did not act as an auxochrome in these compounds. Ethoxy-groups apparently only exhibited auxochromic action when they could act as salt-forming groups by combination with acids.

PATENTS.

Azo dyestuffs ; Manufacture of new ——. H. Levinstein and Levinstein, Ltd., Manchester. Eng. Pat. 23.992, Oct. 19, 1909.

THE glycine of 2-amino-5-naphthol-7-sulphonic acid, $SO_3H{\cdot}C_{10}H_5(OH){\cdot}NH{\cdot}CH_2{\cdot}CO_2H$, or the glycine of 2-amino-5-naphthol-1 : 7-disulphonic acid, when combined in alkaline solution with a diazotised aminoazo-compound of the benzene or naphthalene series or with diazotised aminoazo-compounds containing the benzene or naphthalene nucleus in the first or second component, furnishes new dyestuffs which are remarkably bright and fast to light and vary in shade from claret to blue. For example the dyestuff produced by combining diazotised aminoazobenzenesulphonic acid with 2-amino-5-naphthol-7-sulphonic acid dyes unmordanted cotton in bluish red shades.—J. C. C.

Vat dyestuffs ; Production of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,773, Nov. 29, 1909. Addition to Eng. Pat. 7819, April 1, 1909 (this J., 1910, 81).

DYESTUFFS similar to those mentioned in the chief patent can be prepared by using acenaphthenone instead of 1-naphthol or 1-anthrol. The product of condensation of dibromoisatin chloride and acenaphthenone ,gives a violet vat from which cotton is dyed in fast bluish red shades.—J. C. C.

Azo dye. A. Blank and K. Heusner, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 969,450, Sept. 6, 1910.

CLAIM is made for the azo dyestuff prepared as follows: diazotised *p*-aminoacetanilide is combined with 2-amino-5-naphthol-7-sulphonic acid in alkaline solution, the product is saponified, and the resulting diamino-compound is tetrazotised and combined first with one molecule of 1 : 8-aminonaphthol-4 : 6-disulphonic acid in acid solution and second with resorcinol in alkaline solution. Cotton is dyed in blue shades which on treatment with diazotised *p*-nitraniline on the fibre become black. Instead of 2 : 5 : 7-aminonaphtholsulphonic acid the 2 : 8 : 6-acid can be used ; instead of 1 : 8 : 4 : 6-aminonaphtholdisulphonic acid there can be substituted 1 : 8 : 4- or 1 : 8 : 5-aminonaphtholsulphonic acid or 1 : 8 : 3 : 6-aminonaphtholdisulphonic acid ; and lastly *m*-aminophenol or *m*-phenylenediamine may be employed in place of resorcinol.—J. C. C.

Azo dyestuffs ; Production of new —— *and their intermediate products.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 415,662, May 6, 1910. Under Int. Conv., May 13, 1909.

GREEN dyestuffs producing pure shades on cotton and half-wool are prepared by combining a tetrazo-compound with one molecule of salicylic acid or its derivatives and one molecule of the azo dyestuff prepared from diazotised anilinedisulphonic acid and a 1 : 8-aminonaphtholsulphonic acid (the order of combination may be also reversed), or by combining diazotised anilinedisulphonic acid with the disazo-dyestuff obtained from a para-diamine, salicylic acid and a 1 : 8-aminonaphtholsulphonic acid. An example is given illustrating the combination of the intermediate product from tetrazotised tolidine and one molecule of salicylic acid with the dyestuff prepared from diazotised aniline-2 : 5-disulphonic acid and 1 : 8-amino-naphthol-4-sulphonic acid, the latter combination being effected in acid solution.—J. C. C.

Azo dyestuffs ; Process for the production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 415,986, May 14, 1910. Under Int. Conv., May 26, 1909.

THE dyestuffs obtained by combining diazotised anthranilic acid or its derivatives with acidylaminonaphthols or their derivatives, especially the sulphonic acids, dye wool in shades which are very fast to light after chroming, varying from bluish-red to violet. A table is given in the specification showing the shades produced by 21 dyestuffs prepared in this manner. (Compare Eng. Pat. 10,461 of 1909 and U.S. Pat. 964,786 of 1910 ; this J., 1910, 685 and 1002.)—T. F. B.

Azo dyestuffs ; Production of —— *dyeing cotton direct, and the intermediate dyestuffs from which they are obtained.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 416,021, May 17, 1910. Under Int. Conv., June 1, 1909.

DYESTUFFS of equal fastness to light to those described in Fr. Pat. 402,126 (this J., 1909, 1191) can be obtained by using, in the final position, an aminoacyl-2-amino-5-naphthol-7-sulphonic or 1 : 7- or 3 : 7-disulphonic acid, diazotising this and combining with one of the usual components. The same products are obtained by combining the diazotised aminoacylaminonaphtholsulphonic acid with a component and then acting on the resulting dyestuff with a diazotised aminoazo-compound. Example 1 :—The dyestuff prepared from diazotised aminoazobenzene-4-sulphonic acid and 4′-aminobenzoyl-2-amino-5-naphthol-7-sulphonic acid, the product being diazotised and combined with salicylic acid, dyes cotton scarlet. Example 2 :—Diazotised 3′-aminobenzoyl-2-amino-5-naphthol-1 : 7-disulphonic acid is combined with *m*-toluidine in acid solution : on the other hand *p*-chloroaniline-o-sulphonic acid is diazotised and combined with *m*-toluidine : this intermediate product is now diazotised and combined in alkaline solution with the product mentioned above. The resulting dyestuff dyes cotton a bluish-red shade which, on development with β-naphthol, is fast to washing. Example 3 :—4′-Aminobenzoyl-2-amino-5-naphthol-1 : 7-disulphonic acid is diazotised and combined with *p*-xylidine, and the product is diazotised and combined with benzoyl-2-amino-5-naphthol-1 : 7-disulphonic acid. With the dyestuff so obtained is combined, in alkaline solution, the diazotised product of interaction of diazotised *m*-xylidine-*o*-sulphonic acid and *p*-xylidine. The final product dyes cotton violet.—J. C. C.

Chrome dyestuffs of the triphenylmethane series ; Process for producing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 415,229, April 26, 1910. Under Int. Conv., May 4, 1909.

METHYLENE-DISALICYLIC acid or one of its derivatives, such as methylene-di-o-cresotinic acid, is condensed in presence of an oxidising agent (*e.g.*, nitrosylsulphuric acid or nitric acid) with derivatives of phenols or naphthols with which condensation is not possible in the *p*-position to the hydroxyl group : or the above products may first be condensed to form leuco-compounds, which are subsequently oxidised, or the carbinols are condensed with the phenols and the products oxidised. The dyestuffs thus produced dye chromed wool from a single bath in fast shades of red to violet and blue, which are generally modified by subsequent chroming. For example, the dyestuff obtained by condensing methylene-di-*o*-cresotinic acid with *p*-cresol dyes wool red shades, which become bluish-violet after chroming.—T. F. B.

Indigo ; Manufacture of chlorine derivatives of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 28,042, Dec. 1, 1909.

Tri- and tetra-chloroindigo are obtained by acting on Indigo, mono- or di-chloroindigo or their leuco-compounds with the requisite amount of chlorine in the presence of sulphuryl chlorides or phosphoryl chloride. Example: 262 parts of Indigo are mixed with 2000 parts of sulphuryl chloride, the mixture is cooled and 300 parts of chlorine are passed in. After three hours' stirring the sulphuryl chloride is distilled off in a vacuum, the residue is added to a mixture of 2500 parts of a 10 per cent. sodium carbonate solution and 1500 parts of a 15 per cent. hydrosulphite solution, and the whole is heated to about 50° C. 600 parts of a 35 per cent. solution of sodium hydroxide are now gradually added and the temperature is raised to about 70° C. The trichloroindigo is obtained from this vat by blowing in air and may be purified by boiling with dilute aqueous sodium hydroxide. Tetrachloroindigo is obtained in the same manner except that 400 parts of chlorine are employed.—J. C. C.

Azo dyestuffs from a new amino-oxy-naphthalenesulphonic acid ; Manufacture of ——. Kalle und Co., Akt.-Ges., Biebrich-on-the-Rhine, Germany. Eng. Pat. 9744, April 21, 1910. Under Int. Conv., May 12, 1909.

When 2-amino-5-naphthol-1-sulphonic acid is treated with a diazo-compound in acid solution, the sulphonic acid group is split off and colouring matters derived from 2 : 5-aminonaphthol are produced. If the combination is effected in alkaline solution, the sulphonic group is retained and the diazo-group enters position 6. The dyestuff obtained from diazotised aniline and this acid, the combination being effected in alkaline solution, is yellowish red. With tetrazodiphenyl, under the same conditions, the dyestuff produced dyes cotton in red-violet shades which, when diazotised on the fibre and combined with β-naphthol, become blue with a tinge of red. Diazotised aminoazobenzenemonosulphonic acid furnishes a red dyestuff which dyes both wool and cotton in red shades with a tinge of blue. The acyl derivatives, as for example, the urea derivative (prepared by the action of carbonyl chloride on the new acid), the acetyl and benzoyl derivatives can also be combined with diazo-compounds, the shades obtained being bluer than those produced with the free amino-acid. Lastly the new acid can itself be diazotised and combined with the usual components to give dyestuffs for both wool and cotton.—J. C. C.

Triphenylmethane dyestuffs ; Manufacture of violet to blue ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 12,130, May 17, 1910. Under Int. Conv., May 25, 1909.

Violet to blue dyestuffs which can be subsequently chromed on the fibre, are obtained by heating with an aromatic base a dyestuff prepared by condensing *p*-chlorobenzaldehyde with an ortho-hydroxyarylcarboxylic acid. Example: The dyestuff obtained by condensing *p*-chlorobenzaldehyde and *o*-cresotinic acid and then oxidising the leuco-compound thus produced, is heated with five times its weight of *p*-toluidine and an equal weight of *p*-toluidine hydrochloride on the water-bath. When no further colour change is observed, the mass is rendered alkaline with sodium carbonate and the excess of base expelled by steam. From the remaining solution the dyestuff is precipitated by a mineral acid, collected and washed. The dyeings, which can be subsequently chromed, are of a very pure violet tint and fast to alkalis and milling.—J. C. C.

Vat dyestuff of the anthraquinone series ; Manufacture of a salmon-coloured ——. Farbwerke vorm. Meister, Lucius, und Bruning, Hoechst on the-Maine, Germany. Eng. Pat. 15,523, June 28, 1910. Under Int. Conv., July 31, 1909.

A salmon-coloured vat dyestuff can be prepared by heating β-anthraquinonylurea chloride, in suspended nitrobenzene, with anhydrous sodium acetate. The vat obtained by the aid of an alkaline hydrosulphite is reddish brown and the salmon-coloured shades produced from it on cotton are fast to washing, light and chlorine. β-Anthraquinonyl isocyanate or ββ-dianthraquinonylurea may also be similarly condensed.—J. C. C.

Vat dyestuffs of the anthraquinone series ; Process for preparing brown ——. Farbwerke vorm. Meister, Lucius, und Bruning. Ger. Pat. 224,500, March 26, 1909.

Brown vat dyestuffs are obtained by heating α- or β-aminoanthraquinone with sulphur chloride ; the shade of the dyeings varies according to the amount of sulphur chloride used.—T. F. B.

Aminoarylacidylamino-anthraquinones ; Process for making ——. Farbwerke vorm. Meister, Lucius, und Bruning. Fr. Pat. 415,683, May 6, 1910. Under Int. Conv., May 10, 1909.

When nitro-arylacidylamino-anthraquinones of the formula, $C_{11}H_7O_2.NH.CO.R.NO_2$, are reduced, preferably by zinc dust or finely divided iron in presence of caustic soda, amino-arylacidylamino-anthraquinones are obtained ; these dye unmordanted cotton in shades varying from yellow to orange. Products dyeing faster shades may be obtained by treating the above compounds with acidylating agents, such as organic acid chlorides or anhydrides. Eighteen different dyestuffs, prepared by the above methods, are described in the specification. The nitro-arylacidylaminoanthraquinones may be prepared by condensing aminoanthraquinones with the chlorides of aromatic nitro-carboxylic acids.—T. F. B.

Azo dyestuff suitable for preparing lakes fast to light ; Manufacture of a bluish-red ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst-on-Maine, Germany. Eng. Pat. 22,289, Sept. 26, 1910. Under Int. Conv., Oct. 21, 1909.

By combining the diazo-compound of 5-nitro-2-amino-1-benzylsulphonic acid, $NO_2.C_6H_3(NH_2).CH_2.SO_3H$, with 2 : 3-hydroxynaphthoic acid, a bluish red azo dyestuff is obtained which gives insoluble calcium and barium salts. —J. C. C.

Monoazo dyestuffs insoluble in water ; Process for making yellow —. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 415,017, April 6, 1910. Under Int. Conv., Oct. 16, 1909.

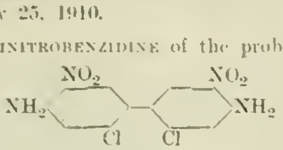
Yellow dyestuffs insoluble in water, and fast to light, which are of value for making pigments, are obtained by combining with aceto-acetanilide the diazo compounds of mono- or dinitro-amines of the benzene or naphthalene series, or their derivatives ; in some cases the combination is facilitated by the presence of an indifferent substance, such as sodium acetate.—T. F. B.

Disazo dyestuffs ; Manufacture of new substantive ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 17,088, July 18, 1910.

Tolylenediaminesulphonic acid
$(CH_3 : NH_2 : SO_3H : NH_2 = 1 : 2 : 4 : 6)$
is tetrazotised and combined first with one molecule of 2-amino-8-naphthol-6-sulphonic acid in acid solution and then with one molecule of *m*-phenylenediamine. The resulting dark brown dyestuff dyes cotton in red shades which when treated with diazotised *p*-nitroaniline on the fibre become vivid reddish brown. Other *m*-diamines and *m*-aminophenols which can be combined with two molecules of a diazo-compound can also be used in place of *m*-phenylenediamine in the above combination.—J. C. C.

Disazo dyestuff ; Manufacture of a new ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 17,614, July 25, 1910.

A dichlorodinitrobenzidine of the probable formula,



can be obtained by nitrating the acetyl compound of *mm'*-dichlorobenzidine and subsequently splitting off the acetyl groups with dilute sulphuric acid. The tetrazo-compound when combined with β-naphthol gives a red dyestuff which is insoluble in water but gives a bluish-red solution in sulphuric acid. The combination may also be effected in the presence of Turkey-red oil, soap, resinate of lime or of a substratum.—J. C. C.

Amino-hydroxyazo dyestuffs ; Process for preparing ——. Anilinfarben- und Extract-Fabr. vorm. J. R. Geigy. Ger. Pats. 224,024 and 224,025, March 30 and April 17, 1909.

The combination of the diazo compounds of aromatic amino-sulphonic or amino-carboxylic acids or their derivatives with *m*-amino-*p*-cresol, in acid or neutral solutions, is considerably accelerated by addition of thiosulphates, thiocyanates, or xanthogenates. Without the addition of these salts, the combination could not be effected in many cases. The *p*-amino-*m*-hydroxyazo dyestuffs thus obtained may serve as intermediate compounds for preparing *o*-hydroxydisazo dyestuffs. The dyestuffs produced from sulphanilic acid and 2.8-naphthylamine monosulphonic acid dye wool orange shades, changed to brown by chroming.—T. F. B.

Wool [azo] dyestuffs ; Process for preparing blue to blue-violet ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 224,499, March 18, 1909.

The diazo compounds of toluenesulpho-*p*-phenylenediamines or their substitution products are combined with 1-acidylamino-8-naphtholdisulphonic acids, and the products treated with sulphuric acid ; in this way the toluenesulpho group is eliminated, the acidyl group remaining intact. The products dye wool level shades of blue and blue-violet, fast to light and alkalis.—T. F. B.

Indophenolic oxidation products and their leuco-compounds from carbazole, or N-alkyl- or N-aryl-carbazoles ; Process for preparing ——. L. Cassella und Co. Ger. Pat. 227,323, April 11, 1909.

The indophenolic products obtained by condensing *p*-nitrosophenol with carbazole or its derivatives (see Eng. Pats. 2918 and 9689 of 1909 ; this J., 1909, 517 and 1910, 481), may also be prepared by condensing equimolecular proportions of *p*-aminophenol or its homologues or substitution products with carbazole or with N-alkyl- or N-aryl-carbazoles in presence of concentrated sulphuric acid and a suitable oxidising agent ; the products may be reduced to their leuco-derivatives in the usual manner. No indophenol-formation takes place when the above compounds are brought together in aqueous solution, or in presence of organic solvents.—T. F. B.

Azo dyestuff ; Manufacture of a new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 370, Jan. 6, 1910. Addition to Eng. Pat. 29,459, Dec. 16, 1909.

See Fr. Pat. 411,192 of 1909 ; this J., 1910, 938.—T. F. B.

[Triphenylmethane] dyestuffs dyeing from an acid bath ; Manufacture of mordant ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2394, Jan. 31, 1910.

See Fr. Pat. 413,383 of 1910 ; this J., 1910, 1099.—T. F. B.

Leuco derivative of the gallocyanine series [leuco-diethylgallocyanine] ; Manufacture of a ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 3601, Feb. 14, 1910.

See U.S. Pat. 962,712 of 1910 ; this J., 1910, 1099.—T.F.B.

Dyestuffs of the anthracene series ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4537, Feb. 23, 1910.

See U.S. Pat. 961,388 of 1910 ; this J., 1910, 1099.—T.F.B.

Dye ; Yellow ——. P. Volkmann, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 972,951, Oct. 18, 1910.

See Fr. Pat. 411,192 of 1909 ; this J., 1910, 938.—T.F.B.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Melanin ; Action of alkali on ——. R. A. Gortner. J. Biol. Chem., 1910, 8, 341—363.

The effect of varying strengths of alkali on the composition of the melanin of black wool has been investigated, the results obtained showing that alkali, except in very small concentrations, readily destroys the greater portion of the melanin molecule. The wool was boiled with successive quantities of 0·2 per cent. sodium hydroxide solution, the extracts were filtered, and the filtrates treated with concentrated hydrochloric acid, the precipitates thus formed being collected, washed with 1 per cent. hydrochloric acid, and then dissolved by boiling with N/20 hydrochloric acid. The black solutions obtained were mixed together, the melanin was precipitated by the addition of a quantity of hydrochloric acid sufficient to raise the concentration to 1 per cent., the supernatant liquid was removed, and the precipitate dissolved in 50 per cent. acetic acid. This solution was submitted to dialysis until all acid and chlorides had been removed, the melanin, remaining as a brown mass, being then dried, extracted with carbon bisulphide, alcohol, and ether, and again dried. Its weight amounted to 13·0 per cent. of the air-dried wool. Thus prepared, melanin consists of a jet black, granular mass which may be ground to a brown powder. When dried by heat it becomes insoluble in all solvents except alkali solutions, but when dried at the ordinary temperature it is soluble in dilute hydrochloric acid, formic acid, acetic acid, and in disodium phosphate solution. This melanin was free from ash and contained hydrogen, 7·28, carbon, 52·60, nitrogen, 13·52, sulphur, 1·33, and oxygen (by difference), 25·29 per cent. When the concentration of the sodium hydroxide solution used for extracting the wool exceeds 0·2 per cent., the composition of the melanin obtained is considerably altered. The nitrogen content falls to 5·12 per cent. when 30 per cent. sodium hydroxide solution is employed, whilst a minimum hydrogen-content, namely, 3·84 per cent., is found when 50 per cent. sodium hydroxide solution is used. The sulphur-content remains practically constant, but the quantities of carbon and oxygen increase as the other constituents diminish.—W. P. S.

Papyrus pulp ; Microscopy of ——. L. Vidal. Papierfabr., 1910, 8, 1042—1045.

The author has made a microscopic study of the elements of the paper pulp obtained from the papyrus rush (*Cyperus papyrus L.*). The fibres of papyrus pulp are very slender, closely resembling those of esparto, whilst the non-fibrous elements amount from 10 to 20 per cent. of the whole pulp ; some of the latter, however, are sufficiently elongated to possess a certain amount of felting value. The length of the fibres varies from 0·5 to 3, or in exceptional cases, to 4 mm., the average length being 1·5 mm. ; the breadth varies from 8 to 25 μ ; average 11–12 μ. The fibres often show a few kinks but no knots; they are cylindrical in section and pointed, sometimes forked at the ends. The lumen is generally narrow, on the average about one-third of the total breadth of the fibre, and the walls are regular in thickness and studded with fine pores. J. F. B.

Cellulose; Contribution to the knowledge of ——. W. O. de Coninck. Bull. Acad. roy. Belg., Classe des sci., 1910, 587—589. Chem. Zentr., 1910, 2, 1159.

Filter paper which has been subjected to the action of concentrated hydrochloric acid for 62 hours does not yield a product capable of reducing Fehling's solution. A product possessing cupric-reducing power is, however, formed by the action on cotton of concentrated hydrochloric acid for 87 hours, or of fuming hydrobromic acid for 24 hours.—A. S.

Artificial silks; The differentiation of ——. P. Maschner. Färber-Zeit., 1910, 21, 352—353.

The author finds that even after considerable practice microscopical examination is not a reliable means of distinguishing the different kinds of artificial silks. The most important chemical tests are the diphenylamine reaction recommended by Suvern for the detection of nitrocellulose silks, Schwalbe's reduction test with Fehling's solution (this J., 1907, 518) for the same purpose and his test with a solution of iodine in zinc chloride solution (this J., 1907, 1044) to distinguish between cuprammonium cellulose and viscose silks. The author finds that of these three reactions only the first is at all reliable, for the other two give different results with artificial silks of the same class. For the same reason the behaviour of artificial silks towards dyestuff solutions is of no use as a means of distinction. A satisfactory means of differentiation, however, is afforded by the action of concentrated sulphuric acid on the fibre. To carry out the test, equal quantities (0·2 grm.) of the silk to be examined and of standard artificial silks of known make (all being air-dried and of the same count if possible) are put in small dry Erlenmeyer flasks which stand on white paper and equal quantities (about 10 c.c.) of chemically pure sulphuric acid are simultaneously poured over them. The flasks are shaken to thoroughly moisten the fibres and the immediate effect of the acid is observed and the flasks are then kept under observation for about one and a half hours. A nitrocellulose silk remains at first quite colourless and only after 40—60 minutes does the liquor take on a weak yellowish tone. Cuprammonium cellulose silks at once take on a yellow or yellowish brown tone and the liquor becomes yellowish brown after 40—60 minutes. Viscose silks are at once turned reddish brown by the acid and the liquor after 40—60 minutes is a rusty brown colour. Tables are given showing the colour reactions produced by the action of sulphuric acid on various artificial silks which are now being produced in bulk.—P. F. C.

Nitrous esters of cellulose. P. Nicolardot and G. Chertier. Comptes rend., 1910, 151, 719—722.

By treating viscose-silk with nitrous gases, in the presence of nitric acid (about 1·5), a mixture of nitrous and nitric esters of cellulose is produced, from which the former may be separated by means of acetone, in which they are insoluble. The nitrites of cellulose, thus obtained, are generally grey in colour, gelatinous when moist and very brittle when dried; they are insoluble in water, alcohol, ether, acetone, chloroform, and ethyl acetate. They lose nitrogen to an appreciable extent at the ordinary temperature, and more quickly on heating, [illegible] yellow, friable, and extremely acid products. Water effects hydrolysis, slowly at the ordinary temperature and completely after twelve hours boiling, and the same occurs in the cold with sulphuric, nitric, and hydrochloric acids, though acetic acid attacks these esters only partially at about 50° C.; methyl, ethyl, etc., alcohols are oxidised by them to aldehydes and even acids. Nitrous esters are liable to occur, under certain conditions in nitrocelluloses prepared from cotton, and cause rapid deterioration; when they are present, lower results are obtained in the determination of nitrogen with the nitrometer than by Schloesing's method, because the nitrites are at once decomposed by sulphuric acid.—F. Sodn.

Patents.

Threads with metallic lustre. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated April 13, 1910, to Fr. Pat. 408,370, Oct. 27, 1909 (this J., 1910, 624).

In coating metallic wires or ribbons with cellulose acetate, either plain or mixed with metallic powders or pigments, a better adhesion of the coating is obtained by first wrapping the wire or ribbon with tissue paper, cotton, or similar material.—J. F. B.

Cellulose esters; Process for producing solutions of ——. Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 16,932, July 15, 1910. Under Int. Conv., July 22, 1909.

Although acetylene tetrachloride is a well-known solvent for cellulose esters, trichlorethylene and dichlorethylene do not dissolve these bodies. According to this specification, however, it is found that dichlorethylene in admixture with alcohol is capable of dissolving cellulose esters. Those esters which are readily soluble in acetone are dissolved by the mixture at the ordinary temperature, whilst those which are soluble in chloroform and only sparingly soluble in acetone are dissolved by the mixture on heating. Suitable proportions are 650—730 parts of dichlorethylene and 150 parts of alcohol.—J. F. B.

Cellulose from vegetable fibres; Process for obtaining ——. C. G. Schwalbe, Darmstadt, Germany. Eng. Pat. 19,142, Aug. 15, 1910. Under Int. Conv., Aug. 14, 1909.

The vegetable fibres are boiled with a solution of a neutral (normal) sulphite to which has been added an acid in aqueous solution or as a gas or as an acid salt. The acid may if desired be introduced gradually into the solution during the process but, however added, the total quantity of acid should not be more than that corresponding to half the equivalent of the quantity of sulphite used. Example:—Wood is impregnated with a 10 per cent. solution of sodium sulphite and, after removing the liquor, is steamed in an atmosphere of carbon dioxide at a pressure of 6 atmospheres.—P. F. C.

Solvent for pyroxylin, etc., and process for making the same. H. V. Walker, Brooklyn, Assignor to The Maas and Waldstein Co., Newark, N.J. U.S. Pat. 972,953, Oct. 18, 1910.

"Gas naphtha" is treated with a solution of an alkali hypochlorite to which sodium bicarbonate has been added, and the oily layer is separated from the aqueous solution and distilled with a caustic alkali (*e.g.*, slaked lime). The product consists of an oxide of a primary olefine having five to eight carbon atoms; when diluted with benzene, they have the property of dissolving pyroxylin. —T. F. B.

Cellulose [acetate]; Non-inflammable products having a basis of ——, and process for their manufacture. W. G. Lindsay. Fr. Pat 415,517, May 4, 1910. Under Int. Conv., May 5, 1909.

Compositions, resembling celluloid, etc., are prepared by mixing acetylcellulose, triphenyl phosphate and a solvent such as acetone so as to form a solution or plastic mass. Suitable proportions are 10–20 parts of triphenyl phosphate to 100 parts of acetylcellulose.—J. F. B.

Acetylcellulose; Products having a basis of ——. W. G. Lindsay. Fr. Pat. 415,518, May 4, 1910. Under Int. Conv., May 5, 1909.

It is claimed that urea, when added to a mixture or solution containing acetylcellulose, imparts the qualities of strength and permanence to the products manufactured therefrom. A suitable proportion consists of 2 parts of urea to 100 parts of acetylcellulose. Mixtures, resembling celluloid, compounded with acetylcellulose and triphenyl phosphate or its equivalent are claimed in conjunction with urea. —J. F. B.

Adhesive solution [from nitrocellulose], unaltered by dampness, for sticking leather, textiles, felt and any fibrous or porous material. F. Rampichini. Fr. Pat. 415,945, May 13, 1910. Under Int. Conv., May 14, 1909.

Nitrocellulose, alone or with the addition of camphor or soluble colouring materials, or insoluble powders, is agitated in a solvent consisting of acetone alone or with the addition of methyl alcohol, ethyl acetate, benzene, nitrobenzene, glacial acetic acid, etc. A viscous liquid is the result, the proportions of the components being varied according to the porosity of the materials to be treated. After the application of the adhesive to the surfaces to be joined, pressure is applied and perfect adhesion is obtained after several hours' drying.—D. J. L.

Cellulose solutions suitable for production of artificial fibres, artificial horsehair, or films; Process for preparing ——. K. Hofmann. Ger. Pat. 227,198, Aug. 27, 1909.

When cellulose is treated with concentrated acetic acid, or with concentrated mineral acids, or with mixtures of acetic and sulphuric acids, solutions are obtained, the fibres produced from which are generally brittle or otherwise unsuitable for industrial purposes. Products having considerable brilliancy and toughness may be obtained by dissolving cellulose, oxycellulose, or cellulose hydrate in mixtures of concentrated acetic and phosphoric acids, and precipitating by means of water, solutions of salts, alcohol, etc. The phosphoric acid is preferably concentrated by heating to 220° C. so that a portion of it is converted into pyrophosphoric acid; it may also be further dehydrated by addition of acetic anhydride or sodium acetate. For example, 20—25 grms. of cellulose are shaken with a mixture of 30 c.c. of concentrated phosphoric acid and 300 c.c. of glacial acetic acid, at the ordinary temperature, until a viscous mass is obtained, which can be pressed through capillary orifices or slits into aqueous or alcoholic coagulating solutions, and the products washed and dried under tension.—T. F. B.

Increasing the resistance of briquettes agglomerated by waste sulphite-cellulose lyes to atmospheric influences. Fr. Pat. 415,566. *See* IIa.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Norgine [new sizing agent]. E. Schmidt. Chem.-Zeit., 1910, 34, 1149—1150.

A new sizing agent has lately been put upon the market under the name of *Norgine*. It consists of the soluble sodium ammonium salt of laminaric acid, which is obtained on a manufacturing scale from the sea-weeds, *Laminaria digitata* and *Saccharinus digitatus*, derived from the N. Atlantic Ocean and the North Sea. Norgine is a neutral, dry, granular substance, which swells up in water forming a brownish-yellow colloidal solution, which is very valuable as a sizing agent, since it possesses a high degree of viscosity and adhesive properties equal to or exceeding those of glue, gum tragacanth, etc. The product is put upon the market in four grades—Norgine (dark, Mark D); Norgine (ordinary); Norgine, S; and Norgine, H, extra. The darkest product has the greatest viscosity, whilst the lightest coloured preparation "Norgine H extra" comes next. Analyses gave the following results:

	Ash.	Ammonia.	Laminaric acid.
	Per cent.	Per cent.	Per cent.
Norgine, dark, D	14·765	1·25	59·38
Norgine, ordinary	16·625	1·44	61·89
Norgine, S	12·644	1·19	44·78
Norgine, H, Extra	9·345	1·02	42·52

The laminaric acid was determined by precipitation with dilute sulphuric acid at 75° C., and drying the washed gelatinous precipitate first at 80° C. and then at 100° C. Brands, "S" and "H extra," consisted of the nearly pure sodium ammonium salt of the acid, but in the other two brands cellulose and calcium salts were present. The preparations gave gelatinous precipitates with barium chloride, lead acetate, silver nitrate, and stannous chloride all being insoluble in acids. A precipitate was given by potassium ferrocyanide and acetic acid, whilst cobalt nitrate gave a very characteristic gelatinous precipitate, which coagulated on heating.—C. A. M.

Patents.

Wool washing and squeezing machines. W. McNaught, Rochdale. Eng. Pat. 27,597, Nov. 26, 1909.

Usually the wool leaves the washing trough on a shoot which delivers it to the squeezing rollers. This shoot is provided with side guides which are perforated to allow excess water in the wool to drain away. The wool, however, accumulates at the sides and chokes up the perforations. To prevent this the side guides of the shoot are made to diverge from the trough-end, making the shoot widen as it approaches the squeezing rollers.—P. F. C.

Bleaching combed wool on bobbins; Apparatus for ——. F. Masurel. Fr. Pat. 415,509, Apr. 30, 1910.

In order to prevent sulphide stains on bleached wools, the bleaching vessel and the pipes for conducting the bleach liquor to it are made of wood, earthenware, glass or some other suitable non-metallic material.—P. F. C.

Weighting silk; Process for ——. Landau et Cie. and I. Kreidl. Fr. Pat. 415,657, May 6, 1910. Under Int. Conv., June 15, 1909.

The material is weighted with salts of the rare earth metals, zirconium salts being specially suitable for whites or light shades. When the required charge has been obtained by repeated immersions in the solution of the salt of the rare earth (which is preferably basic), it is fixed upon the fibre as the hydroxide or phosphate by the usual methods.—P. F. C.

Mercerising, dyeing, bleaching or like treatment of cotton or other vegetable fibre in the roving, sliver or loose state or woven into fabrics. The British Cotton and Wool Dyers' Assoc., Ltd., Manchester, and J. H. Robson, Huddersfield. Eng. Pat. 26,317, Nov. 13, 1909.

Between the entering and delivering ends of an ordinary warp mercerising machine, there is interposed an open tray, having journalled in two opposite sides the ends of two sets of rollers of small diameter arranged as close together as possible. The upper rollers are driven by friction from the bottom set. The fibre or roving is led on to an endless travelling belt between which and another travelling belt it is engaged and carried forward between the two sets of small rollers. During its traverse it is impregnated with a mercerising liquor which is sprayed on to it from above. After leaving the last nip of the small rollers the cotton is next delivered into washing tanks. During the impregnation with the mercerising liquor the cotton is unable to shrink on account of the grip to which it is continually subjected by the small rollers. If it is desired to stretch the fibres during mercerisation, this can be effected by having the diameter of the small rollers at the delivery end rather greater than the diameter of those at the entry end of the machine.—P. F. C.

Hanks of yarn on dyeing sticks; Apparatus for changing the positions of ——. J. Schlumpf, jun., Zofingen, Switzerland. Eng. Pat. 23,410, Oct. 13, 1909.

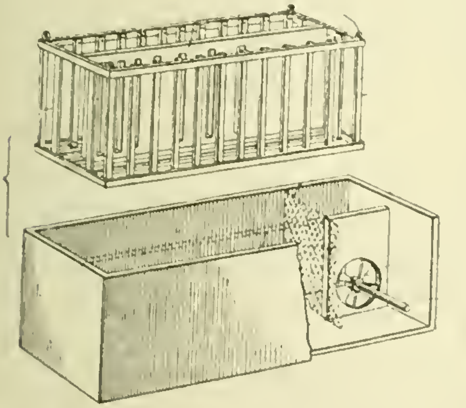
The dyeing sticks (which normally rest with their ends on opposite walls of the vat) are lifted from time to time by devices carried by revolving wheels and are moved through the air in a curved path. At the same time the hanks resting on the sticks are seized by holding devices, which after following the movement of the sticks for a time eventually draw away from them. When a distance approximately equal to the length of a hank separates the holding device from the yarn sticks, the hanks are released and fall over the sticks but in positions different from the previous ones. The sticks are finally automatically placed again with their ends resting on the vat walls. —P. F. C.

Dyeing hairs, furs and the like; Process for ——. Act.-Ges. für Anilin-Fabr., Berlin. Eng. Pat. 18,921, Aug. 11, 1910. Under Int. Conv., June 21, 1910. Addition to Eng. Pat. 5134 of 1910, dated Oct. 23, 1909 (this J., 1910, 1103).

According to the original patent hairs and furs can be dyed with a mixture of a para-diamine with *m*-diaminoanisol or *m*-diaminophenetol. It is now found that dyeings of violet or blue shades are obtained from mixtures of a para-diamine with *m*-aminodimethyl-*p*-anisidine ($OCH_3 : NH_2 : N(CH_3)_2 = 1 : 2 : 4$) or *m*-aminodimethyl-*o*-anisidine ($OCH_3 : N(CH_3)_2 : NH_2 = 1 : 2 : 4$).—P. F. C.

Dyeing-machine. R. H. Comey, Assignor to R. H. Comey Co., Camden, N. J. U. S. Pat. 972,822, Oct. 18, 1910.

The dye-vat, shown in the accompanying figure, has a vertical partition of wire netting, etc., parallel to and near one end of the vat, a second vertical partition perpendicular to the first, in which is fixed a device for creating a circulation of the liquor from one side of the partition to the other, and a movable cage for containing the material to be dyed; this cage is divided down the centre by a vertical partition in which are vertical openings extending from near the top to the bottom, through which the liquor can flow, but not sufficiently large to permit the material to pass through.—T. F. B.



Dyeing pieces; An apparatus for —— *keeping them immersed during the whole process and provided with two winding-on rollers and two driving rollers.* Textil-Maschinenfabr. B. Cohnen. Fr. Pat. 415,522, May 4, 1910. Under Int. Conv., May 6, 1909.

In order to ensure that the material has a constant velocity during its passage from one winding-on roller to the other, each of these rollers is made to rotate by friction with a driving roller. Each driving roller moreover is provided with longitudinal grooves which carry some of the dye-liquor forward and press it into the roll of cloth, thus ensuring that the material is well dyed through. If desired the cloth, in passing from one roller to the other can be led between the nips of two pairs of rollers, each pair comprising a grooved driving roller and a wrapped roller rotating by friction.—P. F. C.

Naphthanthraquinone and its derivatives; Process for fixing —— *on the fibre.* Badische Anilin und Soda Fabrik. Ger. Pat. 223,109, May 18, 1909.

Animal or vegetable fibres are treated with the reduction products of naphthanthraquinone or its derivatives in presence of alkalis or alkaline substances, and then treated with oxidising agents.—T. F. B.

Dyeing animal and vegetable fibres with sulphide dyestuffs; Process for ——. Farbwerke vorm. Meister, Lucius, und Bruning. Ger. Pat. 224,017, March 15, 1907. Addition to Ger. Pat. 199,167, Jan. 17, 1907.

When unions are dyed with sulphide dyestuffs by the process described in the principal patent (see Eng. Pat. 8631 of 1907; this J., 1908, 559) and in Ger. Pat. 221,887 (this J., 1910, 671), at a low temperature, the vegetable fibres will be dyed after a short time, whilst the wool fibres are practically unaltered.—T. F. B.

Textile fabrics; Apparatus for printing ——. Bradford Dyers' Association, D. H. Thornton and A. T. Metcalf, Bradford. Eng. Pat. 23,637, Oct. 15, 1909.

The fabric to be printed is led around a cylinder of large diameter by which it is pressed on to an endless chain of inked printing blocks, supported by a table and moving at the same surface speed as the cylinder. The chain wheels carrying the blocks at the two ends of the machine are free to move along, but rotate with the shafts on which they are mounted. The table is supported on a pair of transverse bars along which it is free to move; the table and, with it, the chain and blocks can be moved by a screw transversely to the machine to any position under the cylinder, and the bars carrying the table can be raised or lowered so as to adjust the pressure of printing. A special arrangement of inking-rollers is described.—J. F. B.

Printed felts; Manufacture of ——. R. J. C. Mitchell, Manchester. Eng. Pat. 28,828, Dec. 9, 1909.

The felt is taken from the milling machine before the maximum milling effect has been produced, is then washed and afterwards printed on both sides with blocks or rolls which are more deeply engraved than usual so as to carry more colour. The design thus produced penetrates the material from face to face. The material is next steamed, washed, milled to completion, washed again and finally dyed. The sequence of the various processes may be varied.—P. F. C.

Reserves under sulphide dyestuffs; Process for producing ——. L. Cassella und Co. Ger. Pat. 223,682, Aug. 7, 1908.

When metallic salts are used as resists for sulphide dyestuffs, they are frequently so loosely associated with the fibre that they dissolve in the dyebath and precipitate the dyestuffs. It is proposed to use animal colloids as reserves, preferably in presence of substances which prevent their fixation on the fibre; they are printed on the fibre in the usual manner, and can easily be removed after dyeing, together with the adhering dyestuff.—T. F. B.

Textile and other materials; Treatment by liquid processes of ——. G. Malard, Tourcoing, France. Eng. Pat. 23,437, Oct. 13, 1909. Addition to Eng. Pat. 759, Jan. 13, 1908.

See Addition of Sept. 7, 1909, to Fr. Pat. 381,097 of 1907; this J., 1910, 558.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Hydrocyanic acid; Vortmann's nitroprusside reaction for ——. H. J. Van Giffen. Pharm. Weekblad, 1910, **41**, 1043—1044. Chem. Zentr., 1910, 2, 1327.

In presence of alcohol, the following modification of the test is recommended:—Some sodium nitrite is dissolved in the solution to be tested, 2—3 drops of ferric chloride solution are added, and after shaking, the solution is acidified carefully with dilute sulphuric acid, heated to boiling, and the excess of iron precipitated with ammonia. After filtering, the solution is evaporated to dryness, the residue dissolved in water, the solution cooled with ice, and a drop of ammonium sulphide solution added, when the presence of hydrocyanic acid is indicated by the production of a violet coloration, which passes through blue and green to yellow.—A. S.

Chemical imports into India. Review of the Trade of India for year ending March 31, 1910. [T.R.]

The following are some additional figures relative to chemical and allied imports into India for the years ending March 31, 1909 and 1910 respectively (see this J., 1910, 1203):—

	1908–9	1909–10
	£	£
Sulphur	22,870	25,000
Disinfectants	20,200	21,200
Bleaching materials	30,400	25,700
Potassium cyanide	21,100	20,400
Calcium carbide	10,900	7,400
Aniline and alizarin dyes	536,500	581,300
Building materials	410,538	381,314
Earthenware and porcelain	282,523	290,493
Glass and glassware	779,553	856,861
Matches	496,671	543,684
Paints, colours, etc.	397,693	381,984
Paper and pasteboard	617,560	675,350
Soap	271,731	309,155

Chloric acid; The reduction of ——. R. R. Enfield. Proc. Chem. Soc., 1910, 26, 231.

A dilute solution of chloric acid free from the presence of other acids is not reduced by sodium amalgam. A dilute solution of chloric acid may be kept in contact with methyl alcohol for several days without any reduction taking place. The velocity of reduction of chloric acid is increased by the addition of other acids. The velocity of reduction of chloric acid by methyl alcohol in presence of certain concentrations of other acids was measured. Experiments were made for nitric, sulphuric, benzenesulphonic, and oxalic acids. The stimulating effects of these acids were found to be in the order of their relative strengths. The reaction between chloric acid and ferrous sulphate was examined in the same way, and the acceleration of the reaction by various acids was determined. Acceleration constants for the various acids were calculated, and shown to be in moderate agreement with the affinity constants of the acids. These results appear to favour the view that the reduction is that of the ClO_3 ion, accelerated by the catalytic influence of hydrogen ions.

Bleaching powder; Researches on ——. R. L. Taylor. Chem. Soc. Proc., 1910, 26, 242.

The author has investigated the action of carbon dioxide and of air on bleaching powder. When carbon dioxide acts on bleaching powder, either solid or in solution, nothing but chlorine is evolved. The conclusion is drawn that such action is exactly like that of any other acid, hydrochloric and hypochlorous acids being produced and decomposing each other with the liberation of chlorine. Hence the action of hydrochloric acid on carbonates is a reversible one. Air free from carbon dioxide sweeps out very slowly a little hypochlorous acid from a solution of bleaching powder. This is due to the hydrolysis of the hypochlorite in the solution. Ordinary moist air liberates from solid bleaching powder at first a mixture of hypochlorous acid and chlorine, and finally nothing but chlorine. In aqueous solution the action is almost the same. It was shown that the action of bromine on alkalis is a reversible one, and the conclusion is drawn that the action of chlorine is the same. The carbon dioxide in air unites with the free lime, and then the calcium chloride present reverses the action, liberating chlorine. Air free from carbon dioxide expels a considerable amount of chlorine from a solution of bleaching powder, from which some of the free lime has been removed. Such a solution bleaches more rapidly than an ordinary solution, and calcium chloride or common salt added to it helps to reverse the action, liberating more chlorine, and further stimulating the bleaching action. In the ordinary bleaching process, chlorine is probably the active bleaching agent, hypochlorous acid only playing a minor part.

G. Senter, referring to the author's view that carbon dioxide liberates both hydrochloric and hypochlorous acids from bleaching powder, said that it did not seem justifiable to adduce as evidence in favour of this suggestion the fact that carbon dioxide turns methyl-orange red in presence of sodium chloride. It could be shown (compare Bohdan von Szyszkowski, Z. physikal. Chem., 1910, 73, 273) that, so far as purely chemical interchange between the components is concerned, the hydrogen-ion concentration in a solution containing carbon dioxide and sodium chloride is less than for the carbon dioxide alone in water. The observed effect on methyl-orange must therefore be ascribed to some other factor, doubtless to the so-called "neutral salt action" illustrated, for example, by the observation of Arrhenius that the catalytic action of acetic acid is increased by the addition of salts, such as sodium chloride. In the present case the neutral salt probably acts by increasing the dissociating power of the medium. The effect on methyl-orange is therefore to be ascribed to increased ionisation of the carbonic acid in the salt solution, and not to the liberation of hydrochloric acid from the sodium chloride. A. G. Green stated that he could confirm the author's view of the reversibility of the reaction between halogens and alkalis, at least in the case of bromine and iodine. Thus an alkaline solution of iodine gave the starch reaction even in presence of a considerable excess of alkali hydroxide. The author, in reply, stated that whilst he had shown that the carbon dioxide in the air caused the liberation of chlorine in the way described, yet the action of pure carbonic acid on bleaching powder was so very much more rapid than that of air that it suggested a complete decomposition (such as is produced by other acids) rather than the reversed action which was induced by the removal of the free lime.

Potash consumers and the potash law. L. Silberberg. Chem. Ind., 1910, 33, 666—671.

The author discusses the position of German potash consumers in relation to the new potash law, which came into force on May 28th last. After 1910, the production of potash salts, and the amounts to be supplied to the home and foreign markets respectively, are to be fixed by a special department consisting of three members nominated by the Imperial Chancellor and four members selected by the potash producers. For the period May 1 to Dec. 31, 1910, the amounts of the different potash salts to be produced, and their allocation, have been fixed provisionally by the Bundesrath, as follows, but these amounts may be subsequently increased, if found necessary.

	Quantities in cwts. of pure potash (K_2O).	
	Germany.	Foreign.
Carnallite with at least 9 and less than 12 per cent. of K_2O	60,000	2,000
Crude salts with 12–15 per cent. of K_2O	2,489,000	1,566,000
Manurial salts with 20–22 per cent. of K_2O	11,000	218,000
Manurial salts with 30–32 per cent. of K_2O	6,000	178,000
Manurial salts with 40–42 per cent. of K_2O, including potash fertilisers with 38 per cent. of K_2O	739,000	290,000
Potassium chloride	694,000	1,097,000
Potassium sulphate with more than 42 per cent. of K_2O	21,000	457,000
Potassium-magnesium sulphate	2,000	91,000
	4,022,000	3,899,000
	7,921,000	

—A. S.

Alkali—phosphoric acid—water; The ternary system: ——. J. D'Ans and O. Schreiner. Z. physik. Chem., 1910, 75, 95—107.

The paper contains the three diagrams showing the relation between the molar concentrations of PO_4 and of Na(NH_4 or K) at 25° C., which are present in solutions in equilibrium with the different solid phases capable of existing at that temperature. In each case only the three simple orthophosphates are obtained as solid phases within the limits of the authors' experiments, which did not extend to extremely acid solutions. The sodium salts are all hydrated ($Na_3PO_4,12H_2O$; $Na_2HPO_4,12H_2O$; $Na_2HPO_4,7H_2O$; and $NaH_2PO_4,2H_2O$), the potassium salts are all anhydrous, while the triammonium salt has three molecules of water of crystallisation. All the salts except the dipotassium phosphate may be crystallised from water. The dipotassium and diammonium salts have both a very narrow region of stability, but the disodium phosphate which forms two hydrates has a relatively large range. The tripotassium salt differs from the other two tri-salts in the absence of a marked minimum of solubility. The solubility curves of the monoalkali phosphates are all characterised by a sharp minimum at which the ratio $\frac{PO_4}{alkali}$ is 1 : 1, *i.e.*, the solubilities of the monophosphates are greatly increased by the addition of either alkali or phosphoric acid. The paper contains also a revision of the solubility data for disodium phosphate.—W. H. P.

Phosphates; Detection of —— with the molybdate reagent. R. E. Liesegang. Chem.-Zeit., 1910, **34**, 1158.

Attempts have often been made to use the nitric acid solution of ammonium molybdate for the recognition of inorganic phosphates in animal and plant tissue. In this connection the author made the following experiment: A gelatin emulsion of tricalcium phosphate was poured into a test-tube, and after it had solidified, several c.c. of the molybdate reagent were poured on top. At the surface of the gelatin a yellow skin of ammonium phosphomolybdate was formed, which after an hour was so firm that the underlying gelatin could be melted without destroying it. No trace of the precipitate could be seen in the gelatin. Though penetrable by phosphoric acid and nitric acid, the gelatin was impermeable to the molybdate. The nitric acid, indeed, in one case, had penetrated 20 mm. deep into the gelatin within an hour. The molybdate reagent is therefore useless for the recognition of phosphates locally. The investigations of Wöhler and Engels (this J., 1910, 1136) indicate, in fact, that the molybdic acid in the reagent is present in colloidal form.—T. St.

Anhydrous chlorides; General method for the preparation of —— and its application in chemical analysis. F. Bourion. Ann. Chim. Phys., 1910, [8], **20**, 547—573. Chem. Zentr., 1910, **2**, 1360—1361.

The methods described depend upon the action of sulphur chloride (S_2Cl_2) or a mixture of sulphur chloride and chlorine on the heated oxide of the metal (see this J., 1904, 370, 441; 1905, 890; 1908, 646; 1909, 41, 203). For thorium, chromium and uranium chlorides and tungsten oxychlorides the use of sulphur chloride alone is recommended, whilst for silicon, zirconium, and beryllium chlorides, the mixture of sulphur chloride and chlorine gives better results.

Separation of cerium, thorium, and beryllium. The mixed oxides are heated to 700°—780° C. in a current of chlorine and sulphur chloride, in a quartz boat in a tube of fused silica; cerium chloride remains in the boat, whilst thorium and beryllium chlorides are carried over. The condensed solution of the two chlorides is allowed to drop into hot sodium hydroxide solution, with stirring; the beryllium remains dissolved, whilst the thorium is precipitated. After cooling, the mixture is diluted with a small quantity of water, filtered through a double filter, and the thoria washed three times by decantation with sodium hydroxide solution. The thoria and beryllia are subsequently precipitated from solution by ammonia in order to free them from sodium hydroxide.—A. S.

Sulphur dioxide; Electrical purification and electrical conductivity of liquid ——. J. Carvallo. Comptes rend., 1910, **151**, 717—719.

When a constant potential difference of 100 volts or more, is established between platinum electrodes immersed in "pure" liquid sulphur dioxide, a current, which diminishes with the time and tends towards a limiting value, passes through the liquid. The variations in the current correspond to a change of specific resistance, and prolonged action of the current is accompanied by a considerable further purification of the substance. The limiting values for the conductivity do not follow Ohm's law, but rather recall the laws applying to the conductivity of gases. For potentials up to 100 volts, the limiting value of the specific resistance is 7 × 10⁹ ohms; at 2250 volts and 4000 volts, it is 4·9 × 10¹⁰ and 5·0 × 10¹⁰ ohms respectively. F. Sodn.

Sulphur; Slow combustion of ——. M. Bodenstein and W. Karo. Z. physik. Chem., 1910, **75**, 30—47.

The authors have made measurements of the velocity of the reaction between molten sulphur and gaseous oxygen in the neighbourhood of 250° C. The velocity constant is that of a monomolecular reaction, being proportional to the exposed surface of the sulphur and independent of the concentration of sulphur dioxide. The temperature-coefficient of the reaction is high, the velocity increasing in the proportion of 1 : 1·87 for a rise of 10° C. The conclusion is that the reaction takes place between the sulphur and the oxygen in its surface layer of adsorbed gas, and that such reactions can be treated in the same way as those in a homogeneous medium. The results differ completely from those of Ewan (Z. physik. Chem., 1895, **16**, 315) who attempted to measure the velocity by absorbing the sulphur dioxide with soda-lime. It is probable that the primary process in Ewan's experiments was the volatilisation of the sulphur followed by its absorption in the soda lime and subsequent oxidation—an entirely different, and apparently more rapid process.—W. H. P.

"Insoluble" sulphur; Solubility of —— (in carbon bisulphide and carbon tetrachloride). A. Wigand. Z. physik. Chem., 1910, **75**, 235—244.

Amorphous sulphur, on treatment with carbon bisulphide or carbon tetrachloride may be dissolved to the extent of one or two per cent. The quantity dissolved depends on the time, the temperature, and the nature of the solvent, but not on the quantity of solvent used. The main cause therefore is probably a partial transformation of amorphous to soluble crystalline sulphur. The residue on evaporating this solution re-dissolves readily in more solvent, with the exception of a minute quantity (not more than 0·1 per cent. of the original amount taken) which appears to have gone into solution originally in the colloidal form as amorphous sulphur. This view is supported by the ultramicroscopic examination of the solution. The value of the melting point of monoclinic sulphur is given as 118·95° C.—W. H. P.

Red platinum as an analogue of purple of Cassius. L. Wöhler and A. Spengel. Z. Chem. Ind. Kolloide, 1910, **7**, 243—249.

The red coloration produced by stannous chloride with platinum solutions is due to colloidal platinum, which is maintained in a finely-divided condition by protective colloids (stannic chloride and its products of hydrolysis); in absence of protective colloids, the red platinum changes immediately into brown colloidal platinum. The red solution can also be obtained by reducing a dissolved platinum salt with an ethereal solution of phosphorus in presence of gelatin as protective colloid. The chocolate-brown precipitate produced in the red solution owing to hydrolysis of the stannic chloride first formed, is not a compound of tin sesquioxide and platinum suboxide as hitherto supposed, but a mixture of stannic acid and metallic platinum, analogous to purple of Cassius. Both the platinum "purple" and the "purple" of Cassius are soluble in ether and in ethyl acetate. Ditte's reaction based on the red coloration produced by silver nitrate with stannous nitrate is an analogous formation of the corresponding silver "purple."—A. S.

Radioactivity of Italian materials. R. Nasini and M. G. Levi. Gaz. chim. ital., 1910, **40**, II., 101—122.

The authors have collected all the data hitherto obtained by themselves and by other investigators on the radioactivity of Italian materials. They point out the great diversity of methods of expressing radioactivity, rendering useful comparison impossible, and recommend the adoption of a uniform method of measuring and of stating results. The most active Italian material appears to be the adherent mud deposited by the hot springs of the Lucca baths. A sample of this mud examined by Magri in 1906 had an activity corresponding to 1696 volts per hour for 5 grms. of substance, as compared with 1655 volts for 0·2 grm. of pitchblende. Unfortunately this mud is found only in small quantities. The most active of the Italian rocks yet studied is a tufa from Fiuggi, with an activity equal to one-fortieth of that of pitchblende, but attempts to obtain concentrated radioactive products from it gave unsatisfactory results. From a mud from a thermal spring in the Euganean Hills, a product was obtained by Nasini and Pellini, by concentration, with an activity 30 times greater than that of pitchblende, whilst Elster and Geitel prepared a product about 4000 times more active than pitchblende from Capri soil. Specimens of cotunnite ($PbCl_2$) from the Vesuvian eruptions of 1872 and 1906, examined by Zambonini had an activity about the same as that of uranium ores containing 45 per cent. of uranium.—A. S.

Monazite and zircon; The production of —— in 1909. [*Analysis of monazite.* R. C. Wells.] D. B. Sterrett. U.S. Geolog. Survey, 1910, 1—11.

Analyses were made by R. C. Wells, of the U.S. Geol. Survey, of monazite sand from Centerville purified until it contained about 95 per cent. of monazite, by the aid of the Freese electromagnetic cleaner. He also accompanied the results of his analyses with notes on the methods employed, more especially regarding the precautions necessary for accuracy. Wells states that it is difficult to get a complete decomposition of the minerals in a monazite sand by any single operation, and although attack by sulphuric acid, or an acid flux is the course recommended by most authorities, the end is secured as quickly by first fusing with sodium carbonate and extracting the phosphate with water. This is particularly desirable if phosphorus is to be determined. Usually three or four attacks of the residue, by both acid and alkaline fluxes are required to get all the rare earths into solution. All the thorium is precipitated by an excess of oxalic acid, even in the presence of ammonium salts, the oxalates being convertible into nitrates by warming with fuming nitric acid, or into chlorides by boiling with sodium hydroxide, filtering, washing the hydroxides, and then dissolving in hydrochloric acid. One of the quickest methods for determining thoria in monazite sand, is that of Benz (this J., 1902, 563), with hydrogen peroxide. The older process with sodium thiosulphate Wells considers more reliable, but demanding more time to carry out. In the peroxide method, wherein the thorium is precipitated as thorium peroxide, Wells finds that adopting all Benz' conditions, there is still a strong likelihood that the thorium will not be completely precipitated. Also that in the presence of cerium, several re-precipitations are necessary in order to get rid of the cerium; indeed, that it is practically impossible to get rid of it completely. Results by the peroxide method, Wells concludes, rest partly upon a compensation of errors, the results by it being defined as "a fair approximation" to the truth. (See also Benz, this J., 1902, 563.) Even with the thiosulphate method, it usually requires more than one precipitation to get a product free from cerium, and it is best to convert the last precipitate first into hydroxide, and then into oxalate again, in order to get it wholly free from impurity. The following results were obtained by analyses of monazite from the Centerville Company, and illustrate the variations likely to arise when modified processes are employed. *Determinations of thoria in monazite sand from Centerville, Idaho*:—

	Per cent. of ThO_2.
1. Alkali attack, one reprecipitation of peroxide	2·64
2. Acid attack, one reprecipitation of peroxide	3·34
3. Attack with sulphuric acid, and one precipitation with sodium thiosulphate	3·22
4. Alkali attack, one precipitation with thiosulphate	3·06
5. Varied attack, two precipitations with thiosulphate	2·77
Mean	3·01

(See also this J., 1902, 563 and 901; 1904, 839.)

Zirconia and erbia earths from titaniferous mineral. K. A. Hofmann. Ber., 1910, 43, 2631—2636.

Selected portions of a sample of euxenite were almost free from silica, and had a high titanium content, the composition corresponding to the formula, $3TiO_2,2RO$. The mineral thus differed from a typical euxenite. Zirconia obtained from it gave an arc-spectrum which showed strange lines, and the equivalent weight, after careful purification of the material by precipitating with hydrogen peroxide, exceeded that of zirconia obtained from the silicate. The pieces selected were black and glistening, had a sp. gr. at 20° C. of 4·98 to 5·01, and a refractive index higher than 1·7. On anylysis they gave the following results:—Loss on ignition, 2·80; Nb_2O_5, 4·65; TiO_2, 45·74; rare earths, 36·17; SiO_2, 0·53; PbO, 0·33; ZrO_2, 2·83; Fe_2O_3, 2·06; Ur_3O_8, 2·73; and CaO, 1·60 per cent. The average equivalent weight of the rare-earth metals was found to be 41·15. The mineral was heated with strong sulphuric acid. Zirconia was separated as the potassium double flouride, and the greater part of the titanium and iron by fusing the remaining oxides several times with potassium carbonate. The rest of the titanium was precipitated by means of hydrogen peroxide from an aqueous solution of the sulphates. Holmium and dysprosium were separated by crystallisation of the ammonium double oxalates. Very pure oxide of erbium was obtained from the residue by first heating the sulphates to 845° C. for 10 hours and extracting with water, and then heating the undecomposed sulphates to 950° C. for 30 minutes and again extracting with water. The first heating decomposed the sulphates of the less basic metals, and the second one produced the oxide of erbium without affecting the sulphates of the stronger bases. No further treatment on the same lines could alter the oxide thus obtained either as regards the spectrum lines or the equivalent weight. The author first converted the erbium oxide thus obtained into the oxalate by means of which it was freed from impurities which had been introduced by reagents and apparatus. The oxalate after drying for a week in air had the composition, $Er_2(C_2O_4)_3+10H_2O$. It was obtained as bright rose-red, strongly double-refracting spangles. On heating to 575° C. the almost pure oxide was obtained. Characteristic spectrum-lines were given by the rose-coloured oxide when mechanically mixed with large quantities of other oxides, but compounds such as the titanate, aluminate, and zirconate did not give them. In this connection it is of interest that native oxide containing much oxide of ytterbium gave the characteristic lines sharply and unaltered. The normal sulphate of erbium remained constant in weight when heated at a temperature of 575° C. for 34 hours. When heated to 854° C. the weight again became constant, corresponding to a basic sulphate of the composition, Er_2O_3,SO_3. On heating to 1055° C. the oxide was left. From the normal sulphate the atomic weight of erbium was determined, the mean value obtained being 167·68.—T. St.

Titanic acid; Solubility and precipitation of ——. K. Bornemann and H. Schirmeister. Metallurgie, 1910, 7, 646—649.

Titanic acid is only slightly soluble in concentrated sulphuric acid and hydrofluoric acid, being most soluble when ignited below 700° C. The authors recommend the use of potassium bisulphate, and alkali carbonates or bifluorides for fusion, and instead of the tedious solution in cold water a clear solution not precipitated on boiling is obtained by using one part of sulphuric acid in two parts of water. Also when separating silica by hydrochloric acid from the carbonate fusion, the dried residue, with the exception of the silica, is soluble in the same strength of sulphuric acid. This strong acid solution can also be heated and precipitated by ammonia or alkalis and the precipitate is still soluble in dilute acid, and it is only difficultly soluble when dried. In the fresh undried state it is soluble even in aqueous sulphurous acid. Clear solutions in strong sulphuric acid can only be obtained when not heated to boiling, and the authors find no difference in behaviour between ortho- and meta-titanic acids.—A. H. C.

Hydrogen; The manufacture of ——. "Times" Eng. Suppl.' 1910, Nov. 2.

The chief drawback to the use of hydrogen for inflating balloons is its high rate of diffusion, which is 3·83 if the rate of diffusion of air be taken as unity. Although this drawback is being minimised by improvements in the manufacture of balloon fabrics, it is highly important for the maintenance of large dirigible balloons to be assured of a regular supply of pure hydrogen gas.

The manufacturer of tungsten filaments for metallic filament lamps requires a regular supply of hydrogen to prepare the inert atmosphere in which the filaments are heated to a high temperature during the final treatment. There is some doubt whether the hydrogen is really inert in this operation, and in those cases where a carbonaceous binding material is employed, the hydrogen probably assists in the complete removal of the carbon, it having been shown that carbon unites slowly with hydrogen to form methane at a temperature of about 1000° C. However this may be, it is the almost universal custom to employ a mixture containing approximately equal proportions of hydrogen and nitrogen when the filaments are heated to a white heat by the passage through them of an electric current during the sintering operation. Since tungsten filaments when heated to incandescence are extremely sensitive to oxidation it is of great importance that the hydrogen employed should be of a high degree of purity.

For the autogenous welding of metals, the working of platinum, and the manufacture of laboratory utensils and mercury vapour lamps from fused quartz, hydrogen in the form of the oxyhydrogen blow-pipe flame is used in large quantities, although here it has to meet the competition of acetylene, a gas which is cheaper and readily obtainable as required from calcium carbide.

At the present time most of the hydrogen used for inflating the gas-bags of dirigible airships is produced either electrolytically or by the action of steam on red hot iron turnings. The electrolytic process has been developed to a considerable extent in Germany. It depends for its success upon a cheap supply of electric energy, and as for every two volumes of hydrogen there is simultaneously produced one volume of oxygen this is also a source of profit. The plant requires comparatively little attention, and the hydrogen can be generated in a condition of great purity.

The other method has been developed in this country by Howard Lane, Fr. Pat. 386,991 of 1908, this J. 1908, 809. In this process steam is passed over red hot iron, whereby hydrogen is produced and the metal converted into oxide. The oxide formed, however, can be reduced again to metallic iron by passing water gas, coal gas, and other gaseous fuel into the retorts. By employing a number of retorts, some of which are producing hydrogen while in others the oxide is being reduced, it is possible to arrange for a more or less continuous supply of gas. Lane's process has found favour with manufacturers of tungsten lamps because it is also possible to arrange the plant so that when the oxide is being revivified nitrogen can be collected, it being customary for the lamp filament makers to employ a mixture of hydrogen and nitrogen.

There is undoubtedly much to be done before aeronauts can be sure of the immediate delivery of hydrogen in sufficient quantities to meet their requirements.

Potash industry in Austria. Ch. of Comm. J., Nov., 1910. [T.R.]

An Austrian syndicate has recently been organized for the development of the salt deposits near Kalusz, in Galicia. These fields have up to the present been under Government management. A private company with an initial capital of about £200,000 has now been organized, which, under contracts with the Government, proposes to take over the existing Government mines, extend the work into adjacent territory, and to erect factories for the production of high per cent. potassium salts, especially fertilizing salts, potassium chloride and bisulphate, and magnesium bisulphate. The laws of Austria forbid the manufacture of mineral salts by private persons, and the proposed business of the new company will, therefore, be conducted under the form of a Government lease, authorizing the manufacturing of the salt and its sale to the Government at a fixed price. The crude potassium salts will be prepared by the company at a factory to be erected in Kalusz, and the output will be sold on the Kalusz and Vienna markets. The mines have been worked to only a limited extent and are known to be rich in fertilizing and other salts. Austria imports annually about 5,000 tons of potassium salts from Germany, where the business is a monopoly. The high original cost, the freight charges, and the Austrian import duty of about 1s. 7½d. per 100 kilos. have prevented the extensive use of these salts in Austria, though their consumption is constantly increasing.

Potassium nitrate in Hungary; Bill for creating a state monopoly of ——. *See* II.

Italian tartaric materials. Chem. and Drug., Nov. 12, 1910. [T.R.]

The following statistics show the quantity of tartar and argol exported from Italy from October 1, 1908, to September 30, 1909, the total being 15,460 tons, valued at about £472,250 :—

	Half-refined argol.	Vinaccia argol.	Crude argol.	Wine-lees.
To	Tons.	Tons.	Tons.	Tons.
United Kingdom	1½	1,148½	440	444
United States ..	93	1,486	3,307	814
Germany	195½	392	492	2,605
France	120	—	238	2,784½
Austria-Hungary, etc.	24½	755½	119½	—
	434½	3,782	4,596½	6,647½
Value	£21,725	£178,925	£168,575	£103,025

Patents.

Sulphuric acid: Process for the purification of burner gases serving for the manufacture of ——. A. G. Duron and E. Hartmann. Fr. Pat. 415,658, May 6, 1910. Under Int. Conv., April 19, 1909.

The hot burner gases are first filtered through a layer of ferric sulphate or other appropriate substance, which removes the coarsest impurities and retains most of the arsenic, and are then treated in a series of chambers with "pulverised" sulphuric acid; the gases, thus cooled to 100°—150° C., are next made to pass, in many subdivided currents, up a wash-tower fed with cold water (which becomes heated and does not, therefore, retain sulphur dioxide), and the cold gases, after traversing filters filled with an inert substance (such as quartz or coke), are finally heated afresh by passing through reheaters arranged in the first filtering chamber for the hot gases, so that the purified gases may be used in the manufacture of sulphuric acid, either by the chamber or contact process. In the first stage of the process the gases are enriched by sulphur dioxide produced by decomposition of sulphur trioxide evolved from the ferric sulphate, and any ferric oxide, also formed and carried forward by the gases, is reconverted into ferric sulphate by the treatment with sulphuric acid.
—F. Sodn.

Hypochlorous acid; Process of making ——. H. V. Walker, Brooklyn, Assignor to The Maas and Waldstein Co., Newark, N.J. U.S. Pat. 972,954, Oct. 18, 1910.

Hypochlorous acid, or a liquid rich in hypochlorous acid, is obtained by adding to an aqueous solution of an alkali hypochlorite (*e.g.*, 85 parts of sodium hypochlorite) a sufficient excess of sodium bicarbonate (75 parts) to produce sodium carbonate and hypochlorous acid.—T.F.B.

Lead oxide; Method of and means for making ——. S. Pope, Manchester. Eng. Pats. 11,526, May 15, 1909; 24,768, Oct. 28, 1909; and 25,203, Nov. 2, 1909.

The lead is melted in an open or closed pot, whence it passes into one or more chambers provided with "liquid seal" devices. These communicate with the oxide pot, which contains revolving agitators arranged one above the other, and also a breaker-plate fixed more or less vertically, at a distance from the outlet, between the central shaft of the agitators and the inner wall of the pot. The lead is thus directed upwards in a pulverised condition, and is oxidised by means of a current of air, the oxidation being prolonged if required by having an upper annular channel in the pot, round which the lead is carried. Thence it passes to a collecting chamber in which the oxide is deposited in a fine powder. This chamber and the oxide pot are connected with the works' chimney by means of a valved pipe, so that when their doors are open there is an inward current of air, whilst the air (and any oxide) issuing from the collecting chamber is made to pass through a washing tower, in which it is subjected to the action of acids or solutions of lead salts in order to retain the lead oxide.—C. A. M.

Pickling liquors [from the manufacture of tinplate and galvanised iron]; Process for the utilisation of —— in order to regenerate hydrochloric acid and obtain iron in the form of commercial salts. C. Millberg and the Firm: Benker et Hartmann. Fr. Pat. 414,958, Jan. 3, 1910.

Sufficient sulphuric acid is added to the liquor to convert all the contained ferrous chloride into ferrous sulphate; the liberated hydrochloric acid is recovered by distillation, leaving as residue a concentrated solution of ferrous sulphate or a greyish powder of the anhydrous salt. Phosphoric acid or other acid capable of displacing the hydrochloric acid may be used instead of sulphuric acid.
—F. Sodn.

Silicon carbide; Manufacture of ——. The Carborundum Co. Fr. Pat. 415,087, April 21, 1910.

Silicon carbide, in a very dense form, is made by heating a mass of porous crystalline carbide of silicon, prepared in the usual way, in contact with silicon, which may be made to penetrate the mass in the gaseous form or be produced within it; a dense mass of crystals, cemented together by free silicon, is thus obtained.—F Sodn.

Alkali and alkaline-earth nitrates; Manufacture of ——. P. A. Guye and G. Darier. Fr. Pat. 415,143, July 5, 1909.

The process consists in allowing nitric acid, of less than 35 per cent. strength, to react with an alkali or alkaline-earth chloride, at a temperature below 80° C., and under a pressure below 300 mm., the dilution being maintained, as far as possible, during the operation. A current of air may be passed through the apparatus, instead of working under reduced pressure, and, in order to convert any oxides of nitrogen present in the gases into nitrates, these gases, mixed with air or oxygen if desired, are passed through apparatus filled with solid chloride, before the hydrochloric acid is recovered by solution in water. With sodium chloride, for instance, working at 22 mm., about 93 per cent. of the nitric acid used may be transformed into nitrate in the reaction vessel, the remainder being almost entirely retained as nitrate by the solid chloride.
—F. Sodn.

Hydrogen peroxide; Continuous process for the preparation of ——. A. de Hemptinne. Fr. Pat. 415,361, April 28, 1910.

A mixture of hydrogen and oxygen, containing the former in considerable excess and the latter in such proportion (below 5 per cent.) that explosion is impossible, is submitted to the silent electric discharge, preferably in an apparatus consisting of a vessel containing a number of upright plates or pairs of concentric tubes, which dip into water at their lower ends and are connected in pairs to an alternator; the gaseous mixture from a reservoir is circulated through this vessel by means of a pump, so as to pass between the plates or tubes and through the water which absorbs the hydrogen peroxide formed; it then passes back to the reservoir and, after the necessary oxygen has been added, is pumped into the upper part of the reaction vessel again.—F. Sodn.

Metallic sulphides; Electrolytic manufacture of —— and particularly of zinc sulphide. P. G. Jacolliot. Fr. Pat. 415,605, April 16, 1910.

The process consists in the utilisation of the solvent action of an alkali for sulphur, which surrounds the cathode of the electrolyser, whilst the metal dissolves at the anode in the alkaline solution, or in the acid produced from the alkali salt, such as sodium sulphate, which is used as the electrolyte. The two compounds formed react together, precipitating the sulphide of the metal, whilst the original electrolyte is re-formed during the action.—B. N.

Slaked lime; Manufacture of —— as a powder free from granules. C. Schroeder. Fr. Pat. 415,783, May 10, 1910.

Unslaked granules in lime cause swelling and other defects when the lime is used as mortar. A sieve is therefore placed at the bottom of the slaking shaft in order to retain any lumps; these are then either broken down first in a mill or returned direct to the top of the shaft to go through the slaking process as many times as may be necessary.—H. H. S.

Atmospheric nitrogen; Process of oxidation of —— by means of flame or spark electric discharges. K. Kaiser. Fr. Pat. 415,976, May 14, 1910. Under Int. Conv., May 19, 1909.

A mixture of nitrogen and oxygen, such as air, is mixed with a small proportion of ammonia and subjected to the action of electric flame or spark discharges, the ammonia being preferably added by allowing the main air current to draw an auxiliary supply of air through a vessel containing ammonia. A considerably increased yield of nitric oxide is said to be caused by this addition.—F. Sodn.

Potassium-magnesium sulphate; Process for the manufacture of ——. K. Kubierschky. Ger. Pat. 222,623, Sept. 3, 1907.

Carnallite (or a mixture of carnallite and potassium chloride) is stirred at a moderate temperature with a mixture of magnesium sulphate solution and "sulphate liquor" (potassium chloride solution) so long as the solution still contains chlorides. It is stated that by this process, potassium magnesium sulphate is obtained directly as a crystalline precipitate, according to the equation: $KMgCl_3,6H_2O+(KCl+nH_2O)+(2MgSO_4+nH_2O)=MgSO_4,K_2SO_4,nH_2O+(2MgCl_2+nH_2O)$.—A. S.

Reducible salts and minerals, especially alkaline-earth sulphates; Process for the treatment of ——. P. Prior. Ger. Pat. 227,175, Aug. 29, 1909.

The substance is mixed with fuel, the mixture is ignited, and a current of air is forced or drawn through the mass. Barium sulphate when treated by this method yields a mixture containing sulphide, oxide, carbonate, and sulphate, from which the soluble barium compounds may be removed by lixiviation. By suitably varying the conditions, a greater or smaller proportion of any one of the reaction products can be obtained.—A. S.

Air; Process of separating —— into its elements by fractional distillation. M. Hazard-Flamand. Second Addition, dated July 19, 1909, to Fr. Pat. 394,881, Dec. 10, 1907 (this J., 1909, 310; 1910, 88).

The air supplied to the apparatus described in the principal patent is deprived of moisture by passing it through a vertical heat-interchanger, in an upward direction, so that the condensed moisture may flow back, as the gas is cooled, towards the warmer part of the apparatus, to be there removed, and then through a drying tower, at a temperature not lower than − 50° C., in order to ensure the full activity of the desiccating material (*e.g.*, calcium chloride); the cooling of the air is completed, if necessary, in a second interchanger.—F. Sodn.

Sulphuric acid; Manufacture of ——. Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 23,142, Oct. 13, 1909. Under Int. Conv., April 15, 1909. Addition to Eng. Pat. 20,401 of 1909.

See Addition of Oct. 4, 1909, to Fr. Pat. 406,641 of 1909; this J., 1910, 627.—T. F. B.

Condensing acid vapours [in sulphuric acid concentrators]; Process and apparatus for ——. P. Vialleix and F. Perrin, Volvic, France. Eng. Pat. 28,302, Dec. 3, 1909. Under Int. Conv., Dec. 4, 1908.

See Fr. Pat. 397,080 of 1908; this J., 1909, 707.—T. F. B.

Hydrosulphites; Manufacture of stable anhydrous ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 30,379, Dec. 29, 1909.

See Addition of Jan. 5, 1910, to Fr. Pat. 341,718 of 1904; this J., 1910, 949.—T. F. B.

Zinc salt of boro-disalicylic acid; Process of producing a ——. A. Foelsing, Offenbach on Maine, Germany. Eng. Pat. 1616, Jan. 21, 1910.

See Fr. Pat. 411,614 of 1910; this J., 1910, 976.—T. F. B.

Ammonium salts from gas; Process of obtaining ——. K. Burkheiser, Aix-la-Chapelle, Germany. U.S. Pat. 973,164, Oct. 18, 1910.

See Fr. Pat. 394,926 of 1908; this J., 1909, 359.—T. F. B.

Barium chloride and strontium chloride; Process of treating —— for producing chlorine and hydroxides of the said metals. A. Clemm, Mannheim, Germany. U.S. Pat. 973,171, Oct. 18, 1910.

See Fr. Pat. 413,553 of 1910; this J., 1910, 1204.—T. F. B.

Oxalates from formates; Process of making ——. A. Wiens, Assignor to Electrochemische Werke G. m. b. H., Bitterfeld, Germany. U.S. Pat. 973,832, Oct. 25, 1910.

See Eng. Pat. 19,943 of 1907; this J., 1907, 1253.—T.F.B.

Air; Process for the continuous production of liquid —— and for the continuous separation of the same into its constituents. E. Jänecke, Hanover, Germany. Eng. Pat. 23,107, Oct. 9, 1909.

See Fr. Pat. 407,852 of 1909; this J., 1910, 627.—T. F. B.

VIII.—GLASS; CERAMICS.

Glass; Requisite properties of —— for mechanical manipulation. R. L. Frink. Trans. Amer. Ceram. Soc., 1910, 12, 585—613.

Four factors conduce to the satisfactory quality of glass—homogeneity, viscosity, temperature of working, and density. Homogeneity is best tested by viewing a cut specimen by polarised light: no striæ nor indication of lamination should be apparent. Illustrations are given showing the appearance of a non-homogeneous glass that averaged 83 per cent. breakage, and of a good glass with only 3 per cent. loss. By viscosity is meant the degree of fluidity of the metal, on which depends the rapidity with which it acquires the shape of a containing vessel or escapes through an aperture. The author measures it by making an orifice 100 mm. long by 3 mm. wide in the bottom of a receptacle filled with molten glass at a given temperature under a pressure of 100 mm. of mercury. Through this orifice will flow a stream of glass varying in width according to the viscosity. Thus window glass might give a stream 80 mm. in width and a lead glass one of 60 mm., their viscosities being called 80 and 60 respectively, "being the relation of the width of the stream of glass, measured where it has attained a constant cross section, to the width of the orifice." If the viscosity of the fluid be 100, none will escape. This method has been employed for studying the relative qualities of salt cake and soda ash in glass. A glass in which the soda is supplied by saltcake has a higher viscosity than one made with soda ash, so that 9 lb. may be drawn from a bath from the former as against 8¼ from the latter, but the economic advantage is reduced to practically nothing by the greater sensitiveness and breakage of the saltcake glass. On the temperature of working depends the viscosity and it follows that for every glass there is a specific temperature at which it is best worked. The density is useful as an expression of the completeness of fusion. A glass incompletely fused contains "blebs" of gas which will lower the density. In the subsequent discussion the question of magnesia in glass was raised. Its use is of great assistance in increasing fluidity while retaining hardness. It may be introduced in any quantity up to 10 per cent.—H. H. S.

Glass; Barium in ——. R. L. Frink. Trans. Amer. Ceram. Soc., 1910, 12, 370—375.

Barium, introduced as oxide or carbonate, imparts to glass some properties that are advantageous and some disadvantageous. It increases the density, refractive index, elasticity, tenacity, and modulus of rupture. It lowers the specific heat, thereby being useful for making chimneys, globes, etc., in the manufacture of which ware it can be made to replace lead compounds entirely. Glass containing barium has no more "tendency to sulphur" than other glasses worked in gases containing oxides of sulphur. It is said that 100 lb. of barium will replace 150 lb. of lead, 200 lb. of lime, and 150 lb. of soda. On the other hand, when melted in pots or in the tank, barium in glass causes separation, stratification and lamination, and it tends to devitrification.
—H. H. S.

Colloid matter in clays; Technical control of ——. H. E. Ashley. Trans. Amer. Ceram. Soc., 1910, 12, 768—817.

The chemical reactions of the colloids in clay are remarkably similar to those of fats and soaps. Thus, the sodium, potassium and ammonium sols of clay colloids are soluble in water; the acid gels are insoluble, and bivalent and trivalent bases form insoluble gels with the colloids. Colloids are estimated by the amount of dye they absorb, malachite green oxalate being the best for the purpose, as its amino base forms insoluble compounds with the colloid acid radicals, while the oxalate radical forms insoluble oxalates with all the bases that keep clay coagulated. Our knowledge of colloids is now sufficient to be applied to practical purposes, and the author gives eight examples of its usefulness. (1) The determination of the soluble salts in a clay is made much more accurate by adding sufficient magnesium sulphate solution, measured of course, to coagulate the sols. (2) When barium carbonate is added to a clay to prevent efflorescence of soluble sulphates, it has always been found that the theoretical amount of barium is not sufficient to neutralise the sulphates present. The action of the colloids may be prevented by adding 4 grms. of aluminium chloride to 100 grms. of clay and the test with barium will then be accurate. (3) The mechanical analysis of a clay is impossible till the clay be deflocculated. Alkalis are efficient for this purpose save when the colloid is combined with a polyvalent base such as calcium. In this case sodium oxalate is best added. (4) The choice of deflocculants in the casting process has hitherto been empirical, but it is now possible to determine the soluble salts and to find what bases are combined with the gel, and hence to decide what reagent is best suited to dissolve the colloids. (5) A clay is most plastic when it becomes acid on ageing, which indicates that the hydrogen gel is the most plastic and the alkali gels least so. It may now be studied also to what extent the presence of soluble salts is beneficial to plasticity. (6) Clays may be improved in other ways than plasticity. Thus refractory clays may be rendered less fusible by substituting hydrogen or aluminium for such bases as may be combined in the colloids. Conversely, by washing out refractory bases with solutions of alkali salts, clays may be matured at a lower temperature. The principle objection to ball-clays is the dirt carried by them. By dissolving out the colloids, the dirt is left behind and the colloids can then be coagulated and mixed with kaolin or any other desired material. (7) Fuller's earth, which is a clay of especially high colloid content, may be further improved by adding colloids dissolved from other clays. (8) Sliphouse water has an important effect on blunging clay, and this may now be regulated by the addition of suitable reagents.—H. H. S.

Clay products; Relation between porosity and crushing strength of ——. A. V. Bleininger. Trans. Amer. Ceram. Soc., 1910, **12**, 564—584.

THE specifications for building brick recommended by the American Society for Testing Materials relate to four tests, these being transverse strength, compression, absorption, freezing and thawing. In the compression test half bricks are bedded flatwise, even bedding being secured by the use of blotting paper or plaster, and the minimum requirements are :—thoroughly dry, 2500 lb. per sq. in.; thoroughly saturated, 2000 lb.; after freezing and thawing, 2000 lb. The author studies this test and that of absorption, and endeavours to correlate them. He finds that the bricks are better tested on edge although they are not placed in this position when used. When bedded flatwise, there is a serious experimental error due to shape. To find the relation between crushing strength and absorption, as expressed by the percentage gain in weight after 48 hours soaking, 178 stiff-mud bricks were tested. The curve was approximately a straight line from maximum down to 5 per cent. absorption and then took a steep inclination down to 0 per cent. absorption. The former relation is expressed by the formula, crushing strength $=\frac{\text{a constant}}{\text{absorption.}}$ The constant depends on the particular class of brick in question. To find it, not less than 10 or 15 bricks of the class should be correlated for absorption and crushing strength. When the absorption is less than 5 per cent., the relation is more complex. A particular class of brick, of which 140 specimens were tested, yielded the empirical formula, $y=a+bx+cx^2$, where $a=6400$, $b=-38{\cdot}75$, $c=-16{\cdot}25$, x the absorption, and y the crushing strength in pounds per square inch. But given a sufficient number of correlated tests, the crushing strength of a brick may be calculated from its absorption.—H. H. S.

Clay; Relation between tensile strength and transverse strength of raw ——. H. Ries and S. W. Allen. Trans. Amer. Ceram. Soc., 1910, **12**, 141—143.

As a test of the transverse strength of air-dried clay approximates more to the conditions to which ware is subjected before burning, it was decided to compare this test with that of the tensile strength. The latter is carried out by moulding the kneaded clay into briquettes and pulling them apart in a machine. For the transverse test, the clay was moulded into bars 3½ in. × 1·25 in. × 0·7 in.; the bars were supported on rounded wooden edges, 2½ inches apart; a steel rod $\frac{3}{16}$ in. in diameter was laid across the bar exactly halfway between the supports, and from this a pail was suspended. Shot was fed into this pail till the bar broke. The fracture in every case was smooth and the results show less variation than in the tensile test. On plotting the results a regular curve is obtained, the tensile strength rising directly with the transverse strength. The transverse test is accordingly recommended as being easy to carry out and as giving more uniform results.—H. H. S.

Clays; Notes on preheating treatment of ——. A. V. Bleininger. Trans. Amer. Ceram. Soc., 1910, **12**, 504—516.

IN continuation of his previous work (this J., 1909, 1128), the author studies the effect of preheating on the structure of clays. This treatment increases the density of a clay, decreases the surface factor owing to the coagulation of the colloids, and increases the porosity; also, the preheated clay requires more careful lubrication in drying. Every clay requires individual treatment, but the best general rule is to heat for 3 to 5 hours to a temperature not exceeding 300° C. High temperatures result in excessive porosity which may give rise to cracking during burning. Some clays cannot be preheated with safety owing to the small range of temperature in which the change takes place. Temperature-shrinkage curves are helpful in indicating the behaviour of a clay. Preheated clays may effloresce owing to a tendency to release their soluble salts more easily than normal clays.—H. H. S.

Clays: Some chemical and physical changes in —— *due to the influence of heat.* J. M. Knote. Trans. Amer. Ceram. Soc., 1910, **12**, 226—264.

THE temperature range in which changes may occur in a clay extends from atmospheric temperature to 1850° C., at which point the most refractory clays are affected. Ashley (see this J., 1910, 628) studied the colloidal matters in clay at ordinary temperatures. Bleininger (this J., 1909, 1128) obtained important results by heating below the point of dehydration. Clark (U.S. Geolog. Survey, Bull. No. 125) and others have examined the process of dehydration, but little work has been done regarding the change in a clay between the stages of dehydration and incipient vitrification. The author deals with this deficiency and divides his work into two parts, the one concerning the behaviour of clays below 1000° C., and the other the same above that temperature. The physical changes below 1000° C. were studied by determining the specific gravity by means of a pycnometer. The samples were also tested for solubility in hydrochloric acid and for their puzzuolanic character when mixed with lime and water. The following results were obtained. On dehydration the density of clay decreases, increasing again suddenly at about 950° C., at which point Le Chatelier reported an exothermic reaction. Essentially the same density curve was obtained for all clays tested, but non-plastic clays attain a slightly higher density at 950° than do plastic clays. Dehydrated clays which have not been heated above 900° C. are puzzuolanic, but lose this property if heated above 950° C. Clays heated above 950° C., when mixed with lime and water and subjected to high-pressure steam, give a very much stronger body than similar mixtures, using clays which have been heated below 950° C. Raw clays and clays heated above 950° C. are attacked less strongly by hydrochloric acid than dehydrated clays heated to intermediate temperatures. The residue after treatment with acid is but slightly puzzuolanic. The author suggests that on dehydration the aluminium silicate, $Al_2O_3,2SiO_2,2H_2O$, decomposes into water and the silicates, Al_2O_3,SiO_2 and $Al_2O_3,3SiO_2$, and not into water, silica, and the silicate, Al_2O_3,SiO_2, as generally supposed. The second part of the paper deals with clays fired between cones 010 and 23, and tests were made of the apparent density, the porosity and shrinkage. There is a striking difference in the behaviour of clays, not in what takes place, but in the temperature at which it takes place. By sufficiently severe heating all clay wares assume a crystalline structure, the clay substance breaking up into one silicate rich in alumina and another rich in silica. In porcelain, sillimanite is formed, but the experimental data go no further than this at present. Moreover, Seger has shown that clays of the same chemical composition do not necessarily behave in the same way even at high temperatures. —H. H. S.

Hydrated silicic acid; Determination of —— *in clay.* F. K. Pence. Trans. Amer. Ceram. Soc., 1910, **12**, 43—53.

SJOLLEMA'S diethylamine method (Analyst, 1903, 123) and Herman's sodium paratungstate method (Z. anal. Chem., 46, 318) of separating amorphous from combined or crystalline silica are said to be too expensive for commercial analysis. The author therefore examines the older methods of separation by caustic soda or sodium carbonate. He finds that caustic soda is useless in this respect, as even a 1 per cent. solution will attack the combined silica. Sodium carbonate, however, gives better results, the method being as follows: 5 grms. of the finely-ground material are boiled with 120 c.c. of 5 per cent. sodium carbonate solution for 10 minutes. After settling for a short time, the solution is decanted, and the sample treated twice more with the carbonate solution. The clay is then transferred to the filter-paper, washed with hot dilute sodium carbonate solution, and the silica in the combined filtrates determined in the usual way by acidification and evaporation to dryness. A control determination should be conducted at the same time, as the vessels usually yield a quantity of silica corresponding to about 0·2 per cent. on a 5 grm. sample. Should the amount of amorphous silica in a clay be unusually large, *i.e.*, more than 3 or 4 per cent., a smaller sample should be used.—H. H. S.

Roofing tile clays; Warpage of ——. W. G. Worcester. Trans. Amer. Ceram. Soc., 1910, **12**, 818—866.

Warpage is usually attributed to a clay with high shrinkage, but neither this nor viscosity can explain the phenomenon altogether. Samples of clays—glacial, semi-glacial, alluvial and shale—were tested for density, amount of water required to develop plasticity, drying shrinkage, burning shrinkage "at various cones," density and porosity of burnt trials, and these tests were compared with the tendency to warping exhibited by the various clays. The warpage was studied by three sets of trials—the first pertaining to ordinary flat tiles, the second to the Spanish tile, the third to thin bars 12 in. long, 1·25 in. wide and 0·5 in. thick, this last being the Cramer test. The author deduces from these experiments that change of shape in the burning of clay ware results from the formation of a viscous matrix while the principal part of the clay is still solid, and that the changes in shape which occur early in the burn and are desired are effects of the same process that results in destroying the shape when the ware is overfired. The rate of change of shape is parallel to the rate of other changes (shrinkage, porosity, etc.) for a time, but as the latter decrease on approaching completion, the rate of change of shape increases. The tendency to warpage cannot be prophesied from other properties; while high shrinkage and low porosity incline us to expect high warpage, it does not always follow. In determining the value of a clay, a practical test for warpage must therefore be made.—H. H. S.

Sagger mixes; Method of testing ——. H. E. Ashley. Trans. Amer. Ceram. Soc., 1910, **12**, 277—293.

In practice a sagger has to withstand two strains—one caused by sudden changes in temperature through opening kiln doors and so on, the other due to the weight in the sagger causing it to buckle at high temperatures. The first may be represented in the laboratory by a quenching test, the other by heating with a weight of about 1000 grms. on the sagger. The author concludes that a coarse-grained plastic clay is the best to use for this ware. A good mix should show an absorption of from 16 to 20 per cent. and should contain as much coarse grog as is practicable to work.—H. H. S.

Dust pressed wares; Manufacture of ——. G. Simcoe and A. E. Smith. Trans. Amer. Ceram. Soc., 1910, **12**, 196—204.

By adding 10 c.c. of a solution of 1 oz. of dry gum tragacanth in 20 quarts of hot water to 2 lb. of screened clay, any clay, however high or low in plasticity, may be used for dust pressing. Much depends on the way the clay is pressed, the pitch of the screw in most modern presses being much too great for the final pressure. To make the clay separate freely from the die, a slight addition of 3 parts of coal oil mixed with 1 part of pure lard oil to the clay gives excellent results.—H. H. S.

Firebricks; Behaviour of —— under load conditions at 1300° C. A. V. Bleininger and G. H. Brown. Trans. Amer. Ceram. Soc., 1910, **12**, 337—369.

Clays and clay mixtures do not possess a definite melting point. The phenomena of fusion manifest themselves at heats hundreds of degrees below the stage of viscous fusion as shown by the bending of a test pyramid. Such a test is useless for a firebrick, since under such conditions the distortion coincident with softening fails to become evident, owing to the viscosity of the mass and to the fact that no load is imposed on it. It is recommended therefore that a load of 50 lb. per square inch be imposed and that the temperature be not higher than 1350° C. This test approximates to practical conditions at average furnace temperatures, and it cannot be replaced by chemical analysis or by determination of so-called melting-point. The results show that the RO constituents, including FeO, should not exceed 0·22 equivalent. The content of fluxes is more important than the silica content. The amount and fusibility of the least refractory constituent govern the behaviour of the brick under load. Improvement will result by grinding the less refractory clay intimately with silicious materials low in fluxes, by improving the density, and by harder burning. A first-class brick under this test should not be shortened more than one inch in the standard nine-inch length.—H. H. S.

Porcelains; Study of the vitrification range and dielectric behaviour of some ——. A. V. Bleininger and R. T. Stull. Trans. Amer. Ceram. Soc., 1910, **12**, 628—675.

The object of the work was to show by graphical means the proportions of felspar, flint and various clays which produce vitrified bodies at temperatures within the limits of American practice, and opportunity was taken to study the relation between chemical composition and electrical resistance. The results are given in a series of diagrams. The fact that felspar is a solvent and does not react chemically with the clay substance is brought out, as well as the observation that it begins its dissolving action at a low temperature. The structure and fineness of grain of clay in a body has great influence on vitrification. In one case, that of a Tennessee ball clay, the felspar-flint mixture even behaved as a refractory constituent in a body containing 50 per cent. of the clay; from which it follows that the felspar content required depends on the individual clay employed and not on the total clay-substance. The rate of vitrification is not constant but shows an acceleration, usually between cones 4 and 7. English china clay has a more uniform rate and greater range of vitrification than the two American kaolins tested. Vitrification is accompanied by increase in specific volume. Electrical resistance, at ordinary temperatures, depends more on sound vitrification and good mechanical structure than on chemical composition. At higher temperatures the resistance decreases and chemical composition becomes an increasingly important factor, so that a high felspar porcelain which may be an excellent non-conductor at ordinary temperatures might break down altogether at several hundred degrees Centrigrade.—H. H. S.

Flemish ware; Production of ——. S. P. Ward. Trans. Amer. Ceram. Soc., 1910, **12**, 531—532.

The object of the experiments was to produce a blue-gray stoneware, soft in colour, impervious to water, and having raised decorations in deep blue. The body was obtained by adding 10 per cent. of felspar to a stoneware clay, mixing 0·0625 per cent. of cobalt oxide into it, and firing to cone 8. For glaze, the following stood the salt glaze treatment best at cone 4:—$0{\cdot}5PbO$, $0{\cdot}2K_2O$, $0{\cdot}2CaO$, $0{\cdot}1ZnO$, $0{\cdot}3Al_2O_3$, $0{\cdot}05Co_3O_4$, $1{\cdot}9SiO_2$.—H. H. S.

Glaze formula; Position of boron in ——. F. G. Singer. Trans. Amer. Ceram. Soc., 1910, **12**, 676—716.

Boric oxide has been placed in the molecular formula with the silica by Seger, with the alumina by Purdy and Fox, and with the bases by Binns. The author inclines to the alumina position for the following reasons. In matt glazes the substitution of an equivalent amount of boric oxide for alumina does not change the character of the glaze but merely reduces the melting point. The influence of alumina and boric anhydride in intensifying the colour of cobalt glazes is the same in principle but differs in the more powerful action of boric oxide. In copper glazes both oxides act similarly in degrading turquoise-blue to a dirty greenish blue, the boric oxide being again more powerful in the colour change. Red and green underglaze colours are spoiled by excess of both oxides, this action appearing when the sum of the two oxides exceeds approximately $0{\cdot}52R_2O_3$. Lead chromate does not act as indicator of the acidity or basicity of fusions containing boric oxide, showing that the oxide has neither quality. Isomorphous zeolites may be artifically prepared by molecularly replacing alumina by boric oxide and also by vanadium trioxide, manganese sesquioxide, ferric oxide, and cobalt trioxide. They are all mutually isomorphous and also possess the property of being able to exchange their bases by washing with salt solutions of mono- or bivalent metals. The copper-aluminate and copper-borate zeolite possess the same bright green colour, while Pukall's copper silicate free from sesquioxide is bright blue.

—H. H. S.

Opalescence and the function of B_2O_3 in the glaze. R. T. Stull and B. S. Radcliffe. Trans. Amer. Ceram. Soc., 1910, **12**, 129—140.

WHITEWARE glazes were made up showing all stages from clear and colourless through opalescence to opaque white. The field covered corresponded to the general formula,

$$0{\cdot}3K_2O,\ 0{\cdot}2Na_2O,\ 0{\cdot}4CaO,\ 0{\cdot}1PbO,\ 0{\cdot}45Al_2O_3,$$
$$1{\cdot}76—6{\cdot}1SiO_2,\ 0—1{\cdot}0B_2O_3.$$

To detect faint opalescence it is necessary to examine thick layers of the glaze, and tiles were accordingly made having conical depressions 0·5 inch in diameter and 0·25 inch in depth, the depressions being filled with the glaze under consideration and the trials then burned to cone 3. The authors conclude that—(a) boric oxide added to a glaze whose previous oxygen ratio is not more than 2 acts as an acid, and when present in acid form it tends to produce clear glazes and crazing; (b) when the glaze has a ratio greater than 2, boric oxide combines as a base, producing opalescence and non-crazing tendencies, any excess of boric oxide being present as an uncombined acid in solid solution; (c) opalescence is caused by the precipitation of a silicate in which boric oxide is evidently basic, the intensity of opalescence not depending on the quantity of boric oxide present but on the quantity combined as silicate. (See also Binns, this J., 1908, 1061.)—H. H. S.

Crazing; Contraction of glazes on solidifying, as a cause of ——. H. F. Staley. Trans. Amer. Ceram. Soc., 1910, **12**, 322—326.

THE theory is advanced that crazing is due to the coefficient of contraction of a glaze as it solidifies rather than to its coefficient after having become solid. If enamelled iron does not craze on solidification it will not craze at all. In fact, crazes often appear on the just solidified glaze that become healed up subsequently. The theory is confirmed by the difference between Seger's series of fluxes in their order of crazing and Hovestadt's series in the order of thermal expansion. Hovestadt's series is, beginning with the base giving the highest coefficient, K_2O, PbO, Na_2O, BaO, CaO, ZnO, B_2O_3, MgO. Now if crazing is due to a high coefficient of the solid glaze, it should be cured by replacing part of any flux in this series by one following it. This is not found to be the case in practice, while substitutions in accord with Seger's series, PbO, BaO, K_2O, ZnO, B_2O_3, Na_2O, CaO, MgO, have been proved beneficial.—H. H. S.

Matt glazes. W. P. Earle, M. F. Gilson, and W. N. Claflin. Trans. Amer. Ceram. Soc., 1910, **12**, 531, 533—534, 536—543.

A MATT glaze maturing at cone 7—8 has the formula, $0{\cdot}15K_2O$, $0{\cdot}33PbO$, $0{\cdot}52CaO$, $0{\cdot}45Al_2O_3$, $1{\cdot}4SiO_2$, $0{\cdot}18SnO_2$. For cone 2—4, a matt glaze is obtained from $0{\cdot}15K_2O$, $0{\cdot}10PbO$, $0{\cdot}10ZnO$, $0{\cdot}35CaO$, $0{\cdot}30BaO$, $0{\cdot}27Al_2O_3$, $1{\cdot}9SiO_2$. Another, burned at cone 1 in 30 hours, may be applied, by dipping, to biscuit without using gum. It has the formula, $0{\cdot}45PbO$, $0{\cdot}0—0{\cdot}15ZnO$, $0{\cdot}15—0{\cdot}10K_2O$, $0{\cdot}40—0{\cdot}30CaO$, $0{\cdot}34Al_2O_3$, $1{\cdot}62—1{\cdot}31SiO_2$. The idea that a high alumina content is essential to mattness is erroneous. Orton stated that an oxygen ratio of 2·3 was necessary to obtain a matt, but good matts may be obtained with a ratio of 1·2. Binns defined mattness as the formation of aluminates in mutual solutions with silicates, but Claflin prefers to attribute it to the crystallisation of one or more of the components of the glaze, these components not necessarily being aluminates.—H. H. S.

Enamel and enamel raw materials; Methods of analysis for ——. R. D. Landrum. Trans. Amer. Ceram. Soc., 1910, **12**, 144—174.

THE author claims little originality in the analytical methods described, but states that the adaptations of them to the technical needs of the potter are convenient. The first part of the paper deals with the analysis of an enamel which may contain fluorine, antimony, tin, phosphate and borate, besides colouring matters and silica and alumina. The second part treats of raw materials of which the most important, from an analytical point of view, are those which contain both fluorine and silica, the method being the same as in the case of an enamel containing fluorine. The silica is removed, after fusion with mixed carbonates at a very low heat and subsequent digestion of the solution with ammonium carbonate, by Schaffgotsch solution, which consists of mercuric oxide dissolved in ammonia and ammonium carbonate. Any phosphates that may be present in an enamel from bone ash are in the filtrate and may be precipitated with silver nitrate. Excess of silver is removed by sodium chloride and the fluorine then separated by boiling with a large excess of calcium chloride. The fluorine content obtained by this method is from 2 to 4 per cent. too low.—H. H. S.

Sheet steel enamels; Testing ——. J. B. Shaw. Trans. Amer. Ceram. Soc., 1910, **12**, 463—493.

THE paper is a sequel to Orton's on the same subject (this J., 1909, 1130). Enamelled sheet steel ware has to withstand solubility in acids and sudden changes of temperature, as in cooking utensils, and also impacts, as in automobile tags. Only the first two tests are dealt with in the present paper. The basis of investigation was an enamel of the general formula, $0{\cdot}4Na_2O$, $0{\cdot}2K_2O$, $0{\cdot}4CaO$, xAl_2O_3, $ySiO_2$, zB_2O_3, where x, y and z, are variables. For an acid test, sulphuric and acetic acids are compared, and preference is given to the former, as a 1 per cent. solution of it has a greater solvent action on enamels than a 75 per cent. solution of acetic acid. The sample is accordingly boiled in a 1 per cent. solution of sulphuric acid for 15 minutes and the loss in weight determined and reduced to loss per square inch. On a good ware this should not be more than 0·008 grm. per sq. inch. Everything else being constant, the solubility decreases with increase of silica, with increase of alumina, and with decrease of boric acid. The change of temperature test was carried out by plunging the nearly red-hot ware into cold water. No certain relation can be traced between chemical and physical steadfastness, but the following enamels are recommended as safe chemically and physically: R_2O, $0{\cdot}3Al_2O_3$, $3{\cdot}3SiO_2$, $1{\cdot}1B_2O_3$; R_2O, $0{\cdot}2Al_2O_3$, $2{\cdot}9SiO_2$, $0{\cdot}73B_2O_3$; R_2O, $0{\cdot}2Al_2O_3$, $2{\cdot}5SiO_2$, $0{\cdot}5B_2O_3$; R_2O, $0{\cdot}3Al_2O_3$, $3{\cdot}6SiO_2$, $0{\cdot}6B_2O_3$; R_2O, $0{\cdot}1Al_2O_3$, $2{\cdot}6SiO_2$, $0{\cdot}38B_2O_3$.—H. H. S.

Enamel brick; Notes on manufacture of —— *with some investigations on enamel brick slips.* R. T. Stull. Trans. Amer. Ceram. Soc., 1910, **12**, 711—767.

CLAYS suitable for enamel brick should possess low shrinkage, good bond, freedom from warping and cracking, should stand up well at cone 4 and burn to a light colour free from iron spots. Plastic clays, mixed with grog to reduce shrinkage, are best. To determine the causes and remedies of manufacturing loss, briquettes composed of 70 parts of plastic fireclay and 30 parts of 16-mesh grog were made up and slips, or engobes, within the limits 25—75 parts of clay to 75—25 parts of non-plastic materials, were applied to them. The results are given in the following table which refers, it must be remembered, to the slip, the overglaze not having been applied in these experiments:—

Defect.	Cause.	Remedy.
Pinholes.	1. Using freshly made slips.	1. Age slips a week or more.
	2. Dust on surface of brick.	2. Scrub surface before dipping.
	3. Pinholes in surface of brick.	3. Scrub surface.
	4. Bad dipping.	4. Experience
Cracking before firing.	5. Too much clay in slip.	5. Increase non-plastic portion or add borax, soda ash, or water-glass.
	6. Too much kaolin in slip.	6. Increase ball-clay or add soluble material as in 5.
	7. Body too dry before dipping.	7. Dip brick in softer condition.
	8. Slip too thick.	8. Thickness not more than 0·05 inch.
	9. Slip too fine.	9. Blunge slips instead of grinding.
Flaking before firing.	10. Slip too low in clay.	10. Increase proportion of clay.
	11. Slip too high in kaolin.	11. Increase ball-clay.
	12. Oil or dust on dipping surface.	12. Scrub surface.
	13. Dipping before brick has hardened.	13. Allow brick to be leather hard before dipping.
Crazing	14. Slips too high in flint.	14. Reduce flint and increase clay, felspar or Cornish stone.
	15. Slip too high in spar or stone.	15. Increase clay.
	16. Burning too high when felspar is flux.	16. Reduce burning temperature.
	17. Burning too low when stone is flux.	17. Increase burning temperature.
Cracking in fire.	18. Too much clay in slip.	18. Reduce clay and increase flint, stone or spar.
	19. Too much spar or stone.	19. Increase flint.
Flaking in fire.	20. Dipping slips too thick.	20. Same as No. 8.
	21. Too much clay.	21. Same as No. 18.
	22. Too much spar.	22. Reduce spar and increase stone.
	23. Too much flint.	23. Reduce flint, increase stone.
	24. Burning too high.	24. Reduce burning temperature.

—H. H. S.

Patents.

Glass: Manufacture of strengthened ——. E. Benedictus, Paris. Eng. Pat. 17,242, July 20, 1910. Addition to Eng. Pat. 1790 of 1910; dated Aug. 10, 1909 (this J., 1910, 818).

In the manufacture of strengthened glass, by interposing between sheets of glass, a sheet of celluloid or other suitable material, the surfaces of which have been previously softened by a solvent, the various sheets are made to adhere to one another, not by the application of mechanical pressure, but by the application of a vacuum, in order to completely remove the solvent, which can then be recovered for further use.—W. C. H.

Glass furnaces. C. Royer. Second Addition, dated April 23, 1910, to Fr. Pat. 390,102, May 11, 1908 (this J., 1908, 1020, and 1909, 141).

Fixed pots are substituted for the movable crucibles in which the glass is melted. These pots are joined together so as to isolate the upper part of the furnace. The heat is radiated from the arch of the furnace and a higher temperature is obtained through the confined space. A current of cold air protects the outsides of the pots and increases their life.—H. H. S.

Glass-drawing furnace. G. H. Bulle. Fr. Pat. 415,801, May 11, 1910.

Two crucibles are placed on a longitudinal axis so that one is in a vertical position when the other is horizontal, and *vice versa.*—H. H. S.

Glass-drawing furnace. V. H. Gregory. Fr. Pat. 415,870, May 11, 1910.

After glass has been drawn from a crucible, the latter is reversed and the residue of glass drips back into the furnace in streams which are apt to meet the escaping gases and cause obstructions. To avoid this, the escape-flue for the gases has a bottom inclined towards the furnace, of such shape that the threads of glass return to the furnace along the flue-bottom.—H. H. S.

IX.—BUILDING MATERIALS.

Wood: Impregnation of —— *with brine in Russia.* Charitschkoff. Chem.-Zeit., 1910, 34, 1159.

In Russia, particularly in the south-east, brine is very largely used for impregnating railway-sleepers and telegraph poles. Though not so effective a preservative as creosote, brine is considerably cheaper. Special impregnating basins have been constructed in which the sleepers are placed in rows, and allowed to remain in the brine for from 3 to 4 months. The brine contains 164 grms. of saline matter (136 grms. of sodium chloride) per litre. The brine does not penetrate far into the wood, the sleepers absorbing from 70 to 100 per cent. of their weight.—T. St.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron carbide: Influence of silicon on the maximum solubility of —— *in γ-iron.* C. Schols. Metallurgie, 1910, 7, 644—646.

Thirty-one alloys of iron, carbon, and silicon were prepared by melting a cast iron containing 3·75 per cent. of carbon, 0·2 of manganese, and 0·02 of silicon with a Swedish nail iron containing 0·127 per cent. of carbon, and 0·01 of silicon, with addition of ferro-silicon containing 47·88 per cent. of silicon. On analysis the alloys were found to contain either about 1·2, 1·5, 1·9, or 2·5 per cent. of carbon, while the silicon varied up to ten per cent. Cooling curves were taken, and diagrams are given for each of the carbon contents showing the influence of silicon on the commencement of solidification, the eutectic point, and the pearlite point. It is shown that for all the percentages of carbon the addition of silicon lowered the temperature of the first crystallisation; the eutectic point was constant at 1120° C., while the pearlite point was raised for increasing contents of silicon, and the pearlite disappeared in alloys of 1·2 per cent. of carbon containing 5·6 per cent. of silicon or more, and in those of 1·5 per cent. of carbon with 4·5 of silicon. The observations of Spiecker that the maximum solubility of carbon in γ-iron is 2·2 per cent., and of Gontermann that this maximum solubility is lowered with increasing silicon content are confirmed. The diagrams also show that for the 1·2 per cent. of carbon alloys there was no eutectic point (1120° C.) up to 5·6 per cent. of silicon, for the 1·5 per cent. of carbon alloys none up to 1·8 per cent. of silicon, and for 1·9 per cent. of carbon it appears at 1·134 per cent. of silicon, while at the saturation point of 2·2 per cent. of carbon in γ-iron no silicon is necessary to give the eutectic point. Microscopical examination of the alloys after being heated in barium chloride to 1140° C., cooled and kept at 1120° C. for ten minutes and then quenched in ice-water, and containing percentages of silicon just above and below these figures showed the presence and absence of the eutectic respectively, and ten microphotographs are given illustrating these observations. —A. H. C.

Steels ; Variations of the resistance to crushing of —— as a function of the temperature. Relation between the static and dynamic properties of steels. F. Robin. Comptes rend., 1910, **151**, 710—712.

THE resistance to crushing of austenitic steels (containing nickel or manganese) and of the alloys of iron and nickel (rich in nickel) decreases continuously as the temperature is raised. Iron and pearlitic steels show special variations. The resistance of all steels is much greater at the temperature of liquid nitrogen, than at the ordinary temperature, and, with carbon-steels, the resistance decreases to a minimum at about 300° C., as the temperature is raised, then increases to a maximum at about 500° C., and finally, after falling rapidly to about 800° C., decreases more slowly up to the melting point. As regards speed of impact and the number of blows in crushing, carbon-steel behaves as a hard and elastic body at low temperatures, and as a relatively soft one at a red heat. The speed of the crushing impact (*i.e.*, the number of blows in a given time) has little influence up to about 400° C., but at higher temperatures an increase of speed raises the resistance to crushing in a marked way. The static crushing of steel appears to be correlated with resistance to fracture. Certain steels, in particular the austenitic and some martensitic steels, show, contrary to the behaviour of pearlitic steels, a much greater resistance to static than to dynamic effects, at the ordinary temperature, so that the action of the speed of impact depends on the metal in question.—F. SODN.

Copper mattes ; The successive stages in the Bessemerising of —— as indicated by the converter flame. D. M. Levy. Inst. Min. and Met., Nov. 16, 1910. [Advance proof.]

THE matte charged into the converter is essentially a copper-iron sulphide containing about 45 per cent. of copper. In addition, it may contain zinc, lead and arsenic. These latter, and the coke which is always added with the matte, give the initial flame a smoky appearance, but the flame rapidly assumes a red to red-brown colour. It then becomes more and more tinged with green, until after about 15 minutes it is altogether of a vivid apple-green colour. During this stage the iron is converted to oxide, which combines with the silica of the converter lining to give a slag. When all the iron has thus passed into the slag, the colour of the flame becomes white-blue. This indicates that copper is being oxidised and converted to silicate. At this stage the slag is poured off. The charge left consists of practically pure copper sulphide, and is known as "white metal." This stage is reached about sixty minutes from the beginning. During the blow from sulphide to metal, the colour of the flame is red-brown passing to red-purple, the latter colour persisting with very slight change to the end of the operation. This second period of the blow takes from 60 to 75 minutes. Coloured reproductions from photographs taken on Lumière autochrome plates show the flames (1) at the beginning of the blow (appearance of the green), (2) during the slagging stage (vivid green), (3) during the "white metal" stage (flame chiefly blue), and (4) during the "blowing to blister" stage (flame bronze-purple).—T. ST.

Copper and copper alloys ; Colouring —— black. E. Groschuff. Deutsch. Mechan.-Zeit., 1910, 134—138, 141—146. Chem. Zentr., 1910, **2**, 1340.

COPPER and copper-rich alloys are not coloured black by alkali solutions alone, but only in presence of an oxidising agent. The author recommends heating the metal for a few minutes at 100° C., in a 5 per cent. solution of caustic soda, with frequent additions of about 1 per cent. of potassium persulphate. Zinc, tin, aluminium, iron, nickel, German silver, "constantan," and hard and soft solders are not coloured black by this treatment ; for brass and aluminium bronze, a 10 per cent. solution of caustic soda must be used. A film of cuprous oxide is coloured black more rapidly than metallic copper. Spots of solder or of passive copper on the surface of the metal are preferably coated electrolytically with copper before the treatment. —A. S.

Zinc blende ; Influence of steam and hydrocarbons on the roasting of ——. F. Thomas. Metallurgie, 1910, **7**, 610—613, 637—643.

BRIQUETTES were made from zinc blende with wet tar and powdered pitch, and then roasted in a steam-containing gas at a temperature of from 700° C. to 750° C., and the analytical results tabulated. It is shown that there is a considerable economy of fuel, and a high temperature was unnecessary. The absence of sintering at the lower temperature was beneficial, the sulphide being readily converted into oxide. A mechanical roaster was also found to give the best results.—A. H. C.

Mercury determination [in ores] ; Apparatus for ——. G. A. James. Eng. and Min. J., 1910, **90**, 800—801.

THE apparatus consists essentially of a nickel crucible having a closely-fitting silver lid, which latter is cooled by means of a small copper water-tank pressed into contact. The cooling vessel is connected with a half-gallon inverted bell jar by means of two vertical tubes, one extending nearly to the water level, and the other terminating near the bottom. In use 0·5 to 2 grms. of ore is mixed with an equal bulk of precipitated chalk, and four times its weight of clean iron filings, and placed in a crucible, which is supported in a hole in a ¼-inch asbestos board. The crucible is covered with the previously weighed silver lid, and the cooling vessel adjusted upon it, a drop of water being placed between them to ensure a satisfactory contact. The bottom of the crucible is maintained at a red heat for 15 minutes, and then allowed to cool, the increase in the weight of the silver lid representing the mercury content of the sample. If the film of water between the lid and the cooling vessel evaporates during the heating, it indicates that the heat has been excessive. The addition of the calcium carbonate is said to render the volatilisation of the mercury more uniform.—F. R.

Vanadium ; Preparation of metallic ——. W. Prandtl and B. Bleyer. Ber., 1910, **43**, 2602—2603. (See this J., 1909, 1202).

VANADIUM pentoxide can be reduced by the thermite reaction by mixtures either of aluminium and calcium, or aluminium and fluorspar in magnesia crucibles, and also by aluminium alone on a fluorspar hearth. Whichever method is used however, the resulting vanadium regulus never contains more than about 95 per cent. of vanadium. The deficit, therefore, does not consist of impurities introduced by the calcium, as the authors first thought, but must be practically all oxygen, as only traces of aluminium, silicon and iron could be detected. Probably a lower oxide of vanadium and metallic vanadium unite to form an alloy which withstands further reduction.—T. ST.

Radium ; Preparation of metallic ——. E. Ebler. Ber., 1910, **43**, 2613—2618. (See also Curie and Debierne, this J., 1910, 1111).

RADIUM-BARIUM bromide, containing 9 per cent. of radium bromide was dissolved in water and the carbonates precipitated by means of ammonium carbonate. The precipitate was filtered, washed, and whilst still damp, dissolved in the smallest sufficient quantity of an aqueous solution of pure azoimide. The solution was evaporated in a vacuum over sulphuric acid and caustic potash. There was thus obtained 0·6 mgrm. of a white crystalline substance which remained constant in weight and radioactivity when kept for 8 days in a vacuum over sulphuric acid. The substance was transferred as completely as possible into a narrow glass capillary tube, and again dried in a vacuum over sulphuric acid and caustic potash. The tube was then enclosed in a wider glass tube, the whole placed in a small specially constructed sand-bath and very gradually heated to 180—250° C. Both before and during the heating, the wider tube was connected with a mercury-pump. After this temperature had been maintained for several hours, a glistening metallic mirror was formed. The mirror was melted by means of a small pointed flame, and the radio-activity measured. The strength of the saturation current showed that about 73 per cent. of the radium (and barium) had thus been converted to the metallic state. The capillary tube was then cautiously broken in an agate mortar and extracted first with water and then with dilute hydrochloric acid. The extract was cautiously evaporated and the radio-activity of the chlorides measured, the value obtained being about of the same order as that of the original salt. To obtain the mirror in the above manner, it is absolutely necessary to obtain the azoimide compound quite free from moisture, and in heating, to raise the temperature very slowly. In a preliminary experiment the author proved that the barium salt of azoimide is unaffected by the radiations of radium. The results show that radium salts can be reduced to metallic radium without any loss of radioactive properties, and that metallic radium has properties analogous to those of metallic barium; hence the possibility that radium is not a true element appears to be excluded.—T. St.

Mineral production of British India in 1909. Board of Trade J., Nov. 3, 1910. [T.R.]

The following particulars relative to the mineral output of British India are taken from a report of the Geological Survey of India :—

The total value of minerals for which returns of production are available was returned as £7,499,228 in 1909, as compared with £7,861,935 in 1908, a decrease of 4·6 per cent. This fall in value does not denote any serious diminution in the activity displayed in exploiting the mineral resources of the country. The over-speculation of the previous years caused in 1908 an abnormal production of coal, the mineral mainly responsible for the decrease this year, leaving huge stocks to be disposed of in the following year, when, as a natural result, the average price per ton fell from 3 rs. 15 annas (5s. 3d.) to 3 rs. 8 annas (4s. 8d.).

The quantities and value of minerals raised in 1909, as compared with 1908, were as follows :—

—		1908.		1909.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Coal	tons.	12,769,635	3,356,209	11,870,064	2,779,865
Gold	ozs.	567,630	2,177,847	574,816	2,204,866
Petroleum	galls.	176,646,320	702,009	233,678,087	910,172
Salt	tons.	1,368,261	522,794 (*a*)	1,255,598	453,630 (*a*)
Manganese ore	,,	674,315	498,269 (*b*)†	642,675	508,483 (*b*)†
Saltpetre (*c*)	cwts.	386,199	292,758	404,946	296,838
Mica	,,	53,543	130,513 (*b*)	32,903	156,199 (*b*)
Jadestone (*f*)	,,	3,211	74,402	4,088	84,450
Ruby, sapphire, and spinel		..	47,954	..	58,649
Graphite	tons.	2,873	14,365	3,132	12,529
Tin ore	cwts.	1,906	11,015	1,672	9,645
Iron ore	tons.	72,300	15,149 (*d*)	83,456	16,563 (*d*)
Chromite	,,	4,745	6,338	9,250	5,767‡
Magnesite	,,	7,534	2,009 (*e*)	737	196 (*e*)
Diamonds		..	940	..	1,089
Amber		..	364	..	287
Total value		..	7,861,935	..	7,499,228

(*a*) Prices without duty. (*b*) Values of exports only. (*c*) Exports. (*d*) Estimated values for provinces other than Bengal. (*e*) Estimated values. (*f*) Exports from Rangoon in 1907–8 and 1908–9.

† Exclusive of exports from Mormugao. ‡Exclusive of the value of the output from Mysore, which amounted to 4,925 tons.

Russian platinum. Chem. and Drug., Nov. 12, 1910. [T.R.]

A Bill has just been introduced into the Russian Cabinet Council by the Minister for Commerce and Industry, which proposes both to prohibit the exportation of raw platinum and to erect State refineries in Russia. A considerable proportion of the Russian output of platinum is now refined abroad, a great amount being treated at Hamburg by the Norddeutsche Affinerie. Of the entire production only about 2 per cent. is refined in Russia. An outside firm has now a monopoly of the business, and has succeeded within quite recent years in increasing the price from 17,000 roubles to 41,000 roubles per pood. It is thought that this continuous and rapid advance will receive a severe check if exportation be prohibited and the refining operations be carried out under State control.

Mineral survey of Ceylon. W. R. Dunstan. Colonial Office Report No. 74 (price 3½d.). [T.R.]

The initial stage of the work of the Mineral Survey of Ceylon may now be regarded as largely completed. It is clear that the island contains, in addition to gem stones, a number of minerals of commercial importance, of which only graphite, mica, and thorianite are at present worked. The mining of graphite is on a large scale and in some cases is under European supervision. This mineral is an important article of export. Mica is mined to a small extent by primitive methods, and there is room for further enterprise in this material now that it is known that much of the Ceylon mica is of value for special purposes.

Thorianite is a new mineral discovered as a result of the operations of the Survey, and so far not known elsewhere than in Ceylon. Comparatively large quantities have been profitably exported in recent years and utilized in this country as a source of the thoria used in the manufacture of the incandescent gas mantle. Much remains to be done in discovering new localities in which this mineral is present, and also in devising better methods of recovering it from the river beds and alluvia in which it is known to occur.

Patents.

Iron and steel from oxide iron ores; Direct production of ——. W. S. Simpson and H. Oviatt, London. Eng. Pats. 9163, April 17, 1909; 10,790, May 6, 1909; and 25,152, Nov. 1, 1909.

Finely divided iron oxide ore is mixed with sodium or other chloride, and if necessary, sufficient silica and lime to form a readily fusible silicate and heated out of contact with air. In treating titaniferous iron ores from 2—6 per cent. or more of manganese dioxide is added. If steel is desired, sufficient carburising material and manganese dioxide are also added.—F. R.

[Bessemer] Converter ; Method of work in the ——. O. Thiel. Fr. Pat. 415,042. April 20, 1910.

In order to prevent, to some extent, the loss of a certain amount of iron which becomes oxidised and enters the slag, the charge in the converter is not treated in a single mass, but in separate quantities, the treatment being terminated by giving the blast to the whole charge. Taking, for example, a charge of 15 tons of cast iron, 12 tons were poured into the converter and subjected to a preliminary blowing lasting 7 minutes and to a final blowing which lasted for 1 min. 15 secs. The slag was then found to contain 11·44 per cent. of iron. The remainder of the charge being added, the blast was again passed for 2 mins. 5 secs., when finally the slag was found to contain only 8·16 per cent. of iron. The total time of blowing is less than that required when the charge is blown at one operation and greater charges may be employed, since a portion of the slag, which is unusually rich in phosphoric acid, may be removed before adding the second portion of the metal. It is not essential that this second portion be of the same composition as the first ; on the contrary it may be composed of a cast iron poor in phosphorus, and it may be accompanied, advantageously, by a certain proportion of iron ore, the amount of the latter depending of course on the conditions of working, but being in any case greater than that which has previously been added in practice.—C. A. W.

Armour plates ; Decarburisation of —— carburised in excess or not in excess. A. F. Mitchell and W. H. Jones. Fr. Pat. 415,337. April 28, 1910.

The plates, preferably containing not more than 0·5 per cent. of carbon, are carburised to a depth of $1\frac{1}{2}$ inch, so that the carbon content at the surface is increased to about 1·5 per cent. They are then arranged with the surfaces to be decarburised in contact with a layer of powdered silicon or finely-ground iron ore and heated to a temperature of about 1025° C. In this way the carbon content is reduced to about 0·1 per cent. at the surface, which becomes very soft. In order therefore to obtain an average hardness at that point, the plate may then be covered with some carboniferous material and heated to 975° C., the final result, after quenching, being a plate possessing a surface of average hardness (0·45—0·80 per cent. of carbon), a softer stratum below and a point of maximum hardness (0·9 to 1·1 per cent. of carbon) lying about $\frac{3}{4}$ of an inch beneath the surface. In consequence of the finer crystallisation obtained near the surface by this method, it is claimed that the plate is less liable to crack or scale during the manufacture, its working in the machine can be effected more rapidly, whilst, ultimately, it offers a greater resistance to the attack of a projectile.
—C. A. W.

Armour plates ; Manufacture of —— for ships and other uses, without cementation. A. Lucertini. Fr. Pat. 415,389, April 29, 1910.

The steel of which the plate is to be manufactured should preferably have the following composition : carbon, 0·88 ; silicon, 0·150 ; sulphur, not more than 0·03 ; phosphorus, not more than 0·03 ; manganese, 0·26 ; chromium, 3·40 ; nickel, 3·80 per cent. ; but these proportions may be slightly varied, so long as the sulphur, phosphorus and manganese contents are kept low. The ingot, immediately after removal from the mould, is slowly cooled to a temperature of about 450° C., care being taken to obtain a perfectly uniform temperature throughout the mass. The temperature of the ingot is then raised to about 750° C., diminished slowly to a dull red heat and again raised to 620° C., where it is maintained for several hours. The ingot, having advantageously received a further heating to a dull red heat, is then removed to the annealing furnace, care being taken to avoid any sudden variation of temperature. The rolling is commenced at a temperature of about 1150° C. and is effected in several periods, with small increases of pressure at each operation ; the plate is then taken back to the furnace, cooled slowly to about 400° C. and again heated to a temperature of 590°—610° C. The metal is now submitted to a series of annealings at high and low temperatures, and quenchings, in order to effect the transformation from a granular to a fibrous structure. The annealing at high temperature is effected between 750° and 900° C., and that at low temperature between 590° and 630° C., according to the results obtained on samples previously taken from the plates, the metal in each case being cooled to redness and then quenched at a low temperature. The operation being completed, as determined by rupture tests made on a series of samples, the plate is brought approximately to the shape desired, planed and polished to the exact thickness required and, after being heated to 600° C., curved in the press. Finally the two faces are heated and separately quenched, the upper face at about 860° and the lower one at 600° C. or even less. For the purpose of heating in this case, the plate may be supported in the furnace upon a metallic bed of scrap iron or rods varying in shape according to the curvature of the metal.—C. A. W.

Cementation of objects of iron, steel or steel alloys. Soc. Anon. Italiana Gio Ansaldo Armstrong & Co. Fr. Pat. 415,985, May 14, 1910. Under Int. Conv., April 13, 1910.

The objects to be carburised are placed in a receptacle of steel or some refractory material and surrounded with layers of granular wood charcoal. The chamber is provided with inlet and outlet pipes, and having been entirely filled with charcoal and closed, a slow stream of carbon dioxide is circulated through the mass, the speed of the current being varied according to the depth of cementation it is desired to obtain. The receptacle is then heated in a furnace to a bright redness (900° to 1100° C.) and maintained at a constant temperature for a fixed length of time (say two hours), easily determinable by previous experiment, when, finally, the current of gas is stopped and the charcoal removed through a small opening at the bottom. The objects can then be taken out and quenched in the ordinary manner ; but if it be desired to produce a deeper zone of cementation without obtaining at the same time too high a carbon content, the heating may be continued with only a small amount of charcoal, insufficient to cover the objects, in the retort. The same result can be obtained in the first case by mixing with the carbon dioxide a definite volume of air, in a proportion which is made the greater the lower the carbon content it is desired to obtain. Conversely, if a very high carbon content (up to 1·5 per cent.) be desired, it is only necessary to introduce into the receptacle, during the operation, larger or smaller quantities of some liquid or gaseous hydrocarbon, such as benzol, petrol or acetylene.
—C. A. W.

Iron or steel to prevent rusting ; Process for the treatment of ——. W. E. Bullock and J. Calcott, Coventry. Eng. Pat. 16,300, July 13, 1909.

The article to be treated is immersed in a boiling mixture of water, phosphoric acid, and iron filings, and an electric current passed through the mixture, the article being treated acting as the cathode.—F. R.

Iron or steel ; Treatment of —— to prevent oxidation or rusting thereof. The "Coslett" Anti-Rust Syndicate, Ltd., Birmingham, and T. W. Coslett, Northfield, Worcester. Eng. Pat. 22,743, Oct. 6, 1909.

About equal volumes of water and strong orthophosphoric acid are heated with sufficient finely divided iron to form a comparatively clear solution containing a large proportion of iron and only a small proportion of free phosphoric acid. Articles to be treated are subjected to the action of this solution after the requisite dilution, and the strength of the bath is maintained by the addition, from time to time, of a portion of the concentrated solution.
—F. R.

Ores ; Separation of metalliferous materials from their —— or other matter carrying same. J. D. Wolf, London. Eng. Pat. 15,469, July 2, 1909.

In Eng. Pat. 17,407 of 1904 (this J., 1905, 1300) it was proposed to separate metallic values from a mixture of finely divided metal and gangue by feeding the wet ore pulp on to a travelling belt coated with some viscous tacky material and inclined in the direction of its travel, the gangue and waste being washed away by a stream of water. It is now proposed to employ a belt inclined in a direction transverse to the travel. This belt is stretched between two rollers which are slightly inclined to the horizontal and fixed one at each end of a rigid frame, the frame itself being supported upon small metal pegs resting in cup bearings upon a second frame, so that, by means of a shaft and eccentric at the side, a lateral reciprocating motion can be given to the whole device. Means for giving a slight vertical motion are also provided. Beneath the machine, the belt is passed between two rollers, one of which serves to drive it and the other to cover its surface with the viscous oil or tacky material. The ore pulp is washed by a steam of water on to the belt at the highest side, so that, as the material travels laterally across the surface, the metalliferous bodies will be separated, the gangue and wash water pouring off from the opposite side at the bottom as the belt travels along. The operation is assisted by the laterally reciprocating motion emphasised in the opposite direction to the downward flow. It may be advantageous to divide the belt into two unequal portions by means of a longitudinal ridge and to cover with oil only that portion farthest from the ore-feeding attachment: a partial separation of metal is then made on the uncoated surface, the gangue and water passing over the ridge. The amount of lateral inclination to be given to the belt must be determined for each class of ore, the machine being adjusted as required.—C. A. W.

Metalliferous slimes; Apparatus for the treatment of ——. J. M. Holman, J. L. Holman and J. Coad, Camborne, Cornwall. Eng. Pat. 16,936, July 20, 1909.

The apparatus consists of a fixed convex table having a well at the centre, into which the slimes are delivered and from which they overflow on to the surface of the table. A rotating reservojr is provided, about the central well, divided concentrically into two parts, into which the slime and clean water are respectively divided. A radially arranged perforated launder, in connection with the water supply, is provided for washing off the "concentrates" when required.—F. R.

Magnesium and magnesium alloys; Purification of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 23,439, Oct. 13, 1909.

The magnesium or magnesium alloy is fused with an alkali chloride which has a melting point considerably higher than that of the metal to be purified. For this purpose, sodium chloride or potassium chloride may be employed, or any such mixture of the two as will conform with the requirements. The mass having been intimately mixed by stirring, it is allowed to cool until the chloride has solidified to a crust at the top enclosing all the impurities of the metal. The metal is then poured into a closed vessel, heated slowly to about 700° C. and maintained at this temperature, while a slow current of hydrogen is passed over the surface or, alternatively, while a vacuum is maintained in the vessel. In this way, any remaining traces of chloride rise to the surface and can be removed, a proceeding which is absolutely necessary, since any such traces would ultimately cause corrosion of the metal. —C. A. W.

Magnesium and magnesium alloys; Purification of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 23,440, Oct. 13, 1909.

Magnesium or magnesium alloys are purified from contamination with chlorides by passing hydrogen or other gas, inert to magnesium, through the molten metal or alloy at a temperature at which the chloride volatilises. The gas used may be purified by previously passing it through molten magnesium or over incandescent magnesium chips.—F. R.

Castings of magnesium or magnesium alloys; Manufacture of dense ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 23,441, Oct. 13, 1909.

Dense castings of magnesium or magnesium alloys are produced by maintaining the molten metal, for a few minutes, at a temperature a few degrees above its melting point, whereby the occluded hydrogen is able to escape. If desired, the metal may be poured into moulds and then maintained, for the necessary time, at the required temperature.—F. R.

Metals of the chromium group; Treatment of ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, New York. Eng. Pat. 3981, Feb. 17, 1910.

In order to reduce the diameter of the end of a rod or wire of tungsten, molybdenum or like metal, for the purpose of wire drawing, the end is dipped in a bath of a fused oxidising salt, such as sodium nitrite or nitrate, with if necessary, the addition of a diluent, such as sodium chloride or hydroxide, to prevent too vigorous an action.—F. R.

Separation and the pulverisation of materials [slags]. E. C. R. Marks, London. From Badische Maschinenfabrik und Eisengiesserei, Durlach i Baden, Germany. Eng. Pat. 8713, April 11, 1910.

Material containing a pulverisable and a non-pulverisable component, such as a slag containing metallic particles, is fed into a ball mill. The pulverisable component is crushed and discharged through a screen: the non-pulverisable material passes to the end of the mill where a helical blade carries it into a casing leading to a centrally situated discharge; the latter may be provided with a conveying worm to assist the discharge.—F. R.

[Open-hearth] furnace. A. Arthur, Buffalo, N.Y. U.S. Pat. 967,876, Aug. 23, 1910.

The patent consists essentially in providing a more durable port arch for open-hearth and other furnaces. The arch between the air and gas ports consists of a water-jacket having a refractory lining on the underside, the bricks of which are provided with a series of longitudinal ventilating conduits in contact with the water-jacket, stopping short of the front and rear ends of the arch. A transverse conduit connects the longitudinal conduits with the outside of the furnace.—F. R.

Metal salts and metals; Method of producing ——. J. W. Beckman, Niagara Falls, Ontario, Canada. U.S. Pat. 973,336, Oct. 18, 1910.

The metal is obtained from a compound, such as the impure oxide, by heating the oxide of the metal with calcium oxide in an electric furnace, so as to produce a calcium salt of the metal. The salt is maintained in a state of fusion in the furnace, additional oxide of the metal being supplied, and the fused salt electrolysed.—B. N.

Vanadium; Extraction of — *contained in chromium ores.* Jaboulay et Cie. Fr. Pat. 415,008, April 1, 1910.

The solution of alkali chromate and vanadate obtained in the manufacture of chromates and bichromates from chromium ores, or the mother liquor obtained after crystallisation, is rendered ammoniacal and mixed with a sufficient quantity of some manganese salt, such as the chloride or sulphate. The manganese vanadate which is precipitated may then be converted into vanadic acid or utilised directly in the electric furnace for the preparation of vanadium alloys, the manganese being easily volatilised at the high temperatures involved.—C. A. W.

Aluminium and its alloys; Galvanisation of ——. Akt.-ges. Mix und Genest, Telephon-und-Telegraphen-Werke. Fr. Pats. 415,123, April 22, 1910. (Under Int. Conv., Jan. 6 and 14, and March 1, 1910) and 415,228, April 26, 1910 (Under Int. Conv., March 24, 1910).

(1) After cleaning, the metal is put into a heated bath, feebly alkaline in reaction, containing borax, sodium

phosphate, soluble glass, etc., and afterwards coated in the usual manner. In order to further weaken the alkaline action, agents hindering the action, such as alcohols, gelatin, etc., are added. In lieu of the alkaline bath, one may be used composed of dilute acids of the halogen group, with the addition of polyhydric alcohols, such as glycerin, gelatin, or acids containing hydroxyl. (2) The metal is introduced for a short time, after cleaning, into a heated aqueous solution of chlorides or nitrates of polyvalent metals, such as chloride of iron, and afterwards coated as usual; or the bath may contain bromides, sulphates or alums of polyvalent metals, or chlorides of polyvalent metals, such as iron, mixed with ammonium chloride.—B. N.

Titaniferous iron ores; Method of fusion of —— producing two artificial ores, one rich, the other poor in titanic acid. J. J. Loke. Fr. Pat. 415,262, March 7, 1910. Under Int. Conv., Feb. 23, 1910.

THE ore, previously purified by magnetic separation so as to contain up to 80 per cent. of iron oxides, 16 per cent. of titanic acid and only 5 per cent. of gangue, is heated to a temperature of 1600° C. without the addition of carbon or other reducing flux. By this means, the greater part of the iron oxide is fused and sinks to the bottom of the crucible, whilst the titanic acid is eliminated and rises to the surface with most of the gangue, the operation being facilitated by stirring. The lower layer, consisting of iron oxide mixed with a small amount of titanic acid and gangue, can then be cast into moulds in order to form a hard and resistant material which it is proposed to call "rutiloke." As a secondary product, a mass consisting mainly of titanic acid, mixed with oxides of iron and gangue, is obtained.—C. A. W.

Furnace; Automatic roasting ——. Erzröst Ges. m. b. H. Fr. Pat. 415,672, May 6, 1910.

IN roasting furnaces possessing several superposed floors on which the ore is agitated by rotating arms provided with teeth, it is proposed to give the teeth on opposite halves of a stirring arm different angles of attack. The teeth on one half, as in the usual manner, are set at an angle opposed to those on the other, so that the slow advancement of the ore in a radial direction is determined by the difference of the projections of the angles of attack, a difference which can be made as small as desired. In this way, the arms can be revolved at a greater speed, so that the ore is stirred more energetically whilst at the same time it is advanced more slowly through the furnace. A smaller furnace or a greater quantity of ore can then be employed.—C. A. W.

Ores; Extraction of lead and zinc from mixed ——. E. Sanna. Fr. Pat. 415,639, May 6, 1910.

THE ore, reduced to grains of 1 to 1·5 mm. diameter, is treated in iron vessels for two hours with a boiling solution of caustic soda which dissolves the lead and the zinc. Oxide and carbonate ores can be treated directly, but sulphide ores must previously be mixed with a certain amount of carbon, and possibly limestone, and roasted at a moderate temperature in a reverberatory furnace. The solution of lead and zinc having been decanted through sand filters, it is pumped into an iron vessel in which are suspended zinc plates in circuit with the iron of the receptacle. In this way, the lead is separated in a spongy condition, so that it floats on the surface; it is collected, washed and fused. The residual solution is passed into a funnel-shaped zinc vat which contains in its interior a concentric funnel of iron functioning as an anode, the cathode being formed by the outer vat. A difference of potential of about 3 volts being maintained so as to obtain a current density of 10 ampères per sq. dm. of electrode, the zinc is obtained as a flocculent precipitate which is finally washed and compressed in steel moulds at a temperature of 100° to 110° C. It can then be melted without danger of spontaneous combustion.—C. A. W.

Copper or copper alloys; Method and apparatus for the treatment of scraps of ——. L. Jourdan and A. Gaillard. Fr. Pat. 415,760, May 6, 1910.

THE operation is effected electrolytically, the electrolyte being composed of a solution of a copper salt which is mixed, when scraps of an alloy are employed, with a salt of the metal associated with copper, such as zinc. The scraps are made into packets, which are placed in perforated receptacles of earthenware, porcelain or some other unattackable material. These packets, which form the anodes in the electrolysis, are so arranged as to emerge slightly from the electrolyte, the necessary connection with the dynamo being obtained through conducting plates pressed down on to the emergent surfaces by means of weights. The cathodes are formed by copper or lead gratings surrounding the earthenware vessels and presenting a surface which is made so small that a high current density is obtained during the operation. The metal is deposited in a pulverulent form upon the cathodes, from which it immediately becomes detached and sinks to the bottom of the vat. A number of electrodes are arranged in parallel within each vat, the vats themselves being connected in series to the dynamo. At the conclusion of the operation, the precipitated copper is washed through a hole at the bottom into a receptacle, the electrolyte together with the first wash water is poured back into the bath, whilst the metal, after cleansing, is separated by chemical means from any accompanying tin and employed in the preparation of copper oxide. When the electrolyte becomes too highly concentrated with the salt of the allied metal, its copper may be recovered by substituting anodes of carbon or lead for the metallic scraps previously employed, and conducting the electrolysis in the same manner as before.—C. A. W.

Zinc; Method for separating the —— from galvanised scraps by means of a zinc lye. T. Goldschmidt. Fr. Pat. 415,856, April 23, 1910.

THE galvanised scraps are cleaned and freed from solder, charged into perforated drums and treated in iron vessels with a boiling solution of zinc chloride. The zinc chloride solution is preferably slightly basic, being made to contain 25 parts (instead of 26 parts) of chlorine for each 24 parts of zinc; it is taken in such a quantity that its basicity at the end of the operation will be about 2 to 3 per cent. When no further hydrogen is evolved, the drum containing the scraps is removed and washed, the basicity of the residual solution being reduced to its original value by the careful addition of hydrochloric acid and the solution subsequently employed again. Only a small amount of iron is dissolved during the process, and this may subsequently be precipitated by means of calcium chloride.—C. A. W.

Ores; Production of metals by the reduction of —— and product obtained by the application of this method. S. E. Sieurin. Fr. Pat. 415,894, May 12, 1910. Under Int. Conv., May 15, 1909.

THE crushed ore, roasted or unroasted, in powder or in briquettes, is mixed with a solid reducing agent and charged into closed receptacles. If desired, the material may be arranged in alternating layers with the reducing agent, and, if the latter contain sulphur, a calcium compound such as limestone may be introduced in layers between the two or mixed intimately with the reducing agent. The mixture is now heated, with the exclusion of air, for some days, the reduction being effected without allowing the metal to melt. The product may then be separated from the reducing agent by mechanical means, such as sifting or fanning, or by the electromagnetic method. The reducing agent may be composed of coal or charcoal and may be rich in ash, since the latter will not contaminate the metal.—C. A. W.

Projectiles and other articles of steel; Hardening of ——. P. Girod, Ugine, France. Eng. Pat. 29,597, Dec. 17, 1909. Under Int. Conv., Jan. 23, 1909.

SEE Fr. Pat. 408,441 of 1909; this J., 1910, 637.—T. F. B.

Iron and steel; Direct production of —— from iron oxide ores. W. S. Simpson and H. Oviatt. Fr. Pat. 414,861, April 16, 1910. Under Int. Conv., April 17, 1909.

See Eng. Pat. 9163 of 1909; preceding.—T. F. B.

Zinc and lead; Separation of —— from mixed sulphides, ores, or products. C. A. L. W. Witter, Hamburg, Germany. Eng. Pat. 26,410, Nov. 15, 1909.

See Fr. Pat. 408,612 of 1909; this J., 1910, 635.—T. F. B.

Pyrophoric metal alloys. H. Beck, Oberhausen, Germany. Eng. Pat. 2876, Feb. 5, 1910. Under Int. Conv., Feb. 5, 1909.

See Fr. Pat. 414,057 of 1910; this J., 1910, 1210.—T. F. B.

Blast-furnace slag; Apparatus for granulating ——. W. R. Warren, New York. U.S. Pat. 974,003, Oct. 25, 1910.

See Eng. Pat. 4692 of 1910; this J., 1910, 1256.—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Lampblack; Electrophoresis of ——. A. Reychler. Bull. Soc. Chim. Belg., 1910, 24, 345—354.

Lampblack, purified by treatment with sulphuric acid and potassium bichromate, and then washed with hydrochloric acid and water, the washing being spread over a period of 15 days, furnished a product, which after removal of the first deposits, remained in suspension in water for more than a month. In the experiments upon the electrophoresis of such lampblack suspended in water, the liquid was placed into a special U-tube into the limbs of which were introduced the electrodes of a battery. The results obtained were in accordance with the deductions from Perrin's observations (J. Chim. Phys., 2, 601; 3, 50). In an alkaline medium ($\frac{1}{100}$, $\frac{1}{1000}$, or $\frac{1}{10000}N$) the particles of lampblack took a direction contrary to that of the current, collecting around the anode, whilst being repelled by the cathode. Acidification of the liquid by the addition of half its volume of $\frac{1}{100}$ or $\frac{1}{1000}$ N-hydrochloric acid caused the suspensions to be very unstable, and the liquids to become clear in the course of a few minutes, or at most, two days. In the slightly acidified liquids the tendency was still for the carbon to be deposited in the direction of the anode, whilst the addition of a larger amount of acid caused complete deposition of the carbon, and thus prevented the observation of cataphoresis, if any took place. With reference to the conclusions of Spring upon the detersive action of soap, which were based upon the results of experiments with lampblack (this J., 1909, 430), the author considers that they are not supported by sufficient evidence. For they require that the lampblack should invariably be deposited in the direction of the cathode, whereas the experiments described by the author show that that condition is certainly not fulfilled. —C. A. M.

The system, Oil—Water. (1). Groschuff. (2). Vosmaer. *See* IIa.

Electrolytic separation of nickel and cobalt. Bruylants. *See* XXIII.

Patents.

Secondary batteries; Electrodes of ——. H. Garde and A. J. Adams, London. Eng. Pat. 9066, April 16, 1909.

These electrodes for secondary batteries of the Faure or pasted type are first "grown" to their full extent by peroxidation, then reduced to spongy lead by electrochemical action, and finally rolled into the form of a double or multiple roll or spiral ready for insertion into the containing vessels.—W. C. H.

Active mass for the positive electrode of alkaline accumulators. Nya Ackumulator Aktiebolaget Jungner. Fr. Pat. 415,414, April 30, 1910. Under Int. Conv., May 13, 1909.

The active mass is prepared by mixing a solution of a salt of nickel or cobalt, with a solution of a salt of another metal, more basic than the former, preferably a compound of silver, mercury, cadmium or copper, and then adding a compound, such as caustic soda, which precipitates the oxides or hydroxides of the metals. The process may be varied by treating a solution of the sulphates of nickel and cadmium with a solution containing caustic soda and sodium chloride. B. N.

Heating liquids [electrically]; Means for ——. A. E. Coleman, London, and J. C. McClelland, Merton, Surrey. Eng. Pat. 22, 592, Oct. 4, 1909.

This device for heating liquids is especially applicable to solutions in electrolytic baths, and comprises an inner and outer casing, separated by heat-insulating material, immersed in the electrolyte. The inner chamber is provided with a number of compartments containing the means for heating, such as electric lamps or electric resistance wires, and the liquid circulates by convection around these compartments.—B. N.

Electric furnaces; Process for increasing the factor of work (cos ϕ) and the stability of ——. Norsk Hydro-Elektrisk Kvaelstofaktieselskab. Fr. Pat. 414,925, April 19, 1910. Under Int. Conv., April 21, 1909.

Two or more induction bobbins, connected in parallel, are mounted in series with the furnace, thus augmenting the factor of power (cos ϕ) and the inertia of electric furnaces, particularly in the case of those of considerable dimensions.—B. N.

Furnace; Electric —— with fixed electrodes. C. R. J. Louis. Fr. Pat. 415,507, April 29, 1910.

The furnace is provided with several contacts for one of the terminals, so that contact may be established with electrodes, fixed in the walls of the furnace at different heights, forming one of the poles, the second terminal being connected to the sole of the furnace forming the other pole. The intensity of the furnace may be thus regulated and the progressive heating of the material secured, whilst the gases formed in the reaction are completely utilised in the furnace.—B. N.

Furnace; Electric —— and process of charging it. Stora Kopparbergs Bergslags Aktiebolag. Fr. Pat. 415,548, March 17, 1910. Under Int. Conv., March 19, 1909.

The furnace consists of a crucible forming the chamber of fusion, and a tower-like chamber disposed above the crucible for the introduction of the charge, so that an annular space is formed in the crucible in which the electrodes are introduced. This annular space may be separated from the outside atmosphere by a suitable cover, provided with openings through which a portion of the charging material may be introduced. A phase of the current may be supplied through one or more electrodes in the base of the crucible.—B. N.

Electrolytic decomposition of solutions. C. P. Townsend, Washington, Assignor to The Development and Funding Co., New York. U.S. Pat. 972,947, Oct. 18, 1910.

See Fr. Pat. 345,871 of 1904; this J., 1905, 33.—T. F. B.

Carbon electrode for galvanic elements; Hollow ——. S. Benkö, Assignor to Company Limited for Exploitation of Inventions by Stephen Benkö, Budapest, Austria-Hungary. U.S. Pat. 974,016, Oct. 25, 1910.

See Eng. Pat. 12,677 of 1909; this J., 1910, 703.—T. F. B.

Electrolytic manufacture of sulphides, particularly zinc sulphide. Fr. Pat. 415,605. *See* VII.

XII.—FATS; OILS; WAXES.

Oils and fats from new and little known fruits. C. Grimme. Chem. Rev. Fett-Ind., 1910, **17**, 233—237; 263—269.

(A) *Oenocarpus batava* (Mart.), a large tree belonging to the palm family, is of frequent occurrence in tropical S. America, and bears a berry-like fruit which ripens all through the year. The edible fruit pulp contains seeds which, when dry, are brown on the outside but white in the interior. On extraction with ether they yielded 34·8 per cent. of a light yellow, odourless, slightly-drying oil, having a pleasant taste and known generally as "Comou" oil. The residue from the extraction contained 32·15 per cent. of proteins. (B) *Attalea spec.* Trees of this species belong to the palm family and are found throughout S. America from the mouth of the River Plate to Honduras. The egg-shaped fruits, which are of a brown or greenish-brown colour, are known to the natives as "Drupas." The seeds which were examined were from 3 to 5 cm. long and 1 cm. thick, and were either triangular or cylindrical with flattened sides. They yielded, on extraction with ether, 52·9 per cent. of a white, crystalline fat. The residue contained 19·2 per cent. of proteins. (C) *Virola venezuelensis* (Aubl.). As its name indicates this member of the *Myristica* family is indigenous to Venezuela. The brittle light-brown shell forms 17 per cent. of the almost spherical seed, the kernel being light brown in colour and having a marbled appearance when cut across. From the latter 74·7 per cent. of a light-brown crystalline fat was obtained. The residue contained 33·5 per cent. of proteins. (D) *Virola guatemalensis* (Warb.). The seeds of this *Myristica* are known in commerce as "African oil nuts." They are of an elongated egg-shape, about 20 mm. long and 12—15 mm. broad. The seed has two shells, the outer being extremely thin and brittle, whilst the inner is hard and, on the under side, closely attached to the kernel. The latter is of a brownish-grey colour and unlike most of the seeds of the *Myristicaceæ* is not aromatic. The seeds which were examined consisted of 14·6 per cent. of shell and 85·4 per cent. of kernel, the latter containing 60·7 per cent. of a light-brown crystalline fat. The residue contained 31·7 per cent. of proteins. (E) *Pongamia glabra* (Vent.). Owing to the wide distribution of this large leguminous tree throughout India, Southern China, and North Australia, it is known variously as *Gadelupa indica* (Lam.), *Gadelupa pinnata* (L.), *Dalbergia arborea* (Willd.) and *Caju gadelupa* (Rumph.). The seeds, which weigh on the average 1 to 1·25 grms. consist of 4·5 per cent. of a moderately thin shell and 95·5 per cent. of kernel. The latter contains 34·75 per cent. of an oil known under various names, but chiefly in England as "Pongam" or "Korung" oil. It is of a dark-yellow or light-brown colour, of buttery consistence and has a bitter taste. The residue contained 23·3 per cent. of proteins. (F) *Irvingia gabonensis* (Baill.) or *Irvingia barteri* (Hook.). This tree is indigenous to the West Coast of Africa from Sierra Leone to Gaboon. The fruit is known to the natives as "Dika," "Iba," or "Oba," and in literature as the African mango. It is a single-stone fruit, having a thick sarcocarp and a thick hard endocarp. The broadly elliptical seeds are covered with a thick felt of coarse yellow hair, and weigh about 6 grms., of which about half is shell. The kernels in shape and colour resemble large almonds. By boiling these with water and skimming off the separated fat the natives prepare the so-called Dika butter, which, at first white, becomes yellow with age and has the consistence of cacao-butter. On extraction with ether the kernels yielded 67·8 per cent. of a white pleasant-smelling crystalline fat. The residue contained 28·3 per cent. of proteins. (G) *Allophyllus racemosus* (L.) or *Schmedelia racemosa* (D.C.), a large tree belonging to the *Sapindaceæ*, is known in Ceylon as "Hangola-Del." The white, spherical seeds, which are about 1 cm. in diameter, have a thin outer skin which forms 9·25 per cent. of their weight. The greyish-brown kernels gave, on extraction with ether, 22·3 per cent. of a brown, crystalline, very hard fat. The residue contained 21·6 per cent. of proteins. (H) *Pentadesma butyracea* (Sab.), a large tree indigenous to West Africa and the islands of S. Thomé and Principe. Known to the natives as "Oba" or "Matapassa," it is also frequently described as the "butter" or "tallow tree." The fleshy, irregularly oval fruit is 10—12 cm. long and 7—9 cm. in diameter. The chestnut-coloured shell encloses a yellow edible pulp in which are found 2 or 3 chocolate-brown, irregular, flattened-oval seeds, 4—5 cm. long and 1—2 cm. broad, from which the natives prepare a fat known as Kanga butter. On extraction with ether, the seeds yielded 46·6 per cent. of a white, solid fat. The residue contained 6·4 per cent. of proteins. (I) *Garcinia balansae* (Pierre). This tree, which is one of the *Guttiferæ*, is indigenous to India. The cylindrical seeds, which are 2—3 cm. long and 1·5 cm. broad, are surrounded by a thin, brittle, light- to dark-brown shell which forms 4·8 per cent. of their weight. The kernels yielded, on extraction, 63·4 per cent. of a dark brown fluid oil. The residue contained 21·85 per cent. of proteins. (J) *Calophyllum inophyllum* (L.), a very large tree belonging to the *Guttiferæ* is dispersed over a wide area which extends from East Africa through the East Indies to Polynesia. It is commonly referred to in literature as the Alexandria laurel. The spherical fruits, known variously as "Laurel" or "Domba nuts" or as "Udilo" or "Dilo seeds," weigh about 6·5 grms. of which the shell forms 4·5 grms. The dried seeds yielded, on extraction with ether, 60·4 per cent. of a dark-green, feebly-drying oil, which had an aromatic smell. The green colour is due to the presence of a resin which can be removed by treating the oil with boiling alcohol or by shaking it with a dilute solution of sodium carbonate. After this treatment the oil is of a yellowish-brown colour. The residue contained 26·2 per cent. of proteins. (K) *Bertholletia excelsa* (H. et B.). This fine tree, belonging to the *Lecythiadaceæ*, is indigenous to the forests of the Orinoco and Amazon rivers, but is now largely cultivated in many parts of tropical S. America. The large capsular fruit contains, as a rule, from 16 to 20 triangular seeds which have two flat and one somewhat arched side. The rough, greyish-brown shell is hard and woody and contains an oily, white kernel. From the latter, which forms 43 per cent. of the weight of the seed, there was obtained, by extraction with ether, 65·8 per cent. of a slightly coloured, odourless and tasteless oil, which, on standing became cloudy, owing to the separation of glycerides of solid fatty acids. The residue contained 51·4 per cent. of proteins. (L) *Poga oleosa* (Pierre). This tree, which is indigenous to the West Coast of Africa, is known to the natives of Gaboon as "M'poga." It bears a four-celled stone-fruit, which has a fleshy exocarp and a very thick wooden endocarp. Only one seed is contained in each cell and frequently one or two of the cells are barren. The seeds, known as Inoy kernels, are about 2 cm. long and 1 cm. in diameter, the shell forming 25·8 per cent. of the whole weight. The kernels yielded to ether 55·3 per cent. of a thin, fluid, non-drying oil, which was light-yellow in colour and without taste or smell. The residue contained 44·83 per cent. of proteins. (M) *Telfairia pedata* (Hook.), a climbing plant belonging to the *Cucurbitaceæ*, which covers large trees with its vigorous growth, takes a prominent place amongst the oil-producing plants of East Africa, and is largely cultivated for its edible seeds. The highly characteristic fruit, which resembles a gigantic cucumber, being about a yard long, contains about 200 flat, disc-shaped seeds, known under the native names of "m'kungu" and "limabu." They have a light-yellow shell, about 2 mm. thick, which is closely covered with short hairs, and which forms 42 per cent. of the weight of the seed. The kernels yielded 60·75 per cent. of a thinly-fluid, yellow, pleasant-smelling, slightly-drying oil, known as Telfairia or Koëme oil. The residue contained 65·6 per cent. of proteins. (N) *Telfairia occidentalis* (Hook.). This climber very closely resembles *T. pedata*. The seeds consist of 31·2 per cent. of shell and 68·8 per cent. of kernel, which contained 48·2 per cent. of a dark-brown, viscous, semi-drying oil. The residue contained 59·2 per cent. of proteins. (O) *Citrullus spec.* The seeds which were examined came from South West Africa and belong to an unidentified member of this species. They were light-brown in colour, of a pointed egg-shape, 1 cm. long and 0·5 cm. broad. The very hard shell enclosed a glassy white kernel. On grinding up the whole seed and extracting the powder with ether, 11·8 per cent. of a light-yellow, odourless, fluid oil was obtained, which had a pleasant taste and possessed weak drying properties. The residue contained 10·4 per cent. of proteins. (P) *Oilnuts from Singapore.* The botanical source of these nuts, known in their place of origin as "boea Sieer," is undetermined, though it is probable that they are the fruit of one of the *Lauraceæ*. They resemble a hazel-nut in size and have a thin brown shell, which encloses an outwardly white, but internally light-green kernel, the latter forming 97·5 per cent. of the whole nut. By extraction with ether, the kernels yielded 38·5 per cent. of a greyish-green, crystalline fat. The residue contained 21·2 per cent. of proteins. The characters of the above-described oils and fats, and of the fatty acids therefrom are collated in the following table :—

	Oil or fat.							Fatty acids.								
	Sp. gr.	M. pt.	Solidif. pt.	n_D	Acid value.	Sapon. value.	Iodine value.	Insol. acids + unsap.	Unsapon.	M. pt.	Solidif. pt.	n_D	Neutralisation value.	Iodine value.	Mean mol. wt.
		° C.	° C.	at ° C.				per cent.	per cent.	° C.	° C.	at ° C.			
(A)	0·9248 (15°)	—7·5	—9·0	1·4691 (15°)	1·4	190·5	80·0	96·06	0·76	19·5	17·8	1·4502 (45°)	190·2	85·3	292·2
(B)	0·8692 (30°)	24·5	23·0	1·4527 (30°)	8·1	256·6	3·6	93·53	1·08	38·5	36·5	1·4304 (60°)	256·8	8·8	218·7
(C)	0·8996 (50°)	47·0	44·5	1·4541 (40°)	19·1	221·5	12·4	95·18	0·86	43·0	39·5	1·4482 (45°)	221·8	12·9	253·2
(D)	0·9005 (50°)	41·0	38·5	1·4539 (50°)	27·96	244·0	13·8	94·83	1·13	38·0	36·8	1·4486 (50°)	225·5	15·6	246·5
(E)	0·9289 (30°)	+2·0	+0·	1·4770 (25°)	42·28	185·1	77·3	91·18	8·16	43·5	42·5	1·4637 (50°)	180·1	78·8	308·7
(F)	0·9125 (50°)	41·3	39·9	1·4505 (50°)	3·98	241·2	4·3	94·38	1·43	40·8	38·1	1·4357 (50°)	254·8	14·5	218·3
(G)	0·8983 (75°)	63·0	61·0	1·4629 (60°)	136·7	242·2	39·4	95·76	2·31	62·0	60·5	1·4567 (60°)	226·5	39·9	248·0
(H)	0·9165 (30°)	42·0	38·5	1·4617 (25°)	26·4	197·0	42·3	96·10	0·92	57·0	54·5	1·4429 (60°)	198·7	42·8	279·7
(I)	0·9127 (15°)	8·6	3·2	1·4682 (49°)	19·9	176·3	86·2	93·18	4·23	32·5	30·3	1·4564 (60°)	161·8	89·1	341·4
(J)	0·9415 (15°)	7·5	4·5	1·4772 (15°)	67·5	198·7	95·3	78·3*	0·35	36·5	32·5	1·4654 (45°)	192·3	94·8	289·0
(K)	0·9180 (15°)	+0·	—2·5	1·4643 (25°)	79·4	202·0	98·3	96·82	0·85	29·5	27·0	1·4528 (45°)	196·7	99·2	286·6
(L)	0·9085 (15°)	—4·0	—5·0	1·4700 (15°)	4·2	177·5	91·1	95·83	0·35	28·0	24·5	1·4499 (45°)	153·5	93·6	362·1
(M)	0·9185 (15°)	10·0	8·5	1·4686 (15°)	2·44	186·5	84·2	96·20	0·34	43·5	41·8	1·4492 (50°)	209·1	86·7	265·8
(N)	0·9135 (50°)	—1·0	—2·5	1·4763 (20°)	61·54	262·2	43·4	96·29	0·38	42·0	39·5	1·4613 (50°)	221·0	45·9	251·5
(O)	0·9158 (15°)	—10·0	—11·5	1·4751 (15°)	6·52	195·6	119·5	95·9	9·28	34·0	33·0	1·4568 (45°)	194·5	122·3	285·8
(P)	0·9021 (50°)	440	41·5	1·4549 (40°)	52·06	169·5	38·9	95·85	1·37	55·0	53·5	1·4424 (55°)	207·2	38·2	268·3

* Contained 18·26 per cent. of a saponifiable resin.

—J. A.

Oil seeds from the French colonies; New ——. M. E. Heckel. Les Mat. Gras., 3, No. 29. Chem. Rev. Fett-Ind., 1910, 17. 273—274.

The fruits of *Garcinia mangostana* (L.), which is of frequent occurrence in India, Cochin-China, Madagascar and the Seychelles, are much prized on account of their highly palatable pulp. This contains one or two kernels which yielded on extraction with carbon bisulphide 45 per cent. of a highly-coloured fat containing 2 per cent. of unsaponifiable matter.

Pongro, Couchoun, or Koesambie oil is obtained from *Cambodge pongro* seeds. The shell of these forms 35 per cent. of their weight, the kernel yielding to carbon bisulphide 62·7 per cent. of an oil having the sp. gr. 0·924 at 15° C. The oil appears to contain a fatty amide, since ammonia is formed on treating it with an alkali or sulphuric acid.—J.A.

Palm oil; Utilisation of —— as an edible fat. E. Fickendey. Tropenpflanzer, 1910, 14, 566—570.

Since the problem of treating the fruit of the oil-palm by means of machinery has been satisfactorily solved, the attention of the manufacturers of margarine has been directed towards the utilisation of palm oil. Hitherto, however, all attempts in this direction have been unsuccessful, not because of the orange colour, which can be readily removed by means of oxidation, but on account of the high proportion of free fatty acids. When the fully ripe fruit is broken up and extracted with ether, the acid value is invariably extraordinarily high. If, however, the fruit is first heated to 90° or 100° C., the acid value of the extracted fat is very low. Thus four samples of the fresh fruit yielded fat with an acid value of 94·5 to 116·0, whilst when the extraction was made after 24 hours the acid value was 146·5; and 147·2 after 48 hours. The same fruit after a preliminary heating yielded fat with an acid value of 1·8 to 5·3. The formation of free fatty acids in the fat in the fresh fruit is to be attributed to the action of an enzyme, but attempts to cause the enzyme to act upon other oils such as linseed and cottonseed oil were unsuccessful. These experiments prove that it would be possible to put a good palm oil upon the market provided that the following conditions were observed: (1) Use of fresh completely ripe fruit; (2) destruction of the lipolytic enzyme by boiling; (3) rapid treatment of the fruit. The last condition is important since micro-organisms rapidly act upon the fat in the heated fruit.—C. A. M.

Oils; Absorption spectra of ——. R. Marcille. Ann. Falsif., 1910, 3, 423—425.

There is no essential difference between the absorption spectra of different vegetable oils, apart from the intensity. Leaving out of the question the yellow colouring matter, which absorbs more or less of the rays, the only spectroscopically active substance is chlorophyll, or one of its derivatives, which gives a spectrum with its chief band at 665 or at 652. These chlorophyll derivatives are present in oils in very variable proportions. Some oils, such as arachis and cottonseed oil, contain only slight traces thereof, whilst others, such as linseed oil (for painting), industrial castor oil, olive oil, and olive marc oil, contain considerable amounts. In cold-drawn oils the chief absorption band is at 665, whilst in the case of oils that have been heated in the presence of water, the principal band is at 652. In the case of certain oils, again, such as sesamé and industrial castor oil, the band extends from 665 to 652, and this is shown to be due to the incomplete action of heat and water. Since olive oil is the only common edible oil containing a high proportion of chlorophyll it is possible to detect by means of its absorption spectrum with the principal band at 665, as little as 10 per cent. of that oil in a mixture of other oils giving a faint chlorophyll reaction. Heat alone does not appear to alter the spectrum of olive oil, and the characteristic bands were obtained with the oil in which tunny fish had been preserved. In the case of the oil from sardine boxes the spectrum was less pronounced.—C. A. M.

Electrophoresis of lampblack. Reychler. *See* XI.

Patents.

Oil; Extraction of —— from the residues derived from the decortication and bleaching of rice. Hércules y Cia. Fr. Pat. 415,226, April 26, 1910. Under Int. Conv., May 11, 1909.

The residues from the decortication, bleaching, etc., of rice are ground to powder, heated and expressed in a hydraulic press, and the expressed oil passed through a filter.—C. A. M.

Fuller's earth: Process for utilising spent ——. N. Sulzberger, New York. U.S. Pat. 968,092, Aug. 23, 1910.

Fuller's earth or other mineral substances that have been used in deodorising and decolorising oils or fats may be rendered again commercially available by saponifying the absorbed fat, so as to yield a soapy compound. If desired, the water may be evaporated and the product obtained in the form of a dry powdered detergent.—C. A. M.

Manufacture of alcohol, using oleaginous grains and residual cakes from oil factories. Fr. Pat. 415,535. *See* XVIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Linoxyn; The iodine value of ——. F. Wilhelmi and Meister. Chem. Rev. Fett-Ind., 1910, **17**, 260—262.

The author states that the best solvent for oxidised linseed oil (linoxyn or serim oil) is glacial acetic acid, the degree of oxidation determining the solubility therein, since highly oxidised oils are only partially soluble even in the hot acid. Nevertheless, glacial acetic acid is to be preferred to chloroform and the other solvents generally used in determining the iodine value, although the end reaction with highly oxidised oils is not so distinct as in ordinary cases, the mixture being greenish instead of colourless. Results of experiments are quoted in which the percentage increase in weight of boiled linseed and wood oils through absorption of oxygen, and the concurrent decrease in iodine value, are compared.—J. A.

Axin, a Mexican lac. H. Bocquillon. J. Pharm. Chim., 1910, **2**, 406—407.

Axin is a waxy secretion of a Mexican rhynchotrous insect, *Llaveia axinus*, which feeds on *Spondias lutea*, *Xanthoxylum clava-herculis*, and *X. pentanome*. When fresh, it has a butter-like consistence, an odour of rancid fat, and a yellow colour. It melts at 38° C., and is soluble in hot alcohol and in ether. It rapidly absorbs oxygen when exposed to the air, becoming dark brown, hard, and insoluble in the above solvents. It is readily saponified; Hooffer has extracted from it a definite substance, "axinin," which yields axinic acid and glycerol on hydrolysis. Axin is obtained by first washing the insects to remove dust and the down with which they are covered, then heating them in water and removing the supernatant melted wax. A further yield is obtained by pressing the residual insects. In its properties of darkening and hardening on exposure to air, axin closely resembles Japan lac. It forms an excellent lacquer for wood and metals, and is used by the natives as a varnish for pottery.—J. O. B.

"Ye-no-abura," a Japanese oil from the seeds of Perilla ocimoides, and its use in manufacture of lacquer. Oil Paint and Drug Rep., Oct. 28, 1910.

The U.S. Consul General at Yokohama reports that Ye'no'abura is derived from the seeds of the *Perilla ocimoides*, an annual plant, which resembles the *Perilla pekinensis*. Sandy soil is favourable to the cultivation of the plant, and the yield is estimated at twenty bushels of seeds per acre. The annual production throughout Japan amounts to an average of 325,000 bushels, from which over a gallon of oil per bushel is extracted. The oil is retailed at 1s. 6d. per sho (0·4766 gallon), and is used in the manufacture of paper umbrellas, lanterns, oil papers and artificial leather. It is also used in preparing materials for the manufacture of printer's ink, paint, varnish and lacquer. Refined lacquer contains 85 per cent. of lacquer and 15 per cent. water and organic matter resembling rubber. The juice dries by absorbing oxygen, but this takes place only when the atmosphere is damp. On adding a little glycerin, the drying process requires only two hours, whereas, under normal conditions, more than ten hours are necessary. Alcohol is used in melting the material.

The gum is sold direct to the dealers in lacquer, who refine the raw material themselves. It is first passed through a filter made of cloth into a porcelain or wooden receptacle. The waste remaining in the sieve is rejected, and the gum which may still adhere to its sides is mixed with the yeno abura and strained again into the receptacle. The resulting liquid is exposed to the air and, after being carefully stirred for a day or two, it attains a standard thickness. Heat is used to evaporate the water which may remain. Colouring matter, kneaded with Ye-no-abura, is added to the material while it is raw.

Lacquer production in Japan. Oil, Paint and Drug Rep. Oct. 28, 1910.

The usual method of collecting lacquer in Japan is to tap the trees about nine inches above the ground, although occasionally the trees are cut down. Four days after the first collection of gum the trees are tapped again. This process is carried on throughout the season—July to September. The trees used, are generally fifteen years old. A large tree is estimated to produce 90 grms. while a small tree produces only 56 grms. of the gum. There are three different grades of gum—(1) Ro-iro uru-shi, a superior quality, of a greenish black colour, non-adhesive, and almost transparent when applied as a paint; (2) se-shi-me uru'shi, an inferior quality, brown colour, and, owing to its adhesive properties, used for jointing, but not for painting; (3) hana-uru-shi, a medium quality, resembling both the above in colour and in adhesiveness, and purified by filtration through thin paper. The lacquer is produced in the Tochigi, Aomori, Nara, Ibaraki, and Ishikawa prefectures. The Chinese product is still imported, owing to the gradually increasing demand for the domestic market. The imports of raw juice, principally from China, amounted to 1,294,285 lb., valued at £43,972 in 1908. The following statement shows the production of lacquer in Japan in 1903, 1906, and 1907, the latest for which statistics are available:—

	1903.	1906.	1907.
Number of trees	2,815,382	2,857,341	2,858,607
Quantity produced .. lb.	431,700	665,850	812,720
Value of production	£32,360	£51,819	£67,990
Number of houses engaged	1,441	1,123	1,086

(See also this J., 1908, 456; 1910, 639 and 1119.)

Patents.

Preserving preparations [paints, etc.]. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,010, Oct. 8, 1909. Addition to Eng. Pat. 10,073 of April 28, 1909 (see Fr. Pat. 403,103 of 1909; this J., 1910, 33).

The modification of the original claim consists in replacing the salts or anhydrides of mercury-substituted organic acids by metallic salts (calcium, copper, or lead) of mercury-substituted phenols, cresols, sulphonic acids, etc., and the anhydrides of oxymercuric phenols, cresols, anilines, toluidines, etc.—G. W. McD.

Pigments and process of making the same. A. Moffatt, Indianapolis, Ind. U.S. Pats. 973,373 and 973,374, Oct. 18, 1910.

Barium sulphate is obtained in an extremely fine state of subdivision by fusing natural barium sulphate with an alkali sulphate, such as sodium sulphate, cooling the fused mass and dissolving out the alkali sulphate from the barium sulphate by means of water. The pigment body, prepared as above, is claimed.—B. N.

Lead carbonate [white lead]; Process for the manufacture of basic ——. H. Hof and B. Rinck. Ger. Pat. 226,245, Jan. 1, 1910.

Materials containing lead sulphate, for example the sludge from sulphuric acid chambers, is treated with a concentrated solution of alkaline-earth chloride, preferably the final magnesium chloride liquor obtained in the manufacture of potassium salts, the mixture being boiled and agitated. On cooling the resulting solution, a double chloride of lead and alkaline-earth metal (*e.g.* $2MgCl_2,PbCl_2,13H_2O$) separates. This is suspended in water, treated with the requisite quantity of slaked lime, and carbon dioxide led into the mixture until the liquid is no longer alkaline. The liquid is now drawn off, and the residue suspended in water, and agitated therewith for 4 hours at about 80° C., whereby a basic lead carbonate of high covering power is obtained.—A. S.

Rust-preventing paints; Process for preparing and using ——. E. Liebreich. Ger. Pat. 226,630, Feb. 1, 1910. Addition to Ger. Pat. 203,957, May 11, 1907.

In working the process described in the chief patent (see Fr. Pat. 391,084 of 1908; this J., 1908, 1122), it has been found that the use of substances which yield ammonia, presents certain disadvantages. In such cases therefore it is now proposed to add also substances which will react with any liberated ammonia to form an ammonium salt and a non-volatile or less volatile base, and so prevent the formation of bubbles in the paint film.—A. S.

Rosin oil; Process of extracting —— from wood tar "goudron." J. Ljubarski. Fr. Pat. 414,919, April 18, 1910.

The stem and other parts of the tree that produce the tar (*goudron*) are cut into pieces and extracted with a boiling solution of an alkali. The alkali rosin soap is then dried and distilled to separate the rosin oil, after which the alkali may be recovered and used again.—C. A. M.

Artificial oil of turpentine; Process of manufacturing ——. R. Valette. Fr. Pat. 415,218, July 6, 1909.

The light fractions obtained in the distillation of crude petroleum oil, and especially those distilling between 70° and 120° C., are treated successively with sulphuric acid, with an aqueous solution of sodium bisulphite and with water rendered slightly alkaline, each washing being separated by decantation after each treatment. They are then thoroughly washed with water, and dried by shaking with calcium chloride. The petroleum spirit thus purified and deodorised is mixed with natural turpentine oil, to which has been added a small quantity of camphor, colophony, and terpene, so that the mixture shall have the same specific gravity as natural turpentine oil.—C. A. M.

Elastic products and substitutes for natural lacquers or varnishes; Processes for the preparation of ——, *and products obtained thereby.* L. C. T. Turcat and G. Nuth, Neuilly sur Seine, France. Eng. Pat. 23,668, Oct. 15, 1909. Under Int. Conv., Oct. 16, 1908.

See Fr. Pat. 404,357 of 1908; this J., 1910, 225.—T. F. B.

Bluish-red azo dyestuff suitable for preparing lakes fast to light. Eng. Pat. 22,289. *See* IV.

Preventing changes produced in the autoxidation of caoutchouc, gutta-percha, colours, varnishes, etc. Fr. Pat. 416,177. *See* XIV.

XIV.—INDIA-RUBBER ; GUTTA-PERCHA.

Rubber production in America and Asia. D. Sandmann. Gummi-Zeit., 1910, **25**, 49—50. (See this J., 1910, 578.)

The author discusses the relative prospects of wild and plantation rubber. In 1909 America produced two-thirds of the world's supply of wild rubber, mostly in the Amazon region; 80 per cent. is harvested rationally; 20 per cent. is Caucho from Castilloa trees. The cost of production is estimated at 4½ milreis per kilo. (2s. 7d. per lb.) varying with the cost of living. If this could be improved the author considers that the cost might be brought down to M. 1·60—1·70 per kilo. (8½d.—9½d. per lb.). The possibility of increase of production is small. Planting will not be of much avail as the difficulty is rather lack of labour than of trees. Concerning the half million acres planted in Asia it is noted that the cost per acre per day should not exceed about M. 2 (1s. 11½d.). Here again the problem will be to find sufficient workers: two millions will be required, and it is always necessary to bear this in mind.—H. E. P.

Rubber: Critical investigations on the analytical methods for raw ——. O. Korneck. Gummi-Zeit., 1910, **25**, 4—9, 42—46, 77—88.

Working under the direction of Harries on eleven different sorts of rubber, the author has compared the various methods which have been proposed for the analysis of raw rubber. He concludes that:—(1) Spence's method furnishes very similar results to the modified nitrosite method (see below). (2) The tetrabromide method (Budde, this J., 1909, 1149) in its present form does not yet appear suited for the quantitative determination of rubber. (3) All other methods examined cannot be compared with the above. Spence's method consists essentially in estimation of resin by complete extraction with acetone, determination of insoluble matter by solution in benzene without limitation of time, and estimation of rubber by evaporation of the filtered solution of the resin-free rubber. The methods mentioned in (3) include those of Schneider (this J., 1903, 885), Fendler (alcohol precipitation, this J., 1904, 1117, modified by the use of carbon tetrachloride as solvent as recommended later by Fendler and Kuhn), and Fendler-Harries (nitrosite method, Ber. deutsch. Pharm. Ges., 1904 [5]). The author especially emphasizes the importance of treatment till the weight remains constant, instead of for a specified time, in both vacuum drying and acetone extraction. It is shown that the resins must be quantitatively removed in the Fendler-Harries method. Fendler prescribes 6 hours' extraction, but the author urges that this is not sufficient for all rubbers. The new form of Harries' nitrosite method (which obviates this difficulty) is as follows:—1 grm. of finely divided technically pure rubber (best dried and acetone-extracted) is dissolved as far as possible in 75 c.c. of benzene in a beaker. Nitrous fumes are passed in till a dark green colour is obtained, stirring meanwhile to break up the precipitate. After settling a moment the clear green solution is decanted through a Gooch crucible. The precipitate is washed with benzene several times, 75 c.c. of benzene are added, and nitrous fumes are again passed. The beaker and leading tube (covered with a clock glass) are allowed to stand for 24 hours. The precipitate is kneaded together, pressed on the walls of the beaker, the clear green solution decanted through the Gooch crucible and the precipitate washed with benzene till the filtrate is colourless. The nitrosite is then transferred to the crucible and washed with absolute ether till a homogeneous, fine bright yellow powder is left. The beaker, tube, nitrosite and crucible are dried for half an hour *in vacuo* and then at 80° C. in an ordinary oven till of constant weight. 50 c.c. of acetone are then placed in the beaker, which is warmed on the water bath till nothing more dissolves. The liquid is filtered through the Gooch crucible and the precipitate washed with acetone. The beaker, tube and crucible are again dried till of constant weight; the difference gives the weight of nitrosite. Pure rubber = Nitrosite × $\frac{136}{289}$. The nitrous fumes are prepared from nitric acid (sp. gr. 1·3) and arsenic trioxide in pieces the size of hazel nuts. The flask, provided with a dropping funnel, is warmed in an air bath at first and afterwards cautiously with a small flame. The gas is passed through a washing-flask to remove nitric acid and is then dried over phosphorus pentoxide. The values obtained for pure rubber by this method when added to those for insoluble matter (Spence method) and resins (in this case determined by a new method using ozone), approximate very closely to 100 per cent., whereas the values for pure rubber by Budde's method are from 1·5—10 per cent. lower.—H. E. P.

PATENTS.

Caoutchouc; Method and apparatus for separating —— from resinous products. General Caoutchouc Co., Ltd. First Addition, dated April 23, 1910, to Fr. Pat. 404,307, June 22, 1909 (this J., 1910, 225).

A GLASS tube is introduced in the pipe through which the solvents are decanted off from the mixing machine, so that any turbidity can be detected.—G. W. McD.

Caoutchouc, gutta-percha, colours, varnishes and similar crude or manufactured products; Process of preventing the changes produced in the autoxidation of ——. E. Benjamin. Fr. Pat. 415,177, April 25, 1910.

THE substances are treated either in the course of manufacture or in the finished state with aromatic nitrogenous compounds (neutral or basic), or with heterocyclic compounds (neutral or basic), or with alkaloids, or mixtures of these bodies, with the object of preventing the deterioration produced in time by the action of light and air. Thus, 10 kilos. of crude rubber in small pieces may be mixed with 450 grms. of aniline and left for 24 hours. Or a vulcanised rubber article may be immersed in a 10 per cent. solution of dimethylaniline in benzene, and dried before use. The addition may also be made to the latex from which the rubber is prepared. The nitrogenous compounds may also be applied in the form of vapour. In the manufacture of linoleum suitable quantities of aniline may be added to the thickened linseed oil, or the finished article may be treated with a solution of one of the suitable nitrogenous compounds.—C. A. M.

Natural gum contained in manufactured rubber; Process of extracting ——. C. P. Bary. Fr. Pat. 415,213, July 6, 1909.

VULCANISED rubber is extracted with "liquid" hydrocarbons boiling below 130° C. (*e.g.*, naphthalene or xylol) at a relatively low temperature, and either at the atmospheric pressure or under a pressure not exceeding 3½ atmospheres. During the process of extraction a substance capable of combining with the liberated sulphur may be introduced, such as *e.g.* metals or oxides of metals that will form oxysulphides. The solution is then decanted and the dissolved gum may be separated by evaporation of the solvent or by coagulation by means of a substance such as acetone, which dissolves the naphthalene but not the gum.—C. A. M.

Caoutchouc; Method of manufacture of a composition similar to ——. zu Aichlburg. Fr. Pat. 415,542. *See* XV.

XV.—LEATHER; BONE; HORN; GLUE.

PATENTS.

Leather; Tanning of ——. F. R. Kron, Sydney, N.S.W. Eng. Pat. 13,133, May 31, 1910.

LEATHER which has been tanned by the ordinary wattle bark process is well dried and immersed in a bath, at 110°—140° F., of wattle bark liquor of about 45° Barkometer, to which has been added gambier and oak extract. After three days' soaking the leather is removed, allowed to drain and again immersed for 4—7 days. A small quantity of picric acid added to the bath improves the colour of the leather, which is subsequently rinsed, scoured and finished in the usual manner. It is claimed that the treatment results in a more even-coloured leather which is mellower and less liable to spread and freer from odour than would otherwise have been the case.—D. J. L.

Tannic extracts and tannic acid; Process for the preparation of ——. P. M. Justice, London. From Nitritfabrik Akt.-Ges., Cöpenick, Germany. Eng. Pat. 14,861, June 20, 1910.

ACCORDING to Eng. Pat. 16,440 of 1909 (this J., 1910, 227) decomposition of tannic acid during the lixiviation process was prevented by a preliminary heating of the tanning material in a dry state. The same effect may be produced by exposure, in the cold, to sulphurous acid gas. The sulphurous acid is afterwards expelled by sterilised air to avoid the formation of sulphuric acid in the liquor. Solutions thus obtained may be kept for a long period even in a dilute state without decomposition. —D. J. L.

Currying or other treatment of skins in a rotating drum; Method of ——. Vulcano Tanning and Machine Co. Fr. Pat. 415,661, May 6, 1910. Under Int. Conv., May 7, 1909.

THE skins are attached to the periphery of the interior of the drum in such a way as to hang in the form of a sack or bottle. As they rise from the liquid by the movement of the drum, quantities of the solution are raised in the interior of the skins on account of the method of suspension. Rapid penetration of the currying material, etc., is produced by the forcing of the liquid through the skins in addition to the usual drumming effect. The skins may be fastened in addition to a point near the axis of the drum in such a way as to remain in a radial position during the whole revolution of the drum, in which case the fastening is not rigid as this would result in possible damage to the skins by the weight of liquor carried up by them. The distance between the suspending devices on the periphery and the axis is adjustable, to allow of the treatment of skins of different sizes.—D. J. L.

Elastic or resilient masses [from gelatin]; Production of ——. W. Plinatus, Paris. Eng. Pat. 9609, April 20, 1910. Under Int. Conv., Sept. 6, 1909.

GELATINOUS substances, *e.g.* gelatin and appropriate solvents, are treated with aldehydes containing more than one carbon atom in their molecule (or their polymerisation products) or with similar compounds from which such aldehydes may be separated. Suitable compounds for this purpose are acetaldehyde, unsaturated aldehydes, and particularly acrolein. Or a mixture of such aldehydes with tannin or its condensation products may be employed. It is stated that the elastic masses thus obtained are more elastic than those obtained with formaldehyde, and do not undergo the deterioration commonly shown by the latter.—C. A. M.

Caoutchouc; Method of manufacture of a composition similar to ——. F. zu Aichlburg. Fr. Pat. 415,542, March 2, 1910. Under Int. Conv., March 6, 1909.

GLUE or gelatin is mixed with glycerin, and a precipitant (such as formaldehyde, salts of chromium or tannin), is added in conjunction with a soluble salt of aluminium. The following substances and quantities are mentioned as being added to 100 parts of glue or gelatin. An aluminium salt (2 parts), and either formaldehyde (4 parts) or formaldehyde (2 parts) and tannin (4 parts). An aluminium salt (4 parts) and either a chromium salt (6 parts), or formaldehyde (2 parts) and a chromium salt (2 parts).—G. W. McD.

XVI.—SOILS ; FERTILISERS.

Alkali soils ; Irrigation waters. G. S. Fraps. Texas Agric. Exp. Station, Bull. No. 130, 1910, 1—29.

Data regarding the occurrence and nature of alkali soils in Texas are given together with the results of investigations respecting the irrigation of such soils. Ordinary "alkali" consists essentially of sodium sulphate, sodium chloride, and sodium carbonate; other salts, calcium chloride for instance, may also be present. "Alkali" is produced by the decomposition of rocks. Generally, the salts produced are washed out of the soil by rain, but in arid climates the rainfall is not sufficient to serve this purpose and the salts accumulate. Irrigation waters which contain much alkali or which are improperly used may give rise to alkali, and the rising of ground water to within a few feet of the surface, so that the soil is subirrigated, is in arid regions a sign of danger that alkali may accumulate. The most effective method of utilising alkali soils is by means of flooding and underdrainage. In order to prevent accumulation of alkali, evaporation must be checked, and the main movement of the water must be downwards through the soil so that the soluble salts are washed into the country drainage. Alkali occurs in many districts in Texas, even in humid districts, but the land affected is generally small in area. The effect of alkali on certain plants is described, and analyses are given of waters used for irrigation.—W. P. S.

Calcium phosphate ; Solubility of —— in saturated solutions of carbon dioxide containing ammonia. B. Foster and H. A. D. Neville. Chem. Soc. Proc., 1910, **26**, 236.

The solubility of calcium phosphate, and of the phosphates in commercial phosphatic manures, was determined in saturated solutions of carbon dioxide containing ammonia. With increasing quantities of ammonia the quantity of phosphate passing into solution increases at first rapidly, and then more slowly, the solubility of phosphate then being almost directly proportional to the amount of ammonia present.

Patent.

Calcium cyanamide powder ; Process of granulating commercial ——. A. d'Ercole, Rome. U.S. Pat. 973,019, Oct. 18, 1910.

See Fr. Pat. 396,358 of 1908 ; this J., 1909, 666.—T. F. B.

XVII.—SUGARS ; STARCHES ; GUMS.

Starch ; Colloidal properties of ——. F. Bottazzi and C. Victorow. Atti. R. Accad. dei Lincei, Roma., 1910, [5], **19**, II, 7—14. Woch. f. Brau., 1910, **27**, 575.

The authors prepare their starch as follows :—Pure commercial starch is suspended in water and mixed with 60 per cent. caustic potash solution, heated for 3 hours at 100° C. and mixed with twice the volume of 96 per cent. alcohol. The mass is broken up after twenty-four hours, washed with alcohol and dissolved in a little hot water. The cold solution is again precipitated with alcohol and the precipitate, after washing, dried *in vacuo*. A two per cent. solution is dialysed till free from alkali, whereby amylopectin is precipitated while amylose remains in solution with a little amylopectin which is precipitable by addition of acid. The solution under the influence of high tension currents shows decided migration of particles towards the anode. This migration is inhibited in presence of *N*/200 caustic soda or *N*/1500—*N*/2000 sulphuric acid. By addition of acid to the starch solution the amylose and amylopectin are separated. Solutions of these, submitted to dialysis till free from acid, differ in that the amylose shows no electrolytic migration while the amylopectin does. Amylose thus differs markedly from the ordinary colloids although undoubtedly belonging to this group of substances. It appears to be a transition product between the crystalline saccharides and the colloidal polysaccharides.—R. L. S.

Dextrins ; Method of investigating the colorations produced by iodine in the presence of ——. G. Rivat. Chem.-Zeit., 1910, **34**, 1141.

Iodine shows a greater affinity for dextrins than for starches, for, whereas even a very dilute solution (0·00012 grm. of iodine per c.c.) gives an immediate and intense coloration with starch free from dextrins, in the presence of these it is the dextrins which are first coloured by such dilute solutions, and, moreover, the amounts of iodine required to produce equal colorations in two solutions are found to be a measure of the relative quantities of dextrin present. It is found also that the more fully hydrolysed and depolymerised dextrins, such as achroodextrin, absorb iodine without giving a colour, and that, in general, the appearance of colorations with the less advanced dextrins (amylo- and erythrodextrin) requires more iodine, the greater are the amounts present and the more strongly they are hydrolysed. A dilute solution of iodine is suggested, therefore, as a valuable reagent for the detection and study of these substances.—F. Sodn.

Starch-iodine reaction. Harrison. *See* XXIII.

Patent.

Sugar manufacture ; Method of ——. H. C. Christianson, Fanwood, N.J. U.S. Pat. 968,327, Aug. 23, 1910.

In this process the very finely divided impurities present in crude sugar solutions are removed in stages by passing the juice through an apparatus consisting of a number of concentric conical chambers with perforated walls, each chamber rotating at a higher peripheral speed than the next chamber inwards. The solution is thus subjected to a continuous rapid rotary and centrifugal action at successively and progressively increasing rates of speed, and the impurities displaced at each stage of increase are separated and collected, whilst the solution at the final highest stage of centrifugal action is caused to pass through a fine filtering medium, such as paper. The peripheral speed of the cones is of considerable importance : the first or inner cone should travel at a speed of not less than 9,800 feet per min. nor over 10,250 feet per min. at its largest diameter, whilst the outermost cone should travel at 16,100—16,900 feet per min. at its largest diameter. The number of cones provided may vary according to the nature of the impurities, but six is a convenient number, these various cones having the effect of classifying the impurities according to their specific gravities. The filter paper is arranged to cover the apertures of the outer chamber or "basket."—J. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Malt analysis (coloured malt and caramel) committee, 1910 ; Report of the —— of the Institute of Brewing. J. Inst. Brew., 1910, **16**, 529—533.

The committee was appointed to select certain standardised methods for the commercial estimation of extract and colour of coloured malts and of colour of caramel. The methods selected are as follows :—

Brown and crystal malt.—*Extract* :—50 grms. of the sample shall be ground in a Seck mill so set that there is a distance of 0·5 mm. (measured by a feeler gauge) between the rolls, and the grist mashed with 300 c.c. of distilled water at 158° F. and 100 c.c. of cold water malt extract (prepared from a well modified pale malt of diastatic power 30—40° [Lintner] by digestion with three times its weight of distilled water for one hour at 60—70° F., and subsequent filtration) previously heated to 150° F. The mixture shall be kept for one hour at 150° F., then cooled to 60° F., made up to 515 c.c., shaken, filtered and the specific gravity taken. The necessary correction for the cold water malt extract employed shall be obtained by diluting a volume of 100 c.c. of the malt extract with 300 c.c. of water, the mixture being kept at 150° F. for one hour. Subsequently, it shall be cooled to 60° F., made up to 500 c.c.;

filtered, and its specific gravity taken. The extract shall be stated, to the nearest first place of decimals, in lb. per standard quarter of 336 lb. *Colour* :—A volume of 20 c.c. of the above extract, which must be brilliant, shall be diluted to 100 c.c. and the colour read in a 1 inch cell, using a Lovibond tintometer and glasses of the "52" series.

Black barleys and malts.—*Extract* :—A little over 50 grms. of the sample shall be finely ground in a coffee mill, and of this 50 grms. shall be extracted with about 350 c.c. of boiling distilled water. The infusion shall be kept in a bath of boiling water for one hour, after which it shall be cooled to 60° F., made up to 515 c.c., shaken, filtered and the specific gravity taken. *Colour* :—20 c.c. of the above extract diluted to 1000 c.c. shall be read in a 1 inch cell using a Lovibond tintometer and the "52" series of glasses.

Caramel.—*Colour* :—10 grms. of the sample shall be dissolved in distilled water and made up to 100 c.c. at 60° F. Of this solution 10 c.c. shall be diluted to a litre and the colour read as in the other cases. The committee remark that it is now recognised that the distance between the rolls of different Seck laboratory mills when set at 25° is not invariable, and further that it increases with wear. They find by direct examination of a number of mills that 25° corresponds to an average distance, measured with a feeler gauge, between different parts of the rolls of 0·5 mm., and recommend that mills for malt analysis should be used set by gauge to this distance and not by the maker's scale.—R. L. S.

Malt ; Determination of sulphuring of ——. O. Reinke. Chem.-Zeit., 1910, **34**, 1159.

The sulphuring of malt can be estimated by distilling an aqueous extract with phosphoric acid in a current of carbon dioxide. The sulphur dioxide is absorbed in an iodine solution, and the resulting sulphuric acid precipitated with barium chloride. To make the extract, 100 grms. of whole grain and 300 grms. of water are allowed to stand for three hours and then 200 c.c. are filtered off. Only malt containing over 0·001 per cent. of sulphur dioxide can be considered to be sulphured. It often happens that a sample which gives no barium precipitate when tested by the above method, gives a brown stain on lead acetate paper, when tested qualitatively with zinc and sulphuric acid. In these cases the colour results from the action of organic bodies.—T. St.

Invertase. H. Euler, E. Lindberg and K. Melander. Z. physiol. Chem., 1910, **69**, 152—167.

Invertase may be obtained from the yeast cells in which it is contained either by drying them and extracting with water or by allowing the pressed yeast to liquefy by autodigestion. Both these methods have been shown by previous observers to yield very active preparations which, however, have not hitherto been directly compared. The authors have prepared such solutions and find that the same yield of enzyme is obtained by either method but that by autolysis it is obtained in far more concentrated form. By repeated treatment of such a solution of invertase with kaolin and charcoal, and precipitation by alcohol, a crude invertase was obtained, containing nitrogen 0·36 per cent., carbon 42·3 per cent. and ash 2·07 per cent., which was more active than any preparation that has previously been described. 0·05 grm. of the product dissolved in 5 c.c. of 0·5 *N* sodium dihydrogen phosphate when added to 20 c.c. of a 20 per cent. solution of sucrose reduced its optical activity to zero in 14 minutes at 20° C.—R. L. S.

Beer yeast ; Modification of the properties of top-fermentation. F. Schönfeld. Woch. f. Brau., 1910, **27**, 541—542, 553—556.

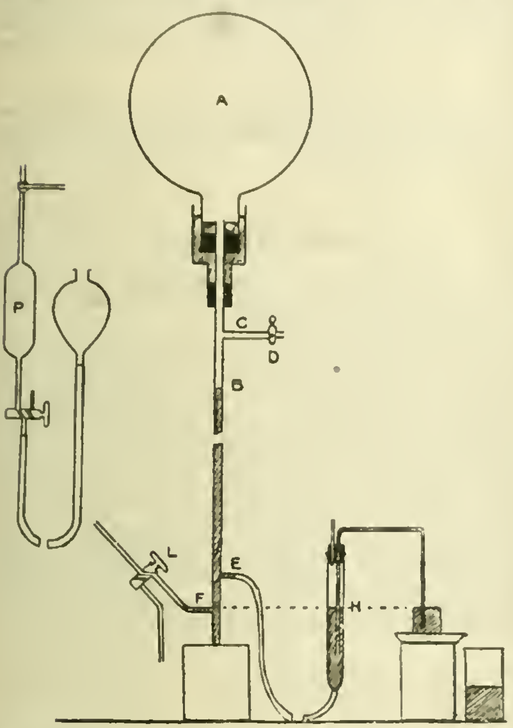
One of the most noticeable differences shown by various races of yeast is in the tendency to "break," or form aggregates of cells, at a certain stage of the fermentation. In some yeasts this is well marked whereas in others there is no tendency to "break" and the beer remains turbid after fermentation is complete. The author shows that top-fermentation yeast of strains which "break" well, lose the property after a score or so of generations grown at 30° C., and suggests that it is the high temperature to which the fermentations are allowed to rise which has, in so many cases, deprived English brewery yeasts of this property. He shows further that the "break" is acquired by yeasts which have been stored under beer for some months at temperatures approaching 0° C.—R. L. S.

Waste yeast ; The biological disposal of ——. W. J. Dibdin. J. Inst. Brew., 1910, **16**, 535—541.

Examination of growths of yeast subjected to the full activity of cultures of bacteria, such as are present in biological beds dealing with normal sewage, the higher *infusoria*, such as *carchesium*, *anguillula*, etc., and moulds such as the *mucors* has failed to detect any cell which could be said to have been penetrated by these organisms. The living processes of the yeast cells were in an active state except that no budding occurred. On the other hand dead cells, from which the contents become liberated, at once become a prey to the organisms. From these considerations it is clear that for biological disposal the yeast cells must first be killed. The death of the cells appears to be hastened by the presence among them of other living organisms such as those mentioned. It is evident, therefore, that the natural method of effecting the disposal of waste yeast is to spread it in thin layers on surfaces supporting the maximum number of living organisms, such as the various bacteria, *infusoria*, *anguillulæ*, and moulds, which must be kept suitably moist and aerated, when budding of the cells will cease and disintegration take place according to the usual routine of biological action. The yeast in suspension is run into beds, from 3—5 feet deep, containing shelves of rough slate, $\frac{3}{4}$—1 inch apart, supported on slate blocks. The bed is started with humus from a sewage bed in full working order which is allowed to settle on the plates and deposit the organisms which will afterwards consume the yeast. If the yeast settles badly from suspension, lime and iron must be added just before it is run into the bed. After allowing sufficient time for sedimentation to take place, 1—2 hours is ample, the water is drawn off and the outlet left open for drainage and aeration until it is required to refill the bed. The effluent from the slate beds should be passed on to fine contact beds. It is calculated that with slates 1 inch apart, 680 cubic yards of bed are necessary to dispose of 1 ton of pressed yeast *per diem*.—R. L. S.

Fermentation ; Apparatus for collecting and measuring the gases evolved during ——. A. Harden, J. Thompson, and W. J. Young. Bio-Chem. J., 1910, 5, 230—235.

When the amount of gas evolved in a fermentation is comparatively small a Schiff's nitrometer may be used. The fermentation flask fitted with a three-way tap is connected by glass and rubber tubing, using as little of the latter as possible, with the delivery inlet of the nitrometer. The reservoir of mercury is fitted with a doubly-bored stopper, one hole of which is fitted with a siphon, the other with a small pressure bulb. The siphon communicates with a beaker which can overflow into a basin. The top of the beaker is on a level with the delivery inlet of the nitrometer, and the top of the reservoir is a little higher than this. The nitrometer is filled with mercury and the siphon started by the pressure bulb. The fermentation flask is connected by means of the three-way tap. The mercury displaced by the gas produced, flows into the reservoir, thence by the siphon into the beaker, the gas being thus collected at a constant pressure. When the nitrometer is filled with gas, the three-way tap is closed, the reservoir filled with mercury, and raised to fill the nitrometer in the usual way. The reservoir is replaced in its original position, the siphon started, and the fermentation flask again connected. If larger quantities of gas, 3—7 litres, are evolved, an apparatus constructed on the same principle (see fig.) is used. The graduated portion of the nitrometer is replaced by a calibrated vertical tube, B, about one metre in length and 10 mm. diameter. This is sealed at the lower end and provided with a gas inlet, F, connected by a three-way tap, L, with the fermentation flask, and an outlet, E, for the mercury connected to a reservoir, H, maintained at constant level by a siphon.



Near the top of the vertical tube is a side tube, C, and stop-cock, D, connected with a Fleuss pump. The top of the tube projects by about 2 cm. through the rubber stopper of a large inverted bolthead flask, A. This joint is sealed within and without with mercury as shown. The lower connection tubes and the reservoir are filled with mercury and the large flask exhausted as far as possible, the mercury in the vertical tube rising to nearly the height of the barometer at the time. The fermentation flask is connected and fermentation allowed to proceed, causing the mercury in the vertical tube to fall. Knowing the volume of the tube and flask, the pressure inside the flask can be ascertained from the height of the mercury in the tube and hence the gas evolved corrected to normal pressure. Samples for analysis can be withdrawn through the side tube, C, and collected in the pipette, P. The apparatus has the advantage that large amounts of gas can be collected and measured over mercury without using unmanageable amounts of the latter.—F. Sodn.

Alcoholic fermentation ; Action of nitrates in ——. A. Fernbach and A. Lanzenberg. Comptes rend., 1910, **151**, 726—729.

Contrary to the general opinion, that nitrates exercise a harmful influence in alcoholic fermentation, the authors find, in experimenting with various yeasts, that nitrates either increase the rate at which alcohol is produced or are without influence. The increased activity is associated with the zymase and is not due to greater vitality of the yeast itself ; in fact, the yeast cells multiply at a much slower rate as the proportion of nitrate is increased.
—F. Sodn.

Manganese ; Detection and determination of —— in wine. Dumitrescou and E. Nicolau. Ann. Falsif., 1910, **3**, 407—410.

Manganese must be regarded as a normal constituent of wine, since it has been found in all kinds, both white and red. The proportions of manganese recorded have varied from 0·12 mgrm. to 27 mgrms. per litre, but there is always a relationship between the amount of manganese in the soil and that found in the wine. The determination may be rapidly made by means of the ammonium persulphate method (see also this J., 1910, 1224).—C. A. M.

Currants ; Production of alcohol and calcium tartrate from Greek ——. A. Haury. Z. Spiritusind., 1910, **33**, 525—526.

Currants, which are unsuitable for food, have been employed in Greece for the manufacture of spirit. The author describes the process and apparatus formerly used in an Italian currant distillery working the diffusion process. The diffusers, 20 in number, consisted of wooden tuns, narrower at the bottom than at the top, and provided with false bottoms of perforated copper plates. A freshly charged tun was filled up with hot water, which was allowed to remain in contact with the currants for 2 hours, the juice being drawn off to a reservoir at a density of 34°—35° Balling. The tun was filled up again with hot water for 1½ hours and a second running drawn off at a density of 20°—22° Balling. The juice went to the fermentation tuns, and was made up at a density of 14° Balling. Fermentation started at 20°—22° C. and finished at about 36° C. in 32—35 hours. Distillation was effected in a continuous rectifying apparatus, and the quality of the spirit was very good. From the spent wash calcium tartrate was precipitated by means of dilute milk of lime. The currants contained from 50 to 55 per cent. of sugar, and yielded 28·5—33 litres of absolute alcohol per 100 kilos. ; the yield of calcium tartrate, containing 50—51 per cent. of tartaric acid, amounted to 2·5—2·8 per cent. of the weight of the currants.—J. F. B.

Ethyl alcohol in presence of methyl alcohol ; Detection and determination of ——. G. Denigès. Bull. Soc. Chim., 1910, **7**, 951—952.

The process, which is based upon the fact that ethyl alcohol is readily oxidised to acetaldehyde by means of bromine water, whereas methyl alcohol, under similar conditions, is not appreciably affected, consists in heating a mixture of 0·2 c.c. of the alcohol and 5 c.c. of bromine water (0·3 c.c. of bromine in 50 c.c. of water) in a boiling water bath, for 5—6 minutes unless the colour is discharged sooner, then cooling the mixture and, if still coloured, adding commercial sodium bisulphite solution (36°—40° B.), diluted to one-fifth, drop by drop, until the colour just disappears, and finally adding 5 c.c. of bisulphite-fuchsin solution and allowing the mixture to stand for 5—8 minutes. In the presence of ethyl alcohol, a red or reddish-violet coloration is developed, the intensity of which is proportional to the amount of alcohol present, and the method, which allows the detection of 1 per cent. of alcohol, may be made quantitative by comparing the colour with a standard. The fuchsin solution is best prepared by adding 10 c.c. of sodium bisulphite (30° B.) to 1 litre of an aqueous solution of fuchsin (0·1 per cent.), and, when the colour has become faint, adding 10 c.c. of concentrated hydrochloric acid. For very small quantities, a blank experiment with pure methyl alcohol is made for comparison. Ethyl alcohol is detected in the absence of methyl alcohol, or in the presence of only a small proportion of the latter, by adding an equal volume of methyl alcohol to the sample to be tested, and in examining very dilute solutions of ethyl alcohol (0·05 to 3 per cent.), the mixture to be heated is made by adding 0·2 c.c. of methyl alcohol and 0·03 c.c. of bromine to 5 c.c. of the alcohol.—F. Sodn.

Colorations produced by iodine in presence of dextrins. Rivat. *See* XVII.

Patents.

Alcohol from maize, grain, vinaceous materials, molasses, coal and the like ; Process for obtaining ——. S. Fabbri, London. Eng. Pat. 27,713, Nov. 29, 1909.

A saccharified mash is sown with yeast and there are added 1—10 per cent. of sugar and 10—15 per cent. of pit coal. After 48 hours the fermentation is completed and 1—3 per cent. of calcium oxide is added ; distillation is effected 2 hours later. According to another process the coal is powdered and mixed with 50 per cent. of water to which is added 1—10 per cent. of sugar, the whole being heated at 140° F. for 3 hours. The wort is fermented with yeast for 48 hours at 120° F. and 1—3 per cent. of calcium oxide is added before distillation. The coal provides nitrogenous compounds and antiseptic hydrocarbons and phenols to the fermenting wort.—J. F. B.

[Brewing] Circulation in a liquid; Production of —— by means of gases. A. Aumann, Iversgehofen, Germany. Eng. Pat. 1224, Jan. 17, 1910.

Claim is made for a process of using carbon dioxide of fermentation, or other gas, to effect the circulation and mixing of liquids, especially fermentable liquids. The bunghole of a fermentation cask is fitted with a screw bung carrying a tin pipe which extends to the centre of the cask and is perforated at the bottom. Outside the cask, the bung is fitted with a lantern-like glass cylinder, which contains a float sliding on a vertical guide rod. The top of the cylinder communicates with a chamber provided with two valved openings, one of which leads to the external air or to a gas meter, whilst the other communicates with the space between the screw bung and the tin pipe. The carbon dioxide which collects in the upper part of the cask above the fermenting liquid, forces the liquid through the tin pipe into the glass cylinder; the float rises until it strikes a stop on the guide rod, whereby the valve leading to the external air is closed and the other valve is opened. The gas now escapes from the cask through the space between the screw bung and the tin pipe to the chamber above mentioned, and thence into the upper part of the glass cylinder, whereby the liquid previously forced into the cylinder, is now expelled, through a pipe at the bottom of the cylinder, to the bottom of the fermentation cask. The float falls until it strikes a stop at the bottom of the guide rod, whereby the valve communicating with the external air is opened and the other valve is closed. The gas again accumulates in the space in the cask above the fermenting liquid (a space which should amount to 50—100 litres) and the cycle is repeated. The pipe which leads the liquid from the cylinder to the cask is provided with a check valve. The cask may be modified in that it is fitted with two horizontal, perforated partitions forming a chamber separated from the bottom of the cask and from the surface of the liquid; the solid portions of the mash are thus prevented from settling to the bottom of the cask and from rising to the surface of the liquid. The liquid returned to the cask is introduced into this intermediate chamber.—L. E.

Alcohol; Manufacture of ethyl —— using oleaginous grains and residual cakes from oil factories. J. Jean and D. de Vulitch. Fr. Pat. 415,535, July 15, 1909.

The grains or cakes, from which most of the oil has been extracted in the factory, are freed from the remainder of the oil by being heated with a volatile solvent, preferably carbon tetrachloride, under a pressure of 1—3 kilos. The grains or cakes are separated from the solvent, and freed from the last traces of the latter by being subjected to the action of a current of steam. They are then heated with phosphoric acid (15—25 grms. of acid per litre of water) in an autoclave under a pressure of 3—6 kilos. The saccharine liquor thus obtained is neutralised with tricalcic phosphate or phosphatic chalk; the liquor is filtered off, fermented, and distilled; the solid residue is dried, and constitutes a phosphatic and nitrogenous manure.—L. E.

Wines of a definite colour-intensity; Process for obtaining —— based on the use of sulphurous compounds and of pitching yeasts containing aldehydes. V. Martinand. Fr. Pat. 415,841, Apr. 13, 1910.

The must expressed from the grapes is treated with sulphurous compounds (sulphurous acid, sulphites, and alkali bisulphites) in amount corresponding to the coloration desired; this amount is determined by trial experiments with samples of the must. The mixture of sulphited must and marc is allowed to stand for some hours, the must then being drawn off and fermented with a large quantity of yeast. The pitching yeast may be prepared from wine yeast cultivated in such a way as to contain acetaldehyde, or the yeast may be treated with acetaldehyde or other aldehyde. The aldehyde combines with the sulphurous acid, and the coloration, due to the colouring matter of the grapes, appears.—L. E.

Utilisation in the preparation of foods of weak worts and spent goods from fermentation and distillation. Fr. Pat. 415,073. *See* XIXa.

XIXa.—FOODS.

Milk; Sterilisation of —— by ultra-violet rays. P. H. Römer and T. Sames. Hyg. Rdsch., 1910, **20**, 873—877. Chem. Zentr., 1910, **2**, 1397.

Milk was exposed in a layer 1·5 cm. deep, in a small quartz flask, to the rays from a quartz mercury vapour lamp (6 ampères) at a distance of 15 cm., a reflector being also used. The number of micro-organisms in the milk was considerably diminished by exposure to the rays. After 20 minutes, mould fungi, cocci, and rod bacteria, with and without spores, could be detected; some of these produced peptonisation. When butter fat is exposed to ultraviolet rays its iodine value becomes lower; the effect on the fat in milk and cream is much less pronounced, owing to the presence of substances in colloidal solution which hinder the action of the rays. Ultra-violet rays destroy the oxydase of milk, but the reductase which produces the formalin-methylene blue reaction is more resistant.—A. S.

Milk; The oxidation-index of ——. T. Jona. Bull. Soc. Medico-Chirurgica di Pavia, 1910. Chem. Zentr., 1910, **2**, 1328.

Five c.c. of milk are diluted to 500 c.c. with water, and 10 c.c. of the diluted milk are heated with 20 c.c. of sulphuric acid (1 : 5) to 60°—70° C. on the water-bath, and $N/10$ permanganate solution run in, drop by drop, until a red colour permanent for 10 minutes is obtained. The number of c.c. of permanganate used, referred to 1 c.c. of milk, is called the oxidation-index. A similar determination is made with the milk-serum prepared by treating 100 c.c. of milk with 2 c.c. of 20 per cent. acetic acid, heating in a boiling water-bath under a reflux condenser for 10 minutes, rapidly cooling, and filtering through a dry filter. The oxidation-index of skimmed milk is low, but that of the serum is normal. With watered milk, on the other hand, the indexes of both the milk and the serum are low. Milk which has been both skimmed and watered also gives low indexes both for the milk and the serum, and the difference between the two values is much less than usual. In the case of the milk supplied in the neighbourhood of Pavia, Italy, the oxidation index was 43—45 for the milk and 36—38 for the serum; the limiting values for milks from individual cows were 41—48 for the milk and 32—40 for the serum. On skimming the milk, the oxidation index fell to 42, 40, and finally to 37; whilst on watering, the following values were obtained:—

Water, per cent.	10	20	30	40	50	60	70	80	90	100
Index of milk	38	33	28	24	20	16	12	8	4	0
Index of serum	33	29	25	21	17·5	14	10·5	7	3·5	0

—A. S.

Lactose and fat in milk; New method for the determination of ——. T. Jona. Bull. Soc. Medico-Chirurgica di Pavia, 1910. Chem. Zentr., 1910, **2**, 1328—1329.

The author has found that the fat extracted directly from milk consumes just as much permanganate as corresponds with the difference between the oxidation-indexes (see preceding abstract) of the milk (43—45) and of the serum (36—38). Hence, by determining the number of c.c. of $N/10$ permanganate, consumed by 1 c.c. of the milk and by 1 c.c. of the serum, and multiplying the difference between the two values by 0·49 (a factor found by direct experiments), the percentage of fat is obtained. In the case of the serum, the consumption of permanganate is due to the lactose, and the number of c.c. of $N/10$ permanganate needed for 1 c.c. of the serum, when multiplied by 0·1401, gives the percentage of lactose in the serum. It is stated that 1 c.c. of $N/10$ permanganate oxidises approximately equal quantities of lactose, sucrose, and dextrose.—A. S.

Caseins and curds. A. Burr. Milchwirts. Zentralbl., 1910, **6**, 385—394. Chem. Zentr., 1910, **2**, 1236—1237.

The average composition of a number of samples of commercial casein examined by the author was: water, 10·38; dry substance, 89·62; fat, 1·89; casein, 79·45; and ash 6·51 per cent. In four samples of acid-casein prepared by the author, the water content varied from 5·55 to 8·65 per cent., dry substance, 91·35—94·45; fat, 0·005—0·075; and ash, 0·0 per cent.; the nitrogen content of the dry substance free from fat and ash was from 15·58 to 15·63 per cent., the casein factor being 6·40—6·41. In four samples of rennet-casein (paracasein) also prepared by the author, and dried at 99°—102° C., the water content was from 0·60 to 2·97 per cent., dry substance, 97·03—99·40; fat, 0·08—0·55; and ash, 5·00—8·55 per cent. the nitrogen content of the dry substance free from fat and ash was 15·64—15·74 per cent. The composition of 15 samples of curd prepared by the combined action of rennet and acid was: water, 73·08—80·03 (mean, 76·70): dry substance, 19·97—26·92 (23·30); fat, 0·36—1·10 (0·66); ash, 1·18—2·18 (1·59) per cent. Curd to be used in sour milk cheese making should contain at the most 60—64 per cent. of water. Curd prepared by means of rennet, or mainly by the action of rennet, when only a few days old may contain a relatively large quantity of lactose: from 2·22 to 4·29 per cent. was found, for example, in fatty curds containing 47·70 to 58·81 per cent. of water and 22·35—36·03 of fat.—A. S.

Wheat flour; Effects of bleaching upon the digestibility of——. E. W. Rockwood. J. Biol. Chem., 1910, **8**, 327—340.

Results obtained during an investigation of the digestibility of flour which had been bleached by means of nitrogen peroxide are recorded. Tests were made on a number of samples, a bleached and an unbleached specimen of the same sample of flour being tested at the same time and in the same manner. Moist, uncooked gluten obtained from bleached flour was found to be digested by pepsin-hydrochloric acid as rapidly as that from unbleached flour, whilst pancreatin solution digested the gluten from bleached flour more readily than that from unbleached flour. Cooked gluten from bleached flour was also more rapidly digested, both by pepsin and pancreatin, than was cooked, unbleached gluten. Bread made from bleached flour did not differ in digestibility from that made with unbleached flour: the nitrite-reacting substance almost, or altogether, disappeared before the bread was removed from the oven. The starch was also unaltered by the bleaching treatment, that is, as regards the rate of its digestion or inversion by pancreatin, ptyalin, or diastase.—W. P. S.

Saccharin; Detection and determination of——in foods rich in fat, starch, and proteins. M. Tortelli and E. Piazza. Z. Unters. Nahr. Genussm., 1910, **20**, 489—494.

In the method proposed the saccharin is extracted from the material by means of a mixture of alcohol and sodium chloride solution; the fat is then removed from the extract by extraction with petroleum spirit, and the saccharin is finally separated by means of a mixture of ether and petroleum spirit. The details of the process are as follows:—A weighed quantity of the sample is mixed with about 18 grms. of fine sand and 10 grms. of slaked lime (liquids are evaporated to the consistence of a paste after the addition of the sand and lime) and the mixture is extracted four times with quantities of 50 c.c. of boiling 95 per cent. alcohol, 10 c.c. of saturated sodium chloride solution being added each time. The alcoholic solution is filtered, the filter is washed with a mixture of alcohol and sodium chloride solution, and the filtrate is evaporated to a volume of about 80 c.c. When cold, the residual liquid is mixed with 10 c.c. of saturated sodium chloride solution, and extracted several times with petroleum spirit. After the fatty substances have been thus removed, the liquid is heated on a water-bath until all traces of alcohol have been expelled; it is then cooled, acidified with sulphuric acid, and extracted several successive times with a mixture consisting of equal volumes of ether and petroleum spirit. The ethereal extracts are washed once with water, filtered, and evaporated, when the saccharin present in the sample is obtained as a crystalline residue. From 75 c.c. of milk, to which 0·035 grm. of sodium saccharinate had been added, the authors obtained 0·030 grm. of saccharin. The usual tests may be applied to the residue to identify it as saccharin, but attention is drawn to the fact that a substance known as "dulcine" or "sucrol" (*p*-phenetolecarbamide) is sometimes used in place of saccharin. This substance is extracted from the food by means of alcohol as described above and may be separated from saccharin by extracting the solution with ether, before acidifying with sulphuric acid, as "dulcine" is present as an imide whilst the saccharin is in the form of a salt. "Dulcine" melts at 173 C., and saccharin at 223° C. The two substances may also be differentiated by the presence of sulphur in the saccharin molecule, and by the characteristic violet coloration produced when a trace of "dulcine" is suspended in water and heated with the addition of mercuric nitrate solution free from nitric acid. The coloration usually appears within 15 minutes, and is rendered more intense by the addition of a small quantity of lead peroxide.—W. P. S.

Utilising palm oil as an edible fat. Fickendey. *See* XII

Tin salts in food. U.S. Dept. of Agric., Food Inspection Decision No. 126. Sept. 30, 1910. [T.R.]

All canned goods which are prepared prior to January 1, 1911, will be permitted to enter and pass into interstate commerce without detention or restriction in so far as their content of tin salts is concerned. All foods which are canned subsequently to January 1, 1911, will be permitted importation and interstate commerce if they do not contain more than 300 mgrms. of tin per kilo., or salts of tin equivalent thereto. When the amount of tin, or an equivalent amount of salts of tin, is greater than 300 mgrms. per kilo., entry of such canned goods packed subsequently to January 1, 1911, will be refused. The results of examinations made by the Bureau of Chemistry of various types of canned goods indicate that in a very large majority of cases inconsiderable quantities of tin are found, well within the limit herein set.

Patents.

Whey; Utilisation of——for dietetic purposes. F. T. Bond, Gloucester. Eng. Pat. 23,127, Oct. 11, 1909.

Whey is allowed to stand in a suitable vessel for from 2 to 6 days at the ordinary temperature until it has attained the desired degree of acidity, as is ascertained by testing portions of the liquid from time to time, and the clear liquid is then drawn off and heated to a temperature of 170° F. The dissolved proteins are thus coagulated and are separated; after being washed, the coagulum may be dried, powdered, and used as a food. The clarified whey is then bottled while it is in a hot and sterile condition. If desired, the whey, after bottling, may be inoculated with a quantity of a culture of lactic acid bacilli in order to increase the acidity; this result is aided by the addition of a small quantity of dextrose, and the bottles may be closed before the fermentation is completed, so that an aerated beverage is produced. An alternative method consists in treating the fresh whey with a sufficient quantity of hydrochloric acid to precipitate the proteins when the mixture is heated to 170 F. The coagulated proteins are then removed, and the solution is inoculated with lactic acid bacilli.—W. P. S.

Flour and meal; Treatment of ——. W. Jones, King's Norton, Worcester. Eng. Pat. 24,278, Oct. 22, 1909.

The flour is agitated in a closed chamber into which a constant quantity of phosphoric anhydride vapour is admitted; the flour is introduced at the top of the chamber and leaves through an opening at the bottom. The phosphoric anhydride vapour is produced by heating phosphoric anhydride in a suitable closed vessel through which a current of air is forced by means of a pump or fan, the mixture of air and vapour being then conducted to the treatment chamber. Instead of phosphoric anhydride, other substances, such as yellow phosphorus, phosphorus bisulphide, or phosphorus pentasulphide, may be used for generating the gaseous mixture employed in the process.
—W. P. S.

Pneumatic separators for granular substances. H. J. Haddan, London. From Alpine Maschinenfabrik Ges. m. b. H., Augsburg, Germany. Eng. Pat. 10,216, April 26, 1910.

In apparatus for separating grits from meal in which the mixture to be separated is fed on to a rotating tray and is separated after being flung outwards by a current of air, a loss frequently occurs owing to the small quantity of meal carried back to the apparatus with the air returned from the depositing chamber. In order to avoid this, the returning air is caused by means of baffles to flow outwards from the under surface of the rotating tray so that the falling grits do not carry the meal into the grit discharge.
—W. H. C.

Fruit juices; Apparatus for the continuous or intermittent desulphitation of —— with or without concentration of the treated juice. E. A. Barbet. First Addition, dated July 13, 1909, to Fr. Pat. 403,771, Oct. 2, 1908 (this J., 1910, 104).

The plates of the desulphiting column are made of sandstone or of glazed earthenware. The porcelain caps which act as baffles, are not bolted to the plates, but fit into grooves on the plates and are cemented in the grooves with a mixture of talc and sodium silicate. The raised edges of the outlets under the caps are perforated at the base, so that when the desulphitation process is arrested, the liquid on the plate flows through the notches in the lower part of the caps and through the hole in the base of the raised edge of the outlet, to the plate beneath; the plates are thus completely freed from liquid. The desulphited juice passes to a heater where it is concentrated by boiling, the vapour liberated being used to desulphite fresh juice. The sulphurous vapours from the desulphiting column pass to the heater of a second effect. The partially concentrated juice from the first effect passes to the second effect, and, if desired, a third effect may be used. The double or triple effect must be worked with a sufficiently high vacuum in order that the juice may be highly concentrated without danger of caramelisation.—L. E.

Weak worts and spent goods yielded in the fermentation and distillation of starch-containing substances; Utilisation in the preparation of articles of food of ——. Soc. Française des Distilleries de l'Indochine. Fr. Pat. 415,073, July 3, 1909.

The weak worts or the spent goods, or both, are added to the raw material used to prepare sauces, condiments or other articles of food in order to increase their food value or to utilise the valuable constituents of the worts or goods.—R. L. S.

Extraction of oil from the residues from the decortication and bleaching of rice. Fr. Pat. 415,226. *See* XII.

XIXb.—WATER PURIFICATION; SANITATION.

Water containing much suspended matter; Method of clarifying ——. Charitschkoff. Chem.-Zeit., 1910, **34**, 1175.

Calcium permanganate in aqueous solution, dissociates in accordance with the equation,

$$Ca(MnO_4)_2 = CaO + 2MnO_2 + O_3;$$

it acts therefore as an oxidiser, and at the same time as a precipitating and coagulating agent. It is superior to alum for this purpose, and an example is given of a river water, containing 6 per cent. of suspended matter, which was quickly rendered pure and quite clear by treatment with 0·01 grm. of calcium permanganate per litre, though requiring large quantities of alum to produce a similar result. An excess of the reagent must not be employed.
—F. Sodn.

Cresosteril (m-cresol-o-oxalic ester). E. Bierotte and H. Haserodt. Hyg. Rdsch., 1910, **20**, 1042—1048. Chem. Zentr., 1910, **2**, 1397.

m-Cresol-*o*-oxalic ester melts at 54° C., and is decomposed by water into cresol and oxalic acid. A 0·25 per cent. solution kills *B. coli* in 15 minutes, typhus bacilli in 10 mins., *staphylococci* in 7 mins., *pyocyaneus* in 5 mins., and cholera bacilli in 1 min. With a 1 per cent. solution the organisms mentioned are killed in less than one minute. Spores of anthrax bacilli are killed within 6 hours by a 3 per cent. solution of the ester. Solutions of *m*-cresol of the same concentration are much less effective.
—A. S.

Disinfecting power of complex organic mercury compounds. I. Aromatic mercury-carboxylic acids. W. Schrauth and W. Schoeller. Z. Hyg. u. Infekt.-Krankh., 1910, **66**, 497—504. Chem. Zentr., 1910, **2**, 1395—1396.

Krönig and Paul's view (see this J., 1900, 1033) that the disinfecting power of mercury salts increases with their degree of ionisation in solution, does not hold good for complex organic mercury compounds, for solutions of many of these, which can contain only small quantities of mercury ions, have considerable disinfecting power, some of them being superior to strongly ionised mercury salts. The authors have examined the effect of different substituting groups on the sodium salt of hydroxymercuric-benzoic acid, which has a high disinfecting power. When the hydroxy group united to the mercury is replaced by iodine, cyanogen, or a veronal (diethylmalonylurea) residue, the disinfecting power is diminished, and still more so when the hydroxy group is replaced by sulphur or its compounds, whilst when the mercury is united by both its valences to the benzene nucleus, the disinfecting power is practically *nil*.
—A. S.

Biological disposal of waste yeast. Dibdin. *See* XVIII.

Patents.

Disinfectant and method of producing the same. Gebr. Heyl und Co. Act.-Ges., Charlottenburg, Germany. Eng. Pat. 23,230, Oct. 11, 1909. Under Int. Conv., June 30, 1909.

The disinfectant consists essentially of a mixture of cresolsulphonic acid and aluminium sulphate. It is prepared by mixing together 20 parts of cresol (obtained by steam-distilling crude cresol in the presence of copper acetate), 20 parts of concentrated sulphuric acid, and 15 parts of aluminium sulphate; a gentle heat is applied during the mixing operation and the residual free sulphuric acid is then neutralised by the addition of a mixture of alumina and iron oxide. The resulting compound is practically odourless.—W. P. S.

Water and other liquids; Process and apparatus for the sterilisation of —— by means of ozone. G. F. Jaubert. Fr. Pat. 415,574, July 19, 1909.

The apparatus consists of a horizontal quartz mercury-vapour lamp; this lamp is surrounded by a jacket and the liquid to be sterilised is caused to circulate through the space between the lamp and the jacket. The liquid should contain air or oxygen in solution or suspension, so that ozone is formed when the liquid is subjected to the action of the ultra-violet rays emitted by the lamp.
—W. P. S.

Sterilisation of liquids or the destruction of microbes; Apparatus for the —— by means of ultra-violet rays. V. Henri, A. Helbronner and M. von Recklinghausen. Fr. Pat. 415,842, April 20, 1910.

Several devices are described for ensuring that the liquid under treatment shall present a perfectly smooth surface while it is being subjected to the action of ultra-violet rays proceeding from a mercury-vapour lamp. This object is attained by placing a number of rectangular tubes in the vessel through which the liquid flows during treatment, or by means of partition plates reaching alternately nearly to the top and bottom of the vessel. Tubes of various sizes may be placed in the vessel in order to equalise the velocities of the different currents in the liquid and the latter may be passed through a series of inclined tubes, the inlet ends of which are slightly above the surface of the liquid.—W. P. S.

Water; Apparatus for freeing —— from contained iron in a continuous circuit. L. H. Darapsky, Assignor to Deseniss und Jacobi A.-G., Hamburg, Germany. U.S. Pat. 973,263, Oct. 18, 1910.

See Eng. Pat. 12,246 of 1909; this J., 1910, 107.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

[Quininiçum] Chininum bihydrochloricum and "dragées" containing it; Customs tests of —— imported into Greece. A. K. Dambergis and T. Komnenos. Pharm. Post, 1910, **43**, 789. Chem. Zentr., 1910, **2**, 1507.

A. *Chininum [Quininicum] bihydrochloricum.* The aqueous solution (8 : 60) of the salt is made "alkaline" with *N*/1 sodium hydroxide, then allowed to stand for 2 hours in contact with 5 grms. of crystallised sodium sulphate, filtered, and the quinine determined by Kerner's method (this J., 1887, 841). 0·1 grm. of the salt should leave no weighable residue on ignition. B. "Dragées" of *Chininum bihydrochloricum.*—50 pieces are powdered and extracted with 30 c.c. of petroleum benzine. The extract on evaporation should not yield more than 0·5 grm. of paraffin. The residue from the extraction is dissolved in 50 c.c. of water, treated with 30 c.c. of a 15 per cent. solution of sodium hydroxide, and extracted three times with ether (50 c.c. each time). The ethereal extract should leave a residue of at least 8 grms. on evaporation.—A. S.

Poppy enzyme. M. Gonnermann. Apoth.-Zeit., 1910, **25**, 804—805. Chem. Zentr., 1910, **2**, 1485.

The author has investigated the cause of the decrease of morphine content during the ripening of poppy-capsules. This is considered to be due to the action of certain enzymes which oxidise the morphine, probably to oxydimorphine. An invertase isolated by the author from poppy-capsules had no action on morphine hydrochloride.—A. S.

Nux vomica extract. A. Goris and A. Wirth. Bull. Sci. Pharmacol., 1910, **17**, 515—520. Chem. Zentr., 1910, **2**, 1414—1415.

The alkaloid-content of *Nux vomica* extract was fixed at 16 per cent. by the Brussels Convention, but no standard method of determination was prescribed. The authors point out that the volumetric method of the French Codex gives results up to 8 per cent. lower than those furnished by the gravimetric method of the Belgian Pharmacopœia. The latter method is preferred by the authors because it is simpler and quicker, and yields a perfectly white product, completely soluble in *N*/10 sulphuric acid. The fixing of a definite alkaloid-content is considered to be useless, unless a standard method of determination is also prescribed. —A. S.

Ergoxantheine, a new active constituent of ergot. W. T. Wenzell. Amer. J. Pharm., 1910, **82**, 110—116.

In a brief historical review of the chemistry of ergot, the author points out that ecboline and ergotine were first discovered by him (see Amer. J. Pharm., 1861), and he protests against the change of name of the former to cornutine by Kobert in 1884 and to ergotoxine by Barger (this J., 1907, 483) and of the latter to ergotinine by Tanret in 1875. Another active substance, which increases the blood pressure and causes the pulse to beat more slowly, has now been isolated from the fluid extract of ergot, and has been named ergoxantheine or ergot-yellow. 25 c.c. of Squibb's fluid extract were mixed with 75 c.c. of 95 per cent. alcohol, and after allowing to stand for 12 hours, with occasional shaking, the mixture was filtered, and the filtrate freed from alcohol by evaporation at 30° C. The residue was diluted with water to 50 c.c., filtered, and the insoluble matter washed with water till the filtrate amounted to 100 c.c. The latter was extracted first with chloroform and then with ether. On evaporating the ethereal solution, ergoxantheine was obtained as an amorphous orange-yellow substance, the yield being about 0·25 per cent. It is soluble in alcohol, ether, benzene, ethyl acetate, amyl alcohol, acetone, and carbon bisulphide, insoluble in water, chloroform, and carbon tetrachloride. It appears to be closely related to luteine, but gives a dark orange coloration with concentrated nitric acid, whereas luteine gives a blue colour. It is precipitated by basic lead acetate and phosphotungstic acid from alcoholic solutions, but not by barium chloride. Its alcoholic solution becomes blood red when rendered strongly ammoniacal, and then gives a characteristic absorption spectrum, which it is suggested might be utilised for the determination of ergot in its preparations.—A. S.

Ephedrine and pseudo-ephedrine. W. Calliess. Apoth.-Zeit., 1910, **25**, 677—678. Chem. Zentr., 1910, **2**, 1480.

Ephedrine cannot be completely converted into pseudo-ephedrine by heating with 25 per cent. hydrochloric acid, as the reaction is reversible. When ephedrine is acetylated, however, it is converted completely into the acetate of pseudo-ephedrine, $C_{10}H_{11}(C_2H_3O)ON.HCl$ (m.pt. 175° C., $[\alpha]_D^{\circ} = +96\cdot8°$), which is not affected by sodium carbonate solution, but yields pseudo-ephedrine hydrochloride when warmed with hydrochloric acid.—A. S.

Dioscorine. K. Gorter. Ann. du Jardin Botan. de Buitenzorg, 2. Serie, Suppl. III. [1909], 385—392. Chem. Zentr., 1910, **2**, 1228—1229.

Dioscorine, $C_{13}H_{19}O_2N$, is a crystalline alkaloid first isolated by Boorsma from the tubers of *Dioscorea hirsuta* Bl., and later examined by Schutte (this J., 1897, 1037; 1898, 945), who found it to be a mono-acid base yielding a hydrochloride, with 2 mols. of water of crystallisation (m.pt. of the anhydrous salt, 204° C.). The anhydrous platinum salt melted at 199°—200° C., the gold salt at 171° C., and the picrate at 183°—184° C. The author isolated the base by extraction with 96 per cent. alcohol faintly acidulated with acetic acid. After purification it could be distilled unchanged *in vacuo*. The hydrobromide melts at 213°—214° C. The alkaloid is a tertiary base, being indifferent to acetic anhydride, and contains no hydroxyl-groups. It behaves as a γ-lactone with dilute potassium hydroxide solution. When heated with concentrated potassium hydroxide to 200°—250° C. in presence of air, it yields methylamine and a phenolic substance. It immediately decolorises acid permanganate solution. —A. S.

Digitoxin determined in the leaves and preparations of digitalis. J. Burmann. Bull. Soc. Chim., 1910, **7**, 973—982.

An examination of the substance isolated in the determination of digitoxin by Keller's method (this J., 1897, 767) has shown that it is not true digitoxin, which is thus obtained, the substance being amorphous and having a different melting point, and differing from digitoxin also in its solubility in water and ether and in its toxicity.

It appears rather to be identical with Cloetta's digalene (or "soluble digitoxin") and is probably a complex mixture.—F. Sodn.

Gelsemium ; The constituents of ——. C. W. Moore. Chem. Soc. Proc. 1910, **26**, 247.

The material employed in this investigation consisted of the dried rhizome and roots of *Gelsemium sempervirens*, Aiton. An alcoholic extract of the drug, when distilled in a current of steam, yielded a small quantity of an essential oil. The non-volatile constituents of the extract consisted of a brown resin insoluble in water, and material which remained dissolved in the cold aqueous liquid. The resin, which amounted to about 3·8 per cent. of the weight of the drug, yielded pentatriacontane; traces of emodin monomethyl ether; a phytosterol, $C_{27}H_{46}O$ (m.p. 136° C.; $[a]_D = -40·4°$); a small amount of ipuranol $C_{23}H_{38}O_2(OH)_2$; and a mixture of palmitic, stearic, oleic, and linolic acids. The portion of the alcoholic extract of the drug which was soluble in water contained scopoletin (a monomethyl ether of æsculetin), which was present in the free state, and also in the form of a glucoside, together with a quantity of sugar. It yielded, furthermore, three alkaloidal products, one of which, gelsemine, has been obtained in a pure, crystalline state, melting considerably higher than has hitherto been recorded (178° instead of 160° C.), and which has been shown to possess the formula $C_{20}H_{22}O_2N_2$. The other alkaloidal products, one of which corresponds with the so-called "gelseminine" of Thompson (Jahresber., 1887, 2218) and Cushny (this J., 1893, 59), were amorphous, and no crystalline derivatives could be obtained from them.

Leptandra ; The constituents of ——. F. B. Power and Harold Rogerson. Trans. Chem. Soc., 1910, 1944. Proc. Chem. Soc. 1910, **26**, 218.

The material employed for this investigation was commercial "leptandra," consisting of the dried rhizome and roots of *Veronica virginica*, Linné (*Leptandra virginica*, Nuttall). A concentrated alcoholic extract of this material, when distilled in a current of steam, yielded a small amount of an essential oil. The latter was a dark-coloured liquid, which distilled between 120° and 160° C. at 25 mm. The portion of the extract which was soluble in water contained 3:4-dimethoxycinnamic acid, $C_6H_3(OCH_3)_2·CH:CH·CO_2H$ (m. p. 180°—181°); a quantity of mannitol, amounting to 2·14 per cent. of the weight of the drug; and a sugar which yielded *d*-phenylglucosazone (m. p. 209°—211°), together with tannin and colouring matter. It yielded, furthermore, a quantity of an amorphous product, which possessed an intensely bitter, nauseous taste, and amounted to 1·6 per cent. of the weight of the drug. By the hydrolysis of this product there were obtained, besides resinous material, cinnamic and *p*-methoxycinnamic acids. The portion of the extract which was insoluble in water consisted chiefly of a dark brown resin, which amounted to 6·2 per cent. of the weight of the drug. From this resin the following substances were obtained: a phytosterol, $C_{27}H_{46}O$ (m. p. 135°—136°; $[a]_D = -33·0°$), the acetate of which melts at 119°—120°, and which it is proposed to designate *verosterol*; a mixture of fatty acids, consisting apparently of oleic, linolic, palmitic, and stearic acids; *p*-methoxycinnamic acid, $OCH_3·C_6H_4·CH:CH·CO_2H$ (m. p. 170°), which was present in the form of an ester, and a very small amount of 3:4-dimethoxycinnamic acid. It has not been possible to confirm the statement recorded in the literature that "leptandra" contains a crystalline, bitter glucoside, designated as "leptandrin," to which its activity may be attributed, nor does it contain a saponin, as has been asserted.

Scammony and jalap resins. G. Weigel. Pharm. Zentralh., 1910, **51**, 721—727. Chem. Zentr., 1910, **2**, 1308—1309.

Scammony resin from *Convolvulus Scammonia*, L., and *Ipomæa Orizabensis*, Led., respectively, cannot be distinguished by their saponification values, and determination of the saponification value is useless also for detecting foreign resins in scammony and jalap resins (compare Taylor, this J., 1909, 613). The acid value, however, is stated to be well suited for this purpose, being never more than 30 for either of the resins, and for jalap resin, usually not more than 20, whereas resins likely to be used as adulterants have much higher acid values. The presence of guaiacum resin may be detected by adding a solution of about 0·5 grm. of the sample in 5—10 c.c. of alcohol to 20 c.c. of a solution of gum arabic in cold water, when the appearance of a blue colour after some time indicates guaiacum resin. The solubility of jalap resin in chloroform is much greater than 10 per cent., the figure erroneously given in some Pharmacopœias. For the distinction of scammony and jalap resins, the chloroform-test should be replaced by an ether test. In ether the solubility of jalap resin is at the most 10 per cent., whereas scammony resin dissolves nearly completely (at least 80 per cent.). The resins should also be examined with regard to ash-content, which should not be more than 1 per cent., and to the presence of water-soluble substances.—A. S.

Essential oil of cocoanut ; Two active alcohols and a third ketone contained in ——. A. Haller and A. Lassieur. Comptes rend. 1910, **151**, 697—699.

Further investigation of the essential oil in cocoanut has furnished, in addition to the ketones previously mentioned (this J., 1910, 704), methylundecyl ketone and also *d*-methylheptyl- and *d*-methylnonylcarbinols, the *l*-isomerides of which occur in oil of rue.—F. Sodn.

Spearmint ; Essential oil of ——. F. Elze. Chem.-Zeit., 1910, **34**, 1175.

In the preparation of *l*-carvone from spearmint oil by Tiemann's method (Ber., 1898, **31**, 3319; see this J., 1899, 169) an oil is obtained as a by-product which, on fractionation, yields phellandrene and the acetic ester of dihydrocumic alcohol; the odour of the oil is due to the latter constituent.—F. Sodn.

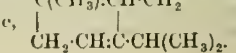
Oil of star-anise ; Adulterated ——. E. J. Parry. Chem. and Drug., 1910, **77**, 45.

The author states that shipments of adulterated star-anise oil have recently arrived in this country. The oil, which had probably been mixed with a fraction from the distillation of camphor oil, has an abnormally low specific gravity and very low melting and congealing points, as the following figures show: Sp. gr. at 20° C., 0·9675—0·9740; refractive index at 20° C., 1·5460—1·5475; m.pt., 12°—15° C., congealing point, 10·5°—12° C.; optical rotation, −0°15′ to +0°35′.—A. S.

Terpenes : Contributions to the chemistry of the ——. *Part VII. Synthesis of a monocyclic terpene from thymol.* G. G. Henderson and M. M. J. Sutherland. Trans. Chem. Soc., 1910, 1616. Proc. Chem. Soc. 1910, **26**, 203.

From thymol, $C_6H_3(CH_3)C_3H_7\beta·OH$, the authors prepared thymoquinone, which, on reduction with sulphuric acid, yielded thymoquinol, $C_6H_2(CH_3)C_3H_7\beta(OH)_2$. This dihydric phenol, when heated with hydrogen in presence of nickel according to the method of Sabatier and Senderens, was converted into the saturated disecondary alcohol, *menthane-2 : 5-diol*, $C_{10}H_{18}(OH)_2$. This compound forms very small, colourless crystals. It melts at 112° and boils at about 155° C. at 15 mm. It is very readily soluble in alcohol, ether, or light petroleum, readily so in benzene, and very sparingly so in water. When heated at 110°—200° with anhydrous potassium hydrogen sulphate, it yields a *terpene*, $C_{10}H_{16}$, which is a colourless liquid, boiling at 179° C. at 760 mm. It has a rather faint odour somewhat like that of limonene, and is practically insoluble in water, but readily soluble in the usual organic solvents. It at once reduces permanganate, and unites additively with bromine, but apparently does not react with nitrous acid to form a nitrosite. It is probably

Δ1:4-menthadiene,



$$\begin{array}{l} C(CH_3){:}CH·CH_2 \\ | \qquad\qquad\quad | \\ CH_2·CH{:}C·CH(CH_3)_2. \end{array}$$

Nitro-derivatives; Reduction of —— by spongy copper. A. Mailhe and Murat. Bull. Soc. Chim., 1910, 7, 952—956.

Spongy copper, as obtained by Bougault's method (this J., 1909, 307), reduces all organic nitro-derivatives, both fatty and aromatic, in the presence of an excess of sodium hypophosphite, the corresponding amino-derivatives being obtained almost without loss. The reaction is common both to mono- and poly-nitro compounds and is in no way interfered with by the presence of halogen or hydroxyl groups; it is effected by adding a solution of sodium hypophosphite to a mixture of spongy copper and the nitro-derivative (dissolved in water or alcohol) and is complete in a few hours. The method has been found specially useful for the preparation of aminophenols.—F. Sodn.

Bismuth benzoates. Godfrin. J. Pharm. Chim., 1910, 2, 385—396.

Normal bismuth benzoate, Bi(C$_6$H$_5$CO$_2$)$_3$.—Six grms. of crystallised bismuth nitrate are dissolved by trituration with a mixture of 6 grms. of glycerol and 12 grms. of distilled water. To this, a solution of 6·2 grms. of sodium benzoate in 6 grms. of glycerol and 12 grms. of distilled water is quickly added, with constant trituration to break up any aggregated precipitate. The homogeneous mass is then treated, with constant stirring, with 80 c.c. of a 1 : 500 aqueous solution of benzoic acid, and allowed to stand at 10° to 15° C., for five to 10 days. The crystalline magma obtained is drained with the aid of the filter-pump, and washed twice successively by suspension in 30 c.c. of aqueous benzoic acid solution saturated at about 15° C. After final draining, the crystals are dried, either at ordinary temperatures in the air, or over sulphuric acid, or at 60° C. The salt forms long bright needles, resembling light quinine sulphate in appearance. These are moistened with difficulty by water; they are quite free from nitric acid, and contain only a trace of free benzoic acid. The latter is easily driven off at 110°—120° C. at which temperature the salt is quite stable: it does not begin to turn yellow or to part with the combined benzoic acid until the temperature reaches 140° C. *Basic bismuth benzoates.*—The salt, Bi$_4$O$_3$(C$_6$H$_5$CO$_2$)$_6$, is obtained with difficulty by treating the normal salt with 20 times its weight of absolute alcohol, added gradually, with frequent agitation, and then setting aside, at the ordinary temperature, for 90 minutes in all, finally quickly draining. It forms a dense dull white powder: stable in the air, and not altered by heat below 160° C.; it is decomposed by water, by alcohol, and by ether. It consists of well-formed microscopic cubes. Another basic salt, Bi$_2$O$_3$(C$_6$H$_5$CO$_2$BiO)$_{12}$, is obtained by leaving the normal benzoate in contact, for several days, in the cold, with at least 20 times its weight of ether or of 95 per cent. alcohol. It is a yellowish white powder, partly amorphous and partly indistinctly crystalline under the microscope. A third basic salt, Bi$_2$O$_4$(C$_6$H$_5$CO$_2$BiO)$_6$, is obtained by boiling the normal benzoate with at least 35 times its weight of 95 per cent. alcohol. It is a dull white, microcrystalline powder, apparently composed of minute clinorhombic prisms. *Bismuthyl benzoate.*—In addition to the above, the salt, BiOC$_6$H$_5$CO$_2$, has been prepared as a light, shining, crystalline powder, composed of micro-prisms apparently of the clinorhombic system. It has been introduced into medicine, as a substitute for bismuth salicylate, under the name of "Lutol."—J. O. B.

Cinchona bark; Prize for the analysis of ——. Pharm. J., Nov. 5, 1910.

The Preanger Kinabond at Bandoeng offers a prize of five hundred guilders for the best method of estimating quinine in cinchona bark; the process must be so accurate that, when effecting parallel analyses, differences may be reduced to 0·2 per cent. The time required for the analysis, as well as its cost, will also form points of judgment. In the description of the method of analysis no detail whatever should be omitted. Competitions, either in Dutch, French, English, or German are to reach the Secretary of the Preanger Kinabond at Bandoeng not later than one year from the present date. They are to be delivered in the handwriting of the author, but signed by a motto, which should be repeated on the sealed envelope, containing a note bearing the name and address of the author, accompanying his essay.

Citric acid in citrates and in lemon juice; Accurate method for the direct determination of ——. M. Spica. Chem.-Zeit., 1910, 34, 1141—1142.

The method consists in decomposing the citric acid (first separated as calcium citrate) by gently warming with concentrated sulphuric acid and measuring the evolved carbon monoxide, 1 molecule of which is obtained from each molecule of citric acid. The apparatus used is shown in the accompanying figures. The upper part, A, is fitted to the flask, B, (150 c.c. capacity), by a ground joint, and the tubes, D and E and G and E, may be connected respectively through the tap, R, as also may the flask and the exterior. 2 grms. of the calcium citrate, moistened with water, are introduced into B, and the air in the flask is completely displaced by carbon dioxide, the absence of air being ascertained by means of an auxiliary nitrometer, filled with potassium hydroxide solution (1:5) and attached to the T-piece. 25 c.c. of concentrated sulphuric acid are then run into B from A, and a slow current of carbon dioxide is again passed into the flask, which is warmed to 80°—100° C., and occasionally shaken, the carbon monoxide evolved being collected in a nitrometer of 200 c.c. capacity, of which the lower part B^1 (100 c.c. capacity) is graduated in fifths of a cubic centimetre. When the volume of gas becomes constant, the nitrometer is allowed to stand for half-an-hour and then, after washing the gas with potassium hydroxide solution, introduced through I, the volume is read, and the usual corrections are made for temperature and pressure. 1 c.c. of carbon monoxide, at 0° C. and 760 mm., indicates 0·009407 grm. of citric acid (C$_6$H$_8$O$_7$,H$_2$O). The same apparatus may be used for

Fig. 1.

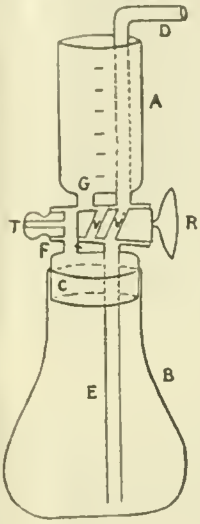
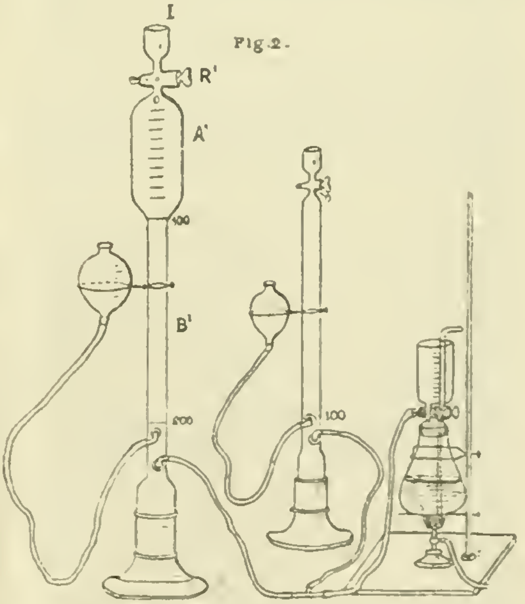


Fig. 2.



the determination of carbonate in a citrate, by decomposing with a known volume of concentrated hydrochloric acid and measuring the evolved carbon dioxide over water. —F. Sodn.

Cinchona cultivation in Madras. Chem. and Drug., Nov. 12, 1910. [T.R.]

The official statement of cinchona cultivation in the Madras Presidency for 1909-10 shows that the Nilgiri plantations are the largest, and besides these the plantations in Coimbatore, though with fewer trees, yield large quantities of bark. The Government plantations in the Nilgiris extend over 1.148 acres, with over 2,225,000 mature plants and 700,000 immature plants: the total yield was 255,371 lb. The area of the plantations was reduced because certain plots were converted into fuel reserves. The crop of 1909 is said to be the largest recorded. The private plantations are distributed in Coimbatore, Malabar, the Nilgiris, and Tranvancore, but those in Coimbatore are equal to the Government plantations in yield, though the area is considerably smaller. The total yield of bark in these was 246,000 lb. The plants of Malabar were immature, whereas the private plantations in the Nilgiris extended over 165 acres, containing 281,320 mature and 27,270 immature plants. The former yielded 49,000 lb. of bark, the decrease being due to the abandonment of cultivation in some estates and to non-receipt of returns from other plantations. The statements from Travancore plantations are imperfect, but over 600 acres were covered with cinchona-plants, of which one species yielded 40,000 lb. of bark last year.

Patents.

Cod-liver oil preparations. R. Weiss, London. Eng. Pat. 418, Jan. 7, 1910.

A preparation of cod liver oil is claimed containing a therapeutically effective percentage of assimilable phosphorus, for instance, in the form of lecithin; 0·25 per cent. or more of lecithin are recommended.—J. F. B.

Formyl derivatives of alcohol bases [alkaloids]; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 531, Jan. 8, 1910.

See Ger. Pat. 222,920 of 1909; this J., 1910, 901. Tropine, pseudo-tropine, and other alkaloids may replace the morphine alkaloids, whilst formic esters may be used instead of formic acid in the preparation of the products. —T. F. B.

Pharmaceutical product [diethylbromo-acetylurea]; Manufacture of a ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2888, Feb. 5, 1910.

Diethylbromo-acetylurea, $(C_2H_5)_2.CBr.CO.NH.CO.NH_2$, which is said to possess sedative properties, may be obtained (1.) by treating urea with diethylbromo-acetyl halides; (2.) by the addition of one mol. of water to diethylbromo-acetylcyanamide, *e.g.*, by the action of concentrated sulphuric acid in the cold; (3.) by treating diethylbromo-acetylurethanes with ammonia; (4.) by replacing the sulphur of diethylbromo-acetylthiourea by oxygen, *e.g.*, by treating with permanganate; (5.) by brominating diethylacetylurea. The new compound forms colourless, tasteless, odourless crystals, of m. pt. 114°—115° C., scarcely soluble in cold water or petroleum spirit, but easily soluble in alcohol or acetone.—T. F. B.

Allyl ester of salicylic acid; Manufacture of the ——. Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 22,779, Oct. 1, 1910. Under Int. Conv., Nov. 3, 1909.

The allyl ester of salicylic acid is prepared by heating allyl alcohol with salicylic acid in presence of a condensing agent, or by the action of an allyl halide or allyl sulphate on a salicylate, or by other method of esterification. It is a colourless liquid having a powerful "herbaceous odour," of b. pt. 247°—250° C. under ordinary pressure (105°—106° C. at 5 mm.); its sp. gr. at 15° C. is 1·100. It is suitable for use in perfumery or in medicine.—T. F. B.

Iron-albumin-glycerophosphate and process of making same. E. Fischer, Gronau, Germany. U.S. Pat. 972,523, Oct. 11, 1910.

Neutralised solutions of iron salts (*e.g.*, ferric chloride) are added to solutions of alkali-albumin-glycerophosphates in presence of sodium acetate, until all the alkali has been replaced by iron; the precipitate is then separated from the solution, washed with alcohol and ether, and dried. It is a brownish powder, insoluble in water and organic salts and soluble in dilute solutions of acids and alkalis. —T. F. B.

Chlorhydrins and process of making same. H. V. Walker, Brooklyn, Assignor to The Maas and Waldstein Co., Newark, N.J. U.S. Pat. 972,952, Oct. 18, 1910.

Chlorhydrins are prepared by the action of olefines on an "alkaline solution of hypochlorous acid" containing no free chlorine, obtained by adding excess of sodium bicarbonate to a solution of an alkali hypochlorite; the mixture is kept cool during the reaction. Chlorhydrins containing five or more carbon atoms are produced in this manner by using "gas naphtha," the oily layer obtained being finally fractionated.—T. F. B.

Octene-dione and its homologues; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 227,176, Sept. 1, 1909.

Octene-dione, $CH_3.CO.(CH_2)_3.CO.CH:CH_2$, and its homologues are formed when methylene ketones (see Fr. Pat. 409,403 of 1909; this J., 1910, 719) are heated or allowed to stand for a long time; they may also be obtained by the action of dehydrating agents on octanedionol and its homologues (see Ger. Pat. 227,177, following). Octene-dione is obtained by boiling methylene-acetone on an oil-bath, under a reflux condenser; the liquid gradually becomes thicker, and its boiling point rises: the diketone is obtained from the product as an oil of boiling point 75°—76° (21 mm.), possessing a pleasant odour, and soluble with difficulty. Dimethyloctene-dione, obtained from methylene-ethylmethylketone, has a b. pt. of 83°—85° C. (17 mm.), and is immiscible with water. The products are quite stable, unlike the other known 1.5-diketones. Quantitative yields of the diketones may be obtained from the corresponding octanedionols by dehydration with potassium bisulphate.—T. F. B.

Octanedionol and its homologues; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 227,177, Sept. 1, 1909.

Like other unsaturated ketones, the methylene-ketones (Fr. Pat. 409,403 of 1909; this J., 1910, 719) are condensed in presence of alkalis, to form octanedionols (saturated hydroxylated 1·5-diketones): the condensation may also be effected by means of water or dilute acids. Further, octene-dione and its homologues (see Ger. Pat. 227,176, preceding) are converted into octanedionol and its homologues by addition of the elements of water. Suitable alkaline condensing agents are alkali carbonates, borax, and sodium phosphate. The new compounds are colourless, odourless, very stable oils. Octanedionol boils at 142°—143° C. (22 mm.) and dimethyl-octanedionol at 148° C. (18 mm.): both are miscible with water in all proportions. —T. F. B.

C.C-Dialkylbarbituric acids; Process for preparing ——. A. Einhorn. Ger. Pat. 227,321, Nov. 4, 1909. Addition to Ger. Pat. 225,457, June 10, 1909 (see this J., 1910, 1178).

The conversion of dialkylmalonamides to C.C-dialkylbarbituric acids by means of oxalyl chloride may be accomplished without the aid of heat, if the reaction be carried out in presence of acetic anhydride or other diluent which is indifferent to oxalyl chloride; for example, 1 part of diethylmalonamide is converted in to diethylbarbituric acid after 24 hours by treatment with 1·5 parts of oxalyl chloride and 100 parts of acetic anhydride.—T. F. B.

Cerium-protein compounds soluble in water ; Process for preparing ——. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 227,322, Jan. 31, 1909.

The insoluble or sparingly soluble compounds of cerium with proteins are rendered soluble in water by treatment with solutions of albumose. A solution of 50 grms. of cerium nitrate is added, with stirring, to a solution of 500 grms. of egg albumin, the product is filtered off, washed with water, and introduced into a 30 per cent. solution of 350 grms. of albumose ; the mixture is digested at 40—50° C. until solution is complete, when it is evaporated to dryness *in vacuo* at 40°—50° C. : the product is boiled with water for some time, filtered, and the solution again evaporated as before. The cerium-albumin compound thus produced is easily soluble in water : its solutions are not coagulated by heating nor decomposed by light. It contains 8 to 9 per cent. of cerium, and may be utilised in medicine.—T. F. B.

Eugenol and albumin ; Preparation of ——. H. Belart, Huddersfield. U.S. Pat. 973,908, Oct. 25, 1910.

See Eng. Pat. 9246 of 1908 ; this J., 1908, 998.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Colour photography. R. Ruth, Charlottenburg, Germany. Eng. Pat. 25,998, Nov. 10, 1909. Under Int. Conv., Nov. 12, 1908.

A photographic colour screen plate is prepared by applying successively to a glass support, a layer of gelatin, a colour screen composed of gelatin, a thin waterproof, flexible film of rubber, etc., and a panchromatic emulsion ; the colour screen may be of line, grain, or mosaic form, and the colours, which must be transparent, are either applied to or suspended in the gelatin ; it may be prepared according to Eng. Pat. 16,273 of 1910 (this J., 1910, 1272). The plate is exposed in a camera or under a coloured positive, with its glass towards the source of light ; it is then developed, the reduced silver dissolved away, and redeveloped in daylight to obtain a positive, which is stripped from the support : the unsensitised layer of gelatin is then sensitised by means of an alkali bichromate solution and dried, and the film is exposed to light through the silver positive, developed, and the image transferred to paper as in the ordinary pigment process.—T. F. B.

Polychrome screens for colour photography ; Process for making ——. L. Gimpel. Fr. Pat. 414,953, June 30, 1909.

A screen composed of parallel lines is photographed on an ordinary photographic plate, and the developed and fixed image is toned in a primary colour (*e.g.* red) to give an image of as fine a grain and as transparent as possible. The film is now coated with a sensitive emulsion, and the screen is photographed again on this, but with the lines perpendicular to those of the first image ; after development and fixing, the second image is toned in a second primary colour (*e.g.*, blue), and the plate is once again coated with an emulsion, and exposed to the light through the crossed screen already formed, so that only the portions not coloured are affected ; it is finally developed, fixed, and the image of small squares toned to the third primary colour (yellow).—T. F. B.

Photographic emulsion. Y. Schwartz, Hanover, Assignor to Synoloids, Ltd., London. Reissue No. 13,162, dated Oct. 25, 1910, of U.S. Pat. 710,019, Sept. 20, 1902.

See Fr. Pat. 320,451 of 1902 ; this J., 1903, 44.—T. F. B.

XXII.—EXPLOSIVES ; MATCHES.

Explosives containing alkali salts ; Experiments at the Testing Station at Lievin with ——. J. Taffanel. Z. ges. Schiess- und Sprengstoffw., 1910, 5, 305—307, 333—337, 348—352, 372—376, 392—395.

In the first series of experiments photographs were taken of the flame produced from 50 grms. and 100 grms. on detonating the explosive both in the open and in the bore-hole of a mortar. The explosives were selected from amongst those which produce combustible gases when fired. The following were experimented with :—(*a*) Pulped guncotton with and without the addition of sodium bicarbonate (2 per cent.) and potassium sulphate or lead nitrate (3 per cent.). (*b*) Trinitrotoluene with and without the addition of potassium nitrate (5 per cent.) or barium nitrate (10 per cent.). (*c*) *Carbit* consisting of nitroglycerin (25 parts), potassium nitrate (34), flour (39·5), barium nitrate (1), and sodium carbonate (0·5 parts), and for comparison. (*d*) The French safety explosives *Grisoutine Favier*, consisting of nitroglycerin (29·1 parts), collodion cotton (0·9), ammonium nitrate (69·5), and sodium carbonate (0·5 parts), and *Grisounit Favier* consisting of dinitronaphthalene (8·5 parts) and ammonium nitrate (91·5 parts). In the second series of experiments safety explosives with and without the addition of potassium nitrate were fired in an explosive mixture of pit gas and air, and in some instances, with the addition of coal dust. The explosives used were :—(*a*) Trinitrotoluene *Grisounit* consisting of ammonium nitrate (86—88 parts) and trinitrotoluene (14—12 parts), and (*b*) *Grisoutine Favier* and *Grisounit Favier*. The author's conclusions are a confirmation of those arrived at by Dautriche (this J., 1910, 46). By the addition of potassium nitrate the *charge limite* of the explosives was, in some instances, raised from 50 grms. to 200 grms. When the explosives were fired in an explosive mixture of pit gas and air, it was found that the addition of potassium nitrate increased the factor of safety. This was true of the different types of explosives investigated, whether the temperature developed on explosion was high or moderately low. The effect of the addition of potassium nitrate was also found to be the same whether the explosives were fired freely exposed in the gallery, or from the mortar with varying diameters of bore-hole. On the other hand, when coal dust was present, the addition of potassium nitrate to the explosive did not show any favourable results. The author considered that the mechanism of the ignition is not the same in the two cases and that many influencing factors are unknown. The presence of potassium nitrate, leading to the production of potassium carbonate after explosion, whilst not appreciably influencing the power, lowers very considerably the heat developed. The speed of the reaction of the decomposition products is also probably lowered by the presence of alkali salts, and thus the possibility of ignition of the gases is reduced. In the author's opinion the determining factor in the ignition of coal dust is quantity of heat rather than actual temperature. In view of these results the addition of potassium nitrate to safety explosives is considered advisable, as, from the manufacturing point, there is no objection to its use, whilst the results obtained point very strongly, at least in the case of pit gas, to an increase of the factor of safety.—G. W. McD.

Explosions ; Propagation of —— *in mixtures of petroleum vapour and air in tubes.* C. E. Munroe. Proc. Amer. Phil. Soc., 1910, **49**, 203—206.

Following upon a collision at a railway yard at Pittsburg, in which a tank-car was damaged and over 7000 galls. of "stove naphtha" escaped, a series of explosions occurred, one of which took place at the end of a culvert which drained the yard. In order to test the possibility of the passage of flame through the culvert, which discharged at a point 2785 ft. from the place of the collision and varied in diameter from 2 to 10 ft., experiments were made with glass tubes up to 1·5 in. in diameter, and with steel tubes 4 in. in diameter. The tubes were inclined and naphtha slowly poured in at the upper end. After a considerable quantity of liquid had flowed through the tube, a flame was applied at the upper end. It was found that when the length of the tube was 63·44 times the diameter or above, the flame did not travel completely through the tube.—A. T. L.

Nitrous esters of cellulose. Nicolardot and Chertier. *See* V.

Patents.

Explosive for detonating pellets and the like. C. Polster, Gevelsberg, Germany. Eng. Pat. 20,494, Sept. 2, 1910.

The explosive consists of potassium chlorate (48 parts), dextrin (4 parts), and either calcium phosphate or "sulphophosphite" (46 parts).—G. W. McD.

Match composition. J. Dart, Bristol. Eng. Pat. 5335, March 3. 1910.

The claim is for the employment of barium carbonate instead of barium sulphate in match composition. Its use is said to insure greater safety in manufacture, prevent absorption of moisture, and to cause more rapid ignition when the match is struck.—G. W. McD.

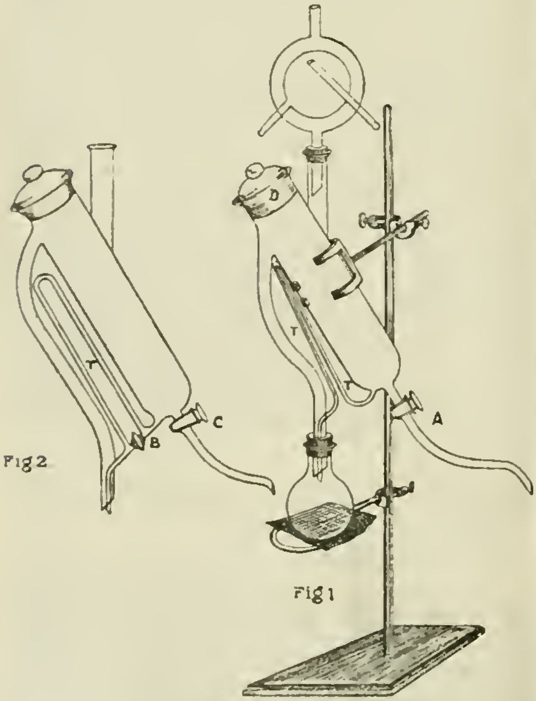
Railway-signal fusees; Compounds for ——. I. Niditch, Dorchester, Mass., U.S.A. Eng. Pat. 14,396, June 14, 1910. Under Int. Conv., Dec. 16, 1909.

See U.S. Pat. 954,330 of 1909; this J., 1910, 593.—T. F. B.

Solvent for pyroxylin, etc. U.S. Pat. 972,953. *See* V.

XXIII.—ANALYTICAL PROCESSES.

Extraction apparatus; An improved form of —— J. McConnell Sanders. Chem. Soc. Proc. 1910, **26**, 227—228.



The form of extraction apparatus illustrated in the accompanying diagram possesses several advantages over the usual form of Soxblet extractor, or similar appliances in which the substance to be extracted is contained in a vertical tube the upper orifice of which is closed by the cork carrying the reflux condenser, the cork having to be removed each time a fresh quantity of material has to be introduced. Fig. 1 shows the simpler form of apparatus, which when once mounted with its condenser is always ready for use; successive quantities of material may be introduced by simply removing the glass stopper D, the extraction being carried on with the tap A closed, when the apparatus acts as an intermittent extractor. When extraction is complete, the tap A is opened, and the solvent distilled off directly through the side-tube. When using very volatile solvents, such as ether or carbon bisulphide, the subsequent distillation of the solvent is facilitated by removing the cartridge containing the exhausted material, and substituting a glass boiling tube containing cold water or crushed ice. The more elaborate form shown in Fig. 2 has two taps B and C, and when both these are kept closed, the tubes, T, T act as a siphon, and the extractor works intermittently. With C closed and B open, the apparatus works as a continuous extractor, or can be used also as a reflux condenser, especially if an inner tube containing cold water or ice is used. With B closed and C open, the apparatus can be used for distilling off the solvent, as described in the case of Fig. 1. In the author's laboratory a large model constructed of tinned copper has been in use for several months, and has proved of great value in cases where the probable amount of extractive matter was unknown, since in the event of too small a quantity of material being taken in the first instance, it was an easy matter to place a succession of weighed cartridges in the extractor and extract with the same amount of solvent without dismounting the apparatus. This copper extractor has an internal capacity of 1000 c.c., and in order to adapt it for use with smaller quantities of material a number of "dummy" cartridges of thin sheet copper are used to fill up a certain amount of space before placing the material in position.

Colloid precipitates [metastannic acid and zinc sulphide]; Collection of ——. M. Liebschutz. Chem. News, 1910, **102**, 213.

The addition of a dilute solution of albumin to the solution in which the metastannic acid is suspended, followed by heating for a short while to coagulate the albumin, is recommended. The precipitate can then be readily separated by filtration, and any copper retained by it can be easily removed by subsequently boiling it with dilute nitric acid. In the case of the gelatinous zinc sulphide precipitate present when separating copper from zinc by the cyanide method, a few drops of lead acetate solution are added; the precipitated lead sulphide carries the zinc sulphide down with it, and after filtration, the zinc can be determined as usual by boiling the precipitate with dilute hydrochloric acid and titrating with ferrocyanide.—A. S.

Methyl-orange and methyl-red in acid solutions: The colour changes of ——. H. T. Tizard. Proc. Chem. Soc., 1910, **26**, 225.

The author has measured quantitatively the changes in molecular colour of methyl-orange and methyl-red in solutions of varying concentrations of hydrogen ions. From the results the following constants have been deduced:—

	K_a.	K_b.
Methyl-orange (at 25°) .... $NMe_2{\cdot}C_6H_4{\cdot}N:N{\cdot}C_6H_4{\cdot}SO_3H$	$4{\cdot}25 \times 10^{-4}$	$< 10^{-14}$
Methyl-red (at 18°) .... $NMe_2{\cdot}C_6H_4{\cdot}N:N{\cdot}C_6H_4{\cdot}CO_2H$	$1{\cdot}05 \times 10^{-5}$	3×10^{-13}

The value of methyl-red as an indicator was discussed, and it was shown that its "neutral point" lies between concentrations of hydrogen ions of $10^{-5{\cdot}7}$ and 10^{-7}, which are very close to one another and to the theoretical neutral point at 10^{-7}.

Nickel and cobalt; Electrolytic separation of ——. P. Bruylants. Bull. Soc. Chim. Belg., 1910, **24**, 367—372.

The author has been unable to obtain satisfactory results with the method of Pinerua-Alvarez (Ann. Chim. analyt., 1910 [5]), on account of the difficulty of determining the right amount of potassium cyanide to be added to the solution of the mixed salts. If the quantity is insufficient the nickel precipitation is incomplete, whilst an excess redissolves the precipitate. In either case, both metals are found in the filtrate. He has obtained better results, though still not a complete separation, in the following manner:—The solution of the mixed salts is treated with potassium cyanide until the precipitate is just redissolved, the solution then containing the two ions: $Ni(CN)_4''$ and $Co(CN)_6''''$. On oxidising the liquid, preferably with bromine water, the complex cobalt ion is completely transformed into $Co(CN)_6'''$, which is scarcely modified on the addition of an acid, whereas the complex nickel ion gives a precipitate of nickelic cyanide, which is soluble in an excess of acid, yielding Ni ions. These combine with the $Co(CN)_6'''$ ions to form a bluish-green compound, nickel cobalticyanide, $Ni[Co(CN)_6]_2$. This is soluble in ammonia, and a solution is thus finally obtained containing the ions $Co(CN)_6'''$ and $Ni(NH_3)_6$, the first of which is a form not readily decomposed, whilst the second is in a condition advantageous for electrolysis. Under the most favourable conditions, however, the completely precipitated nickel contained from 2 to 4 per cent. of cobalt (see this J., 1909, 1225).—C. A. M.

The starch-iodine reaction. Wm. Harrison. Chem. Soc. Proc., 1910, **26**, 252—253.

The author finds that in the formation of the blue iodide of starch the presence of iodides is not necessary. The blue colour is formed with pure iodine, but the depth is increased by the presence of any salt or weak acid. The gradual addition of alcohol changes the blue to violet, red, orange, and yellow, and the reverse change takes place on dilution with water. The same colour-change is produced by carefully heating the blue solution, and the reverse phenomena are observed on cooling. This colour-change is analogous to the colour-change of colloidal gold solution, investigated by Zsigmondy, which changes from red to blue on adding salts. The author succeeded in preparing a blue colloidal solution of iodine in water containing glycerol and no starch, but the colour only remained for a fraction of a second, the iodine being precipitated. It was shown that all the iodine can be removed from starch iodide by washing with pure water, and the conclusion is drawn that the blue solution of iodine and starch is a colloidal solution of iodine, the starch acting as a protective colloid. It was further shown that the reactions of dextrins and starch celluloses can be obtained with starch under certain conditions, from which the conclusion is drawn that dextrins and starch celluloses are all different colloidal states of starch and not chemically different compounds.

Aromatic hydroxy-sulphoxides. M. Gazdar and S. Smiles. Chem. Soc. Proc., 1910, **26**, 253.

The hydroxy derivatives of aromatic sulphoxides are attacked by concentrated sulphuric acid, furnishing substances which exhibit a deep blue colour in that medium. As a preliminary to the investigation of the reaction, the sulphoxides of *p*-cresol, *o*- and *p*-chlorophenol and their derivatives have been examined.

Differentiation of artificial silks. Maschner. *See* V.

Vortmann's nitroprusside reaction for hydrocyanic acid. Van Giffen. *See* VII.

Detection of phosphates with the molybdate reagent. Liesegang. *See* VII.

General method for the preparation of anhydrous chlorides and its application in chemical analysis. Bourion. *See* VII.

Red platinum as an analogue of purple of Cassius. Wöhler and Spengel. *See* VII.

Solubility and precipitation of titanic acid. Bornemann and Schirmeister. *See* VII.

Determining hydrated silicic acid in clay. Pence. *See* VIII.

Methods of analysis for enamel and enamel raw materials. Landrum. *See* VIII.

Testing sheet steel enamels. Shaw. *See* VIII.

Apparatus for mercury determination [in ores]. James. *See* X.

Absorption spectra of oils. Marcille. *See* XII.

Critical investigation on the analytical methods for raw rubber. Korneck. *See* XIV.

Colorations produced by iodine in presence of dextrins. Rivat. *See* XVII.

Report of malt analysis (coloured malts and caramel) committee, 1910, of the Institute of Brewing. *See* XVIII.

Determining sulphuring of malt. Reinke. *See* XVIII.

Apparatus for collecting and measuring the gases evolved during fermentation. Harden and others. *See* XVIII.

Detection and determination of manganese in wine. Dumitrescou and Nicolau. *See* XVIII.

Detecting and determining ethyl alcohol in presence of methyl alcohol. Denigès. *See* XVIII.

Oxidation-index of milk, and determination of lactose and fat in milk. Jona. *See* XIXa.

Detection and determination of saccharin in foods rich in fat, starch, and proteins. Tortelli and Piazza. *See* XIXa.

Customs tests of Chininum bihydrochloricum, and dragées containing it, imported into Greece. Dambergis and Komnenos. *See* XX.

Nux vomica extract. Goris and Wirth. *See* XXIII.

Digitoxin determined in the leaves and preparations of digitalis. Burmann. *See* XX.

Scammony and jalap resins. Weigel. *See* XX.

Determination of citric acid in citrates and in lemon juice. Spica. *See* XX.

Trade Report.

Statement showing the Rates of Customs Duty levied on the undermentioned articles, the produce of manufacture of the United Kingdom, on importation into Italy; together with the English equivalents of those duties.

Prepared by the Exhibitions Branch of the Board of Trade at the request of the Chemical Industries Committee of the Royal Commission for the Turin Exhibition.

(The italic *g* indicates that the duty is levied on the *gross* weight.)

Tariff Classification.	Tariff Rates of Duty.			English Equivalents.		
			Lire ct.			£ s. d.
OILS, FATS, RESINS, ETC.						
Glue	100 kilos.	*g*	2 00	Cwt.	*g*	0 0 9¾
Fish glue (real)	,, ,,	*g*	15 00	,,	*g*	0 6 1¼
Glycerine, raw or refined	,, ,,	*g*	4 00	,,	*g*	0 1 7½
Isinglass	,, ,,	*g*	15 00	,,	*g*	0 6 1¼
Cart grease, composed of resin oil and lime	Free			Free		
Cart grease, other, not containing mineral oil, or containing not more than 15 per cent. of mineral oil of a specific gravity greater than 0·875	100 kilos.	*g*	5 00	Cwt.	*g*	0 2 0½
Stearin and palmitin	,, ,,	*g*	8 00	,,	*g*	0 3 3
Olein; and fatty acids solidifying at a temperature between 40° and 48°	,, ,,	*g*	4 00	,,	*g*	0 1 7½
Vaseline :—						
Natural	,, ,,	*g*	15 00	,,	*g*	0 6 1¼
Artificial	,, ,,		30 00	,,		0 12 2½
Greases, not specially mentioned, including fish grease	Free			Free		
Heavy oils	100 kilos.	*g*	8 00	Cwt.	*g*	0 3 3
Residues from the distillation of mineral oils	1000 kilos.	*g*	2 00	Ton.	*g*	0 1 7½
Benzine and other tar oils, light and limpid, denaturated, for the manufacture of colours, varnish, etc.	100 kilos.	*g*	5 00	Cwt.	*g*	0 2 0½
Mineral oils, other kinds[1]	,, ,,		24 00[2]	,,		0 9 9[2]
Black pitch	,, ,,	*g*	2 00	,,	*g*	0 0 9¾
Mineral pitch (bitumen, solid)	,, ,,	*g*	0 50	,,	*g*	0 0 2½
Colophony and Greek pitch	,, ,,	*g*	2 00	,,	*g*	0 0 9¾
Other resins and gum resins :—						
Native, raw	,, ,,	*g*	2 00	,,	*g*	0 0 9¾
Not specified	,, ,,	*g*	9 00	,,	*g*	0 3 8
Linseed oil :—						
Boiled	,, ,,		26 00	,,		0 10 7
Other	,, ,,		24 00	,,		0 9 9
Cottonseed oil, pure or mixed with other oils	,, ,,		21 50	,,		0 8 8¾
Note.—Cottonseed oil, pure or mixed with olive or other oils, is subject to a surtax of	,, ,,		14 00	,,		0 5 8½
Other kinds of seed oils	,, ,,		24 00	,,		0 9 9
Palm oil	Free			Free		
Cocoanut oil	100 kilos.	*g*	4 00	Cwt.		1 7½
Cocoa butter	,, ,,		30 00	,,		12 2½
Fish oils :—						
In receptacles not exceeding 5 litres	,, ,,		10 00	,,		4 0¾
In other receptacles	,, ,,		6 00	,,		2 5¼
Mineral coal tar	,, ,,	*g*	8 00	,,	*g*	0 3 3
Bitumen	,, ,,	*g*	0 50	,,	*g*	0 0 2½
Vegetable tar	,, ,,	*g*	2 00	,,	*g*	0 0 9¾
Natural turpentine, unrefined	,, ,,	*g*	2 00	,,	*g*	0 0 9¾
,, ,, refined; and artificial turpentine	,, ,,	*g*	9 00	,,	*g*	0 3 7¾
Oil of turpentine	Free			Free		
Lard	100 kilos.		10 00	Cwt.		0 4 0¾
Animal wax, unmanufactured :—						
Yellow	,, ,,	*g*	15 00	,,	*g*	0 6 1¼
White	,, ,,		30 00	,,		0 12 2½
Waste and strainings of wax candles	,, ,,	*g*	10 00	,,	*g*	0 4 0¾
Vegetable wax :—						
Mixed in any proportion with animal wax	Dutiable as			animal wax.		
Other	,, ,,	*g*	8 00	Cwt.	*g*	0 3 3
Ceresine, pure or mixed with paraffin	,, ,,	*g*	8 00	,,	*g*	0 3 3
Paraffin	,, ,,	*g*	15 00	,,	*g*	0 6 1¼
Paraffin candles (including stearine candles mixed with more than 30 per cent. of paraffin)	,, ,,		20 00	,,		0 8 1½
Stearine candles	,, ,,		15 00	,,		0 6 1¼
Varnish, non-alcoholic, containing mineral oil	,, ,,		30 00	,,		0 12 2½
Varnish, spirit	,, ,,		30 00	,,		0 12 2½
	In addition to a surtax			for the alcohol content.		
BEERS, WINES, SUGARS, ETC.						
Beer :—						
In casks or barrels	Hectol.		3 00	Gall.		0 0 1½
In bottles	Per 100		3 00	Per 100		0 2 6
Wines :—						
In casks or barrels	Hectol.		12 00	Gall.		0 0 5½
In bottles	Per 100		20 00	Per 100		0 16 4
Spirits :—						
Pure, in casks or barrels	Hectol.		30 00	Gall.		0 1 2
Sweetened or perfumed, including rum, cognac, in casks or barrels	,,		60 00	,,		0 2 4
In bottles of from ½ to 1 litre	Per 100		60 00	Per 100		0 16 4
In bottles of less than ½ litre	,,		45 00	,,		1 16 0
Sugar of the first-class (*i.e.*, yielding more than 94 per cent. of refined sugar	100 kilos.		99 00	Cwt.		2 0 3
Sugar of the second class	,, ,,		88 00	,,		1 15 9
Molasses	,, ,,		10 00	,,		0 4 0¾
Glucose :—						
Solid	,, ,,		80 00	,,		1 12 6
Liquid	,, ,,		50 00	,,		1 0 4
Milk sugar	,, ,,		60 00	,,		1 4 5
Yeasts	,, ,,		12 00	,,		0 4 10½

Statement showing the Rates of Customs Duty, &c.—continued

Tariff Classification.	Tariff Rates of Duty			English Equivalents		
			L. ct.			£ s. d.
CHEMICAL PRIMARY MATERIALS AND CHEMICAL PRODUCTS						
Acetic acid :—						
Impure[3]	100 kilos	g	2 00	Cwt	g	0 0 9.
Pure, containing anhydrous acetic acid in the following proportions (by weight) :—						
10 per cent. or less	.. ..	g	17 00[4]	..	g	0 6 10.[4]
More than 10 per cent. and less than 30 per cent.	.. ..		57 00[4]	..		1 3 2[4]
30 per cent. or more, but less than 50 per cent.	.. ..		100 00[4]	..		2 0 8[4]
50 per cent. or more, but less than 70 per cent.	.. ..		140 00[4]	..		2 16 11[4]
70 per cent. or more, but less than 90 per cent.	.. ..		180 00[4]	..		3 13 1[4]
90 per cent. or more, but less than 98 per cent.	.. ..		200 00[4]	..		4 1 3[4]
98 per cent. or more (glacial acetic acid	.. ..		202 00[4]	..		4 2 1[4]
Boric acid :—						
Crude	Free				Free	
Refined	100 kilos.	g	7 00	Cwt.	g	0 2 10¼
Sulphuric acid	.. ..	g	0 50	,	g	0 0 2½
Hydrochloric acid	.. ..	g	1 00	..	g	0 0 5
Nitric acid	.. ..	g	1 50	..	g	0 0 7¼
Carbolic acid, unrefined, containing more than 20 per cent of mineral or tar oils	.. ..		48 00	..		0 19 6
Carbolic acid, other ; oxalic, tartaric, and phosphoric acids	.. ..	g	10 00	..	g	0 4 0¾
Tannic acid, impure	Free				Free	
Gallic and tannic acids, pure	100 kilos.	g	10 00	Cwt	g	0 1 0¾
Citric acid	.. ..		50 00	..		1 0 4
Salicylic acid	.. ..		80 00	..		1 12 6
Lactic acid	.. ..		25 00	..		0 10 2
Arsenious acid	.. ..	g	4 00	..	g	0 1 7½
Acids not specially mentioned	.. ..	g	10 00	..	g	0 4 0¾
Acetone	Hectolitre		40 00	Gall.		0 1 6½
Sulphate of alumina and compound alums	100 kilos.	g	1 00	Cwt.	g	0 0 4·88
Ammonia	.. ..	g	5 00	..	g	0 2 0½
Bromide and iodide of ammonium	.. ..		50 00	..		1 0 4
Sulphate of ammonia	Free				Free	
Salts of ammonia, not specially mentioned	100 kilos.	g	10 00	Cwt.	g	0 4 0¾
Arsenic, metallic	.. ..	g	7 50	Ton	g	3 1 0
Arsenious acid	.. ..	g	4 00	..	g	1 12 6
Orpiment and realgar :—						
In masses	.. ..	g	4 00	..	g	1 12 6
In powder	.. ..	g	10 00	..	g	4 1 3
Chloride of lime	.. ..	g	4 00	..	g	1 12 6
White bone ash (manure)	Free				Free	
Borax or borate of soda	100 kilos.	g	5 00	Cwt.	g	0 2 0½
Bromine	Free				Free	
Sulphate of iron, sulphate of copper, sulphate of zinc	100 kilos.	g	2 00	Ton	g	0 16 3
Ether (sulphuric) and chloroform (including the weight of immediate receptacles)	.. ..	g	90 00	Lb.		0 0 3·92
Nitric and other ethers[5]	Kilo.		3 00	..		0 1 1
Iodine	Free				Free	
Magnesite (natural carbonate of magnesia), even calcined	Free				Free	
Magnesia, calcined or caustic, pure	100 kilos.		50 00	Cwt.		1 0 4
Carbonate of magnesia, artificially prepared : and unrefined, calcined, or caustic magnesia	.. ..		25 00	..		0 10 2
Note.—Calcined or caustic magnesia, impure, is admitted free of duty if it is for metallurgical use, is of grey-brown colour, and contains not less than 5 per cent. of ferric oxide						
Sulphate of magnesia	.. ..	g	1 50	Ton	g	0 12 2½
White and red phosphorus	.. ..		100 00	Cwt.		2 0 8
Note.—Phosphorus for the manufacture of matches may be imported duty free, subject to regulations of the Minister of Finance. The importation of phosphorus for any other purpose is subject to the authorisation of the Minister of Finance.						
Potash and Salts thereof.						
Sulphate of potash ; crude tartar ; also chloride of potassium (*potassio*)	Free				Free	
Cream of tartar ; chloride (hypochlorite) of potash (*potassa*)	100 kilos.	g	4 00	Ton	g	1 12 6
Carbonate and bi-carbonate	.. ..	g	0 50	..	g	0 4 0¼
Silicate :—						
In solution	.. ..	g	0 50	..	g	0 4 0¼
Solid	.. ..	g	1 20	..	g	0 9 9
Caustic potash	.. ..	g	2 00	..	g	0 16 3
Sulphite, bisulphite, and hyposulphite	.. ..	g	5 00	..	g	2 0 8
Nitrate	.. ..	g	3 00	..	g	1 4 5
Acetate, oxalate (bi-oxalate), cyanide, sulphide, chromate, bi-chromate, manganate, and phosphate	.. ..	g	4 00	..	g	1 12 6
Chlorate and perchlorate	.. ..	g	20 00	Cwt.	g	0 8 1¼
Ferrocyanide and ferricyanide	Free				Free.	
Soda and Salts thereof.						
Silicate of soda :—						
Liquid or in solution	100 kilos.	g	0 50	Ton	g	0 4 0¼
Solid	.. ..	g	1 20	..	g	0 9 9
Caustic soda	.. ..	g	2 00	.	g	0 16 3
Carbonate, bicarbonate, and sulphate of soda	.. ..	g	0 50	..	g	0 4 0¼
Acetate, chromate, bichromate, sulphide, phosphate, and manganate of soda	.. ..	g	4 00	..	g	1 12 6
Hypochlorite of soda	.. ..	g	4 00	..	g	1 12 6
Nitrate of soda :—						
Crude	Free				Free	
Refined	100 kilos.	g	3 00	Ton	g	1 4 5
Sulphite, bisulphite, and hyposulphite of soda ; borate of soda (borax)	.. ..	g	5 00	..	g	2 0 8
Chlorate and perchlorate of soda	.. ..	g	20 00	Cwt.	g	0 8 1¼
Other salts of soda	.. ..	g	10 00	Ton	g	4 1 3
Saccharin[6]	Kilo.		10 00	Lb.		0 3 7¼
Crude or refined sulphur, and flowers of sulphur	Free				Free	
Gold and platinum salts	Kilo.		10 00	Lb.		0 3 7¼
Antimony salts	100 kilos.		15 00	Cwt.		0 6 1¼
Silver nitrate	.. ..		5 00	..		0 2 0¼
Tin, oxide of	.. ..		8 00	..		0 3 3
Tin, salts of	.. ..		10 00	..		0 4 0¾
Mercuric chloride	.. ..		30 00	.		0 12 2¼
Mercuric sulphide	.. ..		80 00	..		1 12 6

Statement showing the Rates of Customs Duty, &c.—continued.

Tariff Classification.	Tariff Rates of Duty.		English Equivalents.			
		Lire ct.		£	s.	d.
Other mercury salts	100 kilos.	100 00	Cwt.	2	0	8
Bismuth salts	,, ,,	100 00	,,	2	0	8
Bromides and iodides (not alkaloidal)	,, ,,	50 00	,,	1	0	4
Salicylates (not alkaloidal)	,, ,,	80 00	,,	1	12	6
Nitrobenzene	,, ,,	4 00	,,	0	1	7½
Camphor :—						
Raw	Free			Free		
Refined	100 kilos.	25 00	Cwt.	0	10	2
Barium sulphate	,, ,,	1 00	,,	0	0	4½
Manganese sulphate	,, ,,	5 00	,,	0	2	0¼
Manganese and calcium chlorides	,, ,,	1 00	,,	0	0	4½
Calcium sulphite and bisulphite	,, ,,	5 00	,,	0	2	0½
Lead oxide and carbonate	,, ,,	8 00	,,	0	3	3
Barium carbonate	,, ,,	2 00	,,	0	0	9¾
Alumina and iron oxides	,, ,,	4 00	,,	0	1	7½
Zinc oxide	,, ,,	5 00	,,	0	2	0½
Chemical products not specially mentioned	,, ,,	10 00	,,	0	4	0¾
Wood, roots, barks, leaves, etc., for dyeing and tanning :—						
Unground	Free			Free		
Ground	100 kilos.	2 00	Cwt.	0	0	9¾
Gambier and catechu	Free			Free		
Indigo, cochineal, and kermes	Free			Free		
Colours derived from tar or other bituminous substances, dry, or in paste or liquid	Free			Free		
Colouring extracts from dyewoods, and other dyeing materials of all kinds	100 kilos.	10 00	Cwt.	0	4	0¾
Colours in cakes, powder, etc.	,, ,,	10 00	,,	0	4	0¾
Cinchona bark :—						
Not pulverised	Free			Free		
Pulverised	100 kilos.	20 00	Cwt.	0	8	1½
Saffron	Kilo.	20 00	Lb.	0	7	3
Celluloid :—						
Crude, in the mass, or in plates, sheets, rods, or tubes, not polished or unmanufactured	Free			Free		
In plates, sheets, rods, or tubes, polished or otherwise manufactured on the surface	100 kilos.	15 00	Cwt.	0	6	1½
Volatile oils and essences :—						
Rose	,, ,,	20 00	,,	0	8	1½
Orange and its varieties	,, ,,	1 50	,,	0	0	7½
Cloves	,, ,,	7 50	,,	0	3	0¾
Mint	,, ,,	7 50	,,	0	3	0¾
Not specified	,, ,,	3 00	,,	0	1	1½
Amber and manufactures thereof	,, ,,	100 00	,,	2	0	8
Soap :—						
Common	,, ,,	8 00	,,	0	3	3
Scented	,, ,,	35 00	,,	0	14	4
Gunpowder :—[7]						
Blasting	,, ,,	200 00	,,	4	1	4
Sporting	,, ,,	325 00	,,	6	12	2
Other explosives[7]	,, ,,	430 00	,,	8	14	10
Fertilisers and manures, not specially mentioned	Free			Free		
Wood pulp :—						
(*a*) Cellulose	Free			Free		
(*b*) Other (including straw pulp, etc.) :—						
Containing at least 50 per cent. of water	100 kilos.	0 50	Cwt.	0	0	2¼
Dry	,, ,,	1 00	,,	0	0	4½

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[1] The duty on petroleum and other mineral oils suitable for lighting purposes, included under this heading, may be calculated, at the option of the importer, either on the weight or on the volume. In the latter case 125 litres at 15° C. are to be taken as equivalent to 100 kilos. net.

[2] This duty is to be reduced to 16 *lire* per 100 kilos. (6s. 0d. per cwt.) from the 1st January, 1911.

[3] Including crude pyroligneous acid, and acetic acid, even colourless, containing substances which have an empyreumatic or bituminous odour, derived from the distillation of wood, and a total acetic strength of less than 50 per cent.

[4] Including surtax countervailing internal duty.

[5] Spirituous essences are subject, in addition to the Customs Duty, to a surtax on the alcohol at the rate of 1·54 *lire* per kilo. of essence (including the weight of immediate receptacles).

[6] The importation of saccharin for other than pharmaceutical purposes and under special regulations is prohibited.

[7] Including the manufacturing tax.

Books Received.

DER PORTLANDZEMENT; SEINE HYDRATBILDUNG UND CONSTITUTION. Von Dr. S. KEISERMANN. Sonderausgabe aus "Kolloidchemische Beihefte." Theodor Steinkopff's Verlag. Dresden. 1910. Price M. 1.

8vo. volume, containing 35 pages of subject matter, in which the following are the leading themes :—I. The new combinations formed in the hydration of Portland cement. II. The rationale of the investigation, and the methods. III. The experiments and their results. (*a*) Hydration of normal cements. (*b*) Preparing fluxes of different composition. (*c*) Hydration of calcium aluminates. (*d*) Hydration of calcium silicates. (*e*) Hydration of calcium chromites and ferrites. (*f*) Hydration of chromium- and iron cements. III. Constitution of clinker. (*a*) Qualitative composition. (*b*) Quantitative composition. IV. Significance of the two components of clinker, alike in the burning and binding of cement.

DIE ABSORPTION. GESAMMELTE ABHANDLUNGEN ÜBER KOLLOIDE UND ABSORPTION, von J. M. VAN BEMMELEN. Emer. Professor der Universität Leiden. Mit Unterstützung des Verfassers, neu herausgegeben von Dr. WO. OSTWALD. Theodor Steinkopff's Verlag. Dresden. 1910. Price M. 12; geb. M. 13.50.

8vo. volume, containing 540 pages of subject matter with indexes of authors and subjects, numerous illustrations, a frontispiece portrait of the author, and his biography. The text is classified as follows :—I. The nature of colloids and their content of water. II. Absorption compounds and the absorptive capacity of arable land. III. The hydrogel of ferric oxide, the crystalline ferric hydroxide, potassium ferrite and sodium ferrite. IV. The hydrogel and the crystalline hydrate of cupric oxide. V. Absorption of water by the colloids, especially by the gel of silicic acid (Absorption I.). II. Formation of the gels and their structure (Absorption II.). VII. Absorption III. VIII. The isotherma of colloidal ferric oxide at 15° C. (Absorption IV.). IX. Absorption of hydrochloric acid and potassium chloride from aqueous solution by colloidal stannic oxide (Absorption V.). X. Absorption of substances from solutions (Absorption VI.). XI. Action of high temperatures on the texture of the hydrogel of silicic acid

(Absorption VII.). XII. Absorption compounds of hydrogels, when chemical compounds or solutions can also occur (Absorption VIII.). XIII. Difference between hydrates and hydrogels and the modification of the hydrogels (Zirconic acid and metazirconic acid). (Absorption IX). XIV. Contribution to our knowledge of the properties of the hydrogels during dehydration and rehydration (Absorption X.).

Year-Book of Pharmacy: Comprising abstracts of papers relating to Pharmacy, Materia Medica, and Chemistry contributed to British and Foreign Journals from July 1, 1909, to June 30, 1910. With the transactions of the British Pharmaceutical Conference at the 47th Annual Meeting held in Cambridge, July, 1910. Editor of the Year-Book, J. O. Braithwaite. Editors of the Transactions, E. Saville Peck, and Horace Finnemore. J. and A. Churchill, 7, Great Marlborough Street, London, 1910. Price 10s. 6d.

An Introduction to the Chemistry of Colloids. A Compendium of Colloidal Chemistry for Students, Teachers, and Works Managers. By Dr. Victor Pöschl. Translated from the second, enlarged, German Edition. By Herbert H. Hodgson, M.A., Ph.D. Chas. Griffin and Co., Limited, Exeter Street, Strand, London, 1910. Price 3s. 6d. net.

Small 8vo. volume, containing 107 pages of subject matter, and indexes of authors and subjects. The matter is subdivided in accordance with the following classification:—I. General characteristics. Nomenclature. II. Properties of colloidal solutions. III. Relation of colloidal solutions to solutions proper and to suspensions. IV. The dispersoids and their classification. V. Preparing colloidal solutions. VI. Research methods. Ultramicroscopy. VII. Recent views on the nature of the colloid state. VIII. Importance of colloidal chemistry to other sciences. IX. Importance of colloidal chemistry in chemical industry and technology. X. Bibliographic reference table.

A Text Book of Organic Chemistry. By William A. Noyes, Professor of Chemistry in the University of Illinois. Second Edition, revised. Henry Holt and Company, New York. 1910. Price $1.50 net.

12mo. volume, with 521 pages of subject matter, and an alphabetical index of subjects. The text has the following classification:—I. Purification, analysis, determination of molecular weights and formulæ. II. Physical properties. III. Hydrocarbons. Marsh gas series. IV. Ethylene series. V. Cyclic hydrocarbons. VI. Acetylene and other series. VII. Benzene series. VIII. Related hydrocarbons. IX. Classification of derivatives of the hydrocarbons. X. Alcohols and phenols. XI. Ethers. XII. Aldehydes and ketones. XIII. Acids. XIV. Acid derivatives. XV. Hydroxy-acids. XVI. Ketonic and aldehyde acids. XVII. Carbohydrates, etc. XVIII. Halogen compounds. XIX. Nitro compounds. XX. Amines. XXI. Diazo, azo, hydrazo, and other nitrogen compounds. XXII. Sulphur compounds. XXIII. Heterocyclic compounds. XXIV. Alkaloids. XXV. Compounds of interest in physiology and pathology.

Mines and Quarries. General Report and Statistics for 1909, by the Chief Inspector of Mines. Part II.—Labour. [Cd. 5399.] Wyman & Sons, Fetter Lane, E.C. Price 10½d.

This publication contains a general report and statistics relating to persons employed and accidents in mines and quarries in the United Kingdom, and to the enforcement of the Mines and Quarries Acts. According to these statistics, the total number of persons employed in mines and at the quarries under the Quarries Act in the United Kingdom and the Isle of Man during the year 1909 was 1,126,372, of whom 1,042,435 were employed at mines, and 83,937 at quarries. Compared with the preceding year there was an increase of 24,695 persons employed at mines, and a decrease of 1,538 at quarries. In 1909, 1,303 separate fatal accidents occurred in or about mines and quarries, causing the loss of 1,577 lives; this, as compared with 1908, was an increase of 39 in the number of fatal accidents, and of 140 in the number of lives lost.

Census of Production (1907). Preliminary Tables summarising the Results of the Returns received under the Census of Production Act, 1906. Part V. [Cd. 5397.] Wyman & Sons, Fetter Lane, E.C. Price 5½d.

Containing particulars relating to—(54) Grain-milling factories; (55) Bread and biscuit factories and workshops:—(a) Private farms, (b) Army bakeries; (56) Cocoa, confectionery, and fruit-preserving factories and workshops; (57) Factories and workshops manufacturing farinaceous preparations and household articles for cleansing and polishing (except soap); (58) Cattle, dog, and poultry food factories and workshops; (59) Ice factories; (60) Sugar and glucose factories; (61) Brewing and malting factories and workshops; (62) Spirit distilling factories; (63) Spirit compounding, rectifying, and methylating factories and workshops; (64) Bottling factories and workshops; (65) Aerated waters, cider, British-made wines, non-alcoholic beverages (brewed), and vinegar factories and workshops; (66) Tobacco factories and workshops; (67) Naval victualling yards (Home establishments).

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (I) in the case of Applications for Patents, the dates of Application, and (II) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

25,225. Smith. *See under* VI.

25,560. Scheinemann. Evaporating apparatus. [Austrian Appl., Nov. 9, 1909.]* Nov. 3.

25,716 Wyld. *See under* VII.

26,058 Armstrong. *See under* II.

26,231. Jones. Trays for filter-presses.* Nov. 11.

Complete Specifications Accepted.

25,299 (1909). Pritchard. Apparatus for contacting vapours and gases with liquids and molten substances. Nov. 9.

25,638 (1909). Waterhouse and Bourne. Method and apparatus for distilling. Nov. 16.

25,679 (1909). Durant, and Metals Extraction Corporation. Apparatus for bringing a gas into contact with a liquid. Nov. 16.

25,768 (1909). Fairweather (Hutl Electrostatic Separator Co.). Separating ingredients of comminuted materials. Nov. 16.

1925 (1910). Gebr. Siemens und Co. Manufacture of fire- and acid-proof moulds, crucibles, etc. Nov. 16.

3316 (1910). Hildebrandt. Liquefying gases with a low boiling point. Nov. 9.

3690 (1910). Crossley and Atkinson. Raising and forcing liquids. Nov. 9.

18,698 (1910). L'Air Liquide. Desiccation of air and other gases. Nov. 16.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

25,254. Ross. Incandescent gas mantles. Oct. 31.

25,336. Macklow-Smith. *See under* XXIII.

25,825. Harrop. Manufacture of incandescent bodies or mantles. Nov. 7.

26,045. Krannichfeldt. Production of electric incandescence bodies.* Nov. 9.

26,058. Armstrong. Coke ovens, gas producers, calciner furnaces, etc. Nov. 9.

26,072. Bickerton, Bradley, and Clerk. Gas producers. Nov. 9.

26,109. Weldon, Lound, and Atkinson. Incandescence mantles and their manufacture. Nov. 9.

26,168 and 26,242. Simmance and Abady. *See under* XXIII.

Complete Specifications Accepted.

18,334 (1909). Noad. *See under* III.

25,019 (1909). Richards and Pringle. Distilling or partly distilling coal and producing fuel. Nov. 9.

25,808 (1909) Bone, Wilson, and McCourt. Combustion of mixed gases. Nov. 16.

26,432 (1909). Pudney and Sadler. Incandescent gas mantles. Nov. 9.

29,313 (1909). Smith and Shaw. Vertical gas retorts. Nov. 9.

29,430 (1909). Bone, Wilson, and McCourt. Combustion of gaseous fuel. Nov. 16.

30,148 (1909). Von Unruh. Manufacture of incandescing bodies for use in gas lighting. Nov. 16.

2444 (1910). Dunlop. Gas producers. Nov. 9.

13,978 (1910). Benninghoff and Klönne. Cooling coal-gas and the like. Nov. 16.

III.—TAR AND TAR PRODUCTS.

Applications.

25,266. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of a sulphurised derivative of carbazole. Oct. 31.

25,461. Newton (Bayer und Co.). Manufacture of alkylated derivatives of azimino-*o*-toluidines and the monoazo dyestuffs therefrom. Nov. 2.

26,336. Newton (Bayer und Co.). Manufacture of anthracene compounds. Nov. 12.

Complete Specifications Accepted.

18,334 (1909). Noad. Apparatus for distilling shale and other bituminous substances. Nov. 16.

15,711 (1910). Raschig. Tar paint or tar coatings. Nov. 9.

IV.—COLOURING MATTERS AND DYES.

Applications.

25,291. Newton (Bayer und Co.). Manufacture of mordant dyestuffs of the triphenylmethane series. Oct. 31.

25,292. Bayer und Co. Manufacture of diazotisable dyestuffs. [Ger. Appl., May 3, 1910.]* Oct. 31.

25,294. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Oct. 31.

25,461. Newton (Bayer und Co.). *See under* III.

26,209. Vanicek. Manufacture of halogenised indigo dyestuffs. Nov. 11.

26,249. Newton (Bayer und Co.). Manufacture of basic azo dyestuffs. Nov. 11.

Complete Specifications Accepted.

532 (1910). Newton (Bayer und Co.). Manufacture of *o*-oxyazo dyestuffs. Nov. 16.

1411 (1910). Newton (Bayer und Co.). Manufacture of dyestuffs of the triphenylmethane series. Nov. 16.

2105 (1910). Newton (Bayer und Co.). Manufacture of vat dyestuffs. Nov. 9.

5808 (1910). Kalle und Co. Manufacture of vat dyeing colouring matters. Nov. 9.

19,000 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). Manufacture of a monoazo dyestuff suitable for preparing pigment colours. Nov. 16.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

25,393. Stocks. Manufacture of pulp for paper-making, etc. Nov. 1.

25,986. Guadagni. Production of artificial silk. [Addition to No. 1265 of 1908. Ital. Appl., Nov. 9, 1909.]* Nov. 8.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

25,217. Reuss. Machinery and process for bleaching. Oct. 31.

25,225. Smith. Water filter for use in dyeworks. Oct. 31.

25,957 and 25,958. Johnson (Badische Anilin und Soda Fabrik). Production of discharge effects on fibre. Nov. 8.

26,132. Knecht, and Peter Spence and Sons, Ltd. Discharging and dyeing of fabrics. Nov. 10.

Complete Specifications Accepted.

24,607 (1909). Psarski. Dyeing machine. Nov. 9.

1641 (1910). Haddan (Lüttgen). Chemical cleansing by means of benzine, benzol, etc. Nov. 16.

7051 (1910). Riesenfeld. Apparatus for treating textile goods with liquids. Nov. 16.

8306 (1910). Habel. Mercerising warp yarns, etc. Nov. 9.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

25,386. Hale and Scott. Manufacture and concentration of nitric acid. Nov. 1.

25,575. Hale and Scott. Manufacture and concentration of nitric acid. Nov. 3.

25,576. Hale and Scott. Recovery of corrosive acids from their absorbments. Nov. 3.

25,872. Kinzlberger und Co. Manufacture of anhydrous hydrosulphites. [Austrian Appl., Nov. 25, 1909.]* Nov. 7.

25,886 and 25,887. Burckhardt. Manufacture of quartz or silica. Nov. 8.

COMPLETE SPECIFICATIONS ACCEPTED.

25,082 (1909). Gerrard. Treating salt and by-products. Nov. 9.

26,258 (1909). Swan and Kendall. Apparatus for making alkaline cyanides. Nov. 16.

30,324 (1909). Peniakoff. Manufacture of alkali alu- minates. Nov. 16.

30,562 (1909). Johnson (Badische Anilin und Soda Fabrik). Manufacture of nitrates. Nov. 16.

1585 (1910). Exley. Manufacture of barium sulphate. Nov. 9.

14,023 (1910). Haber. Manufacture of ammonia. Nov. 9.

15,525 (1910). Guye and Darier. Manufacture of alkali nitrates and alkaline earth nitrates. Nov. 9.

18,311 (1910). Glaser and Muller. Refining salt. Nov. 9.

23,157 (1910). Pietzsch and Adolph. Manufacture of potassium persulphate. Nov. 16.

23,923 (1910). Act.-Ges. f. Anilinfabr. Manufacture of sulphuryl chloride. Nov. 16.

VIII.—GLASS; CERAMICS.

APPLICATIONS.

25,886 and 25,887. Burckhardt. *See under* VII.

26,023. Podmore and Bailey. Treatment of ceramic and like semi-fluid or plastic or granular materials. Nov. 9.

26,142. Costar, Bates, and British Insulated and Helsby Cables, Ltd. Enamelling wire. Nov. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

25,692 (1909). Fletcher. Enamelling muffles. Nov. 9.

1925 (1910). Gebr. Siemens und Co. *See under* I.

IX.—BUILDING MATERIALS.

APPLICATION.

25,541. Earle (Enricht). Manufacture of materials having a silicious binding agent. Nov. 3.

COMPLETE SPECIFICATIONS ACCEPTED.

22,585 and 25,146 (1909). Hewitt. Drying and burning or calcining slip, slurry, chalk, clay, limestone, etc. Nov. 16.

25,370 (1909). Boldi. Building materials. Nov. 9.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

APPLICATIONS.

25,383. Levin. Recovery of tin or zinc from coated scrap metal.* Nov. 1.

25,401. Johnson. Treatment of ores of tungsten, etc. [U.S. Appl., Jan. 31, 1910.]* Nov. 1.

25,411. Gray (Schwab). Manufacture of tungsten wires, filaments, etc.* Nov. 1.

25,493. Vautin. Recovery of metal from slags. Nov. 2.

25,504. Soddy. *See under* XX.

25,581. Elektrostahl G. m. b. H. Manufacture of iron and steel. [Ger. Appl., March 26, 1910.]* Nov. 3.

25,695. Cammell, Laird, and Co., and Newton. Manufacture of armour plates. Nov. 4.

25,736. Eisenwerk Krone and others. Siemens-Martin furnaces. Nov. 5.

25,741. Kohlhaas. Manufacture of steel. [Ger. Appl., Nov. 12, 1909.]* Nov. 5.

25,959. Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of nickel lined vessels and other articles. Nov. 8.

25,969. Langbein-Pfanhauser Werke. Manufacture of ductile electrolytic iron. [Addition to No. 24,841 of 1909. Ger. Appl., Nov. 12, 1909.]* Nov. 8.

26,115. Stockmann. Working ore dust from blast furnaces and fine iron ore. Nov. 9.

26,262. Holloway. Ore dressing. Nov. 11.

26,335. Smith. Manufacture of steel and iron. [Ger. Appl., Nov. 13, 1909.]* Nov. 12.

26,356. Roux. Process for making precious metals such as silver and gold by treating chemically pure iron.* Nov. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

23,108 (1909). Ramen and Beskow. Roasting of ores. Nov. 16.

25,847 (1909). Masson. Recovery of pure antimony from ores, concentrates, tailings and slimes. Nov. 9.

25,915 (1909). Jensen (Spitz). Separation of tin or other metal from waste metal, alloys, etc. Nov. 16.

30,425 (1909). Marks (Colorado Iron Works Co.). Furnaces for smelting ores. Nov. 16.

3061 (1910). Reid. Hardening surfaces of iron or steel or their alloys. Nov. 9.

5267 (1910). Brougham (Poldihütte Tiegelgusz-stahlfabr.). Melting and refining furnaces. Nov. 16.

XI.—ELECTRO-CHEMISTRY.

COMPLETE SPECIFICATION ACCEPTED.

11,716 (1910). Thomson. Electric furnaces. Nov. 16.

XII.—FATS; OILS; WAXES.

APPLICATION.

25,669. Wynberg. Obtaining waxes, fats, and oily substances.* Nov. 4.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

COMPLETE SPECIFICATIONS ACCEPTED.

17,615 (1910). Meister, Lucius, und Brüning. Manufacture of bluish-green colour lakes. Nov. 16.

19,000 (1910). Bloxam (Chem. Fabr. Griesheim-Elektron). *See under* IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

APPLICATIONS.

25,293. Newton (Bayer und Co.). Manufacture of substances similar to caoutchouc. Oct. 31.

25,573. Livingston and Cairney. Treatment of the latex obtained from rubber and analogous trees. Nov. 3.

25,850. Bayer und Co. Manufacture of substances milar to caoutchouc. [Ger. Appl., Dec. 27, 1909.]* Nov. 7.

26,093. Turns. Manufacture of artificial india-rubber and the like. Nov. 9.

26,173. Pahl. Process for coagulating the latex of caoutchouc producing plants. [Ger. Appl., Feb. 4, 1910.]* Nov. 10.

Complete Specifications Accepted.

1335 (1910). Tarver. Manufacture of articles from waste rubber, ebonite, vulcanite, etc. Nov. 9.

9579 (1910). Van der Heyden and Jurgens. Manufacture of an elastic caoutchouc-like substances. Nov. 9.

XV.—LEATHER; BONE; HORN; GLUE.

Complete Specification Accepted.

7066 (1910). Hönig. Manufacture of extracts for use in tanning. Nov. 9.

XVI.—SOILS; FERTILISERS.

Application.

25,241. Radcliffe. Chemical manures and the manufacture thereof. Oct. 31.

XVIII.—FERMENTATION INDUSTRIES.

Complete Specification Accepted.

20,489 (1910). Kuhn. Manufacture of beverages from grapes and raisins. Nov. 16.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

25,668. Brown and Maconochie. Treatment of organic liquors, etc. Nov. 4.

25,882 and 25,883. Henri, Helbronner, and von Recklinghausen. Apparatus for destroying bacteria in water supply systems.

26,046. Blank. Manufacture of formaldehyde.* Nov. 9.

26,064. Wojik. Process of pasteurisation.* Nov. 9.

26,094. Permutil Filter Co. Softening water or relieving it of iron and manganese. [Ger. Appl., May 10, 1910.]* Nov. 9.

26,264. Faitelowitz. Testing the freshness of milk. Nov. 11.

Complete Specifications Accepted.

27,607 (1909). Candy and Candy. Apparatus for use in purifying water. Nov. 16.

579 (1910). Chambers, and Watson, Ltd. Treatment of trade effluents. Nov. 9.

3508 (1910). Müller. Reducing the proportion of salts and sugar in cows' milk without diminishing the content of fat and casein. Nov. 16.

13,877 (1910). Koch. Apparatus for purifying sewage water. Nov. 16.

21,283 (1910). Stiff. Bacterial filter beds. Nov. 9.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

25,504. Soddy. Separation of mesothorium from monazite sand, and its concentration in products obtained from minerals containing thorium. Nov. 3.

25,696. Folmer. Manufacture of organic compounds of calcium. Nov. 4.

25,698. Kaufmann. Manufacture of aromatic antimony compounds.* Nov. 5.

25,873. Wellcome and Pyman. Manufacture of a therapeutic compound. Nov. 7.

25,967. Consortium f. Elektrochem. Ind. Production of acetylene tetrachloride. [Ger. Appl., Nov. 9, 1909.]* Nov. 8.

Complete Specifications Accepted.

25,470 (1909). Einhorn. Manufacture of benzoyl salicylic acid. Nov. 9.

30,592 (1909). Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Nov. 9.

2104 (1910). Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Nov. 9.

6031 (1910). Horsley, and United Alkali Co. Manufacture of monochlor-acetic acid. Nov. 9.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

25,751. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Intensifying or toning silver salt photographic images. [Fr. Appl., July 16, 1910.]* Nov. 5.

XXII.—EXPLOSIVES; MATCHES.

Applications.

25,274. Van Pittius. Explosives. Oct. 31.

25,328. Trench. Manufacture of gunpowder. Nov. 1.

26,334. Nitroglycerin Aktiebolaget. Explosive. [Appl. in Sweden, Nov. 26, 1909.]* Nov. 12.

Complete Specifications Accepted.

26,359 (1909). Demetriade, Jonescu, and Coanda. Explosives. Nov. 16.

17,194 (1910). Bichel. Explosive charges. Nov. 9.

XXIII.—ANALYTICAL PROCESSES.

Applications.

25,336. Macklow-Smith. Gas calorimeters. Nov. 1.

26,168. Simmance and Abady. Gas analysis apparatus.* Nov. 10.

26,242. Simmance and Abady. Recording gas calorimeters. Nov. 11.

26,264. Faitelowitz. *See under* XIX.

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Birmingham Section.

Meeting held at Birmingham University, on Thursday, October 20th, 1910.

DR. T. SLATER PRICE IN THE CHAIR.

THE INTERPRETATION OF COLOUR VALUES OBTAINED BY LOVIBOND'S TINTOMETER.

BY ARTHUR W. KNAPP, B.SC., F.I.C.

The Lovibond Tintometer is being more and more used as a convenient instrument for the measurement and recording of colours. The theory of the tintometer is that any colour can be matched with a suitable combination of red, yellow and blue standard glasses.

In using the Lovibond Tintometer I found that it was possible to make glasses of different values match the same colour or match one another, for example:

3·0 Red 5·0 Yellow 1·0 Blue
gave the same colour as
2·2 Red 4·2 Yellow 0·2 Blue

In examining a body with this colour, two experimenters with perfect eyesight might correctly record different results. This is an obvious objection to the use of the instrument, and therefore I thought it worth while to find the cause, in order that this possibility of obtaining inconsistent results might be eliminated.

The following experiments revealed the cause: the standard glasses are not perfectly transparent to white light; and hence a little white light is lost for each glass that is passed through. This is what one would naturally expect, for perfectly transparent bodies are unknown, but I have not seen it mentioned anywhere that the amount of light so lost must be considered in recording the colour. Of a large number of comparisons of combinations of glasses, the following are selected to illustrate this point.

(1) (It will be remembered that the standard glasses are intended to be so arranged that equal amounts of red, yellow and blue give a neutral tint. Actually, such combinations do give greys almost free from colour.) A combination of 12 glasses:

·2, ·2, ·2, ·2 Red ·2, ·2, ·2, ·2 Yellow ·2, ·2, ·2, ·2 Blue
does not give the same depth of grey as
·8 Red ·8 Yellow ·8 Blue
but gives the same grey as the three glasses:
4·0 Red 4·0 Yellow 4·0 Blue

This apparent error in the standards is produced by ignoring the white light which each glass absorbs and scatters. Theoretically, white light passing through an ideal yellow glass would retain the whole of its yellow component and would only be diminished in its red and blue components. Practically, when light passes through one of the standard yellow glasses, marked 0·2, there are actually absorbed red and blue rays corresponding to 0·2 of yellow, and also, as the calculation below shows, about 0·36 of white light (*i.e.*, 0·36 each of yellow, red and blue). If we assume that the glasses are correct so far as their primary colours are concerned, then the average amount of white light absorbed in the above comparison by each glass is calculated thus: the first combination contains nine more glasses than the second, and these nine glasses are responsible for 4·0 − 0·8 = 3·2 of grey. Or one glass absorbs as an average 3·2 ÷ 9 = 0·36 of white light.

(2) Comparing glasses of one colour, it might be expected that the five glasses 0·1, 0·2, 0·4, 0·5, 0·8 (= 2·0) of yellow would match the one glass, 2·0 of yellow. We find that they look, in a sense, equally yellow, but that the screen seen through the one glass appears by comparison flooded with sunlight. And to make it match the five glasses, it is necessary to add ·2 each of red, yellow and blue. One glass thus absorbs in this case 0·2 of white light.

These two examples must not be taken as indicating that the standard glasses, supplied with the tintometer, are not true as far as their primary colour is concerned, but simply that their property of stopping white light has been ignored. Thus 0·1 of yellow is 0·1 of yellow, but also about 0·3 of grey. That the glasses are correctly standardised was shown by having *the same number of glasses* in any two combinations compared, so as to cancel out the greyness. Examples:

(1) 2·0, 0·5, 0·2, 0·1 (= 2·8) of any colour match
1·0, 0·8, 0·6, 0·4 (= 2·8) of the same colour.

(2) The six glasses 2·0 of Red and ·1, ·2, ·4, ·5, ·8 of Yellow match the six glasses ·1, ·2, ·4, ·5, ·8 of Red and 2·0 of Yellow.

In all such combinations the matches were perfect or almost perfect: which shows that the glasses are carefully standardised and that their greyness is not markedly variable. It will now be seen that in using the Lovibond Tintometer the colour values represented by figures on paper do not vary proportionally with the actual colour values; they make, however, a very useful record, for one can, provided one knows the *number* of glasses used, always obtain the same colour again. The note above shows that we should be more nearly expressing the truth if we added, to the values for the red, yellow and blue, from 0·2 to 0·4 of grey for each glass used. And further, if this were done, disagreements, due to the use of different numbers of glasses, would be avoided. This will be seen from the following examples:

(*a*) 3·0 Red 5·0 Yellow 1·0 Blue
give the same colour as
(*b*) 2·2 Red 4·2 Yellow 0·2 Blue

They are here recorded in the usual way. In (*a*) three glasses are used, and in (*b*) five glasses. Accurately to record the grey introduced by the glasses we should need to know the exact amount of white light that each particular glass absorbs. It will be sufficiently near for our purpose to consider each one as introducing the average 0·3 of grey found above. Adding 0·3 grey (= 0.3 red, 0·3 yellow, 0·3 blue) for each glass used, we get, since 3 × ·3 = 0·9 and 5 × 0·3 = 1·5:—

(*a*)	3·0 Red	5·0 Yellow	1·0 Blue
	0·9	0·9	0·9
	3·9	5·9	1·9
(*b*)	2·2 Red	4·2 Yellow	0·2 Blue
	1·5	1·5	1·5
	3·7	5·7	1·7

which agree as well as can be expected under ordinary working conditions. If we prefer to express (*a*) and (*b*) in terms of their visual composition, as suggested by Mr. Lovibond, we see that the error occurs in the black:

(*a*) Black 1·0 Orange 2·0 Yellow 2·0
(*b*) Black 0·2 Orange 2·0 Yellow 2·0

To apply the suggested correction when the colours are so expressed we have merely to add 0·9 to the black in (*a*), and 1·5 to the black in (*b*).

As a final example:

(*c*) 1·9 Red 1·9 Yellow 0 Blue
was very different from 2·0 red and 2·0 yellow, but was almost identical with
(*d*) 3·0 Red 3·0 Yellow 1·0 Blue

Each 1·9 was made up of 1·0, 0·5, 0·4, so that (*c*) was made up of six glasses and (*d*) of three glasses. Applying the suggested correction, we obtain:

(*c*) 3·7 Red 3·7 Yellow 1·8 Blue
(*d*) 3·9 Red 3·9 Yellow 1·9 Blue

The same result could be obtained, more tediously, experimentally, if one had some pieces of uncoloured glass, each of which had the same greyness (probably about 0·3) as the coloured glasses. The experimenter would arrange to have, on the object side of the match, the same number of such uncoloured glasses as there were coloured glasses in the combination which matched. I believe Mr. Lovibond has suggested the use of such glasses for special substances, like water-white oils, glycerine, etc.

DISCUSSION.

Mr. J. F. **LIVERSEEGE** said that the colour of the Welsh water in Birmingham had been regularly determined with the tintometer, and notable seasonable variations had been found. The amount of colour was smallest in the middle of the year. About September there was a decided increase, the maximum being attained about November. The colour then gradually fell till about May. The colour was determined at several stations, and it was, of course, advisable that different workers should get the same results. A sample of water was examined in Wales and the colour given as 2·4 of red, 10·6 of yellow and 0·5 of blue. Mr. Knapp and himself had examined the sample the next day and found the colour to be: red 3·0, yellow 11·2, blue 1·0. With the glasses then in use the first colour could be produced by either using five or eight glasses. The latter was a fair match of the water. They used six glasses in their match, and if, for the two extra glasses, 0·6 was added to the figures of the observer in Wales, the result was very similar to what they obtained. To avoid this cause of disagreement, rules previously drawn up for tintometer observations were amended as follows:—The white reflector must be placed so that the surface is uniformly illuminated. The sun must not shine on it. The right and left fields must have the same appearance. The equality of the fields should be tested occasionally by transferring the trough from one side of the instrument to the other. This reversal should make no difference to the colour of the water as determined by the glasses. The reflector, the glasses, and the trough must be kept clean. The bottle of water should be shaken thoroughly before the trough is filled. If the water is turbid, the contents of the trough should be stirred periodically. Welsh water should be matched if possible with yellow and red glasses only, not less than 0·2 of a colour being added at once. With dark waters the addition may be 0·4 or 1·0. If red and yellow glasses alone give a colour brighter than the water, add blue, and increase the red and yellow proportionately. (The Triple "neutral" glasses may be used as a guide to the amount of increase.) In cases of doubt, record the smaller amount of blue. For instance, if between 0 and 0·2, put down 0; if between 0·2 and 0·4, put down 0·2. Use the smallest possible number of glasses, that is, replace 0·2 and 0·4 of the same colour by 0·6; or replace 0·4 and 0·6 by 1·0. When a match is apparently obtained, give the eyes a little rest, stir the water if turbid, then test the accuracy of the match by adding 0·2 of red (or 0·4 if the water is dark) to the right and left of the instrument, and if the change effects an improvement, modify the glasses accordingly. Then try 0·2 of yellow in the same way, then red and yellow together, and finally 0·2 each of red, yellow, and blue together. If none of these changes make an improvement in the match, the result is recorded. No "neutral" glasses must be present in the final match, and all glasses must be on one side. *Glasses used.*—Red, yellow, and blue, 0·2, 0·4, 0·6, 0·8, 1·0, 2·0, 3·0, 4·0, 5·0, 10·0, 15·0, 20·0; neutral (for trial matches only) 0·2, 0·5, 1·0.

Mr. F. H. **ALCOCK** said it appeared to him that the author's suggestion presented some difficulty. He did not think that it was a question of multiplication, addition, subtraction, or division. They had to look for the difficulty in the reflection, diffusion, refraction and polarisation of light. When he was dealing with turbid waters such considerations, which were constantly cropping up, in the subject of light, were concerned in the variation.

Mr. **KNAPP**, in reply, observed that Mr. Liverseege had recommended that 0·1 should no longer be used in matching the colour of Birmingham water. He thought that was wise, since a 0·1 glass added 0·1 of colour, and 0·3 of grey to the light passed through; so that, for example, the addition of a 0·1 yellow glass caused a reduction of brightness which was more marked than the increase in yellow. Personally, he had found that where there were more than 5 units of a colour already present, his eye was not always sensitive even to an addition of 0·2 of that colour. In his own experiments the possibility of refraction, etc., having an influence was eliminated, for he had used no medium, but had compared the standard glasses with one another.

Manchester Section.

Meeting held at the Grand Hotel, Manchester, on Friday, November 4th, 1910.

DR. G. J. FOWLER IN THE CHAIR.

CONTRIBUTION TO THE STUDY OF CHEMICAL DISINFECTANTS.

BY PROFESSOR SHERIDAN DELÉPINE, M.B., C.M., M.SC.

I propose to approach this subject from the bacteriological and hygienic point of view only. I cannot attempt to deal fully with all the facts bearing upon the biological and hygienic aspect of disinfection by chemical disinfectants, all I can hope to do is to indicate by means of records of experiments and observations some of the factors which have to be considered. For this purpose I propose to utilise chiefly the work which has been carried out in my laboratory either by myself or by several workers who have employed under my supervision the same methods as those I have used. During this period I have gradually improved many technical details, but most of my older work has been controlled by more extended experiments conducted in my laboratory in the course of the last ten years by a number of research workers.

As I am not at liberty to refer in detail to the investigations I have carried out on behalf of a number of firms, I will not refer to any patent disinfectant by name (except when published statements are available). I propose, however, as soon as I have been able to complete independent and strictly comparable series of tests with all the most important disinfectants at present on the market, to publish my results. In the time at my disposal it is impossible to refer to the work done by other observers, but as I have given elsewhere* a general account of the subject I may perhaps be excused for this omission.

The problem of disinfection is more complicated than is generally supposed. In principle it is simple enough; we know that infectious diseases and fermentations are due to living microbes, and that by killing or rendering these microbes inactive we may stop the spread of infection. We may therefore say that chemical disinfectants are substances which prevent the spread of infection by bringing about the death of the living organisms causing infection. It is not always easy to distinguish between the results brought about by the death of the infecting microbes and those caused by a suspension or inhibition of their activities. Certain products have the power even in very minute doses to arrest the multiplication and other activities of bacteria so completely that perfect sterilisation is simulated. Substances acting in this way are generally termed antiseptics; they are only inhibitory agents. The same product may in small doses act as an antiseptic and in larger doses as a disinfectant, in fact this is usually the case.

Inhibitory action is very different in its effects from lethal action, for microbes which have been kept in a state of suspended activity by the action of an antiseptic may begin to multiply again when the material containing them is mixed with other products or simply diluted.

The mode of action of antiseptics is understood in very few cases only.

Geppert showed in 1889 that mercuric chloride may be fixed by the living bacteria and inhibit their growth and multiplication without killing them. This is easily proved by transferring the bacteria which have been exposed for a certain length of time to the action of certain dilutions of mercuric chloride to fluids containing ammonium sulphide or free sulphuretted hydrogen. When this is done an inert sulphide is produced and the bacteria resume their suspended activity.

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*Standardizing of Disinfectants, J. Royal Inst. of Public Health. 1908.

The same kind of phenomenon may occur in connection with other substances, but is not so easily demonstrated as in the case of mercuric chloride. I have made several experiments in order to ascertain to what an extent this inhibitory action interfered with estimates of the germicidal actions of mercuric chloride, and found that even non-sporing organisms could be revived after a time considerably exceeding the duration of their exposure to fairly strong solutions of the salt. With the assistance of Dr. H. Osborne I repeated several years ago some of these experiments. Silk threads were impregnated with a 48 hours old culture of *Bacillus coli communis*, and were allowed to remain dry for four days; at the end of that time they were severally immersed for 20 minutes in various watery dilutions of mercuric chloride, after which a first lot was washed for 60 minutes in distilled water, and transferred to peptone bouillon, a second lot was washed in distilled water for 60 minutes, and then treated by saturated watery solution of sulphuretted hydrogen for 20 minutes, and then transferred to peptone bouillon, a third lot was left in distilled water for 35 minutes, then in sulphuretted hydrogen solution, before being transferred to bouillon, the fourth lot was placed in sulphuretted hydrogen solution immediately after removal from the mercuric chloride solution, and after a stay of 20 minutes in the sulphuretted hydrogen was transferred to bouillon, the results of this experiment are summed up in Table I.

TABLE I.

Antelethal inhibitory action of mercuric chloride.

Bacillus coli threads 4 days old. Temperature of solutions 21° to 21° 5. C. Duration of exposure, 20 minutes.

Duration of stay in distilled water before transfer to nutrient medium = time allowed for delayed action.	Duration of stay in sulphuretted hydrogen water.	Dilutions of mercuric chloride.							
		$\frac{1}{100}$	$\frac{1}{500}$	$\frac{1}{1000}$	$\frac{1}{2000}$	$\frac{1}{3000}$	$\frac{1}{4000}$	$\frac{1}{5000}$	$\frac{1}{20000}$
1 60 min.	None	—	—	—	—	—	—	0	0
2 60 „	20 min.	0	0	0	0	0	0	+	—
3 35 „	20 „	0	0	0	+	+	+	+	—
4 0 „	20 „	0	+	+	+	+	+	+	

— = no observation. 0 = no growth, *i.e.*, bacilli killed. + = growth, bacilli not killed.

From these results it would appear that the first product of the action of the mercuric chloride upon the bacillus coli (probably an albuminate of mercury) remains localised and probably quite superficial when the bacilli are treated with solutions of a strength less than $\frac{1}{100}$, but that even the small amount of toxic product thus formed can bring about the death of the whole bacillus in the course of 60 minutes when dilutions ranging between $\frac{1}{4000}$ and $\frac{1}{2000}$ have been used, and in 35 minutes after exposure to $\frac{1}{1000}$ and $\frac{1}{500}$ dilutions.

The relation between the quantity of disinfectant and the duration of what I call the *antelethal inhibitory period* deserves careful study. The amount of mercuric chloride retained by the silk thread must be taken into consideration. Experiments made with bacteria in fluid culture yield equally striking results, although they are not so convenient for demonstrating the relative duration of antelethal inhibition. Phenol and emulsified higher phenols, especially the latter, have also an inhibitory action which is, however, more difficult to study than that of mercuric chloride, and which may possibly be due to the clinging of the insoluble or very slowly soluble disinfectant to the surface of the bacteria. If threads loaded with anthrax spores are left for one hour in emulsions of certain phenoloids, at a temperature of 15° to 20° C., washed in water, transferred to bouillon, and incubated, no growth is usually observed even after 168 hours' incubation. But if similar anthrax spores, prepared at the same time and with the same cultures as the threads used in the previous experiments, are left in the emulsion for 24 hours, at the same temperature, and guinea pigs are inoculated with these threads they contract anthrax and die of the disease almost as rapidly as those inoculated with threads that have not been treated.

I made the first experiments of this kind in 1895 and I have repeated them since then with the same results.

The same fact may be brought out in a more striking manner by exposing the anthrax spores for 20 hours to the undiluted disinfecting emulsion, washing them for 20 minutes in water, transferring them to peptone bouillon and incubating them for 48 hours. After ascertaining that no apparent growth has taken place, the threads are then removed from the first tube of bouillon, washed and transferred to a second tube of fresh bouillon in which growth generally takes place. It is thus possible by culture methods to demonstrate the same fact which is brought out so clearly by the inoculation method.

These examples are sufficient to show the importance of distinguishing between inhibiting and sterilising action, and the difficulty of proving that a given dose of a substance has actually produced the death of certain bacteria in a given time without making lengthy experiments.

As infection is almost invariably conveyed by some organic product containing the microbe, it is necessary to consider at least three main special factors in the problem of disinfection:—1. The kind, quantity and state of the microbe. 2. The composition, quantity and state of the disinfectant. 3. The composition, quantity and state of associated matter. These three factors are considerably influenced by general factors of which the most important are:—The duration of exposure; the temperature of exposure; the degree of dilution or division of the disinfectant. There are, however, other influences that must be taken into consideration, so that the problem of disinfection is one of very great complexity and not lending itself to simple treatment. I am of opinion that our empirical knowledge of the action of disinfectants is not yet sufficiently advanced to justify our expressing that knowledge in mathematical terms. I must, therefore, discuss successively the three main factors, *viz.*, the microbe, the disinfectant, and the associated matter.

The microbe.—Under the term microbe I cover all minute protophyta and protozoa. As bacteria include the most resisting microbes, I will specially refer to them. The ordinary bacteria multiply by fission, and it might be assumed that when a certain amount of nutrient material is inoculated with one non-sporing bacterium all the descendants of that bacterium should be of the same age and offer the same resistance to various agents. But this is probably never the case, for it is practically impossible for all the bacteria growing in a medium to satisfy equally all their requirements. Moreover, it is probable that the process of fission does not necessarily yield equal units. As a matter of fact, evidence is found in bacterial cultures of differences between individuals, and among the most striking differences I may mention the morphological differences between normal bacteria and bacteria that have undergone involution. Involution forms are most striking features of cultures of the diphtheria bacillus in which one may see, side by side, slender bacilli of nearly uniform diameter, and other bacilli with considerably swollen extremities and the bulk of which is often several times that of normal bacilli. Differences so easily recognisable are not exhibited by all bacteria, but it may be assumed that analogous changes do take place. Even in cultures in which there is no clear evidence of alteration in the shape of the organisms, one generally observes marked differences in the size of various individuals. This is particularly evident in cultures of the *Bacillus typhosus* in which some of the bacilli are so short as to resemble cocci, while others form long filaments, the mass of which may be 10 or more times that of the shorter elements. These differences must affect the relative resistance of the individual bacilli to chemical agents, for mass is an important factor in chemical reactions. We may, therefore, suppose that even pure cultures of a given bacterium are not composed of individuals having all the same powers of resistance to external agencies. It is therefore necessary to remember that when cultures of microbes are used for the purpose of testing the action of any physical or chemical agents, it is not safe to look upon these cultures as composed of absolutely homologous parts, but we must rather look upon them as mixtures of elements which are heterologous as regards their physical and chemical properties. An estimate of the action of a chemical reagent upon such a mixture based upon counting the number of bacteria which have survived after exposures of various duration has not the same meaning as, for instance, an estimate of the amount of acid which has been left unneutralised by the addition of a given amount of alkali. The number of bacteria surviving after the addition of a germicidal agent may indicate either the number of bacteria with which the germicidal agent has not yet combined, because contact has not been possible or sufficiently long, or the number of bacteria which, though they have been exposed to the action have been able to resist on account of their greater resistance or greater mass. It is to avoid this difficulty that I have always rejected Krönig and Paul's method (which has been used only by a few workers), and that *I invariably use the lethal point as my guide.* When one uses cultures obtained under identical conditions, and of the same age, it is obvious that although the elements are heterologous the mixture must on an average be composed of approximately the same number of the various elements. The differences between non-sporing bacteria of the same species, though appreciable, are not considerable, but those between an ordinary vegetative bacterial cell and the spores which it may produce are enormous. It is not always realised that chemical substances that have the reputation of being strong disinfectants, because they easily cause the death of non-sporing bacteria, are under ordinary conditions practically without lethal effect upon the spores of the same bacteria. This is not special to chemical agents; the same phenomenon is observable in relation to physical agents such as heat, and suggests that the difference of resistance is due to the structure and composition of the walls surrounding the sensitive protoplasm.

As an example of this difference between the resistance of a bacillus and of its spores I may take the anthrax bacillus. Non-sporing anthrax bacilli in the moist state are usually killed in 10 minutes at 54° C., and in 1 or 2 minutes at 85° C. Sporing anthrax bacilli in the moist state are not killed for hours at 54° C., are not killed in 15 minutes at 85° C., but are killed in about 1 minute at 100° C. Spores of the *Bacillus anthracis* may be kept for many hours in strong carbolic acid at ordinary room temperature without being killed or losing their virulence. It is necessary to raise the temperature of the disinfectant to 30° or 40° C. to obtain effects within a reasonable time.

If it is not safe to argue from the degree of resistance of the various individuals composing cultures of the same organism, it is still less safe to apply to all bacteria deductions based upon the study of any single organism, for various bacteria differ very widely with regard to their resistance to physical and chemical agents. Account has therefore to be taken of the action of several physical agents which influence the action of chemical agents.

The resistance of various bacteria to drying has been carefully studied in my laboratory by Dr. G. G. Buckley, who has recorded his results in a Thesis (1907). It will be sufficient for my purpose to refer to the results obtained by exposing cotton wool infected with various bacteria to air dried over sulphuric acid. The results of these experiments show that when dried under the above conditions the *Spirillum choleræ* lived only 3 hours and died in 4 hours. *Bacillus pestis* lived 25 days and died in 34 days. *Bacillus typhosus* lived 50 days and died in 57 days. *B. coli communis* lived 50 days and died in 64 days. *B. diphtheriæ* lived 81 days and died in 103 days. *Staphylococcus pyogenes aureus* lived 134 days and died in 145 days.

Although some other experiments gave slightly different results, they all indicated the same kinds of differences.

The action of heat upon bacteria is of special importance in connection with the study of the bactericidal action of disinfectants, which is also considerably influenced by temperature. The optimum as well as the lower and higher inhibitory temperatures vary according to bacteria, and the following examples may be taken to indicate the range of these variations.

TABLE II.

Influence of temperature upon the growth of six kinds of bacteria.

	Lower inhibitory temperature.	Optimum.	Higher inhibitory temperature.
	° C.	° C.	° C.
Bacillus phosphorescens (Fischer)	about 0	5 to 10	about 35
Bacillus typhosus	+ 4	25 to 30	„ 45
Bacillus anthracis	+ 12	about 30	45
Pneumonococcus	+ 20	35	42
Bacillus tuberculosis	+ 25	38	42
Bacillus thermophilus (Miquel)	+ 40	65	70 to 72

It is obvious that the influence of temperature upon the germicidal power of a disinfectant may be considerably modified by the action of temperature alone upon the bacteria exposed to the action of that disinfectant. Equally marked differences are observed with regard to the resistance of spores to heat and to chemical disinfectants. Thus spores of the *Bacillus anthracis* are killed by current steam in less than 1 minute, while the spores of the *Bacillus mesentericus ruber* generally require 180 minutes.

Exposed to the action of a thin layer of a 1 in 10 solution of chlorinated lime (3 per cent. available chlorine), the spores of the *Bacillus anthracis* were generally killed in 3 minutes, while those of *Bacillus mesentericus* were killed in 60 minutes. When the solution was reduced in strength to 1 in 100 the spores of the *Bacillus anthracis* were killed in 15 minutes, but those of *B. mesentericus* resisted for several hours.

Non-sporing bacteria resist also very unequally the same chemical disinfectant, as is shown by exposing the *Bacillus coli*, the *Bacillus typhosus*, and the *Bacillus pestis* to the action of different watery dilutions of phenol at the same time and under the same conditions.

The following table shows the results of 2 sets of experiments made respectively with the thread and suspension methods which I will describe in the second part of this paper. In this, as in the following tables, I have indicated the strength of the solutions in parts per 100,000 (*i.e.*, in mgrms. per 100 c.c.), and recorded the highest dose found insufficient to kill and the lowest lethal dose observed.

These experiments show that the *Bacillus pestis* is much less resistant to phenol than the *Bacillus typhosus*, which itself is less resistant than the *Bacillus coli*.

TABLE III.

Resistance of three bacilli to phenol.

	Bacilli suspended in fluid medium. Exposure 5 minutes.		Bacilli dried on threads. Exposure 20 minutes.	
	Lowest lethal dose observed.	Highest non-lethal dose observed.	Lowest lethal dose observed.	Highest non-lethal dose observed.
Bacillus coli communis	$\frac{1}{60}$	$\frac{1}{70}$	$\frac{1}{70}$	$\frac{1}{80}$
Bacillus typhosus ..	$\frac{1}{70}$	$\frac{1}{80}$	$\frac{1}{110}$	$\frac{1}{120}$
			Exposure	5 minutes.
Bacillus pestis	$\frac{1}{150}$*	$\frac{1}{200}$	$\frac{1}{140}$	$\frac{1}{150}$

$\frac{1}{60}$ = 1666 parts per 100,000; $\frac{1}{70}$ = 1428; $\frac{1}{80}$ = 1250; $\frac{1}{110}$ = 909; $\frac{1}{120}$ = 833; $\frac{1}{150}$ = 666; $\frac{1}{200}$ = 500.

It has been generally assumed that the age of bacterial cultures had probably an influence upon their resistance to germicidal agents; it would, however, be desirable to differentiate between the effects which the number of bacteria and the age of the cultures might have. Up to some 10 years ago I was under the impression that cultures and more especially potato cultures of the *Bacillus coli*, were more resistant at the end of 8 or 9 days than when younger, and I used such cultures for testing disinfectants. I have since realised that young agar or bouillon cultures are more resistant than older cultures, and to obtain full data on this point I asked Dr. Howarth to compare agar and bouillon cultures of 3 different bacilli. Each set of cultures was obtained from the same original stock and kept for various lengths of time. Equal quantities of these various cultures were at intervals used to prepare cultures, the resistance of which to phenol was tested within 24 hours. This method gave a distinct chance of rejuvenation, and does not indicate quite correctly the state of the bacilli in the original cultures; the results are, however, very interesting, and show that as cultures of non-sporing bacilli get older their resistance diminishes, though this occurs very slowly.

Table IV. shows the effect of the age of cultures on the resistance of the *bacillus coli communis* to phenol. Both cultures in fluid and cultures on solid media show evidence of diminished resistance after the first few days, when in fluid cultures the resistance remains almost constant for over two months. That of agar cultures is altered even more slowly.

TABLE IV.

Effect of the age of cultures of Bacillus coli communis on the resistance of the bacillus to phenol.

Cultures in peptone bouillon (+ 5) incubated at 37° C. in closed tubes.
Cultures on peptone bouillon agar (+ 5) ,, ,, ,, ,,

Age of cultures before rejuvenation by subculture for 24 hours.	Bouillon cultures tested by the suspension method. Exposures, 5'. Average Temp., 17·5° C.		Agar cultures tested by the thread method. Exposures, 20'. Average Temp., 17·5° C.	
	Minimal lethal dilution observed.	Maximal non-lethal dilution observed.	Minimal lethal dilution observed.	Maximal non-lethal dilution observed.
	parts per 100,000	parts per 100,000	parts per 100,000	parts per 100,000
24 hours	$\frac{1}{60}$ = 1666	$\frac{1}{70}$ = 1428	— —	— —
48 ,, ...	$\frac{1}{60}$ = ,,	$\frac{1}{70}$ = ,,	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250
3 days	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	— —	— —
4 ,, ...	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
5 ,, ...	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
6 ,, ...	— —	— —	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250
7 ,, ...	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
8 ,, ...	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111	— —	— —
9 ,, ...	$\frac{1}{80}$ = ,,	$\frac{1}{90}$ = ,,	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111
10 ,, ...	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	— —	— —
14 ,, ...	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111
21 ,, ...	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
28 ,, ...	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000
42 ,, ...	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	$\frac{1}{90}$ = ,,	$\frac{1}{100}$ = 1000
49 ,, ...	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
56 ,, ...	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111
63 ,, ...	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	— —	— —
70 ,, ...	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000
77 ,, ...	$\frac{1}{100}$ = 1000	$\frac{1}{110}$ = 909	— —	— —
84 ,, ...	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000	$\frac{1}{110}$ = 909
99 ,, ...	$\frac{1}{80}$ = ,,	$\frac{1}{90}$ = ,,	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111
113 ,, ...	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000	$\frac{1}{100}$ = 1000	$\frac{1}{110}$ = 909
126 ,, ...	$\frac{1}{90}$ = ,,	$\frac{1}{100}$ = ,,	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000
140 ,, ...	— —	— —	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111
141 ,, ...	$\frac{1}{110}$ = 909	$\frac{1}{120}$ = 833	— —	— —
168 ,, ...	— —	— —	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000
169 ,, ...	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000	— —	— —
182 ,, ...	$\frac{1}{90}$ = ,,	$\frac{1}{100}$ = ,,	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000
196 ,, ...	$\frac{1}{90}$ = ,,	$\frac{1}{100}$ = ,,	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000
211 ,, ...	$\frac{1}{100}$ = 1000	$\frac{1}{110}$ = 909	$\frac{1}{100}$ = 1000	$\frac{1}{110}$ = 909
224 ,, ...	$\frac{1}{100}$ = 1000	$\frac{1}{110}$ = 909	$\frac{1}{100}$ = 1000	$\frac{1}{110}$ = 909

— Means no observation. The figures given are based on five simultaneous tests made with consecutive dilutions.
Under "Parts per 100,000" the figures indicate the number of milligrammes of phenol in 100 c.c. of solution.

I will mention only two other sets of observations bearing upon the effects of drying. These observations are important in relation to the disinfection of dust and other dry material, and also to the use of dried bacteria for the purpose of testing disinfectants.

A large number of silk threads of the same size, and loaded with a mixture of cultures of the *Bacillus coli communis* in such a way as to secure uniformity, were prepared, dried, and kept in the dark at a temperature of 14° to 18° C., for three months, and at frequent intervals during that period the resistance of these threads to phenol was tested. One-half of the threads was tested by Dr. Haworth and the other half by myself in a different place.

The results of this double experiment are given in Table V., and show that, with the exception of some divergent results attributable to experimental errors, the resistance of the dry bacilli remained almost constant up to the 17th day, after which more than half of the threads had distinctly lost some of their resistance.

These differences were brought out more clearly when the temperature of the disinfectant was raised by 2° or 3° C. The results recorded under A and B, Table V., indicate clearly the effects which slight changes of temperature have upon the germicidal action of phenol.

The Disinfectant.

Products that have been used as disinfectants.—Out of the large number of products, which have been used as disinfectants since Sir John Pringle attempted in 1750 to estimate the "Comparative powers of salts in resisting

TABLE V.

Effect of drying for various lengths of time upon the resistance of the Bacillus coli communis to phenol.

18 hours old agar culture of *Bacillus coli communis* dried rapidly on silk threads. Duration of exposure to solutions of phenol, 20 minutes in every case.

Time the bacillus was kept dry.	A.		B.	
	Temperature, 14° to 18° C.		Temperature, 18° to 22° C.	
	Minimal lethal dilution observed.	Maximal non-lethal dilution observed.	Minimal lethal dilution observed.	Maximal non-lethal dilution observed.
	parts per 100,000	parts per 100,000	parts per 100,000	parts per 100,000
1 day	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	— —	— —
2 days	— —	— —	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111
3 ,,	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	— —	— —
4 ,,	— —	— —	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111
5 ,,	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111	— —	— —
6 ,,	— —	— —	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000
7 ,,	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	— —	— —
8 ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000
9 ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
10 ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000
11 ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
12 ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
13 ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000
15 ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
16 ,,	— —	— —	$\frac{1}{100}$ = 1000	$\frac{1}{110}$ = 909
17 ,,	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111	— —	— —
20 ,,	— —	— —	$\frac{1}{110}$ = 909	$\frac{1}{120}$ = 833
21 ,,	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000	— —	— —
22 ,,	— —	— —	$\frac{1}{110}$ = 909	$\frac{1}{120}$ = 833
24 ,,	— —	— —	$\frac{1}{100}$ = 1000	$\frac{1}{110}$ = 909
25 ,,	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000	— —	— —
28 ,,	— —	— —	$\frac{1}{100}$ = 1000	$\frac{1}{110}$ = 909
30 ,,	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111	— —	— —
37 ,,	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	— —	— —
46 ,,	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111	— —	— —
50 ,,	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	— —	— —
53 ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
61 ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
67 ,,	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111	— —	— —
74 ,,	$\frac{1}{80}$ = ,,	$\frac{1}{90}$ = ,,	— —	— —
80 ,,	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000	— —	— —
86 ,,	$\frac{1}{90}$ = ,,	$\frac{1}{100}$ = ,,	— —	— —
95 ,,	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111	— —	— —
105 ,,	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	— —	— —
115 ,,	$\frac{1}{80}$ = 1253	$\frac{1}{90}$ = 1111	— —	— —

N.B.—The lethal point was determined in each case by five simultaneous tests made with five consecutive dilutions.

putrefaction," very few have retained the confidence of hygienists. Dr. Baxter's investigations (Report of the Medical Officer of the Privy Council and Local Government Board), published in 1875, have perhaps done more than any other investigation in indicating the relative value of some of the disinfectants used at the time and some of the most important factors influencing their germicidal power.

In the classical paper of Nicolai Jalan de la Croix published in 1881, the results of comparative experiments made with 20 antiseptic substances are given in a table, part of which I reproduce in this paper chiefly for the purpose of indicating the nature of the products which had attracted the attention of hygienists up to that date. The table is, however, also interesting as a record of very good work which may still be consulted with advantage.

The bactericidal action was tested by adding carefully measured quantities of the products under investigation to raw meat juice diluted with 40 parts of distilled water, which after exposure to air had become infected with various sporing and non-sporing organisms carried into the fluid by the air. The table shows (*a*) the smallest proportion of each disinfectant capable of rendering the infected fluid sterile, and (*b*) the largest proportion that failed to sterilise although it might arrest for a time the growth of bacteria.

TABLE VI.

Some experiments by Jalan de la Croix, with raw meat juice diluted with 40 parts of water and infected by aerial bacteria.

Disinfectant.	Dilutions of the disinfectant. (*a*.) Sterilizing.	Parts per 100,000.*	(*b*.) Failing to sterilize.
Mercuric chloride	1 in 2525	39	1 in 3358
Chlorine	1 „ 1061	94	1 „ 1364
Bromine	1 „ 875	114	1 „ 995
Iodine	1 „ 843	118	1 „ 919
Aluminium acetate	1 „ 478	209	1 „ 584
Salicylic acid	1 „ 343	291	1 „ 450
Sulphurous acid	1 „ 135	748	1 „ 223
Picric acid	1 „ 100	1000	1 „ 117
Benzoic acid	1 „ 77	1290	1 „ 121
Sulphuric acid	1 „ 72	1388	1 „ 116
Potassium permanganate	1 „ 35	2857	1 „ 50
Oil of mustard	1 „ 40?	2500?	1 „ 60?
Thymol	1 „ 20	5000	1 „ 36
Alcohol			1 „ 142
Chloroform			1 „ 122
Sodium borate			1 „ 37
Eucalyptol			1 „ 30
Phenol			1 „ 10

* I have added these figures to make comparison with other tables easier.

This table does not include some of the compounds tested by Jalan de la Croix and others which have been extensively used or have been the subject of scientific investigation, among these I may mention:—

Ozone, peroxide of hydrogen, hypochlorites, hydrochloric acid, oxides of nitrogen, arsenious acid, chromic acid, osmic acid, salts of iron, zinc, copper, silver, etc., and various organic compounds such as hydrocyanic and formic acids, allyl alcohol, quinine, various tar products, etc.

Among the disinfectants which have gained repute in latter years I may specially mention formaldehyde and the emulsions prepared with the higher phenols or phenoloids. Creolin was, I believe, the first of these preparations, having been introduced before 1880.

Of the higher phenols, *ortho*-, *meta*-, and *para*-cresol have been most extensively used, as well as another product or mixture having a higher boiling point than cresol and xylenol, and which is known under the name of Izal oil.

All these products are more or less insoluble and are much less poisonous than phenol; they form the basis of a great number of patent disinfectants which, on account of the insolubility of their chief constituents, have to be used as emulsions. A list of the best known of these preparations was given in the *Lancet* twelve months ago (*Lancet*, 1909, p. 1457) with the results of various tests carried out by Professor Woodhead and Mr. Vasey. Table VII. is taken from their report and includes besides the names of the disinfectants some of the figures obtained by Mr. Vasey, and which indicate roughly some of the constituents of these preparations.

Properties of disinfectants.—A study of the general physical and chemical properties of the various products included in the previous lists of disinfectants reveals the fact that they have only one property in common, *viz.*, their antiseptic power, and that they possess that property in widely different degrees.

Their antiseptic or germicidal action is obviously due to reactions widely different. The nature of these reactions can only be inferred from what we know of the action of various poisons upon the larger cells of which the higher animals and plants are composed, but even that knowledge is most incomplete and unsatisfactory. Perhaps the most scientific attempt which has been made to interpret the action of poisons upon protoplasm was that made by Loew, who divided poisons into:—

A.—*General poisons.* 1. *Oxidising poisons*: Chromic acid potassium permanganate, ozone, hydrogen peroxide hypochlorites, chlorine, bromine, iodine, phosphorus, arsenious acid.

2. *Poisons acting by the production of salts*: Acids, bases, salts of the heavy metals.

TABLE VII.

Analysis of various Disinfectants on the Market by S. A. Vasey, F.I.C.

Disinfectant.	Phenol and phenoloids.	Resins and fatty acids.	Water.	Soda.	Potash.	Gelatine.	Dextrine	Inert bodies (hydrocarbons) by difference.
Cook's Cofectant fluid	66·27	24·66	6·40	—	2·67			—
MacDougall's M.O.H. disinfectant fluid	47·13	33·54	5·60	—	2·10			11·63
Kerol	40·56	19·14	2·40	1·41	—			36·76
Okol (Sanitas)	48·50	—	38·50	0·20	—		5·90	6·90
Crude Carbolic	82·65	—	2·80	—	—			14·55
Bactox (Sanitas)	39·70	16·70	6·00	—	1·82			35·72
Cyllin (medical) (Jeyes')	32·08	35·11	6·40	—	1·48			24·93
Calvert's No. 5 Carbolic A.	93·26	—	6·00	—	—			0·74
Cyllin (bulk sample)	40·41	31·23	10·40	2·24	—			15·72
Izal	41·35	—	47·14	0·10	—	11·41		Traces
Lysol	50·96	28·12	18·40	—	2·52			—
Lawes' Fluid	28·20	25·73	13·60	2·60	—			29·87
Pearsons Fluid	20·70	17·35	8·00	3·87	—			50·08
Jeyes' Fluid (Chemists)	17·80	20·19	6·40	1·60	—			54·01
Krysyl fluid	14·16	15·22	12·00	2·20	—			56·42
Zotul	10·00	35·42	21·60	2·49	—			30·49
Jeyes' No. 2 (Grocers)	5·13	23·21	22·40	1·38	—			47·88

3. *Substitution poisons:* Ammonia, carbolic acid, hydrocyanic acid, etc. (interfering, even when highly diluted, with the aldehyde- or amido- groups).

4. *Poisons having a catalytic action:* Ethyl ether, chloroform, chloral, etc.

B. *Special poisons.* 1. *Toxic proteids, toxins, antitoxins, enzymes, etc.*

2. *Organic bases:* Strychnine, atropine, etc.

3. *Poisons working indirectly:* Carbon monoxide, sulphites, etc.

This classification is unsatisfactory in many respects, but has at least the advantage of placing into two fairly natural groups the most powerful germicidal substances, and of suggesting a possible explanation of the action of these disinfectants. But if this explanation is correct it would appear that these poisons act upon living protoplasm in the same way as they do on dead proteid substances. Thus the poisons grouped among the oxidising poisons are also capable of oxidising dead proteid matter, so that it is possible that after all it may only be the action which these products have on the dead cells that the classification indicates and not the action which causes death.

The mode of action of emulsions of almost insoluble phenoloids is among the most difficult to understand. If it is only when in solution that they act upon bacteria the toxicity of the soluble parts must be very considerable, and it is remarkable that higher cells should be so little affected by them, for bacteria are almost invariably more resistant to poisons than the more differentiated cells.

If, on the other hand, they act owing to the high state of division of some of their constituents, behaving like colloidal solutions, it would appear that the molecular structure of bacteria is looser than that of the more differentiated cells, or that the constituents of bacterial protoplasm are very different from those of higher cell protoplasm.

The application of ultramicroscopy to these emulsions is not as helpful as one might have hoped, because they are composed of various elements, and it is not easy to distinguish among the finest particles which can be detected whether they consist of active or inactive ingredients.

When these emulsions are examined under the high powers of the microscope by transmitted light, or better, illuminated by means of the paraboloid condenser, one observes that between the larger globules, many of which are barely larger than ordinary bacteria, there is a large number of finer globules smaller than bacteria and in a state of active Brownian motion. In the spaces left between these small globules there are very much smaller particles, difficult to see and which often appear to form nebulæ-like clusters.

It is reasonable to suppose that some of these granules may remain attached to the surface of bacteria, but when I mixed active typhoid bacilli with an emulsion, diluted sufficiently not to kill the bacilli rapidly, I was not able to observe clearly what happened to the finest particles. The small globules were frequently hit by the moving bacilli but did not appear to adhere to them. After immobilising the bacteria and the globules I was not able to recognise any suggestive alteration in the appearance of the bacilli. These observations are, however, unsatisfactory, because it is difficult to appreciate accurately slight changes in objects that are in a state of active motion, and when they have been rendered motionless it is not easy to interpret the meaning of the appearances observed.

Differences in germicidal power.—Baxter, Jalan de la Croix, Koch, and many other observers have shown in various ways how the germicidal powers of various disinfectants differ.

In order to obtain a fairly accurate idea of the relative power of disinfectants belonging to various types I conducted some years ago an experiment with the assistance of 14 students who had been made familiar with the two methods of testing which I use, *viz.*, the *thread method* and the *suspension method*. The solutions, the test cultures and threads had all been prepared accurately for them at the same time and were therefore of the same composition and age, all the tests were conducted simul-

TABLE VIII.

Results of tests applied simultaneously to seven disinfectants.

Disinfectants.	Thread method. Test microbe = *Bacillus typhosus* grown for 48 hours on peptone bouillon agar (+5) at 37° C. Solutions of phenol prepared with distilled water two threads 2 cm. long in 10 c.c. of phenol solution. Temperature, 17° C. Time of exposure, 20 minutes.		Suspension method. Test microbe = *Bacillus typhosus* grown for 24 hours on peptone bouillon (+5) at 37° C. Solutions of phenol prepared with distilled water $\frac{1}{10}$ c.c. of culture added to 10 c.c. of phenol solution. Temperature, 17° C. Time of exposure, 10 minutes.	
	Minimal lethal dilution observed.	Maximal non-lethal dilution observed.	Minimal lethal dilution observed.	Maximal non-lethal dilution observed.
	parts per 100,000	parts per 100,000	parts per 100,000	parts per 100,000
Boric acid	— —	$\frac{1}{20}$ = 5000	— —	$\frac{1}{20}$ = 5000
Phenol	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111
Lysol	$\frac{1}{90}$ = 1111	$\frac{1}{100}$ = 1000	$\frac{1}{200}$ = 500	$\frac{1}{300}$ = 333
Phenoloid A	$\frac{1}{150}$ = 666	$\frac{1}{200}$ = 500	$\frac{1}{500}$ = 200	$\frac{1}{800}$ = 125
Phenoloid B	$\frac{1}{150}$ = 666	$\frac{1}{200}$ = 500	$\frac{1}{500}$ = 200	$\frac{1}{800}$ = 125
Chlorinated lime (32 per cent. avail. Cl.)	$\frac{1}{1600}$ = 62	$\frac{1}{2000}$ = 50	$\frac{1}{2000}$ = 50	$\frac{1}{3200}$ = 31
Mercuric chloride	$\frac{1}{6400}$ *? = 15	$\frac{1}{10000}$ *? = 10	$\frac{1}{3200}$ * = 31	$\frac{1}{6400}$? = 15

The figures given in this table are each based upon the results of five simultaneous tests made with five consecutive dilutions.

* Beyond thorough washing and shaking, and use of large quantity of nutrient fluid, no attempt was made to neutralise the action of any of the disinfectants at the end of exposure. (See previous remarks upon antelethal inhibitory period.)

taneously, at the same temperature and in the same room, so that all the conditions were identical.

The results obtained are shown in Table VIII. The disinfectants selected include a metallic salt forming combinations with proteid matter, an oxidising hypochlorite, two emulsions of different types and containing phenoloids, a soluble soap containing cresols, phenol, and boric acid, the last representing one of the weakest mineral antiseptics.

The results show that the germicidal power of soluble disinfectants remains very much in the same ratio whether the bacteria are suspended in a fluid or partly protected by the fibres of a thread, but that the action of insoluble disinfectants is very much impeded by this protection.

Mr. Burgess published in 1900 the results of very complete tests carried out entirely by himself, by the thread method used at the time in my laboratory where he had recently studied it. The figures in Table IX. show the relative value of 14 disinfectants, as estimated by my method, for exposures of one minute to one hour. They also show the maximal non lethal and the minimal lethal doses observed. It will be noticed that various disinfectants are very unequally affected by the *duration* of the exposure, a fact which is of great importance as affecting the meaning of "coefficients" so-called.

Effect of dilution.—The degree of dilution of the disinfectant taken *in conjunction with the duration of exposures* is another important factor. By prolonging exposures it is possible to obtain a germicidal action with doses of a disinfectant which are quite inefficient in shorter exposures, but there is a limit to this, and after a certain degree of dilution has been reached, the duration of the exposure becomes immaterial, for no germicidal action is observed. (See Table X.)

TABLE IX.

Results of five series of tests applied to 14 disinfectants by the thread method (Arthur H. Burgess, M.B., M.Sc., F.R.C.S.). (adapted from the original article in "The Lancet," June 23, 1900).

Test microbe = *Bacillus coli communis* grown for 10 days at 37° C. on potato.

Disinfectants.	Duration of the exposure to the action of the disinfectant.									
	1 minute.		5 minutes.		10 minutes.		30 minutes.		60 minutes.	
	lethal.	non-lethal	lethal.	non-lethal	lethal.	non-lethal	lethal.	non-lethal.	lethal.	non-lethal
Mercuric iodide*	1 in 1,000	1 in 1,500	1 in 5,000	1 in 7,500	1 in 20,000	1 in 25,000	1 in 80,000	1 in 100,000	1 in 200,000	1 in 250,000
Mercuric chloride*	,, 750	,, 1,000	,, 2,000	,, 3,000	,, 7,500	,, 10,000	,, 15 000	,, 20,000	,, 40,000	,, 50,000
Chlorinated lime	,, 80	,, 100	,, 150	,, 200	,, 500	,, 600	,, 1,500	,, 2,000	,, 3,000	,, 4,000
Formaldehyde	,, 30	,, 40	,, 50	,, 60	,, 100	,, 150	,, 150	,, 200	250	, 300
Lysol	,, 10	,, 20	,, 30	,, 40	,, 100	,, 150	,, 250	,, 300	,, 300	,, 400
Carbolic acid	,, 10	,, 20	,, 40	,, 60	,, 80	,, 100	,, 100	,, 150	,, 150	,, 200
Izal	—	undiluted	,, 10	,, 20	,, 80	,, 100	,, 250	,, 300	,, 300	,, 400
Medical izal	—	undiluted	,, 10	,, 20	,, 20	,, 100	,, 250	,, 300	,, 300	,, 400
Creolin	—	undiluted	,, 5	,, 10	,, 60	,, 80	,, 150	,, 200	,, 200	,, 300
Jeyes' fluid	—	undiluted	,, 3	,, 5	,, 60	,, 80	,, 100	,, 150	,, 200	,, 300
Walker's IXL disinfectant	—	undiluted	undiluted	,, 2	,, 30	,, 40	,, 80	,, 100	,, 100	,, 150
Condy's fluid	—	undiluted	—	undiluted	,, 2	,, 3	,, 10	,, 20	,, 40	,, 60
"Sanitas" fluid	—	undiluted	—	undiluted	undiluted	,, 2	,, 2	,, 3	,, 3	,, 4
Boric acid	—	saturated	—	saturated	—	saturated	—	saturated	—	saturated

* N.B.—The results recorded have to be interpreted in the light of the experiments relating to the antelethal inhibitory period, recorded at p. 1345 of this communication.

TABLE X.

Combined effects of dilution of disinfectants and duration of exposure. (*Ultimate lethal dilutions.*)

All the tests were conducted simultaneously by the thread method, all the threads had been prepared at the same time from the same cultures, peptone bouillon agar (+5) incubated for 18 hours at 37° C.

Duration of exposures. Temperature, 14° to 18° C.	Test microbe = *Bacillus coli communis.*						Test microbe = *Bacillus typhosus.*					
	Disinfectants.						Disinfectants.					
	Phenol.		Phenoloid A.		Phenoloid B.		Phenol.		Phenoloid A.		Phenoloid B.	
	Lethal.	Non-lethal.	Lethal.	Non-lethal.	Lethal.	Non-lethal.	Lethal.	Non-lethal.	Lethal.	Non-lethal.	Lethal	Non-lethal.
1 hour	—	$\frac{1}{100}$	—	$\frac{1}{600}$	—	$\frac{1}{600}$	$\frac{1}{100}$	$\frac{1}{200}$	—	$\frac{1}{800}$	—	$\frac{1}{400}$
2 hours ..	$\frac{1}{100}$	$\frac{1}{200}$	—	$\frac{1}{600}$	—	$\frac{1}{800}$	$\frac{1}{100}$	$\frac{1}{200}$	—	$\frac{1}{800}$	$\frac{1}{800}$	[illegible]
4 ,, ...	$\frac{1}{100}$	$\frac{1}{200}$	$\frac{1}{600}$	$\frac{1}{800}$	$\frac{1}{600}$	$\frac{1}{800}$	$\frac{1}{200}$	$\frac{1}{300}$	$\frac{1}{800}$	$\frac{1}{1000}$	[illegible]	[illegible]
6 ,, ...	$\frac{1}{100}$	$\frac{1}{200}$	$\frac{1}{800}$	$\frac{1}{1000}$	$\frac{1}{800}$	$\frac{1}{1000}$	$\frac{1}{200}$	[illegible]	$\frac{1}{800}$	[illegible]	$\frac{1}{1000}$	[illegible]
24 ,, ...	$\frac{1}{200}$	$\frac{1}{300}$	$\frac{1}{1000}$	$\frac{1}{2000}$	$\frac{1}{1000}$	$\frac{1}{2000}$	$\frac{1}{300}$	$\frac{1}{400}$	$\frac{1}{1000}$?	$\frac{1}{2000}$	[illegible] ?	[illegible]
48 ,, ...	$\frac{1}{200}$	$\frac{1}{300}$	$\frac{1}{1000}$	$\frac{1}{2000}$	$\frac{1}{2000}$	$\frac{1}{4000}$	$\frac{1}{400}$?	$\frac{1}{500}$	$\frac{1}{2000}$?	[illegible]	[illegible] ?	[illegible]
75 ,, ...	$\frac{1}{300}$?	$\frac{1}{400}$	—	$\frac{1}{4000}$	—	$\frac{1}{4000}$	$\frac{1}{400}$?	$\frac{1}{500}$	$\frac{1}{2000}$?	$\frac{1}{4000}$	[illegible] ?	$\frac{1}{4000}$

— Means no observation, *i.e.*, a suitable dilution was not included in the series tested.
? Means that out of a series of observations, some results were positive and some negative.
According to these results the *ultimate lethal dilutions* observed in 75 hours were

When tested against the *Bacillus coli communis*—Phenol between $\frac{1}{300}$ and $\frac{1}{400}$ $\frac{1}{200}$ = 500 parts per 100,000
Phenoloid A ,, $\frac{1}{1000}$ and $\frac{1}{4000}$ $\frac{1}{300}$ = 333 ,, ,, ,,
Phenoloid B ,, $\frac{1}{2000}$ and $\frac{1}{4000}$ $\frac{1}{500}$ = 200 ,, ,, ,,
When tested against the *Bacillus typhosus*— Phenol ,, $\frac{1}{400}$ and $\frac{1}{500}$ $\frac{1}{1000}$ = 100 ,, ,, ,,
Phenoloid A ,, $\frac{1}{1000}$ and $\frac{1}{4000}$ $\frac{1}{2000}$ = 50 ,, ,, ,,
Phenoloid B ,, $\frac{1}{1000}$ and $\frac{1}{4000}$ $\frac{1}{4000}$ = 25 ,, ,, ,,

The *minimal lethal dilutions* vary according to the disinfectant, and the ratio between the lethal doses of two disinfectants is not the same for exposures of various durations. Thus the ratio between the lethal dilutions of phenol and of a certain phenoloid, which is on an average as 70 to 150 when typhoid threads are exposed for 20 minutes, becomes 200 to 1,000 after six hours, 300 to 2,000 after 24 hours, and 400 to about 3,000 in 75 hours.

In the case of phenol the minimal lethal dilution for exposures of great duration is about $\frac{1}{400}$, a dilution of $\frac{1}{500}$ having no appreciable effect even after 75 hours upon the *Bacillus typhosus;* for the *Bacillus coli communis* the minimal lethal dose for threads is about $\frac{1}{300}$. The smallest dilution effective after prolonged exposures may be termed *ultimate lethal dilution.*

If dilution is pressed beyond the ultimate lethal dose a degree is reached when disinfectants, instead of inhibiting the growth of bacteria, actually excite it. This can be proved in various ways. One of the simplest is to place a thread soaked in a solution of mercuric chloride on the surface of a gelatine plate immediately after inseminating it with a suitable micro-organism, such as the *Bacillus coli.* After two days' incubation it will be found that there is a clear zone round the thread where bacteria have not grown; beyond that zone the gelatine is crowded with colonies, and between the sterile part of the gelatine and that full of colonies, there is a narrow zone where the colonies are more crowded and larger and which appears as a dense marginal zone (see photograph). The same phenomenon is produced when pieces of certain metals such as copper and silver are placed on the media.

Table XI.

Influence of certain associated products upon the resistance of the Bacillus Coli Communis to phenol.

Cultures used for *thread method* grown on peptone bouillon agar (+ 5) for 48 hours at 37° C.
,, ,, *suspension method* ,, ,, peptone bouillon (+ 5) for 24 hours at 37° C.

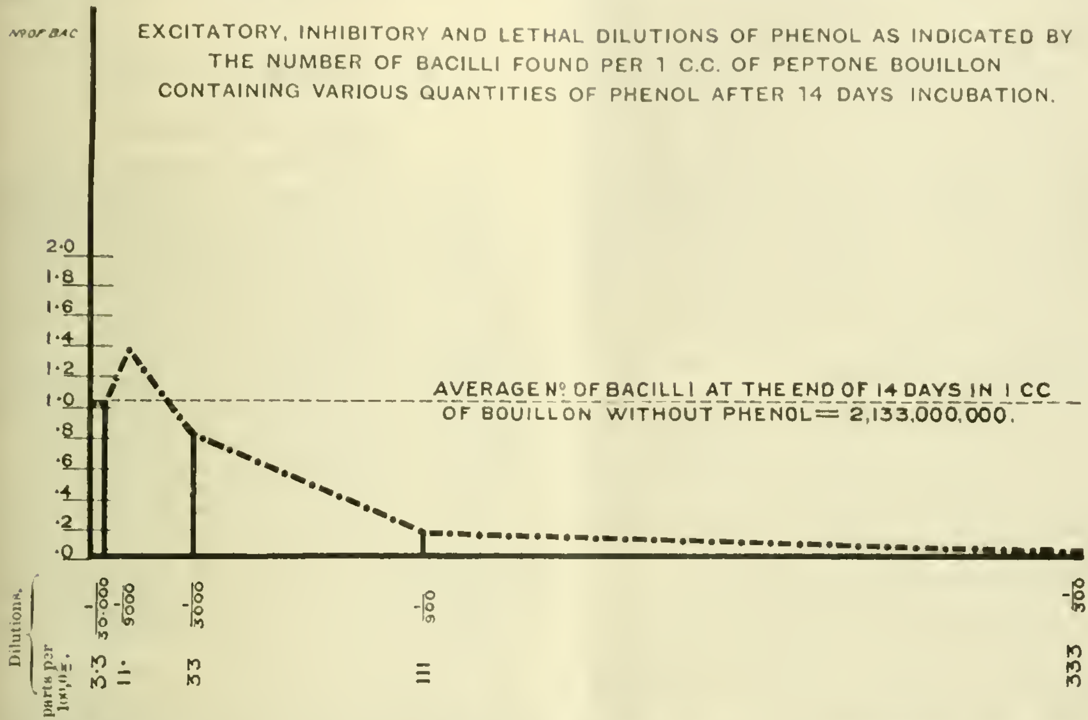
Associated matter.				Phenol.			
Products added to the dilutions of phenol.	Quantity added.	Effect without phenol.		Thread method. Exposure, 20 minutes. Average temp., 17° C.		Suspension method. Exposure, 5 minutes. Average temp., 17° C.	
				Phenol dilutions.		Phenol dilutions.	
		Threads in 20′.	Suspension in 5′.	Lethal.	Non-lethal.	Lethal.	Non-lethal.
	parts per 100,000			parts per 100,000	parts per 100,000	parts per 100,000	parts per 100,000
None	—	—	—	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250
Acetic acid	$\frac{1}{400}$ = 250	not lethal	not lethal	$\frac{1}{140}$ = 714	$\frac{1}{150}$ = 666	$\frac{1}{140}$ = 714	$\frac{1}{150}$ = 666
Hydrochloric acid	$\frac{1}{8000}$ = 12·5	,,	,,	$\frac{1}{130}$ = 769	$\frac{1}{140}$ = 714	$\frac{1}{80}$ = 1250	$\frac{1}{90}$ = 1111
Caustic soda	$\frac{1}{2000}$ = 50	,,	,,	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250	$\frac{1}{70}$ = 1428	$\frac{1}{80}$ = 1250
Ammonium carbonate	$\frac{1}{500}$ = 200	,,	,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,
Glucose	$\frac{1}{50}$ = 2000	,,	,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,
Lactose	$\frac{1}{50}$ = 2000	,,	,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,
Sputum	$\frac{1}{2}$ = 50000	,,	,,	$\frac{1}{70}$ = ,,	$\frac{1}{80}$ = ,,	— —	— —
Faeces	$\frac{1}{2}$ = 50000	,,	,,	$\frac{1}{60}$ = 1666	$\frac{1}{70}$ = 1428	— —	— —
Blood serum	$\frac{1}{33}$ = 3000	,,	,,	$\frac{1}{60}$ = ,,	$\frac{1}{70}$ = ,,	$\frac{1}{60}$ = 1666	$\frac{1}{70}$ = 1428

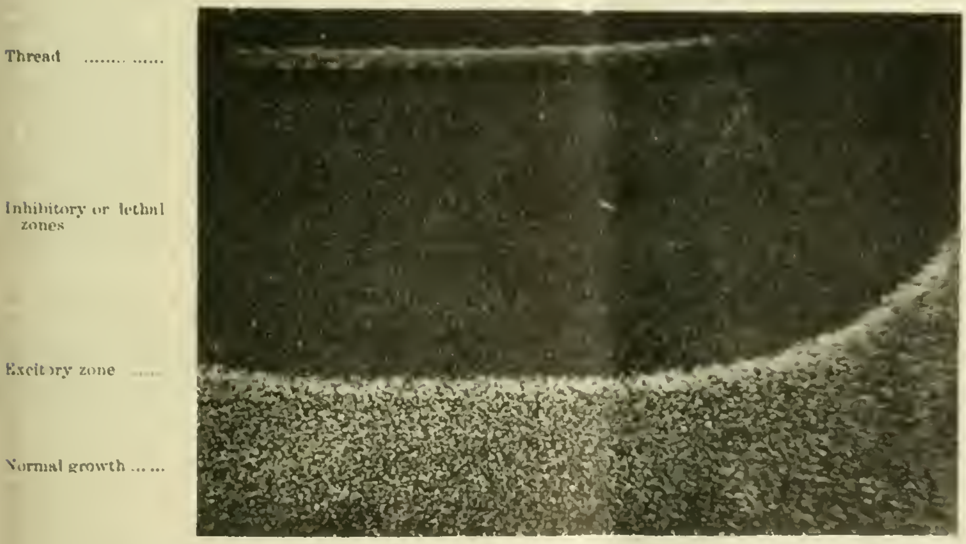
N.B.—Each figure indicating a lethal or a non-lethal dilution is based upon three sets of experiments, consisting each of five tests with five consecutive dilutions.

Dr. H. G. Ward has for the last six months been engaged in estimating accurately the influence which this stimulating effect had upon the number and physiological characters of bacteria.

The results of one of his sets of experiments are summed up in the accompanying diagram which shows that dilution of phenol of the strength of $\frac{1}{9000}$ actually stimulates the multiplication and growth of the bacilli, and as Dr. Ward can find no evidence of degenerative changes in the bacilli, it may be assumed that part of the phenol is utilised as food. My supposition receives support from some observations made recently by Dr. Fowler, who has succeeded in breaking up products of the phenol series contained in certain effluents by means of a bacillus which has been studied by Dr. Sidebotham, who found that it was the *Bacillus Helvolus* (Zimmerman).

Associated material.—Much of what I have said indicates the importance of associated material. It is obvious that agents which are used up by entering into combination with proteid or other matter, or who are capable of oxidising it, are in great part used up in doing that work when proteid or other matters, acted upon by the disinfectant, are present in large quantities. This fact was pointed out long ago by Baxter. One of the most important features of phenol and phenoloids is that their action is but little affected by proteid and allied matters. During the years 1906 and 1907 Dr. Haworth investigated under my direction the effects of the association of some compounds with phenol, with the results recorded in Table XI. In each case the amount of the material added to phenol had been proved to have no material effect upon the *Bacillus coli communis* in the time allowed for the exposures.





Photograph of a part of a gelatine plate inseminated with bacilli and treated with mercuric chloride thread.

It is generally understood that infection is almost invariably conveyed by some organic product containing the microbes which are the essential cause of infection, but the importance of the nature of the material is not always appreciated. For example, the excreta, and more specially the faeces and urine of patients suffering from typhoid fever, may be thrown upon a piece of ground upon which vegetables are cultivated; part of these excreta may be washed by the rain into a shallow well or into a stream, and this water may be used to wash utensils, which are afterwards employed to hold milk or various eatables. Flies may alight on the excreta and carry with them some of the material with which they may infect various articles of food in which, under suitable conditions of temperatures, the typhoid bacillus may multiply. The excreta may rapidly dry, and when reduced to dust may be carried to neighbouring places and infect various articles of food. The persons attending the patients, if not careful, may, while handling the patients, or carrying vessels containing their excreta, infect their hands and clothing, and in this way convey infection to milk, broth, jellies, ice creams, etc. The patients themselves may act as carriers when able to go about. The soiled clothing and bedding of the patient may be sent to a laundry where they may convey infection to many people in some of the ways already mentioned.

All this is not special to typhoid fever and may be said with equal truth of other infectious diseases, though the most infectious products are not always excreta, and the infective microbe is not always capable of multiplying in articles of food as the *B. typhosus* and allied organisms may. When the problem of disinfection is considered from the preventive medicine point of view, it is therefore necessary to consider how the infective bacillus can be destroyed when present:—*a*, in excreta, *b*, on the skin of persons, *c*, on clothing and various other fabrics and bedding, *d*, in various animal and vegetable articles of food, *e*, in water, *f*, in soil, *g*, in dust, *h*, in insects and vermin generally, to mention only the most important sources and carriers of infection.

It will be obvious at once that if the infection is allowed to be carried out of the sick room the problem becomes very complicated, if not insoluble. Thus, when a patch of ground has become infected it is practically impossible to deal with certainty with all the infective material, part of which may have already passed into water or been scattered as dust, or by means of insects, and, possibly, higher animals.

All articles of food may be sterilised by heat; chemical disinfectants are not applicable to them.

Chemical disinfectants are specially applicable to the disinfection of premises. Water may be sterilised by chemical products, as for instance ozone, chlorine or hypochlorites, or by the ultra violet light, but it is always safer to use unpolluted water.

With regard to disinfectants in the sick room, the problem, though still difficult, is not beyond solution. By sick room, I do not necessarily mean a single room, but the part of the house or hospital where infectious products must be kept for a time. Perhaps the term—infected area—might be more suitable. It is clear that if all the excreta, all the fabrics or articles exposed to infection were sterilised before leaving the infected area, and if the attendants coming in contact with the sick and their excreta removed any possible contamination by frequent ablutions and disinfection, there would be very little chance of the extension of infection beyond the infected area.

Although heat is the most reliable disinfecting agent, it is only applicable to bedding, fabrics, and vessels. The disinfection of excreta by heat in a private house is often impracticable.

From what has been previously stated it is obvious that what has chiefly to be effected is the disinfection of faeces, vomit, urine, blood, sputa, pus, and other morbid discharges, fresh or dry, either in bulk or spread on clothing, sheets, walls, floors, furniture in the sick room.

It is therefore not the bacteria alone that have to be considered, but the bacteria plus the moist or dry products with which they are associated, and which, specially when they have undergone desiccation, may offer a serious barrier between the disinfectant and the bacteria. Moreover these associated products may produce more or less inert compounds with disinfectants, and thus reduce considerably the amount available for actual disinfection.

Among the substances found in various morbid products, which affect in different manners the action of disinfectants, the following may be specially mentioned:—Various proteid substances and their derivatives, fats, urea, uric acid, various organic and inorganic salts, alkalis, acids, masses of non-pathogenic bacteria and cells, etc. The relative value of disinfectants is determined by their action not on pathogenic bacteria alone, but on the bacteria plus these various associated products.

Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, October 24th, 1910.

MR. F. W. RICHARDSON IN THE CHAIR.

ACIDS IN TAN LIQUORS.

BY PROF. H. R. PROCTER AND A. SEYMOUR-JONES.

The present great interest in the subject of this paper, as shown in the recent conference of the I.A.L.T.C., has rendered its early publication desirable, a fact which we somewhat regret since the recent important paper of Sörensen on "Enzymes" bears largely on a similar subject. In the present paper we have devoted much attention to indicators, and have had necessarily to accept certain of the views of other chemists who have worked on this subject; and Sörensen's work promises to throw fresh light on many points that we had regarded as settled. As we have as yet had insufficient time to digest his work and none to perform further experiments, much that follows must be regarded as more or less provisional.

For the past twenty-five years the question of the acidity of tan-liquors has been prominent in the chemistry of leather manufacture, and during that period upwards of twelve methods have been devised to estimate it, none of which have proved wholly satisfactory. On the other hand, the effect of the acids on the absorption of tannin by the skin and the rôle which they play in the production of sound leather, has only been studied empirically by practical tanners, and has received no attention from the research chemist.

It therefore seemed advisable to study both these questions; but in the present paper, we only propose to give an account of our work on the estimation of the acidity of tan liquors, leaving the study of its effects to a later publication. As the whole question largely depends on facts in physical chemistry which are of somewhat recent elucidation, it may be well to preface the account of experimental work by some remarks of a theoretical character.

The distinction has long been made in practice between "strong" and "weak" acids, without any very clear conception of the nature of the difference. Equal molecular quantities of either will neutralise or saturate equal quantities of base; but if a "strong" acid, such as hydrochloric, is added in excess to the salt of a weak acid such as acetic or carbonic, the weak acid is liberated and the strong takes its place in the salt. Corresponding to this, salts of strong bases with weak acids often exhibit in solution marked alkaline properties, though chemically neutral (*e.g.*, sodium carbonate). The acid "strong" in this sense does not become "weak" by dilution with water, but rather the "weak" acid when diluted approaches the properties of the "strong" acid of the same concentration.

While the alkali-saturating power of all acids of equivalent molecular concentration is the same, their other effects are often widely different, and though their swelling effect on hide cannot be said to vary directly with their "strength," it is yet closely connected with it, and acids of a very weak character have no appreciable swelling power, though they still neutralise lime. As to the nature of "strength" and "weakness," the following may be stated. All acids may be regarded as compounds of the hydrion H' and an anion or acid forming group, and, and all alkalis as hydroxyl, OH, and a kation or basic group. When the two are brought together the H and OH unite to form water, while the anion and kation constitute the salt. The more loosely the hydrogen is held and the more readily it reacts, the stronger the acid is; and the same holds of a base with regard to its hydroxyl. In modern chemical theory the strong acid is supposed in dilute solution to be already almost wholly separated (ionized) into hydrion (the single H') and anion, while in the weak, only a small proportion, which however increases with increasing dilution is so dissociated. Whether this percentage of ionization is actual, or only represents a certain average freedom, is unimportant—it is at least a convenient numerical way of stating what in some sense or other is an established fact.

The strength of an acid is therefore dependent on the amount of hydrogen ions in a given volume of the solution, or, in other words, on the hydrion concentration of that solution. Just as we measure the concentration of an acid or an alkaline solution in normal, decinormal, centinormal, etc., so we measure the hydrion concentration in the same way. A normal solution of hydrion would contain one gram. molecule of hydrogen ions per litre, and such a solution would correspond approximately to a 1·35 normal hydrochloric acid solution.

We have thus two meanings for the strength of an acid solution, firstly the total molecular quantity of acid which it contains, *i.e.*, its value as measured by the quantity of "normal" alkali required to saturate it; and secondly its acid strength as measured by its sourness and other "acid" properties, and more strictly by its hydrion-concentration. In the case of $N/10$ HCl, these two quantities are nearly the same, since almost all the acid hydrogen is present as free hydrions; while in an $N/10$ solution of gallic acid they are extremely different, as nearly the whole of the hydrogen remains attached to its anion, and the solution is not perceptibly sour. If, however, caustic soda is added, the small percentage of free hydrions unite at once with its hydroxyls to form water; more hydrions are evolved from the undissociated acid to take their place, and in turn are used up. The hydrogen ions which thus remain in reserve in the undissociated acid molecule are known as "potential" hydrogen ions. In the end the whole of these are combined to form water and the soda is neutralized; though at no time has the solution been more than feebly acid. The importance to the tanner of this difference of behaviour is obvious, since by the use of a chemically weak acid he is able to neutralize lime and other bases in the hide without producing undesirable swelling, while on the other hand for swelling purposes the acid employed must have a certain concentration of free hydrions. In discussing the very great dilutions which have to be considered in some cases, it is to be remembered that water itself is not wholly devoid of acid and basic properties, but contains free hydrions and free hydroxyl ions in equal quantities and each to the extent of about 10^{-7} normal ($N/10000000$). Therefore in neutralizing an acid the point of true neutrality is not 0 as might be supposed, but 10^{-7} normal; even alkaline solutions containing free hydrions, though balanced by larger amounts of free hydroxyl ions.

As before indicated, we may directly determine the "acidity" in two ways; the first method is to measure the "actual" hydrion concentration; the second, to determine both "actual" and "potential" hydrogen ions by direct titration. In the latter we have to use indicators, and with regard to these there are certain points which technical chemists often fail to realize. Firstly, the colour change of the large majority of indicators is gradual, extending over a considerable range, although between definite limits of hydrion concentration, which vary with the nature of the indicator. Phenolphthalein has a fairly sharp colour-change at 10^{-8} to 10^{-9} normal hydrion concentration, while methyl orange has a gradual colour change extending from 10^{-3} to 10^{-5} normal. In the light of these facts the discussion of haematein later in the paper should prove interesting.

It should now be obvious that as different indicators change their distinctive property, colour or other characteristic, at definite though different hydrion concentrations, varying amounts of strong and weak acids will be estimated according to the indicator used. This raises an interesting point, as some chemists lay great stress on the "accuracy" of a method; that is to say that they take an artificially acidified liquor and endeavour to estimate the same amount of acid as that put in. Let us suppose that to 95 c.c. of a neutral solution of tannin they have added 5 c.c. $N/1$ acid, this latter having been prepared by standardization against $N/1$ alkali and phenolphthalein, the colour-change of the latter taking place at 10^{-8} normal hydrion concentration. In estimating the acidity of this liquor unless the colour-change of the indicator used takes place at the same hydrion concentration as phenolphthalein, the amount of acid estimated will always differ from the amount originally added, by amounts varying with the strength of the acid used and the neutral salts of weak acids present. Thus the search after a method which will estimate the same amount of acid as that put in, is futile so long as the indicators are mixed and the relationship between them is not specified.

One other point requires discussion before proceeding to a consideration of the work accomplished, *viz.*, the effect of extensive dilution of the acid solution. It can easily be seen that dilution with water would, in most cases, affect the hydrion concentration. If all the acid were not dissociated then addition of water would cause a certain number of "potential" ions to be converted into "actual" ions, while if the acid were wholly ionized then addition of water would decrease the hydrion concentration. Thus if to an acid solution which has a hydrion concentration of 10^{-4} normal, *i.e.*, just sufficient to turn congo red blue, we add water until the hydrion concentration has fallen to 10^{-5} normal, the solution will no longer affect congo red. Thus dilution of an acid solution always tends to alter the amount of acid estimated, and is in most cases highly undesirable.

Under the same heading we may speak of the effect of the presence of neutral salts on the hydrion concentration. It must be accepted by the layman as a fact that the presence of neutral salts, especially those which have an ion in common with the acid (*e.g.*, sodium acetate and acetic acid) always tends to prevent the dissociation of an acid into its ions, and while the determinable acidity of such a solution may still be high, the actual hydrion concentration may fall very low.

The first step in our experimental work was the examination of the published methods for estimating the acidity of tan liquors. All these methods were carried out in their most recent published details. *Procter's lime water method* depends on the principle that tannin and many allied phenolic bodies form insoluble calcium (or possibly lime) salts on the addition of a clear saturated solution of calcium hydroxide to the liquor, while the organic acids usually present in the liquors form soluble calcium salts. In this way is determined the actual "lime dissolving" power of the liquor, and an important piece of information conveyed to the tanner.

In Procter's Textbook of Tanning the following passage occurs: "A liquor may have acidity equal to several c.c. of lime water and yet react absolutely alkaline to methyl orange. Hence the acidity of a liquor available for plumping may be taken as represented by the lime water required to change the red of methyl orange to yellow, and if the liquor does not redden methyl orange then it is incapable of plumping."

These words were written thirty years ago, and we can now show them to be perfectly true. Methyl orange changes colour at a hydrion concentration of 10^{-4} normal, and although solutions of about 10^{-5} normal showed a slight tendency to plump, it was found that the limit might be more correctly fixed between 10^{-4} and 10^{-5} while that of the lime-water method is nearer 10^{-6}.

Theoretically the lime water method is good as it involves no detannization or dilution of the liquor, but it has to be used very carefully to give concordant results, and apparently the experiences of the American leather chemists with it have been far from happy ones. They state that with tail liquors which contained very little tannin no end point was obtainable as only a darkening of the liquor took place without any turbidity. This difficulty could no doubt have been overcome by the addition of some neutral tannin solution as indicator, though it may be remarked in parenthesis that absolutely neutral tannin solutions, especially of the pyrogallol variety, are difficult to obtain. The presence of acids giving insoluble lime salts in acid solution, such as oxalates may be met by the addition of some calcium chloride before filtration.

The real objection to the method lies in the uncertainty of the indicator, *viz.*, the insoluble calcium tannin compounds. This involves two main defects, since certain tannins give somewhat soluble lime salts and some organic calcium salts are insoluble; and secondly, the indefiniteness of the end point. It is not easy to obtain exact concordance between two observers, for difference of opinion nearly always exists as to what constitutes "a trace of turbidity," which marks the commencement of the formation of the calcium tannin compounds. The results of five observers are given in c.c. of saturated lime water per 10 c.c. of liquor :—

Observer	1	2	3	4	5
Liquor X	14·7	14·9	14·6	15·05	15·0
Liquor Y	11·6	12·0	11·7	12·1	11·8

Fifteen readings taken by one observer on two favourable liquors at intervals of five minutes were as follows :—

Liquor X.	14·7	14·65	14·65	14·7	14·6	14·7	all others 14·7 c.c.
„ Y.	11·6	11·6	11·5	11·55	11·5	11·65	„ „ 11·6 c.c.

Abnormal liquors were, however, examined, which did not yield such concordance. For example, a very dark, strong handler liquor was examined and, though filtered clear, five titrations had to be made before concordance to 0·3 c.c. could be obtained. More concordant results could be obtained by dilution of the liquor with distilled water, though as has been stated dilution is never desirable. It is, however, apparent that if the observer and the concentration of the lime water be kept constant, and if trouble be taken to obtain brilliantly clear filtrates and with the aid of printed matter underneath the titration vessel, the method is useful for all practical purposes.

The method of Kohnstein and Simand (Ding. Polyt. Journ., 1885, cclvi. pp. 38, 84) depends on the treatment of the tan-liquor with magnesia free from carbonate and lime, and upon the difference in solubility of the magnesium salts subsequently formed, and only estimates those acids with soluble magnesium salts, and if a tannin chances to have a soluble magnesium salt then that tannin will be estimated as an acid.

This method is very laborious, and we have been unable to obtain the accuracy and concordance which have been claimed for it. The following are the results of experiments on six liquors, stated in grams of acetic acid per litre. Although the various sub-divisions of the method were carried out only the total acid results are given, as their accuracy did not seem to justify further detail.

	First titration	Second titration	Third titration
Liquor 1	0·0477	0·0504	0·0450
„ 2	0·0292	0·0346	0·0308
„ 3	0·1471	0·1393	0·1309
„ 4	0·3684	0·3418	0·3777
„ 5	1,4518	1,5822	1,5200
„ 6	3·8670	3,0920	4,4878

A defect pointed out by Bennett and Wilkinson (this J., 1907, 1186) was confirmed by the present experiments, *viz.*, the inconstancy of composition of some of the magnesium compounds with organic acids, excess of magnesia forming basic salts. A theoretical advantage of the method is that it involves no dilution of the liquor, but in the authors' opinion it is too elaborate and too little reliable for general use.

A method suggested by Bennett and Wilkinson in this Journal (*loc. cit.*) involves the use of lead oxide (litharge) both as a precipitant for tannin and as an absorbent for acids, only those acids with soluble lead salts being estimated.

The details of this method as laid down in the J.S.C.I. were most carefully carried out, but it does not appear that lead oxide is a satisfactory means of differentiating acids and tannins, and the compounds formed with both are apparently of irregular composition and uncertain solubility. Results obtained with the method show that leads salts of the acids are formed of varying range of basicity, and this seriously affects the final estimation.

A comparison of the above method with the lime water method is interesting. Results are given in grams acetic acid per litre :—

	Liquor A	Liquor B	Liquor C	Liquor D
Lime water method..	1·34	1·50	3·63	2·44
Bennett and Wilkinson	2·17	1·62	2·41	1·98

The method published by Koch (Ding. Polyt. Journ. 1887, page 395) and subsequently modified by Paessler & Spanjer (Collegium, 1903, pp. 10 and 17) depends on the removal of tannin by precipitation with a 0·2 per cent. aqueous gelatine solution, and subsequent titration of the supernatant liquor with standard alkali and an indicator. The method which has been largely adopted, was very thoroughly examined with no very satisfactory results. Theoretically azo-litmin should be a good indicator for the purpose, as its main colour change takes place at a hydrion concentration of 10^{-8} normal, which includes most bodies with any claim to acidic properties, but the colour change is gradual and the end point difficult to determine, so that the personal equation enters largely, and concordance between observers is not usually good. Examples are given of six liquors and five observers. Results in c.c. *N*/10 alkali for 25 c.c. liquor :—

Observer ...	1	2	3	4	5	
	c.c.	c.c.	c.c.	c.c.	c.c.	
Liquor A. ..	19·4	19·1	19·3	19·8	19·4	N/10 alk.
„ B. ..	21·7	21·2	21·45	22·1	21·3	„
„ C. ..	15·9	15·0	15·9	15·5	15·15	„
„ D. ..	17·3	17·1	17·8	17·4	17·9	„
„ E. ..	17·0	16·8	17·4	16·5	16·9	„
„ F. ..	24·55	24·0	24·1	23·8	24·4	„

A very serious objection may be advanced against nearly all methods involving detannization, *i.e.*, that a certain amount of acid is co-precipitated with the tannin. It will be shown later that in every case of detannization so far examined varying amounts of the bodies otherwise estimated as acids are carried down with the tannin.

Another objection to the method is that even an experienced observer usually has to make about five titrations before concordant results can be obtained.

Results in c.c. *N*/10 KOH for 25 c.c. One observer :—

Results in c.c. *N*/10 KOH for 25 c.c. One observer.

	Liquor A.	Liquer B.	Liquor C.
	c.c.	c.c.	c.c.
1st titration	21·1	23·4	12·7
2nd „	20·6	22·8	12·1
3rd „	20·2	22·6	12·1
4th „	20·0	22·45	12·0
5th „	20·0	22·40	12·0

A zinc oxide and hide powder method proposed by the commission (A.L.C.A. Journ., 1906, p. 223) appointed by the American Leather Chemists Association was carefully examined, though without much hope of good results.

The working details were the following :—

Sixty c.c. of the liquor were diluted to one litre. To 200 c.c. of this solution 20 grams of moist hide powder and one teaspoonful of chemically pure zinc oxide were added. These were shaken in a shake machine for five minutes and then filtered; 100 c.c. of the filtrate were titrated with decinormal alkali in the presence of phenolphthalein, adding a little zinc oxide to give a sharper end reaction. The requisite correction was made for moisture in the hide powder, and a blank sample run to determine free acid in the latter.

The results obtained were not concordant, and in every case were much lower than with any other method. This was due not only to the fact that hide powder very readily absorbs acids, but that zinc oxide combines with most acids to form neutral salts.

A few corrected results are compared with the lime water method below, the results of the latter having been calculated into c.c. *N*/10 alkali.

Liquor	1	2	3	4	5
	c.c.	c.c	c.c.	c.c.	c.c.
ZnO + Hide Powder	10 9	12·7	12·5	8·8	9·8 *N*/10 alk.
Lime water	15·4	16·1	16·8	12·4	10·3 ,,

For some years past the American Leather Chemists Association has been particularly persevering in its endeavours to find an accurate and concordant method for the estimation of acidity of tan liquors. The charcoal method of Simand was first of all adopted as official. This method consists in detannizing a measured volume of the liquor by animal charcoal, and estimating the acidity of the remaining solution by titration.

Although the animal charcoal used was labelled C.P., we found it an altogether unsatisfactory agent for the removal of tannin and colouring matters in the presence of acid. Very varying results were obtained and a number of blank experiments showed that the errors were due to the unequal amounts of acid absorbed by the animal charcoal together with the tannin; varying in six blank experiments from four to fourteen per cent. of the total acid. This serious defect has also come under the notice of the American chemists, who universally condemn the method.

In 1906, A. W. Hoppenstedt tried to solve the problem by removing the tannin by means of an alcoholic solution of quinine, and then titrating the filtrate consisting of the quinine salts of the acids with caustic alkali in the presence of phenolphthalein. (J.A.L.C.A. for September, 1907.) In experiments carried out in this way the precipitation of quinine and tannin filtered well, but on titration the dense precipitation of the liberated base considerably masked the end reaction. This could, however, be remedied by a number of titrations. Instead of titrating 100 c.c. of the filtrate it was found more convenient to work with smaller volumes, and more concordant results were obtained by titrating 20 c.c. of the filtrate at a time. The following figures show the concordance of the method :—

	c.c.	c.c.	c.c.	c.c.	c.c.
Liquor A...	31·3	31·2	31·2	31·2	31·25 *N*/10KOH
,, B...	28·4	28·3	28·2	28·25	28·3 per 20 c.c.
,, C...	24·9	24·8	24·7	24·8	24·75 liquor.
,, D...	10·7	10·5	10·35	10·55	10·2

Although the method involves detannization and considerable dilution of the liquor, both of which tend to lower the results, it gives higher results than most other methods; although quinine co-precipitates quite an appreciable percentage of acid. This fact is probably due to the production of weak acids by oxidation, and the use of phenolphthalein, which estimates many bodies of very feebly acid properties.

Comparison was made between this method and a direct titration with *N*/10 alkali and phenolphthalein paper, working in an atmosphere of coal gas to avoid oxidation of the liquor :—

Liquor	1	2	3	4
Detannized	31·2	28·3	24·8	27·7
Undetannized	31·75	28·5	25·1	27·9

The method has to be worked quickly and the filtration must be very rapid to prevent oxidation and darkening of the filtrate. This renders the method awkward to manipulate, and an undesirable and laborious condition, in which a considerable error is possibly introduced, is the necessity of making yard liquors up to the same strength as that used in tannin analysis.

Phelan and Fiske have suggested a means (J.A.L.C.A., 1908, pp. 99)) whereby the method ordinarily employed to determine CO_2 in carbonates is so modified as to be available for determining the acidity of tan liquors. A definite volume of liquor is mixed with calcium carbonate, the carbon dioxide driven off, dried, and collected in U tubes containing soda lime. The increase in weight of the tubes is taken as proportional to the amount of acid in the original liquor. In this case only those acids which, at boiling temperature, will liberate carbon dioxide from calcium carbonate are estimated. The method is ingenious, but requires a somewhat elaborate apparatus and is quite as laborious as the Kohnstein-Simand, neither the additional labour nor the additional apparatus being justified by accuracy or concordance of results. It should be stated that a similar apparatus was given an extended trial at Leeds some years prior to the above publication and did not prove successful.

In the J.A.L.C.A. for March, 1908, p. 85, Reed describes two new methods for the estimation of acids in tan liquors based on the precipitation of tannin by an alcoholic solution of gelatine, and subsequent titration of the filtrate from the tanno-gelatine precipitation with standard alkali, using an alcoholic solution of haematein as indicator. In the second method he merely modifies the first by substituting a basic dye for the alcoholic gelatine solution, and titrating the solution as before in the presence of the same indicator.

Both these modifications were thoroughly investigated, and the first as a practical works control method is certainly good; the second method is in no way promising. As indicator a pure sample of haematein was obtained from the University Tinctorial Chemistry Department, of which a fresh solution had to be prepared each day, as haematein in solution rapidly undergoes change.

In his original paper, among other observations, the author makes the following :—" It is not necessary that the supernatant solution from the tanno-gelatine precipitation should be clear, nor is it imperative that there should be an entire absence of tannin in the solution, as haematein is practically neutral to tannin." Reed also states that " where a water solution of gelatine or salted solution of gelatine was used, a much bulkier precipitation was obtained and an appreciable loss of acid resulted. When alcohol is used there is perhaps a trifling loss of acid. It was observed that the alcoholic gelatine solutions gave a better precipitation on standing than when freshly made." He also admits that a correct end-point determination with haematein requires much practice, and trusts " that the method will not be condemned if the analyst fails immediately to make successful determinations." It is also noted that " haematein is affected to a much less degree by salts of gallic acid in the presence of alkalies than is phenolphthalein. In the titration of acetic, lactic, and gallic acids and their mixtures, it will give with standard alkali practically the same calculated acid as will phenolphthalein, perhaps a shade less as it is more susceptible to alkalies." These statements may be confirmed and the method was found convenient to work and gave fairly concordant results, combined with rapidity of execution, but the end point with haematein is never easy to determine. The best results obtained were :—

Titration	1	2	3	4
Liquid A	10·7	10·65	10·6	10·5
,, B	15·2	15·2	15·25	15·25
,, C	15·6	15·5	15·45	15·45
,, D	20·0	20·8	20·8	20·8
,, E	17·55	17·40	17·35	17·40
,, F	21·4	20·0	20·5	20·2

Results are given in c.c. *N*/10 KOH required for 25 c.c. of liquor.

Liquors A, B, C, D, and E, represent the best results and F one of the worst, and the method is open to one or two objections. Detannisation with alcoholic gelatine solution is little, if any, more advantageous than that with aqueous gelatine, in so far as the extent of the co-precipitation of acid is concerned, but filtration is much easier since the precipitate is less bulky and more compact, probably because of the dehydrating power of the alcohol. A second difficulty is the character of the indicator used. While other indicators change colour more or less sharply at a definite hydrion concentration, haematein is practically always changing colour from a hydrion concentration of twice normal ($-6{\cdot}034 \times N/1$ HCl) to 10^{-15} normal ($-6{\cdot}8 \times N/1$ KOH), but the authors estimate that the particular colour change taken as end-point by them took place at about 10^{-7} normal. The question of the haematein indicator is gone into more fully later, but the following is a comparison of two observers using the gelatine haematein method on five liquors :—

Liquor	1	2	3	4	5
Observer 1	10·65	15·2	15·6	20·9	17·45
„ 2	10·8	15·6	15·95	21·2	17·7

The basic dyes recommended in Reed's second method are lemon yellow " O " (sold by the Berlin Aniline Works), thioflavine F, methyl violet, and auramine. Only the latter pair were tried by the present authors, but the precipitation of tannin seemed very imperfect. Clear liquids were never obtained by a single filtration and were always highly coloured, which absolutely precluded the use of haematein as an internal indicator.

In the J.A.L.C.A. for June, 1910, Yocum and others propose a modification of the gelatine haematein method by removing gallic acid by precipitation with gelatine in the presence of gum arabic. They state that the one serious defect of the original method is that it includes the non-plumping acids in the estimation, and where a large proportion of the tanning materials used are of the pyrogallol variety, the amount of gallic acid thus estimated is very considerable.

Experiments show, however, that the reaction is by no means a quantitative one, and considerable amounts of gallic acid are found in the liquor after treatment ; while gum arabic itself is usually quite acid in solution. A much more convenient and scientific method is to select an indicator such as congo-red paper, which is not sensitive to hydrogen-ion concentrations too weak to plump.

Haematein is scarcely affected by tannins, and if the titration is conducted under petroleum ether as described in a subsequent part of this paper, and the liquid spotted on haematein paper freshly blued by very dilute ammonia, well washed, and used on a tile in a moist condition, very good results are obtained, though it is still not easy to fix on a definite end-point.

An incomplete and unpublished method by Procter and Law consisted in the direct titration of the unfiltered and undetannized liquor with $N/10$ NaOH, using haematein paper as an external indicator.

Probably the best method for detannisation which was examined, was that of Stiasny, which involves the precipitation of the tannin by formaldehyde in the presence of hydrochloric acid, but is unfortunately restricted to the catechol tans, which alone are completely precipitated. The details of the estimation were as follows :—

Twenty-five c.c. of the tan liquor were pipetted into a flask, 20 c.c. of $N/2$ HCl and then 10 c.c. of carefully neutralized formaldehyde were added, and the whole boiled with a reflux condenser for ten minutes. The whole of the tanning and colouring matters were precipitated, leaving the 20 c.c. $N/2$ HCl and the unknown quantity of acid in a brilliantly clear solution. The flask was rapidly cooled under the tap, the solution filtered, and the precipitate well washed. The filtrate and washings were then titrated with $N/2$ KOH and phenolphthalein, when any c.c. of $N/2$ KOH above the 20 c.c. required to neutralize the HCl added, represented the acid previously present in the liquor.

This method was thoroughly tested on quebracho, mimosa and gambier liquors. It was shown that in this case, owing possibly to the unusual character of the tannin precipitation, very little co-precipitation took place. The results were somewhat high, as the indicator used was phenolphthalein. It was found convenient instead of performing the whole titration with $N/2$ KOH, to add 20 c.c. of the latter to neutralise the 20 c.c. of $N/2$ KOH, and then titrate with $N/10$ KOH. Unfortunately the reaction with pyrogallol tans is neither complete nor quantitative.

A method which was formerly in use at the Vienna research station, though not tested in the present work, is interesting in that while theoretically wrong, it gave in many cases fair practical results. The principle of the method was to run into the acid liquor excess of standard caustic soda, and then utilize the excess of soda to liberate ammonia from ammonium sulphate, the gas being collected in standard acid in the usual way. This of course would enable the operator to calculate the concentration of acid in the original liquor.

We have not had time to examine the complicated method and apparatus of Georg Grasser (Collegium, October, 1910, p. 406), but many difficulties and at least theoretical objections present themselves to anyone familiar with the problem, and in the final estimation of non-volatile acids it relies on the method of Koch, which we have already criticised. With regard to volatile acids, we need only point out as a well-known fact, that in steam distillation considerable quantities of lactic acid are invariably carried over with the acetic.

This completes the list of published methods. It will be seen that the great difficulty lies in the fact that a tan-liquor may contain any acid from strong acids like formic to phenolic bodies with feebly acid functions, and that if we estimate the acidity by titration with an alkali we always have to make an arbitrary choice of the end point by specifying a certain indicator. Thus no one method can give the tanner all the information he requires. If he wants to know the lime dissolving power of his liquors, probably nothing can give it better or more directly than the lime water method. If he requires the actual present acidity of his liquor it can only be given in the form of the hydrion concentration, but this point will be discussed later. If he requires the total acid, he must, by choice of a suitable indicator, decide at what point he will draw the line between acid and non-acid bodies. Phenolphthalein, for instance, will include not only all true acids, but some substances which are really not acids at all, though they have a feeble power of combining with bases ; while methyl orange or congo red exclude many of the weaker true acids. It must also be remembered that in presence of the excess of alkali, which is required to influence such indicators as phenolphthalein, many really neutral bodies are hydrolysed to bodies of a more acid character, as for instance tannin to gallic acid ; and in the presence of oxygen still more profound changes take place, mostly in the direction of increased acidity.

Several of the methods which have been described involve the previous detannisation of the liquor, and it has been pointed out that this in almost all cases is accompanied by marked co-precipitation of acid. A rather considerable series of experiments was therefore made to test the effect of different methods of detannisation, using throughout each series the same indicator. In each case 25 c.c. of the liquor was titrated under petroleum ether to avoid oxidation, and the figures given are the number of c.c. of $N/10$ KOH required for neutralisation. To prevent or lessen oxidation, petroleum ether was used as described in a later part of the paper.

SERIES I.

Indicator.	Moist haematein paper.				
Liquor	A.	B.	C.	D.	E.
Strength (grs.tan.)	·70	1·5	2·3	2·8	3·04
Gelatine, aqueous	16·4	15·5	10·9	18·7	19·4
„ alcoholic	16·2	15·7	10·8	19·05	19·6
ZnO and HP....	14·3	14·1	8·2	15·6	16·55
No detannisation	16·7	16·05	11·1	19·2	19·85

SERIES II.

Detannisation with gelatine salt solution as used in the Loewenthal method. Indicator moist haematein paper :

Liquor.	Before detannisation.	After detannisation.
Gambier A.	14·45	13·9
„ B.	16·05	15·6
Gallotannic	6·7	6·4
Mixed mimosa	10·3	10·1
Quebracho	10·05	9·6
Mixed liquor	11·3	11·05
Light leather suspenders	16·5	16·05

SERIES III.

Comparison of the Stiasny formaldehyde method of detannisation of catechol tanning liquors with the Simand animal charcoal method :—

Indicator-phenolphthalein paper.

Liquor.	Stiasny	Simand	No detannisation	
	c.c.	c.c.	c.c.	
Quebracho	10·70	10·40	10·65	N/10 KOH
Mimosa	7·45	7·30	7·45	
Gambier	14·1	13·75	14·0	
Mixed catechol	9·9	9·70	10·0	
Mimosa	10·95	10·7	10·95	

It will be seen from these results that in every case except Stiasny's method, detannisation lowers acidity, though mostly not to a serious extent for works control. The tannins themselves are either non-acid, or of such feeble acidity that for practical purposes it may be disregarded, and it is not difficult to choose indicators on which they have no observable effect, so that probably the most accurate results are obtained by direct titration without detannisation, but with a suitable indicator. We have therefore made a somewhat detailed study of the possible indicators, not merely as regards the possibility of a rapid and accurate estimation of the total acid, but with a view of determining the proportion of acids of different "strengths"; and while our efforts to find ideal indicators have not been wholly successful, details of our results are given, in the hope that they may at least save others from useless investigation.

Since rapidity and ease of execution is often of equal importance to extreme accuracy in technical work, it is clear that a liquid internal indicator would present considerable advantages, but in most cases this is precluded from the dark colour of the undetannised liquor, and resort must be had to the less satisfactory spotting on paper, which, however, often obviates the necessity of a somewhat tedious filtration. On the whole the greatest difficulties arise from the slow colour-change of most indicators which renders it difficult to fix a precise end-point recognisable by all operators.

It is well known that gallotannic acid and all other pyrogallol tannins hydrolyse or oxidise rapidly in alkaline solution in contact with air or oxygen to form increased quantities of acid. Consequently when an acid pyrogallol tannin solution is slowly titrated without any precautions to exclude oxidation, the value obtained is much higher than with a rapid titration; and in fact, within limits, the slower the titration the greater the amount of acid estimated. The precautions taken to prevent this have been mentioned, but it may be of interest to give a short account of the work carried out to obviate this difficulty.

In a good many preliminary experiments we attempted to obtain a neutral atmosphere inside the titration flask by bubbling coal gas through the liquor. This had the advantage that the reducing action of the coal gas to some extent counteracted the oxidising action of the alkali, and gave quite satisfactory results, but the use of coal gas is objectionable owing to its explosive properties when mixed with air. Petrol ether, boiling below 40° C., which is a neutral liquid with a heavy vapour and sufficiently volatile to produce a neutral atmosphere on agitation, was tried with great success, and a further modification was introduced by the use of a small separating funnel. Into this was run the liquor to be titrated (usually 25 c.c.), 2 c.c. of the petrol ether were added, forming a layer over the oxidisable liquid, and by judicious agitation the vapour could be made to rarefy the air in the funnel to a considerable extent. The tan liquor was now titrated by dropping the standard alkali through the layer of petrol ether, and vigorously shaking to ensure thorough mixing and the maintenance of a neutral atmosphere. The tube of the separating funnel was cut off just below the tap, so that after each addition of alkali one drop of the liquor could be withdrawn and spotted on the paper indicator. This method was very effective in preventing any rapid oxidation. When the titration was finished and the reading had been taken, the tan liquor was run out from the bottom of the funnel, and the petrol ether left, where, if required it could be thoroughly washed in the funnel with water, and used again.

This method was used on all the following indicator tests :

Mauvein was found to be only sensitive to acids above decinormal in strength, and was consequently useless for the purpose in view.

Methyl violet did not prove at all useful as the colour-change was very gradual, and the only distinct change from blue to violet took place at a hydrion concentration of 10^{-2} normal.

Benzopurpurin has too gradual a colour-change, allowing of differences up to 5 per cent.

Congo Red changes colour from violet to scarlet at 10^{-4} normal, and as paper is quite the best indicator for this acid concentration. The paper is kept in the red (alkaline) state, as this is the most stable. This indicator may well be used by the separating funnel method to estimate the plumping acids of any liquor. Readings can usually be obtained to 0·1 c.c.; it can conveniently be used in conjunction with some indicator of a later colour change to estimate both strong and weaker acids. Sörensen has found that congo red, being a colloidal indicator will not estimate acids in the presence of proteid matter. As we propose to use the indicator in the form of test paper, by which the congo red is already strongly adsorbed, we believe that this difficulty will be obviated.

Methyl Orange changes colour at a hydrion concentration at 10^{-4} normal, and is quite serviceable in the form of paper. It gives approximately the same end-point as congo red, but the colour-change is not so pronounced, though the results obtained showed excellent concordance.

Gallein is useless as an internal indicator for liquors, and in paper the colour-change is not sufficiently definite.

Sodium Alizarin monosulphonate has a rapid colour-change at 10^{-5} normal hydrion concentration, and proved fairly useful as paper. It was not so good as congo red or methyl orange for ordinary work but proved very serviceable in the approximate estimation of the actual hydrion concentration.

Carminic and Rosolic acids in pure acid and alkaline solutions have sharp but delicate colour changes at 10^{-5} and 10^{-7} normal respectively. The delicacy of the colour changes was such as to render it impossible to use the indicators either internally or as paper.

Lime water. The advantages and disadvantages of using the action of lime water on tannin as an indicator have been discussed.

Lacmoid changes colour at a hydrion concentration of 10^{-6}—10^{-7} normal, and in the form of paper is moderately serviceable, but generally inferior to azo-litmin. The colour change is neither very distinct nor sharp.

Haematein. Test paper was made by saturating strips of good quality filter paper in a freshly-prepared 0·1 per cent. alcoholic solution of the purest obtainable haematein, and allowing to dry without heat. The paper had to be kept in the yellow (acid) condition, as in the bluish purple (alkaline) state the colour faded rapidly. The paper was rendered blue immediately before use by immersion in a *very* dilute aqueous ammonia solution, washing, and removing superfluous moisture by pressing between filter papers, and then used in the moist condition. The end point of the titration is seen much more accurately if the paper is moist, as the mere moistening of haematein paper produces a slight change of colour. It was also found that haematein paper, even in the acid condition, did not keep satisfactorily for more than one week. The end point of the titration was supposed to be reached when no yellow colour was produced in the indicator paper immediately on spotting with the liquid under titration, since further colour-changes almost immediately take place. The greatest difficulty is the extremely gradual nature of the colour-change, the yellow colour almost imperceptibly gives place to a yellowish pink very difficult to distinguish from it. The following particulars are taken from a paper by Salm, "Studie über Indikatoren" (Zeit. für Physik. Chemie. Band LVII., 1907. page 471) to which we are indebted for much of our information on this subject, and represent the colour-changes of haematein from a hydrion concentration of twice normal to one of 10^{-15} normal hydrion concentration.

Hydrion concentration.	Colour.
2 normal ..	.. raspberry red
1 ,, ..	.. pink.
10^{-1} ,, ..	.. green grey.
10^{-2} ,, ..	.. greenish yellow slowly going grey.
10^{-3} ,, ..	..
10^{-4} ,, ..	.. green yellow.
10^{-5} ,, ..	..
10^{-6} ,, ..	.. brown with a trace of red.
10^{-7} ,, ..	.. bright lilac.
10^{-8} ,, ..	.. violet.
10^{-9} ,, ..	.. red violet.
10^{-10} ,, ..	.. red violet turning brown.
10^{-11} ,, ..	..
10^{-12} ,, ..	.. dark red violet.
10^{-13} ,, ..	.. dark red, later slowly brown.
10^{-14} ,, ..	.. dark red, later brown, then yellowish green.
10^{-15} ,, ..	.. blue violet.

Salm remarks that most of the colours are not permanent. The present authors do not claim, of course, that all these variations in colour could be observed without the use of a colorimeter, but they are sufficiently obvious in the normal course of experiments to explain certain peculiar colour effects and to render haematein a very difficult indicator.

Acetic, lactic, gallic and benzoic acids and all strong inorganic acids are moderately well estimated by the use of haematein paper, while boric acid only produces a slight reddening. Certain phenols in strong solution turn haematein paper reddish brown, but the colour produced by such strengths of these bodies might be found in the liquors is very slight, and is readily distinguishable from the yellow colour produced by bona-fide acids. The purest gallotannic acid which could be prepared was distinctly acid to haematein.

Azo-litmin paper was purchased. Changes colour at a hydrion concentration of 10^{-8} normal. The colour change is somewhat slow, and there are four distinct shades in it, viz.: a pink violet, violet, bluish violet and blue. The indicator did not prove very serviceable, and the readings obtained with the filtered and undetannized solutions were not very concordant. As used in Koch's method the indicator is somewhat unsatisfactory, and on the whole it does not compare very favourably with some others.

Phenolphthalein changes colour fairly sharply at a hydrion concentration of 10^{-9} normal and seems to estimate a few bodies not included in the haematein value. It was not very serviceable with liquors either in the solution or as paper. By diluting the liquor and spotting on a tile fairly concordant results could be obtained. Its most prominent defect for our special purpose was the very decided alkalinity required to produce the colour-change, which led to hydrolysis and oxidation of the tanning matters.

Alizarin only changes colour when the hydrion concentration is below 10^{-11} normal, *i.e.*, in decidedly alkaline solution, and consequently is unsuitable for tan liquors for the same reason as phenolphthalein.

Fluorescein is an indicator which does not depend on an ordinary colour-change, but on the appearance of green fluorescence, beginning at a hydrion concentration of N 10^{-5} and increasing to about N. 10^{-7}. It is used as an internal indicator in the solution, and is applicable even with dark-coloured liquids. It is therefore an excellent indicator for estimating the total acidity of a tan liquor, and in Collegium, No. 419, we ventured to outline a method using the maximum fluorescence as end-point. For six months, working with one sample of fluorescein, we obtained excellent results, but recently we have found that the personal equation involved by this method is much higher than we had previously reason to suppose. We have found that the standard fluorescence obtained by adding excess of alkali to 10 c.c. of tan liquor containing five drops of 2 per cent. alcoholic fluorescein solution was not always definite. We tried to overcome this difficulty by using the fluorescence produced by a solution of definite hydrion concentration, viz.: 10^{-7}, as standard, and hoped in that way to obtain perfectly definite results, but ultimately found that different samples of fluorescein gave slightly different fluorescence, and the amount of indicator solution added had a great effect on the result.

It has been found, ont only by ourselves, but by colleagues in other parts of England, that the fluorescein method as outlined by us in the Collegium is capable of giving good results in the hands of one observer, but as we have previously stated, this is common to many methods. We are very reluctant to abandon fluorescein, as with its use a direct titration of the unfiltered liquor may be made with great accuracy, the real difficulty being to obtain a definite standard of colour capable of being reproduced by different observers; and we shall be glad if leather chemists will assist us in making experiments in this direction as it is quite evident that this indicator is well worthy of our attention. We now propose to experiment with the following indicators kindly provided by the University Tinctorial Chemistry Department:—aesculin, methyl red, 1 : 4 amido naphthol benzaldehyde o-sulphonic acid, and an unknown fluorescing substance.

A considerable series of experiments was carried out to test the fluorescein method, and in most cases the concordance was very similar to that with haematein; close for any single practised observer; less good for a variety of observers fixing their own standards, but a few observers seemed regularly to obtain results constant in themselves but differing from the majority. Congo red, methyl orange and haematein papers were also carefully tested by titration under petrol ether with different liquors and each gave results not differing among themselves at the most by more than about 0·2 c.c. and usually much closer.

The following table shows the results obtained on a series of liquors containing the material of an ordinary mixed tannage taking that found by haematein which closely indicates the true point of neutrality as 100. Of course the actual relation only holds good for the individual liquors as it is dependent on the proportion of different acids present.

Indicator. Approx. Hion concentration.	1	2	3	4	5	6	7	8
Azolitmin	106	100	104	104	109	—	—	—
Haematein....	100	100	100	100	100	100	100	100
Fluorescein ...	88	89	93	87	62	—	—	—
Resolic Acid	88	93	93	92	66	—	—	—
Lime Water ..	82	96	93	—	69	49	65	63
Congo Red ...	82	71	74	75	44	32	33	37

The last three liquors contained oakwood extract and oak bark only.

The figures of course represent the percentages of the total acid of the acids reaching the strengths or hydrion concentrations assigned to the various indicators. Acids which are not indicated by congo red have little or no plumping effect though they will still dissolve lime.

Below are given a few comparative results on four liquors from a light leather yard which were tested for acidity by the lime water, haematein, and congo red methods. The haematein and congo red were used as outside indicators with the separating funnel method before described. The big difference between the two latter indicators in all the readings was very puzzling, and can only be accounted for by the assumption that the liquors contained very few of the stronger acids.

Liquor No. I. Oakwood Extract and Oakbark.

Acidity by
Lime water = 25 c.c. of liquor require 8·0 c.c. N/10 alk
Haematein = ,, ,, ,, 16·0, 16·05, 16.05c.c. N/10 alk
Congo Red = ,, ,, ,, 5·9, 5·8, 5·9 ,, ,, ,,

Liquor No. II. Same composition.

Acidity by
Lime water = 25 c.c. of liquor require 9·8 c.c. N/10 alk
Haematein = ,, ,, ,, 15·25, 15·15, 15·10 c.c. N/10 alk
Congo Red = ,, ,, 5·0, 5·0, 4·95 ,, ,, ,,

Liquor No. III. Same composition.

Acidity by
Lime water = 25 c.c. of liquor require 10·4 c.c. N/10 alk.
Haematein = ,, ,, ,, 16·5, 16·4, 16·5 c.c. N/10 alk.
Congo red = ,, ,, ,, 6·0, 6·1, 6·0 ,, ,, ,,

Liquor No. IV. Same composition.

Acidity by
Lime water = 25 c.c. of liquor require 10·2 c.c. N/10 alk.
Haematein = ,, ,, ,, 16·4, 16·3, 16·25 c.c. N/10 alk.
Congo Red = ,, ,, ,, 5·9, 5·9, 6·0 ,, ,, ,,

Handler liquor, Valonia, Myrobs, Oakbark, and Chestnut 22° Bkr.

Acidity by
Lime water = 25 c.c. of liquor require 9·2 c.c. N/10 alk
Haematein = ,, ,, ,, 14·4, 14·45, 14·5 c.c. N/10 alk.
Congo Red = ,, ,, ,, 10·8, 10·7, 10·6, 10·6 ,, ,,

The above figures, which appear somewhat inexplicable, are given to show that the use of a number of indicators in the titration of a tan-liquor acidity seems to throw some light on its acidic composition and certainly conveys more information to the tanner. In these cases the haematein result might stand for the total acid value, that of the congo red for the total plumping value, and the lime water for the lime dissolving power.

A number of interesting phenols and aromatic acids, which if they do not occur in the liquors at least form the basis of many tannins, were examined. We trust to publish more fully on this point at a later date, but it may be sufficient for the present to give the following results. We found that gallic acid was ionized to a much greater extent than protocatechuic acid in equivalent solution, *i.e.*, that gallic acid is the "stronger" acid and there can be little doubt that it possesses a slight plumping power. Both acids turn congo red paper blue.

Of the phenols pyrogallol and resorcinol are both acid to haematein, the former considerably and the latter slightly so. Neither produced any colour-change in congo-red. Phlorogucinol did not affect either congo red or haematein.

It may be added that all these tests were performed on the purest obtainable products.

Discussion (at Leeds).

Mr. F. W. **Richardson** said that many of the suggestions in the paper might be very useful in general laboratory work, such as the determination of organic acids, where the question of dilution and the reagents used were very important. No two analysts, for instance, used phenolphthalein in the same way, and where very accurate results were required work with it was questionable. His experience with dilution methods was not very fortunate. The proposal to use the inversion of sugar as a criterion, reminded him that curious results were sometimes obtained when complex organic bodies were also present.

Mr. A. G. **Perkin** said that as yet there was no evidence of the presence of a carboxyl group in the natural catechol-tannins. It was possible that catechol-tannins might exist in nature, which were similar to the artificial product Schiff obtained by the condensation of two molecules of protocatechuic acid, and if so would be expected to possess an acid nature. On the other hand, it was hardly likely that such a compound would give the phlobophane reaction, so characteristic of the well known catechol-tannins. In his opinion this property was not necessarily due to the presence of a catechol nucleus, but rather arose from the peculiar structure of the compound as in the case of catechin and cyanomaclurin, and this was evidently of a more complex nature than that possessed by gallotannin. According to numerous workers catechin is the parent substance of catechutannic acid and can be very easily converted into this compound, which seems to be a typical catechol-tannin. Such being the case, it was not easy to understand, in the light of (Kostanecki's) formula for catechin, how catechutannic acid could possess a carboxyl group.

Dr. L. L. **Lloyd** said that if solutions contained any neutral salts there was the possibility of the production of mineral acids. Thus a mixture of wool and formic acid at a temperature above 50° tended to produce mineral acid which might hydrolyse tannin. Possibly leather might have a similar action.

Dr. H. **Ingle** said that he always doubted the results obtained on titrating organic substances containing double linkages with alkali unless the atmosphere was absolutely excluded. Thus if saponification values of resins were done in open air there was a tendency to get an inaccurate result. Petroleum spirit did not altogether overcome the difficulty of the presence of atmospheric oxygen since by the law of partial pressures a little oxygen must be present. In the titration of highly coloured liquids he had found certain sulphonated phenylrosaniline compounds very useful. Fluorescein was better, since the colour impression in this case depended on reflected instead of transmitted light, and was therefore more or less independent of the colour of the solution.

Prof. H. R. **Procter** said that the film of petroleum spirit on the surface of the liquid excluded air almost completely, and tannin substances were not very absorbent of oxygen in the acid condition. Difficulties in the use of fluorescein as an indicator were in obtaining a standard colour for comparison. He believed that by the use of one or two acid salts, such as sodium hydrogen phosphate, along with Bismarck Brown, the colour with fluorescein would be a good imitation of that of the tannin liquors. He suggested the use of flattened capillary tubes. These gave a fairly wide surface. One of the tubes should be used for the standard liquid, and the other should be a pipette with a bulb very much like a pipette filler which could be dipped into the liquid. The drop removed could be returned after examination. He pointed out the difference between the strength of an acid, *i.e.*, its sourness, and its concentration. Sörensen had recently investigated this with regard to enzymes, by the use of indicators, but checking his results by the determination of the hydrion concentration electrolytically. Although he had rejected this method in practice on account of its difficulties, he intended to check indicators by actual electrical measurements, which were now comparatively easy by the employment of Dr. Sand's apparatus as used by Wood and Law. Indicators on paper often gave quite a different effect from that in solution. On the paper they were probably in colloidal combination, and therefore less likely to be affected by colloidal proteid.

Mr. A. **Seymour-Jones** said that whereas the lime water method only estimated those acids which had soluble calcium salts, the fluorescein method estimated the potential and actual hydrogen ions. Fluorescein gave higher results than lime in the proportion of about 1·1 to 1·0. Petroleum spirit was sufficient for practical purposes. Sörensen had found that Congo Red was colloidal in character, whilst fluorescein was crystalloidal, as it belonged to the eosin group.

Discussion (at Nottingham).

Mr. D. J. **Law** said that in dealing with the acidity of tan liquors they were concerned with hydrogen ion concentration. The original hydrion concentration of the liquid future investigations would probably show to be related to its swelling power; on the other hand, there was the amount of alkali which had to be added until the liquid assumed approximately the hydrion concentration of pure water. This would be a measure of the capacity which the liquor would show for dissolving lime. The fact that methods for the determination of hydrion concentrations, involving the use of indicators, would always suffer from a certain lack of flexibility, more especially when dark liquids, such as tan liquors were to be investigated, would militate against their application when such problems as the relation of hydrion concentration to plumping effects were to be investigated. These considerations led Mr. J. T. Wood to suggest to Dr. Sand and himself that they should investigate the applicability of the electrometric method to the examination of tan liquors. The electrometric method, which was based on the determination of the difference of potential between the liquid under examination and a plate of platinised platinum saturated with hydrogen, was formerly more or less impracticable owing to complication of apparatus. Recently, however, the apparatus for such purposes had been so much improved by Dr. Sand for the purpose of the electro-analytical separation of metals (Trans. Faraday Soc., 1909, 5, 159) that its application was now an exceedingly simple matter. The results obtained so far, showed that for the titration of acids, such as acetic and lactic acid, added to given quantities of tan liquors, the electrometric method was easy of application and gave very satisfactory results. He hoped that the investigation referred to would shortly be completed when it would be laid before the Society.

Dr. J. **Gordon Parker** said in the past it had been assumed that lactic, formic, and similar acids were the panacea for all troubles, but until the effects of those acids had been thoroughly investigated by some method resting upon a scientific basis it was unwise to make such assumptions. He admired the simplicity of the electrometric process and hoped that the price of the apparatus would not be prohibitive.

Prof. H. R. **Procter** remarked that it was of the greatest importance to tanners to know not only the total quantity of acid present in a liquor, but its "strength" under the actual working conditions, since upon this its effect on the tanning process mainly depended. The "strength" differed greatly in different acids, and was proportional to the concentration of free ionised hydrogen atoms actually present in the liquor, which was measured directly and with great accuracy by the electrical method, and he congratulated Messrs. Sand and Law on having shown that the method was convenient and practical in the laboratory, since Mr. Seymour-Jones and himself had been deterred from attempting to use it in practice from its apparent difficulty with the ordinary apparatus, and had tried to solve the same question by the use of coloured indicators in a less perfect but much more simple way.

Mr. J. T. **Wood** said he had the privilege earlier in the year of reading and judging Mr. Seymour-Jones' thesis for his B.Sc. degree, on "the acidity of tan liquors," and this caused him to give attention to the subject and to read Salm's paper as well as to refer to the literature of the electrometric method by Böttger and others. Had it not been for Dr. Sand's loan of his potentiometer and his help in discussing the problems presented to the tanner, probably nothing would have come of it. He considered that it was the simplicity of Dr. Sand's arrangement which rendered the electrometric method practicable. He was sure it would give the tanner much useful information as to changes taking place in the liquors.

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I.—GENERAL PLANT; MACHINERY.

Patents.

Separators; Centrifugal ——. M. Pedersen, Dursley. Eng. Pat. 21,862, Sept. 25, 1909.

The separator has two sets of plates or cones inclined in opposite directions, the inner set being provided with annular pockets. The necessary velocity is imparted to the liquids by a rotating and a stationary helix at the end of the inlet pipe and the whole machine is so supported that it maintains its horizontal position even when the support on which it is placed is inclined from any cause.—W. H. C.

Heating and evaporating liquids by means of steam. D. B. Morison, Hartlepool. Eng. Pat. 24,074, Oct. 20, 1909.

In order to facilitate inspection and repair, the coil or coils through which the steam passes are arranged upon a rotatable hollow steam-chest or frame supported on suitable bearings within the evaporator. The steam and exhaust connections to the frame can be easily disconnected and the frame rotated so that each coil comes in succession opposite to the door of the vessel. The coils have a central vertical pipe connected with the steam inlet channel so that the steam flows upwards to the highest part of the coil and then the steam and condensed water flow downward together to the exhaust channel. The bore of the coil-pipes is contracted at the flange joints so that the joints are easily made tight owing to their reduced area without impeding the flow of the fluid.—W. H. C.

Temperature exchanging apparatus; Conduits for ——. G. Hildebrandt, Berlin. Eng. Pat. 30,404, Dec. 29, 1909.

The conduit consists of a nest of tubes in contact with one another, and surrounded by an outer tube. In order that the conduit as a whole may be flexible, the outer tube is made of lead and strengthened by being wrapped round with string or other slightly extensible material, which also serves as a heat-insulating covering. The inner tubes are formed of flexible copper pressure tubing. The inner tubes serve as the high-pressure conduit and the space between the inner and the outer tubes as the low-pressure conduit.—W. H. C.

Compressors; Centrifugal ——. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 12,858, May 26, 1910.

In order to lessen the pulsations of centrifugal compressors, an automatic valve is placed between the inlet and outlet of the compressor. This valve automatically increases or decreases the cross-sectional area of the air passage as the quantity of air delivered by the compressor increases or diminishes.—W. H. C.

Ejectors and centrifugal compressors or pumps. Allgemeine Elektricitäts-Ges., Berlin. Eng. Pat. 17,474, July 22, 1910. Under Int. Conv., Aug. 9, 1909.

The impelling fluid (water) used in centrifugal compressors is apt to become vaporised and carried away by the compressed air or gas. To avoid this a space is left between the running and directing wheels through which the vaporised fluid escapes to a separate exit. The gas entrance openings are maintained at a higher pressure than the vaporised liquid openings.—W. H. C.

Compression of air or other gas. H. A. Branch. Fr. Pat. 417,081, June 13, 1910.

The gas is conducted to the chamber of a rotatory compressor and compressed to a certain degree. The refrigerating agent is then passed into the chamber, intermittently, and in such a manner as to be in contact with the internal surfaces of the chamber and to mix with the gas under compression. The mixture is conducted to the separating chamber where, in contact with refrigerating surfaces, the precipitation of a certain quantity of the more condensable portion results; this condensed portion is employed as refrigerating agent in the earlier stages of the process.—W. E. F. P.

Exhausting air and gases. Allgemeine Elektricitäts-Ges., Berlin. Eng. Pat. 15,754, June 30, 1910. Under Int. Conv., July 1, 1909.

In order to avoid the use of the large quantities of water under pressure that are required when starting centrifugal exhausters which use an impelling fluid, a valve is interposed between the suction of the pump and the vessel to be exhausted. When starting, this valve is nearly closed so that a vacuum sufficient to suck up the necessary water from the well is soon formed in the pump. As soon as the vacuum is formed, the supply of water under pressure is shut off and the pump slowly exhausts the receiver, the nearly closed valve preventing the vacuum in the pump from being broken. When the receiver is fully exhausted, the valve is opened wide.—W. H. C.

Furnace. L. L. Knox, Avalon, Pa., Assignor to Keystone Furnace Construction Co., Pittsburg, Pa. U.S. Pat. 973,943, Oct. 25, 1910.

The end wall and roof of a regenerative furnace are constructed with an inner transversely arched wall of refractory material supported by "skew-backs" attached to outer hollow cooling plates.—W. H. C.

Gases; Desiccation of ——. Soc. l'Air Liquide (Soc. anon. pour l'Etude et l'Exploitation des Proc. G. Claude). Fr. Pat. 416,556, Aug. 9, 1909.

The process consists in the addition of a suitable volatile liquid (such as methyl- or ethyl-alcohol) to the gas before the refrigeration is commenced. The added liquid is much more volatile than water, with which it is miscible, forming mixtures which remain liquid at temperatures well below 0° C., the vapour tension at low temperatures being negligible. The whole of the water vapour is thus easily removable (when the refrigeration of the gas has proceeded to the proper degree) the obstruction of the tubes, etc., of the apparatus by ice being thereby obviated.—W. E. F. P.

Gases; Apparatus for the purification of —— and the separation of dust therefrom. A. Geyer and W. Witter. Ger. Pat. 227,387, June 18, 1908.

A horizontal shaft mounted in the vessel through which the gas to be purified is passed, carries radial rotating arms provided with beating-blades, which revolve at the rate of several hundred revolutions per minute and are moistened with water sprayed into the vessel from above. The total surface of the beating-blades is nearly as large as the cross-section of the space through which the gas passes, and in order to diminish the resistance offered to the passage of the gas, the points at which the arms are joined to the horizontal shaft are disposed in spiral form around the latter.—A. S.

Desiccation of liquid or semi-liquid material; Apparatus for the continuous ——. Gebrüder Glass. Fr. Pat. 416,839, June 6, 1910.

The apparatus comprises an arrangement of endless bands which traverse suitably heated surfaces. The material to be evaporated or dried flows upon the band at one extremity of the heating arrangement, and being dried in its passage, is removed at the opposite extremity. By means of an oscillating feeding device the liquid is distributed upon the band in zig-zag fashion, thus exposing a large surface to evaporative action.—W. E. F. P.

Distilling volatilizable solids and for drawing off gases in vacuo; Apparatus for ——. W. S. Simpson, London. Eng. Pat. 24,458, Oct. 25, 1909.

See Fr. Pat. 414,634 of 1910; this J., 1910, 1190.—T. F. B.

Distilling and rectifying apparatus. F. Vallat, Assignor to G. A. Pfizer, Paris. U.S. Pat. 974,213, Nov. 1, 1910.

See Fr. Pat. 387,558 of 1908; this J., 1908, 871.—T. F. B.

Liquefying gases for demonstration purposes; Apparatus for ——. G. H. Ryberg. Fr. Pat. 416,122, May 19, 1910.

See Eng. Pat. 11,161 of 1910; this J. 1910, 1290.—T. F. B.

Desiccating liquid substances; Apparatus for ——. A. G. Kalb. Fr. Pat. 416,332, May 10, 1910.

See U.S. Pats. 957,685, 957,686, 957,849, and 957,850 of 1910; this J., 1910, 743.—T. F. B.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Anthracite coal; Accurate method for calorimetric determinations on ——. O. W. Palmenberg. J. Ind. Eng. Chem., 1910, **2**, 404—406.

Accurate results are seldom obtained in the oxygen bomb calorimeter when testing anthracite coals, owing to incomplete combustion; the error is greater the higher the ash-content of the coal. A satisfactory method has proved to be as follows:—About 0·2 grm. of a semi-bituminous coal of known sulphur content and calorific value (about 14,300 to 14,500 B.T.U.), is weighed into a shallow nickel capsule of about 1 in. × ⅞ in., which fits conveniently in the supports of the Atwater-Mahler calorimeter; it is then spread evenly over the bottom of the capsule, and covered with a weighed quantity (about 0·8 grm.) of the anthracite coal, powdered to pass a 100-mesh sieve; the charge is then ignited and the determination completed in the usual manner. The residual ash very seldom contained any unburnt carbon, and never sufficient to affect appreciably the result. Various samples of anthracite, containing from 9 to 26 per cent. of ash, were examined, and determinations were made by different workers; the results agreed very well, both among themselves and with the "pure coal factor" calculated by Lord and Haas' formula.—T. F. B.

Coal; Constants and variables in the destructive distillation of ——. A. H. White and B. M. Ferguson. J. Gas Lighting, 1910, **112**, 567—572.

A series of tests made on five American coals showed that the rate of gas production from a retort is independent of the weight of the charge, provided the coke is drawn as soon as the gas evolution is finished, and the retort is kept in continuous operation. The rate of gas evolution is apparently a function of the rate of heat transmission through the walls of the retort; and this rate of heat transmission is more affected by the thickness of the skin of carbon on the inside of the retort than by ordinary variations in furnace temperature. The candle power and calorific value of the gas are also unaffected by the weight of charge, but variations in retort pressure, causing leakage of gas through the walls of the retort, have an important effect on the quality and quantity of the gas produced. The calorific value of the gas from a pound of coal is a maximum at moderate retort temperatures. Some of the samples of coal had been stored in the open for a year, but no effect due to weathering was detected. It was observed that the temperature of the inside of a retort, after the charge has been thoroughly burnt off and the coke withdrawn, is very nearly as high as that of the furnace outside.—H. H.

Explosions in gas and other internal combustion engines; Phenomena of ——. D. Clerk. J. Gas Lighting, 1910, **112**, 397—400.

A mixture of coal-gas and air at atmospheric pressure, containing just sufficient air for complete combustion, on explosion in a closed vessel reaches a maximum (average) temperature of about 2000° C., the temperature at the centre of the vessel being about 300° C. higher. The increase in pressure is about 100 lb. per sq. in. The maximum pressure after explosion increases in direct proportion to the initial pressure up to initial pressures of over 1000 lb. per sq. in., the initial temperature being kept constant. Under the same conditions the temperature reached on explosion increases slightly with increased initial pressure. The rate of cooling after the explosion depends on the capacity of the vessel in which the gases are confined. Increased density causes decreased rate of fall of temperature but increased rate of heat flow per unit area of the surface of the vessel. The rate of increase of pressure during the explosion accordingly depends on the size of the vessel, and the density and temperature of the gases, the rate of ignition increasing with decreased volume, and with increased density and initial temperature. Combustion is not complete at maximum pressure, and probably 5 per cent. of the heat of combustion is set free after this point. The specific heat of steam and of carbon dioxide increases very rapidly with temperature, and that of air increases slowly. A certain quantity of heat is lost by radiation from the flame during the explosion, and under the conditions prevailing in a gas engine cylinder this may amount to 5 per cent. of the total heat of combustion. The British Association Committee found from actual tests on a gas engine with cylinder of 14 in. diam. and with a stroke of 22 in. that 34·6 per cent. of the heat supplied was converted into indicated work. The author has found this to represent 88 per cent. of the work that could be obtained if the cycle were carried out perfectly without heat loss, the theoretical efficiency being 39·5 per cent. The thermal efficiency of the gas engine cannot be much further increased without the use of greater expansions or of compounding. These complications would not be justified commercially in engines of the sizes for which coal-gas is used as fuel, and attention should therefore be directed more to reducing the selling price of the gas.—A. T. L.

Sulphate manufacture for small works. P. G. G. Moon. J. Gas Lighting, 1910, 112, 474—477.

In the case of small gas-works where the small production will not justify the installation of an ammonium sulphate plant of the ordinary type, the author recommends absorbing the ammonia directly by means of dilute sulphuric acid. At Wareham where this process has been used with good results, the gas after passing the condensers and a simple tar extractor, is bubbled through sulphuric acid of about 3° Tw. in a lead-lined box. Fresh acid is added twice daily. When the specific gravity of the solution reaches 45°—50° Tw., the liquid is run off through two sand-filters to an evaporating tank, wherein ammonium sulphate of good colour and containing 25·2 per cent. of ammonia is recovered by crystallisation. The weak acid used has no appreciable effect on the illuminating power of the gas. At Dunstable a more elaborate plant on similar principles has been installed, provision being also made for the recovery of the fixed ammonia. The gas from the hydraulic main is passed through a condenser-washer, in which the condensed liquor is made to flow in the reverse direction to the gas, and thus leaves the apparatus warm and containing very little free ammonia. This liquor is distilled with alkali in a direct-fired apparatus and the evolved ammonia is led to the acid washer, through which the main stream of gas is also passed. H. G. Colman pointed out that if the ammonia was removed completely from the gas, by means of the dilute acid, there might be a difficulty in the subsequent oxide purification, owing to the formation of iron pyrites, which could not be revivified by exposure to air. This could, however, be easily avoided by passing a small quantity of the crude gas, containing ammonia, together with the gas from the acid washer, through the purifiers.—A. S.

Petroleum field of Maikop. Chem. Ind., 1910, 33, 723—724.

The presence of petroleum in the district of Maikop (Caucasus) has long been known, but until the beginning of the present century the oil was only used locally, and the few wells that had been sunk had not been worked owing to lack of capital. The discovery by the Baku Black Sea Co. of a gigantic fountain on August 30, 1909, which flowed until September 2, and then, taking fire, burned for 12 days, attracted the attention of the world to this district. Other fountains were discovered not far away, but like this first one, had to be temporarily stopped up owing to a lack of tanks to hold the petroleum. So far as is known at present the petroleum area occupies a relatively narrow strip of about 40 versts (26½ miles). It cannot be asserted positively that the whole of this strip is rich in petroleum, though there is no doubt as to the central and eastern portions. The chief advantage possessed by the Maikop oil-field over Baku and Grosny is its geographical position. The area is almost upon the coast of the Black Sea, not far from the port Tuapse, through which it can get into touch with all parts of the world; whereas in the case of the Baku, Galician and American oil-fields a costly installation of pipe lines is required to convey the petroleum to the sea coast. Another advantage of the Maikop area is the shallow depth of the petroleum-bearing strata, large quantities of petroleum being obtained from wells the maximum depth of which does not exceed 50 fathoms. The dip of the strata in the western part of the area indicates that the greatest depth for the borings will not exceed 100 fathoms, the average being 60 to 70 fathoms. In Bibi-Eibat the mean depth is 300 fathoms, and in Galicia 500 to 550 fathoms. These two advantages promise considerable savings in the cost of production and distribution of the oil. Maikop petroleum is rich in valuable constituents, as is shown by the following results:—Petroleum spirit (benzine) of sp. gr. 0·7231, 16·5 per cent.; oil of sp. gr. 0·820 (flash-point 286° C.), 36·12 per cent.; masut (residue), 45·90 per cent.; and loss 1·48 per cent. Hence the Maikop oil-field must sooner or later occupy a leading position in the petroleum industry of the world, and possibly revolutionise it. For these reasons Maikop has become a centre of business speculation in Russia and especially in England. A large proportion of the numerous concessions in the area, however, are of doubtful value, partly owing to their production of petroleum being questionable, and partly owing to doubtful rights of tenure due to frequent transference of the plots. Speculation has assumed enormous dimensions, and 10,000 to 30,000 roubles (£1058—£3175) are paid for concessions that originally cost 200 to 300 roubles (£21—£32). An immense number of companies, mainly English, has been floated, some with a capital of only £200 to £300. There are, however, numerous companies with considerable capital and proper management, many of which have already acquired a large number of plots and have started preliminary work, and in a short time a network of pipe lines will be seen. The Baku firms have also begun to acquire areas in Maikop. The chief drawback to the development of the Maikop industry, apart from the want of plant, is the absence of railways, the construction of which will entail great difficulties owing to the district being mountainous and covered with forests. In the whole of the district there is only one made road—that between Maikop and Tuapse. Many years must therefore elapse before the Maikop petroleum industry can fill its destined place.—C. A. M.

Petroleum hydrocarbons; Oxidation of —— by Étard's method. F. Schulz. Petroleum, 1910, 6, 189—190.

The chromyl chloride used by the author in his experiments with Étard's method of oxidising petroleum hydrocarbons (Ann. Chim. Phys., 1881, 22, 218) was obtained by fusing together potassium bichromate (1·2 parts) and sodium chloride (1 part), distilling 200 grms. of the fused mass with 350 grms. of concentrated sulphuric acid, and filtering the distillate through glass wool. Carbon tetrachloride (previously treated with a few drops of chromyl chloride and filtered after standing for a few days) was employed as the diluting agent. The addition compounds formed were determined by separating them by means of an asbestos filter, washing them with petroleum spirit, and drying them in a current of dry air. The reaction took place slowly and was not quantitative, even in the presence of an excess of chromyl chloride. Comparative determinations were made with the different fractions of a crude Boryslaw petroleum, about 0·5 grm. of the oil being treated with 50 grms. of a 5 per cent. solution of the reagent in carbon tetrachloride, and filtered, after standing for 48 hours. A determination of the chromium in the dry yellow powder was made, and the proportion of combined chromyl chloride calculated from the results, the relative quantities of hydrocarbons that would form insoluble addition compounds with chromyl chloride under these conditions being thus obtained. These results were as follows :—

Fraction.	Amount taken.	Addition-compound.	CrO_2Cl_2 in addition-compound.	Calculated amount of hydrocarbons
	grms.	grms.	per cent.	per cent.
Petroleum spirit,				
sp. gr. 0·654	0·4305	0·2990	84·6	10·7
sp. gr. 0·680	0·4635	0·6492	81·2	27·7
sp. gr. 0·720	0·4925	0·6945	80·1	28·1
Refined lamp oil,				
sp. gr. 0·810	0·5201	1·4724	76·1	67·6
Refined lubricating oil,				
sp. gr. 0·912	0·4172	1·2230	65·6	100·9
Paraffin wax				
(m. pt. 54° C.)	0·5305	0·1950	65·9	12·5

The readiness to react with chromyl chloride increased with the rise in the sp. gr. of the fractions. In each case the addition compound was a dark yellow powder, which was immediately decomposed on contact with water, with the liberation of an oil with a strong odour resembling that of peppermint oil, this being particularly pleasant in the case of the fraction of sp. gr. 0·819. The petroleum spirit fractions could be treated with a small proportion of pure chromyl chloride without danger. The dark red solutions thus obtained became partially decolorised after a few days. If, however, pure chromyl chloride was added drop by drop to the lamp oil or lubricating oil, with continual shaking, a dark green powder immediately separated, and on continuing the addition a characteristic decomposition occurred, followed, on further addition of the reagent, by a violent explosion. This also took place on treating the petroleum spirit fractions with an excess of a moderately concentrated (*e.g.*, 33 per cent.) solution of chromyl chloride. In further experiments the fraction of sp. gr. 0·655 was separated by fractional distillation, and the fraction of b. pt. 40° to 45° C. eventually obtained was treated with the dilute reagent. The voluminous precipitate was treated with dilute sodium bisulphite solution, and the aqueous layer separated from the petroleum spirit layer, and washed with petroleum spirit of the same composition. The petroleum spirit extracts were distilled, leaving a thin, yellow oil. This had a pronounced odour of peppermint. It reduced alkaline silver solution in the cold, and Fehling's solution on heating. On treating its solution in petroleum spirit with dry ammonia gas there separated a dark oil and a solid crystalline mass, whilst a fragrant odour recalling that of lemons was produced. From the further results the author concluded that in the reaction between petroleum spirit of sp. gr. 0·654 and chromyl chloride there was only a small yield of a mixture of oxidised and chlorinated products. Of these, only about 5 per cent. combined with sodium bisulphite, and they formed no oxide. Further oxidation of these products with nitric acid yielded only oily non-crystallisable acids.—C. A. M.

[Mineral] Lubricating oils ; Action of sunlight and air upon some ——. C. E. Waters. J. Ind. Eng. Chem., 1910, 2, 451—454.

By exposing lubricating oils to air and sunlight, the author has observed the formation of an oxidation product which is insoluble in the oil and in ligroin (petroleum spirit). The oxidation is accompanied by an increase in the weight of the oil, and by the evolution of carbon dioxide and water. The oxygen absorbed is not entirely found in the oxidation product, some of it remaining either dissolved in the oil or combined in some soluble form. The acid value of the oil increases with oxidation as much as 100-fold in 22 days. Attempts to purify and crystallise the oxidation product were not successful. W. H. P.

Purification of blast-furnace gases in Germany. Grosse. *See* X.

Patents.

Fuel ; Manufacture of artificial or patent —— and apparatus therefor. Graigola Merthyr Co., F. C. Yeo, and T. A. Goskar, Swansea. Eng. Pat. 23,555, Oct. 14, 1909. (See also this J., 1900, 521.)

In the process of manufacturing artificial fuel, in which a mixture of small coal, pitch and tar is continuously passed through an externally heated, closed-in vessel so as to prevent the escape of volatile matter therefrom, as described in Eng. Pats. 682 and 6853 of 1896, and 7905 of 1900 (this J., 1897, 228 ; 1901, 350), (1) the passages leading to and from the closed-in vessel are hermetically sealed by plugs of the fuel mixture made sufficiently solid to resist pressures of from ½ to 20 lb. per sq. in. within the chamber ; for this purpose weighted or spring-pressed metal-plates are placed in front of the archimedean screws supplying and withdrawing the fuel in such a manner as to compress the latter to the desired extent : (2) the material is maintained at a temperature of from 200° to 500° F. for a prolonged period : (3) the archimedean screw which is employed to force the fuel through the heating chamber is not supported in bearings at one end, but rests upon the wall of the chamber : (4) the fuel is cooled by means of a water jacket as it passes through the outlet and is further cooled if necessary before it is made into briquettes.—H. H.

Fuel blocks ; Process of manufacture of —— [with waste sulphite-cellulose lyes]. E. Trainer, Dresden, Assignor to Gewerkschaft Pionier, Walsum-on-the-Rhine, Germany. U.S. Pat. 974,001, Oct. 25, 1910.

The process consists in adding an aldehyde and a substance having an acid reaction to the concentrated waste lye from the sulphite cellulose process, heating the mixture until it gelatinises, adding the mass to the fuel, and drying by heat.—H. H.

Briquettes ; Process and apparatus for the preparation of the mixture of coal and binder for ——. H. Steven. Fr. Pat. 416,428, May 26, 1910. Under Int. Conv., Mar. 22, 1910.

The coal and the pitch or other binder are mixed in the usual manner in a vessel to which steam is admitted, but special means are adopted for cooling and drying the material as it leaves the mixer. The mixer discharges into a cylindrical chamber through which air is drawn by a fan or ejector connected to an outlet in the top. The material from the mixer is distributed by revolving arms over a perforated plate, and in falling from this plate through the height of the chamber it is cooled and dried by the current of air.—A. T. L.

Fuel for increasing the power of internal-combustion engines. K. Hadorff. Fr. Pat. 416,325, April 27, 1910.

The fuel consists of " benzene picrate " mixed with benzene or other liquid hydrocarbon, and is said to burn without the formation of any deposit in the cylinder. The " benzene picrate " is prepared by dissolving picric acid in benzene, heating for a prolonged period, and finally separating the excess of benzene by distillation.—A. T. L.

Distilling or partially distilling coal ; Process for —— and for the production of fuel. R. S. Richards, Wraysbury, Bucks, and R. W. Pringle, Richmond, Surrey. Eng. Pat. 25,019, Oct. 30, 1909.

A thin layer of coal, in the form of fine dust, is carried on a moving conveyor through a distilling chamber maintained at a temperature not exceeding 650° C., access of air being prevented. The distillates are collected through a series of ascension pipes into which they are aspirated, whereby they are prevented from coming into contact with the fuel or other distillates being produced at different stages of the process.—H. H.

Vertical gas retorts. A. H. Smith and F. G. Shaw, Darwen, Lancs. Eng. Pat. 29,313, Dec. 15, 1909.

A HOLLOW core or pipe, having a number of inlet openings, is suspended in the upper part of a vertical gas retort in such a manner that it can be partly rotated. A branch pipe at the top leads to the gas outlet of the retort, and a smaller branch pipe, passing out through a sliding stuffing-box, serves for the introduction of steam or water and also as a handle for the actuation of the pipe. The apparatus facilitates the downward passage of the coal in the retort, and also allows the gas to escape without passing through so great a thickness of tarry coal, whereby the illuminating power is increased.—H. H.

Hydraulic mains in gas works; Prevention of deposits in ——. J. T. Catling and F. Corner, London. Eng. Pat. 24,816, Oct. 28, 1909.

THE liquid contents of the hydraulic main are intermittently or continuously agitated by means of an endless chain provided with projecting lateral agitator arms. The chain passes round sprocket wheels at each end of the main.—W. H. C.

Gas producers. J. Dunlop, Glasgow. Eng. Pat. 2444, Feb. 1, 1910.

A GAS producer of the combined up and down draught type comprises a vertical metal cylinder with a firebrick lining projecting inwards at three points so as to divide the producer into four chambers. Steam and air are introduced between the top two chambers, the gas produced is withdrawn from between the middle two chambers, and the bottom chamber, which serves as an ash-pit, is connected with the space between the top two chambers by a pipe. The gas which is distilled in the top chamber, after mixing with air and steam, divides into two portions which pass respectively downwards and upwards through the middle or gas-producing chambers and so to the outlet. Compressed air is forced into the connecting pipe at starting, the products of combustion being allowed to escape through the fuel opening at the top of the producer until the conditions are adapted for making gas.—H. H.

Gas generator. E. Brauss, Linden, Germany, Assignor to Gebr. Körting Akt.-Ges., Körtingsdorf, Germany. U.S. Pat. 974,639, Nov. 1, 1910.

THE stack-like generator-chamber is widened at its upper part, and has a cover in which there are openings provided with removable doors. The charge is fed in through a conduit ending in the widened part of the chamber, and surrounded by a conduit for the blast, which extends downwards below the end of the feed-conduit, terminating at about the level of the upper end of the stack-like part of the chamber. This blast-conduit is of smaller diameter than the stack. The gas outlet is near the lower part of the generator-chamber.—A. S.

Producer-gas; Apparatus for making ——. W. O. Amsler, Pittsburg, Pa. U.S. Pat. 974,945, Nov. 8, 1910.

AN apparatus for introducing a quantity of water directly proportional to the quantity of air entering a producer comprises a receptacle divided into two water compartments connected respectively with the outlet pipe of the producer and with a vaporiser in communication with the producer inlet.—H. H.

Water-gas; Conversion of carbon monoxide in —— *into methane.* L. Vignon. Fr. Pat. 416,699, Aug. 12, 1909.

WATER-GAS is passed through a mixture of slaked lime and quicklime in closed vessels at 400° C.; the carbon monoxide is eliminated and hydrogen, methane and ethylene are formed, in accordance with the equations:—

(1). $2CO + Ca(OH)_2 = Ca(COOH)_2$;
(2). $Ca(COOH)_2 = Ca(COO)_2 + H_2$;
(3). $2Ca(COOH)_2 + CaO = 3CaCO_3 + CH_4$;
(4). $4Ca(COOH)_2 + 2CaO = 6CaCO_3 + C_2H_4 + 2H_2$.

—A. T. L.

Coal and like gas; Treating —— *for the removal of cyanogen therefrom.* P. E. Williams, Leytonstone. Eng. Pat. 23,624, Oct. 15, 1909.

THE gas, after the removal of the tar, is passed through a mass of spent oxide in a moist state. The ammonia and sulphuretted hydrogen in the gas react with the free sulphur to produce ammonium polysulphide in strong solution, and this absorbs the cyanogen to form ammonium sulphocyanide which drains into a receptacle. The coal gas is then passed through the usual washing plant and purifying boxes.—H. H.

Gas scrubber. W. McArthur, Tenino, Wash. U.S. Pat. 975,054, Nov. 8, 1910.

AN air-cooled scrubber comprises a cylindrical casing divided by three horizontal plates into four chambers, viz.: an upper conical hood connected with a smoke stack, a central chamber containing coke, a drainage chamber, and an air chamber at the bottom. The middle plate is perforated, and pipes connecting the air chamber with the hood pass completely through the central chambers. The gas to be scrubbed enters the drainage chamber and passes up through the coke and out through a pipe opening near the top of the coke chamber.—H. H.

Light oils from heavier mineral oils; Production of ——. W. A. Phillips and J. G. Bulteel, London. Eng. Pat. 23,977, Oct. 19, 1909.

IN the process for producing light oils from heavier mineral oils in which the heavier oil is heated with hydrogen or hydrogenised gases in the presence of a catalyst, such as powdered nickel, a rapid gyratory or rotary movement is imparted to the mixture of oil, gas, and catalyst as it enters the heated cylinder. A better yield of light oil is thereby obtained.—H. H.

Petroleum and similar hydrocarbons; Autoclave for the treatment of ——. A. Testelin and G. Renard. Fr. Pat. 416,244, May 12, 1910.

THE apparatus comprises a heating coil and a cooling coil through which the oil is pumped continuously under a pressure higher than the vapour tension of the oil at the temperature of the heating coil. This pressure is obtained by providing the delivery end of the cooling coil with a discharge valve suitably loaded. The coils may be of steel tube, 10 mm. internal diameter and 60 m. long. The heating coil is immersed in a bath of molten lead at a temperature of 400°—450° C., the discharge valve being loaded to deliver at a pressure of 40 atmospheres.—A. T. L.

Petroleum; Treatment of ——. Terpol A.-G. Fr. Pat. 416,714, June 3, 1910.

THE crude oil is distilled in a current of saturated steam at 100° C. The vapour is passed through a purifying chamber filled with peat fibre, in order to deodourise the distillate. The distillate may be collected in two fractions, consisting of a light petroleum and a burning oil. The residue which does not distil with the steam can be burned for heating purposes, or it may be further treated for the preparation of a lubricating oil.—A. T. L.

Hydrocarbons or essential oils; Aqueous emulsions of ——. P. Mercier. Fr. Pat. 416,766, Aug. 13, 1909.

STABLE emulsions are obtained by the use of acetone with the soap, alkali, gum, or other emulsifying agent. For example, 4 parts of soap are dissolved in 1 to 4 parts of acetone, and 4 to 50 parts of a hydrocarbon, such as petroleum or turpentine, are gradually introduced. The desired quantity of water is then mixed in.—A. T. L.

Aromatic hydrocarbons; Process for the preparation of —— from petroleum or petroleum distillates. J. Hausman and S. Pilat. Ger. Pat. 227,178, April 1, 1909.

Petroleum or a petroleum distillate, in the form of vapour, is passed, together with air, into a heated tube containing a contact substance consisting of a metallic oxide, peroxide, or salt (iron oxides, lead oxide, cerium oxide, manganese peroxide, iron sulphate, calcium manganite, etc.) capable of acting as an oxygen-carrier. A. S.

Petroleum residues and tars; Process for separating solid hydrocarbons, such as paraffin, ceresin, or ozokerite, from ——. J. Tanne and G. Oberländer. Ger. Pat. 227,334, Oct. 28, 1909. Addition to Ger. Pat. 226,136, Jan. 7, 1909 (see Fr. Pat. 409,516 of 1909; this J., 1910, 747).

Propionic acid, butyric acid, or other homologue of acetic acid may be used in place of acetic acid in the process described in the principal patent. It is stated that when using the higher acids, the solid hydrocarbons crystallise more readily from the solution, so that the separated products are harder.—T. F. B.

Coke-oven. W. W. Peek, Manchester. U.S. Pat. 974,423, Nov. 1, 1910.

See Eng. Pat. 24,469 of 1908; this J., 1910, 11.—T. F. B.

Gas producers working by suction; Automatic regulation of ——. C. G. Viatour, Rueil, France. Eng. Pat. 14,100, June 10, 1910. Under Int. Conv., June 12, 1909.

See Fr. Pat. 403,963 of 1909; this J., 1910, 12.—T. F. B.

Gas; Process and apparatus for making ——. E. E. Slick. Fr. Pat. 416,319, April 21, 1910.

See U.S. Pats. 957,006 and 957,007 of 1910; this J., 1910, 684.—T. F. B.

Gas and coke; Retort for the manufacture of ——. J. Bowing. Fr. Pat. 416,393, May 25, 1910. Under Int. Conv., May 27, 1909.

See Eng. Pat. 12,583 of 1909; this J., 1909, 934.—T. F. B.

Water-gas; Retort for the production of ——. J. Bowing. Fr. Pat. 416,436, May 26, 1910.

See Eng. Pat. 11,491 of 1910; this J., 1910, 934.—T. F. B.

Manufacture of sulphate of ammonia from moist gases. Eng. Pat. 16,193. *See* VII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING

Filaments for electric incandescence lamps; Manufacture of ——. H. F. Baumhauer. Z. angew. Chem., 1910, **23**, 2065—2068.

The method now almost universally employed for the manufacture of carbon filaments is based upon the same principle as that of the manufacture of artificial silk. It is essential that only pure materials should be used (*e.g.*, the collodion cotton must leave the smallest possible amount of residue on ignition), whilst the coagulation or hardening of the filaments pressed through the openings must be done very rapidly, to effect which an addition is made of sodium carbonate to the mass. It is also extremely important to wash the filaments thoroughly, since any trace of acetic acid or its salts (from the original acetic acid solution of the collodion cotton) has an injurious effect in the subsequent denitration process, which usually consists of a lengthy treatment with ammonium sulphide. In order to obtain the filaments in the required shape they are twisted round blocks, usually of retort carbon, which are enclosed in boxes of fire-proof clay imbedded in graphite or powdered carbon and are placed in the carbonising furnace. The temperature is gradually raised to 1700° C. by means of an oil-gas blast, and after carbonisation, the filaments are allowed to cool. They are then brought to as high a temperature as possible (2000° C.) by means of an electric current in an atmosphere of petroleum spirit (benzine) in order to remove the last traces of volatile substances, and are finally coated with a regular film of graphitic carbon to increase their resistance and flexbility. A good filament must show an equal resistance in all parts, and must be completely homogeneous and of equal diameter throughout. It must also have been heated to a sufficiently high temperature to have been converted as far as possible into graphitic carbon, so as to prevent early blackening of the lamp glass. The great consumption of electricity by the carbon lamps led to a renewal of the attempts (first made seventy years ago) to make use of metallic filaments for the purpose. Of all the metals of sufficiently high m. pt., tantalum alone has been found suitable for the direct preparation from the pure metal of thin filaments, and tantalum lamps have now been on the market for some years. Weiss (Z. anorg. Chem., 1909, **65**, 288) showed that titanium and zirconium melted at too low temperatures to be suitable for incandescent filaments, but did not succeed in melting tungsten (the estimated m. pt. of which is about 2800°). Although, as yet, it has not been found possible to draw filaments from metallic tungsten, the problem has been solved in another way. Thus in the so-called Just lamps the filaments were originally prepared by exposing carbon filaments to the vapour of sublimed tungsten compounds (*e.g.*, the chloride) so as to coat them with a deposit. The filaments were then cautiously heated in hydrogen to expel the carbon and leave a filament of reduced tungsten. This method was found too complicated (whilst the filaments offered too little resistance), and was therefore soon abandoned. At the present time the filaments are made by reducing tungsten trioxide with zinc dust. The oxide is mixed with the calculated amount of zinc dust plus 25 per cent., and is heated in a loosely-covered iron vessel until, in about 8 minutes, the reaction takes place. The zinc is then dissolved from the mass by means of hydrochloric acid, and the pure tungsten is left in the form of a finely divided, amorphous black powder. This is now made into a paste with water and a suitable agglutinating material (especially gum tragacanth or caramel), to which a little glycerin or castor oil has been added. This paste is forced through minute openings (about 0·05 mm. in diameter for lamps of 16 candle power) and the resulting filaments are dried and heated to 1000° to 1100° C. in an atmosphere of hydrogen, whereby the agglutinant is burned away and the diameter of the filaments is reduced by about 30 per cent. Finally the filaments are made white hot, by the passage of an electric current, in an atmosphere of an inert gas, such as hydrogen or ammonia. Another and still more recent method of manufacturing tungsten filaments is by the use of a colloidal solution of tungsten, obtained by the alternate treatment of the metal with acid and alkaline reagents. By this means a colloidal solution containing up to 400 grms. of tungsten in a litre of water may be obtained. The metal is then precipitated by the addition of ammonium chloride, 1 grm. of which is sufficient to separate 1 kilo. of the metal in a flocculent form. After separation of the supernatant liquid the gelatinous tungsten is freed from water by kneading it in silk, and may then be pressed into filaments (without the necessity of any binding agent) which, when dry, are subjected to the action of an electric current, and are then ready for use. The filaments in the "Sirius" and "Colloid" lamps are made by this method, whilst in other tungsten lamps a binding agent is used in the preparation. Attempts to use other metals of high m. pt. such as osmium and zirconium, as in the "Osram" (= osmium and zirconium) and "zirconium" lamps, have not proved very successful. Methods in which additions have been made to carbon filaments to increase the light or reduce the consumption of electricity have also proved unsatisfactory. Thus in a lamp recently upon the market the carbon filament was coated with a film of zirconium, but as in all such attempts, the consumption of electricity soon rose to that of an ordinary carbon lamp, whilst on the other hand, the life of such prepared filaments was shorter. The filaments in metallic lamps are supported upon nickel arms fixed to a central vertical glass rod, whilst in lamps of high candle power the supports consist of platinum hooks. More recently molybdenum wires have been used in place of platinum. —C. A. M.

Air analysis and flueless gas-heated steam radiators. Yates. *See* XIXB.

PATENTS.

Coal; Furnace for the distillation of ——. E. Auburtin. Fr. Pat. 416,799, May 30, 1910.

A SINGLE carbonising chamber is formed with heating flues in the two side walls leading to a regenerator beneath the chamber. Each such chamber is supplied with producer gas from a main, the separate units being quite independent of one another. In order that the coal-gas may be of constant composition during the distillation, the walls of the carbonising chamber are of increasing thickness from the bottom.—A. T. L.

Filaments; Production of incandescent electric lamp ——. W. Rühling, Assignor to H. Malachowski, Berlin, Germany. U.S. Pat. 973,883, Oct. 25, 1910.

CARBON filaments are provided with a coating which is either formed of, or contains, antimony or an element of the antimony-arsenic group. An outer layer of carbon may be deposited over the antimony coating.—H. H.

Electric-lamp filaments; Process of making incandescent ——. H. C. Parker, Assignor to Parker-Clark Electric Co., New York. U.S. Pat. 974,812, Nov. 8, 1910.

THE filaments are flashed in an atmosphere containing hydrogen saturated with chromium oxychloride and an absorbent gas, such as ethylene, for taking up the gases liberated in the flashing process.—H. H.

Coal; Apparatus for the distillation of —— and the recovery of the products. R. S. Richards, Wraysbury, and R. W. Pringle, Richmond. U.S. Pat. 974,919, Nov. 8, 1910.

SEE Eng. Pat. 15,643 of 1909; this J., 1910, 552.—T. F. B.

Incandescence gas mantles, especially those made of artificial silk; Manufacture of ——. Dr. Kreidl und Heller. Fr. Pat. 416,308, Aug. 3, 1909.

SEE Eng. Pat. 17,862 of 1909; this J., 1910, 1097.—T. F. B.

Metallic filament lamps; Exhaustion of ——. H. Kuzel, Baden, Austria. Eng. Pat. 25,889, Nov. 9, 1909. Under Int. Conv., Dec. 21, 1908.

SEE Fr. Pat. 408,624 of 1909; this J., 1910, 618.—T. F. B.

Electric glow-lamp. H. Remané and E. Hurwitz, Berlin, and E. Gottschalk, Charlottenburg, Assignors to Deutsche Gasglühlicht A.-G., Berlin. U.S. Pat. 974,296, Nov. 1, 1910.

SEE Eng. Pat. 16,503 of 1907; this J., 1908, 890.—T. F. B.

Pyrophoric metal alloys. Eng. Pat. 15,507. *See* X.

III.—TAR AND TAR PRODUCTS.

PATENTS.

Hydrocarbons [tar]; Process for the treatment of liquid ——. G. L. Davies and W. E. W. Richards, London. Eng. Pats. 16,968, July 20, 1909, and 19,081, Aug. 19, 1909.

IN order to separate the lighter from the heavier constituents of liquid mixtures of hydrocarbons, such as tar, the mixture is first treated with a small quantity of an acid or substance of acid character, and the separation is effected by stirring with a suitable mineral or vegetable oil, such as kerosene, petroleum residues, naphtha, benzene, linseed oil, etc. For example, gas tar heated to about 180° F., is stirred with from 1 to 2 per cent. of its weight of sulphuric acid, from 3 to 4 per cent. of one of the above oils is then added, and the stirring continued until the separation is complete, which generally occurs after a few minutes. The lighter oils are then run off, and the residue, consisting of the acid and heavier oils, may be freed from sulphur by treatment with air or other gas, and then washed with hot water to remove the acid. The consistency of the resulting pitch depends on the quantity of acid used; the hard pitches obtained by this process are said to have much higher melting points, and the soft pitches to be more resilient, than those obtained in other ways.—T. F. B.

Tarry coatings; Process for preparing ——. F. Raschig. Fr. Pat. 416,177, May 21, 1910.

EMULSIONS of tar with clay form efficient coatings for iron, wood, and any other surfaces; they will adhere to damp surfaces, but will not absorb moisture when dry. The coatings are not softened by heat, and are much less combustible than ordinary tar coatings. A clay-tar emulsion may be prepared by mixing 200 kilos. of clay with 100 kilos. of water, and adding gradually, with stirring, 500 kilos. of tar and 200 kilos. of water; such emulsions can be diluted to any extent with water. (See also this J., 1910, 758.)—T. F. B.

Coal tar; Process for obtaining oils rich in bitumen from ——. G. Krojanker. Ger. Pat. 227,492, July 28, 1909.

THE processes usually employed for extracting bituminous substances from coal tar are to treat it either with coal tar oils of very high boiling-point, or with a large excess of oils of low boiling-point, *e.g.*, benzene. It has been found, however, that the greater the volume of benzene used, the greater is the insoluble residue: for example, when from 2·7 to 36 parts of benzene are used to extract one part of tar, the insoluble residue varies between 5 and and 6·9 per cent., whilst when using 0·9 part of benzene to one part of tar, only 3·25 per cent. of residue remains undissolved. The patentee therefore claims the use of very small quantities of benzene, preferably 90 per cent. of the weight of the tar to be extracted, the benzene being distilled from the resulting solution in the usual manner. —T. F. B.

Anthraquinone and its derivatives; Process for producing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 416,735, June 3, 1910. Under Int. Conv., Nov. 2, 1909.

ANTHRACENE and its derivatives are oxidised to anthraquinone and its derivatives by means of nitric peroxide in presence of a suitable solvent or diluent. 30 kilos. of nitric peroxide are mixed with 100 kilos. of nitrobenzene, and 25 kilos. of anthracene are added at a temperature of about 15° C.; after standing for some hours at the ordinary temperature, the mixture is slowly heated to about 100° C., and, when the evolution of nitric oxide has ceased, is allowed to cool, and the anthraquinone filtered off and washed; the nitric oxide is re-converted into the peroxide for use in another operation.—T. F. B.

Indoxyl, oxythionaphthene, and their homologues and substitution products; Production of derivatives of ——. Soc. pour l'Industrie Chimique à Bâle. Fr. Pat. 416,767, Aug. 13, 1909.

BY the action of phosgene on indoxyl, or oxythionaphthene, or their homologues or derivatives, new carbonyl derivatives are obtained, which are not decomposed by air. The product obtained from indoxyl is a greyish-white substance, of m. pt. 109°—110° C., soluble in alcohol, benzene, and acetic acid; when treated with bromine in presence of acetic acid, it is converted quantitatively into dibromo-isatin, of m. pt. 246°—247° C.—T. F. B.

N-Alkyl- and N-aryl-arylsulphamino-anthraquinones; Process for preparing ——. F. Ullmann. Ger. Pat. 227,324, Dec. 14, 1909. Addition to Ger. Pat. 224,982, July 20, 1909 (see this J., 1910, 1098).

WHEN halogen-anthraquinones or their derivatives are treated with derivatives of arylsulphamides of the formula, R·NH·SO$_2$·Ar (where R represents aryl or alkyl), preferably in presence of catalytic agents and substances which combine with halogen acids, the corresponding sulphanamino anthraquinones are produced; they may be utilised in the preparation of dyestuffs. T. F. B.

Tar paint or tar coatings. F. Raschig, Ludwigshafen on Rhine, Germany. Eng. Pat. 15,711, June 30, 1910. Under Int. Conv., May 4, 1910.

See Fr. Pat. 416,177 of 1910; preceding.—T. F. B.

Alkyl and aryl esters of phthalic acid as solvents. Ger. Pat. 227,667. *See* XIII.

IV.—COLOURING MATTERS AND DYES.

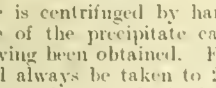
Logwood; Valuation of ——. G. Grasser. Collegium. 1910, 461—463.

The method consists in measuring the volume of the precipitate produced when an aqueous extract of logwood is treated with lead acetate. The process does not afford a quantitative estimation of the dyestuff but gives good results as regards the comparison of various samples among themselves. Five grams of ground Campechy wood, containing 10·5 per cent. of water are extracted with 200 c.c. of water for 1½ hours. The solution is diluted to 250 c.c., of which 50 c.c. are precipitated with 20 c.c. of a 20 per cent. lead acetate solution. A portion of the precipitate is centrifuged by hand for 5 minutes when the volume of the precipitate can be read off, a sharp division having been obtained. From 4 to 6 grms. of logwood should always be taken to 200 c.c. of water, otherwise inexact results are obtained. It is also safer simultaneously to carry out a blank experiment throughout with a sample of standard material.—J. C. C.

Sulphide dyestuffs. II. H. Wichelhaus. Ber., 1910, **43**, 2922—2926. (Compare this J., 1907, 146.)

In following up his hypothesis that the simplest sulphide dyestuffs are derived from cellulose, the author has distilled pure cotton-wool (20 kilos.) and shows that phenol is the sole product of a phenolic nature. When phenol is oxidised, phenoquinone, $C_{18}H_{14}O_4$, is produced. This has an intensely red colour but no dyeing properties. When, however, it is heated in the usual way with sulphur and an alkali sulphide (best under pressure at 200°—220° C.) it is readily converted into a sulphide dyestuff which dyes cotton in dark brown shades. These facts seem to confirm the conclusion that Croissant and Brètonnière's sulphide dyestuff was derived from cellulose. That the dyestuffs present in wood are also derived from cellulose was shown by the fact that phenoquinone, when left in contact with sodium acetate and water at the ordinary temperature for 10 days, yields a dyestuff, soluble in sodium carbonate, which dyes cotton brown.

Dithiofluorescein chloride



which has no dyeing properties, yields, when condensed in the presence of sulphuric acid, products which dye from a sodium sulphide bath.—J. C. C.

Aniline Black. IV. R. Willstätter and C. Cramer. Ber., 1910, **43**, 2976—2988. (See also this J., 1909, 695, 1244; 1910, 1196.)

The authors have worked out a method for determining the number of quinonoid groups in a quinonoid compound, which consists in heating the substance with phenyl hydrazine carbamate in an atmosphere of carbon dioxide and measuring the nitrogen evolved. Examples are given showing the application of this to several quinonoid and azo-compounds and the method is made use of in ascertaining the number of quinonoid groupings in the various Aniline Blacks. In all these the reduction takes place in sharply distinct phases, thus for example, in the case of the trebly quinonoid black, "Bichromate Black," the first stage is at 30°—45° C., the second at 80° C., and the third at above 120° C. The final product is colourless. The amount of hydrogen required during the first stage is a measure of the molecular weight, and this is found, confirming previous experiments, to be in all cases one which corresponds with the presence in the molecule of 48 atoms of carbon. The quadruply quinonoid hydrolysed Black is the most difficult to reduce and indeed the reduction could only be effected by adding a trace of Green's Black which appears to act catalytically. The latter Black is, moreover, itself very easily reduced and it seems probable that this Black contains some slight amount of an impurity which gives rise to the catalysis. The following table shows the number of quinonoid nuclei contained in various Aniline Blacks examined.

	Before reduction.	50° C.	100° C.	150° C.	Catalytic reduction 150° C.
Bichromate Black	3	2	1	0	—
„ hydrolysed	3	3	2	1	0
Green's Black	4	3	1	0	
„ hydrolysed	4	4	3	0	—
Chlorate Black ..	4	3	2	0	—
„ hydrolysed	4	4	3	2	0

—J. C. C.

Anthraquinone derivatives; Colour and affinity for mordants of ——. *H. G. Heller.* Ber., 1910, **43**, 2890—2892. (Compare this J., 1908, 1147.)

The conclusion previously drawn that the affinity for mordants of anthraquinone derivatives varies with the intensity of colour of the sodium salts is apparently contradicted by the statement (Elbs and Eurich, J. prakt. Chem. 1890, [ii], **41**, 8) that the salts of anthraquinone-1 : 3-, -2 : 3-, and -1 : 4-dicarboxylic acids are reddish. A repetition of the work cited has shown, however, that the alkaline solutions of these substances, when in the pure state, are completely colourless. The substances are fixed by metallic mordants only to a very slight extent.—J. C. C.

Patents.

Vat dyestuffs and process of making same. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated June 1, 1910 (under Int. Conv., July 9 and Dec. 27, 1909), to Fr. Pat. 407,507, Oct. 1, 1909.

The substituted isatins mentioned in the chief patent (see Eng. Pat. 7819 of 1909; this J., 1910, 81) may be replaced by analogous derivatives of naphthisatin. For example, β-naphthisatin is converted into the chloride by means of phosphorus pentachloride and the product is condensed with α-anthrol. The dyestuff obtained gives an orange yellow vat which dyes cotton in greenish gray shades.—J. C. C.

Azo-dyestuffs and their intermediate products; Production of ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated April 30, 1910 (under Int. Conv., July 9, 1909), to Fr. Pat. 413,982, March 10, 1910 (see Eng. Pat. 28,717 of 1909; this J., 1910, 1050).

Diazo-derivatives of aromatic amines which do not contain nitro- or sulphonic groups are combined, in neutral or alkaline solution with 2-aryl- or 2-arylalkylamino-8-naphthol-6-sulphonic acids or their 1-substituted derivatives. For example the dyestuff prepared from *o*-chloroaniline and 2-phenylamino-8-naphthol-6-sulphonic acid dyes wool in reddish brown shades.—J. C. C.

Anthraquinone derivatives [dyes]. Badische Anilin und Soda Fabrik. Fr. Pat. 416,734, June 3, 1910. Under Int. Conv., April 4, 1910.

When aminoanthraquinones are treated with perchloromethylmercaptan (prepared by the action of dry chlorine on carbon bisulphide containing a trace of iodine) in presence of solvents or diluents, and with or without addition of catalytic agents, such as copper or copper salts, and substances which combine with hydrochloric acid, derivatives are obtained, which can be used directly as dyestuffs, or may be converted into dyestuffs. The compound obtained from 2-aminoanthraquinone, having the formula, $CS(NH.C_{14}H_7O_2)_2$, forms reddish-brown vats with alkali hydrosulphites, in which cotton is dyed red-brown shades, changing to orange when washed, and exposed to the air. The dyestuff from 2.6-diaminoanthraquinone gives yellow shades; that from the 1.4-compound, grey shades, and that from 1-aminoanthraquinone violet-brown shades.—T. F. B.

Dyestuffs dyeing cotton direct; Manufacture of ——. Read Holliday and Sons, Ltd. Fr. Pat. 416,898, June 8, 1910.

ORTHO- or para-chlorodiazobenzene or a mixture of the two is combined with aminonaphtholdisulphonic acid H in acid solution and then a molecule of a diazo- or tetrazo-compound is added to the product in alkaline solution. In case a tetrazo-compound has been used, one molecule of an amine or a phenol is finally added. When the intermediate monoazo-compound described above is treated with tetrazotised benzidine, and *m*-phenylenediamine is used as the end component, a dyestuff is obtained which produces deep black shades on cotton.—J. C. C.

Dyestuffs of the anthracene series; Manufacture of ——. P. A. Newton, London. From Farbenfabr vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4536, Feb. 23, 1910.

SEE U.S. Pat. 961,387 of 1910; this J., 1910, 1099.—T.F.B.

Azo dyestuff; Process for making an ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 416,472, May 27, 1910. Under Int. Conv., Dec. 7, 1909.

SEE Eng. Pat. 29.458 of 1909; this J., 1910, 1051.—T.F.B.

Vat-dyeing colouring matters; Manufacture of ——. Kalle und Co., A.-G., Biebrich on Rhine, Germany. Eng. Pat. 5808, March 8, 1910. Under Int. Conv., March 19, 1909.

SEE Fr. Pat. 413,799 of 1910; this J., 1910, 1099.—T.F.B.

Aminohydroxynaphthalene sulphonic acid; Process for making an ——, *and azo dyestuffs therefrom.* Kalle und Co., A.-G. Fr. Pat. 416,963, May 4, 1910. Under Int. Conv., May 11 and 12, 1909.

SEE Eng. Pats. 9743 and 9744 of 1910; this J., 1910, 872 and 1297.—T. F. B.

Vat dyestuffs dyeing like indigo; Production of halogenated ——. Soc. pour l'Industrie Chimique à Bâle. Eighth Addition, dated Aug. 14, 1909, to Fr. Pat. 372,627, Dec. 17, 1906.

SEE Eng. Pat. 6351 of 1910; this J., 1910, 1197.—T. F. B.

Anthracene dyestuffs; Production of —— *and of intermediate products.* Soc. pour l'Industrie Chimique à Bâle. Second Addition, dated Aug. 18, 1909, to Fr. Pat. 398,015, March 12, 1908.

SEE Eng. Pat. 20,127 of 1909; this J., 1910, 267.—T.F.B.

[Azo] dyestuffs; Black —— *and process for making them.* Farbwerke vorm. Meister, Lucius, und Brüning. Third Addition, dated May 30, 1910, to Fr. Pat. 405,928, Aug. 11, 1909, Under Int. Conv., July 5, 1909.

SEE Eng. Pat. 23,204 of 1909; this J., 1910, 938.—T.F.B.

Monoazo dyestuff; Process for making a ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 416,052, April 4, 1910. Under Int. Conv., April 27, 1909.

SEE Eng. Pat. 9497 of 1910; this J., 1910, 1051.—T. F. B.

Monoazo dyestuff; Process for making a red ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 416,275, May 23, 1910. Under Int. Conv., May 25, 1909.

SEE Eng. Pat. 12,426 of 1910; this J., 1910, 1002.—T.F.B.

Vat [thioindigo] dyestuffs; Process for making brown ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 416,414, Aug. 6, 1909.

SEE U.S. Pat. 959,617 of 1910; this J., 1910, 809.—T.F.B.

Anthraquinone series; Manufacture of a salmon-red vat dyestuff of the ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 417,113, June 13, 1910. Under Int. Conv., July 31, 1909.

SEE Eng. Pat. 15,523 of 1910; this J., 1910, 1297.—T.F.B.

Indigo white; Solid, stable preparations of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 417,071, June 11, 1910. Under Int. Conv., Nov. 10, 1909.

SEE Eng. Pat. 30,197 of 1909; this J., 1910, 1051.—T.F.B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Sulphurous acid in waste lyes of sulphite pulp mills; Determination of ——. A. Stutzer. Chem.-Zeit., 1910, **34**, 1167—1168.

THE standard method for the determination of sulphurous acid in foodstuffs is to distil with a current of carbon dioxide together with steam in presence of phosphoric acid, collecting the vapours in iodine and weighing the sulphuric acid produced as barium sulphate. In this way are determined not only the inorganic sulphites but also the sulphurous acid held in combination with aldehydes and sugars. The waste lyes of sulphite wood pulp mills contain in addition to these forms of sulphurous acid, combined sulphurous acid in the form of calcium lignosulphonate, and when such lyes are treated with phosphoric acid in the manner described, the results are variable, according to the degree of decomposition undergone by the various organic derivatives of sulphurous acid present. The values obtained increase with the time of distillation and the concentration which the phosphoric acid thereby undergoes. But in the analysis of waste sulphite pulp lyes, it is for most purposes only of interest to determine the quantity of sulphurous acid which is readily split off under certain conceivable circumstances, whilst the more firmly fixed sulphurous acid may generally be considered as harmless. The author therefore proposes distillation with acetic acid instead of with phosphoric acid, the weaker acid readily decomposing the inorganic sulphites but only attacking the sulphurous acid in combination with aldehydes and lignin to a slight extent in a short duration of distillation. 250 c.c. of water are placed in an Erlenmeyer flask of 750 c.c. capacity, the air is expelled by carbon dioxide, and 25 c.c. of the waste sulphite lye and 25 c.c. of 25 per cent. acetic acid are added. The liquid is kept in full ebullition for 15 minutes whilst the vapours are collected in iodine solution. This period of distillation is ample for the decomposition of sodium and calcium sulphites. Aldehyde-sodium bisulphite is decomposed only to the extent of 4·8 per cent., as against 22·8 per cent. with phosphoric acid under similar conditions; calcium lignosulphonate is decomposed (using 50 c.c. of acetic acid) to the extent of 3·3 per cent.—J. F. B.

Volumetric determination of nitric acid in nitrocellulose, nitroglycerin, and other compounds. Bronnert. *See* XXII.

Patents.

Floss and waste silk ; Process for the destruction of hairs and other extraneous matter in ——. C. Seignol, Lyons, France. U.S. Pat. 974,440, Nov. 1, 1910.

Hairs, horsehair, nails, and horny, gelatinous, or other substances are removed from floss or waste silk by treatment with a dilute solution of an alkali sulphide containing a small quantity of oil, rapidly washing in hot water, and finally rinsing in cold water to remove traces of sulphide and the débris of the animal impurities.—T. F. B.

Floss silk and the products which are obtained from it ; Process for treating ——. T. Inouye and T. Mochida. Fr. Pat. 416,627, March 25, 1910. Under Int. Conv., July 15, 1909.

(1) To obtain a partially degummed product, the waste produced in spinning silk is plunged into cold water to wet it out evenly and then immersed in clean water at 45° C. for 24 hours. The excess of water is next removed and the silk is treated with a detergent solution. During this process the fibres swell, separate from one another and then absorb a moderate amount of fatty substances which enable them to undergo the subsequent processes with less risk of breakage. (2) To obtain a completely degummed product the material is immersed in cold water and then boiled for 1—1½ hours with a solution containing 15 per cent. of soap on the weight of silk. Subsequent washings first in lukewarm water and afterwards in cold water complete the process.—P. F. C.

Threads ; Brilliant —— with metallic lustre. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated June 11, 1910, to Fr. Pat. 408,370, Oct. 27, 1909 (this J., 1910, 624, 1299).

In the coating of threads with cellulose acetate, with or without metallic powders or pigments, the addition of certain organic substances is specified, with a view to increasing the pliability of the coating layers. The organic substances mentioned include certain amines, anilides, amides, imides, ethers, esters and halogenated derivatives. Specific examples relate to ethylbenzoyl-*o*-toluidine, acetin and acetylbenzyl-*o*-toluidine.—J. F. B.

Retting flax ; Process for ——. A. and N. Cousinne. Fr. Pat. 416,339, May 12, 1910.

Sacks containing the woody part of flax (annats) are placed inside a tank into which water is afterwards run. As soon as this water has become saturated with the soluble part of the material contained in the sacks, it is run into a second tank, being delivered through a perforated pipe into the space between the two false bottoms with which this tank is provided. The delivery pipe is also surrounded by sacks containing the woody part of flax. The flax to be retted is placed on the upper false bottom and is kept below the surface of the water in the tank by means of a hurdle. The second tank is also fitted with stopcocks and valves for regulating the supply of water and with a steam pipe for heating it.—P. F. C.

Vapours of volatile solvents particularly ether, during the spinning of viscous substances ; Means for collecting the ——. J. Fournaud. Fr. Pat. 416,064, July 28, 1909.

An arrangement for collecting the vapours of ether during the spinning of artificial filaments from collodion is described. It consists of a casing enveloping as closely as possible the spinning tubes. This envelope consists of three parts: a fixed shield of metal on the inside, a perforated channel at the bottom, and a movable shield on the outside, which is balanced by weights so that it can be dropped when access is required to the tubes. The shape of the casing is designed so as to avoid eddies and so that a very small volume of air is aspirated by fans which at the same time produce very strong suction.
—J. F. B.

Cellulose or pyroxylin compound. P. H. A. Lesler, Assignor to A. M. Hanlino and E. E. Quandt, Baltimore. U.S. Pat. 974,285, Nov. 1, 1910.

From 3 to 10 per cent. of sulphur, dissolved in chloroform, is added to a solution of "cellulose" or pyroxylin in acetone or other solvent, and the mixture is evaporated to dryness at normal temperature. T. F. B.

Seaweed ; Cellulose product derived from —— as substitute for absorbent cotton. C. A. Sabourin and E. E. Marinier. Fr. Pat. 416,046, March 26, 1910.

A substitute for cotton wool and lint for dressings, also for wool and horsehair in certain of their uses, is prepared from marine plants, particularly algæ. The algæ are first subjected to the decolorising treatment described in Fr. Pat. 412,909 (this J., 1910, 1102). The material thus prepared then undergoes a process of boiling under pressure with a solution of sodium or potassium hydroxide mixed with rosin in the proportions necessary to form a soap, to which is also added one-tenth of its weight of a saturated solution of zinc chloride. Digestion is continued until only the fibrous cellulose of the algæ remains and the purified product is dried.
—J. F. B.

Cellulose esters and their treatment. H. S. Mork. Fr. Pat. 416,752, June 4, 1910. Under Int. Conv., Feb. 10, 1910.

The lower acetates of cellulose, monoacetate or diacetate or any product of intermediate composition, are prepared by the partial hydrolysis of the triacetate. It is known that only in this highest degree of acetylation are the cellulose esters capable of being formed into films or threads. Consequently, the latter are first produced from the triacetate and then submitted to the limited action of a hydrolysing agent: sodium hydroxide, ammonia, sodium carbonate, etc. In this way the films or threads may be converted superficially or in patterns or designs into the lower acetates of cellulose, which possess hygroscopic properties different from those of the triacetate. This conversion is stated to be advantageous in the case of backing-films for photographic emulsions or in the case of artificial silk which has to be dyed.—J. F. B.

Cellulose from esparto and other fibrous materials ; Manufacture of —— by means of sea or salt water. A. Lotte. Fr. Pat. 417,035, June 11, 1910. Under Int. Conv., June 21, 1909.

Sea water or saline water is purified by the addition of ammonium phosphate and sodium carbonate in order to precipitate the magnesium compounds. Lime may also be used to facilitate the precipitation. The water thus obtained is utilised for the preparation of what is called a chloro-sulphite of calcium liquor, by absorbing sulphur dioxide in the saline water in presence of lime. For the manufacture of cellulose, the material, suitably prepared, is steeped in a mixture of purified saline water and an old digestion liquor for 24 hours. It is then washed and crushed in a mill, and is finally heated with the chloro-sulphite of calcium or of sodium.—J. F. B.

Albuminoids ; Process for preparing solutions of ——, and their applications. H. L. J. Chavassieu. Second Addition, dated July 31, 1909, to Fr. Pat. 395,402, Dec. 27, 1907 (see this J., 1909, 422; 1910, 416).

Certain albuminoid substances, especially caseins, are converted by treatment with solutions of alkali sulphocarbonates, into solutions which are coagulated by ammonium sulphate or by dilute acids. When these solutions are mixed with solutions of cellulose xanthate, products similar to those described in the principal patent are obtained; they may be used for the preparation of threads, films, etc. Similar solutions are also produced by mixing solutions of viscose with solutions of proteins in 8 to 10 per cent. caustic alkali solutions.—T. F. B.

Peat dust; Manufacture of a pliable, porous and felted material from ——. G. H. F. Pape. Fr. Pat. 416,782, May 10, 1910.

The peat obtained from the upland marshes, also called peat dust or small peat, is ground in suitable mills and is then mixed with powdered asbestos or talc, etc., so as to form an intimate mixture, the fibres of the peat becoming coated with a layer of mineral matter. Alternatively, the mixture may be effected without the special grinding of the peat. The felted material thus obtained is eminently suitable for packing purposes, for insulating pipes, etc., lining walls and floors, and for other industrial uses. —J. F. B.

Sizing and impregnating paper, wood, and like substances; Process for ——. A. Kuldkepp and H. Graf, Kerrefer Estate, Russia. Eng. Pat. 24,111, Oct. 20, 1909.

See Fr. Pat. 408,555 of 1909; this J., 1910, 624.—T. F. B.

Pulp fibres; Method of and apparatus for separating —— *from pigments and other impurities, such as are present in waste papers.* B. W. Petsche, Yonkers, N.Y., U.S.A. Eng. Pat. 10,229, April 26, 1910.

See U.S. Pats. 955,898 and 955,990 of 1910; this J., 1910, 689.—T. F. B.

Bagasse; Method of treating ——. T. J. Hutchinson, Manchester. U.S. Pat. 975,387, Nov. 8, 1910.

See Eng. Pat. 20,266 of 1907; this J., 1909, 105.—T. F. B.

Pyroxylin composition; Odourless ——. W. G. Lindsay. Fr. Pat. 416,843, June 7, 1910. Under Int. Conv., June 26, 1909.

See U.S. Pat. 961,360 of 1910; this J., 1910, 875.—T. F. B.

Manufacture of fuel blocks [*with waste sulphite-cellulose lyes*]. U.S. Pat. 974,001. *See* IIa.

Separating certain substances or impurities from solutions. Fr. Pat. 416,974. *See* XI.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Adsorption [*of dyestuffs*]; *Influence of chemical affinity in the phenomena of so-called* ——. L. Vignon. Comptes rend., 1910, **151**, 673—675.

The author has extended his experiments (this J., 1910, 937) on dyestuffs (picric acid, Fuchsine S) in real solution, using, besides asbestos, zinc oxide, hydrated alumina, hydrated and ignited silica, and silk. Whilst the figure representing the adsorption by the silica and the asbestos was 0·06, the corresponding figure for zinc oxide was 5·45, for alumina 4·02, for silk 7·91. All these three substances, though insoluble, have yet determinate chemical functions, and chemical affinity is the force which determines the fixation on their surfaces of the dissolved colouring matter. The phenomena of adsorption comprise two distinct cases: substances in pseudo-solution or in suspension are fixed by molecular (or particular) attraction; those which are really dissolved are fixed by chemical affinity.—J. T. D.

Patents.

Scouring wool and other analogous operations; Apparatus for ——. J. F. White. Fr. Pat. 416,481, May 23, 1910. Under Int. Conv., April 22, 1910.

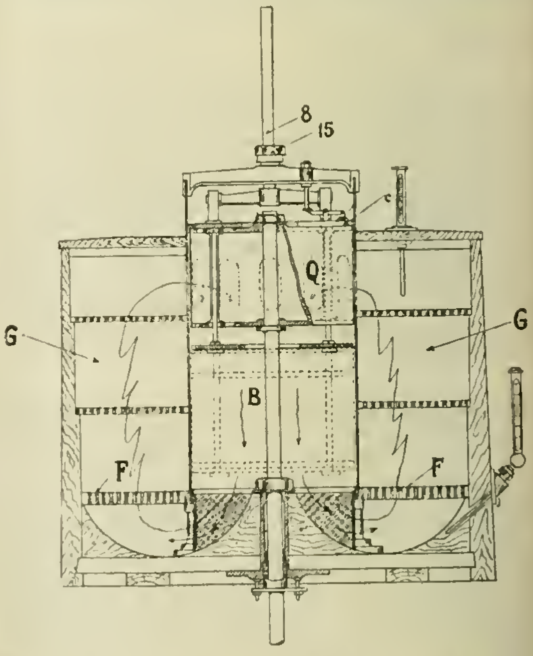
The wool is delivered by a carrier into a channel arranged in the upper part of the washing chamber and whilst travelling along, is sprayed with washing liquor until it becomes thoroughly saturated. It is then allowed to fall on to the upper of two horizontal compound supports or tables, one higher and the other lower, each consisting of series of perforated longitudinal supports. The two series have imparted to them compound to-and-fro motions in opposite directions. After travelling the length of one table, the wool falls on to a second, the tables being so arranged that in falling the wool turns over and so exposes a fresh surface to the action of the spraying devices situated above each table. One or more receivers are placed under each table and under the channel to catch the washings which drain from the wool and deliver them to special reservoirs on the floor of the chamber. From these reservoirs the liquor is again pumped up to the spraying devices on a cumulative principle, the most concentrated liquor being sprayed on to the wool at its entrance into the machine whilst clean water is used for the final washing. When the liquor in the first reservoir has reached a certain density it is run into a special recipient for the subsequent recovery of the suint.—P. F. C.

Mercerisation of warp-yarns; Process and apparatus for the ——. D. Habel, Berlin. Eng. Pat. 8306, April 6, 1910. Under Int. Conv., April 8, 1909.

The dry warps are first wetted out in warm dilute lye and then squeezed between a pair of wringing rollers. They are next impregnated in concentrated lye, again squeezed, sent underneath a cold water spray and afterwards washed once in cold diluted lye and twice in hot water, the warps being nipped between squeezing rollers after each immersion. All these processes are carried on in a continuous series. If the squeezing rollers are positively driven, the second pair is made to revolve more slowly than the first pair so as to permit the yarns to shrink during the treatment with concentrated lye. The third pair is made to revolve rather quicker than the second pair to stretch the yarns during the cold water treatment. The fourth and fifth pair are made to revolve even quicker than the third pair to complete the stretching during the warm water washing. If it is desired to imitate hank mercerising, the rollers may be driven in a yielding or elastic manner by means of a varying friction drive.—P. F. C.

Textile materials and mixing liquids; Apparatus for treating ——. R. Diederichs. Second Addition, dated May 28, 1910, to Fr. Pat. 390,105, May 11, 1908 (this J., 1908, 1016; 1909, 471).

On the aspirating bell, Q, which ascends and descends in the interior reservoir, B, there is fixed in addition to the upper partition provided with a valve, c, a lower perforated partition which is also provided with a valve placed below it at a fixed distance. This latter valve is connected with the valve, c, of the upper partition and both can be



actuated from a device S, 15, quite independently of the movements of the aspirating bell. When the bell descends, the lower valve is pressed against the perforated false bottom and closes the openings in it, thus converting the bell into a piston which forces the liquid into the circular space between the two concentric reservoirs. The perforated false bottom, F, of the circular compartment, G, consists of flat iron bars arranged in the form of a grate with their width vertical, thus forming vertical channels which direct the flow of the liquid displaced from the central reservoir by the aspirating bell.—P. F. C.

Weighting silk; Process for ——. Landau et Cie. and I. Kreidl. Fr. Pat. 416,238, May 7, 1910. Under Int. Conv., June 15, 1909.

THE silk is impregnated with a solution of a colloidal metallic hydroxide, zirconium hydroxide being specially suitable for the purpose. The "sol" fixed on the fibre is then converted into a "gel" by a suitable coagulating agent such as sodium phosphate.—P. F. C.

Sodium phosphate baths used for the weighting of silk; Process for regenerating the ——. C. E. Sachse. Ger. Pat. 227,434, March 23, 1909.

AFTER being used several times, the solutions of sodium phosphate in which tin-weighted silk has been treated, become useless, since they contain too much tin. In order to remove this, phosphoric acid or other acid is added to the solution until it gives no coloration with phenolphthalein, when it is boiled for some time and then rendered alkaline to phenolphthalein by adding milk of lime or a hydroxide of barium, strontium, magnesium, or zinc; when the precipitate has been removed, the solution may again be utilised for treating the silk.—T. F. B.

Dyeing machine. J. T. Psarski. Fr. Pat. 416,866, June 7, 1910.

THE material to be dyed is packed into a cylindrical vat provided with a perforated false bottom and having a perforated drum arranged in the middle of it. The vat is closed by means of a cover (perforated near its circumference) which rests on the top of the drum. In order to regulate the capacity of the vat according to the quantity of material to be dyed, or according to the diminution in volume during dyeing, the false bottom of the vat can be raised at will. The bottom of the vat is provided with three openings, one for the entry of the dye-liquor into the drum, one for the exit of the liquor from the vat and a third for the admission of steam for heating purposes. A pipe is also arranged for the delivery of dye-liquor into the vat from above and an opening in the wall of the vat just above the level of the perforated cover allows for the overflow of the dye-liquor. In order to obtain more even dyeings, this one opening can be replaced by a series of slots in the wall of the vat which deliver the overflowing liquor into an annular channel which in turn communicates with an exit pipe. Means are also provided for sampling the goods during the dyeing operation.—P. F. C.

Dyeing with colloidal solutions of alizarin; Process for ——. Chem. Fabr. Grünau, Landshoff und Meyer. A.-G. Ger. Pat. 226,941, Oct. 5, 1909.

ALIZARIN may be obtained in solution in the colloidal form, by dissolving it in alkali, and adding dilute acid until the solution is almost or quite neutral, or even feebly acid; the solutions of the alizarin preparation described in Ger. Pat. 219,757 (this J., 1910, 484) may be acidified with similar results. The colloidal solutions of alizarin thus prepared can be used for dyeing unmordanted cotton, the shades produced being yellower than those obtained when using the mono-alkali alizarin preparation, and brighter than those resulting from the old Turkey-red process.—T. F. B.

Dyeing by means of solutions of dyestuffs in hydrocarbons, carbon tetrachloride, or other substance used in dry cleaning; Process for ——. R. Hömberg and K. Jorns. Ger. Pat. 227,648, April 28, 1908.

MOST classes of dyestuffs dissolve completely in mixtures of benzene, carbon tetrachloride, or other dry-cleaning agent, with an alcohol and an ester or a substance which contains one or more acid groups, but which is not a strong acid; such substances are nitro-compounds, hydroxy-compounds, aromatic sulphonic acids, etc. These solutions are used for dyeing made up articles of various kinds, the dye bath being heated if deeper shades are required; the dyeings are fast to rubbing. The following is given as an example of such a mixture of solvents:—Benzene, 60 parts; alcohol, 20 parts; amyl acetate, 20 parts.—T. F. B.

Sulphide dyestuffs; Process for fixing —— *in dyeing and printing.* L. Cassella und Co. Ger. Pat. 225,314, Aug. 7, 1908.

SULPHIDE dyestuffs are completely fixed on the fibre, in dyeing and printing, by the use of animal colloids.—T. F. B.

Formaldehyde sulphoxylic acid; Process for preparing nitrogenous condensation products of ——. K. Sunder. Ger. Pats. 228,206, Dec. 6, 1908, and 228,207, Jan. 9, 1909.

(1) ANILINE bisulphite, prepared by treating aniline with the requisite amount of sulphur dioxide in presence of water, is reduced by means of zinc dust in aqueous solution, at a temperature of about 40°–50° C., and the reduction product is then condensed with formaldehyde. The same product is also obtained by condensing aniline bisulphite with formaldehyde, and reducing the resulting substance with zinc dust. The product is of value for discharging fabrics dyed with *p*-Nitraniline Red, the condensation product being printed on the goods, which are subsequently steamed. A substance possessing similar properties is obtained by treating hexamethylenetetramine in aqueous solution with seven molecular proportions of sulphur dioxide, reducing with zinc dust, and condensing the product with formaldehyde. No bisulphite is formed by the action of sulphur dioxide on hexamethylenetetramine; the first product is a sparingly soluble acid, which is converted, on further treatment with sulphur dioxide, into a more readily soluble acid; both these are reduced to sulphoxylates by zinc dust. (2) The aniline derivative of formaldehyde-sulphoxylic acid described in the first patent may be prepared by treating the double salt of aniline and zinc hydrosulphite with formaldehyde, the mixture being cooled during the reaction; the compound is obtained in the form of a yellowish syrup.—T. F. B.

Yarns coated with cellulose esters; Process for finishing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 417,027, June 10, 1910. Under Int. Conv., Dec. 24, 1909.

AN exceptional brilliance can be imparted to yarns which have been coated with cellulose esters by "filling" them with a preparation containing substances capable of softening, swelling or dissolving the coating. Alcohol, substituted alcohols, acetone, ethyl acetate, organic or inorganic acids are suitable for this purpose. Example: The material is treated for some minutes with a mixture containing 300 grms. of rice starch, 3000 grms. of water, 50 grms. of Senegal gum, 75 grms. of acetin and 150 grms. of alcohol. The excess of filling is next removed and the yarn is finally dried and polished.—P. F. C.

Silk; The loading of ——. Landau und Co., and I. Kreidl, Vienna. Eng. Pat. 11,056, May 4, 1910. Under Int. Conv., June 15, 1909.

SEE Fr. Pat. 415,657 of 1910; this J., 1910, 1300.—T. F. B.

Mercerising, dyeing, or like treatment of loose or woven cotton or other vegetable fibre; Machine for ——. J. H. Robson, Huddersfield. U.S. Pat. 975,074, Nov. 8, 1910.

SEE Eng. Pat. 26,317 of 1909; this J., 1910, 1300.—P. F. C.

Dyeing machines. J. T. Psarski, Cleveland, Ohio, U.S.A. Eng. Pat. 24,607, Oct. 26, 1909.

SEE Fr. Pat. 408,307 of 1909; this J., 1910, 623.—T. F. B.

Cop-tube. F. H. Daniell, Franklin, N.H. (M. B. Daniell, Executrix). U.S. Pat. 974,126, Nov. 1, 1910.

See Fr. Pat. 408,400 of 1909; this J., 1910, 623.—T. F. B.

Yarn; Packaging —— for dyeing. F. H. Daniell, Franklin, N.H. (M. B. Daniell, Executrix), and J. C. Hebden, Providence, R.I. U.S. Pat. 974,127, Nov. 1, 1910.

See Fr. Pat. 408,480 of 1909; this J., 1910, 623.—T. F. B.

Union fabrics; Process for producing coloured woollen effects in —— dyed in the piece. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 416,906, Aug. 17, 1909.

See Eng. Pat. 18,828 of 1909; this J., 1910, 752.—T. F. B.

Separating certain substances or impurities from solutions. Fr. Pat. 416,974. *See* XI.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Nitrous gases; Behaviour of —— towards water and aqueous solutions of alkalis. F. Foerster and J. Blich. Z. angew. Chem., 1910, **23**, 2017—2025.

The authors have carried farther the work of Foerster and Koch (this J., 1908, 1110), examining in especial the effect of rise of temperatures upon the reaction between oxygen and nitric oxide. They find that, between 0° and 100° C., the oxidation of nitric oxide by free oxygen (or air) proceeds more rapidly at low than at high temperatures, so that the speed of reaction has a (not very great) negative temperature-coefficient. The same conclusion was arrived at by Bodenstein, and the authors consider that the explanation of the fact is to be found in Raschig's suggestion, which it supports, that the oxidation consists first in the attachment of a molecule of oxygen to the molecule of nitric oxide, with formation of a "primary oxide," which then reacts on a second molecule of nitric oxide to form two molecules of nitrogen peroxide. The first reaction is reversible, and tends to an equilibrium, which as the temperature rises favours the non-production or dissociation of the "primary oxide," and the lessened concentration of this at higher temperatures more than counterbalances the greater speed of reaction between the "primary oxide" and the nitric oxide. Alkali was found to absorb nitrogen trioxide much more rapidly than nitrogen peroxide, and the authors consider that this result confirms the assumption of Le Blanc, that in a gas in which part only of the nitric oxide is oxidised, the equilibrium $NO+NO_2 \rightleftarrows N_2O_3$ exists, and that alkali absorbs nitrogen trioxide from such a mixture, so that towards alkali it behaves as though it consisted entirely of trioxide. It follows that mixtures of nitric oxide and nitrogen peroxide are much more rapidly and completely absorbed by alkali (as far as materials exist in them for the production of trioxide) than is pure nitrogen peroxide. —J. T. D.

Nitrosisulphonic acid of Raschig (Sabatier's nitrosodisulphonic acid) and the theory of the lead chamber process; The supposed ——. W. Manchot. Z. angew. Chem., 1910, **23**, 2113—2114.

Compounds of an exactly similar type to those formed by the union of ferrous sulphate and copper sulphate with nitric oxide (this J., 1910, 563, 1202) are formed from nitric oxide and other salts of iron and copper; it is therefore considered that the sulphate compounds cannot be regarded as salts of the blue acid obtained by reducing a mixture of sulphuric acid and dry sodium nitrite, and called by Raschig nitrosisulphonic acid (this J., 1905, 923), although this blue substance can be used as a source of nitric oxide for their production. This view is supported by the fact that no trace of the blue acid is formed directly from nitric oxide and sulphuric acid, even at the temperature of liquid air, although the gas is so readily absorbed in the presence of iron or copper; the somewhat high solubility of nitric oxide in sulphuric acid, with the development of a red colour, observed by Raschig, is not confirmed, and is considered due to the presence of iron in Raschig's acid. Raschig's formula for the blue substance, which is based mainly on a study of the supposed copper salt, and to which he has attached so much importance in developing his theory of the chamber process (*loc. cit.*), is rejected therefore, as also is that put forward by Sabatier (Comptes rend., **122**, 1417, 1479, 1537; **123**, 255), on similar grounds. The "purple acid," liable to be formed in the Gay Lussac tower, is regarded as merely a solution of the compound of nitric oxide with iron sulphate in sulphuric acid.—F. Sodn.

Waste sulphuric acid; Determination of organic matter in ——. R. Michel. Chem.-Zeit., 1910, **34**, 1210-1211.

Titration methods being unreliable owing to the nitrous and nitric acids present, the author proposes to oxidise in a closed space with potassium permanganate, and measure the carbon dioxide produced. The oxidation is carried out in a small flask closed with a ground stopper carrying a tap funnel and delivery tube. After the reaction all the gaseous contents of the flask are forced over into a gas burette and subjected to the action of concentrated potassium hydroxide. The contraction then gives the carbon dioxide produced, from which the amount of organic matter (chiefly resinous) is estimated on the assumption that it contains 75 per cent. of carbon. —W. H. P.

Chlorine in hydrochloric acid; Electrolytic determination of —— with the use of a silver anode and a mercury cathode. J. S. Goldbaum and E. F. Smith. J. Amer. Chem. Soc., 1910, **32**, 1468—1471.

Commenting on the failure of Gooch and Read to obtain satisfactory results by the electrolytic method (this J., 1910, 47), the authors point out that a mercury cathode was used in the original process, whereas Gooch and Read employed one of platinum. In the present investigation the anode consisted of a silver-plated disc of platinum gauze, the silver coating being in a porous condition favourable to the retention of the chlorine. Most of the determinations were conducted in a beaker 6 cm. in diameter and 8 cm. high, containing a layer of mercury 3 mm. deep. Cathode connection with the mercury was made by means of a platinum wire sealed into a glass tube. The total volume of the electrolyte was about 90 c.c., the quantity of chlorine present varying from about 0·07 to about 0·14 grm. The anode—situated at least 15 mm. above the surface of the mercury—was rotated at the rate of 300 revolutions per minute; the current was used at 2·5 to 5 volts, and the time occupied in the separate determinations varied from 20 to 35 minutes. At the conclusion of each experiment the anode was heated for 10 or 15 minutes, to a temperature of 300° C. in an electric oven, to effect the decomposition of the silver oxide formed by secondary reaction during the electrolysis. From the results obtained the authors conclude that the process is extremely accurate and reliable, and is, moreover, equally applicable to the determination of bromine in hydrobromic acid.—W. E. F. P.

Borax; Behaviour of —— towards zinc salts in aqueous solution. F. Borchers. Z. anorg. Chem., 1910, **68**, 269—291.

The precipitation of a cold saturated solution of borax by a zinc salt (sulphate or chloride) gives the best yield of zinc borate when the zinc solution is added to the borax solution, the borax being kept in slight excess, and the zinc solution being as strong as possible or the salt being added in the solid form; at the most, 38·6 per cent. of the borax is precipitated as zinc borate. With a supersaturated solution of borax or with solid borax, however, precipitates are obtained which contain up to 83 per cent. of the boric acid. The addition of excess of the precipitant is attended by a reduced yield, zinc borate being soluble in zinc sulphate solution, owing to the formation of complex salts, and, in fact, a sufficient excess of zinc sulphate prevents precipitation altogether. Other salts, especially sodium chloride, exert a considerable solvent action on zinc borate. Manganese chloride and sulphate behave very like the corresponding zinc salts. The addition of solid boric acid increases the number of polyborate ions and causes the borax present in solution and part of the added boric acid to be precipitated as zinc borate, but the introduction of hydroxyl ions by the addition of sodium hydroxide, brings about the precipitation of not more than 70 per cent. of the dissolved borax. By repeatedly removing the zinc borate precipitate and precipitating the filtrate again with zinc salt, after neutralising with sodium hydroxide, 94 per cent. of the borax may be separated from solution. In the presence of free carbonic acid, very small quantities of borate are precipitated from cold saturated solutions of borax, because in such solutions the boron corresponding to the carbon dioxide content must be present as free boric acid which does not react with zinc salts; results with sodium carbonate are not, therefore, as good as those with the equivalent quantity of sodium hydroxide. In borax solutions containing, besides sodium carbonate, other salts, such as sodium chloride or sulphate, an excess of zinc salt gives the largest quantity of borate precipitate.—F. Sodn.

Alums; Diffusion phenomena of the ——. C. L. Parsons and W. W. Evans. J. Amer. Chem. Soc., 1910, **32**, 1378—1383.

The authors show that, when dissolved in water, alums decompose into simple sulphates which may be separated by diffusion. The alums examined included those of ammonium-chromium, potassium-chromium, potassium-aluminium, ammonium-aluminium, and ferric-ammonium, and it was found that separation by diffusion was effected more readily with the chrome alums than with those containing aluminium.—W. E. F. P.

Barium (or strontium) nitrate and barium (or strontium) hydroxide; Solubility of —— in the presence of each other. C. L. Parsons, H. P. Corson, and C. L. Perkins. J. Amer. Chem. Soc., 1910, **32**, 1383—1389.

The solubility of the hydroxide in the corresponding nitrate solution was found to increase with the concentration of the latter, at the temperature at which the experiments were conducted (25° C.) For the barium salts, the isotherm obtained consisted of two distinct branches, the solid in equilibrium with any solution being the compound, $Ba(OH)_2,8H_2O$, on one branch and barium nitrate, $Ba(NO_3)_2$, on the other. A similar result was obtained in the case of the strontium salts, but the solubility of the nitrate was much greater, and the hydroxide much less, than that of the corresponding barium compounds. The authors therefore conclude that no basic nitrates of either metal exist at 25° C.

—W. E. F. P.

Great Salt Lake; Comparative analyses of water from ——. W. C. Ebaugh and W. MacFarlane. J. Ind. Eng. Chem., 1910, **2**, 454.

From 1900 to 1904 the level of Great Salt Lake sank so rapidly that fears of its extinction were expressed. Since that time a succession of rainy years has caused the level to rise, and fears of danger in the other direction are now entertained. The analyses published illustrate the variations in specific gravity and total solids for the last forty years. The annual variation shows a minimum in the spring and a maximum in the autumn. In October, 1903, the specific gravity was 1·2206, total solids 338·36 grms. per litre. In October, 1909, the figures were 1·1561 and 242·25.—W. H. P.

Lithium silicates. I. R. Rieke and K. Endell. Sprechsaal, 1910, **43**, 683—685.

The authors have plotted the cooling curves of molten mixtures of lithium carbonate and sand in order to determine what definite lithium silicates are formed. The curves show that a meta-silicate, Li_2O,SiO_2, is formed, which contains 66·7 per cent. of silica, and melts at 1180° C. This is 12° C. higher than the melting point recorded by R. C. Wallace (this J., 1909, 793), possibly because the melts in his experiments were made in a carbon tube, and the junction of the thermocouple was protected by a porcelain tube. It forms highly refractive, long, prismatic crystals, which exhibit strong double refraction. The compound resists the action of water much more than other alkali silicates. An ortho-silicate, $2Li_2O,SiO_2$, was also formed. It has a melting point of 1215° C., is much less resistant to water than the meta-silicate, and is rapidly decomposed by hydrochloric acid. Mixtures, intermediate in composition between the meta- and ortho-silicates, were examined and gave an eutectic, melting at 998° C. which had the composition, 57·5 per cent. of silica and 42·5 per cent. of lithia, corresponding with the formula $3Li_2O,2SiO_2$. Irregular polygons could be seen in thin flakes of this, but the typical eutectic structure was wanting. Mixtures containing a larger content of silica than the meta-silicate were tried, but with over 82 per cent. of silica the melts were too viscous to give crystallised products, and a large amount of quartz remained undissolved. These experiments, however, showed the possible existence of a lithium di-silicate, $Li_2O,2SiO_2$.—W. C. H.

Vanadic acid; The precipitation of —— as silver vanadate, and the determination of phosphoric and vanadic acids in the presence of one another. G. Edgar. Amer. Chem. J., 1910, **44**, 467—472.

If a neutral solution of pure sodium pyrovanadate be treated with excess of silver nitrate, the precipitate dissolved in ammonia, and the ammonia removed by boiling, the vanadium is precipitated quantitatively as silver orthovanadate on standing. A solution of pure sodium pyrovanadate previously acidified with acetic or nitric acid and similiarly treated gives an almost quantitative yield of silver pyrovanadate. After experiments to determine the effect of the presence of excess of acids and alkalis, the author gives the following general process for the estimation of vanadic acid:—The solution is acidified with nitric acid and boiled to expel carbon dioxide. Dilute sodium hydroxide is then added to the boiling solution until the yellow colour is discharged. An excess of standard silver nitrate solution is then added, the precipitate is dissolved in ammonium hydroxide, and the solution boiled until the odour of ammonia has disappeared, a few fragments of porous tile being added to prevent bumping. The solution is cooled and filtered through asbestos (or paper) and the filtrate is acidified with nitric acid and titrated with standard ammonium thiocyanate. The vanadic acid is calculated on the assumption that the precipitate is silver orthovanadate, Ag_3VO_4. In presence of phosphoric acid both acids are precipitated as silver ortho-salts and may be estimated together. The precipitated silver salts are subsequently transferred to the precipitation flask, dissolved in sulphuric acid and the vanadic acid determined oxidimetrically (see this J., 1908, 472; compare also this J., 1908, 838, 1057; 1909, 261, 493; and 1910, 1179).—B. G. McL.

Argon; Preparation of ——. G. Claude. Comptes rend., 1910, **151**, 752—753.

Oxygen obtained in the liquefaction of air forms a suitable material for the rapid preparation of argon. If the liquid contains over 95 per cent. of oxygen as in practice is invariably the case, its chief impurity is a large proportion of argon, the volatility of which is intermediate to that of oxygen and of nitrogen. Thus 96 per cent. oxygen normally contains more than 3 per cent. of argon. In order to separate the latter the oxygen may be absorbed by copper and the nitrogen by magnesium. For this purpose the author passes the gas through a copper tube (50 cm. long and 6 cm. in diameter), which is heated to a dull red heat by a group of four Bunsen burners. This tube is charged with 2·5 kilos. of reduced copper mixed with a little turnings to increase its absorptive capacity. The gas leaving this tube traverses an iron tube (40 cm. long and 3 cm. in diameter), containing magnesium powder, and heated to redness; and finally it passes through a heated silica tube (30 cm. by 2 cm.)

containing copper oxide, to absorb any hydrogen derived from the moisture in the copper or the oxygen. By means of this apparatus 3 litres of gaseous oxygen may be treated per minute, and from 4 to 6 litres of argon per hour obtained for two hours, or a total of 8 to 12 litres before the copper becomes spent. The copper may be regenerated with hydrogen in less than an hour and a half.—C. A. M.

Thorium sulphate; Basic ——. O. Hauser. Ber., 1910, **43**, 2776—2778.

The author and Wirth had shown previously to the appearance of Barré's paper (this J., 1910, 947), that Demarçay's basic salt was a mixture. The author now finds that the transformation described by Barré, which occurs so slowly at ordinary temperatures, takes place much more rapidly at 125° C., and that the salt, $ThO(SO_4),H_2O$, is stable between 125° and 180° C. He has not investigated the possible formation of other hydrates, but finds that the above salt is obtained pure by heating a solution of anhydrous thorium sulphate (1 part) in water (140 parts) for some hours to 160° C. Barré's results as to the existence at 100° C. of the salt, $ThO(SO_4),2H_2O$, have been confirmed by the author.
—J. T. D.

Sulphur industry in Sicily: Compulsory association of producers in the ——. Chem. Ind., 1910, **33**, 708—710.

Under the control of the "Consorzio obligatorio" which was established in 1906 (this J., 1909, 937, 1086; 1910, 624) the output of sulphur in Sicily has continued to be in excess of the demand, so that after three years the unsold stock had risen from 433,000 tons (metric) to 607,500 tons. The methods of the control have also proved unwieldy, whilst its functions were not clearly defined. Hence on June 30 of this year a new statute was passed and immediately came into force. The most important of its regulations were as follows:—As before, the Association includes all present and future owners and lessees of the Sicilian sulphur mines and shall continue for a further 12 years. The governing body of the Association may, if it thinks fit, allow the price of sulphur to be reduced, and especially when the sulphur is to be used in a new industry. In such cases guarantees are required as to the actual and final use of the consignment. This particularly applies to raw sulphur, the use of which in the manufacture of sulphuric acid has been recommended. If necessary, the Association may buy up the raw sulphur from the mines, at a price based upon the amount of sulphur that could be extracted from it by the methods in use. The sulphur produced is classified into four grades in accordance with its physical properties and degree of purity, and a normal price is fixed for each grade. It is strictly forbidden to place sulphur (in any form) either on rail or on board ship without a permit from the Association. New concessions of sulphur mines upon the island are only granted to such persons who show that they are in a position to work them properly, under skilled management. With the exception of the small quantity that is directly exported with a permit, the whole of the sulphur produced on the island must be delivered to the storehouses of the Association, and State assistance is given in the matter of transport from the mine. Advances may be made to the extent of four-fifths of the value of the total amount of sulphur deposited. The capital of the mine bank has been increased to 6 million lire, the additional 2 millions being provided free of interest by the State Treasury, to be repaid, with the other capital advanced, when taken over in the form of bonds by the merchants. Reductions in the provincial and local taxes are allowed to all owners and lessees of sulphur mines, as well as to all who make use of sulphur in home industries. With regard to the effect of this over-production of Sicilian sulphur upon the chemical industry of Germany, it is hardly to be expected that the price of the sulphur will be lowered to such an extent as to render large quantities available for use in Germany. It is suggested, however, that attention should be directed towards the establishment of chemical industries in Sicily itself or on the Italian coast. Both places offer advantages for the exportation of finished products, whilst on the other hand, Italy itself with its high protective tariff on certain articles and its still considerable importation of many others, presents a favourable ground for the establishment of factories for the production of inorganic products on a large scale.
—C. A. M.

Hydrogen: Delicate reaction for ——. C. Zenghelis. Z. anal. Chem., 1910, **49**, 729—732. (See also this J., 1896, 472; 1905, 153.)

A delicate test for hydrogen is based on the reduction of a molybdate solution by the gas in the presence of platinum or palladium. The gas to be tested must be freed from sulphuretted hydrogen and sulphur acids, by passing through sodium hydroxide solution. In the cold or with a very small quantity of the gas, the colour is a light greenish blue. The molybdate solution is made by dissolving 1 grm. of molybdenum trioxide in dilute sodium hydroxide solution, adding a slight excess of dilute hydrochloric acid and diluting to 200 c.c. with water. With palladium the reaction is more delicate but care must be taken that the molybdate solution contains the smallest possible quantity of free acid. To detect traces of hydrogen, the author uses a glass tube about 25 cm. long, open at one end and having a cock at the other, a small bulb being blown a little above the cock. Thin palladium gauze (or a film obtained by electrolysis) after ignition in a current of carbon dioxide, is placed in the bulb. Carbon dioxide is then passed through the tube, the cock closed and the tube dipped in water; the cock is re-opened and the tube gradually lowered until the water nearly reaches the bulb. The gas to be tested is then introduced from below, and the palladium heated by a small flame to 80°—120° C. The occlusion of the gas by the metal is facilitated by raising and lowering the tube a little for a few minutes. When cold, the palladium is taken out and warmed with a few drops of the molybdate. 0·5 c.c. of hydrogen gives an intense blue, and a single bubble (less than 0·00001 grm.) gives a light blue colouration. Hydrogen phosphide and arsenide must be removed previously by silver nitrate solution, and carbon monoxide with cuprous chloride. Methane, ethylene, and acetylene, freed from hydrogen by passing through three such tubes, do not give the reaction.—A. Sbld.

Charcoal: Adsorption of gases by ——. A. Titoff. Z. physik. Chem., 1910, **74**, 641—678. (See also Homfray, this J., 1910, 1055.)

The author has studied the adsorption of the gases hydrogen, nitrogen, carbon dioxide, and ammonia, using comparatively large quantities (up to 35 grms.) of pure gas-free cocoanut charcoal. The temperatures varied from −79° to +151·5° C., and the pressures from 0 to about 77 cm. of mercury. The results are given in tables and the relations illustrated by isothermal and isobaric curves. Direct determination was also made of the heat of adsorption in the case of nitrogen, carbon dioxide, and ammonia. Mathematical expressions are deduced which agree well with both the amount of adsorption and of heat evolution under varying conditions. Hydrogen, the gas which is adsorbed in least quantity, appears to obey Henry's law for a considerable range of temperature (−80° C. to +80° C.). The author prefers a surface condensation theory as an explanation of the phenomena, and consequently he uses the term adsorption, rather than absorption, which would seem to suggest ordinary solution.
—W. H. P.

British radium. Brit. and Col. Drug., Oct. 21, 1910, 333.

According to Sir W. Ramsay the Trenwith Mine, in Cornwall, has already yielded some 5000 mgrms. of radium product, containing 10 per cent. of pure radium bromide, being the first extracted in Great Britain from British ore. Polonium and actinium also exist in the concentrates of the pitchblende from the Cornish mines.

Pyritic smelting and sulphuric acid manufacture. Falding and Channing. *See* X.

Solubility of lead sulphate and chromate alone, and in the form of oil colours, in dilute hydrochloric acid, and equilibrium of chromate and bichromate in solution. Beck and Stegmuller. *See* XIXB.

Colorimetric determination of hydrogen cyanide. Chapman. *See* XXIII.

Detection and determination of arsenic acid in presence of arsenious acid by magnesia mixture. Brunnich and Smith. *See* XXIII.

East African soda deposits. Times Fin. and Comm. Suppl., Nov. 18, 1910. [T.R.]

The following details concerning the great soda deposits at Lake Magadi have been received as the result of an expedition which, at the end of last year, went to survey the route for a line to connect the lake with the Uganda Railway. Lake Magadi lies due north and south, between parallels 1° 40′ and 2° south latitude and roughly upon the meridian 36° 17′ of east longitude. The southern extremity is about 15 miles from the frontier of German East Africa. What in the case of an ordinary lake would be water consists at Magadi of a solid deposit of soda, with a hard surface looking like pink marble. During the wet season, which in this region is very short, the surface is covered with a few inches of water, but immediately afterwards it becomes dry, with the exception of a margin about 30 yards wide. Even during the wet season, however, the amount of water on the surface in no way hinders the working of the deposit. For many years Indians from Nairobi, who use the soda, have been removing it from the lake without regard to the season. The deposit, the area of which is about 30 square miles, is divided into several distinct horizontal layers, of which the top layer is about 10 inches thick. When a block of soda is removed the mother liquor rises to the surface level and immediately begins to form a fresh crust. The Indians say that the crystalline mass is re-formed so rapidly that they work the same spots year after year. Confirmation of this was found on examining several poles which they had been using to break up the soda and had left in the holes thus made. These poles were firmly set in a solid mass of crystals which had formed round them, and which proved on examination to be of the same composition as the permanent deposit. There are good reasons for assuming that the deposit extends in a solid mass to the full depth of the valley. A bore-hole sunk to a depth of 9 ft. passed through a continuous mass of crystalline soda. Assuming only a uniform depth of 9 ft. all through the deposit, it is estimated that this would represent about 200,000,000 tons. It is not proposed, however, to remove more than the upper layers, which alone contain many millions of tons, and which are easily separable from those beneath. The physical and chemical characteristics of the soda are uniform over the whole surface of the deposit. The crystalline mass cleaves readily into blocks, from which the mother liquor drains rapidly, leaving a friable lump of crystals. It contains 43·55 per cent. of sodium carbonate and 40·41 per cent. of sodium bicarbonate. The total amount of soda present, calculated as Na_2O, amounts to 40·38 per cent., which upon the calcined product would amount to 58·08 per cent. soda (Na_2O) or 99·3 per cent. dry soda ash. The absence of sulphate of soda enables the calcined Magadi soda to be economically employed in the manufacture of soda crystals and caustic soda.

In order to facilitate the development of the soda industry, the Government of the East Africa Protectorate will, under certain conditions, grant land for the construction of a railway connecting the "lake" with the Uganda Railway at or near Kin or Sultan Hamond and for a port at or near Kilindini. This railway, the route for which has now been thoroughly surveyed, is said to present no very serious engineering difficulties. When it is finished it will become a feeder to the Uganda Railway.

Patents.

Arsenical sulphuric acid; Purification of ——. J. Raschen, C. S. Imison, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 30,196, Dec. 24, 1909.

The process is based upon the fact that in the presence of a suitable quantity of hydrochloric acid, any compounds of quinquevalent arsenic contained in sulphuric acid react to form arsenious chloride and chlorine. Hydrochloric acid, in quantity equivalent to the arsenic present, that is, three equivalents for each equivalent of trivalent arsenic and five equivalents for each equivalent of quinquevalent arsenic, together with such an excess as may be necessary to cover working losses, is added to the sulphuric acid to be purified, and, at the same time, such conditions are maintained that the liberated chlorine escapes, whilst the arsenious chloride all remains in the acid, to be removed by blowing with air, as described in Eng. Pat. 7916 of 1905 (this J., 1906, 477), or in other suitable manner. The preferred conditions are a sufficiently prolonged contact of the sulphuric acid with hydrochloric acid gas, for example, in a tower packed with suitable material, and the maintenance of a temperature as nearly atmospheric as possible, such that the chlorine, which is comparatively insoluble, can alone escape.—F. Sodn.

Nitric acid; Apparatus for the manufacture of ——. K. Soderman. Fr. Pat. 416,036, Feb. 21, 1910.

A spiral tube of platinum or other resistant material, enclosed in a furnace in which a mixture of gas and air is burnt, serves for the passage of a mixture of oxygen and nitrogen, which thus becomes heated to about 1400° C., and a horizontal extension, surrounded by a burning mixture of a hydrocarbon or alcohol vapour and air enriched with oxygen, effects a further rise of temperature to 2000° C. The extension leads the gases into a sheet-iron reaction pipe, slightly inclined downwards in the direction of the current and completely immersed in a basic solution (*e.g.*, of lime) contained in a reservoir, and on entering this pipe the temperature is increased to 2400°—2600° C., either by introducing a little acetylene or by means of an electric arc. In the upper surface of the pipe are a number of holes through which the solution can enter in a pulverised state, and, by means of a lever, these may be opened at will, so as to admit a shower of the absorbent liquid, in order suddenly to cool the gases after the reaction, an opening above allowing the flame to be examined with a view to regulating the process. A receiver is situated at the lower end of the reaction pipe, and the solution of nitrate, formed in the pipe, passes into this and is pumped back into the reservoir, to be used again until sufficiently concentrated. —F. Sodn.

Nitric acid; Process for obtaining —— *from nitrogen peroxide, water, and oxygen.* K. B. von Vietinghoff-Scheel. Ger. Pat. 225,706, Dec. 18, 1908.

By the interaction of nitrogen peroxide, water and oxygen under pressure, nitric acid of a higher degree of concentration can be obtained than by the usual method.—A. S.

Nitrogen-oxygen compounds; Method of making ——. K. Kaiser, Wilmersdorf, Germany. Eng. Pat. 20,325, Aug. 31, 1910. Under Int. Conv., Aug. 31, 1909.

A mixture of ammonia and previously heated air is passed over a heated contact substance, the air being heated preferably to 300°—400° C. by passing through a heated tube of quartz or other suitable material; ammonia is made to enter this tube through a side branch in front of the heated portion, and the mixed gases then pass through a fine platinum net which is kept heated in the fore part of the tube.—F. Sodn.

Compounds containing oxygen and nitrogen; Production of —— *by electrical means.* P. Bunet and A. Badin. Second Addition, dated Aug. 10, 1909, to Fr. Pat. 402,012, Aug. 17, 1908 (this J., 1909, 1198).

In conjunction with the modification described in the First Addition (this J., 1910, 1212), the gases are made to pass through an apparatus, in which they are subjected to the silent electric discharge, so as to oxidise nitrous compounds to nitric acid.—F. Sodn.

Nitrogen and oxygen at high temperature; Process and apparatus for the fixation of ——. Soc. l'Air Liquide (Soc. Anon. pour l'Étude et l'Exploit. des Proc. G. Claude). Fr. Pat. 416,557, Aug. 9, 1909.

A mixture of nitrogen and oxygen is strongly heated under pressure, and is then allowed suddenly to expand, so as to effect rapid cooling, which may be accelerated by the addition of air or of previously cooled reaction gases. A suitable apparatus for the purpose consists of a gas-tight metallic cylinder, in the centre of which is a thin-walled tubular reaction chamber of magnesia or other infusible and unoxidisable material, held loosely in place by rings attached to the ends of the cylinder, and means may be provided for cooling the end walls by the circulation of water. The mixed compressed gases pass through the tube and escape at the further end through an orifice which may also constitute the orifice of a Giffard's injector, thus allowing a large proportion of air or of the cooled reaction product to mix with the expanding gases. The annular space between the reaction chamber and the envelope is filled with powdered magnesia or other appropriate infusible material, and the reaction chamber is not made gas-tight with respect to the envelope. The heating may be effected electrically or by combustion, and the jet through which the gases escape is kept sufficiently hot to maintain the gases as nearly as possible at their maximum temperature until the moment of expansion.—F. Sodn.

Nitric oxide; Process for the production of —— *by means of electric arcs.* Badische Anilin und Soda Fabrik. Ger. Pat. 227,012, July 22, 1908.

An arc is produced by means of continuous current between a hot cathode and a cooled hollow anode, through which the reaction products are withdrawn. The pressure in the apparatus is preferably kept at about 500 mm. of mercury. The distance between the electrodes and the energy supplied per unit of electrode-surface are kept so small that, owing to heat conduction, a relatively cool arc is produced. It is stated that with this apparatus it is possible to obtain moderate concentrations of nitric oxide with very good current-yields, or with smaller current-yields, very high concentrations of nitric oxide. (See Morden, this J., 1909, 529.)—A. S.

Ammonia or other nitrogen-hydrogen binary compounds, or alkyl ammonia, or ammonia bases; Process of making ——. H. S. Blackmore, Mount Vernon, N.Y., Assignor to R. E. Robinson and D. C. Spruance, New York. U.S. Pats. 974,633, 974,741, and 974,742, Nov. 1, 1910.

Energy is supplied (*e.g.*, electrically) to a mixture of nitrogen and hydrogen or to non-oxidising substances, containing nitrogen and hydrogen, "in a yielding state," in the presence of a substance capable of uniting with ammonia or with ammoniacal substances, and in a non-oxidising atmosphere, preferably under pressure; the union may be augmented by means of a contact substance, such as mercury.—F. Sodn.

Ammonia; Process for the production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 416,877, May 13, 1910. Under Int. Conv., June 14, 1909.

Nitrogen and hydrogen, preferably under a high pressure (such as 100—200 atmos.), and free from moisture and impurities giving rise to it, are made to combine under the influence of uranium as a catalyst, the uranium being employed as metal, or as an alloy (*e.g.*, with manganese), or as nitride, or in other form. The catalyst may also be used mixed with indifferent substances or with other catalysts, or it may be converted into the desired form in the course of the process, as by the use of uranium carbide, for instance, which is converted into a very active form of uranium nitride by the mixed gases. —F. Sodn.

Ammonium chloride; Manufacture of —— *from ammonium sulphate and sodium chloride.* F. A. Freeth, Great Crosby, Lancs., and H. E. Cocksedge, London. Eng. Pat. 86, Jan. 1, 1910.

Equivalent quantities of ammonium sulphate and sodium chloride are allowed to interact in the presence of a "nucleus solution," which contains ammonium chloride, sodium sulphate, and sodium chloride in definite proportions, these proportions, however, varying with the temperature, at which the reaction is carried out. This temperature is always below 100° C., and the conditions are such that the addition of the products of interaction to the "nucleus solution" causes the precipitation of sodium sulphate, which is then removed from the solution. The residual liquid is then cooled with constant stirring until ammonium chloride (but no further quantity of sodium sulphate) separates out. By washing the respective precipitates of sodium sulphate and ammonium chloride free from adhering mother-liquor, thus compensating the solution for loss of water due to evaporation, the mother-liquor remaining after separation of the ammonium chloride is in the same state of chemical equilibrium as the "nucleus solution" first prepared, and ready for the next charge of raw materials.—O. R.

Ammonium carbonate; Manufacture of ——. J. Bueb and Deutsche-Continental-Gas Ges., Dessau, Germany. Eng. Pat. 9177, April 15, 1910.

Gaseous ammonia, carbon dioxide, and steam, in about the proportions in which they exist in sublimed ammonium carbonate, are heated separately to a temperature above that at which ammonium carbonate can be produced, and, after being mixed by passing through a tube of small bore, are led into a subliming chamber which is cooled from the outside and has suspended or supported therein hollow plates or the like which are cooled internally. The formation of solid ammonium carbonate takes place immediately the gases become cooled below 60° C., the salt being deposited in thick crusts on the walls and cooling surfaces. The quantity of steam to be used is inversely proportional to the required ammonia content of the salt, which may be varied from about 20—40 per cent., carbon dioxide remaining practically constant at about 50 per cent. The process may be advantageously applied to the production of ammonium carbonate from ammonia and carbon dioxide, isolated separately, from the ammoniacal liquors of gas works.—F. Sodn.

Sulphate of ammonia from moist gases; Process and apparatus for the manufacture of ——. F. J. Collin, Dortmund, Germany. Eng. Pat. 16,193, July 6, 1910.

The essential features of the process are that the saturator is heated from the outside and that the mother liquor which is returned from the drip table and centrifugal machine is re-heated and concentrated before its return to the saturator, so that the carbonisation gases may be cooled to remove tar, without dilution of the saturation bath. For this purpose, the saturator may be surrounded by an outer jacket, through which hot gases or air are passed, such gases being, if desired, subsequently treated in the saturator. The jacket is subdivided horizontally or spirally, and the hot gases pass in at the top, so that the zone in which the separation of ammonium sulphate takes place is heated first. A steam injector removes the ammonium sulphate to a drip table, and the mother liquor, returning to the saturator, passes first through an evaporating trough which surrounds the saturator over the top of the heating jacket.—F. Sodn.

Carbon dioxide; Apparatus for moulding solid —— [*into sticks, etc.*]. H. V. R. Read, London. Eng. Pat. 27,576, Nov. 26, 1909.

Carbon dioxide snow is prepared in a perforated cylinder lined with a porous fabric, the cylinder being easily attachable to and detachable from the container of the compressed or liquid gas. The lower end of the cylinder is connected by way of a conical funnel with a mould, which can be opened or closed by means of a cap. When the cylinder contains enough carbon dioxide snow, it is removed from its attachments to the carbon dioxide container, and the snow is forced through the funnel into the mould, from which the stick of solid carbon dioxide can be withdrawn by removing the cap.—O. R.

Lime-water ; Process for producing saturated ——. H. H. Sutro, New York. U.S. Pat. 973,992, Oct. 25, 1910.

Water is treated in a saturator with an excess of lime, and the sludge, containing lime, from this treatment, is transferred to another saturator, in which it is treated with a further quantity of water, so as to dissolve the remaining lime ; the partially saturated water from this vessel is then treated with an excess of fresh lime in the former saturator, the exhausted sludge being finally discharged.—F. Sodn.

Hydrogen peroxide ; Stable mixture for producing ——. R. Grüter and H. Pohl, Assignors to Chem. Werke vorm. Dr. H. Byk, Charlottenburg, Germany. U.S. Pats. 975,129, 975,353, and 975,354, Nov. 8, 1910.

See Fr. Pat. 401,911 of 1909 ; this J., 1909, 1198. Sugar, or salts having disinfecting and astringent properties, may be added to the mixture.—T. F. B.

Alkali peroxide in a permanent form ; Process of manufacture of a hard and dense composition containing an ——. Soc. Anon. ci-dev. Stolz et Kambli. Fr. Pat. 416,145, May 20, 1910.

An alkali peroxide, such as sodium peroxide (40 parts), is incorporated with a fused, anhydrous, and readily fusible inorganic material, for example, potassium nitrate (12 parts) or a mixture of nitrates, so as to give, on cooling, a compact, dense product which, when immersed in water, sinks and generates hydrogen peroxide slowly and regularly, without any danger of explosion, even with boiling water. The composition may be cast into moulds and then coated with a substance, such as resin or stearic acid, which will form a soap with the alkali liberated by the action of water ; or, if a neutral or acid bath is required, the material may be dipped into molten nitrate, to which an acid substance, such as potassium bisulphate, has been added.—F. Sodn.

Carbonic acid from gaseous mixtures containing it ; Process of separating ——. E. A. and J. G. Behrens. Fr. Pat. 416,489, May 28, 1910.

The process consists in subjecting the highly compressed gaseous mixture to a low temperature, so as to liquefy part of the carbon dioxide, and bringing the remaining gas into contact with a liquid, such as alcohol, which absorbs the residual carbon dioxide ; this is then separated from the solvent by reduction of pressure and is returned to the compressor to enrich the mixture. In the apparatus described, the compressed gas passes down a coil surrounded by alcohol at −65° C., and the carbon dioxide thus liquefied is removed ; the remaining gas, still under pressure, is then made to travel upwards, in a spiral path, through a cylinder, in which it meets a descending stream of cold alcohol. The gas is next freed from suspended particles of alcohol, by means of baffle-plates, and is allowed to expand in a turbine which helps to drive the compressor, the very cold expanded gas being utilised subsequently in cooling the alcohol. The refrigerating and the absorbing alcohol each follow a closed circuit ; the former passes continuously from the top of the cylinder containing the refrigerating coil to a jacket surrounding the absorption cylinder, in which it is cooled by a coil receiving the expanded gas and by another coil connected with an ammonia machine, and is then pumped back to the bottom of the first vessel ; the latter passes out from the bottom of the absorption cylinder, through a valve, to a vessel in which the pressure is normal, and the carbon dioxide is thus liberated, the alcohol being pumped again to the top of the absorption cylinder.
—F. Sodn.

Silicates of sodium (known also as soluble glass) ; Process for the preparation and solution of ——. V. F. Valentin. Fr. Pat. 416,572, May 23, 1910. Under Int. Conv., May 24, 1909.

Finely powdered crystallised sodium silicate is mixed with sodium carbonate, and the preparation is dissolved, when required for use, by boiling with water ; the proportion of sodium carbonate is varied according to the product to be obtained.—F. Sodn.

Sodium nitrate contained in clays or schists ; Extraction of ——. P. Duvieusart. Fr. Pat. 416,915, June 9, 1910.

Schists or clays are subjected to the action of water or a solution of sodium chloride or other salt capable of coagulating clay, until the mass assumes a sandy (*graveleuse*) appearance (which may take a fortnight or more), and the aqueous extract is then concentrated, preferably by boiling, so as to obtain a hot saturated solution of sodium nitrate and eliminate much of the sodium chloride and sulphate ; the solution is finally cooled to 35° C., when sodium nitrate of 95 per cent. purity is precipitated. The process is intended to be applied specially to the treatment of the cretaceous deposits of Egypt, particularly the Esna schists.—F. Sodn.

[*Calcium cyanamide*] ; *Process and electric furnace for the continuous preparation of nitrogen compounds* —— *by means of alkaline-earth carbides and nitrogen.* O. F. Carlson. Fr. Pat. 417,054, June 11, 1910.

The powdered carbide, which may be mixed, if desired, with fluorides or other substances, is continuously introduced, either cold or in a preheated state, into a closed air-tight furnace, in which the material is heated by electrical means and is induced to descend from stage to stage by periodical agitation, thereby causing its intimate and systematic contact with nitrogen which is regularly admitted ; the nitrogen may also be heated beforehand and under pressure. To this end, the furnace may be provided with a number of superposed floors, attached alternately to opposite walls, and scrapers, actuated mechanically from without through stuffing-boxes in the walls, being employed to cause the material to move periodically from floor to floor, these scrapers, during the intervals of repose, resting in comparatively cool chambers, arranged in the furnace walls at the end of each floor. The material is introduced through a hopper at the top of the furnace, constructed so as to prevent any escape or entry of gas during the operation, and, from the bottom floor, the cyanamide drops into a waggon in a closed passage, below the furnace proper. The furnace may be heated electrically by means of resistances disposed at appropriate points in the walls or by means of electrodes placed above the floors (in either case replaceable without interrupting the working), and it is preferred to provide a relatively lofty space, fitted with resistances or electrodes, between the top floor and the hopper, so as to heat the material sufficiently to start the reaction at this point.
—F. Sodn.

Contact substance for catalytic reactions. O. Niedenführ. Ger. Pat. 225,705, July 31, 1908.

A hollow, perforated metal support is coated with platinum electrolytically or otherwise.—A. S.

Lead in the form of oxide or sulphate ; Process for the extraction of —— *from impure products.* H. Hof and B. Rinck. Ger. Pat. 227,389, Oct. 13, 1909.

The material containing lead oxide or sulphate is boiled with a concentrated solution of an alkaline-earth chloride, preferably the final magnesium chloride liquor from the manufacture of potassium salts ; a soluble double chloride of lead and magnesium is thus formed. When the process is applied to the sludge from lead sulphuric acid chambers, the selenium present accumulates in the insoluble residue and subsequently can be easily recovered, free from lead, by known methods. (See also this J., 1910, 501.)—A. S.

Manganese dioxide, chromium dioxide, and lead dioxide in stable, colloidal form ; Process for obtaining preparations containing ——. Chem. Fabr. von Heyden. Ger. Pat. 227,491, May 22, 1909.

Aqueous solutions of permanganates, manganates, or bichromates are reduced, or aqueous solutions of lead salts are oxidised, in presence of gum arabic, starch, or other colloidalising substance of mild action: the resulting solutions of colloidal manganese, chromium, or lead dioxide can be evaporated or precipitated by alcohol, etc., to produce solid, soluble, colloidal preparations of the oxides. Both the solutions and the solid preparations are stable. Colloidal solutions of the oxides are obtained by reduction or oxidation of the above named salts, respectively, in presence of powerful colloidalising albuminoid substances, tannin, etc., but they are unstable; from the solution of manganese dioxide for instance, the insoluble dioxide is precipitated on warming.—T. F. B.

Sodium cyanide; Process for preparing ——. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Rössler. Ger. Pat. 227,780, April 19, 1910. Addition to Ger. Pat. 223,027, Aug. 19, 1909 (see this J., 1910, 1157).

Trimethylamine is passed into molten sodium, and the carbon which separates is removed by subsequently passing ammonia into the melt, with or without addition of a further quantity of sodium.—T. F. B.

Thorium hydroxide; Process for the preparation of colloidal ——. Kreidl und Heller. Ger. Pat. 228,203, July 10, 1909.

Thorium hydroxide precipitated from a solution of a thorium salt by means of the equivalent quantity of alkali or ammonia, and well washed, is converted into the colloidal condition by warming, preferably in presence of water. If an excess of alkali be used, the precipitated hydroxide cannot be converted into the colloidal form by warming. The colloidal hydroxide is soluble in water, forming an opalescent solution, which yields a horny mass on evaporation to dryness.—A. S.

Oxygen and hydrogen; Electrolytic apparatus for the production of pure ——. R. Eycken, C. Leroy, and R. Moritz, Wasquehal, France. Eng. Pat. 24,716, Oct. 27, 1909. Under Int. Conv., Dec. 9, 1908.

See Fr. Pat. 397,319 of 1908; this J., 1909, 799.—T. F. B.

Sodium cyanide; Manufacture of ——. G. W. Johnson, London. From Deutsche Gold- und Silber-Scheide-Anstalt vorm. Roessler, Frankfort on Maine, Germany. Eng. Pat. 9375, April 18, 1910.

See Ger. Pat. 223,027 of 1909; this J., 1910, 1157.—T.F.B.

Sodium cyanide; Process for preparing ——. Deutsche Gold- und Silber-Scheide-Anstalt vorm. Rössler. Fr. Pat. 417,110, June 13, 1910. Under Int. Conv., Aug. 19, 1909, and April 18, 1910.

See Ger. Pats. 223,027 and 227,780; this J., 1910, 1157, and preceding.—T. F. B.

Nitrogen; Process of oxidising —— *by means of electric discharges.* K. Kaiser, Wilmersdorf, Germany. Eng. Pat. 12,229, May 18, 1910. Under Int. Conv., May 19, 1909

See Fr. Pat. 415,976 of 1910; this J., 1910, 1306.—T.F.B

Alkali nitrates and alkaline earth nitrates; Manufacture of ——. P. A. Guye and C. Darier, Geneva, Switzerland. Eng. Pat. 15,525, June 28, 1910. Under Int. Conv., July 5, 1909.

See Fr. Pat. 415,143 of 1909; this J., 1910, 1306.—T. F. B.

Salt; Process of refining ——. C. Glaser and G. J. Muller, Baltimore, U.S.A. Eng. Pat. 18,311 of 1910, dated Dec. 7, 1909.

See U.S. Pat. 957,417 of 1910; this J., 1910, 756.—T.F.B.

Barium hydroxide; Process of making anhydrous ——. C. Rollin, Assignor to Hedworth Barium Co., Ltd., Newcastle-on-Tyne. U.S. Pat. 974,993, Nov. 8, 1910.

See Eng. Pat. 27,587 of 1908; this J., 1910, 151.—T. F. B.

Calcium carbide; Treatment of ——. C. C. Wakefield, London. U.S. Pat. 975,306, Nov. 8, 1910.

See Eng. Pat. 1424 of 1909; this J., 1910, 227.—T. F. B.

Stannic chloride from stannic oxide; Process and apparatus for making anhydrous ——. R. Steiger. Fr. Pat. 416,061, April 13, 1910. Under Int. Conv., May 1, 1909.

See Ger. Pat. 222,838 of 1909; this J., 1910, 879.—T. F. B.

Nitrous and nitric acids, nitrates and nitrites, or sulphonitrates and sulphonitrites of calcium, sodium, or, potassium; Manufacture of ——. J. Price. Fr. Pat. 416,224, April 29, 1910. Under Int. Conv., April 29, 1909.

See Eng. Pat. 10,164 of 1909; this J., 1910, 1104.—T. F. B.

Nitric acid; Process for concentrating ——. E. Brauer. Fr. Pat. 417,166, June 15, 1910. Under Int. Conv., June 16, 1909.

See Ger. Pat. 222,680 of 1909; this J., 1910, 879.—T. F. B.

Iron pickling liquors and gas liquor; Process for recovering useful products from ——. F. J. Falding and W. R. Cathcart. Fr. Pat. 416,291, May 24, 1910.

See U.S. Pats. 961,763 and 961,764 of 1910; this J., 1910, 871.—T. F. B.

Sulphuric acid from gases from pyrites burners; Process for making ——. J. P. Channing. Fr. Pat. 416,988, May 26, 1910.

See U.S. Pat. 962,493 of 1910; this J., 1910, 960.—T.F.B.

VIII.—GLASS; CERAMICS.

Drying plants for clay and clay products. R. Grünhut. Trans. Eng. Ceram. Soc., 1909—1910, **9**, 227—239.

The best drying temperatures for clay are between 100° and 180° F. Much depends on the size, thickness and shape of the ware, and still more on the nature of the clay. Fat plastic clays require slower drying and lower temperatures than gritty sandy porous clays. The grain of the clay is also important, coarse-grained materials being less sensitive. The process of manufacture must be regarded, as process-made and repressed bricks have their pores closed up by oil and require longer drying than wire-cut bricks. Clay ground in a ball mill will take longer to dry than pan-ground clay, as in the first case the clay particles are round, whilst in the second they are more like edged splinters with plenty of space between them. Very colloidal clays, which may contain 30 per cent. of water, present the greatest difficulty in drying. The drying apparatus may be any of the following:—hot floors, drying towers, rotary drums, ventilating plants, chamber dryers, progressive or tunnel dryers. The material either rests or travels, and the drying air may travel in the same direction or oppositely or transversely. Hot floors are extravagant and nearly obsolete. Drying towers are used more in the cement than in the clay industry. Rotary drums show a high degree of efficiency, as much as 86 per cent. Ventilating plants should be built all on one floor, where ground is available, to save lifting and lowering the goods. It is said that 1000 bricks can be handled and dried for about 8d. in a good ventilating plant. In chamber dryers the air is passed through repeatedly till saturated with moisture, and moist air is used for drying, so that no premature surface drying occurs, which is of importance in terracotta. The efficiency of the plant is increased by using an air condenser as the source of heat, and the same may be said of tunnel-dryers, which vary in length from 60 to 175 feet. In these the goods are put on trolleys and travel from the cold to the hot end, the heating apparatus consisting of steam radiators or pipes carrying fire gases.—H. H. S.

Vitrification of clays; Speed of ——. J. W. Mellor. Trans. Eng. Ceram. Soc., 1909—1910, **9**, 79—91.

The author lays stress on the importance of recognising vitrification as a time reaction, the velocity of which is accelerated by rise of temperature, and consequently that the softening temperatures of clays cannot be compared unless the rate of rise of temperature be the same in all cases. Neglect of this precaution is probably the cause of the frequent discrepancies between the results obtained with "trials" in a muffle, where the maximum temperature is attained in a comparatively short time, and with the same materials in the oven on the large scale where the heating is much more gradual. Assuming that the rate of change in a clay or body subjected to successive firings follows a law analogous to that which holds for bimolecular reactions, and that the contraction is a measure of the change, the author deduces the formula: $x = \frac{a^2kt}{1 + akt}$ where x is the contraction after any number of firings, t; a is the maximum contraction after an indefinite number of firings, and k is a constant, and shows that in the case of a bone china (cast) fired in a glost oven to between cones 01 and 1 (1130°—1150° C.) for approximately 20 hours each firing, the observed and calculated contractions agreed well. The equation mentioned may, it is stated, be taken as representing "a provisional law" of contraction of, say, a firebrick, when fired time after time in a furnace.

In the preparation of chrome tin pink uniform results can only be obtained by carrying the reaction as near completion as possible. Rodgers and Mellor (this J., 1905, 1305) found that for a stain of a given composition, the colour is independent of the source of the chromium, and it is suggested that the different results obtained by Purdy and Brown (this J., 1909, 1129) were due to the fact that under the conditions used by the latter authors, the reaction was incomplete. When a mixture of a suitable chromium compound and stannic oxide is heated, chromium oxide is volatilised and absorbed or adsorbed by stannic oxide to give the "pink," which has been shown by Petrik to consist probably of a kind of lake of very finely divided chromium oxide and stannic oxide. The speed of volatilisation may vary according to the nature of the chromium compound, but if the calcined mixture be washed, ground, and re-calcined a number of times, the final product is the same in all cases, provided the ultimate composition be constant.—A. S.

"*Spit-out*"; *Discussion on* ——. Trans. Eng. Ceram. Soc., 1909—1910, **9**, 1—16. (See Moore and Mellor, this J., 1909, 474.)

General agreement obtained in the discussion that "spitting" was a body, and not a glaze, effect. W. Jackson disagreed with the authors that fritted lead glazes were more subject to blister than those made with raw lead. White lead would be more liable to absorb sulphur trioxide from the combustion gases than lead bisilicate, and the sulphur oxides would be evolved at a higher temperature when combination with silica began, thereby causing blistering. He opined that quite 95 per cent. of spitting was due to the body. Unsorted biscuit was liable to cause the phenomenon, especially old ware; but if a piece be broken in two or glazed on one side only, it will not "spit." J. G. Roberts stated with regard to the presence and combustion of organic matter in the body as a source of failure that it would be no less difficult for the air necessary for combustion to enter the pores of the body than for the carbon dioxide formed to escape. He thought that the carbon had occluded many times its own volume of air before combustion; hence the greater liability of old ware to spit. L. L. Grimwade testified to the efficacy of prolonging the firing in the biscuit between 700° and 900° C., but remarked on its difficulty. Other speakers agreed with Jackson that the shape of the biscuit was of importance. J. W. Mellor appends a note taken from an official German report on the action of water on glass, as being connected with the subject. The glass gives up some of its alkalis, and water is absorbed by the silica which undergoes molecular changes. Most of the absorbed water is driven off at 100°, the rest at 500° C. If the glass be heated rapidly between 200° and 500° C., water escapes in small bubbles and the glass turns white, but does not peel (this J., 1899, 832; 1900, 246; 1908, 899).—H. H. S.

Porcelain; Black colour effects in —— *by means of carbon.* H. Fleisner. Sprechsaal, 1910, **43**, 667—670.

A study of the silicate slags resulting from metallurgical operations is often of importance to the ceramist. The author concluded from experiments on blast-furnace slags (see this J., 1910, 760) that the black coloration often visible in these were due to carbon and he produced the colour artificially by heating a slag of the composition:—silica, 40; alumina, 23; and lime, 37 per cent., in a porcelain crucible packed in charcoal. As the glaze of the porcelain was also stained in the same way, deliberate attempts were made to produce the colour effects in porcelain by firing in closed muffles packed with charcoal. The "carbon" glazes are said to be successful and the effect is attributed to the adsorption of carbon monoxide by the glaze and its subsequent decomposition into carbon and carbon dioxide at a lower temperature. —H. H. S.

Glaze construction; volume relationships. A. J. Hopkins. Trans. Eng. Ceram. Soc., 1909—1910, **9**, 120—125.

The theory is advanced that the behaviour of a glaze, especially with regard to crazing, depends on the atomic volumes of the bases if the alumina and silica be kept constant. The atomic volumes of zinc, sodium, calcium, barium and potassium are 9, 24, 28, 37, and 47 respectively, and this is said to be the same order with regard to crazing, potassium being the most troublesome element in that respect. The author conceives of a varying strain caused by the elements of different atomic volume combining with oxygen of the fixed volume 14·3, and to this "oxygen strain" he attributes the behaviour of glazes with regard to crazing. In the subsequent discussion it was pointed out that copper has an atomic volume less than zinc and should therefore, according to this theory, be less liable to cause crazing, which does not agree with practice. The author's series, also, is not in accord with Damour's experimental results, which gave the series $ZnO.PbO.CuO.CaO.BaO.Na_2O$, nor with Hovestadt's on glass which is $ZnO.PbO.BaO.CaO.K_2O.Na_2O$.—H. H. S.

Fritted lead glazes; Toxic possibilities of ——. W. Thomason. Trans. Eng. Ceram. Soc., 1909—1910, **9**, 198—208.

The Home Office method for testing the solubility of the lead compounds in a glaze is to extract the glaze in the cold for one hour with 0·25 per cent. hydrochloric acid, and the author attempted to ascertain how far this accords with the conditions in the human system where also lactic and acetic acids, enzymes, food of all kinds, and a higher temperature may increase or diminish the solubility of lead. He finds that the small amounts of other acids present in the gastric juice are unimportant and that in this respect the official use of hydrochloric acid is sound. The rise to body temperature increases solubility in the ratio of 5:3, but pepsin retards the solubility of lead in acid, the proportion being as 9:10, and if albumen be also present, as 8:10. Other food substances, such as bread and milk, also retard solubility slightly in presence of pepsin. It follows therefore, as the experiments were done at body temperature, that the official procedure is as good an indication of the solubility of a frit in the stomach as can be obtained in a laboratory. The change from the stomach to the upper bowel is, chemically, that from an acid to an alkaline solution with a change of enzyme. Under these conditions with pancreatin, food and an alkaline solution of sodium carbonate, practically no lead absorption takes place and it follows that the poisoning effect of lead glazes is confined to the stomach. The presence of carbon dioxide slightly lessens the solubility of lead.—H. H. S.

White lead and plumbism. W. Thomason. Trans. Eng. Ceram. Soc., 1909—1910, **9**, 209—226.

Raw lead glazes differ from those made with fritted lead in that the whole of their lead content is soluble in excess of acid. The author examines the influence of gastric juice, enzymes and food on the solubility of white lead in acid. No appreciable retardation in solubility is observed in presence of pepsin alone, but when foodstuffs are present the effect varies with the proportion of acid, food and lead present. The percentage solubility of white lead in the stomach varies with the acidity and inversely as the amount of lead and of proteid food present. It must be remembered that under industrial conditions the amount of lead absorbed in the system is not more than 3 mgrms. a day, so that the acid of the stomach is always in excess, a condition which promotes the absorption of lead by the system. This may be checked to some extent by the continual presence in the stomach of foodstuffs, of which the most effective are those high in protein, such as beef and mutton. (See also Bedson, this J., 1894, 610.)—H. H. S.

Zinc oxide; Note on solubility of —— in fused lead silicate and borate. A. D. Holdcroft. Trans. Eng. Ceram. Soc., 1909—1910, **9**, 37—40.

Zinc oxide shows great tendency to crystallise out in a glaze, and is used for that purpose in the making of crystalline glazes. Its solubility in lead silicate and lead borate was therefore determined by firing mixtures containing increasing amounts of zinc and noting at what content milkiness appeared. The solubility of zinc oxide in 100 grms. of silicate or borate was found to be:—

	1000° C.	850° C.
	grms.	grms.
PbO,SiO_2	13—14	7—10
PbO,B_2O_3	60—70	50—60

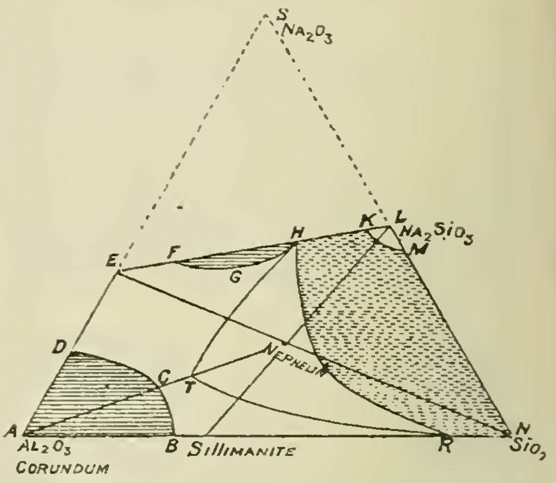
—H. H. S.

Glazes containing lead; Examination of ——. N. Schoorl. Z. anal. Chem., 1910, **49**, 741—743.

Referring to Funk's observations (this J., 1910, 354) on the difficulties arising in the examination of glazed vessels for lead, from the presence of other metals such as copper, iron, bismuth, etc., the author states that these are avoided by employing potassium chromate as the reagent instead of sulphuretted hydrogen and following the recommendations of the Dutch Central Sanitary Authority. The vessels after being twice shaken for 15 min. with boiling water are boiled out for an hour with a solution of 40 grms. of anhydrous acetic acid and 10 grms. of sodium chloride in 1 litre of water (or filled with the boiling liquid and shaken for an hour). The liquid is then evaporated to dryness to expel acetic acid, the residue dissolved in 50 c.c. of hot water and made up to the original volume with cold water. To 100 c.c. of this liquid (filtered through asbestos if not clear) a few drops of a 10 per cent. potassium chromate solution are added and the turbidity compared with that obtained with solutions containing known quantities of lead acetate. If lead be found the vessels must be boiled out a second and even a third time with the acid salt solution and the lead similarly determined in the resulting liquids. Of 292 vessels thus examined 228 were found to contain notable quantities of lead. (See also this J., 1909, 714; 1910, 153, 950, 981, 1058, 1206).—A. Sbld.

Silicates; High temperature work on ——. R. C. Wallace. Trans. Eng. Ceram. Soc., 1909—1910, **9**, 172—197. (See this J., 1909, 793.)

The three-component-system Na_2O,Al_2O_3,SiO_2 is summarised in the diagram (see Fig.). The dotted area HKMNR represents the compositions of mixtures which on cooling give only a glass. In the shaded areas ABCD and FGH complete fusion takes place only above 1950° C. The area DCBRHGFE represents mixtures that crystallise completely, and in this region only three types of crystal appear—corundum, sillimanite and nepheline. In other regions crystals of SiO_2, Na_2O, and Na_2SiO_3 also are found. Crystallisation takes place under 1600° C. only in the areas THR and KLM. Mineralisers, such as sodium tungstate, affect crystallising capacity but not crystallisation velocity.—H. H. S.



Patents.

Silica glass; Production of ——. H. A. Kent, Bounds Green, and H. G. Lacell, Finchley. Eng. Pat. 10,930, May 3, 1910.

Silica is allowed to fall or is projected on to an electrically heated body so that a mass of silica-glass is built up on the body and this mass is then blown, moulded or drawn so as to produce the required article.—H. H. S.

Glass; Manufacture of ——. Siemens und Halske Akt.-Ges. First Addition, dated June 8, 1910 (under Int. Conv., June 19, 1909), to Fr. Pat. 389,962, May 7, 1908 (this J., 1908, 750).

To avoid the preliminary fusion of the glass which was necessary in order to make it conduct the current, the partitions of the furnace are made of a conducting material such as a metal or alloy, or graphite or silicon mixed with a refractory substance, and they are protected from attack by the glass by a covering of clay or other resistant material.—H. H. S.

Kilns for burning bricks, tiles, pipes, terra-cotta goods, lime and the like; Continuous ——. J. Osman and Co., Ltd., London, and F. Fidler, Wigan. Eng. Pat. 24,213, Oct. 21, 1909.

The kiln is of the type in which a series of chambers are grouped around, and arranged transversely to a medium division wall. The main smoke flue, communicating with the stack, is arranged below the division wall, and in the wall are a main hot-air flue, and a main steam flue which is independent of the smoke flue and communicates directly with the smoke stack of the kiln. Branch flues are built in the transverse walls separating the chambers, and by means of dampers can be put into communication with either the main steam, or hot-air flue. Holes are formed between the branch flues and the chambers and serve for the introduction of fuel, the escape of steam from goods which are being dried, or for the withdrawal of heat from chambers which are cooling. The openings of these holes into the branch flues can be closed with caps when required, and cover-plates are arranged on the top of the branch flues above the caps; these plates become hot when the caps are removed from the holes, and form drying surfaces for ceramic and other goods. Fuel benches or grids are placed on the floor of the chambers, and flues are built in the walls separating the chambers, to convey air from the branch flues to the spaces below the fuel benches, and also serve for the conveyance of cool air into the chambers.—W. C. H.

Ceramic materials; Apparatus for burning ——. H. L. Doherty, New York. U.S. Pat. 974,646, Nov. 1, 1910.

A SERIES of vertical shafts or kiln-chambers is situated over a tunnel, in which is a single discharging device travelling on rails, so that it can be moved into position under any shaft. Each shaft may be closed at the bottom by a movable gate, and there are inlets provided with dampers, near the bottom, for the introduction of air; above the air inlets are others for combustible gases, and above these are passages for the withdrawal of combustion gases; removable bars to support the charge in the shaft may be adapted to bear in the air ports. The discharging means may comprise a movable truck carrying a hydraulic lift, on the plunger of which a platform is mounted, supporting a movable car, a force pump supplying water, under pressure, to the lift.—F. SODN.

Enamelling muffles. D. Fletcher, Stourbridge. Eng. Pat. 25,692, Nov. 8, 1909.

MUFFLES used for heating metal goods during the enamelling process are constructed of the usual tunnel shape arched over at the top, and provided with an outer casing of brick, the smoke from the fires rising over vertical divisions fixed in the side space between the two chambers, travelling across the top of the outer one and down the side space through openings in the floor to two outer flues arranged below the inner chamber, thence into two interior flues below the chamber where the unconsumed gases are led to a central down flue leading to the stack. The apparatus is provided with a series of air inlets controlled by plugs or dampers, and it is stated that the muffle is maintained at a uniform heat and the duration of the firebrick lining of the muffle is prolonged.—H. H. S.

Enamelling metal; Process for ——. S. and A. Sonntag, Pforzheim, Germany. Eng. Pat. 19,233, Aug. 16, 1910.

To obtain a uniform layer of enamel and to prevent waste by excess of powder falling off, metallic objects, such as works of art, are moistened by means of steam or by sprayed water, which may, if desired, contain a little gum, before applying the enamel powder in the usual manner. The moistening process may be repeated as often as required, in order to apply further layers of enamel.—H. H. S.

Vitreous matter; Composition of ——. C. A. Kraus, Newton Highlands, Mass. U.S. Pat. 974,801, Nov. 8, 1910.

A VITREOUS homogeneous composition for application on iron or other metal consists of sodium boro-silicate and the oxide of a metal of the iron group having an atomic weight between 52 and 59. Such a composition may be made from soda glass, borax and ferric oxide. —H. H. S.

White enamel. Landau und Co. Fr. Pat. 417,078, June 13, 1910. Under Int. Conv., June 13, 1909.

A SUBSTITUTE for tin oxide or antimony oxide as opacifier is made by mixing soluble white oxides with refractory earths in order to form a solid solution which shall be insoluble in acids and difficultly fusible. Such a product is obtained by heating a mixture of zirconium nitrate and calcium nitrate in the proportions necessary to give 70 per cent. of zirconia to 30 per cent. of lime.—H. H. S.

Mica; Preparation of ——. F. Lilienthal and G. Lauer, Cologne, Germany. Eng. Pat. 4980, Feb. 28, 1910.

MACHINERY is substituted for manual labour in the preparation of mica by splitting it into plates or very thin sheets. To the two faces of the mica to be split, bodies are attached either by paste or by suction, and the moving apart of the bodies is so effected that the mica is first split along one edge and then gradually along the whole surface, the operation being facilitated by making the bodies flexibly or yieldingly connected or constructed so as to roll one upon another. By nicking the mica at the required place, it is possible to obtain sheets of any desired thickness.—H. H. S.

Kaolin; Kilns for the treatment of ——. P. Westacott. Fr. Pat. 416,382, May 25, 1910. Under Int. Conv., Dec. 18, 1909.

SEE Eng. Pat. 29,694 of 1909; this J., 1910, 1251.—T. F. B.

IX.—BUILDING MATERIALS.

Portland cement, its hydration and constitution. S. Keisermann. Sonderausgabe aus Kolloidchem. Beihefte, 1910, Band I. (See this J., 1910, 1338.) (See also Le Chatelier, this J., 1888, 847; Ambronn, this J., 1909, 366.)

THE author devised a method of staining to aid in a microchemical study of the constitution of cement, the reagents used being Patent Blue which colours alumina and aluminium compounds, but is unaffected by lime, silica, and calcium silicates; Methylene Blue, which in neutral solution colours free amorphous silica (not quartz), and in acid solution, silicates; and alcoholic anthrapurpurin, which colours lime and its compounds. Experiments were made with products of known composition, including cements, and calcium aluminates, silicates, chromites, and ferrites, the products being hydrated and examined microscopically, with and without staining. The fine needles produced during the hydration of calcium silicates consist of hydrated calcium monosilicate (CaO, SiO_2, aq.); they are formed gradually also from mixtures of lime and amorphous hydrated silicic acid. The gel-mass or matrix of cement, after setting, is also hydrated calcium monosilicate, containing more water than the needles, and possibly incrusted with a little free lime. The large hexagonal crystals observed consist of calcium hydroxide. The small hexagonal plates are tricalcium aluminate; calcium chromites containing two or three mols. of chromium oxide per mol. of lime, yield crystals of similar form, but coloured green, on hydration. Portland cement clinker appears to consist of a conglomerate of dicalcium silicate and tricalcium aluminate in the proportions: $4(2CaO.SiO_2)$- $3CaO.Al_2O_3$. Free lime is not an essential constituent of the cement; the calcium hydroxide crystals produced during the setting are due to decomposition of dicalcium silicate. The setting of the cement is due to the hydration of the dicalcium silicate, the fine needles of calcium monosilicate produced becoming interlaced and penetrating the calcium monosilicate gel also formed, and being firmly cemented together by the latter as the setting and hardening progress. The tricalcium aluminate plays no essential part in this process, but acts as a flux in the preparation of the cement clinker, prevents the disintegration of the latter on cooling, and accelerates the hydration of the dicalcium silicate. In accordance with this view is the fact that cements in which the alumina is replaced by iron oxide set quite satisfactorily, although calcium ferrites do not set at all with water.—A. S.

Action of dust and bituminous vapours upon the eyes. True and Fleig. *See* XIXB.

Experiments with Portland cement cupels. Holt and Christensen. *See* XXIII.

PATENTS.

Wood-filling [impregnating]; Process for ——. C. Wittkowsky, Berlin. Eng. Pat. 23,632, Oct. 15, 1909.

THE surface of the wood to be treated is smoothed, and coated with a solution of albumin, casein or like animal or vegetable substance. As soon as the coating is dry, the treated surface is subjected to heat and pressure. —W. C. H.

Lumber; Method of drying ——. W. E. Lake, London. From Grand Rapids Veneer Works, Grand Rapids, Mich., U.S.A. Eng. Pat. 24,193, Oct. 21, 1909.

The lumber is subjected to heat in an enclosed space, and the exterior is protected from case-hardening during the period in which the moisture is being expelled from the interior, by maintaining about the lumber a very humid atmosphere, but one in which the humidity is practically uniformly below the point of saturation, until the interior of the lumber is thoroughly dry. Any undue excess of humidity is prevented by keeping a regulated draught in the kiln during the period in which moisture is being expelled from the interior of the lumber. At the beginning of the operation the requisite amount of humidity in the kiln may be secured by the admission of steam, the amount of which can afterwards be increased or diminished as desired. The moisture is continuously driven off from the lumber by the application of heat, and as the lumber adds its moisture to the atmosphere in the enclosed space the humidity is maintained practically constant until the interior of the lumber is thoroughly dry, though the temperature may be gradually increased during the operation. During the operation, heavy acid vapours and gases are expelled from the lumber, and on account of their high specific gravities settle at the bottom of the kiln, from which they are withdrawn, the entrance of air being excluded during their removal.—W. C. H.

Artificial stone; New process for manufacture of sand-lime ——. W. Wyssling. Fr. Pat. 416,466, May 27, 1910.

Silicious waste is mixed with lime and the mixture is subjected to the action of steam at a high temperature, a process which is said to volatilise impurities such as saltpetre or sulphates. More lime is then added and the product subjected to steam under high pressure.—H. H. S.

Zeolite-stones; Process for the manufacture of artificial ——. A. Hambloch. Ger. Pat. 227,248, April 28, 1908.

Substances such as puzzuolana, trass, volanic ashes, etc., rich in reactive or "soluble" silicic acid, are mixed with slaked lime, and if desired, also with cement, then formed into stones of the desired shape, and subjected to the action of superheated steam. It is stated that owing to the formation of calcium hydrosilicate throughout the mass, the products, which resemble natural zeolites, are much stronger than ordinary sand-lime bricks.—A. S.

Cement kilns; Rotary ——. F. K. Siemens, London. Eng. Pat. 8724, April 11, 1910. Under Int. Conv., May 28, 1909. Addition to Eng. Pat. 23,534, Oct. 14, 1909 (this J., 1910, 701).

Gas firing is substituted for a coal dust flame; but the difficulty arises that combustion extends too far into the kiln, whereby the differentiation into drying, decarbonating and sintering zones is lost, to the detriment of the clinker produced. A reversible horse-shoe flame is therefore used, part of it traversing the whole length of the kiln, the rest being drawn backwards in the same horizontal plane so that it is confined to the sintering zone, whilst the products of its combustion heat the regenerator. —H. H. S.

Wood; Method of preserving ——. G. Hartmann and O. A. Schwerdtner, Gross Schönau, Germany. U.S. Pat. 974,962, Nov. 8, 1910.

See Eng. Pat. 3740 of 1910; this J., 1910, 819.—T. F. B.

Cement; Preparation of ——. Thorrand, Durandy, et Cie., Nice, France. Eng. Pat. 21,315, Sept. 13, 1910. Under Int. Conv., Oct. 15, 1909.

See Fr. Pat. 408,060 of 1909; this J., 1910, 631.—T. F. B.

Cement from slag; Process and apparatus for making ——. T. H. Lodge. Fr. Pat. 416,690, June 2, 1910. Under Int. Conv., June 5, 1909.

See Eng. Pat. 13,183 of 1909; this J., 1910, 880.—T. F. B.

Tarry coatings. Fr. Pat. 416,177. *See* III.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Blast furnace; Balance sheet between the heat and material of the ——. W. Gillhausen. Stahl u. Eisen, 1910, **30**, 1956—1961.

A tabulated summary is given of the calorific value of the air and fuel as compared with that of the yield of iron, based on the heat produced by the combustion of one gram of carbon to carbon dioxide, the metallurgical reactions in the production of the iron, the heat lost in the slag, and the nature of the flux, without taking into account the heat lost by radiation and cooling. The estimates include those of the production of a ten per cent. spiegeleisen, steel, hæmatite pig, and Thomas iron, and it is calculated that 1000 kilos. of hæmatite pig need 287 heat units and of Thomas iron, 258 heat units for their production. —A. H. C.

Thomas process; The actual state of the —— *in Germany.* Esser and A. d'Auriac. Rev. Met., 1910, 7, 983—992.

The modifications introduced into the general organisation of steel works since the introduction of the Thomas process are shown by means of several diagrams. With regard to the converters, during the last six years there has been an increase of 25 per cent. in capacity, 15·3 per cent. in height, and 5·4 per cent. in the greatest interior diameter. The mixers are now cylindrical in shape with a 1000 tons capacity and are electrically controlled, while a good lining lasts 200 charges. In discussing the part played by the Thomas process in the various regions, Esser points out that in Silesia it cannot hold its own against the hæmatite process, the pig obtained being too rich in manganese and silicon for use by the Thomas process. In Franconia and the High Palatinate the mineral is excellent for the Thomas process, containing 40 to 55 per cent. of iron, 0·3 to 5 of lime, 4 to 12 of silica, and a little less phosphorus than the oolitic ironstone, but enough manganese to dispense with the addition of manganous mineral to the blast furnace, and from recent investigations it appears that this region will become very extended and rich. Esser then discusses the value of the products of the Thomas furnace, and concludes that there is an advantage of 25·7d. per ton in favour of the Thomas process over the hæmatite process.

D'Auriac tabulates the total production of steel by the Bessemer, Thomas and Martin processes respectively in Germany, the United States, and Great Britain for thirty years, and explains the increase in the percentage of Martin steel from several standpoints. 1. With regard to the crude materials, the converter requires a pig which only varies within narrow limits, and the economical production depends on the natural conditions, while the Martin process accommodates itself to various conditions, the proportion of the pig in the charge varying within wide limits as well as in composition. 2. With regard to the nature of the product, Martin steel, all conditions being equal, shows as great a purity and regularity as Thomas steel and is better applicable to a certain number of uses. 3. The Martin process is applicable to small works while the converter is not economical for large works. The relative slowness of refining, and the net cost of Martin steel under the same local conditions being generally greater than that of the converter is, however, disadvantageous. In England the acid process predominates although during the last few years there has been a marked increase in the basic Martin process. D'Auriac calls attention to the electric furnace and to its possibilities in relation to the Bessemer and Martin furnaces, and predicts the refining of Thomas steel in the electric furnace for uses in which at present Martin steel alone gives satisfaction.—A. H. C.

Thomas steel ; Nature of the scoriae in ——. M. Matweieff. Rev. Mét., 1910, 7, 848—858.

Examination of the slag particles disseminated through basic steel shows them to contain phosphorus, and an excess of basic constituents, so that they probably consist of calcium phosphate and ferrite. The author has endeavoured to imitate them, and to discover etching reagents for their identification, by inserting phosphates of calcium, magnesium, manganese, and iron, and calcium ferrite, into cavities in steel bars, which were then closed by plugs of the same steel, and heated to 1300° C. It was found that: 1. A cold 2 per cent. solution of ammonium oxalate slowly attacks cementite, giving a red coloration after 30 minutes. 2. Neutral sodium picrate, boiling, attacks ferric phosphate, but leaves intact cementite, pure iron, the eutectic of iron and ferric phosphide, and pearlite. The same reagent with picric acid added, still colours the phosphide, but colours pearlite still more strongly. 3. Two per cent. solution of ammonium oxalate in the hot water bath, disintegrates in 20 minutes the slag particles in basic steel, by dissolving out the lime combined with the ferric oxide, without affecting the surface of the metallic iron. These slag particles are not attacked by hydrogen nor by steam at a red heat, and are thus distinguishable from the slag particles composed of iron and manganese oxides found in puddled iron or acid steel. They are attacked by weak acids, and leave holes visible after re-polishing the surface of the iron which the acid has also attacked.—J. T. D.

Iron ; Dephosphorisation of —— in the presence of carbon. E. Richarme. Rev. Met., 1910, 7, 993—998.

In order to obtain a good dephosphorisation, the silicic, aluminic, and ferrous acids should be present in the form of their most basic compounds in the slags, and the bases then left uncombined should be sufficient to form with the phosphoric acid the most basic phosphates possible. From the study of the composition of the tribasic silicates, tetrabasic phosphates, tribasic aluminates, and dibasic ferrites of iron, manganese, lime and magnesia, the author has devised an empirical formula by means of which the acidity of the slag from the point of view of its power of dephosphorisation may be calculated, and hence the quantity of bases (calculated as lime) which it is necessary to add to a given slag in order to produce the limiting composition. An iron containing 4·00 per cent. of carbon, 0·9 of silicon, 1·9 of manganese, 1·93 of phosphorus, and 0·07 of sulphur was dephosphorised to a steel containing 0·75 per cent. of carbon, 0·028 of silicon, 0·16 of manganese, 0·01 of phosphorus, and 0·008 of sulphur before the addition of ferrosilicon and ferromanganese, the whole of the analytical and experimental details being tabulated. The author lays particular stress on the possibility, by the use of his formula, of the dephosphorisation of iron in the presence of carbon by the suitable addition of the calculated quantity of flux at each stage of the operation.—A. H. C.

Spiegeleisen ; Slow cooling of ——. B. Osann. Stahl u. Eisen, 1910, 20, 1918—1921.

Having observed the presence of quantities of graphite in the residues in the blast-furnace, and that the presence of manganese favours the supercooling of the metal and hence on rapid cooling the formation of a highly brittle alloy in a state of great tension, the author carried out experiments in which the alloy was allowed to cool very slowly in order to produce as great a separation of graphite as possible with the production of a non-brittle alloy. Fifty kilos. of spiegeleisen containing 12 per cent. of manganese, 4·6 of carbon, and 0·12 of graphite and protected by a slag of glass and potassium carbonate were melted in a crucible in a crucible furnace and were allowed to cool very slowly during seven days by covering with smouldering briquettes of brown coal. 243 grms. of graphite in the form of large plates were extracted from between the slag and the iron. Instead of the usual brittle alloy a product was obtained which was not only extremely hard, but which was only broken after five blows with a steam hammer. The top layer in contact with the separated graphite contained 5·15 per cent. of carbon while in the underneath portion there was only from 3·8 to 3·9 per cent. Similar experiments were carried out with Thomas iron and with foundry pig iron and in both cases there was a separation of graphite and segregation of carbon in the upper layer. The technical applications of the slowly cooled material are indicated.—A. H. C.

Electric furnace ; Notes on the ——. G. Arnou. Rev. Met., 1910, 7, 1051—1058.

The analyses of several steels prepared in the electric furnace are given, ranging from one containing 0·08 per cent. of carbon, 0·16 of magnanese, 0·012 of sulphur, 0·008 of phosphorus, and 0·10 of silicon, to one containing 0·87 per cent. of carbon, 0·31 of manganese, 0·01 of sulphur, 0·005 of phosphorus, and 0·37 of silicon. Attention is called to the low manganese content, to the absence of gases and of oxide as well as to the remarkable homogeneity of the products, which results in a great malleability cold and very great resistance to shock. Details are given of the mechanical tests such as tension, deflection on bending, and resistance to the shock of a falling weight, which show the great superiority of electric steel. With an equal content of carbon, tungsten, manganese, etc., the initial magnetisation was five or six per cent. greater than in ordinary magnets, while the permanent magnetism was about the same.—A. H. C.

Electric furnace ; The influence of firing and metallurgical reactions on the crystallization in the acid and basic ——. O. Thallner. Rev. Met., 1910, 7, 1061—1063.

The author compares the different methods of firing electric-furnaces and shows that it is sufficiently uniform in the Héroult furnace. The influence of heat on the properties of the steel produced is then discussed and the necessity of distinguishing between the influence of a mean temperature and that of a fall of tempertaure produced in the bath. It is shown that the properties of a steel which has been completely refined is dependent on the temperature at which it has been maintained; the effect of the temperature is shown in the crystalline structure, which is better in a metal cast at a higher than in one cast at a lower temperature. A mixed structure is characteristic of a bath in which there has been a great fall of temperature. The basic furnace enables an alloy to be made of absolutely definite composition but being a good conductor of heat may produce a fall of temperature thus limiting the control of the crystalline structure. The acid furnace not only furnishes a metal of appropriate composition, as well as acting rapidly in refining but, because of the lower conductivity of heat by the silica, produces a better crystalline structure.—A. H. C.

Ferric oxide ; Reduction of —— by solid carbon. G. Charpy and S. Bonnerot. Comptes rend., 1910, 151, 644—645.

In examining the action of solids on one another, it is almost impossible to avoid the presence of traces of gas; in this research, therefore, the authors have endeavoured to discover whether solid carbon reacts with ferric oxide by heating to 950° C. an intimate mixture of ferric oxide and graphite, whilst maintaining during the experiment a nearly constant very low pressure, and observing the rate of production of carbon monoxide at each pressure. The hourly rate of production of gas, which at 8 mm. pressure was 1·07 c.c., steadily fell as the pressure was reduced, till at 0·1 and 0·01 mm. it was 0·14 and 0·10 c.c. respectively. The conclusion is that solid carbon does not reduce ferric oxide at 950° C. (See also this J., 1910, 214, and following abstract.)—J. T. D.

Carbon; The rôle of —— and carbon monoxide in metallurgical reactions. G. Charpy. Rev. Met., 1910, **7**, 962—964.

In studying the effect of pure carbon at high temperatures on iron and allied metals, very great difficulty is experienced in eliminating all occluded gases. With the oxides of these metals the temperature of their dissociation affects the results very considerably. It is, however, concluded that up to a temperature of 1000° C. pure carbon has no action on the metals of the iron family, or their oxides; that carbon monoxide at the same temperatures carburises iron, reduces all the oxides of iron and nickel, and the higher oxides of manganese, oxidises metallic chromium and manganese, and has no appreciable action on metallic nickel, manganous oxide, and chromium trioxide.—A. H. C.

Carborundum; Determination of —— in coke crucibles. H. Wdowiszewski. Chem.-Zeit., 1910, **34**, 1209—1210.

Crucibles made of coke and fireclay, unlike those in which graphite is used, give evidence after use of the presence of appreciable quantities of carborundum. This does not allow of any simple chemical estimation, so the analysis of the crucible material is carried out in the usual way. The loss on ignition is first determined and it is necessary here to record the maximum loss in weight, since after the combustion of the coke, a slow gain in weight is observed due to oxidation of some of the carborundum. After fusing with alkali carbonates the analysis is carefully completed in the usual way, the carborundum finding expression in the final result as the equivalent quantity of silica. This causes the total percentage to exceed 100, the amount of excess providing the data for calculating the amount of carborundum, and the true silica content. The analytical study indicates that the carborundum is produced by the action of the coke on the clay at the high temperature of the furnace. —W. H. P.

Galvanising; Influence of —— on the strength of steel wire. H. Winter. Rev. Met., 1910, **7**, 1064—1074.

In order to explain the cause of the difference in strength between galvanised steel wires used in coal mines and the original material, especially with regard to bending and twisting, the author has microscopically examined them in the various stages of manufacture. One series contained 0·09 per cent. of carbon, while another contained 0·84 per cent. The wires were electroplated with copper, and then coated with Rose's alloy, after which they were sectioned and polished being finally polish-etched with an ammonium nitrate solution and rouge. The differences in strength are attributed to the cleaning of the wires in acid, too long an immersion in the bath of zinc with the formation of a thick layer of brittle zinc-iron alloy, and too high a temperature of the bath itself which will alone alter the mechanical properties of the wire. Attention is called to the great superiority of electrolytically galvanised wires, and it is also pointed out that tests carried out with greased wires show that they are excellently protected against acid waters. The paper is illustrated by fifteen microphotographs.—A. H. C.

Nickel steels; Resistance to shock of —— at variable temperatures. L. Guillet and L. Révillon. Rev. Métall., 1910, **7**, 837—844.

A number of steels of varying carbon- and nickel-content, and some ferronickels, were heated to different temperatures and subjected to the shock-test. In general the resistance to shock increased as the temperature rose, till at temperatures varying with the metal from 550° to 800° C., the metal was no longer brittle at all, but bent completely under the blow. Those specimens which showed micrographically a γ-iron structure had a high resistance at the ordinary temperature, and did not show much variation with temperature, till those temperatures were reached at which they became perfectly ductile. The metals showing martensitic structure had usually a wide range between their transformation-points for rising and for falling temperature, the latter being the lower, and within this range of temperature they showed a double nature: if they had not been heated above the test-temperature they were brittle (though less so than at lower temperatures), but if they had been heated above the upper transformation-point and allowed to cool to the test-temperature, they showed a much higher resistance to shock.—J. T. D.

Carbon and sulphur in high-percentage alloys of tungsten, molybdenum, and vanadium with iron; Determination of ——. E. Müller and B. Diethelm. Z. angew. Chem., 1910, **23**, 2114—2124.

The determination of carbon by the moist combustion process in iron alloys containing a large proportion of tungsten, molybdenum, or vanadium is found to be quite unreliable, whereas dry combustion, under proper conditions, gives accurate results. In the authors' experiments the combustion was carried out in a porcelain tube, glazed externally, heated to 1100° C., in an electric resistance furnace. 2·5 grms. of the alloy, in pieces of 2—3 mm. diameter, were used, and the temperature raised to 1100° C. in 45 minutes, after which about 15 minutes was sufficient for the burning (in oxygen); the combustion gases were passed through a tube containing strongly heated copper oxide and moderately heated lead chromate, and then the carbon dioxide produced was absorbed, preferably by soda-lime. If sulphur be present, the combustion gases are passed over lead peroxide, heated to about 350° C., before entering the tube containing copper oxide. The sulphur content of the alloy is then accurately determined by heating the lead peroxide with a 5 per cent. solution of sodium carbonate for 2 hours, filtering, and precipitating the sulphuric acid from the filtrate, slightly acidified with hydrochloric acid, by means of barium chloride. In the presence of molybdenum, the barium sulphate precipitate is allowed to stand for at least 15 hours before filtering, the solution containing free hydrochloric acid, to the extent of 25 c.c. of the strong acid for every 350—400 c.c. —F. Sodn.

Blast-furnace gases; Actual state of the purification of —— in Germany. C. Grosse. Rev. Met., 1910, **7**, 967—974.

Attention is called to the necessity of the removal of dust and moisture from blast-furnace gases when they are to be used as fuel, especially when required for gas engines, and particular stress is laid on the dryness which is obtained by cooling. Reference is made to the various cooling systems in use, and diagrams of the installations are given. As a result of the purification the majority of blast-furnaces reduce their consumption of coke by 40 to 100 lb. per ton of metal produced. The temperature of the blast is also raised by 60° to 100° C. The Cowper stoves may be heated up in about half the time, and consequently the blast heated for thirty minutes more, the excess gas, about forty per cent., being available for other purposes. The production of steam is raised by 10 per cent., the life of the Cowper stoves prolonged from 2—3 to 12—14 months, that of the hearths of the boilers from one to three or four months. The height of the Cowpers may be increased if it is not desired to increase the temperature of the gas.—A. H. C.

Silver ore; Assay of arsenical nickel-cobalt ——. D. K. Bullens. Eng. and Min. J., 1910, **90**, 809—810.

The high nickel, cobalt and arsenic content of the silver ores of the Cobalt district, Ontario, together with the presence of metallic silver, renders the sampling and assaying specially difficult. The author describes the methods of sampling in present use on two of the mines, the main features being the careful reduction in size of the big sample, the use of mechanical samplers and the separate assaying of the fine ore and "metallics." The comparative efficiency of scorification and crucible assays is discussed and it is stated that, with the exception of very rich ores high in nickel, cobalt and arsenic, the crucible assay gives the best results. Ores from the oxidised

zone present no special difficulty, as the nickel and cobalt are readily prevented from entering the lead button by an excess of litharge. If, however, more than 0·5 per cent. of nickel oxide enters the button, the latter becomes covered with a scum of the oxide during cupellation and finally freezes. For sulphide ores, a strongly basic slag, high in soda and approaching to a sub-silicate, is employed, as arsenic, in addition to nickel and cobalt sulphides, may be slagged off by an excess of an alkaline flux at a low temperature. The fusion must, however, be conducted rapidly in order to prevent the formation of a speiss, so that only small amounts of those ores which have a high nickel, cobalt, and arsenic content can be used, as little as 0·1 or even 0·05 of an assay ton being occasionally employed. For low-grade silver ore rich in nickel and cobalt, a flux containing an excess of litharge has proved satisfactory. The sulphide assay using metallic iron, may be employed for comparatively high arsenic-nickel-cobalt ores if a large excess of the alkaline flux is used.
F. R.

Cyaniding silver ores in Mexico. E. Girault. Mines and Minerals, 1910, 618. J. Chem., Met. and Min. Soc., S. Africa, 1910, **11**, 135—137.

Useful data regarding the cyaniding of silver ores at the San Rafael mines, Mexico.—F. R.

Flue dust; Agglomerating ore fines and ——. H. Haas. Eng. and Min. J., 1910, **90**, 814—817.

After referring to the Grœndal process of briquetting and clinkering the bricks, the author enumerates the causes that influence the production of flue dust such as charging the furnace with brittle ores without previous treatment, the construction of the copper furnace as contrasted with that of the lead furnace and their relative gas velocities. A process of sintering is then described which is applicable to lead and copper ores and which depends on the heat generated by the oxidation of the sulphides to agglomerate with them any ore fines and dust, from 8 to 12 per cent. of sulphur being sufficient for the operation. An illustration is given of a section through a blast roasting and sintering plant in which it is proposed to divert to separate beds in the proportion of a stock blast furnace charge all fine ores, concentrates and what flue dust is produced. From the beds the material is picked up by power shovels which deliver it into a conveyor system and thence to revolving mixers, the latter discharging into another conveyor running over the storage bin above the sintering apparatus. The roasters are so arranged that when they are tilted the sintered mass will fall several feet on to a hard floor.—A. H. C.

Lead; Determination of —— in non-ferrous alloys. C. P. Karr. Trans. Amer. Brass Founders Assoc., 1910, **3**. 47—55.

A summary and discussion of the various methods which have been proposed for estimating lead in non-ferrous alloys. The methods referred to are (1) gravimetric methods including estimation as sulphate, peroxide, and molybdate; (2) volumetric methods including titration with ammonium molybdate, potassium ferrocyanide, potassium permanganate, and potassium cyanide; (3) a colorimetric method for alloys containing small quantities of lead, the coloration being produced by the addition of a sulphide; (4) a centrifrugal method in which the lead is precipitated as sulphate or molybdate, the liquid centrifuged, and the volume of the precipitate in the end of the tube measured; (5) a microphotographic method in which, after elimination of tin, copper, antimony, and arsenic, a button of lead-zinc alloy is obtained, which is etched with nitric acid, photographed, and the area of lead measured and compared with that found in alloys of known composition; (6) an electrolytic method in which lead is deposited from nitric acid solution as peroxide and weighed. The author considers that the best method for rapid accurate work is the electrolytic one.—H. H.

Copper [in ores]; Thiocyanate determination of ——. U. Tsukakoski. Eng. and Min. J., 1910, **90**, 969.

Copper is precipitated from the solution of the ore as cuprous thiocyanate, which is filtered off, and if of small bulk is dissolved by treating with hot nitric acid (1 : 1) on the filter. If the bulk is large, it is better to wash the precipitate from the paper into a beaker, and dissolve in from 1 to 2 c.c. of strong nitric acid. This solution, after being boiled for 2 or 3 minutes, is used to dissolve any precipitate remaining on the paper. The filter is well washed with hot dilute nitric acid and then with hot water. The copper nitrate solution is boiled for a few minutes and ammonia added in slight excess. The excess of ammonia is removed by boiling and then 2 or 3 c.c. of acetic acid are added. The solution is cooled and titrated with sodium thiosulphate. Results obtained by this method agreed very closely with those obtained by electrolysis, and by precipitating the copper with sodium thiosulphate in place of the thiocyanate, followed by the thiosulphate titration.—T. St.

Pyritic smelting and sulphuric acid manufacture. F. J. Falding and J. P. Channing. Eng. and Min. J., 1910, **90**, 555—558.

A discussion of the conditions necessary for the production of sulphuric acid from the sulphur in pyritic ores, when smelted in the blast-furnace primarily for the production of matte. The conditions requisite are, first, that sufficient air must be added, by a second upper set of tuyères above the hearth, or by admission higher in the furnace, to furnish oxygen for the conversion of the sulphur dioxide into trioxide (including the excess found in practice to be necessary), and that the amount of coke needed to smelt the ore shall not be so great that its products of combustion shall dilute the furnace gases below a practical strength in sulphur dioxide for making sulphuric acid. Calculations are made in the paper showing the amount of coke required with ores containing 20, 30, 40 per cent. of iron and given amounts of sulphur, and the relation between the coke and the percentage of sulphur dioxide is shown in curves. The uniformity of gas supply desirable for satisfactory sulphuric acid making is much more easily attained in the average product from several furnaces than from a single furnace. Sulphuric acid cannot be profitably made from pyritic-smeltery gases unless the plant has been arranged for the production of suitable and regular gas supply and unless care is exercised in the charging and other operations to preserve this regularity as far as possible. Fortunately, all the conditions necessary for satisfactory sulphuric acid manufacture are such as tend to the improvement of the working and output of the smeltery itself.—J. T. D.

Copper; The outlook for hydrometallurgy of ——. W. E. Greenawalt. Eng. and Min. J., 1910, **90**, 960—962.

A discussion from an economic standpoint of the various methods of producing copper commercially by smelting, and wet processes, including the Siemens-Halske and the Hoepfner processes. No satisfactory wet method has yet been devised, but the advantages which would be realised by a successful wet process over smelting, on ore adapted to it are summed up as follows:—The ore may be treated directly at the mine, in any unit, without the admixture of other ores or fluxes; if the process is electrolytic, power may be acquired from a distance; the end products are pure copper which may be sold at the full market price direct to the consumer, and gold which may be disposed of at the mint.—T. St.

Copperhill, Tennessee; Notes on the metallurgy at ——. G. A. Guess. Eng. and Min. J., 1910, **90**, 866.

A saving of 2 lb. of copper per ton of ore smelted, is effected by producing a low-grade matte and concentrating, instead of producing a matte high enough to convert direct. During 1909 the matte fall in the green-ore furnaces averaged 18·3 per cent. with a copper content of 9·5 per cent. The furnaces both for the original smelting and the concentration, are run fast, and as soon as they begin to slow, they are tapped out and started afresh. If no general overhauling is required, it only takes 24—36 hours from the time the blast is shut off until the furnace is again running. The rate of working in a 44 by 180 in. concentration furnace sometimes exceeds 800 tons of charge per day. If limestone is omitted from the charge, an extensive crystalline growth of whitish lustrous transparent plates, having approximately the composition, $2FeO,3SiO_2$, is produced in the settler. Firebrick linings to the settlers, have been substituted for the magnesite or chrome ore, and give good results. The copper content of the green-ore smelting slags is 0·23 per cent. and that of the concentration slag is 0·37. The total slag averages 0·265 per cent. of copper.—F. R.

Copper: Cast —— of high electric conductivity. E. Weintraub. Amer. Electrochem. Soc., Chicago, Oct. 1910. Met. and Chem. Eng., 1910, **8**, 629—630.

The defective conductivity of cast copper is attributed to pinholes and cavities caused by the liberation of the oxygen dissolved by the molten metal. The elimination of the gas with the production of a mechanically sound casting is readily accomplished by the use of small quantities of deoxidising agents, all of which up to the present however have proved to combine with the copper and affect its conductivity. Boron appears to be an element which will remove the oxygen, and leave the copper unaffected. It is not necessary to use the pure element, the cheaper product previously obtained by the author and called by him a "suboxide" (this J., 1910, 23.) being quite efficient, even when only 1/30 per cent. is used. No deleterious effect is produced on the copper with as much as 1 per cent. It is even cheaper to use directly the product of the action of excess of boric anhydride on magnesium (containing magnesium borate, boric anhydride, and boron suboxide). 1 to 1½ per cent. of this material is added (equivalent to 0·08 to 0·1 per cent. of suboxide) and the result is a casting with at least 90 per cent. conductivity and as much as 97·5 per cent., if the copper is originally quite pure. The properties of the material are:—Tensile strength 24,350, elastic limit 11,450, elongation 48·5 per cent., reduction in area 74·49 per cent. The process is as simple as the casting of brass, the product is very valuable and convenient especially for electrical machinery, and the cost of treatment is less than ⅜d. per lb. of copper.—W. H. P.

Red brass ingot; Manufacture, uses and advantages of ——. W. M. Corse. Trans. Amer. Brass Founders' Assoc., 1910, **3**, 1—7.

According to the method now generally adopted for the manufacture of ingot brass, a mixture of red brass borings and copper, together with any white metals that may be necessary to bring the mixture to a definite composition, is usually employed. Owing to the oxidation of the finely-divided metal during melting, and to the impurities present, brass ingot made from borings alone is often unsuitable for good castings, and it is therefore necessary to add a quantity of new metal—generally copper—to the extent of from 25 to 30 per cent. of the charge. As a rule, ingot brass is made to a standard formula, and contains approximately 82 per cent. of copper, 4 of tin, 6 of lead and 8 of zinc. The total impurities should not exceed 1 per cent. and the author regards the following as a typical specification for this material:—Copper within 0·5 per cent. (or not less than 82 per cent.), tin within 0·1 (or not less than 4 per cent.), lead within 1·0 (or not more than 7 per cent.), zinc within 1·0 (or not more than 9 per cent.), iron less than 0·35 per cent. and antimony less than 0·35 per cent. The author is in favour of the crucible, rather than the reverberatory (or other furnace), method of manufacture, the former being regarded as giving a more satisfactory product in the hands of the average melter. The principal advantages in using ingot brass are stated to be: uniform composition, low shrinkage in melting, decreased cost in handling, exact amount of impurities known, value received for the price paid, and saving in first cost over new metals.—W. E. F. P.

Brass turnings; Melting —— in the oil-furnace. E. H. McVeen. Trans. Amer. Brass Founders' Assoc., 1910, **3**, 21—23.

The composition of the turnings (from which ornamental and other castings are ultimately produced) averages 60 per cent. of copper, 36 of zinc and 4 of lead. The stationary oil-furnace employed holds two No. 30 crucibles in one chamber, uses an air pressure of 7 lb. and consumes 3 galls. of fuel oil per 100 lb. of brass melted. The melting of 200 lb. of metal (30 lb. of "gates" and "sprues" and 170 of turnings) occupies two hours, or three hours when starting with a cold furnace. The loss in metal is about 3 per cent. and each crucible serves for 20 or 25 meltings. In practice, each crucible is charged with about 10 lb. of gates or sprues and sufficient turnings to nearly fill it; about an ounce of rock-salt is added as flux and the charge is covered with a 2-inch layer of fine charcoal. After heating for about 30 minutes, the pasty mass in the upper part of the crucible is gradually forced down into the molten metal by means of an iron bar; more turnings are then added, and the operation repeated until each crucible is full of molten metal. The temperature is then raised until the zinc begins to volatilise, when the charge is ready for pouring.—W. E. F. P.

Fluxes as applied to the brass foundry. E. S. Sperry. Trans. Amer. Brass Founders' Assoc., 1910, **3**, 67—75.

The following fluxes, etc., are recommended for use in melting the various metals and alloys with which the brass foundry is concerned:—For aluminium, zinc chloride; for nickel, a flux composed of 3 parts of lime and 1 of fluorspar; for copper, potassium ferrocyanide, or preferably deoxidants such as silicon-copper, magnesium, etc., for brass, bronze and similar compositions, common salt. For German silver a mixture of sodium nitrate and manganese dioxide is sometimes used, but common salt is frequently employed, and some manufacturers use no flux at all; the use of metallic manganese, as a deoxidant for nickel alloys generally, is recommended. In the melting of the washings, grindings, etc., from the reclaiming of brass foundry ashes and other waste material, the author finds plaster of Paris an excellent flux. Except in the case of aluminium, charcoal should be used as a cover when melting the above metals and alloys.
—W. E. F. P.

Tin dross; Reduction of ——. R. S. Wile. Amer. Electrochem. Soc., Chicago, Oct. 1910. Met. and Chem. Eng., 1910, **8**, 629.

By using a shaft furnace heated electrically, the dross mixed with the right percentage of carbon can be fed on to the top of the slag, coming into contact with it only at the point of reduction. Any tin oxide volatilised is retained in the cool upper layer, while the globules of tin pass downward through the slag and lose most of their impurities. The average loss of tin is less than 1 per cent. With two furnaces 20 in. in diameter and 80 in. high, and two 50 kilowatt transformers, the average amount of tin recovered is about 2500 lb. per day, with a consumption of about 44 kilowatts. The amperage is kept nearly constant, the voltage at the start being about 80 volts for each furnace, falling, as the slag becomes less refractory, to 45 or 50. When this value is reached, and analysis indicates that the slag has taken up a considerable quantity of iron and zinc from the dross, the furnace is stopped and the slag changed. The furnaces run continuously except for relining every three or four months.—W. H. P.

Cobalt; Electrochemical behaviour of —— [compared with that of nickel and iron]. R. Schildbach. Z. Elektrochem., 1910, **16**, 967—979. (See also Coffetti and Foerster, this J., 1905, 1116; Richards and Behr, this J., 1907, 326; and Schweitzer, this J., 1909, 989.)

A study of the electrochemical behaviour of cobalt in solutions of its chloride and sulphate. The experiments were carried out in the absence of air, the oxygen of which affects the current yield and the metallic deposit. The separation of cobalt from weak mineral acid and boric acid solutions requires, like the separation of iron and nickel, a potential much greater than the equilibrium value. The excess is greatest in nickel and least in iron, cobalt coming between. As with nickel and iron, rise in temperature tends to eliminate not only this discrepancy, but also the variation of E.M.F. with current density. In the case of cobalt the author has also worked with neutral solutions, and brought to light the fact that part, though not all, of the excess potential is due to the presence of hydrogen ions and disappears in neutral solution. This is probably also the case with iron and nickel. The value of the equilibrium potential of cobalt powder against *N*/1 cobalt sulphate solution in nitrogen and *in vacuo* is from −0·31 to −0·32 volt at 20° C. This value is reached much more rapidly than the corresponding value for nickel (−0·25 to −0·26 at 18° C.) and less rapidly than that for iron. The study of the behaviour of the three metals in a cell of the Daniell type shows the same relation. The tendency to remain passive is very great in the case of nickel, less in cobalt and least in iron. After cathodic polarisation an iron electrode gives at first a high value against *N*/1 ferrous sulphate solution which falls again to the equilibrium value; a cobalt electrode gives a potential which falls to within 0·02 volt of the equilibrium value, while in the case of nickel the discrepancy is very much greater.—W. H. P.

Calcium; Electrolytic preparation of ——. A. R. Johnson. Amer. Electrochem. Soc., Oct. 1910. J. Ind. Eng. Chem., 1910, **2**, 466—474.

A DESCRIPTION of some experiments carried out with various types of apparatus, with a view to the efficient production of cathode rods of metallic calcium. The points to be noted are mainly matters of construction. The cathode current density must not be too high, or the calcium does not adhere, while if the anode current density is too low the electrolyte is not all melted. It is important that the anode and cathode surfaces should be definite under all conditions, and that it should be possible to control the current density. The life of the graphite anode containing vessel is also an important factor. If not properly protected, it is apt to disintegrate where exposed to the air, and to fall to pieces when the bath cools. In the final apparatus the electrolyte was a fused mixture of 100 parts of calcium chloride and 17 parts of calcium fluoride thoroughly heated before electrolysis to dehydrate it completely. The cathode was an iron ribbon which could be run up from below, allowing of more complete control of the current density. In this particular apparatus the best deposits were obtained with 10 amps. per sq. cm. at the cathode. The four best current efficiency results showed from 65 to 93 per cent., the calcium deposit being carefully broken up and freed from all chloride. The paper contains also a discussion of the chemical changes taking place in the bath, arguments being advanced to suggest that the metal is capable of dissolving in the fused chloride at a high temperature, and that no subchloride is formed as is sometimes assumed. A series of curves for the decomposition voltage shows that the critical value is always much less than the theoretical value (3·7 volts), the deviation being attributed to the fact that the electrodes are not completely inert.—W. H. P.

Strontium; Preparation of crystallised ——. A. Guntz and Galliot. Comptes rend., 1910, **151**, 813.

A MIXTURE of finely powdered strontium oxide and finely granulated aluminium, in proportions corresponding to the equation, $3SrO + Al_2 = 3Sr + Al_2O_3$, is placed in the lower part of a soft steel tube, one end of which is closed. The temperature of the tube is raised progressively to 1000° C., an outer porcelain tube, in which the steel tube is contained, being exhausted of gas at the same time: towards 600° C., hydrogen is evolved in abundance, being derived from the strontium hydroxide which always accompanies strontium oxide. The temperature is kept at 1000° C. for four hours, and the apparatus is then allowed to cool. The cold, interior tube is covered with a silvery white deposit of crystalline strontium of 99·41 per cent. purity. It is found that 30 grms. of strontia furnish about 19 grms. of the metal. The sp. gr. of the metal prepared in this way is 2·63, referred to water at 0° C.—L. E.

Cadmium, bismuth and lead; Binary and ternary alloys of ——. W. E. Barlow. J. Amer. Chem. Soc., 1910, **32**, 1390—1412.

THE thermal examination and representation of the ternary alloys being based upon that of the three binary series, the constitution diagrams for the lead-bismuth and the lead-cadmium alloys were first re-determined, the data obtained by previous workers being considered unsatisfactory by the author. In the lead-cadmium series the indicated composition of the eutectic was 82·6 per cent. by weight of lead (72·04 atoms per cent.) and 17·4 of cadmium; the freezing point was 247·3° C., and the freezing-time curve indicated a slight solubility of lead in solid cadmium and a limit of miscibility of cadmium in lead of about 3 per cent. by weight. The eutectic in the lead-bismuth series was found to lie at 56·5 per cent. by weight of bismuth, and between 124·3° and 124·8° C., while a solubility of bismuth in lead up to about 11 per cent. by weight was also indicated. The combined results of Kapp (Diss., Königsberg, 1901) and Stoffel (Z. anorg. Chem., 1907, **53**, 137) were employed for the bismuth-cadmium series, the eutectic containing 44·5 atoms per cent. of bismuth (59·8 per cent. by weight), and having a freezing point of 146° C.; bismuth and cadmium are entirely non-miscible in the frozen state. In the ternary system, the indicated composition of the eutectic was about 8 per cent. of cadmium, 40 of lead and 52 of bismuth; and, cooling curves being taken of a number of alloys having nearly this composition, it was found that two of them showed a very slight pause at 92° C., and a sharply defined ternary freezing point at 91·4° to 91·5° C. For the present, the author gives the precise composition of the eutectic as 40·2 per cent. of lead, 51·65 of bismuth and 8·15 of cadmium. As the mean of twenty determinations the freezing point was found to be 91·5° C.—W. E. F. P.

Silver-sodium alloys; Equilibrium diagram of the ——. E. Quercigh. Z. anorg. Chem., 1910, **68**, 301—306.

A THERMAL study of the silver-sodium alloys shows that these metals, which in the molten state are miscible in all proportions, form no compounds. The absence of a eutectic halting-point in the cooling curves of the alloys rich in silver makes it very probable, however, that mixed crystals are formed, solid silver being capable of holding sodium in solution up to about 13 atoms per cent.—F. SODY.

Sampling of ores; Element of chance in the ——. L. T. Wright. Mining Magazine, 1910, **3**, 353—358.

IN considering the theoretical and practical aspects of sampling, the author deals mainly with the question of the "safe" weight, *i.e.*, the minimum quantity which shall be truly representative of the whole of the ore. As the result of experiments upon the pyritic ores of Gilpin County, Colorado, H. A. Vezin found that the safe weight for a 20-mesh sample was one ounce, and concluded that the safe weights for coarser samples of the same ore could be obtained by calculation, as indicated in the following table:—

Diameter of largest particle (inches)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2
Minimum weight of sample (pounds)	[illegible]	[illegible]	[illegible]	32	256	2048	[illegible]

It is pointed out that Vezin's rule implies that the ratio between the number of particles of mineral and the number of particles of gangue remains the same through all the stages of the crushing of the ore, and that during the grinding the mineral and gangue are crushed at the same rate; whereas in the large majority of commercial ores, the valuable mineral—owing to its greater brittleness, etc.—is more readily broken down than the gangue

By observations made upon two samples of the same ore taken respectively at the ⅛ inch and the 100-mesh stages of the grinding, it was shown that the ratio of the safe weights—for this ore at least—was immensely smaller than that required by Vezin's rule.—W. E. F. P.

Behaviour of iron and nickel anodes in various electrolytes. Schoch and Randolph. *See* XI.

Experiments with Portland cement cupels. Holt and Christensen. *See* XXIII.

Action of carbon tetrachloride vapour on minerals and its use in quantitative analysis. Jannasch. *See* XXIII.

Mineral production of the United Kingdom in 1909. Board of Trade J., Nov. 24, 1910. [T.R.]

The following table, showing the quantity and value (definitive figures) of the minerals produced in the United Kingdom in 1909, as compared with 1908, is taken from the General Report and Statistics on Mines and Quarries, 1909, Part III., recently issued by the Home Office :—

Description of Mineral.	1908.		1909.	
	Quantity.	Value at the Mines and Quarries.	Quantity.	Value at the Mines and Quarries.
	Tons.	£	Tons.	£
Alum shade	5,373	739	9,120	915
Arsenical pyrites	3,218	3,931	179	408
Arsenic	1,936	19,190	2,880	28,187
Barium (compounds)	38,947	35,221	41,766	40,528
Bauxite	11,716	3,025	9,500	2,408
Bog ore	4,295	1,074	2,676	669
Chalk	4,261,585	174,447	4,436,923	175,020
Chert, flint, jasper, &c.	63,790	15,204	52,225	11,654
Clay and shale	14,407,470	1,839,772	14,067,810	1,718,056
Coal	261,528,795	116,598,848	263,774,312	106,274,900
Copper ore	5,186	17,103	3,531	13,859
Copper precipitate	255	7,950	186	5,495
Diatomite	450	500	240	120
Fluorspar	34,700	15,568	42,483	16,029
Gold ore	7,123	2,675	5,538	3,817
Graphite	101	101	—	—
Gravel and sand	2,193,047	163,301	2,164,837	159,441
Gypsum	228,316	88,678	238,996	85,943
Igneous rocks	6,113,735	1,232,838	6,283,297	1,235,046
Iron ore	15,031,025*	3,724,165	14,979,979*	3,689,777
Iron pyrites	9,448	4,339	8,429	3,819
Lead ore	29,249	259,408	29,744	259,254
Limestone (other than chalk)	11,610,656	1,229,155	11,811,122	1,226,967
Manganese ore	6,308	4,858	2,768	2,243
Mica	21,161	8,361	23,927	8,225
Natural gas	Not stated.	Not stated.	236,800 cubic feet.	Not stated.
Ochre, umber, &c.	15,396	11,181	16,313	15,180
Oil shale	2,892,039	795,257	2,967,057	815,937
Phosphate of lime	9	14	4	6
Salt	1,843,959	589,339	1,822,744	548,896
Sandstone	5,024,832	1,426,142	4,600,084	1,339,106
Slate	414,329	1,031,877	402,184	1,007,013
Sulphate of strontia	16,469	12,352	14,042	10,532
Tin ore (dressed)	8,008	594,800	8,289	617,376
Uranium ore	71	7,550	6	Not stated.
Wolfram ore	233	18,785	376	28,340†
Zinc ore	15,225	62,892	9,902	49,320
Total values	..	£130,003,670	..	£119,394,486

* Exclusive of 327 tons in 1908 and 457 tons in 1909 of micaceous iron ore, used for paint, and placed under the heading "Ochre, umber, &c."

† Value of 333 tons only.

The decrease in the total value of the minerals raised during the year is mainly accounted for by the decreased value of coal. The average price of coal was 8s. 0·7d. per ton in 1909, as compared with 8s. 11d. in 1908. The total output of coal was 263,774,312 tons. The quantity of coal exported, exclusive of coke and manufactured fuel and of coal shipped for the use of steamers engaged in foreign trade, was 63,076,799 tons, an increase of more than half a million tons on the exports for 1908. France received over 10,400,000 tons, Germany over 9,650,000 tons, Italy over 9,000,000 tons, Sweden nearly 4,000,000 tons, Russia about 3,300,000 tons, Egypt, Spain, and Denmark each over 2,500,000 tons, and the Netherlands and Argentine each over 2,000,000 tons. Adding the 3,246,300 tons of coal exported in the form of coke and manufactured fuel, and the 19,713,907 tons shipped for the use of the British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 86,037,006 tons. The amount of coal remaining for home consumption was 177,737,306 tons, or 3.949 tons per head of the population. 35,924,723 tons were used in the manufacture of coke and briquettes, and 19,463,471 tons in the blast furnaces for the manufacture of pig-iron, as against 35,704,971 tons and 18,742,464 tons respectively in the previous year. The output of iron ore yielded 4,802,163 tons of iron, or more than one-half of the total quantity of pig-iron made in this country (see also this J., 1910, 458).

Patents.

Iron and steel from waste enamelled articles; Method and apparatus for recovering ——. A de Back, Essen-Ruhr, Germany. Eng. Pat. 3375, Feb. 11, 1910.

The articles are treated in the machine described in Eng. Pat. 3653 of 1906 in such a manner that they are first pressed together to crack the enamel and then cut into strips which, being pushed against suitably shaped scrapers, are thereby distorted and sufficiently opened to allow the enamel to fall away.—W. E. F. P.

[*Steel*] *Smelting ore; Process for* ——. F. T. Snyder, Oak Park, Ill., Assignor to Electric Metals Co., Chicago, Ill. U.S. Pat. 974,608, Nov. 1, 1910.

Iron oxide ore is smelted electrically with a minimum quantity of carbon in a furnace with water-jacketed walls.

The charge rests upon a bath of slag, into which two or more electrodes dip, the electrodes being surrounded by a flux (*e.g.* lime) which will combine with the earthy constituents of the ore to form a slag. The composition of the slag is regulated so that it forms at the required temperature. The low-carbon steel produced is collected below the bath of slag in a crucible of basic refractory material. The cooling produced by the water-jacketed walls of the furnace causes the outer portion of the molten slag to solidify, thus forming an insulating layer of solid slag. —A. S.

(1). *Manganese steel ; Method of treating* ——. (2). *Process of preparing manganese-steel ingots for rolling.* (3). *Production, treating, and rolling of ingots of manganese steel.* W. S. Potter, New York. U.S. Pats. 974,822, 975,370, and 975,371, Nov. 8, 1910.

(1). Manganese steel which has been previously "strengthened and toughened" is reheated to a temperature between 225° and 650° C., say to 400° C., and then worked into the finished shape and cooled. (2). Manganese steel is prepared for rolling by "equalising the temperature within the cast ingot, slowly passing the temperature through a range lying between 600° and 700° C. until reconstruction is effected," then raising the temperature of the ingot to above 1100° C., *e.g.*, 1150° C., and rolling. (3). The manganese steel, substantially free from oxide, is poured at a temperature not more than 50° C. above its freezing point, and is caused to solidify at such a rate as to avoid any considerable variation in composition between different parts of the ingot, and also any considerable separation of carbide. The solidified ingot is heated to a temperature above the "change point" at which rapid absorption of carbon from the carbide by the mixed crystals begins. The heating is continued until the maximum absorption of carbon by the mixed crystals has taken place and until the "carbide residuals," together with any undecomposed carbide, have recrystallised, forming with the mixed crystals a γ-iron structure. The ingots are finally rolled, but preferably the γ-iron crystals are first welded into a more cohesive, ductile mass.—A. S.

Cast iron ; Process for the manufacture of high-grade —— from gray iron scrap and cast iron cuttings. A. Zenzes. Ger. Pat. 224,331, April 26, 1908.

A high-grade cast iron can be produced by melting together gray iron scrap and cast iron cuttings in a reverberatory furnace, and then adding molten pig iron, and at the same time raising the temperature of the molten metal, so that the reaction induced is carried to completion.—A. S.

Ores containing sulphur and iron ; Reduction of ——. A. Wiens, Bitterfeld, Assignor to Elektrochemische Werke Ges. m. b. H., Berlin-Bitterfeld, Germany. U.S. Pat. 973,732, Oct. 25, 1910.

The ores, after roasting, are electrically smelted with carbon and sufficient silica, and at a temperature high enough to produce ferro-silicon, substantially free from sulphur. The volatile metals are recovered by distillation and condensation, and the non-volatile metals recovered with the ferro-silicon.—F. R.

Arsenical iron ores ; Roasting of ——. Köln-Müsener Bergwerks-Aktienverein. Ger. Pat. 223,976, June 16, 1909.

Arsenical iron ores are prepared for smelting by roasting them in presence of a current of air, the temperature being kept sufficiently low to prevent the formation of iron arsenate. The arsenic is converted into arsenic trioxide, which sublimes and is carried away by the current of air. The best temperature is from 300°—400° C., and in many cases it is sufficient to force through a charge of the ore a blast of air heated to this temperature.—A. S.

Crushing or grinding auriferous quartz and other hard ores or substances. G. Johnston, Glasgow. Eng. Pat. 17,087, July 22, 1909.

The material to be crushed is fed, comparatively slowly, and in a thin stream, between rapidly rotating rolls of relatively large and small diameter travelling at a very high peripheral speed. It is claimed that, in conjunction with the slow feed, the high peripheral velocity of the rolls results in more efficient crushing than is obtainable by the use of stamps or rolls of the ordinary kind. W. E. F. P.

Vats, reservoirs or other vessels for separating solids from liquids [ore slimes from cyanide solutions]. A. J. Arbuckle. Fr. Pat. 416,193, May 21, 1910.

Relates to separating vessels of the conical type, such as those employed in the cyanide treatment of the slimes from gold ores. A vertical spindle, centrally disposed in the conical vessel, is supported near its upper end by engagement with a fixed screw nut, the latter being attached to a cross-bar fixed to the upper edge of the vessel. A support-guide for the lower end of the spindle is attached to the inside of the conical vessel, near to the apex; a little above this point the spindle carries a fixed helical blade or worm-screw, the diameter of which is the same as that of the conical vessel at this position. By turning the upper end of the spindle, the latter may be raised or lowered, as required, to regulate the exit of the settled slime through the apex of the vessel.—W. E. F. P.

Lead-zinc ores ; Treatment of refractory ——. P. C. C. Isherwood, Leytonstone. Eng. Pat. 21,584, Sept. 21, 1909.

The roasted ore is leached with dilute sulphuric acid at high temperature and pressure. The amount of acid used being less than that theoretically required for dissolving the zinc oxide present, the latter is brought into solution as basic sulphate, iron oxide remaining insoluble. —W. E. F. P.

Antimony ; Wet process for the recovery of —— in a pure state from ores, concentrates, tailings, and slimes. J. R. Masson, Melbourne, Australia. Eng. Pat. 25,847, Nov. 9, 1909.

The ore is treated with a solution of caustic soda, caustic potash, or other alkali, and from the solution the antimony is precipitated as metal by means of aluminium.—A. S.

Porous metal blocks ; Process of manufacturing ——. V. Löwendahl, Stockholm. Eng. Pat. 25,909, Nov. 9, 1909.

A powdered metal, such as tinned copper, is mixed, with say 10 per cent. of a volatile substance, such as ammonium nitrate, and pressed into blocks, which are heated to a high temperature and then impregnated with a suitable lubricant. (Reference is directed to Eng. Pats. 5255 of 1905 and 18,742 of 1906; this J., 1907, 325.)—F. R.

Extraction and separation of metallic compounds from ores, mattes, residues and other metalliferous substances. A. McKechnie, Birmingham, and F. G. Beasley, Smethwick. Eng. Pat. 29,287, Dec. 14, 1909.

The material, containing two or more non-ferrous metals, is subjected to the action of a suitable solvent, and air, in a pressure vessel at a high temperature. A mineral acid is employed for ferruginous substances, a ferrous solvent (such as ferrous sulphate) being necessary for non-ferruginous materials. A double salt of the non-ferrous metal with iron is thus produced, and, this being subsequently decomposed by the oxidising action of the air, the iron is precipitated and the non-ferrous metal remains in solution. It is claimed that by proper adjustment of the quantity of solvent—of which only sufficient is added at a time to dissolve or combine with one of the non-ferrous metals—the latter may be successively extracted in the order of their affinity for the solvent, the solution in every case being free from iron.—W. E. F. P.

Oxidation, reduction or other treatment of ores, metallurgical products or the like by means of gas or air passed therethrough; Apparatus for continuous ——. F. von Schlippenbach, Stolberg - Binsfeldhammer, Germany. Eng. Pat. 29,779, Dec. 20, 1909. Under Int. Conv., Jan. 23, 1909.

The apparatus, which may be operated by pressure or suction consists essentially of a horizontal, rotatory, annular or circular hearth provided with a grating, below which a system of compartments is arranged. By means of a duct, each compartment is connected with a gas or air exit or exhaust chamber consisting of a bell-shaped part provided with a sealing receptacle and an air or gas exit or exhaust duct. The supply or exhaust of air or gas to or from the various ducts is controlled by valves, the rotation of the hearth being effected by ordinary means.—W. E. F. P.

Cupola furnaces. A. Baillot, Montreal, Canada. Eng. Pat. 2130, Jan. 27, 1910.

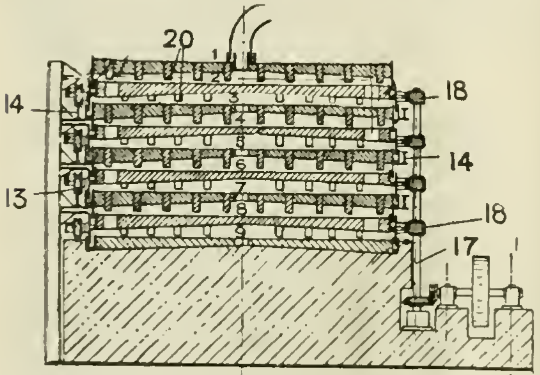
The cupola described, is substantially elliptical in cross-section (the length being rather more than double the width), and it is provided with three or more rows of tuyères, the cross-sectional area of the latter gradually decreasing from the lowest row upwards. The tuyères are so disposed that in any three rows, a quincunx is formed by any two of the upper row with the two in alignment with them in the lower row and one in the intermediate row. By this means a uniform distribution of the blast through the charge is effected, and, only a limited quantity of air at a low pressure being necessary, fuel is economised and the resulting pig is only slightly decarburised.—W. E. F. P.

Rotary [electric] furnaces. J. Thomson and F. A. J. FitzGerald, New York, U.S.A. Eng. Pat. 11,720, May 11, 1910. Under Int. Conv., May 13, 1909.

In the furnace described, a central core, formed of a number of electro-resistive parts, extends along the axis; this core may be contained in a cylindrical refractory casing and provided with terminals entering at both ends. The hearth is formed of longitudinal or segmental sections, separately removable, the arrangement of the bolting of the outer casing of the furnace being such that the sections or bricks are pressed tightly one against the other.—W. E. F. P.

Furnace; Mechanical —— for the continuous roasting of sulphide ores. X. de Spirlet. Fr. Pat. 415,338, April 28, 1910. Under Int. Conv., May 5, 1909.

The essential feature of the furnace, which is intended especially for the roasting of zinc blende, is the use of projections on the hearths themselves, instead of special arms, for moving forward the ore. The furnace (see fig.) comprises a number of superposed hearths (1 to 9) of refractory material, which are provided on their lower concave sides with projections, 20. The hearths, 1, 3, 5, 7, 9, are fixed, but the hearths, 2, 4, 6, 8, are provided with wheels, 13, and rotate on rails, 14, being driven by means of suitable gearing operated by the toothed pinions, 18, on the shaft, 17. When the alternate hearths are thus set in motion, the projections, 20, move the ore forward from the periphery to the centre and *vice versa* on alternate hearths.—A. S.



Pyrophoric metal alloys. H. Beck, Berlin. Eng. Pat. 15,507, June 28, 1910. Under Int. Conv., July 1, 1909. Addition to Eng. Pat. 2876 of 1910 (see Fr. Pat. 414,057, this J., 1910, 1210).

Relates to pyrophoric alloys composed of the rare earth metals and mercury, and consists in the partial replacement of the former by one or more of the commoner metals, or in the addition of non-metallic substances such as sand, kieselguhr, etc.—W. E. F. P.

Galvanising apparatus. A. Niedringhaus, St. Louis, Missouri. Eng. Pat. 5668, Mar. 7, 1910. Under Int. Conv., Mar. 11, 1909.

In order to prevent access of spelter or dross into the flux and galvanising boxes, used in the apparatus for galvanising plates, etc., in which molten lead is employed for the preliminary heating of the plates, each box is provided with an easily fusible or readily destroyed plug for closing its lower aperture. When required the boxes, so plugged, are introduced through the upper layers of spelter and dross, until partly submerged in the molten lead, in which the plugs then fuse, burn out or are broken up.—F. R.

Extracting metals from their ores; Process of ——. W. E. Greenawalt, Denver, Colo. U.S. Pat. 973,776, Oct. 25, 1910.

The ore is treated with an acid solution to dissolve the copper and other metals. The copper in the solution is reduced to cuprous chloride by the action of sulphur dioxide in the presence of a chloride. The copper is then electrolytically deposited and the liberated chlorine brought into contact with water in the presence of sulphur dioxide, the resulting acid solution being used for re-treating the ore, and so on, until the copper is sufficiently extracted. —F. R.

Electroplating process. F. J. McElhone, Jersey City, N.J. U.S. Pat. 973,951, Oct. 25, 1910.

Consists in coating a type mould with graphite, wetting the graphite with an organic acid solution, rinsing the mould to remove the solution and subsequently electroplating.—F. R.

Metal-reducing process. F. W. Gordon, Philadelphia, Pa. U.S. Pat. 974,257, Nov. 1, 1910.

Intended for the recovery of volatile metals from ores. The ore mixed with fuel is maintained in the furnace in the form of a column, into which at the bottom, air is injected, whilst waste gases escape at the top. The furnace charge is divided into two zones. In the lower zone the ore is reduced and the metal vaporised; in the upper zone, metal vapour is condensed and the charge is preheated. A portion of the furnace gases is withdrawn at a point between the two zones, and after recovering, by condensation, part of the metal vapour contained therein, the gases are returned to the furnace to preheat the charge in the upper zone of the furnace, any metal vapour still present being condensed, and gradually passing downwards to the lower zone, where it is re-vaporised. —A. S.

Copper alloys; Process of making —— and the product thereof. J. Naulty and J. Scanlin, Philadelphia, Pa. U.S. Pat. 974,419, Nov. 1, 1910.

The alloys mentioned are formed from nickel, a [illegible] metal (zinc), and a chromium-copper alloy containing 5 per cent. of chromium, the relative proportions of the copper-chromium alloy and the nickel being 5 : 1. The chromium is melted, with aluminium as flux, and then the copper, nickel, and zinc are added in the order mentioned. Mention is made of a product consisting of 120 lb. of a 5 per cent. chromium-copper alloy fluxed with aluminium and 45 lb. of nickel and zinc together.—A. S.

Copper; Process of extracting —— from ore. W. L. Austin, Riverside, Cal. U.S. Pat. 975,106, Nov. 8, 1910.

An artificial drainage level is made below the natural drainage level in a bed of porous rock containing copper, and cross-cuts and winzes are made at different levels throughout the bed. On flushing the bed with water, this percolates through the rock and collects at the artificial drainage level. The solution which accumulates is raised by pumping, and the copper extracted therefrom. —A. S.

Copper; Process for refining raw ——. W. Borchers and G. von Rauschenplatt. Ger. Pat. 227,622, Jan. 25, 1910.

The refining of raw copper is stated to be brought about principally by copper oxides, ferrites, and silicates, acting as oxygen carriers and slag-formers, and if instead of producing these compounds from the raw copper itself during the refining process, they are prepared separately, *e.g.*, by the roasting of copper matte, and used in large quantities, the refining of raw copper can, it is stated, be effected in an electric furnace in a smaller number of minutes than the number of hours required by the usual process in a reverberatory furnace. The slag-making compounds are first melted and heated to a high temperature in an electric furnace and the molten raw copper then added, so that it comes in contact first with slags containing silica as well as oxides of copper and iron, and later with a slag consisting principally of copper and iron oxides. (See also this J., 1910, 356, 431, 1013). A. S.

Tantalum; Process of case-hardening ——. O. A. Simpson, Charlottenburg, Assignor to Siemens und Halske A.-G., Berlin, Germany. U.S. Pat. 974,835, Nov. 8, 1910.

Tantalum is case-hardened by first roughening its surface, and then oxidising the roughened surface; or, the roughened surface may be treated with a hardening agent, subjected to pressure, and then again treated with a hardening agent.—A. S.

Alkali metals: Process of manufacture of the ——. Chem. Fabr. Griesheim Elektron. Fr. Pat. 416,926, June 9, 1910. Under Int. Conv., June 26, 1909.

A mixture of an alkali sulphide and the carbide of an alkaline-earth metal is heated to a temperature at which the liberated alkali metal may be separated by distillation. The mixture may consist, for example, of anhydrous sodium sulphide (30 kilos.) and calcium carbide (45 kilos.), or of anhydrous potassium sulphide (60 kilos.) and calcium carbide (50 kilos.), and the sulphide may be prepared in the retort itself, before introducing the carbide, by heating a mixture of the corresponding sulphate and carbon. —F. Sodn.

Roasting, calcination or reduction and agglomeration, and other operations permitting of endothermic or exothermic reaction; Process for the treatment of finely-divided and other materials by ——. F. W. Yost. Fr. Pat. 417,037, June 11, 1910. Under Int. Conv., June 11, 1909.

Consists essentially in inducing a propagative action (oxidation of mineral sulphides, for example), upon one of the surfaces of the mass of granular or finely-divided material and passing a current of suitable gas (air for example) through the mass from the opposite surface, in such a manner that the action is completely under control and proceeds in a direction opposite to that of the gaseous current.—W. E. F. P.

Precious metals from ores; Process for recovering ——. J. H. Reid, Newark, N.J., U.S.A. Eng. Pat. 24,839, Oct. 28, 1909. Under Int. Conv., Feb. 3, 1909.

See U.S. Pat. 937,387 of 1909; this J., 1909, 1208.—T. F. B.

Metallic surfaces of iron or steel or alloys thereof; Process of hardening ——. J. H. Reid, Newark, N.J., U.S.A. Eng. Pat. 3061, Feb. 8, 1910.

See U.S. Pat. 966,121 of 1910; this J., 1910, 1061.—T. F. B.

Tin-plate waste; Process for removing tin from ——. H. Brandenburg, Kempen on Rhine, Germany. U.S. Pat. 971,463, Nov. 1, 1910.

See Fr. Pat. 386,781 of 1908; this J., 1908, 813.—T. F. B.

Antimony; Process for recovering —— from ores and the like. J. R. Masson, Melbourne. U.S. Pat. 975,118, Nov. 8, 1910.

See Eng. Pat. 25,847 of 1909; preceding.—T. F. B.

Zinc ores; Treatment of —— by the precipitation process. A. Desgraz, Hanover, Germany, Assignor to Imbert Process Co., New York. U.S. Pat. 975,217, Nov. 8, 1910.

See Fr. Pat. 407,305 of 1908; this J., 1910, 196.—T. F. B.

Pyrites; Process for smelting ——. J. P. Channing. Fr. Pat. 416,416, May 26, 1910.

See U.S. Pat. 963,020 of 1910; this J., 1910, 960.—T. F. B.

Steel; Manufacture and treatment of ——. H. A. Richardson. Fr. Pat. 416,617, June 1, 1910. Under Int. Conv., June 5, 1909.

See Eng. Pat. 13,218 of 1909; this J., 1910, 881.—T. F. B.

Mercury from low-grade ores; Electrolytic process for separating ——. B. Szilárd and H. Bergerat. Fr. Pat. 416,835, June 6, 1910. Under Int. Conv., Aug. 13, 1909.

See Ger. Pat. 223,152 of 1909; this J., 1910, 969.—T. F. B.

Furnaces for roasting ores. T. D. Merton and H. M Ridge. Fr. Pat. 416,947, Jan. 26, 1910. Under Int Conv., June 10, 1909.

See Eng. Pat. 13,625 of 1909; this J., 1910, 1113.—T. F. B

XI.—ELECTRO-CHEMISTRY.

Iron and nickel anodes; Behaviour of —— in various electrolytes. E. P. Schoch and C. P. Randolph. J. of Phys. Chem., 1910, **14**, 719—737.

A large number of experiments was carried out in a specially designed apparatus, to ascertain the potentials exhibited by iron and nickel anodes when subjected to various current densities in different electrolytes. As a result, the anions have been arranged in the following order of decreasing tendency to effect metal dissolution (or increasing tendency to effect oxidation):—(1.) Halogens; (2.) sulphates; (3.) acetates; (4.) perchlorates; (5.) nitrates; (6.) chromates, chlorates, bromates, iodates, hydroxides—the last five being practically in one class. The iodate-ion appears to have the greatest tendency to anodic oxidising action. It is also concluded, from the figures obtained, that the corrosive character of solutions for metals cannot be considerably lessened by addition of chromates, hydroxides, etc., as has been suggested; also, the previous passivifying or "chromating" of an iron surface will not appreciably protect it against the action of a natural water containing sulphates, chlorides, etc.—T. F. B.

Aromatic sulphonyl chlorides; Electrolytic reduction of ——. F. Fichter and W. Tamm. Ber., 1910, **43**, 3032—3038.

The authors have extended earlier work on the electrolytic reduction of sulphonyl chlorides. α-Naphthalenesulphonyl chloride yields the mercaptan together with α-naphthyl disulphide and some α-naphthalenesulphinic acid.

β-Naphthalenesulphonyl chloride gives an 80 per cent. yield of the disulphide and some mercaptan and sulphinic acid. Benzene-*m*-disulphonyl chloride similarly furnishes dithioresorcinol, benzene-*m*-disulphinic acid and disulphide. *p*-Anisolesulphonyl chloride is reduced to the mercaptan (which was not isolated but oxidised at once to the disulphide), and the sulphinic acid. *m*-Nitrobenzenesulphonyl chloride yields di-*m*-aminophenyl disulphide and *p*-dimethylanilinesulphonyl chloride gives *p*-dimethylaminothiophenol.—J. C. C.

Electrochemical behaviour of cobalt [and of nickel and iron]. Schildbach. *See* X.

Patents.

Batteries ; Galvanic ——. Dura Elementbau Ges. m. b. H., and A. Lessing, Berlin. Eng. Pat. 8810, April 12, 1910. Addition to Eng. Pat. 23,622, Nov. 1, 1904 (this J., 1905, 94).

The dry electrolyte, or any dry constituent of it, is mixed with pumice, or other similar porous substance having a large fluid-carrying capacity, to facilitate the percolation of water throughout the whole of the electrolyte when the battery is put into use.—B. N.

Electrolytic cell. G. C. Landis, Wadsworth, and J. H. Smith, Rittman, Ohio, Assignors to Ohio Salt Co., Wadsworth, Ohio. U.S. Pat. 974,576, Nov. 1, 1910.

Two series of electrodes are mounted in a containing vessel so as to form a tortuous path for the electrolyte. Tubes of electrically non-conducting material, "each in the form of a series of substantially parallel convolutions," are disposed, one between each pair of electrodes, and a cooling fluid is circulated through the tubes, each of which has inlet and outlet pipes.—A. S.

Furnace ; Treatment of gases by the electric ——, *particularly for the synthetic manufacture of nitrogen products.* C. Sénez and L. Giniès. First Addition, dated May 14, 1910, to Fr. Pat. 414,726, April 11, 1910 (this J., 1910, 1212).

The furnace is furnished with electrodes, consisting of tubes, triangular in section, cooled with water, and disposed in zigzag relationship, one to the other, the current of gas passing between the electrodes and meeting the electric arc, which takes the form of an undulated ribbon following the form of the electrodes. The furnace is provided with an electro-magnetic arrangement for feeding the arc, branched from the network for feeding the furnace, and comprising a pair of auxiliary electrodes of which one at least is movable. These auxiliary electrodes produce automatically the feeding of the arc between the electrodes when the furnace is put into action, or when the arc is broken accidentally, and are put out of action when the arc has been started between the main electrodes.—B. N.

Furnaces ; Electric fusion induction ——. A. Hiorth. Fr. Pat. 416,079, May 18, 1910. Under Int. Conv., May 22, 1909.

The core, at the interior of the furnace, in proximity to the primary coil, is made hollow.—B. N.

Feeding electric furnaces with triphase currents ; Mode of ——. Soc. anon Electrometallurgique (Proc. P. Girod). Fr. Pat. 416,927, June 9, 1910.

The furnace is furnished with three electrodes, or groups of electrodes, bound to the three phases of the secondaries of transformers, and connected to a "centre" of special make, in which one of the phases is reversed ; the common conductor is bound to the conducting sole of the furnace —B. N.

Electrodes of rare earths for Geissler tubes. La Banque du Radium. Fr. Pat. 416,923, June 9, 1910.

The use of electrodes of rare earths allows of the Geissler tubes being put directly into the circuits of electric "sectors," without modifying the usual voltage, the incandescence of the tubes being obtained by an auxiliary heating, and maintained in this manner or by the passage of the current through the tube.—B. N.

Separating certain substances or impurities from solutions ; [Electrolytic] Process for ——. A. Schrey. Fr. Pat. 416,974, May 13, 1910. Under Int. Conv., May 14, 1909.

Certain substances or impurities are separated from solutions by the application of the principle of electro-osmosis, characterised by the introduction of fibrous materials between the electrodes, so that the current can only pass through the capillary openings. Substances contained in the solution are rapidly absorbed, such as alcohol from beer, tartaric acid from wine, caffeine from coffee, etc., thus modifying or improving certain beverages or foods. The process may also be employed for the cleansing of linen, degumming of silk, degreasing of wool, or for bleaching, mordanting and dyeing tissues.—B. N.

Electrolytic apparatus having a liquid anode. Schott und Gen. Jena, Germany. Eng. Pat. 6597, March 16, 1910. Under Int. Conv., March 30, 1909. Addition to Eng. Pat. 14,288 of 1909, dated June 26, 1908.

See First Addition to Fr. Pat. 404,332 of 1909 ; this J., 1910, 960.—T. F. B.

Electrolyte for primary batteries ; Preparation suitable for producing an ——. B. E. R. Newlands and R. M. Parkinson. First Addition, dated May 10, 1910, to Fr. Pat. 415,758, May 9, 1910.

See Eng. Pat. 9176 of 1910 ; this J., 1910, 1064.—T. F. B.

Carbons ; Protective covering for electrode and other ——. Gebr. Siemens und Co. Fr. Pat. 416,260, May 23, 1910. Under Int. Conv., May 24, 1909.

See Eng. Pat. 12,425 of 1910 ; this J., 1910, 1064.—T.F.B.

Preparation of nitrogen compounds [calcium cyanamide] by means of alkaline-earth carbides and nitrogen. Fr. Pat. 417,054. *See* VII.

Manufacturing porous metal blocks. Eng. Pat. 25,909. *See* X.

XII.—FATS ; OILS ; WAXES.

Soya-bean oil industry. J. Lewkowitsch. Chem. Ind., 1910, 33, 705—708.

The method of separating the oil from the soya bean in Manchuria is to soak the seeds in water overnight, to crush them, and, after boiling the mass with a little water, to express the oil in a primitive form of press. Owing to the length of time during which the pressure is continued, the yield of oil is as high, if not higher, than is given by the modern hydraulic presses. The expressed oil is mainly used for food, whilst any that is unfit for that purpose is burned in lamps. The residual cakes in the press, which are about 3 inches thick and 2 to 3 feet in diameter, form a staple food product. Some idea of the trade done in these soya bean cakes may be formed from the fact that during the year 1904 no less than 160,000 tons of soya bean cake (not including the beans themselves or the oil) were exported to Japan alone, although that country itself produced about 2,500,000 hl. (6,875,000 bushels) of beans, which were utilised in 11,000 factories in the manufacture of soy-sauce. In the year 1909 the quantity of beans exported from Manchuria to Japan reached 600,000 tons. Until two years ago considerable difficulties stood in the way of the trade with Europe, for the long sea-voyage through the tropics had such a deteriorating effect upon the beans, that, after removal of about 10 per cent. of oil, the residual oil cake was quite unsuitable as a feeding stuff. It needed therefore particularly favourable conditions to introduce the beans into the European markets.

After the conclusion of the Russian-Japanese war (during which the beans had formed the staple food of the soldiers on both sides) Manchuria was thrown open to the commerce of the world, and the decline in the shipping rates presented a favourable opportunity of exporting large quantities of the beans to England. The first large consignment reached Liverpool towards the end of 1908, and its arrival coincided with a period of great scarcity of other oils and fats, due to various causes, and, in particular, to the increased consumption of edible fats, and the growing demand for dynamite glycerin for the Transvaal mines and the construction of the Panama canal. In addition to this, the cotton-seed harvest in the United States had been poor, and this had caused a considerable increase in the price of Egyptian cotton-seed, so that many oil-mills in England had been forced temporarily to suspend work. Hence attention was at once directed to the new raw material, large quantities of which were available at favourable prices. The imported beans had the following average composition :—Water, 10; oil, 18; proteins, 40; carbohydrates, 22; fibre, 5; and ash, 5 per cent. It was not possible to reckon upon a higher yield of oil than 10 per cent. from the beans, but feeding experiments with the oil-cake showed that whilst it produced as much flesh as cotton-seed oil-cake, it caused the cows to yield a milk richer in cream. Thus for some time past soya cake has fetched higher prices in the market than cotton-seed cake. Had it not been for the timely appearance of soya-bean oil the already high price of cotton-seed oil would have been at least 25 per cent. higher, and there would have been a corresponding increase in price of all the fats used in the soap industry. Immense quantities of the new oil were employed in the manufacture of soap, and during the year 1909 more than 400,000 tons of the beans were imported into England. Only small quantities were sent to America, and, relatively, very little to the continent of Europe. The high tariff on raw materials in Germany and in France prevented the importation of the seed, and at first the English oil manufacturers took advantage of this, and exported large quantities of soya oil and soya cake both to America and the Continent. Only within the last few months have the German oil manufacturers succeeded in obtaining the concession that soya beans may be imported into Germany free of duty, but in the near future the production of soya oil and soya cake may become an important branch of the German oil industry. The chief use of the new material in the manufacture of soap is as a partial substitute for cotton-seed oil in the production of hard soaps, whilst for soft soaps it can completely replace cotton-seed oil and partly replace linseed oil. Soya-bean oil has also been extensively used as an edible oil, and in admixture with cotton-seed oil large quantities of it have been consumed in England. It has also been employed as an oil for the preservation of sardines. Attempts were made to use it as a substitute for linseed oil in the colour and varnish industries, but it can never replace the latter oil completely. The composition of soya-bean oil renders it particularly suitable for the adulteration of both linseed and cotton-seed oils, whilst it is also frequently employed as an adulterant of Japanese rape oil. The chief ports for the export of soya beans are Newchang, Dalny, Vladivostock, and Hankow, whilst the principal Europeans ports for their importation are Hull, London, and Liverpool, and, more recently, Hamburg. The supply of the beans is assured for several years, for, in addition to that produced in Manchuria and South China, attempts, which appear likely to be successful, are being made to cultivate the plant in West Africa and in the East Indies. In the Southern States of North America the soya plants are already grown for fodder, and experiments are now being made to cultivate them for the production of oil seed. It has already been proved that the beans grown in West Africa from Asiatic seed do not yield less oil than the original seed.—C. A. M.

Oils ; "Primary and secondary" bromine values of ——. W. Vaubel. Z. angew. Chem., 1910, 23. 2077—2080.

In determining the bromine value of oils by dissolving them in a suitable solvent, adding potassium bromide solution and hydrochloric acid, and titrating the solution with an excess of potassium bromate, it was found that in the case of certain oils, *e.g.*, olive oil, hardly any bromine was absorbed directly, but that it was necessary to add an excess of potassium bromate and to titrate this excess in order to obtain serviceable results. Drying and semi-drying oils, however, behaved differently in this respect, for a point could be found at which the direct absorption of bromine was perceptibly slower. It was thus possible in the case of these oils to determine two kinds of bromine values—the primary value calculated from the amount of bromine directly absorbed, and the secondary value, obtained by the use of an excess of bromine. In determining the primary value a very small quantity of potassium bromate solution is added and the flask shaken until the liquid is colourless, when more is added, and so on until a faint yellow colour persists and no further absorption of bromine takes place until a large excess of bromate is added. The end-point of the first absorption may be more accurately found by introducing into the liquid a crystal of potassium iodide the disappearance of the violet colour of the iodine liberated therefrom showing that free bromine is present. In determining the secondary bromine value about 5 grms. of the oil are dissolved in 50 to 100 c.c. of chloroform, carbon tetrachloride, or petroleum spirit, and the solution treated with a corresponding amount of potassium bromide solution and sufficient water to make up the aqueous layer to 300 to 500 c.c., after which 10 c.c. of concentrated hydrochloric acid and a crystal of potassium iodide are added, followed by a suitable excess of potassium bromate solution. The stoppered flask is now vigorously shaken for about one minute, and the excess of bromine titrated with standard sodium thiosulphate solution, the end-point of the reaction being shown by the appearance of the iodine coloration. The results thus obtained are in close agreement with the iodine values of the oils. The following results illustrate the differences between oils with regard to their primary and secondary bromine values :—

Oil.	Primary bromine value.	Secondary bromine value.	Iodine value calculated from secondary value.
Linseed	75·2—80	107·7 ; 107·7	170·7
Tung	56·0—57·9	94·6	150
Arachis	50·2—52·8	52·6	91·3

—C. A. M.

Solid fatty acids from liquid fatty acids ; Method of separating ——. David. Comptes rend., 1910, **151**, 756—757.

The method is based upon the fact that the ammonium salts of solid fatty acids are completely insoluble and those of liquid fatty acids completely soluble in a large excess of ammonia solution at 13° to 14° C. By this means it is possible to separate down to 1 per cent. of either solid or liquid acids from a mixture of the two. For a quantitative determination 2 grms. of the fatty acids are dissolved in 5 c.c. of warm 95 per cent. alcohol, 50 c.c. of ammonia solution added at 22° C., and the liquid heated until bubbles of ammonia vapour appear. The clear solution is then allowed to stand for several hours (preferably over-night) at 14° C. (not over 15° C.), and is then filtered. The palmitate or stearate or mixture of the two is washed on the filter until the filtrate no longer gives the slightest turbidity with baryta water, after which it is washed with dilute hydrochloric acid (1 : 1) at 22° C. The resulting ammonium chloride passes through the filter, leaving the solid fatty acid, which is next washed with dilute hydrochloric acid, and then with water, separated from the filter, dried at 100° C., and weighed. In a mixture containing 60 per cent. of solid fatty acids the amount thus found in two determinations was 59·7 and 59·8 per cent. The solid fatty acids obtained in the stearine industry (stearic, palmitic, hydroxystearic, and iso-oleic acids) all formed ammonium salts insoluble in a large excess of ammonia, as did also lauric and arachidic acids. The liquid fatty acids in the filtrate may be found by difference, or the soluble ammonium salts may be decomposed with hydrochloric acid, and the separated fatty acids dried at 120° C. with the usual precautions against loss.—C. A. M.

Wool-grease oleines ; Examination of —— *III.* J. Marcusson. Mitt. Königl. Materialprüfungsamt. 1910, **28**, 469—471.

The method of examining wool-grease oleines, and of detecting mineral and rosin oils therein, described in the former communication (this J., 1904, 1001) has now been simplified and improved. The tedious extraction of the unsaponifiable matter with boiling acetic anhydride may be omitted, since it has been found that cholesterol is absent or at most only present in traces. Thus if the unsaponifiable matter is distilled under a reduced pressure of 0·1 to 0·2 mm., only dextro-rotatory fractions are obtained, the rotation of which gradually but steadily rises. Moreover, even long-continued extraction with acetic anhydride gives no increase in the original dextro-rotatory capacity, as would be the case if lævo-rotatory cholesterol had originally been present. The presence of oxygen in the unsaponifiable matter is attributed to its absorption from the air by unsaturated bodies. Certain samples of English wool-grease oleines were found to be adulterated with colophony, the separated fatty acids giving a sharp reaction in Morawski's test. Other samples which appeared to be pure had, in the main, the same characteristics as French and German wool-grease oleines, excepting that in one instance a lower iodine value was found. The proportion of unsaponifiable matter found in two samples was 48 and 54 per cent., with iodine values of 65·4 and 51·3, and optical rotation $\alpha_D = +24{\cdot}8^\circ$ and 24·1° respectively. The purity of wool-grease oleine may often be ascertained by means of a simple solubility test. In most cases pure wool-grease oleine dissolves in an equal volume of 96 per cent. alcohol at 20° C., whereas in the presence of mineral oil a more or less pronounced turbidity is produced. In this way it is possible to detect with certainty an addition of 20 per cent. of mineral oil. As a further test the optical rotation of the oleine may be determined. This was found to vary from $\alpha_D = +10^\circ$ to $+19^\circ$ in wool-grease oleines of German, French, and English origin. If a wool-grease oleine is soluble in an equal volume of 96 per cent. alcohol, and has an optical rotation exceeding $\alpha_D = +10^\circ$, it may be concluded that no appreciable quantity of mineral oil is present. On the other hand, if either of these tests is unsatisfactory the unsaponifiable matter should be tested for mineral oil.—C. A. M.

Wool-grease oleines ; Detection of mineral oil in ——. G. Winterfeld and W. Mecklenburg. Mitt. Königl. Materialprüfungsamt, 1910, **28**, 471—474.

The alcohol solubility test described by Marcusson (preceding abstract) may be rendered more sensitive by increasing the amount of the solvent to 1½ times the volume of the oleine. This appears to be the best proportion of alcohol, for with 2 vols. instead of 1½, a turbidity was produced with certain wool-grease oleines, which in other respects behaved as pure products. Using 1½ vols. of alcohol, 10 per cent. and in some cases, 5 per cent. of mineral oil could be detected, whilst an idea of its quantity could be formed from the amount that separated. A still better reagent was a mixture of 90 per cent. of methyl alcohol and 10 per cent. of alcohol. When added to an equal volume of pure wool-grease oleine this produced no turbidity, but the addition of 10 per cent. of mineral oil in all cases and 5 per cent. in most cases, could be detected by the production of turbidity and separation of an oily layer at 20° C. A sample of English wool-grease oleine, in which no adulteration could be detected by Marcusson's tests, gave a very pronounced turbidity in the alcohol test, and after the mixture had stood for an hour at 20° C. there separated a mixture of oil and solid substances. Under the same conditions an oleine to which mineral oil had been added gave a deposit of clear oil. The abnormal behaviour of this English sample was attributed to an extraordinarily high proportion of solid unsaponifiable bodies. A similar result was obtained with another sample of English wool-grease oleine, which in other respects appeared pure. It is stated that it is extremely difficult to obtain pure samples of the English product ; and in this connection it is mentioned on the authority of several large firms, that very little English wool-grease oleine is used in Germany, owing to the fact that it cannot be sufficiently washed out of the materials.—C. A. M.

Wool-grease oleines ; Detection of rosin oils in French ——. G. Winterfeld. Mitt. Königl. Materialprüfungsamt, 1910, **28**. 474—476.

The simplest means of detecting rosin oil in wool-grease oleine is a combination of the methyl-ethyl alcohol solubility test of Winterfeld and Mecklenburg (see preceding abstract) with a direct determination of the refractive index of the oleine at 20° C. The addition of 20 per cent. of refined rosin oil may be detected with certainty (and in some cases 10 or even 5 per cent.), by shaking the sample with an equal volume of methyl and ethyl alcohol (90 :10) at 20° C. and noting whether there is any turbidity, or separation of oil after the mixture has stood for an hour at 20° C. On the other hand, an addition of even 20 per cent. of crude rosin oil (rich in colophony) cannot as a rule be detected in this way. The refractive index of pure French wool-grease oleines is usually below 1·480 at 20° C., and an addition of 10 per cent. (or in some cases of 5 per cent.) of crude or refined rosin oil can be detected by the considerable increase in this value.—C. A. M.

Candelilla wax ; Constituents of ——. G. S. Fraps and J. B. Rather. J. Ind. Eng. Chem., 1910, **2**, 454—455.

The authors state that they have isolated from candelilla wax (see Hare and Bjerregaard, this J., 1910, 705) a hydrocarbon melting at 68° C. and having the formula, "$C_{30}H_{62}$," which appears to be "hentriacontane," also found in beeswax. Another substance, probably a hydrocarbon, melting at 85° C., was also separated.—W. H. P.

Cottonseed and other oils for making alimentary fats ; Importation of —— *into France.* Board of Trade J., Nov. 17, 1910. [T.R.]

In accordance with the French Tariff Revision Law of the 29th March, 1910, cottonseed, sesamé, and ground-nut oils intended for the manufacture of alimentary fats are admitted into France at the reduced rate of 6 frs. per 100 kilos. gross weight, subject to official supervision (at the expense of the manufacturers) of the factories importing such oils. A recent French Customs Circular containing the regulations with which manufacturers will be required to comply, and describing the nature of the supervision exercised over the use to which the imported oils are put, may be inspected at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Patents.

Fish refuse ; Method of treating —— [*for oil, glue, and fertilisers*]. G. Lange, A. Pujol, and A. Delpon. Fr. Pat. 416,558, Aug. 9, 1909.

The refuse is heated under pressure in an autoclave, the steam introduced supplying, as it condenses, the necessary quantity of water. The liquid portion is then drawn off, and, after the separation of the oil, the remaining liquid is used for the preparation of fish-glue. The solid matters remaining in the autoclave are withdrawn, and pressed into cakes. The latter may be ground, treated with sulphuric acid and mixed with calcium phosphate so as to form a nitrogenous superphosphate.—W. P. S.

Reduction of organic substances [*oleic acid, nitrobenzene, etc.*] ; *The catalytic* ——. F. Bedford and C. E. Williams, Sleaford. Eng. Pat. 3752 of 1910, date of Appl., July 21, 1909.

When carrying out the reduction process described in Eng. Pats. 2520 of 1907 and 9112 of 1908 (see this J., 1908, 296; 1909, 1005), the nickel soon loses its activity if even minute quantities of sulphur compounds are present in the reducing gas. The present process consists in cooling the gas (water-gas, Riche gas, Siemens gas, etc.) to a sufficiently low temperature (say, −190° C.), to cause the impurities to solidify and passing the purified gas, with or without admixture with similarly purified hydrogen, together with the organic substance to be reduced, over finely-divided nickel. In this way the reduction of oleic acid and linseed oil to stearic acid and its triglyceride, respectively, may be carried out continuously.—T. F. B.

Castor oil; Process for the manufacture of a new sulpho-derivative of ——. L. Blumer. Ger. Pat. 227,993, July 10, 1907.

It is known that soaps soluble in hydrocarbons, fatty oils, etc., can be prepared by heating castor oil at 150°—250° C., and then neutralising with alkali. According to the present patent the oil after being heated is sulphonated as in the usual process of making Turkey-red oil, and the sulphonic acids produced are washed, and neutralised with alkali. The oily product so obtained is said to form a useful substitute for Turkey-red oil. By evaporation, a solid soap can be obtained, which may be mixed with considerable quantities of calcium and magnesium salts without giving insoluble soaps.—A. S.

Soap; Drying or "stoving" of ——. E. Higgins, Wallasey, Chester, and J. W. Spensley, Manchester. Eng. Pat. 27,899, Nov. 30, 1909.

The bars or tablets of soap are dried by subjecting the surfaces to a temperature sufficiently high to cause practically instantaneous drying and fusion, or partial fusion, of the outer skin or face. The source of heat, which may consist of hot gas, non-luminous flames, or radiant heat from incandescent metallic surfaces, and the soap are moved relatively to one another at such a velocity as is sufficient for the purpose.—B. N.

Soap tablets which dissolve readily; Process for manufacturing ——. Saponia-Werke F. Boehm. Fr. Pat. 417,139, June 14, 1910.

Sawdust or the like is impregnated with an agglutinant such as dextrin and mixed with soap powder, and the whole is then pressed into the form of tablets.—W. P. S.

Soaps containing inorganic colloids; Process for the manufacture of ——. K. Roth. Ger. Pat. 228,139. Dec. 22, 1908.

It has been found that the alkali salts of the higher fatty acids, such as are contained in potassium and sodium soaps, are able to play the same part as do sodium protalbinate and lysalbinate in the preparation of metals, oxides and hydroxides, etc., in the colloidal condition (compare Paal, this J., 1902, 994, 996). Potassium or sodium soap in the fused state, or in concentrated solution, is treated with a soluble metallic salt and with the equivalent quantity of caustic alkali. The product containing the oxide or hydroxide of the metal in the colloidal form, is purified by digestion with a little water, or by dialysis, and then concentrated by evaporation. Before purification the colloidal oxide or hydroxide may be reduced to metal by means of a suitable reducing agent. By using mercuric chloride, with ammonia instead of the caustic alkali, a white product is obtained. The products are stated to show the properties of both the soap and the hydrosol present.—A. S.

Alkyl and aryl esters of phthalic acid as solvents. Ger. Pat. 227,667. *See* XIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Sublimed white lead; Manufacture of ——. J. I. Blair. Eng. and Min. J., 1910, **90**, 906—908.

(See this J., 1909, 405). Two "slag-eye" furnaces are continuously fed through openings above them, and which are below the combustion chamber, with a charge consisting of galena table concentrates free from zinc and thoroughly dry various waste sweepings, blue fume, black slag from the "eye" rich in lead, grey slag from the open hearths, iron consisting of boiler scale, tin cans and machine shop sweepings, 40-mesh-fine lime, and coke. Air at 4½ oz. pressure is supplied to the furnace through six 3 in. tuyères directed downwards and situated half way up the furnace. The combustion chamber above the furnace is about thirty feet in length and is water-jacketed near the furnace and covered with a layer of zinc retorts 10 in. in diameter without their closed ends; the air circulating through these retorts keeps them cool and they are easily renewed. The furnaces are kept at a white heat, and the volatilised galena is oxidised in this chamber by the air from the feeding holes into the pigment, which is a basic lead sulphate. The combustion chamber leads to a tower 20 ft. high and 10 ft. in diameter kept as nearly as possible at a temperature of 800° C., and thence into two smaller towers leading to a series of seven goose-necks resting on hoppers from which an inferior pink quality of pigment is collected, which is utilised in the rubber industry. The cooled fume now passes through a seven foot fan to the bag-house in which are 540 unwashed woollen bags each of which is 20 in. in diameter and 30 ft. long. The rate of revolution of the fan controls the temperature of the interior of the combustion chamber. Too low a temperature causes a production of excess of lead oxide, while too high a temperature burns the bags fuses the pigment near the furnaces, thus choking the combustion chamber, and may also decompose the newly formed basic sulphate liberating lead oxide which discolours it. Twice each eight hour shift the bags are shaken and the pigment transferred from the hoppers beneath to a screw conveyor which delivers it to the packers. This screw conveyor is intended more to remove included air and gas, which has hitherto caused the failure of mechanical packing, rather than merely to deliver the pigment. A very silicious slag and a small variable quantity of hard white metal is run off from the eye of the furnace. Only two installations of this plant are in operation in the United States.—A. H. C.

Chrome paint analysis. E. F. Scherubel and E. S. Wood. J. Ind. Eng. Chem., 1910, **2**, 482—483.

The authors made up a chrome paint containing all the ingredients ever likely to be present and subjected it to the following scheme with satisfactory results. Barium sulphate and silica are completely insoluble in hydrochloric acid, whilst the lead and calcium sulphates can be completely removed by extraction with this solvent. Hydrofluoric acid is used to separate the silica, which is estimated by difference, the residue being barium sulphate. Calcium sulphate is determined by precipitation of the equivalent amount of barium sulphate on adding barium chloride to the filtrate from the above extraction. Zinc oxide and calcium carbonate are estimated by extracting a new sample with acetic acid. Hydrogen sulphide precipitates the zinc (with any lead which may have dissolved as oxide) and the calcium is determined in the filtrate. After subtracting the calcium previously found as sulphate, the rest is calcium as carbonate. To the hydrogen sulphide precipitate re-dissolved in hydrochloric acid, sodium acetate and a small excess of potassium chromate are added. This removes the lead, and the zinc in the filtrate gives the zinc oxide originally present. A new sample boiled with 10 per cent caustic soda gives a filtrate from which lead chromate can be reprecipitated and estimated by acetic acid. From the residue ferric oxide can be extracted with hydrochloric acid, and estimated in the usual way after removing any traces of lead. To determine lead oxide all the lead in the original substance is obtained in hydrochloric acid solution, and then addition of sodium acetate and potassium chromate precipitates it all as chromate. The difference between this value and the previous figure for lead chromate is calculated to lead oxide.—W. H. P.

Paint films; Permeability of ——. H. A. Gardner. J. Franklin Inst., 1910, **170**, 345—347.

Tests were made to determine the water-excluding values of various combinations of pigments ground in pure linseed oil. White pine boards were prepared, numbered, and given three coats of the different white paints, and after drying, were weighed, immersed in a tub of water for three weeks, and the gain in weight, corresponding to the amount of water penetrating through the pores of the wood, was observed. They were again immersed and at the end of two months dried and re-weighed. The tests seem to indicate that a mixture of white lead and zinc oxide, with or without a small percentage of inert pigments is not so subject to the action of water as the single pigment paints. Somewhat similar results were given by corroborative tests made by soaking white pine boards in a solution of iron sulphate, coating with one coat of the paint previously used, drying for forty-eight hours and placing on each a few drops of solution of potassium ferrocyanide. The blue coloration varies with the porosity of the film. Again, films of paint were prepared by painting on glue-sized paper and removal by warm water. Ammonium chloride was dialyzed through these films for six days: a film containing corroded white lead allowed the passage of 0·003 grm., another containing corroded white lead and asbestine 0·002 grm., and a third containing corroded white lead and zinc oxide 0·0003 grm. of ammonium chloride. Tests were also made with dilute solutions of other salts such as ferric chloride, with a dilute solution of potassium thiocyanate on the reverse side of the apparatus. In the latter case the pink coloration was formed in a few hours.—R. C. P.

White lead and plumbism. Thomason. *See* VIII.

Solubility of lead sulphate and chromate alone, and in the form of oil colours, in dilute hydrochloric acid, and equilibrium of chromate and bichromate in solution. Beck and Stegmüller. *See* XIXB.

PATENTS.

Red or orange lead; Purification or treatment of ——. W. Eckford, Rhyl, Flintshire. Eng. Pat. 8017, April 2, 1910. Addition to Eng. Pat. 12,480, May 26, 1909 (this J., 1910, 831).

RED or orange lead is first treated with a solution of lead acetate, to remove lead monoxide, and then with a solution containing acetic acid (preferably a dilute solution), in order to dissolve the oxides of copper, iron, zinc, and other metals; the product is finally washed and dried.—F. SODN.

Phthalic acid alkyl and aryl esters, or mixtures of such esters, as solvents; Application of ——. A. Hesse. Ger. Pat. 227,667, June 15, 1909.

THE use of the alkyl or aryl esters of phthalic acid, alone or mixed together, as solvents, especially for resins, fatty and essential oils, and perfumes, is claimed. In general, only a very small quantity of the ester is required for solution; for example, perfectly clear solutions of rosin are obtained by warming it with 30 per cent. of its weight of dimethyl or diethyl phthalate. This solvent action of the phthalates may be employed in the working up of gum copal; when solutions of this in suitable mixtures of esters are heated, the formation of highly coloured by-products, which occurs when the resin is heated alone, is avoided.—T. F. B.

Paints, varnishes, and stains; Manufacture of ——. R. S. Perry, Philadelphia, U.S.A. Eng. Pat. 24,119, Oct. 20, 1909.

SEE U.S. Pat. 938,505 of 1909; this J., 1910, 33.—T. F. B.

Pigments or lakes [from dibenzoyldiaminoanthraquinones]; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 6365, March 14, 1910.

SEE U.S. Pats. 970,072 and 970,073 of 1910; this J., 1910, 1215.—T. F. B.

Lac; Centrifugal separators and the like for the treatment of ——. W. A. Freymuth, London. Eng. Pat. 24,825, Oct. 28, 1909.

SEE Fr. Pat. 409,795 of 1909; this J., 1910, 770.—T. F. B.

Shellac from stick-lac or the like; Process for obtaining pure ——. G. J. Fowler, Urmston, near Manchester. U.S. Pat. 975,224, Nov. 8, 1910.

SEE Eng. Pat. 12,877 of 1908; this J., 1909, 614.—T. F. B.

Solvent [phthalic acid esters]. A. Hesse. Fr. Pat. 416,806, June 4, 1910. Under Int. Conv., June 14, 1909.

SEE Ger. Pat. 227,667 of 1909; preceding.—T. F. B.

Tarry coatings. Fr. Pat. 416,177. *See* III.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubbers; East African plantation ——. *I. Rubber from Amani.* F. Frank and E. Marckwald. Gummi-Zeit., 1910, 25, 193—197.

THE authors have examined 29 samples of *Manihot Glaziovii* rubber, and three samples of *Kickxia* rubber, prepared by different methods. In the case of fourteen of the samples a complete examination—including determination of loss on washing, ash, resins and viscosity—has been made, and on the vulcanised samples, free and combined sulphur, organic acetone extract, tensile strength and elongation, have been determined. In the following table the details of this examination are shown:—

Sample No.	Method of preparation.	Loss on washing.	In washed, dried product.			In vulcanised product.				Apparent alteration in resin content on vulcanisation.	Tests in Schopper machine (20 mm. section).		Quality according to	
			Resin.	Ash.	Viscosity at 20° C.	Total sulphur.	Free sulphur.	Combined sulphur.	Organic acetone extract.		Breaking strain.	Elongation.	Strength and vulcanisation.	Viscosity.
		%	%	%	seconds	%	%	%	%	%	kilos.	%		
2	Acetic acid scraps, washed in water, Manihot	25·5	6·3	0·8	9	8·32	4·1	4·22	8·22	+2·08	42·2	858	II.	6
4	Acetic acid and Purub scraps, washed, Manihot	14·3	5·9	1·3	26	8·95	5·96	2·99	5·42	−0·48	16·3	824	X.	2
5	0·4% carbolic, 0·2% acetic scraps, washed, Manihot	21·0	5·3	0·7	$10\frac{4}{5}$	8·52	2·91	5·61	8·27	+3·03	28·5	824	XI.	4
9	Lemon juice pure, scraps, wet, Manihot	24·0	6·1	1·2	26	9·06	4·40	4·66	6·34	+0·24	46·40	870	I.	1
11	Sisal juice, washed in water, Manihot	29·9	7·2	1·6	$7\frac{1}{5}$	9·01	5·93	3·08	4·91	−2·19	19·0	838	IX.	9
12	1% Purub C, wet, scraps, Manihot	40·4	6·9	1·9	$9\frac{1}{5}$	8·79	4·52	4·27	7·26	+0·46	6·0	500	XIII.	7
21	Carbolic and lemon juice, dry, Manihot	—	6·5	2·9	$4\frac{2}{5}$	7·99	2·72	5·27	10·00	+3·5	21·6	876	XII.	12
22	1% Purub, dry, Manihot	—	7·1	2·1	$7\frac{1}{2}$	8·63	5·46	3·17	7·20	+0·1	24·0	824	VIII.	8
24	Acetic acid and Purub, dry, Manihot	—	8·6	0·9	insol.	7·78	5·36	2·42	8·18	−0·32	21·6	890	VII.	—
25	Purub, dry, Manihot	—	6·5	2·1	$17\frac{2}{5}$	9·50	5·75	3·75	6·65	+0·25	40·4	848	III.	3
27	Carbolic and acetic scraps, dry, Manihot	—	8·8	1·2	$5\frac{1}{5}$	9·98	6·46	2·52	8·00	−0·7	35·0	762	V.	11
28	Carbolic and acetic dry, Manihot	—	6·0	2·0	$9\frac{4}{5}$	9·06	6·25	2·80	8·04	+2·04	26·7	774	VI.	5
29	Mroweka, washed in shot-mill, dried, smoked, Manihot	13·0	6·8	3·6	$5\frac{4}{5}$	9·48	5·75	3·73	6·11	−0·59	32·7	791	IV.	10
19	In water with 1% Purub, Kickxia	14·0	10·3	0·10	$4\frac{1}{5}$	8·29	6·24	2·05	11·16	+0·86	15·6	988	—	13
	Upper Congo	14·0	6·0	—	$9\frac{3}{5}$	8·79	6·47	2·32	6·21	+0·21	35·7	902	—	6

For the vulcanisation tests the samples were mixed with 10 parts by weight of sulphur per 100 parts of rubber, calendered to 5 mm. sheet and heated under a press for 1 hour at 4 atmospheres pressure. The viscosity was determined in the authors' glass viscosimeter with a 7 mm. aperture, the time given in the table being that taken by 100 c.c. to flow from the apparatus; 3 per cent. solutions in xylene were used. In the last two columns the various samples are numbered in accordance with their relative value as estimated (*a*) from mechanical tests (*b*) from viscosity of solutions. The authors propose to revert to this subject in a future communication, but it would appear that viscosity determinations can only be used without qualification as a guide to quality when comparing rubbers of the same class, and possibly only when such rubbers have been prepared under similar conditions. The results shown in the table lead the authors to classify the various samples of *Manihot* rubber into three groups, viz.:—*Group I.*—Samples 9, 2, 25 and 29, showing a relatively high percentage of combined sulphur, together with great nerve in the vulcanised product, and an elongation which diminishes with the percentage of combined sulphur. *Group II.*—Samples 27, 28, 24, 22, 11, 4, in which the combined sulphur is comparatively low, while the tensile strength and elongation are still high. *Group III.*—Samples 5, 21, and 12, showing an exceptionally high percentage of combined sulphur, without exhibiting anything correspondingly remarkable in their other properties. The ashes of these three samples of rubber contained considerable quantities of magnesia. The best sample of rubber was undoubtedly that obtained by coagulating with lemon-juice. Of samples washed and dried at the place of origin that coagulated with "Purub" was the best, although another "Purub" sample (No. 12) was the worst. The acetic-acid samples were particularly good when, like the lemon-juice sample, they had been taken from the tree in the form of strips and carefully washed and cleaned before pressing together into masses.

—E. W. L.

XV.—LEATHER; BONE; HORN; GLUE.

Chestnut extract in the United States; The manufacture of ——. G. A. Kerr. J. Amer. Leather Chem. Assoc., 1910, 5, 485—510.

In 1900, the annual production of tanning extract from native materials in the United States was 125,000 barrels (of 500 lb.). At the present time the rate of output has increased to 500,000. In view of the rapid exhaustion of bark supply, that of chestnut wood for the manufacture of extract becomes of great importance. At the present rate of consumption there is sufficient wood for this purpose for 200 years, the reproduction of the chestnut tree is rapid, and young chestnut forest will produce at the rate of one cord per acre per annum. The greatest economy in the production of the extract is obtained in a small plant producing about 70 barrels a day; installations larger than this should produce at least 250 barrels a day to work with the same economy. With the present installations, 7—10 horse-power is required per barrel of output, the spent wood being utilised in the production of gas-fuel. For grinding the wood, the disc type of chopper, similar to those used for cutting pulp wood, has lately been used with great success, especially where green wood is being dealt with; where this type of chopper is used, a large proportion of the residual chips are, after extraction, used in the manufacture of paper pulp. Concrete has lately been used for building the leaches in place of cypress wood, but it is not yet known how the former will resist the action of acetic acid and heat. The liquors are transferred from one leach to another by the agency of compressed air or steam, the old mechanical pump having been quite superseded. Extraction by decoction, which consists in immersing the raw material in water and then boiling, has advantages over the method of extraction by diffusion in the saving of time thus effected and the smaller volume of water required to complete the extraction. Very thorough extraction is obtained by the method of percolation which consists in sprinkling water over the material and drawing the liquor away as it collects under the false bottom of the container; this method is also advantageous in that each leach constitutes a separate unit. For evaporation and concentration the standard vertical tube evaporator is the one most used. Great saving of fuel is effected by the used of the multiple effect evaporator; 8½ lb. of coal will evaporate 16 lb. of water in a double effect, 22 lb. in a triple effect and 28—30 lb. in a quadruple effect evaporator. This efficiency is somewhat lessened in practice by the formation of scale which takes place from the second to the last effect and for the removal of which, scrapers, actuated manually or by compressed air, are necessary. It is advantageous to pass the extract twice through the evaporator rather than to attempt to reach the concentration, required in the final product, during one passage. The author estimates the cost of an extract plant on a permanent basis to produce 200—250 barrels daily to be $2,000 (about £420) per barrel of minimum daily output.

—D. J. L.

Hides; Disinfection of ——. J. H. Yocum. J. Amer. Leather Chem. Assoc., 1910, 5, 507—510.

The epidemic of foot and mouth disease which occurred in the United States in 1908 caused the Government to formulate several methods of disinfection of hides and skins which would satisfy the officials and in their opinion prevent the spread of infection. The use of sodium arsenite which was suggested at one time for this purpose is not regarded as satisfactory. The Government present, this year, three methods, (1) immersion in a 1—1000 solution of mercuric chloride, (2) immersion in a 5 per cent. carbolic acid solution, and (3) exposure to the fumes of burning sulphur in a closed room. The carbolic acid method is unsatisfactory, as the disinfectant is difficultly soluble in water and will not act on fats. It is also injurious to the hides, and removes from them the salt or pickle, and even then does not destroy the anthrax spore satisfactorily. Sulphur dioxide is also injurious to the hides, and is inefficient as a disinfectant. Mercuric chloride forms insoluble compounds with albuminoids, and as such has no effect on bacteria; this precipitation however can be prevented by the addition of 5 parts of salt to 1000 of the solution. A soluble compound is formed between the salt and mercuric chloride even though the water is hard and contains lime and magnesia in solution. Mercuric chloride in 1—24,000 solution kills the anthrax spore in 20 hours, in 1—1000 solution in 15 minutes, while the germination of the spore is prevented in 1—70,000 solutions. The bacilli themselves are destroyed in 1 minute in a 1—15,000 solution. By immersing the hides in a saturated solution of salt containing the necessary quantity of mercuric chloride the spores and bacilli are destroyed very rapidly and the hides are in practically the same condition as on coming out of pack or pickle. Hides under quarantine may be sprinkled with a solution of one pound of mercuric chloride to 2500 lb. of hide. Dry hides are completely sterilised by immersion in "a saturated salt bichloride solution" for five minutes.

—D. J. L.

Agar-agar and gelatin; Conditions of crystallisation of —— in connection with the mechanism of gelatinisation. P. von Weimarn. J. Russ. Phys.-Chem. Ges., 1910, 42, 653—657. Chem. Zentr., 1910, 2, 1583—1584.

Solutions of agar-agar and gelatin are usually regarded as typical emulsoids (emulsion-colloid solutions), and the gelatinisation of such solutions is considered to be the separation of two partially miscible liquid phases. Lewites has already drawn attention to the similarity between gelatinisation and crystallisation, and the author considers that the two processes are identical. The precipitation of aqueous solutions of gelatin and agar-agar on addition of alcohol is stated to follow an exactly similar course to the formation of suspensions and emulsions on mixing aqueous solutions of crystalline substances with alcohol. If a saturated solution of manganous sulphate be vigorously shaken with five times its volume of alcohol, an emulsion is formed which soon separates into two layers, from one of which crystals of manganous sulphate are gradually deposited. By repeating the experiment with more and more dilute manganous sulphate solution, emulsions of increasing stability are obtained, whilst with a very dilute solution, there are formed directly suspensions and suspensoids (suspension-colloid solutions) from which a micro-crystalline precipitate separates on standing. The stable emulsions of manganous sulphate in alcohol, when suddenly cooled, set to jellies composed of microscopic or ultramicroscopic sphaerolites. Aqueous solutions of gelatin or agar-agar, when precipitated by alcohol, yield precipitates consisting of round or oval sphaerolites composed of visible or scarcely visible minute crystalline grains. According to the quantity of alcohol added, gelatin and agar-agar can be obtained in the form of emulsions or suspensoids. With very dilute (0·1—0·001 per cent.) solutions of gelatin and large quantities (6—12 volumes) of alcohol, stable suspensoids are obtained, which are either clear or only faintly opalescent. By repeatedly boiling such suspensoids of gelatin or agar-agar, the author succeeded in obtaining small quantities of precipitate seen to be composed of minute crystals under the microscope (2000-fold magnification).—A. S.

Patents.

Tanning hides or skins; Process of and apparatus for ——. J. C. Greaves, West Croydon, Surrey. Eng. Pat. 27,573, Nov. 26, 1909.

The apparatus consists of a receptacle for fresh liquor and a series of connected pits, so arranged that the overflow from one pit is delivered by a pipe to the bottom of the next pit. Even distribution of the liquor is obtained by delivering through a perforated coil situated at or near the bottom of each pit. The weaker liquors, by reason of their lower specific gravity, remain above the stronger liquor as it enters and are forced over into the next pit, and the liquor in each pit is thus kept at a normal strength. As long as the supply of fresh liquor is maintained the process continues without requiring any labour or attention, and butts or skins are tanned in half the time usually required, yielding an excellent leather free from drawn or rough grain.—D. J. L.

Extracts for use in tanning; Manufacture of ——. M. Hönig, Brünn, Austria. Eng. Pat. 7066, March 21, 1910. Under Int. Conv., April 19, 1909.

See Fr. Pat. 413,849 of 1910; this J., 1910, 1121.—T. F. B.

Tanning; Process of ——. C. W. Nance. Fr. Pat. 416,616, June 1, 1910.

See Eng. Pat. 26,040 of 1909; this J., 1910, 1216.—T. F. B.

Organic colloids; Process of liquefying ——. F. Supf, Assignor to The Arabol Manufacturing Co., New York. U.S. Pat. 974,448, Nov. 1, 1910.

See Fr. Pat. 394,173 of 1908; this J., 1909, 211.—T. F. B.

Treating fish refuse [for oil, glue, and fertilisers]. Fr. Pat. 416,558. *See* XII.

XVI.—SOILS; FERTILISERS.

Azotobacter; Influence of the mineral constituents of the nutrient solution on the development of ——. K. Krzemieniewska. Anz. Akad. Wiss. Krakau, 1910, Reihe B, 376—413. Chem. Zentr., 1910, **2**, 1551.

Potassium, calcium, magnesium, phosphorus, and sulphur compounds are necessary for the development of the azotobacter, and if there be a deficit of one of these mineral constituents, the development is limited to an extent corresponding to that deficit. For the economic utilisation of 1 grm. of dextrose, 0·38 mgrm. of potassium, 0·36 mgrm. of calcium, 0·35 mgrm. of magnesium, 2·46 mgrms. of phosphorus, and more than 0·49 mgrm. of sulphur are required. The consumption of dextrose by the azotobacter is less affected by a deficit of mineral matter than the nitrogen-fixing power. Potassium, sodium, and magnesium when present in more than certain limited quantities act injuriously, but such injury can be diminished or neutralised by addition of larger quantities of calcium salts or (in the case of potassium and sodium) of magnesium salts. In the author's experiments, sodium humate prepared from soil was added to the nutrient solution in order to favour the development of the azotobacter, but control experiments showed that this humate did not provide the necessary mineral matter. (See also this J., 1909, 432.)—A. S.

Determination of nitrogen by the Kjeldahl method. Hibbard. *See* XXIII.

Patents.

Micro-organisms [e.g., nitrogen-fixing bacteria]; Means for growing, preserving, and transporting cultures of ——. G. H. Earp-Thomas, Bloomfield, N.J., U.S.A. Eng. Pat. 1090, Jan. 15, 1910. Under Int. Conv., Jan. 15, 1909.

The apparatus described consists of a glass vessel having the shape of an ordinary bottle; the neck of the bottle is closed with a rubber stopper through which passes a glass tube extending to about the centre of the bottle. This tube contains one or more plugs of cotton-wool and its lower end may be either straight, bent, or constricted, or it may be closed and a small hole provided in the side of the tube. The upper end of the tube is level with the top of the stopper and a gas bag provided with an inlet may be fitted over the stopper. The stopper may have a flange which fits over and protects the neck of the bottle. The bottle is only partially filled with the medium containing the organisms; this medium may be solid or liquid, but if it be the latter, the arrangement of the glass tube is such that the liquid cannot escape no matter what the position of the bottle may be during transportation.
—W. P. S.

Vinasses; Process for manufacturing fertilisers by the use of distillery ——. F. and E. D. Verbièse. First Addition, dated May 31, 1910, to Fr. Pat. 414,517, June 21, 1909 (this J., 1910, 1219).

The clear liquid obtained in the precipitation process described in the original specification (*loc. cit.*) may be concentrated with the object of recovering useful substances if such be present in sufficient quantity. The liquid may also be used for irrigation or may be mixed with the refuse (scum) from sugar refineries, and dried.—W. P. S.

Treating fish refuse [for oil, glue, and fertilisers]. Fr. Pat. 416,558. *See* XII.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beetroot; Phosphoric acid required by the ——. Wimmer. Deutsch. Zuckerind., 1910, **35**, 829—830.

The method of cultivation of beetroots in sand with the view of determining the amounts of various fertilisers required to produce a crop of given weight and utility is described as an ideal one, indicating the influence of definite alterations of the conditions of development on the plants and, by comparison with the results obtained in the field, showing on what the varying amounts of fertiliser consumed depend. The phosphoric acid requirements of the sugar beetroot, as regards supply of nourishment, are best satisfied when, with a definite and uniform yield of dry weight, the weight of fresh beetroots is the least possible and the quantity of sugar the highest. For a yield of 10,000 kilos. of dry beetroot substance 50 kilos. of phosphoric anhydride are required under normal conditions of moisture of the soil, but the amount used needs to be varied, being increased or diminished as that taken up by the plant is found to be less or more.—L. J. de W.

Sugar in the beet; Determination of —— by Herzfeld's new Institute-method. O. Bialon and W. Taegener. Deutsche Zuckerind., 1910, **35**, 865—866.

Twenty-six samples of beet have been analysed by the new method (see this J., 1909, 846), and the results compared with those obtained by three other methods, viz., the extraction method, Pellet's hot aqueous digestion method, and the Rapp-Degener method of warm alcoholic digestion (see table appended). The new method, which is simple and rapid, gave values for the percentage of sugar differing on the average by less than 0·1 from those obtained by the standard extraction method, the extreme errors being +0·3 and −0·4. Pellet's method gave equally accurate results and may therefore be recommended where time is not of the first importance. The results obtained by the Rapp-Degener method were in all cases low, the maximum error being −1·2 on the percentage of sugar. The statement of Herzfeld that the new method gives good results in the cold, was not confirmed by the authors, who invariably obtained low results; they used Perner's machine, however, in preparing the pulp, whereas Herzfeld used the Sans Pareil press.

No.	Rapp-Degener.	Pellet.	Herzfeld.		Extraction.	New Method + compared with extraction.
			a	*b*		
1	18·2	18·4	18·4	18·4	18·7	0·3
2	18·8	19·2	19·2	19·2	19·2	+0·0
3	18·2	19·1	19·2	19·2	19·4	−0·2
4	15·7	16·8	16·6	16·8	16·6	+0·1
5	14·2	15·2	15·2	15·2	15·3	−0·1
6	17·0	17·0	17·0	17·0	17·1	−0·1
7	18·4	19·2	19·2	19·2	19·3	−0·1
8	17·2	17·2	17·4	17·2	17·4	−0·1
9	18·4	19·2	19·0	19·0	19·3	−0·3
10	17·2	17·2	17·4	17·2	17·3	+0·0
11	16·4	17·2	17·2	17·0	17·2	−0·1
12	16·2	16·8	16·8	16·8	16·8	+0·0
13	17·4	17·8	17·8	17·8	17·9	0·1
14	17·2	17·2	17·2	17·2	17·3	−0·1
15	18·0	18·4	18·4	18·4	18·3	+0·1
16	18·4	19·0	19·2	19·0	19·4	−0·3
17	18·2	18·6	18·6	18·6	18·6	+0·0
18*	9·6	10·0	9·8	10·2	10·0	±0·0
19	17·6	18·0	17·8	18·2	17·9	+0·1
20	17·8	18·2	18·4	18·4	18·6	−0·2
21	14·2	14·8	14·6	14·6	14·8	−0·2
22	19·2	19·6	19·8	19·8	19·6	+0·2
23	18·0	18·6	18·6	18·6	18·3	+0·3
24	17·6	18·0	18·0	17·8	18·0	−0·1
25	19·2	19·6	19·6	19·6	19·6	+0·0
26	17·4	17·8	18·0	17·8	18·1	0·2

* Fodder beet.

J. H. L.

Raw cane juices; Defecation of ——. N. Lévy. Bull. Assoc. Chim. Sucr., 1910, **28**, 194—195.

In the cane sugar factory it is usual to control the amount of lime used for defecation by the indication to litmus paper or by other more or less empirical means. A simple method, consisting in adding an excess of lime to the juice and determining the excess volumetrically, is now described, which is stated to give satisfaction in practice. An average sample of juice is taken from the clarifiers, one litre of this is defecated with 3 grms. of lime, and the liquid filtered as rapidly as possible. 200 c.c. of the filtrate are then titrated with sulphuric acid. It is necessary to know the amount of available lime in the factory lime, and this is conveniently found by triturating 1 grm. with a solution of pure sugar, making the mixture and washings up to 250 c.c., filtering and titrating 100 c.c. of the filtrate with sulphuric acid. From the result and the capacity of the clarifiers, it is easy to calculate the amount of factory lime which must be used for neutral defecation, whilst for alkaline working an excess of about 10 per cent. is added. J. P. O.

Raw [cane] juices and syrups; Formaldehyde as preservative of ——. N. Marx. Archief Suikerind. Nederl., bijbl., 1910, **18**, 485—486.

The author has carried out some experiments having in view the determination of the exact amount of formaldehyde necessary for the preservation of raw cane juices and syrups. It was found in the case of raw juices that 7 c.c. per litre of a solution containing 1 c.c. of commercial formalin in a litre sufficed to prevent any diminution in the sugar content for 6 to 7 hours. With syrups, 2 c.c. of the same formalin solution per litre were necessary to effect complete preservation for 26 hours, and 5 c.c. for 80 hours. Attention is called to the favourable action of formaldehyde on the coagulation of the proteins and pectins of raw cane juice, and also to the effect of this reagent in diminishing the viscosity of the molasses. In the factory it is convenient to mix 50 litres of 40 per cent. formalin with 1000 litres of water in a reservoir placed above the raw juice tank, and use a litre of this dilute solution for every 1000 litres of the raw juice.

J. P. O.

Raffinose; Some properties and the determination of ——. A. Herzfeld. Deutsch. Zuckerind., 1910, **35**, 830—832.

The interest in raffinose was to a certain extent lost with the decrease in the desaccharification of molasses and only aroused a passing attention when, a few years ago, the "runnings" of the sugar manufacture suddenly showed larger quantities of raffinose. The raffinose then crystallised out from table syrups and was prepared in large quantity by Siegert in Hildesheim from whom the "Institut für Zucker-Industrie" received over 8 kilos. of pure raffinose. It is seldom deposited in the solid form on sugar crystals but is more usually contained in the syrup adhering to the crystals and is probably present as the anhydride or in a condition containing less water than crystallised raffinose. Absolute methyl alcohol dissolves crystallised raffinose easily, but the hydrate is converted thereby into the anhydrous form, so that it is never possible to obtain raffinose crystals direct from the solution. However, if such a concentrated solution is largely diluted with water, the hydrate is precipitated in crystals. The methods of determining raffinose discussed by the author are the inversion method, the mucic acid method of Tollens and Creydt, Scheibler's methyl alcohol method and the modification by Gunning, the method of washing off the syrup and treatment with strontium hydroxide, Neuberg's emulsin method, Loiseau's method of fermentation with top yeast, Tollens' naphtho-resorcinol reaction and the proposal of Andrlik to eliminate the disturbing influence of other active substances by making the direct polarisation in a solution acidified with hydrochloric acid, the inversion of sucrose being prevented by the addition of urea. None of these proposals supply a method which can be carried out quickly enough for the direct determination of raffinose, so that recourse must be had to the use of the inversion method and the raffinose formula. The possibility of finding a hydrazone of melibiose which may be precipitated in weighable form from the inverted solution is referred to and work in this direction is proceeding. Attention is drawn to experiments made to determine the melassigenic effect of raffinose and the results indicate that at 20° C. raffinose containing water of crystallisation has a feeble anti-melassigenic action. The influence of raffinose on the solubility of sucrose at higher temperatures has not yet been sufficiently studied. —L. J. de W.

Sugars; Decomposition of the ——. A. Jolles. Biochem. Zeits., 1910, **29**, 152—201.

It is shown that if a solution of dextrose, lævulose, galactose, invert sugar, arabinose, rhamnose, lactose, or maltose, in N/100 alkali, is kept at a temperature of 37° C., the rotatory power shows a considerable decrease, in the course of some hours, to a value which subsequently remains practically constant. In the case of dextrose, the rotation of the 1—2 per cent. solution falls to zero within 24 hours, and in the case of rhamnose, the rotation of the solution first increases and then very slowly decreases nearly to zero; the rotation of sucrose is practically unaffected by this treatment. These sugars also yield acid under these conditions; the formation of acid, which is very slight in the case of sucrose, becomes slower as the solution becomes neutral or acid; it continues on addition of more alkali, until, after the lapse of sufficient time, practically all the sugar is decomposed. The rate of acid-formation is increased by addition of oxidising agents (hydrogen peroxide, silver oxide), and decreased by exclusion of air; hence, in alkaline solution alone, oxidation is due to atmospheric oxygen. The fall in rotatory power, on the other hand, is retarded by the presence of oxidising agents. Enzymes (pepsin, pancreas enzyme) exert only a very slight action on the decomposition of the sugars. It is pointed out that after the lapse of a few hours, the polarimetric determination of a sugar in alkaline solution is quite untrustworthy, though a determination with Fehling's solution gives satisfactory results if it be made within 24 hours of the time of making up the solution. The only acid occurring in considerable quantity amongst the products of decomposition of the sugars (in neutral or $N/100$ alkaline solution) in presence of hydrogen peroxide or silver oxide, is formic acid.—L. E.

Verbascose, a new sugar contained in the root of mullein. E. Bourquelot and M. Bridel. Comptes rend., 1910, **151**, 760—762.

A new sugar has been isolated from the fresh roots of mullein (*Verbascum thapsus* L.) by extraction with boiling alcohol, evaporating the alcohol, concentrating the aqueous residue and adding three times its volume of 95 per cent. alcohol, which precipitated the sugar in a fairly pure condition. The remaining impurities were separated by forming a baryta compound of the sugar, removing the baryta, re-precipitating the sugar with 95 per cent. alcohol, and purifying it by dissolving it in a boiling mixture of methyl alcohol and water, and, after filtering, adding absolute alcohol to the filtrate. On cooling, the sugar was deposited in a crystalline state (spherical aggregates of fine needles). This sugar, for which the name *verbascose* is suggested, yields, on hydrolysis, lævulose, dextrose and galactose, and is thus analogous to stachyose, from which, however, it differs in its higher m. pt. (220° C.) and its greater rotatory power ($a_D = +169{\cdot}9°$).—C. A. M.

Starch; Purification of ——. G. Malfitano and A. N. Moschkoff. Comptes rend., 1910, **151**, 817—819. (See this J., 1910, 506.)

A process for completely demineralising starch is described. A 1 per cent. paste is prepared by heating potato starch with the requisite quantity of pure water (of a purity of $K = 1 \times 10^{-6}$ approx.) in a porcelain dish on the water-bath. The paste is then heated in an autoclave for 2—3 hours at 130° C., and cooled; the supernatant opalescent liquid is decanted from the slight sandy residue, and frozen in a mould of pure nickel. On melting the solid block of ice, a practically limpid liquid (containing most of the mineral matter and very little starch), and a flocculent residue are obtained. This residue is dissolved in pure water, the above-described process being repeated 3—5 times, save that in the later treatments, only the water-bath is used for heating. The small quantity of dextrins formed during heating are removed from the coagulum by washing with pure cold water, and the product obtained is finally dried, first at the ordinary temperature, and then at 125° C. The authors have obtained a very white, fibrous product in this way; an examination of several samples showed that they contained less than 0·02 per cent. of mineral matter, and, as control experiments showed, this small amount must have been derived from the vessels employed. Of the various kinds of starch, commercial potato starch is best adapted to this method of purification. In general, the yield is better and the operations easier according as the starch paste is poorer in mineral matter, whether the latter is derived from the starch itself, or from the vessels, or from the water. A smaller yield is obtained if the heating is effected in Jena glass vessels than if porcelain vessels are employed; on the other hand, the yield is increased if the starch is subjected to a preliminary washing, first with $N/10$ hydrochloric acid and then thoroughly with pure water. The product, demineralised as above described, is characterised, (1) by the blue coloration that it gives with iodine; (2) by its complete conversion into maltose on hydrolysis; (3) by its behaviour towards water and electrolytes (*loc. cit.*). It seems probable that all the modifications exhibited by starch in cereals and in the form of paste are due to associations of the product isolated by the authors, with various inorganic compounds.—L. E.

Patents.

Sugar from sugar-containing plants; Processes of diffusion whereby extraction of —— is rendered more complete. H. A. J. Manoury. Fr. Pat. 416,726, June 3, 1910.

The diffusion battery is divided into two sections, the first of which comprises the diffusion vessels containing the slices that have been more or less completely exhausted. Water is introduced into the first member of this section, and the weak juice drawn off from the last member passes to a heater from which it is pumped up to a reservoir; it is then passed through the second section of the battery the last member of which contains fresh slices. With this arrangement, the number of diffusion vessels may be increased and the exhaustion of the slices thus rendered more complete.—L. E.

Sugar industries; Increasing the yield in ——. M. E. Wolvekamp. Fr. Pat. 416,993, May 27, 1910.

Residual sugar-house liquors are treated with a suitable quantity of dextrose, which replaces part of the sucrose and permits of the recovery of the latter.—L. E.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Germicidal power of macerations of ——, and of macerations of cereals. A. Fernbach and E. Vulquin. Comptes rend., 1910, **151**, 656—658.

The poisonous substances contained in macerations of yeast are complex amines; no simple amine exerts any poisonous action on yeast. Hayduck (this J., 1910, 103 and 507), has disputed the volatility of the poison, and has suggested its identity with the poisonous substances in macerations of cereals, especially wheat. The authors find them to be different, whether their effect be measured by their action on the life of the yeast or on its fermentative activity. The poisonous substance in a wheat maceration kills the yeast, but only in presence of sugar. It is volatile in steam, for the non-volatile residue is inactive, whether in presence or absence of sugar; but, curiously, the distillate kills the yeast only in the absence of sugar. The original maceration lowers the fermentative activity of the yeast, but the substance to which this is due is not volatile; for the steam-distillate is quite inactive, whilst the residue possesses all the power of the original maceration. In the case of the yeast maceration, the original maceration and the distillate are alike toxic to the yeast-cells, whether sugar be there or not; whilst neither the original maceration, nor the distillate, nor the residue, has any retarding effect on the fermentative power of the yeast.—J. T. D.

Alcoholic ferments; Influence of nitrates on ——. E. Kayser. Comptes rend., 1910, **151**, 816—817.

It has recently been shown by Fernbach and Lanzenberg (this J., 1910, 1325) that the influence of potassium nitrate on organisms of alcoholic fermentation is not so unfavourable as had previously been supposed. It has also been shown by the author and H. Marchand that alcoholic fermentation proceeds further in presence of manganese nitrate than in its absence (see this J., 1907, 427). It appears that for each yeast-race there is an optimum concentration of the nitrate; excess of manganese nitrate (3 parts per 1000 parts of liquor in the case of some yeasts and 5 parts for others) hinders fermentation. Manganese nitrate has a greater influence on fermentation than an equal quantity of potassium nitrate.—L. E.

Enzymes; Chemical composition and formation of ——. H. Euler and B. af Ugglas. Arkiv för Kemi, Min. och Geol., 3 [30] and [34]. Chem. Zentr., 1910, 2, 1550—1551.

Variations in the enzyme-content of beer yeast.—Bottom-fermentation beer yeast grown in sucrose solution (45 grms. of sucrose and 5 grms. of peptone) was found to contain twice as much invertase as when grown in dextrose solution (45 grms. of dextrose and 5 grms. of peptone). The invertase was determined by adding 2 c.c. of the aqueous extract of the dried yeast, after clarification with kaolin and a little glacial acetic acid, to 20 c.c. of a 10 per cent. solution of sucrose, making up the hydrogen ion concentration of the solution to 10^{-5} by addition of dilute hydrochloric acid, and then diluting the whole to 25 c.c. The same invertase content was found whether the yeast was dehydrated by means of absolute alcohol or by drying *in vacuo*; the latter method was preferred. The invertase content depends upon the stage of development of the yeast, a specimen of yeast which had effected fermentation in a 0·5 per cent. solution of sucrose containing five times as much invertase as another specimen of the same yeast kept at 0° C. in toluene-water.

Amylase of germinated barley.—Barley which had germinated in a $N/10$ solution of disodium phosphate contained 2·3 times as much amylase as barley which had germinated in water; the amylase was determined by Wohlgemuth's method (Biochem. Zeits., 1908, **9**, 1).

Adsorption of nitrogenous substances, etc.—Albumin and peptone cannot be separated by adsorption by ferric or aluminium hydroxide, but peptones can be almost completely removed from solution by means of charcoal.

Five grams of animal charcoal will remove about 90 per cent of the erythro-dextrin from 50 c.c. of a dextrin solution. Pectic acid (from lemon rinds), like invertase, is adsorbed strongly by animal charcoal, but only to a very slight extent by kaolin. Adsorption experiments with yeast extracts showed that the nitrogenous constituents consist chiefly of peptones.

Autolysis of yeast affords a better method of preparing invertase than extraction of dried yeast.—A. S.

Enzymes; Influence of temperature on —— and the regeneration of their fermentative properties. M. J. Gramenitzki. Z. physiol. Chem., 1910, **69**, 286—300.

The fermentative properties of aqueous solutions of "takadiastase" are immediately lost on heating at temperatures above 80° C. But the author has found that if the heated solution be allowed to stand at a lower temperature, the specific properties of the enzyme are regenerated to a greater or less extent. This regeneration may even be observed after the enzyme solution has been heated for an hour at 100° C. or for ¼ hour at 115° C. Some preparations of "takadiastase" only recover their properties on standing in presence of starch; other particularly active preparations are capable of direct regeneration without the presence of starch. The time required for regeneration and the degree of regeneration depend on the temperature and time of heating and the temperature at which regeneration is conducted. The longer and stronger the heating, the slower and less complete is the regeneration, until finally the enzyme is permanently destroyed. No regeneration takes place at 50° C., but it is most rapid at 40° C.; at the ordinary temperature regeneration is much slower, but it is more complete than at 40° C. The author quotes experiments to prove that the regeneration is not due to the survival of traces of active enzyme after the heating. The oxydase of the preparation known as "maltin" is also rendered inactive by heating at temperatures above 80° C., and is likewise capable of regeneration on cooling after having been heated for 15—20 minutes at 100° C.; the solutions of this oxydase in their temporarily inactive state possess a positive deoxidising action towards guaiacum blue. The amylase (starch-liquefying enzyme) of "maltin" is capable of regeneration after 10 minutes at 100° C. but not after 15 minutes; the amylomaltase (saccharifying enzyme) on the other hand appears to be permanently destroyed by heating up to 100° C. Similarly, the various component enzymes of "takadiastase" behave differently after heating. When the solution of "takadiastase" is heated to 70° C., the catalytic enzyme is destroyed but the inverting and diastatic functions remain active. On further heating to 100° C. both these activities are paralysed, but the diastatic function is capable of regeneration, whereas the inverting function is permanently destroyed.
—J. F. B.

Alcohol; Determination of ether and benzene in ——. H. Wolff. Chem.-Zeit., 1910, **34**, 1193.

The author determines the amount of ether in alcohol and denatured spirits by the following modification of Holde and Winterstein's method for determining small quantities of benzene in brandy (Chem.-Zeit., 1908, 313):—100 c.c. of the sample are diluted to 0·96 sp. gr., and 20 c.c. distilled over into a 100 c.c. graduated cylinder, into which the delivery end of the condenser should dip at least 2—3 cm. 80 c.c. of a concentrated sodium chloride solution are added, the mixture is vigorously shaken twenty times and allowed to stand. The depth of the upper layer gives the proportion of ether. Bubbles of ether carried down by the sodium chloride separating out are easily freed by turning or tapping the cylinder. The error is usually less than 0·5 per cent. Of alcohols containing over 12—13 per cent. of ether, 50 or 25 c.c. are taken. Fleischer and Frank's method (this J., 1907, 838) is stated not to give reliable results in determining small quantities of ether in denatured alcohol. In the determination of benzene in alcohol by Holde and Winterstein's method (*loc. cit.*) it is also found that the substitution of a concentrated sodium chloride solution for water gives more accurate results; a special receiver is unnecessary, the distillate can be received direct in a 30 c.c. tube (graduated in one-tenths of a c.c.) or in a small flask with a graduated neck. Further the receiving vessel can be placed in water, instead of ice, if the condenser is long enough and the delivery end dips into it sufficiently.—A. Sbld.

Patents.

Malting; Process and improved apparatus for ——. P. H. Elmassian. Fr. Pat. 416,076, May 18, 1910.

The grain is steeped for some hours in water at 25° C., after which it is shaken and aerated by a strong current of compressed air, and moistened at intervals of 6 or 10 hours with water at 25° C. When the grain begins to germinate, it is transferred to rotatable metal cages; the latter are divided by perforated, corrugated, galvanised iron sheets into compartments 10—20 cm. broad, which serve for the reception of the malt, and alternate spaces 6—10 cm. broad, which serve for the circulation of a current of warm moist air, whereby the grain is aerated. The circulation of this current of air may be effected by means of ventilators. The apparatus is kept at a temperature of 25° C.; the grain is moistened, according to requirements, with water at 25° C., and it is shaken periodically by rotating the cage. Initially, about two-thirds or three-quarters of the space in the malting compartments are filled with grain, so that sufficient space is left to allow for subsequent swelling.—L. E.

Beer, stout, and the like; Manufacture of ——. H. Finlay, St. Helens, Lancs. Eng. Pat. 12,048, May 14, 1910.

The process relates to the production of beer or stout containing only a small quantity (from 1 to 2 per cent.) of alcohol. The beverage is prepared by adding to any wort the necessary quantity of hops and a small quantity of ordinary fermented beer or stout. For instance, from 1 to 4 galls. of beer of original gravity 1036 are mixed with from 32 to 35 galls. of wort of gravity 1036, and the mixture is allowed to ferment in a barrel for 7 days. The resulting beverage will contain about 1 per cent. of alcohol; if fermentation be allowed to proceed for 3 weeks, the amount of alcohol may rise to 2 per cent. W. P. S.

Fermentation of saccharine musts containing sulphurous compounds; Use of yeasts or ferments of high nitrogen-content in the ——. V. Martinand. Fr. Pat. 416,768, Aug. 13, 1909.

Yeast of high nitrogen-content, obtained by cultivation in wort prepared from barley-, oat-, rye-, or wheat-malt, or by other methods, is employed for fermenting sulphited musts (in particular, wine must); the fermentation is thus effected more rapidly than with ordinary yeast. —L. E.

Malt grist; Process and apparatus for producing —— *for making malt mash.* K. Maxauer. Fr. Pat. 416,512, May 28, 1910. Under Int. Conv., May 29, 1909.

See Eng. Pat. 13,108 of 1910; this J., 1910, 1222.—T. F. B.

Brewers' mash and wort; Preparation of ——. J. Schneible, Weehawken, N.J., U.S.A. Eng. Pat. 12,581, May 24, 1910.

See U.S. Pat. 961,539 of 1910; this J., 1910, 1127.—T. F. B.

Manufacturing fertilisers by the use of distillery vinasses. Addition to Fr. Pat. 414.517. *See* XVI.

XIXa.—FOODS.

Milk; Electrical conductivity of —— *and its application to the detection of added water or electrolytes.* R. Binaghi. Biochem. Zeits., 1910, **29**, 60—79.

The author has determined the electrical conductivity of a number of samples of pure sheeps'-, goats'-, and cows'-milk, at 25° C. with Kohlrausch's apparatus; the results were found to vary only between the following narrow limits:—Sheeps' milk, $K=49{\cdot}43\times10^{-4}$ to $51{\cdot}72\times10^{-4}$; goats' milk, $K=47{\cdot}01\times10^{-4}$ to $49{\cdot}96\times10^{-4}$; cows' milk, $K=47{\cdot}97\times10^{-4}$ to $49{\cdot}78\times10^{-4}$. The conductivity of milk is lowered by addition of water, to an extent proportional to the amount of water added. Thus, it was found that addition of 20 and 40 per cent. of water to a sample of sheeps' milk possessing a conductivity $K=49{\cdot}43\times10^{-4}$, lowered the conductivity to $43{\cdot}89\times10^{-4}$ and $39{\cdot}30\times10^{-4}$ in the respective cases. Addition of electrolytes (*e.g.*, carbonate, bicarbonate, or biborate of sodium, boric acid) to milk increases its conductivity considerably and to an extent proportional to the amount of electrolyte added. Thus, in one instance, addition of 1 and 5 per cent. of sodium bicarbonate was found to increase the conductivity of sheeps' milk from $49{\cdot}43\times10^{-4}$ to $64{\cdot}03\times10^{-4}$ and $202{\cdot}32\times10^{-4}$ respectively. The influence of boric acid is appreciable though not so great as that of sodium bicarbonate. It is concluded that determination of electrical conductivity affords a valuable indication of the presence of added water or electrolytes in milk, and the method has the advantage of being both simple and expeditious.—L. E.

Fruit-jelly-making. N. E. Goldthwaite. J. Ind. Eng. Chem., 1910, 2, 457—462. (See also this J., 1909, 737).

Experiments on the proportion of sugar to fruit juice show that very frequently too much sugar is used in jelly-making. As sugar is increased the time necessary for boiling decreases, the volume of jelly increases, and its structure becomes less coherent. In general, three volumes of sugar to four of juice is best. The investigation of the degree of sugar inversion most desirable has not led to any results. It seems of little moment whether the sugar and juice be boiled together all the time (much inversion) or only mixed shortly before setting (little inversion). No difference of importance could be detected between the jellies made with beet sugar and with cane sugar. If the fruit juice is boiled for a very long time, the acid will hydrolyse the pectin and no jelly can be formed. The juice of raw fruits is sometimes free from pectin, and always contains much less than that from the cooked fruits. In the case of oranges and lemons the white inner skin seems to be the important source of pectin, and should therefore not be rejected in jelly-making. The outer yellow skin renders the jelly bitter and marmalade-like. Irregular results are always observed in making jellies of strawberry and cherry juice. In these cases the temperature of the boiling liquid must be raised about 2° C. above the temperature at which the jelly-test is first observed.—W. H. P.

Soya bean oil industry. Lewkowitsch. *See* XII.

Patents.

Coffee berries free from caffeine; Process of obtaining ——. L. Klein. Fourth Addition, dated May 14, 1910, to Fr. Pat. 409,700, Nov. 11, 1909 (this J., 1910, 779, 837, 1130).

The berries are treated in a drum with a suitable alkali solution and during the subsequent process of extraction are submitted to the action of an inert gas under pressure. This gas is produced in the drum itself by the interaction of such substances as sodium bicarbonate and calcium tartrate; these are placed in separate pockets provided on the interior wall of the drum and are brought into contact with each other and with the liquid in the drum by rotating the latter.—W. P. S.

Coffee berries; Process for removing caffeine from unground ——. E. Utescher. Ger. Pat. 227,380, Aug. 4, 1907.

Unground coffee berries are first softened by heating with a 0·5—5 per cent. solution of a suitable volatile acid (*e.g.*, acetic acid or sulphurous acid), and are then extracted with a solvent of caffeine, such as chloroform or benzene. The extracted berries are finally freed from acid by means of steam or alcohol, and roasted in the usual way.—T. F. B.

Yolks of eggs; Process for the production of a soluble powder formed from the ——. C. Gottsleben, Metternich, Germany. Eng. Pat. 28,150, Dec. 2, 1909.

See Fr. Pat. 406,766 of 1909; this J., 1910, 588.—T. F. B.

Malted preparations from cereals; Manufacture of ——. L. C. Reese, London. U.S. Pat. 974,597, Nov. 1, 1910.

See Eng. Pat. 1528 of 1908; this J., 1908, 764.—T. F. B.

Separating certain substances or impurities from solutions. Fr. Pat. 416,974. *See* XI.

XIXb.—WATER PURIFICATION; SANITATION.

Water; Temporary hardness of ——. H. Noll. Z. angew. Chem., 1910, 23, 2025—2029. (See also this J., 1910, 1077.)

The author has endeavoured, unsuccessfully, to ascertain the share which magnesium carbonate takes in causing the temporary hardness of natural waters. Solutions of calcium bicarbonate of different strengths, when boiled, left in solution approximately 20 mgrms. of calcium carbonate per litre. Solutions of magnesium bicarbonate decomposed much more slowly on boiling; especially during the first half hour, very little precipitation took place, but after that precipitation was almost complete. Solutions containing both bicarbonates deposited practically the whole of their calcium salt very rapidly, and the precipitation of the magnesium salt was greatly accelerated. When both magnesium bicarbonate and calcium sulphate are present together, the latter in excess, complete decomposition of the magnesium salt occurs on boiling, and an equivalent quantity of calcium carbonate is precipitated. When the magnesium bicarbonate is in excess, and still more when other salts (sodium bicarbonate, calcium bicarbonate, magnesium chloride) are also present the results are most irregular, and the amounts of calcium and magnesium carbonate precipitated bear no ascertainable relation to the composition of the original solution. No information could be obtained as to the reaction, if any, of calcium sulphate on magnesium bicarbonate in the cold, by addition of baryta water to the mixture; for when baryta water was added to solutions of calcium bicarbonate the most variable results were obtained, suggesting a partial exchange between the calcium carbonate (supposed to be precipitated as such) and the barium hydroxide. Experiments with natural waters showed considerable differences according as the waters, otherwise similar, did or did not contain peaty matter; and direct experiment showed that the presence of peaty matter retarded or prevented the precipitation by boiling of both calcium and magnesium carbonates. J. T. D.

Manganese in water; Volumetric determination of ——. A. Rodenburg. Chem. Weekblad, 1910, 879. Pharm. J., 1910, **85**, 637.

THE author has so improved Marshall's method, that it can be applied to water containing iron and organic substances. 50 c.c. of water are boiled with 5 c.c. of nitric acid of 50 per cent., for some minutes, and then a little more silver nitrate than is necessary to precipitate all chlorides is added. Then 10 c.c. of a 10 per cent. solution of ammonium persulphate are added and the mixture heated to boiling point. If as little as 0·025 mgrm of manganese oxide (Mn_3O_4) be present, a light pink colour appears. In order to find the average, the solution is diluted to 100 c.c., and compared in a colorimetric tube with the liquid obtained, after identical treatment, from a standard liquid of manganese ammonium sulphate, which contains 25 mgrms. of Mn_3O_4 per litre.

Water; Sterilisation of large quantities of ——, *by means of ultra-violet rays.* V. Henri, A. Helbronner, and M. de Recklinghausen. Comptes rend., 1910, **151**, 677—679.

THE authors have improved their apparatus (this J., 1910, 588) by placing the lamp in a rectangular box with three quartz sides. Round these three sides the water passes, in a semi-circular trough provided with baffle-plates so that it streams alternately towards and from the lamp occupying the centre of the semi-circle. In this way a greater proportion of the ultra-violet radiation of the lamp is utilised. The apparatus was in continuous work for six weeks, during which time it sterilised completely 25 cub. metres of water per hour, at an expenditure of 26 watt-hours per cubic metre. The efficiency of this method of sterilisation is of course greatly dependent on the colour and the clearness of the water.—J. T. D.

Water; Sterilisiation of large quantities of —— *by means of ultra-violet rays.* Urbain, C. Seal and A. Feige. Comptes rend., 1910, **151**, 770—772.

FURTHER investigation of the physical factors upon which the effective sterilisation of water by means of ultraviolet rays depends (this J., 1910, 448) have shown that for the economical treatment of large quantities the chief factor is that the insolation should be homogeneous. An apparatus in which this condition is fulfilled has been constructed, the water being made to circulate in a spiral within a cylinder (2·20 metres in diameter) the opening into which is concentric with the axis. The water entering at a tangent, under pressure, leaves an almost vertical cavity in the centre, within which is placed the source of light. An apparatus of these dimensions will yield from 10 to 50 cubic metres of sterilised water per hour. Under the conditions of the authors' experiments there was a yield of 20 cubic metres per hour, the time of insolation being three minutes, while the maximum distance of the water from the source of light was 1·10 metres and the minimum distance 8 cm. The positive electrode consisted of aluminium coated with 10 mm. of iron whilst the negative electrode was carbon. The iron in the positive electrode fused and dissolved the aluminium, but in spite of oxidation of the mixture its conductivity remained sufficient. The water of Neuilly-sur-Marne has in this way been effectively sterilised at an expenditure of 20 watts per cubic metre.—C. A. M.

Air analysis and flueless gas-heated steam radiators. H. J. Yates. J. Gas Lighting, 1910, **112**, 390.

THE proportion of carbon dioxide introduced into the atmosphere of a workshop owing to the use of gas heating stoves without flues is of importance in view of the recommendation of the Departmental Committee on Ventilation in Factories in 1902, that the maximum limit permissible should be 12 parts per 10,000 in the day-time and 20 parts after dark. Analyses have been made of samples of air taken under similar conditions in various factories using flueless gas-heated steam radiators, on two separate days when the radiators were in and out of use. The results show that when the ventilation is adequate, the use of the radiators increases the amount of carbon dioxide in the air by 5 parts per 10,000. No carbon monoxide is formed. A specimen form is given showing the particulars to be supplied with the sample.—A. T. L.

Lead sulphate and chromate alone, and in the form of oil-colours; Solubility of —— *in dilute hydrochloric acid, and equilibrium of chromate and bichromate in solution.* K. Beck and P. Stegmüller. Arbb. Kais. Gesundh.-Amt, 1910, **34**, 446—483.

THE authors have made solubility determinations with lead sulphate and chromate and with oil colours prepared therewith, in order to ascertain whether any injury to health is likely to arise from the use of such colours. The results of the determination of the solubility of the pigments alone in dilute hydrochloric acid of varying concentration are shown in the following table, the most important figures from the hygienic standpoint being those relating to 0·1 *N*-acid, the action of which corresponds with that of the gastric juice.

Concentration of acid.	Lead sulphate.			Lead chromate.		
	Mgrms. of lead in 100 c.c. of solution at :			Mgrms. of lead in 100 c.c. of solution at :		
	18° C.	25° C.	37° C.	18° C.	25° C.	37° C.
0 (water)	2·60	3·00	3·80	Less than 0·05	mgrm. in 100 c.	c. of solution.
0·1*N*	19·00	22·18	28·04	3·86	4·96	7·40
0·2*N*	35·70	42·88	54·50	8·15	10·06	15·40
0·3*N*	55·37	65·15	84·04	13·56	17·38	27·30
0·4*N*	75·27	88·80	111·90	22·14	27·78	43·60
0·5*N*	—	—	—	32·30	42·60	68·00
0·6*N*	—	—	—	46·09	61·06	97·20

A detailed theoretical discussion of the effect of the concentration of the acid on the solubility is given, and also of the equilibrium between chromate and bichromate in the solution in the case of lead chromate. In the case of mixtures of the two salts, the solubility of the chromate is strongly diminished by the presence of the sulphate, whilst that of the sulphate is influenced but little by the presence of the chromate; for practical purposes, mixtures may be regarded as consisting of lead sulphate alone so far as solubility is concerned. Tests with oil colours prepared with the two salts and then painted on paper showed that the chief effect of the oil film is greatly to retard the dissolving of the pigments. Experiments were also made with transfer pictures containing lead sulphate and chromate, and it was found that in the case of pictures not covered with a film of white lead paint, the quantity of lead dissolved by 0·1N hydrochloric acid at 37° C. was very small; the quantity of lead which would probably be dissolved by use of such transfer pictures would be about the same as that which might be present in 1 litre of drinking water which had passed through lead pipes. Pictures coated with a film of white lead paint yield considerably more lead to dilute acid. The results of the experiments show that the permission accorded in Germany to use oil colours containing lead sulphate and chromate in the preparation of toys is quite justified. With regard to solubility in water and dilute acids, the two salts mentioned may be considered to hold a similar position to galena. (See also under New Books.)—A. S.

Dust and bituminous vapours; Action of —— upon the eyes. H. Truc and C. Fleig. Comptes rend., 1910, **151**, 769—770.

THE results of their investigation of the effect of the dust from tarred roads upon the eyes (this J., 1910, 1224) have led the authors to study experimentally the action of dust and of bituminous vapours in this respect. They find that bituminous dust rapidly produces various lesions in the eyes, and that although these disappear fairly quickly they may leave persistent leucoma. The condition of the eye and the action of sunlight are both predisposing causes. Animals suffer in a similar manner. Dust consisting of a mixture of bituminous powder and of inert non-septic matter is less active than pure bituminous dust; but mixtures of the latter with the ordinary septic dust of roads produce lesions more rapidly and of a more pronounced nature. Bituminous vapours have only a slight action upon the eye. As in the case of the dust from tarred roads, the action of bituminous dust depends upon a mechanical factor, a septic factor, and chemical factors, the last always preponderating, whilst the importance of the other two factors varies with the nature of the dust, etc.—C. A. M.

Carbon monoxide; Presence of minute quantities of —— in the air of coal mines. P. Mahler and J. Denet. Comptes rend., 1910, **151**, 645—647.

IT was a deduction from the results published by Mahler (this J., 1910, 744 and 868), that the air of coal mines should contain traces of carbon monoxide. The authors have examined nine samples of air from galleries and working places of well-ventilated mines, and find on the average 0·002 volume per cent., the maximum being 0·004, in a working place, and the minimum 0·000, in a gallery. The amounts of carbon monoxide and of methane appeared to vary in inverse directions in the samples. —J. T. D.

PATENTS.

Liquids; Apparatus for sterilising ——. J. S. Forbes, Philadelphia, U.S.A. Eng. Pat. 24,182, Oct. 21, 1909. Under Int. Conv., Oct. 22, 1908.

THE liquid is delivered through a valve into a vessel, where it is caused to circulate through or around a series of tubes, and is then passed through a second series of tubes where it is heated to a sterilising temperature by means of a heated liquid surrounding the tubes. The sterilised liquid is discharged over a weir and descends through the first series of tubes, thus parting with its heat to the liquid on its way to the steriliser. The sterilised liquid is finally discharged into a tank provided with a float, which actuates valves controlling the supply of raw liquid and the source of heat. The apparatus is also supplied with an overflow device having its level below that of the above-mentioned weir, but above the normal level of the liquid in the collecting tank, so as to prevent the liquid in this tank rising above a predetermined level. Modifications of the apparatus, or of parts of it, are described. —W. P. S.

Water or any other liquid; Apparatus for the sterilisation of —— by means of ozonisation. C. S. Piestrak, Paris. Eng. Pat. 1117, Jan. 15, 1910.

THE apparatus consists of an inner tube through which the liquid flows and an outer tube; the inner tube is surrounded by one of the electrodes employed in the apparatus, whilst the other electrode is situated in the space between the two tubes. A number of superposed funnels or inverted cones are placed at the upper part of the inner tube so that the ozone formed at the electrodes is drawn into the inner tube by the current of water, the action of this part of the apparatus being that of a simple injector. The funnels may be replaced by a cylindrical body, the walls of which are pierced with holes obliquely directed downwards. The upper part of the central tube, together with the funnels, is made in a separate piece which is attached to the lower portion of the tube by means of a ground-in joint. The two tubes may also be constructed of quartz and so fitted up that the part containing the electrodes forms a lamp which emits ultra-violet rays, the liquid passing down the inner tube being then submitted to the action of these rays.—W. P. S.

Water; Method of hardening abnormally soft ——. J. H. Paul, London. Eng. Pat. 25,665, Nov. 6, 1909.

IN order to prevent the solvent action of abnormally soft waters on lead pipes, the water is treated with a suitable quantity of a mixture consisting of magnesium sulphate, 4 parts, and sodium bicarbonate, 3 parts.—W. P. S.

Water; Apparatus or system for the continuous purification of ——. J. Daime, Marseilles, France. Eng. Pat. 9372, April 18, 1910. Under Int. Conv., May 21, 1909.

THE water to be treated is admitted into a settling tank, the inlet pipe being situated at one side of the tank and reaching nearly to the bottom of the latter. The water rises slowly in the tank and overflows at the top through a pipe reaching nearly to the bottom of a second tank. A number of these tanks are placed in connection with one another, and, as the water flows slowly through them, all suspended matters in the water are deposited. The water flowing from the last tank of the series is conducted to a number of filters situated adjacent to the tanks. Sluices and valves are provided so that any tank of the series may be "cut out" for the purpose of being cleaned, the water during this operation flowing through a by-pass channel to the next tank in use. Sludge cocks are provided in each tank.—W. P. S.

Trade effluents; Method of and means for treating ——. E. V. Chambers, Huddersfield, and H. B. Watson, Liversedge, Yorks. Eng. Pat. 579, Jan. 10, 1910.

THE trade effluent is passed through a settling tank and then flows into a chamber provided with two outlets. Through one of these outlets a portion of the effluent flows through a pipe to the bottom of a conical tank containing lime or other reagent; after passing upwards through the lime this portion of the effluent is discharged over a weir situated adjacent to the second outlet and mixes with the main portion of the effluent flowing from the latter. The mixture is conducted into a precipitating tank provided with baffle-plates, and, after sedimentation has taken place, is passed upwards through a suitable filter and discharged into a river, etc. The outlets from the above-mentioned chamber are provided with sliding doors or similar devices so that the proportion of the effluent passing through the reagent tank may be regulated as desired. Several sludge cocks are fitted at the lowest part of the precipitating tank and these discharge the sludge on to a coke filter.—W. P. S.

Sewage, trade effluents, etc.; Process for the automatic sterilisation of ——. F. Duret. First Addition, dated May 19, 1910, to Fr. Pat. 402,005, April 14, 1909 (this J., 1909, 1220).

Various modifications and alterations are made in the construction of the reservoir containing the sterilising agent and in the method of distributing this agent as described in the original specification (*loc. cit.*).—W. P. S.

Disinfecting action of the smoke from briquettes prepared according to Ger. Pat. 217,789; *Process for increasing the* ——. W. von Skorzewski. Ger. Pat. 228,263. April 27, 1910. Addition to Ger. Pat. 200,489, Jan. 22, 1907.

The disinfecting action of the smoke from the briquettes prepared according to Ger. Pat. 217,789 (this J., 1910, 449) has been found to be due to formic acid. It is considerably increased if the combustible substance, before mixing with the other constituents of the briquettes, is incorporated with substances which evolve formic acid on heating, for example it may be impregnated with a solution of 70 grms. of oxalic acid and 7 grms. of glycerin in 90 c.c. of water.—A. S.

Effluents; Apparatus for removing fat from ——. R. Schilling, Dahlem, Germany. U.S. Pat. 975,081, Nov. 8, 1910.

See Fr. Pat. 412,183 of 1910; this J., 1910, 1022.—T. F. B.

Liquids; Process for purifying ——. M. Coplans. Fr. Pat. 417,076, June 11, 1910. Under Int. Conv., June 11, 1909.

See Eng. Pat. 13,702 of 1909; this J., 1910, 1032.—T. F. B.

Disinfection by means of halogenated naphthols; Process of ——. Chem. Fabr. Ladenburg Ges. m. b. H. Fr. Pat. 416,125, May 19, 1910. Under Int. Conv., May 24, 1909.

See Eng. Pat. 25,472 of 1909; this J., 1910, 975.—T. F. B.

Disinfectant containing formaldehyde, which readily emulsifies with mineral oils, tars, tar oils, and resin oils; Manufacture of a durable ——. K. L. V. Zimmer. Fr. Pat. 416,786, May 13, 1910.

See Eng. Pat. 12,157 of 1910; this J., 1910, 1268.—T. F. B.

Creosote; Process for obtaining a concentrated solution of ——. D. Lodigiani. Fr. Pat. 416,801, May 31, 1910.

See Eng. Pat. 26,296 of 1908; this J., 1910, 113.—T. F. B.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Quinine; A new method of determining —— *by titration.* J. Katz. Ber. deutsch. pharm. Ges., 1910, 20, 316—330.

In the search for an indicator suitable for titrating quinine salts with potassium hydroxide, the author has experimented with Poirrier's blue, with which a very sharp end-point is obtained provided that the liquid contains at least 90 per cent. of alcohol. For the estimation of quinine in bark, etc., it is necessary to bring the alkaloid into the form of a pure salt, and also to decolorise the solution. The author's method takes the following form: 6 grms. of dried and powdered bark are shaken with 15 grms. of chloroform and 5 grms. of a 5 per cent. solution of sodium hydroxide for ½ hour, then 45 grms. of ether and 1 grm. of magnesia are added. After shaking, 40 grms. of the clear solution are filtered off and evaporated to a volume of 1 c.c. This residue is transferred to a dish with 9 c.c. of alcohol, treated with 10 drops of hydrochloric acid and with 0·25 grm. of sodium chloride, and evaporated to dryness. More alcohol is added and the evaporation is repeated: finally the residue is dissolved in alcohol, and, with the aid of the above indicator, titrated with *N*/10 alcoholic potassium hydroxide, made by diluting the *N*-alkali with absolute alcohol. The residue thus titrated consists of the dihydrochloride, and the evaporation effects the removal of any excess of hydrochloric acid. The magnesium oxide added acts as a decoloriser.

Poirrier's blue is not affected by carbon dioxide, and may be used in conjunction with phenolphthalein to estimate mixtures of hydroxides and carbonates of the alkali metals. A form of glass dish is described which has the form of an inverted truncated cone, and prevents creeping of the evaporating liquid.—R. V. S.

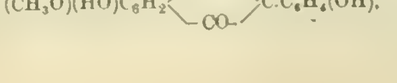
Colchicum seeds; Critical note on several processes for the determination of the total alkaloids in ——. E. H. Farr and R. Wright. Pharm. J., 1910, **85**, 578—580.

The authors have examined several methods for the alkaloidal assay of colchicum seeds, viz., those of Bredeman, Blau, Panchard, and the U.S. Pharmacopœia. These processes have been compared with a new method devised by the authors, and full details of each method are given. According to the new process 5 grms. of the powdered drug are packed in a percolator of 2 cm. diameter, and exhausted by slow percolation with 50 per cent. alcohol. The percolate is evaporated in a porcelain dish with 25 c.c. of water on the water-bath till the volume is reduced to 20 c.c. The warm liquid is transferred to a separator and the dish rinsed with a little water and 25 c.c. of light petroleum. The whole is shaken, the aqueous portion drawn off, and shaken with a further 20 c.c. of light petroleum. The aqueous portion is saturated with sodium chloride, and shaken out with 20, 10 and 5 c.c. of chloroform. The extraction with chloroform is repeated as long as any alkaloid is extracted. The chloroform is distilled off and the residue treated with a mixture of 19 c.c. of water and 1 c.c. of ammonia solution, used in four portions, then with a mixture of 16 c.c. of water and 4 c.c. of dilute sulphuric acid. These solutions are now all filtered into a flask, the acid being in excess, 20 c.c. of iodine test-solution added, and the precipitate filtered off. The flask and precipitate are washed out with 20 c.c. of water containing 1 c.c. each of dilute sulphuric acid and iodine test-solution. The filter and contents are ground to a pulp with a mixture of 20 c.c. of sodium thiosulphate test-solution and 2 c.c. of sodium carbonate test-solution, the latter preventing the liberation of sulphur. The mixture is filtered through cotton-wool into a separator, and the solid matter washed with water till a test portion gives no precipitate with dilute sulphuric acid and iodine solution. The filtrate and washings are shaken out with chloroform using 20, 10 and 5 c.c., and further quantities if all alkaloid is not removed. The chloroform solution is evaporated to dryness at a low temperature, the residue dissolved in 90 per cent. alcohol, evaporated and dried at 100° C. to constant weight. The weight of alkaloid obtained by this method should not be less than 0·025 grm. The alkaloid moreover is pure. Different samples examined yielded the following percentages of alkaloid:—0·54, 0·79, 0·55, 0·54, 0·56.

—F. Shdn.

Prunus; Chemical examination of a species of ——. H. Finnemore. Pharm. J., 1910, **85**, 604—607.

The sample of the bark of Prunus examined by the author is occasionally substituted for that of *P. serotina* Ehrhart, and is closely allied to *P. emarginata*. The bark was extracted with alcohol, and the whole of the residue left after removing the alcohol was found to dissolve in water. The aqueous solution when shaken with ether deposited a new dihydric phenol, *prunetin*,



$$(CH_3O)(HO)C_6H_2\left\langle\begin{array}{c}O.CH\\CO\end{array}\right\rangle C.C_6H_4(OH).$$

which melts at 242° C. (corr.) and crystallises from alcohol in colourless needles. Several derivatives of this substance have been prepared. There were isolated from the ethereal extract of the aqueous solution further quantities of prunetin, an acid m. pt. 121° C., and fatty bodies, from which a phytosterol was separated. The latter melted at 137° C., and its acetyl derivative, $C_{27}H_{45}O(CH_3CO)$, melted at 121° C. After saponification some volatile fatty acids and palmitic acid were obtained. The original aqueous solution after extracting with ether deposited on standing a yellow glucoside, identified as the quercimetrin of *Gossypium herbaceum*. A colourless glucoside was also obtained. This has been styled *prunitrin*. It has the composition, $C_{22}H_{24}O_{11}.4H_2O$, when crystallised from water, and yields prunetin and dextrose on hydrolysis. The author, from his experiments, considers prunetin to possess a flavone nucleus. The corresponding trihydroxyphenol, *prunetol*, crystallises from alcohol and water in colourless needles, m. pt. 290° C.—F. Shdn.

δ-Emulsin. L. Rosenthaler. Biochem. Zeits., 1910, **28**, 408—412. (See also this J., 1910, 450, 1269.)

When a 5 per cent. solution of emulsin (Schuchardt) is heated for 10 hours at 60°—65° C., a product is obtained which has a weak action on *r*-mandelonitrile, producing *l*-mandelonitrile, but does not attack amygdalin. The action of δ-emulsin on amygdalin proceeds in three stages, the amygdalin being converted successively into mandelonitrile glucoside, mandelonitrile and benzaldehyde. Of these, the first two are hydrolyses, but the third is not. The author has therefore attempted to separate from δ-emulsin the non-hydrolysing enzyme to which it it due, using as a test for it the above-mentioned conversion of *r*-mandelonitrile into *l*-mandelonitrile. Saturation of a solution of δ-emulsin with magnesium sulphate yielded a filtrate which possessed only hydrolytic properties, but the non-hydrolysing enzyme could not be isolated from the precipitate. From other experiments the author considers that the enzyme in question is not identical with that which synthesises mandelonitrile from benzaldehyde and hydrocyanic acid.—R. V. S.

Sandal wood oil ; An adulterant of African ——. W. Lenz. Ber. deutsch. pharm. Ges., 1910, **20**, 351—358.

The author has investigated the bark of the Karambusi tree (*Warburgia Stuhlmanni* Engl., *Winteronaceae Canellaceae*), which is found in commerce at Zanzibar along with sandal wood. The bark (of which sections are reproduced) has the sp. gr. 1·18—1·28 at 15° C. On distillation with steam it yields 0·6 per cent. of a viscous, reddish-yellow oil, which has an odour like that of sandal wood oil. The oil has the sp. gr. 0·9864 at 20° C., $[a]_D^{20} = -41.77°$, $n_D^{20} = 1.51269$. It has a scarcely distinguishable acid reaction towards litmus. The saponification value is 11·2, the acetyl value 100·3, which would correspond with 40 per cent. of santalol. The oil contains aldehydic and alcoholic constituents, in addition to esters and traces of acid. Alcohol of 90 per cent. strength dissolves an equal volume of the oil, which is, however, almost insoluble in alcohol of 70 per cent. Except as regards the solubility in alcohol, the oil shows great resemblance to that of *Osyris tenuifolia*, which is called African sandal wood oil. Whether it is used to mix with the latter, or made for use by itself, is not clear. The residue, after steam distillation of the bark, yielded mannitol in some quantity (1·4 per cent. of the bark).
—R. V. S.

Spearmint oil. Schimmel's Report, October, 1910, 131.

The area under cultivation for spearmint in the States of Michigan and Indiana, U.S.A., amounts to 1462 acres for this year, of which 199 acres have been newly brought under cultivation. In 1909 the area was 1495 acres. The principal part of the supply this year must come from fields which are 2 or 3 years old, and as the condition of these is not favourable, the crop is estimated at two-thirds of a normal one. The oil-yield is not expected to exceed 19,000 lb. The output from Wayne County, N.Y., together with the stock carried forward from last year will barely amount to 500 lb. of oil. For these and other reasons the price will rise during the winter to a still higher level, notwithstanding the recent increase of about 15 per cent.
—F. Shdn.

Essential oils. H. Haensel. Geschäftsbericht, April—Sept., 1910. Chem. Zentr., 1910, **2**, 1538—1539.

Cubeb oil.—Bright metallic potassium or sodium remains unaltered in the freshly distilled oil, but in oil which has been kept for some time, it becomes coated with a deposit, owing to the presence of cubeb-camphor in the oil. *Camomile oil.*—The yield of oil from German camomile was 0·2 to 0·36 per cent. ; the aqueous portion of the distillate was strongly acid. *Oil from flowers of Gnaphalium arenarium.*—The flowers, when distilled with superheated steam, yielded 0·04 per cent. of an oil having a dirty green colour, and of sp. gr. 0·921 at 20° C. The oil was purified by treating it in ethereal solution with animal charcoal. After removal of the solvent, the purified oil solidified at 7° C. ; it had the acid value, 14·45 ; "saponification value 9." When the oil was dissolved in 95 per cent. alcohol, a stearoptene (m. pt. 48°—50° C.) separated. The oil also contains a light yellow oily alcohol, and small quantities of an acid melting at 34°—36° C., and a phenol, probably *p*-cresol. *Sunflower oil.*—Sunflowers from Dalmatia yielded on distillation with steam, 0·235 per cent. of a greenish-yellow oil with a sweetish aromatic odour. Sp. gr. 0·9100 at 18·5° C., $a_D = -5·10°$, acid value, 8·9 ; saponification value, 87·66. *Oil of leaves of deadly nightshode (Datura Stramonium, L.).*—By distilling the leaves with superheated steam, 0·045 per cent. of a dark brown oil with a strong tobacco-like odour was obtained. The oil had an acid reaction and solidified at 20° C. ; its sp. gr. was 0·9440 at 30° C. After purification in ethereal solution with animal charcoal, it had the acid value 52·4 ; "saponification value 9·57." After saponification an alcohol with a strong tobacco-like odour was obtained by distillation with steam.—A. S.

Santenone. Schimmel's Report, October, 1910, 118—120.

A quantity of the first runnings obtained in the preparation of santalol was fractionated. A fraction boiling between 76° and 90° C at 9 mm., with the sp. gr. 0·9899 at 15° C., and $a_D = -21° 35'$ was found to contain ketones. One of these is the santalone of F. Müller (Arch. Pharm., 1900, **238**, 366) yielding a semicarbazone m. pt. 175° C. Müller also obtained a semicarbazone m. pt. 224° C. A larger quantity of the latter substance has now been obtained. The ketone, $C_9H_{14}O$, was liberated by the action of dilute sulphuric acid. After distillation, it boiled at 193°—195° C., melted at 48°—52° C., and had $[a]_D = -4° 40'$ in alcohol. When crystallised from light petroleum, it melted at 58°—61° C. The oxime boils at 110°—113° C. at 6 mm. The ketone is thus identical with the π-norcamphor obtained by Semmler from teresantalic acid (this J., 1908, 180) and with the santenone obtained by Aschan from santenol (this J., 1908, 89). This was confirmed by hydrating santene, and oxidising the alcohol, when santenone was produced.—F. Shdn.

Tetranitromethane. E. Berger. Comptes rend., 1910, **151**, 813—815.

The author describes a modification of the method of Pictet and Généquand (Arch. Sciences phys. et nat., 4th Series, 1903, **16**, 193) for the preparation of tetranitromethane, whereby the yield may be much increased. One hundred and sixty grms. of 100 per cent. nitric acid (or 180 grms. of acid of 48° B.) are mixed with 100 grms. of glacial acetic acid in a flask which is cooled in a current of water ; 290 grms. of acetic anhydride are then added slowly, cooling being continued. The whole is left to stand for some hours in cold water, and then for a night at the ordinary temperature, after which it is heated on a water-bath for 3—4 hours at 25°—30° C. ; it is then heated for the same period at each of a succession of temperatures increasing by 5° C., until 65°—70° C. is attained. The reaction-product is now poured into 4 times its volume of cold water whereupon the tetranitromethane is precipitated. The compound is washed with slightly alkaline water, and then with water, and is finally dried over anhydrous sodium sulphate. In this way, 52—60 grms. of tetranitromethane are obtained if concentrated nitric is used, whilst if the ordinary fuming acid is employed, the yield is 28—32 grms. The mother-liquor contains various intermediate products, nitroform being one of them; trinitroacetic acid is probably also present. Tetranitromethane has a density of 1·620 at 22° C.; it distils at 124°—125° C. under 750 mm. pressure, with slight decomposition, and at 21°—23° C. under 22 mm. pressure, without decomposition. Comparison of the boiling points of the nitro-derivatives of methane shows that the volatility diminishes as three of the hydrogen atoms are successively replaced by nitro-groups but that it increases again with introduction of a fourth nitro-group, *i.e.*, when the number of elements in the compound is diminished by one. The heat of formation of tetranitromethane, the use of which for the preparation of explosives of the Sprengel type, has been suggested, is given by, C (diamond) $+2N_2$ (gas) $+4O_2$ (gas)$=C(NO_2)_4+4·7$ (great) calories, the heat of formation of carbon dioxide being taken to be 94·3 (great) calories. (See also this J., 1910, 899).—L. E.

Trichloracetic acid; Decomposition of — into chloroform and carbon dioxide. R. Stollé. Ber. deutsch. pharm. Ges., 1910, 20, 371—372.

This decomposition, which occurs in the presence of many bases, is also effected when the acid is boiled with antipyrine in aqueous solution, and may serve as a means of distinguishing trichloracetic acid from chloral hydrate, which does not yield chloroform under these conditions. —R. V. S.

Rosewood oil. Chem. and Drug., Nov. 19, 1910. [T.R.]

The British Consul for French Guiana, in his annual report for 1909, states that the total exports of oil of rosewood in 1909 amounted to 12,497 kilos., valued at 312,400f., against 7,470 kilos., valued at 186,750f., in 1908, or 5,027 kilos. more. The average production is 22 lb. of oil from 1 ton of wood, the price in France being about 10s. per lb. There are five factories established in Cayenne for the distillation of the oil, which is shipped to France in carboys, and two more factories are in course of erection. In addition, the exports of rosewood were 265 tons in 1909, against 27 tons in 1908, the destination being Grasse, Alpes Maritimes.

Patents.

4-Imino-5-isonitroso-2.6-dioxypyrimidine and its 3-alkyl derivatives; Process for preparing ——. E. Merck. Ger. Pat. 227,390, Feb. 28, 1909.

Cyanoacetylurea, $NH_2·CO·NH·CO·CH_2·CN$, or one of its alkyl derivatives, is converted into the isonitroso compound by treatment with nitrous acid; this is then treated with an alkaline substance, such as an alkali hydroxide or amide, whereby 4-imino-5-isonitroso-2.6-dioxypyrimidine or one of its 3-alkyl derivatives is obtained.—T. F. B.

Diglycolyl-disalicylic acid; Process for preparing ——. Chem. Fabr. von Heyden. Ger. Pat. 227,999, July 17, 1908.

Diglycolyldisalicylic acid, $O(·CH_2·CO·O·C_6H_4·CO_2H)_2$, is obtained by the action of salicylic acid or a salicylate on diglycollic anhydride or mixtures of substances which produce this, preferably in presence of a tertiary base. The new substance melts at 168°—170° C., is odourless, has a very slight taste, and is stated to have a similar physiological action to salicylic acid, the diglycollic acid radical being almost inactive.—T. F. B.

Alkaloids of the tropine and scopoline group; Process for preparing halogen-alkylates and alkyl nitrates of the ——. A. Gerber. Ger. Pat. 228,204, June 12, 1909.

By treating alkaloids of the tropine or scopoline group with dialkyl esters of sulphurous acid under suitable conditions, addition products are obtained, the reaction in the case of atropine being represented by the following equation:—$C_{17}H_{23}O_3N+SO(OCH_3)_2=C_{17}H_{23}O_3N(CH_3)O·SO·OCH_3$. These addition compounds react with metallic halides or nitrates, forming the corresponding halogen alkylate or alkyl nitrate of the alkaloid. —T. F. B.

Alkaloids of the morphine group; Process for preparing halogen alkylates of the ——. A. Gerber. Ger. Pat. 228,247, June 12, 1909.

Morphine alkaloids react with dialkyl sulphites in presence of alcohol, chloroform, etc., in a similar manner to tropine or scopoline alkaloids (see preceding abstract); when the addition compounds are treated with inorganic halogen compounds, such as metallic halides or hydrogen halides, they are converted into the halogen alkylate of the alkaloid.—T. F. B.

Pharmaceutical compounds; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 30,592, Dec. 31, 1909. Addition to Eng. Pat. 28,166, Dec. 2, 1909.

See Fr. Pat. 414,563 of 1910; this J., 1910, 1227.—T. F. B.

Pharmaceutical compounds; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2104, Jan. 27, 1910. Addition to Eng. Pat. 28,045, Dec. 1, 1909.

See Ger. Pat. 224,864 and Fr. Pat. 414,563; this J., 1910, 1133 and 1227.—T. F. B.

Aqueous emulsions of hydrocarbons or of essential oils. Fr. Pat. 416,766. *See* IIa.

Alkyl and aryl esters of phthalic acid as solvents. Ger. Pat. 227,667. *See* XIII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Solarisation; Experiments on ——. G. A. Perley. J. of Phys. Chem., 1909, 13, 630—658; 1910, 14, 685—708.

The tendency of the photographic image towards solarisation is not increased by oxidising agents (hypobromous acid, permanganate, etc.); their effect is to retard the formation of the weak normal image, with the result that a clearer and better positive is produced. Reducing agents do not retard solarisation, but tend to mask it by excessive reduction of the silver halide. For example, if plates are treated with sodium nitrite before exposure, positives can be obtained on them if the concentration of the nitrite is not too great. The action of weak reducing agents (stannous chloride, sodium arsenite, etc.) on silver bromide causes it to pass through the same stages as does the action of light, which points to the conclusion that the latent image is a reduction product; stronger reducing agents, such as normal photographic developers, do not cause the halide to pass through all the possible stages, but they reduce certain silver-halogen solid solutions more rapidly than others containing less halogen. A substance which dissolves silver from the latent image tends to check solarisation, while substances which dissolve silver bromide increase the tendency to solarise. Also, the presence of depolarisers in the film increases the sensitiveness of the emulsion. For the direct production of positives, the best results were obtained by the action of green-blue rays on the plate during development; direct positives are also obtained by the use of a very dilute developer with normally exposed plates, or by giving short exposures to plates containing a weak depolariser in the film. The reversal noted by Waterhouse when thiourea was present in the developer, is due to the sensitising action of the thiourea; better control was obtained by first sensitising with thiourea, and developing in the usual manner. The antagonistic effect of different kinds of light on the photographic plate (Herschel effect) and the Clayden effect (short exposure to intense light followed by short exposure to diffused light yields a reversal: if first exposure is prolonged, only negatives result), are both to be regarded as phenomena of solarisation.—T. F. B.

Patents.

Photography in colours; Process of —— by means of a screen and a special support. E. C. G. Caille. Second Addition, dated Aug. 23, 1909, to Fr. Pat. 389,977, July 16, 1907 (see Eng. Pat. 15,050 of 1908; this J., 1909, 914).

The special screen described in the principal patent may be prepared by combining three films prepared separately, each on its own support. Several processes are described for forming the white covering necessary to produce the half-tones and high lights of the photograph; for example, the sensitised film may be treated with a solution of ammonium oxalate, exposed under a suitable screen negative, washed, and treated with a solution of calcium nitrate, whereby deposits of calcium oxalate of varying degrees of opacity are obtained. (See also this J., 1909, 1064.)—T. F. B.

Photography in colours on paper or other support, using a single plate; Process of ——. La Photographie des Couleurs. Fr. Pat. 416,135, May 20, 1910.

A screen composed of elements of different colours is placed in front of the sensitive plate in the camera; a compensating screen may also be employed if desired. The negative thus obtained is printed on a paper or other support coated with bichromated gum or gelatin, and provided with a screen identical with that used in making the negative, but with the colours complementary. The image thus formed protects portions of the coloured elements against the action of the water used for developing, after which the unprotected elements are removed by means of a solvent. The positive screen elements may consist of coloured particles of resin, some of which are subsequently removed by means of alcohol. The coloured grains which remain may be fused together, after removing the transparent covering, by treatment with hot alcohol vapour, etc.—T. F. B.

Three-colour photographic processes. H. Clement. Fr. Pat. 416,700, Aug. 11, 1909.

The spores of fungi, algæ, mosses, etc., are utilised as "grains" for the preparation of colour screen plates; these spores can be obtained of constant size, by stopping them at the requisite stage of their growth; they are also transparent, and their staining can be effected by cultivating them in suitably coloured media.—T. F. B.

Photography in colours; Process of ——. E. N. White. Fr. Pat. 417,003, June 1, 1910.

A support is coated successively with a number of sensitised films of different colours, the films being arranged in order of the photographic values of their colours or in other suitable ways. Suppose a support to be coated with four sensitised films, red, green, yellow, and white or blue; when this is exposed beneath a negative, the portions beneath the transparent parts of the negative, corresponding to red, will be acted upon most strongly by the light, which will penetrate to the lowest (red) film; on developing this composite film, a reproduction of the original in colours is obtained, provided that the colours of the original were of equal intensity.—T. F. B.

Photographic images; Process for producing —— by means of sensitive surfaces composed of asphaltum and analogous substances, and of caoutchouc, guttapercha, balata, etc. J. Rieder. Ger. Pat. 227,129, Dec. 4, 1909.

When a mixture of caoutchouc, guttapercha, or balata with asphaltum or analogous substance is dissolved and the solution evaporated, a solid solution of the asphaltum in the rubber is obtained; when a thin layer of this is exposed to light, the solution is destroyed, the rubber coming to the surface, and the layer loses its affinity for powdered colours, and also becomes permeable to alcohol. If the layer of asphaltum and rubber is backed with collodion or gelatin, exposed to light under a negative and then treated with a solution in alcohol of a dyestuff which will stain the support, a positive will be obtained; or by using the "dusting" process (see Eng. Pat. 7932 of 1909; this J., 1910, 113), a negative results. If the gelatin or collodion contains an iron salt, and the exposed film is treated with a solution of tannin, a black and white positive is produced. Similar results may be obtained by impregnating the support with suitable metallic salts and then treating with a gaseous substance which will form a coloured compound with the salt. —T. F. B.

Line screens; Process for producing —— from fabrics made of coloured artificial fibres which soften on heating. F. Fritz. Ger. Pat. 227,130, Feb. 14, 1908.

A fabric which has been made from suitably coloured threads of artificial silk, celluloid, etc., which become soft on heating, is laid on a glass plate, and subjected to heat and pressure, whereby the fibres are flattened out and united, forming a line-screen without colourless interstices (compare Ger. Pat. 223,819; this J., 1910, 977).—T. F. B.

Polychrome screen [for photography] and process of making the same. C. L. A. Brasseur, New York. U.S. Pat. 974,464, Nov. 1, 1910.

See Eng. Pat. 18,750 of 1908; this J., 1909, 259.—T. F. B.

Drying of perforated cinematograph films; Apparatus for the continuous ——. Comp. Gén. de Phonographes, Cinématographes, et Appareils de Précision. Fr. Pat. 416,554, Aug. 9, 1909.

See Eng. Pat. 21,099 of 1909; this J., 1910, 720.—T. F. B.

Cellulose esters and their treatment. Fr. Pat. 416,752. *See* V

XXII.—EXPLOSIVES; MATCHES.

Explosives; Method of determining the stability of —— in different countries. Z. ges. Schiess- und Sprengstoffw., 1910, 5, 21—25, 72—74, 210—212, 432—437.

At the sixth International Congress of Applied Chemistry at Rome in 1906, a committee was formed to investigate the question of the unification of the methods of determining the stability of explosives. At the seventh Congress in London, in 1909, a preliminary report was made by MM. Watteyne and Stassart upon the methods employed in various countries.

Great Britain.—Explosives are divided into seven classes, (1) Gunpowder, (2) Nitrate mixtures other than gunpowder, (3) Nitro-compounds (nitroglycerin, nitrocotton, picric acid, etc.), (4) Chlorate mixtures, (5) Fulminate, (6) Ammunition, (7) Fireworks. C. Lundholm gives an account of the official methods employed for testing explosives. The details for heat test, liquefaction, exudation, etc., are quoted from the Home Office specification. The methods employed by the chemical advisers to the explosives department for investigating sensitiveness to shock, friction, etc., which are not dealt with in the specification, are as follows:—*Sensitiveness to shock.*—A layer of explosive is spread out on an anvil weighing 91 kilos. A steel cylinder 1·27 cm. high is then placed on the explosive and a steel ball weighing either 227 grms. or 454 grms. is allowed to fall on the explosive from a determined height. The least height at which explosion does not occur is recorded. The cylinder and ball are cleaned very carefully from all foreign matter, and residues from previous experiments. In testing chlorate explosives the sample is enclosed in tinfoil. A table of relative sensitiveness has been drawn up and new explosives are compared with those of a similar nature already authorised and in use. *Sensitiveness to shock and friction.*—A small quantity of the explosive is placed on a stone slab and tested by striking it with a wooden mallet (327 grms.) or a wooden mallet shod with leather (341 grms). This latter is usually employed for chlorate explosives. Should the hammer test cause explosion, further experiments are carried out with a broomstick which has its end cut off at an angle of 60 degrees. The sample of explosive is spread out, either on stone or wood, and given a glancing blow with the bevelled end of the broomstick. Should this cause ignition it is considered that the explosive is too sensitive to be authorised for manufacture. *Ignition temperature.*—A copper strip 33 cm. long and 1·87 cm. cross section is supported at one end, the other end being heated by a gas flame. After a certain time, owing to radiation, the temperature at any one point of the strip remains constant. The points on the heated strip at which gunpowder and guncotton explode are noted. The point where the explosive under investigation ignites is then determined. Should it explode at a lower temperature than guncotton, further experiments are carried out by heating the explosive in an iron tube immersed in an oil-bath. Should the temperature of explosion prove to be considerably lower than that of guncotton it is very improbable that the explosive would be authorised. *Special tests for chlorate explosives.*—A thin layer of the chlorate explosive, in a shallow dish, is exposed at a temperature of 60° C. for 6 hours, and then at 20° C. for 18 hours. This treatment is repeated fifty times. A second test consists in exposing the sample 25 times alternately to dry and moist air at 60° C. The explosive is, after this treatment, again subjected to the tests for sensitiveness to shock and friction.

France.—The tests to which explosives are submitted are (*a*) Rate of burning in the open. (*b*) Sensitiveness to shock and friction, (*c*) Explosion in pressure bomb, (*d*) Explosion on a lead cylinder in the open, (*e*) Explosion in Trauzl block, (*f*) Explosion in a borehole, (*g*) Investigation of the stability under various conditions. The conditions of carrying out the heat test are, for guncotton, very similar to those in use in England. The following are points of difference. The wet guncotton before testing is dried in an oven at 65° C. The temperature of the test itself is 66° C. The moistening solution consists of glycerin (1 part), and water (9 parts). Nitroglycerin extracted from explosives by water displacement should give a heat test of not less than 20 minutes at 65° C.

Holland.—G. van Pittius states that in Holland explosives are divided into four classes, (*a*) Gunpowder, (*b*) Smokeless powder and nitrocotton, (*c*) Dynamite, and (*d*) Safety explosives. The test for sensitiveness consists in using a weight of 1·8 kilos. falling from a height of 92 cm. The explosive is wrapped in tinfoil. A hammer and anvil test is also employed. The sensitiveness to detonation is determined by using detonators of 0·5, 1·0, 1·5, and 2 grms. of fulminate. In testing safety explosives 10 kilos. are sealed up in a sheet iron canister, which is covered with inflammable material, soaked in paraffin. This is set on fire in order to see whether the explosive will ignite explosively or only burn off quietly. The heat test is carried out at 80° C., using for nitrocotton 1·3 grms., for smokeless sporting powder 4 grms., and for military powder 7 grms. The heat tests should not be below 20 minutes, 5 minutes and 10 minutes respectively. The "fume" test is carried out in a tube of 18 mm. diameter and 55 mm. high, closed with a ground glass stopper. The tube is heated daily in an oil-bath for 8 hours and the time is noted when red fumes appear. Tests for the Army and Navy differ, the temperature varying from 94° C. to 101° C., the quantity of explosive from 2·5 to 10 grms., and the times before which red fumes should not appear from 3 to 10 days. The Bergmann and Junk test (this J., 1904, 953), the 135° C. fume test and the explosion test are also employed.

Spain.—M. Jacqué states that in Spain the heat test for nitroglycerin should not be less than 15 minutes at 72° C., whilst nitrocotton should not give a test of less than 10 minutes at 80° C., and a Vieille test of at least 25 to 30 hours. For the heat test, nitrocellulose is dried at 45° to 50° C., until two weighings at intervals of 4 hours show no difference. The sample is then freely exposed to the air for 24 hours, and finally rubbed through a 0·5 mm. sieve. The dipping solution for the heat test papers consists of water (100 c.c.), starch (5 grms.), zinc chloride (20 grms.), and zinc iodide (2 grms.). The solution for moistening the papers is made from glycerin (1 grm.) and water (10 c.c.). Military explosives when tested at 80° C., are classified as follows:—Over 60 minutes, excellent condition; over 30 minutes, serviceable; over 10 minutes, for immediate use; under 10 minutes, to be destroyed.

Italy.—G. Spica's report states that the heat test of nitrocellulose (1·3 grms.) is carried out at 66° to 67° C., and should not be below 15 minutes, whilst nitroglycerin powder (3·25 grms.) ground and sifted through a 0·4 to 0·5 mm. sieve, should not show a test of less than 12 minutes at 71° C.

United States.—Nitrocellulose when heated in a watch-glass for 8 hours at 115° C., should not show a loss of more than 8 per cent. at the end of 6 days.

Belgium.—M. Levarlet states that in Belgium explosives are now classified as follows:—(1) Powders, (2) Dynamites, inclusive of nitrocellulose and other explosives similar in power to dynamite, such as chlorate explosives, (3) Explosives igniting only with difficulty, such as the ammonium nitrate group of explosives, (4) Detonators. Explosives are submitted to tests for sensitiveness to a falling weight, and also anvil and hammer tests. Tests for power are carried out by using lead cylinders and lead blocks. Explosives are also tested for sensitiveness to detonators of various strengths when fired freely exposed. (See also this J., 1897, 283; 1901, 8; 1902, 687; 1903, 511, 924; 1909, 175—177.)—G. W. McD.

Nitric acid in nitrocellulose, nitroglycerin and other compounds; Volumetric determination of ——. E. Bronnert. Bull. Soc. Ind. Mulhouse, 1910, 80, 251—263.

The author has developed a method proposed by Longi in 1885 for the volumetric determination of nitric acid in sulphuric acid solution by stannous sulphate, according to the equation:

$$4SnSO_4 + 4H_2SO_4 + 2HNO_3 = 4Sn(SO_4)_2 + 5H_2O + N_2O,$$

using diphenylamine as an indicator. The N/10 solution of stannous sulphate is prepared by dissolving this salt or the double sulphate of potassium and tin in a mixture of equal volumes of pure sulphuric acid and water, with the gradual addition of just sufficient strong hydrochloric acid to produce a clear solution. This is standardised against potassium nitrate and is adjusted by the addition of the necessary quantity of 50 per cent. sulphuric acid. For the standardisation, 0·15 grm. of potassium nitrate, dried at 100° C., is dissolved in a few drops of water; 50 c.c. of concentrated sulphuric acid are added all at once, so as to avoid a loss of nitric acid by heating and the mixture is coloured with a drop of diphenylamine reagent. The solution is then titrated with the stannous sulphate until decolorised. Determinations made with nitrocellulose, potassium nitrate and spent nitrating acids have given concordant and fairly satisfactory results. In reporting on this method, E. Wild states that in a series of titrations the maximum divergence from the mean was 2 per cent., and in view of the rapidity and convenience of the method, its accuracy may be regarded as sufficient for many purposes. The stannous sulphate solution alters somewhat rapidly on keeping, first owing to oxidation by the air, and secondly by interaction with the excess of sulphuric acid present, which is gradually reduced to sulphuretted hydrogen. These changes are accelerated by elevation of temperature. The solution should therefore be kept cool, and should be restandardised before each series of tests. There is some difficulty in obtaining a concordant end-point; the best results are obtained by stopping the titration at the first point of decolorisation.
—J. F. B.

Matches; Development of the Chinese industry in ——. Chem. Ind., 1910, 33, 722.

According to a published Japanese report the manufacture of matches in China is rapidly developing (this J., 1909, 544), and factories are now established in Tientsin, Pekin, Hankow, Shanghai, and many other towns. These factories have been erected at the instigation of the Viceroys and are protected by many rules. Not more than one factory may be erected in the same town, so that each one established enjoys a sort of local monopoly. The largest factory, which is at Hankow, employs 3600 workers, male and female, and has a daily output of 50 to 60 tons (metric) of matches. Other Chinese factories produce 30 tons a day. All these factories are established upon a solid business foundation, and many of them are already extending their business connections. This rapid development of the industry in China indicates that in a short time Japanese matches will be unable to compete with the Chinese product, for the cost of labour in China is considerably less than in Japan and the cost of carriage is saved. The decline in the exports of Japanese matches to China must be attributed entirely to the development of the Chinese industry. At present, however, China is entirely dependent upon Japan for the wood required for the matches and the boxes, and unfavourable climatic conditions seem likely to prevent the production of such wood in the immediate future. Hence the development of the Chinese match industry will be accompanied by an increased exportation of Japanese wood to China.—C. A. M.

PATENTS.

Explosive charges. C. E. Bichel, Hamburg, Germany. Eng. Pat., 17,194, July 19, 1910. Addition to Eng. Pat. 19,215 of 1906 (this J., 1907, 115, 991).

In order that nitro-compounds should be as insensitive as possible when used in moulded form in pasteboard cases as charges for shells, the formation of dust between the cases and the charge due to the crumbling of the nitro-compound should be prevented, and the case should surround the charge so closely that on tapping no hollow sound is heard. Even when the charge has been moulded, under pressure, in a thoroughly dried pasteboard case, the absorption by the case of a small amount of moisture is sufficient to cause it to expand and it will then no longer adhere to the charge. To prevent this trouble it is proposed to introduce a pasteboard case into a mould, the internal diameter of which slightly exceeds the outer diameter of the case, and then whilst the case is being filled, air pressure is by a special device allowed to act on the interior of the case only. This expands the case and forces it closely against the enclosing mould. After the charge has solidified, the contraction of the case and its continued elasticity prevents the formation of any interstice between it and the charge.—G. W. McD.

Explosive compound. H. Maxim, New York. U.S. Pat. 974,900, Nov. 8, 1910.

The composition is made by incorporating pyroxylin, trinitroanisol, and nitroglycerin, heating the mixture, keeping the pyroxylin wet during the gelatinising, and then drying.—G. W. McD.

Explosive. L. Gray, Cleveland, Ohio. U.S. Pat. 975,030, Nov. 8, 1910.

See Eng. Pat. 25,553 of 1909; this J., 1910, 235.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Azolitmin; Commercial ——. P. Scheitz. Z. anal. Chem., 1910, **49**, 735—736.

Commercial azolitmin is regarded by the author as an ammonium salt. The ammonia found in the various samples examined, averaged 8·5 per cent., the amounts varying but little. It leaves very little ash. When heated to 100° C. for 3—4 hours it loses the power of dissolving in water. The commercial product is purified by dissolving in ammonia, adding excess of dilute hydrochloric acid and heating the solution on the water-bath until a precipitate is formed. This is well washed with hot water. The dry precipitate is then boiled with dilute alcohol (2 parts to 1 of water) until the alcohol is no longer coloured. The dried residue is amorphous and greenish black. The yield is 22 per cent. It contains nitrogen, does not melt at 390° C., and leaves only traces of ash. It is scarcely soluble in water, alcohol, and ether; it dissolves in concentrated formic acid, but separates again on copiously diluting with water. The ammonium compound is formed by passing ammonia gas over it; the mass quickly becomes hot, and the current of gas is maintained until it cools again, when it is spread out and kept *in vacuo* for 2—3 hours. It is very stable and dissolves in water with a reddish colour. It is a delicate indicator. 1 c.c. of a solution of 0·1 grm. in 100 c.c. of water, added to 100 c.c. of boiled water gives a blue colour with 0·8 c.c. of $N/100$ sodium hydroxide. Addition of 0·5 c.c. of $N/100$ acid colours the solution red. Compounds with methylamine and dimethylamine can also be formed.—A. Sbld.

Litmus: Note on the portion of —— *soluble in alcohol.* P. Scheitz. Z. anal. Chem., 1910, **49**, 736—739.

The author has isolated a characteristic substance from that portion of litmus which is soluble in alcohol. After a series of purifications 1·5 per cent. of ash-free product was obtained from purified litmus. It is light brown in colour and burns on platinum foil without melting. It dissolves easily in pyridine and concentrated formic acid. The ammonium compound is formed by passing ammonia over the product until the heat evolved at first has dissipated, and keeping the resulting compound in thin layers *in vacuo* for 2—3 hours. It has a deep blue colour and dissolves in water with a reddish colour. It is a very delicate indicator, being about twice as sensitive as the purified azolitmin compound (see preceding abstract). It is very stable. At 115° C. it is decomposed without melting. The aqueous solution is very stable and can be kept in closed vessels for a long time, without any alteration. It is sensitive to carbon dioxide. Compounds can be also formed with methylamine and dimethylamine. The portion of litmus insoluble in alcohol consists chiefly of azolitmin. Owing to its indifferent behaviour to solvents, it cannot be obtained in a pure state. (See preceding abstract.)—A. Sbld.

Cupels; Experiments with Portland cement ——. T. P. Holt and N. C. Christensen. Eng. and Min. J., 1910, **90**, 560—561.

The authors find that Portland cement, gauged with 6—10 per cent. of water, forms a convenient substitute for bone ash in making cupels. Cement cupels are strong, and will absorb their own weight of litharge; the loss of silver by absorption is about the same as with bone ash. Cupels made of a mixture of cement and bone ash were in some respects superior to either cement or bone ash alone.—J. T. D.

Nitrogen by the Kjeldahl method; Notes on the determination of ——. P. L. Hibbard. J. Ind. Eng. Chem., 1910, **2**, 463—466.

The author has studied the Kjeldahl method as applied to dried blood and bone meal. The time of digestion required with 10 grms. of potassium sulphate and 0·5 grm. of copper sulphate is about 3 hours. In the distillation with sodium hydroxide or magnesia practically all the ammonia, with 50—75 c.c. of water, is obtained in 10—15 minutes. About 10 grms. of potassium sulphate with 0·5 grm. of copper sulphate seems to be the best quantity. More potassium sulphate causes difficulty during distillation, and more copper sulphate appears to cause loss of nitrogen. Bumping during digestion can be avoided by addition of 1—2 grms. of ferrous sulphate. Ammonia may be lost during digestion if too much acid has been driven out, but the loss does not seem to be connected with the flame striking the flask above the level of the liquid, as is sometimes stated.—W. H. P.

Alkali-metals; Simple method for expelling large quantities of ammonium salts in the determination of ——. J. Jámbor. Z. anal. Chem., 1910, **49**, 733—734.

THE following procedure in the determination of the alkali metals is recommended when large quantities of ammonium salts are present:—The solution containing the alkali salts is evaporated on the water-bath until a crust forms and then allowed to cool; half the volume of concentrated sulphuric acid is now added and the mixture heated over a small flame. After evaporation of the remaining water, the ammonium salts can be quickly driven off, together with the sulphuric acid on heating more strongly. As the boiling point of concentrated sulphuric acid is higher than the dissociation temperature of the ammonium salts of mineral acids and as these salts do not crystallise from the hot concentrated acid, the troubles usually caused by bumping, spitting, and decrepitation are avoided.—A. SBLD.

Gold; The determination of —— by means of hydrogen peroxide. L. Rössler. Z. anal. Chem., 1910, **49**, 739—740.

IN Vanino and Leeman's method for determining gold (this J., 1899, 788), the metal is precipitated by hydrogen peroxide in the presence of an alkali hydroxide, the reaction being complete in a few minutes in the cold. It is found that gold is also precipitated quantitatively (99·66—99·77 per cent.) from an aqueous solution of the chloride by an excess of the peroxide alone, after standing for a day (in the cold); the filtrate gave no coloration on heating with sodium hydroxide. With addition of lithium carbonate (hot saturated solution) the gold is precipitated in a few hours, but the metal must be washed with dilute hydrochloric acid to avoid high results. If a concentrated solution of sodium carbonate be used instead of the lithium carbonate, the gold is precipitated in a short time, 99·89—100·00 per cent. of the amount taken being found.—A. SBLD.

Mercury; Volumetric determination of —— by means of ammonia. G. Bressanin. Ann. Chim. analyt., 1910, **15**, 413—415.

THE author modifies the original method of Archetti (Boll. farm., 1900, 765), of precipitating mercuric chloride solution with excess of ammonia, and then titrating the amount of free ammonia remaining. The modified method is claimed to give results comparable in accuracy with those obtained gravimetrically. Forty c.c. of $N/10$ ammonia solution are run into a stoppered 100 c.c. flask. Twenty c.c. of the solution of mercuric chloride, approximately $N/10$ concentration, are then added, and sufficient distilled water to make the whole up to 100 c.c. After standing well stoppered, until clear, 25 c.c. are pipetted off and titrated with $N/10$ acid, with litmus indicator. It is found that to obtain satisfactory results, the excess of ammonia over mercuric chloride should be in the molecular ratio of 4 : 1. Under these conditions 1 c.c. of $N/10$ ammonia is equivalent to 0·01355 grm. of mercuric chloride.—J. O. B.

Arsenic acid in presence of arsenious acid; Detection and determination of —— by means of magnesia mixture. J. C. Brünnich and F. Smith. Z. anorg. Chem., 1910, **68**, 292—296.

THE authors find (contrary to Lutz and Swinne, this J., 1909, 1225) that arsenic acid may be determined in the presence of arsenious acid, by means of magnesia mixture, if the solution contain not more than 0·5 per cent. of arsenious anhydride and an amount of alkali salts corresponding to an original content of not more than about 1 per cent. of sodium hydroxide. As little ammonia as possible should be present in the magnesia mixture, a suitable solution containing 5·5 per cent. of magnesium chloride ($MgCl_2,6H_2O$), 10·5 per cent. of ammonium chloride, and 1·4 per cent. of ammonia (NH_3); excess of ammonia must not be added as usually recommended. —F. SODN.

Carbon tetrachloride vapour; Action of —— on minerals, and its use in quantitative analysis. P. Jannasch. Ber., 1910, **43**, 3135—3136.

HAVING regard to a recent paper by Camboulives (this J., 1910, 275), the author states that he and his pupils had already carried out a large number of complete analyses of minerals (apatite, triphyline, vivianite, pyromorphite, wolframite, scheelite, molybdenum glance, vanadinite, endlichite, carnotite, and patronite) by means of carbon tetrachloride vapour on the lines previously laid down (see this J., 1909, 936, 961, 962). A detailed communication is promised.—A. S.

Volatile fatty acids; New method for the quantitative determination of ——. E. Welde. Biochem. Zeits., 1910, **28**, 504—522.

THE estimation of volatile fatty acids in liquids of animal origin by distillation in steam at 100° C. yields inaccurate results, chiefly owing to the hydrolyses which may occur in the mixture at that temperature. The author avoids this by effecting the distillation with steam *in vacuo* (10—15 mm.), the distilling vessel being immersed in a bath at 60° C. The experimental arrangement is similar to that of the ordinary vacuum distillation, except that the capillary is connected not with the air but with a boiler which is heated by a flame just large enough to supply the amount of steam required. In addition to an ordinary, water-cooled receiver, a second condensing vessel immersed in ice is introduced between the apparatus and the water pump. The level of liquid in the distilling flask is maintained by occasional additions of water. The method has been used with aqueous solutions of various acids, with fresh and with decomposed milk, intestinal contents, faeces, etc. As a rule, two hours' distillation suffices to drive over quantitatively all the free volatile fatty acids present, including capric acid. If the mixture contains free non-volatile acids, these liberate equivalent amounts of volatile acids from their salts if present, so that the estimation of free volatile acids is only possible if the mixture is free from other acids. The total volatile acids, free and in combination as salts, may be obtained by a similar distillation after acidifying with a small quantity of phosphoric acid. The glycerides of the volatile fatty acids are not decomposed in these circumstances. Lactic acid remains almost quantitatively in the residue, whilst at 100° C. it is volatile in steam.—R. V. S.

Hydrogen cyanide; Colorimetric determination of ——. A. C. Chapman. Analyst, 1910, **35**, 469—475.

THE method proposed is based on the coloration produced when a solution of a cyanide is heated with an alkaline picrate mixture such as is used in Jaffé's method for the determination of creatinine. The author shows that the coloration is due to the formation of either sodium isopurpurate or amino-nitro-phenols; the former substance is formed when the cyanide is in excess and the latter when the picric acid predominates. In dealing with small quantities of cyanide, the picrate reagent is almost certain to be in excess, and in this case the reaction is a reducing one, amino-nitro-phenols being formed, and not isopurpurate. For quantities of hydrogen cyanide varying from 2 to 8 mgrms., the coloration produced is strictly proportional to the amount of hydrogen cyanide present when the solution of the latter is heated for 15 minutes at a temperature of 50° C. with 20 c.c. of a saturated solution of picric acid and 10 c.c. of a 10 per cent. solution of sodium hydroxide. The coloration obtained is compared with those yielded by known amounts of hydrogen cyanide when treated under exactly similar conditions. Should a coloration be obtained in the examination of any given solution, steps must be taken to prove that no substance, other than hydrogen cyanide, capable of reducing alkaline picrate is present. The usefulness of the process appears to be very limited. (See Waller, this J., 1910, 1180).—W. P. S.

Calorimetric determinations on anthracite coal. Palmenberg. *See* IIA.

Valuation of logwood. Grasser. *See* IV.

Determining sulphurous acid in waste lyes of sulphite pulp mills. Stutzer. *See* V.

Determining organic matter in waste sulphuric acid. Michel. *See* VII.

Electrolytic determination of chlorine in hydrochloric acid. Goldbaum and Smith. *See* VII.

Precipitation of vanadic acid as silver vanadate, and the determination of phosphoric and vanadic acids. Edgar. *See* VII.

Delicate reaction for hydrogen. Zenghelis. *See* VII.

Examination of glazes containing lead. Schoorl. *See* VIII.

Determining carbon and sulphur in high-percentage alloys of tungsten, molybdenum and vanadium with iron. Müller and Diethelm. *See* X.

Assay of arsenical nickel-cobalt silver ores. Bullens. *See* X.

Thiocyanate determination of copper [*in ores*]. Tsukakoshi. *See* X.

Element of chance in the sampling of ores. Wright. *See* X.

Primary and secondary bromine values of oils. Vaubel. *See* XII.

Separating solid from liquid fatty acids. David. *See* XII.

Examination of wool-grease oleines. Marcusson. *See* XII.

Detection of mineral oil in wool-grease oleines. Winterfeld and Mecklenburg. *See* XII.

Detection of rosin oil in wool-grease oleines. Winterfeld. *See* XII.

Chrome paint analysis. Scherubel and Wood. *See* XIII.

Some properties and the determination of raffinose. Herzfeld. *See* XVII.

Determination of ether and benzene in alcohol. Wolff. *See* XVIII.

Electrical conductivity of milk and detection of added water or electrolytes. Binaghi. *See* XIXa.

Volumetric determination of manganese in water. Redenburg. *See* XIXb.

Determining quinine by titration. Katz. *See* XX.

Determination of total alkaloids in colchicum seeds. Farr and Wright. *See* XX.

Tetranitromethane. Berger. *See* XX.

Decomposition of trichloracetic acid into chloroform and carbon dioxide. Stollé. *See* XX.

Volumetric determination of nitric acid in nitrocellulose, nitroglycerin and other compounds. Bronnert. *See* XXII.

Patent.

Colours; Apparatus for analysing mixtures of ——. A. Kubiček. Fr. Pat. 416,190, May 21, 1910. Under Int. Conv., May 25, 1909.

See Eng. Pat. 12,715 of 1910; this J., 1910, 1180.—T.F.B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Acetylene; Adsorption of —— *by colloidal palladium.* C. Paal and C. Hohenegger. Ber., 1910, **43**, 2684—2692.

Colloidal palladium exhibits a very marked adsorptive power towards acetylene; the amount of acetylene which it is capable of adsorbing reaches nearly two molecules per atom of palladium, or nearly 5,000 times the volume of the palladium. The action goes on rapidly at first, then more slowly, and does not finish for several days. Rise of temperature and slight increase of pressure accelerate the action, and the gas adsorbed under these circumstances is not given off again at the ordinary temperature and pressure. On exposure to air, part only of the acetylene is given off, and very little is absorbed if this same palladium hydrosol be again exposed to acetylene. Probably solid and liquid polymers or condensation products are formed, which impede the action of the palladium on the gas. Adsorbed acetylene exhibits, as might be expected, increased chemical activity.—J. T. D.

Acetylene; Adsorption of —— *by palladium black.* C. Paal and C. Hohenegger. Ber., 1910, **43**, 2692—2694.

Palladium black, suspended in an aqueous solution of sodium protalbinate, or in water containing ammonia or alcohol, is hardly inferior to colloidal palladium (see preceding abstract) in its power of adsorbing acetylene. The same polymers or condensation products appear to be formed as with colloidal palladium, only in smaller quantity, and the adsorbed acetylene shows the same heightened chemical activity as in the case of colloidal palladium.
—J. T. D.

Books Received.

Technical Mycology: The Utilization of Micro-organisms in the Arts and Manufactures. A practical Handbook on fermentation and fermentative processes for the use of brewers and distillers, analysts, technical and agricultural chemists, pharmacists, and all interested in the industries dependent on fermentation. By Dr. Franz Lafar, Professor of Fermentation-physiology and Bacteriology in the Imperial Technical High School, Vienna. Translated by Chas. T. C. Salter. Vol. II.—Eumycetic Fermentation. Part II. Chas. Griffin and Company, Limited, Exeter Street, Strand. 1910. Price 18s.

8vo volume, containing 695 pages of subject matter, with 50 illustrations, and an extensive bibliography of 135 pages, also an alphabetical index of subjects. This forms the conclusion of a work the first volume of which appeared in 1898, (see this J., 1898, 504), and the second, (Part I.), in 1903 (this J., 1903, 444). The text is subdivided on the following plan, which also indicates the general nature of the contents:—Section XIII. Yeast Nutrition and Yeast Culture. (i), Mineral foodstuffs. (ii), Organic foodstuffs. (iii), Requirements in oxygen. (iv), Cultivation and reproduction of yeast. (v), Effect of certain technically important chemical influences on yeast. Sect. XIV. Life History and Variability of the Saccharomycetes. Classification of the Saccharomycetes and Schizosaccharomycetes. (i), Saccharomycetes in nature. (ii), Variability and heredity in Saccharomycetes. (iii), Classification of *Saccharomycetaceæ* and *Schizosaccharomycetaceæ*. Sect. XV. Morphology and Classification of certain technically important higher Ascomycetes and Allied Forms. (i), Morphology and subdivision of *Aspergillaceæ*. (ii), Chemical activity of the *Aspergillaceæ*. (iii), *Mycosphærella tulasnei* and *Sphærulina intermixta*, otherwise *Cladosporium herbarum* and *Dematium pullulans*. Sect. XVI. General Morphology, physiology, and classification of technically important budding fungi of the group "Fungi imperfecti." (i), *Torulaceæ*, pink yeasts and black yeasts. (ii), *Mycoderma*. (iii), *Saccharomycetes apiculatus*. (iv); The *monilia* and *oidia*. SECT XVII. THE ENZYMES AND ENZYME ACTIONS OF YEASTS. (i). Alcoholase. (ii). Chemistry of alcoholic fermentation. (iii). Enzymes decomposing disaccharides and polysaccharides. (iv). Endotryptase and philothion.

TONINDUSTRIE-KALENDER FOR 1911. Verlag der Tonindustrie-Zeitung G. m. b. H. Berlin, N.W. 21.

POCKET-BOOK size, and compiled in three parts, Part I. serving as almanack and notebook, with pencil, blank pages, etc.; also furnished with tabulated data at the end, formulæ and molecular weights of the most important substances for the chemist and worker in clays, etc., and blank pages for laboratory notes. It is bound in water proof cloth. Part II. contains a concise record of all data likely to be useful to the chemical engineer and manager in the preparation of clays, pottery and building materials. Such data include melting points, fuels, calorific values, explosives, protection from lead-diseases and accidents, tabulated data relating to logarithms, rates of day wages, and wages by the hour, weights and measures; also foreign money tables. There are altogether 155 pages of matter, and an alphabetical index. Part III. contains 210 pages of subject matter, and may be divided into two parts, *the first*, an index of books and works of reference recommended, on all subjects related to the clay, pottery and building material industry, and arranged alphabetically; *the second*, a directory with names and addresses of firms furnishing all requisite articles and materials, but arranged alphabetically as regards the materials, etc., referred to.

NEW REDUCTION METHODS IN VOLUMETRIC ANALYSIS: A MONOGRAPH. By EDMUND KNECHT, Ph.D., M.Sc., and EVA HIBBERT. Longmans, Green and Co., 39, Paternoster Row, London. 1910. Price 3s. net. New York, Bombay, and Calcutta.

8vo volume, containing 104 pages of subject matter, a table of references, and an alphabetical index of subjects. The subject matter is classified as follows:—I. Preparation of titanous salts. Titanous salts as qualitative reducing agents. II. Titanous chloride as a quantitative reducing agent. III. Details of analytical methods. IV. Tungsten and molybdenum.

TRATTATO DI CHIMICA INORGANICA GENERALE E APPLICATA ALL' INDUSTRIA. Dott. E. MOLINARI. Terza edizione riveduta e ampliata. U. Hoepli. Milano. 1911. Price Lire 16.

8vo volume, containing 904 pages of subject matter, with 280 illustrations and 3 plates (1 coloured), and an alphabetical index. The work is divided into three parts. Part I. (170 pages), dealing with general and theoretical chemistry, is prefaced by a brief historical account of the science, and includes sections on the fundamental laws of modern chemistry; laws relating to gases; thermochemistry; substances in the liquid state; solutions; and substances in the solid state. In Parts II. (non-metals, 382 pages) and III. (metals, 352 pages), the arrangement is based on the periodic system. Prefacing Part III. are brief sections on alloys and electrochemistry. Prominent features of the book are the descriptions of technical processes and the trade statistics, figures for recent years up to and including 1909 being given in many cases. The purification of water for industrial purposes is dealt with in an appendix.

DIZIONARIO DI MERCEOLOGIA E DI CHIMICA APPLICATA ALLA CONOSCENZA DEI PRODOTTI DELLE CAVE E MINIERE, DEL SUOLO E DELL' INDUSTRIA CON SPECIALE RIGUARDO AI PRODOTTI ALIMENTARI, CHIMICI, E FARMACEUTICI. Pel Prof. V. VILLAVECCHIA con la Collaborazione dei Dott. G. FABRIS, Dott. G. ROSSI, e Dott. A. BIANCHI. Terza Edizione, completamente riveduta ed ampliata. Vol. I. Lettere A.-M. U. Hoepli, Milano. 1911. Price Lire 15.

THIS dictionary of commerce and applied chemistry is an 8vo volume, containing 1558 columns of subject matter dealing principally with chemical products, and including minerals, plants, drugs, etc. In the case of each product there are given wherever possible the chemical composition, Italian synonyms, foreign equivalents, an account of the origin, preparation, commercial character, properties, composition, adulteration, analysis, and uses of the substance, and also statistics of production, and of Italian imports and exports, price, and Italian Customs duties.

MINES AND QUARRIES: GENERAL REPORT AND STATISTICS FOR 1909. Part III.—Output. [Cd. 5413.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 5d.

THIS return, which is prepared annually by the Home Office, contains statistics as to the quantity and value of various minerals raised in the United Kingdom. (See p 1390.)

REPORT OF THE DEPARTMENTAL COMMITTEE APPOINTED TO ENQUIRE INTO THE DANGER ATTENDING THE USE OF LEAD AND THE DANGER OR INJURY TO HEALTH ARISING FROM DUST AND OTHER CAUSES IN THE MANUFACTURE OF EARTHENWARE AND CHINA AND IN THE PROCESSES INCIDENTAL THERETO, INCLUDING THE MAKING OF LITHOGRAPHIC TRANSFERS. Vol. III. MINUTES OF EVIDENCE. [Cd. 5385.] Wyman and Sons, Fetter Lane, E.C. 590 fcap. pages. Price 4s. 9d.

MANGANESE DEPOSITS OF THE UNITED STATES. By E. C. HARDER. U.S. Geological Survey. Bulletin 427. Government Printing Office, Washington.

THIS volume, which contains 298 pages, is divided into the following chapters:—(1) Sources of manganese; (2) Manganese deposits of the United States; (3) Foreign manganese deposits; (4) Chemistry of manganese; (5) Uses of manganese; (6) The manganese industry of the United States; (7) Bibliography.

ADVANCE CHAPTERS FROM CONTRIBUTIONS TO ECONOMIC GEOLOGY. 1909. Part I. Metals and Non-Metals, except Fuels. U.S. Geological Survey. Government Printing Office, Washington.

THE following sections of Bulletin 430 have been published:—(C.) Lead and zinc, by L. J. Pepperberg. (D.) Rare metals, by H. Bancroft and others. (F.) Structural materials, by E. F. Burchard and others. (G.) Mineral paints, by J. C. Stoddard and others. (I.) Salines, by C. L. Breger and A. R. Schultz. (J.) Miscellaneous non-metallic products, by D. B. Sterrett and H. S. Gale.

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Adressbuch u. Waarenverzeichnis der chemischen Industrie des Deutschen Reichs. Hrsg. v. Otto Wenzel. XI. Ausg. 1910. (XVI. 567, 720, 149 u. 126 S.) gr. 8°. Berlin. R. Mückenberger. Cloth M. 30.

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Beck, Dr. K., und *Stegmüller*, Dr. Ph.: Ueber die Löslichkeit von Bleisulfat und Bleichromat für sich, in Gemischen, und in Form von Ölfarben in verdünnter Salzsäure, sowie über das Gleichgewicht von Chromat und Bichromat in Lösung. Aus "Arbb. a.d. Kaiserl. Gesundheitsamte," 1910, Bd. XXXIV. Heft 4. 41 S. Berlin. J. Springer. 1910. M. 2.40.

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Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I. GENERAL PLANT; MACHINERY.

Applications.

26,457. Kent and Dimelow. Kilns, ovens, and like furnaces. Nov. 15.

26,903. Woore. Multiple-effect evaporating apparatus. Nov. 19.

27,166. Paschka. Apparatus for impregnating liquids with gases.* Nov. 22.

27,383 Shaw. Distilling and concentrating system and apparatus. Nov. 24.

27,389. Le Nitrogène Soc. Anon. Apparatus for producing endothermic chemical reactions in gases. [Addition to No. 21,721 of 1910. Swiss Appl., Nov. 27, 1909.]* Nov. 24.

27,500. Fruit-Juice Co., Ltd. (Fernbach and Chalet). Apparatus for concentrating liquids.* Nov. 25.

27,559. Phillips and Bulteel. Processes wherein products or educts carried forward by gases are condensed or absorbed. Nov. 26.

Complete Specifications Accepted.

26,938 (1909). Soc. Anon. Métallurgique Proc. de Laval. Obtaining a homogeneous mixture of a pulverised material and a gas. Nov. 30.

27,158 (1909). Whittaker. *See under* II.

27,464 (1909). Ormandy and Higgins. *See under* XII.

11,730 (1910). Bredin-Crawford. Apparatus for distilling, concentrating, evaporating, and condensing liquids. Nov. 30.

12,542 (1910). Buhring and Wagner. Apparatus for separating liquids from gases or vapours. Nov. 30.

19,425 (1910). Van der Made. Filters. Nov. 23.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

26,404. Fearns. Manufacture of a metallic medium for electric lighting. Nov. 14.

26,512. Shedlock. Manufacture of artificial fuel. Nov. 15.

26,516. Steel Bros. and Co., Ltd. (Dickie). Refining paraffin wax. Nov. 15.

26,744. Cowper-Coles. Production of smokeless fuel briquettes. Nov. 17.

26,772. Paterson and Twycross. Preparation of charges of limed coal for distillation in gas retorts.* Nov. 17.

27,334. Hodgkinson. Artificial fuel. Nov. 24.

27,398. Wilton. Purification of coal gas and manufacture of sulphate of ammonia. Nov. 24.

27,450. Farnham. Gas producers.* Nov. 25.

27,545. Knowles. *See under* XXIII.

Complete Specifications Accepted.

26,169 (1909). Grice. Suction or other gas producers. Nov. 23.

26,428 (1909). Jones. Treatment of gases from coke ovens or gas retorts. Nov. 23.

27,158 (1909). Whittaker. Apparatus for cooling and washing coal or other gas. Nov. 30.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

27,517 (1909). Burton. Manufacture of illuminating and heating gas. Nov. 30.

27,828 (1909). Pringle and Richards. Carbonisation of coal, etc. Nov. 30.

27,829 (1909). Pringle and Richards. Production of smokeless briquettes from coal. Nov. 30.

4337 (1910). Roseulet. Solidifying liquid hydrocarbons. Nov. 23.

7915 (1910). Brougham (Solvay et Cie.). Apparatus for removing tar from coal gases. Nov. 23.

14,116 (1910). Wolfram Lampen A.-G. Decarbonising filaments for metal-filament glow-lamps. Nov. 23.

17,547 (1910). Otto-Hilgenstock Coke-Oven Co. (Otto und Co.). Regenerative coke oven installations Nov. 30.

21,816 (1910). Zohrab and Dunham-Massey. Treatment of peat. Nov. 30.

III.—TAR AND TAR PRODUCTS.

Applications.

26,432. Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthraquinone dicarboxylic acid. Nov. 14.

27,046. Newton (Bayer und Co.). Manufacture of thiazole sulphonic acids. Nov. 21.

Complete Specification Accepted.

26,936 (1909). Wassmer. Preparation of certain hydrocarbon bodies. Nov. 30.

IV.—COLOURING MATTERS AND DYES.

Applications.

26,577. Levinstein, Baddiley, and Levinstein, Ltd. Intermediate products for making azo dyestuffs and their production. Nov. 16.

26,677. Newton (Bayer und Co.). Manufacture of dyestuffs of the triarylmethane series. [Comprised in No. 6364, March 14, 1910.] Nov. 16.

27,047. Newton (Bayer und Co.). Manufacture of mordant dyestuffs of the triphenylmethane series. Nov. 21.

27,051. Ransford (Cassella und Co.). Manufacture of indophenolic compounds and dyestuffs therefrom. Nov. 21.

27,472. Newton (Bayer und Co.). Manufacture of azo dyestuffs suitable for preparing lakes. Nov. 25.

Complete Specifications Accepted.

26,700 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of azo dyes directly dyeing cotton. Nov. 23.

19,310 (1910). Johnson (Kalle und Co.). Manufacture of nitrogen compounds of acenaphthene and colouring matters therefrom. Nov. 23.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

26,567. Hubers (Radványi-Riegler and Linder). Manufacture of a resistive paper mass for industrial purposes.* Nov. 15.

26,928. Lilienfeld. Manufacture of products suitable as coatings, loadings, films, threads, etc. Nov. 19.

27,258. Eihengrün. Production of celluloid-like masses from acetylcellulose. [Ger. Appl., Nov. 29, 1909.]* Nov. 23.

27,539. Verein. Glanzstoff-Fabr. Utilisation of washing liquids obtained in making cellulose products by the copper process. [Ger. Appl., June 18, 1910.]* Nov. 26.

27,570. Del Prato and Del Prato. Separating fibres, removing gum from and bleaching vegetable fibres, and washing and scouring animal fibres.* Nov. 26.

Complete Specifications Accepted.

27,102 (1909). Pauthonier. Manufacture of acetyl derivatives of cellulose. Nov. 30.

227 (1910). White. Drying machines for wool and other fibres, textile materials, etc. Nov. 23.

4959 (1910). Eichengrün. Manufacture of brilliant frosted or patterned layers or coatings from acetylcellulose. Nov. 30.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Applications.

26,490. Farnworth. Dye-jig for treating cloth or other fabrics. Nov. 15.

26,789. Muskett, and Rubber Substitute (1910), Ltd. Waterproofing solutions. Nov. 17.

27,038. Johnson (Badische Anilin und Soda Fabrik). Production of discharge effects on the fibre. [Addition to No. 30,505 of 1909.] Nov. 21.

27,404 and 27,405. Johnson (Badische Anilin und Soda Fabrik). Production of discharge effects on the fibre. [Additions to No. 30,505 of 1909.] Nov. 24.

27,406. Johnson (Badische Anilin und Soda Fabrik). Production of reserve effects. [Addition to No. 30,505 of 1909.] Nov. 24.

27,570. Del Prato. *See under* V.

Complete Specifications Accepted.

24,006 (1909). Zimmer. Waterproofing and glazing linen or other textile articles. Nov. 30.

3371 (1910). Riley and Co., and Riley. Beam dyeing machines. Nov. 23.

5373 (1910). Maly. Cop or bobbin tubes for dyeing. Nov. 23.

7826 (1910). Meister, Lucius, und Brüning. Product for use in alizarin printing and its application. Nov. 30.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Applications.

26,646. Oesterr. Chem. Werke, and Löwenstein. Manufacture of hydrogen peroxide from impure solutions of persulphuric acid. [Austrian Appl., Nov. 17, 1909.]* Nov. 16.

26,765. Ellis (Chem. Fabr. von Heyden). Manufacture of anhydrous hydrosulphites. Nov. 17.

26,776. Oswald. Manufacture of plaster of Paris. Nov. 17.

26,835. Bergmann und Simons, and Lindgens und Söhne. Conversion of lead into lead oxide. [Ger. Appl., Dec. 11, 1909.]* Nov. 18.

26,992. Lloyd, Ledoux, and Simon-Carves Bye-Product Coke Oven Co. Production of ammonium chloride. Nov. 21.

27,209. Green. Apparatus for concentrating sulphuric acid. Nov. 23.

27,264. Knowles. *See under* XI.

27,398. Wilton. *See under* II.

27,463. Pictet. Process for obtaining pure oxygen from air. [Fr. Appl., Nov. 29, 1909.]* Nov. 25.

27,477. Bollo and Cadenaccio. Reducing sulphates of alkalis and alkaline earths to the sulphides. [Ital. Appl., Nov. 29, 1909.]* Nov. 25.

27,499. Strutt. Production of oxides of nitrogen. Nov. 25.

27,558. Phillips and Bulteel. Obtaining oxides of nitrogen and other products. Nov. 26.

Complete Specifications Accepted.

26,175 (1909). Pope. Means for making lead oxide. Nov. 23.

26,264 (1909). Ormandy and Kay. Manufacture of borax, soap, soap powder, soda crystals, soda ash, etc. Nov. 23.

7856 (1910). Röttger. Separating air into oxygen and nitrogen. Nov. 30.

16,169 (1910). Sefton-Jones (Quade). Production of water-soluble crystalline aluminium formate. Nov. 30.

22,320 (1910). Pauling. Treatment of aqueous nitric acid and the like with sulphuric acid and other hygroscopic substances. Nov. 30.

23,252 (1910). Pietzsch and Adolph. Manufacture of persulphuric acid and its salts. Nov. 30.

VIII.—GLASS; CERAMICS.

Complete Specifications Accepted.

26,309 (1909). West and Lewis. Kilns or ovens for firing bricks, tiles, pipes, china, and like ceramic ware. Nov. 23.

23,051 (1910). McMullin. Manufacture of window glass. Nov. 23.

IX.—BUILDING MATERIALS.

Applications.

27,130. Rauhoff. Manufacture of cement and concrete products.* Nov. 22.

27,142. Kesler. Manufacture of artificial stone.* Nov. 22.

27,568. Thompson (Amme. Giesecke Konegen A.-G.). Treatment of rock material, particularly raw materials for cement.* Nov. 26.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Applications.

26,403. Durant. Separating silver from gold. Nov. 14.

26,415. Von der Linde. Cleaning tin-plate waste before recovering the tin by means of chlorine. [Ger. Appl., Nov. 15, 1909.]* Nov. 14.

26,650. McCall (Wilder). Treatment of gold and silver ores, tailings, compounds, concentrates, etc. Nov. 16.

26,761. Murex Magnetic Co., and Roberts. Treatment of minerals containing copper carbonate. Nov. 17.

26,777. Perret. Extraction of metals. [Belg. Appl., Nov. 24, 1909.]* Nov. 17.

26,788. Moulden. Zinc distillation. Nov. 17.

26,906. Cowper-Coles. Electrolytic refining of copper. Nov. 19.

26,907. Cowper-Coles. Electrodeposition of copper. Nov. 19.

27,263. Schieber. Welding copper or nickel and their alloys.* Nov. 23.

27,458. Van Marken. Puddle furnaces. Nov. 25.

27,467. Rheinisch Nassauische Bergwerks und Hütten A.-G. Distillation of zinc and like volatile metals, and furnaces for use therein. [Ger. Appl., Dec. 15, 1909.]* Nov. 25.

Complete Specifications Accepted.

26,551 (1909). Johnson. Production of steel. Nov. 23.

27,132 (1909). Johnson (Chem. Fabr. Griesheim Elektron). Melting and casting magnesium and its alloys. Nov. 23.

27,249 (1909). Gwynne. Manufacture of tin and terne plates. Nov. 23.

30,428 (1909). Totten. Alloys suitable for obtaining chilled castings. Nov. 30.

2711 (1910). Specialfabr. f. Aluminium-Spulen u. Leitungen. Production of insulating layers of oxide on metal wires and bands. Nov. 30.

12,214 (1910). Hiorth. Electric reduction smelting furnaces. Nov. 30.

XI.—ELECTRO-CHEMISTRY.

Applications.

26,546. Johnson (Deutsche Gold- und Silver-Scheide-Anstalt). *See under* XX.

27,264. Knowles. Apparatus for purifying electrolytic gases. Nov. 23.

Complete Specifications Accepted.

26,844 (1909). Helfenstein. Electric furnaces. Nov. 30.

1021 (1910). Ingle. *See under* XIII.

3421 (1910). Soc. Anon. Electrométallurgique. Supplying electric furnaces with triphase currents. Nov. 23.

11,717 (1910). Thomson and FitzGerald. Electric furnaces. Nov. 23.

11,718 (1910). FitzGerald. Electric furnaces. Nov. 30.

XII.—FATS; OILS; WAXES.

Complete Specifications Accepted.

26,264 (1909). Ormandy and Kay. *See under* VII.

27,464 (1909). Ormandy and Higgins. Packages for soap and other materials liable to lose or be damaged by moisture. Nov. 23.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Applications.

26,759. Johannes. Treatment of lac. Nov. 17.

26,835. Bergmann und Simons. *See under* VII.

27,076. Marks (Southern Manufacturing Co.). Apparatus for extracting products from wood.* Nov. 21.

Complete Specification Accepted.

1021 (1910). Ingle. Preparations for use in making floor coverings, insulating materials, etc. Nov. 23.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Applications.

26,870. Shaw and Cooke. Apparatus for smoking and coagulating rubber latex. Nov. 18.

26,932. Dogny and Henri. Manufacture of mixtures of caoutchouc and other plastic substances. [Fr. Appl., Nov. 20, 1909.]* Nov. 19.

27,189. Werner. Treatment of crude rubber, etc. Nov. 22.

Complete Specification Accepted.

16,456 (1910). Leemans. Purification of vulcanised india-rubber. Nov. 23.

XV.—LEATHER; BONE; HORN; GLUE.

Application.

27,025. Wood. Treatment of leather. Nov. 21.

Complete Specification Accepted.

27,583 (1909). Lapisse. Process for waterproofing leather. Nov. 30.

XVI.—SOILS ; FERTILISERS.

Application.

26,368. Hitchon. Extraction of lime stone dust as a by-product for fertilising purposes. Nov. 14.

Complete Specification Accepted.

9258 (1910). Coates. Production of fertilisers. Nov. 30.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

26,773. Cohendy. Apparatus for the production of bacteria and yeasts. [Fr. Appl., Nov. 22, 1909.]* Nov. 17.

27,489. Reinhardt. Productions of malt grist for brewing purposes. [Addition to No. 13,108 of 1910. Ger. Appl., Dec. 3, 1909.]* Nov. 25.

XIX.—FOODS ; WATER PURIFICATION ; SANITATION.

Applications.

26,684. Liebich and Paproth. Production of deodorising and disinfecting purifying substances.* Nov. 16.

26,783. Nogier. Apparatus for sterilising liquids by ultra-violet rays. [Fr. Appl., Nov. 18, 1909.]* Nov. 17.

26,877 and 26,878. Evans (Neff and Brandes). Treatment of water. Nov. 19.

Complete Specifications Accepted.

26,168 (1909). Bond. Utilisation of whey for dietetic purposes. Nov. 23.

27,798 (1909). Henri, Helbronner, and von Recklinghausen. Sterilising water and other liquids and the cultivation of ferments. Nov. 30.

XX.—ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Applications.

26,546. Johnson (Deutsche Gold- und Silber-Scheide Anstalt). Electrolytic manufacture of glycollic acid. Nov. 15.

26,645. Act.-Ges. f. Anilinfabr. Manufacture of *ω*-*p*-alkyloxyphenylethylamines and their N-alkyl derivatives. Ger. Appl., March 1, 1910.]* Nov. 16.

26,676. Newton (Bayer und Co.). Manufacture of derivatives of *m*-oxyhydrocinnamic acid. Nov. 16.

27,046. Schrauth and Schoeller. Manufacture of mercurised compounds of carboxylic acid esters and their saponification products. [Ger. Appl., Dec. 2, 1909.]* Nov. 21.

27,555. Newton (Bayer und Co.). Manufacture of erythrene, its homologues, and analogues. Nov. 26.

Complete Specifications Accepted.

18,896 (1909). Kaufmann. Manufacture of organic antimony compounds. Nov. 23.

27,908 (1909). Woltereck. Production of isoprene. Nov. 30.

29,751 (1909). Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Nov. 30.

4539 (1910). Newton (Bayer und Co.). Manufacture of santalol compounds. Nov. 30.

7057 (1910). Newton (Bayer und Co.). Manufacture of octendione and its homologues. Nov. 30.

9358 (1910). Newton (Bayer und Co.). Manufacture of octadionol and its homologues. Nov. 30.

23,924 (1910). Act.-Ges. f. Anilinfabr. Manufacture of acetic anhydride. Nov. 30.

25,698 (1910). Kaufmann. Manufacture of aromatic antimony compounds. Nov. 23.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

26,449. Dawson, Finlay, and Thames Colour Plate, Ltd. Colour photography. Nov. 14.

XXII.—EXPLOSIVES ; MATCHES.

Applications.

27,064. Claessen. Manufacture of smokeless propellant powders. [Addition to No. 16,725 of 1906.]* Nov. 21.

27,560. Kope. Composition for igniting the fuses of blasting charges.* Nov. 26.

Complete Specification Accepted.

2039 (1910). Marks (Maxim). Explosives. Nov. 23.

XXIII.—ANALYTICAL PROCESSES.

Applications.

27,253. Arndt. Apparatus for testing air or other gases.* Nov. 23.

27,254. Arndt. Apparatus for testing air or other gases. [Ger. Appl., Nov. 23, 1909.]* Nov. 23.

27,545. Knowles. Gas analysing apparatus. Nov. 26.

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THE RELATION OF CHEMICAL INDUSTRY TO METALLURGY.

BY ARTHUR C. CLAUDET.

Within the ordinary limits of time and space it is impossible to do justice to so large a subject. This paper has been written, therefore, rather with the view of promoting an interesting discussion than of imparting information, and my principal endeavour will be to bring to your notice certain facts bearing on the relationship between the two arts, *Chemical Industry* and *Metallurgy*, more with the view of interesting the younger members of both professions who have to gain their experience, than of instructing the older members who have already gained theirs. The purpose of this paper is to act as a reminder to young engineers starting their professional career, that they may be called upon to control old-established processes and probably to work out new ones. In order to effect improvements in the former or bring the latter to success, considerable chemical and metallurgical knowledge is necessary, especially as the economy of a process must always be considered. In connection with ore treatment, the commercial consideration of making profits is of the utmost importance, and it may be better to sacrifice a large percentage of extraction for a lower one, if by the latter greater profits can be made.

For many years chemical industry and metallurgy were widely separated, but at the present time their boundaries may be regarded as having met and to a large extent overlapped. So much is this the case that one often scarcely knows whether a process is chemical or metallurgical, while undoubtedly there are very many processes that are a combination of both. It is therefore highly desirable that the members of these two great industries should become more intimately associated than they are at present, so that the most rapid progress may be made and the greatest value obtained from each.

It will, of course, be understood that my subsequent use of the words "Chemist" and "Metallurgist" does not imply any duality of person, but is meant only to apply to the exercise of technical functions which have hitherto been regarded (in so many quarters) as belonging to separate provinces. It is my contention that the two sciences are not capable of any such sharp demarcation, and I shall attempt to show that the successful metallurgist must of necessity also be a technical chemist of no superficial order. Indeed, I cannot but feel that the composite science of metallurgy—especially in regard to several of the non-ferrous metals—might have developed still more rapidly during the last 30 years had its practitioners kept more closely in touch with the rapid progression of industrial chemistry during this period. This necessity has been recognised more fully of late years as the curricula of the modern metallurgical schools and colleges show. I could wish that the co-operation were still more intimate; such, however, cannot be fully achieved by any course of educational training, as the special departments of each cover so vast a ground that to embrace both technical sciences with any desirable degree of thoroughness would demand a period lengthy beyond the possibility of students to afford.

Metallurgy is often regarded as an art which has progressed but slowly during our time, except as regards increase of output and economies in working costs, but those who are absolutely engaged in it know that its advances have been marked by changes as drastic as any which have occurred in chemical industry, and that in many cases processes have been so entirely altered or modified that they are almost beyond recognition. Again, materials which were once useless are employed by one or the other industry. By-products, often now almost as important as the material which once was the sole object of a process, in some cases contribute a large proportion of the total profit. From a metallurgical point of view it cannot be denied that, without the aid of chemical industry, metallurgy would not be so complete a science as it is now, the successful treatment of many ores and products often depending on both of them.

It must also be remembered that both sciences are largely dependent on a third—mechanical engineering—as in many cases the greatest difficulty incurred in working out a process is of a mechanical nature. Special plant has often to be designed, and the success of the process is made or marred by the efficiency or inefficiency of the machinery installed, *e.g.* (1) the delayed utilisation of electrolytic methods (now so important) pending the development of the dynamo; (2) the whole new science of electro-metallurgy recently opened up by the same, and by mechanical harnessing of water-power, etc.; (3) the extended metallurgical applications due to the gas producer (in the metallurgy of iron and zinc, etc.); to mention three out of many instances that might be quoted.

This leads one to suggest that anyone wishing to be successful in the economical treatment of ores or products should receive sound training, not only in chemistry and metallurgy, but also in mechanical engineering. It is not for one moment suggested that the student should be capable of erecting machinery as well as evolving chemical or metallurgical processes; but it is necessary that he should possess sufficient knowledge to enable him to realise what can or cannot be done in regard to what he starts out to do. He should know, theoretically and practically, a considerable number of standard types of machinery, common to both the chemical and metallurgical industries, and at least the chief applications of thermo- and electro-dynamics, power distribution, heat production and measurement, etc.

These remarks touch on educational matters which might to some of those present appear to be undesirable in a paper of this nature, but the excuse must be that, as sound technical education is much to the fore at the present moment, it seems only right and proper to draw attention to the fact that *practical* men need practical assistants. To this end, then, a student should be given opportunities to prolong the technical portion of his education, so that he may reap the benefit of it afterwards. How often, much more often than one realizes, does the machinery erected for a special purpose fail because the chemist or the metallurgist has been unable from lack of knowledge to help the mechanical engineer to understand what is required of him before it is too late. Cases have occurred, probably within the knowledge of all of you, where a process has absolutely failed, not from any demerits of its own as a process, but owing to the mechanical part of it failing to do the work required. It is not too much to assert that several ingenious and metallurgically sound processes have failed heretofore for want of suitable appliances now available. That the solution of several such problems has now been reached by other means does not invalidate the argument that the mechanical furnace, the vacuum filter, the converter, the contact process for sulphuric acid, and many other appliances of recent introduction, would have achieved lasting success for methods now abandoned and only remembered as failures.

The utilization of *by-products* from smelting processes occupies the attention of the chemist much more than formerly. Selenium, tellurium, bismuth, gold, and silver, which are often present in copper ores, follow the copper through the smelting processes and are finally collected as valuable residues during the electrolytic refining of the blister copper; they are then subjected to chemical treatment for their separation and are thus made valuable. Arsenic is collected in large quantities in the form of white arsenic from the flues of smelting furnaces, and is a valuable by-product, especially in the calcination of Cornish tin ores. Coke oven and blast furnace gases yield by-products of great value to the chemist, of which ammonium sulphate is an example. It is only necessary to remind you that the success of the shale oil industry depends largely upon the profits derivable from the ammonium sulphate by-product, and of the utilisation of blast furnace gases both as a source of energy and for the manufacture of sulphuric acid. Basic phosphatic slag from the iron furnaces is a valuable fertiliser, and in certain cases is worth as much as the iron itself. Some iron slags are utilised to make Portland cement.

Electric smelting seems likely to considerably alter the position of many metallurgical industries, as in the case of the work now being carried out in Norway and Sweden, where power is cheap, on zinc ores and concentrates.

Among the large number of ore-treatment processes which might be quoted as covering one of the many branches of metallurgy where a knowledge of chemical industry is essential, I have ventured to select only the following, as exemplifying the interdependence of the two arts and as, I hope, affording matter for amplification by others.

1. *The Cementation process* carried out at mines operated in Southern Spain on cupriferous pyrites, such as at Rio Tinto, Tharsis, San Domingos (Portugal), etc. As you are all aware, there is an immense belt of cupriferous iron pyrites, containing, say, two per cent. copper on the average, with 46 to 50 per cent. sulphur combined with iron and copper. In my opinion the processes used on the spot for the economical extraction of the copper belong both to chemical industry and metallurgy. This is a case where the chemicals are formed naturally, and *in situ*, for the purpose of rendering the copper soluble. Shortly, the process consists in building up enormous heaps of mineral, so arranged that air can penetrate through them; water is pumped on to them, and aided by the heat of the sun, chemical reactions are set up *in situ*; the copper sulphides are more easily oxidised than the iron pyrites, and are dissolved by the water. These solutions find their way through the mass of the ore, and, after passing through a filter bed of small pyrites, are led by suitable channels to precipitating tanks, where the copper is precipitated by means of pig iron, the precipitate being subsequently collected and sent to the smelting works. The pyrites heaps, after their copper contents have been extracted, are sold to sulphuric acid works, whence, after burning out their sulphur contents, their oxide residues are sold to iron works to be smelted. The copper precipitate is sold to the copper smelter.

This appears to be a simple process, but it has its complications. The chemist must thoroughly understand the reactions in order to keep the costs down, and to be able to send to the smelter copper precipitate as free as possible from impurities, so that the best prices may be obtained. This requires metallurgical as well as chemical knowledge, *i.e.*, a full knowledge of the requirements to which such products are required to conform at the hands of the smelter and in the market.

In this well-known process the main reactions involved are as follows:—Oxidation is promoted by the action of the outside air, which is naturally warm owing to the climate, penetrating through the heaps, helped by the water percolating through them. When once the oxidation commences, considerable heat is generated, which has to be carefully controlled. The copper sulphide becomes copper sulphate, and the iron sulphide becomes converted into ferrous and ferric sulphates. This latter salt exerts a powerful action on the oxidation of further quantities of copper sulphide, being thereby reduced to the ferrous state, then reoxidised to ferric salt and so on. The liquors on issuing from the heaps contain a large proportion of iron as ferric sulphate, and in order that the greatest economy in the consumption of the pig iron shall be practised, they are led through filter beds of fine ore, and in this way the ferric sulphate becomes reduced mainly to ferrous. It may here be remarked that much more iron is used up in precipitating the copper than is required by theory, and this excess consumption is reduced considerably, according to the proportion of the ferric salt present in the liquors, before the liquors enter the precipitating tanks. The number of these tanks, which are filled with cast iron pigs, and the length of the series, are determined by the work done by the iron; that is to say that when the iron consumed costs more than the copper precipitated the liquors are run to waste.

In the iron precipitation process, the copper precipitate gets contaminated by the impurities in the iron, and this is noted in the quality of the precipitate produced during the final stages. The pig iron used varies from 92 per cent. to 94 per cent. of metallic iron, the balance being made up of carbon and phosphorus.

In most descriptions of this leaching process the latter element, phosphorus, is rarely alluded to. The precipitate at certain stages of the process will therefore contain considerable quantities of these two elements, and in addition arsenic from the ore itself, which is chiefly thrown down also in the final stages of the process. It is therefore desirable that the copper precipitate should be collected in grades of quality, as by doing so the precipitate will command higher average prices than if grading were not practised. The heaps, after having been denuded of their copper to a non-payable limit, are sold to sulphuric acid makers all over the world. On an average these washed pyrites contain 45 to 50 per cent. sulphur, and the United States take a considerably larger tonnage than any other nation.

This is a very brief description of one of the most important industries of the world. It requires considerable skill to keep costs down to the lowest limit, and to control it in order to effect this object, it requires well trained technical men who should possess sound knowledge of mineral chemistry and metallurgical requirements. Some years ago the ore was roasted in heaps, but such enormous quantities of sulphurous acid fumes were evolved that the agricultural country for miles around the mines was devastated, and the Spanish Government insisted that the mining companies should gradually abandon calcination and adopt the natural weathering process that is now universal—an enlightened policy having regard to the magnitude of the industry locally.

2. *The treatment of Spanish cupreous iron pyrites* imported direct to Great Britain and other European countries for sulphur and copper extraction. The composition of this ore is very much the same as given under No. 1, except that it is richer in copper. This class of ore is first burnt by the sulphuric acid manufacturer for its sulphur contents. This reversal of the order of operations (as practised in Spain) is an example of the influence of economics in determining the process to be adopted. The ore in both cases is essentially the same, but one or two per cent. more copper permits of its direct shipment to centres where metallurgical facilities are greater, and where consequently a closer recovery of the ore values can be obtained, the additional profit outweighing the freightage costs. The burnt ore is calcined with salt, and lixiviated with waters containing hydrochloric acid recovered from the furnace gases by ordinary condensation. The residue representing the bulk of the ore is thereafter sold to the iron smelter. The liquors pass to tanks where the silver and gold (present in very small proportions) are separated by means of a soluble iodide, and then pass on to tanks where the copper is precipitated by wrought iron scrap. The silver and copper precipitates are sold to smelters.

It is again necessary to point out that the chemist in order to attain economy should know the metallurgical treatment of his products, in order to have some control on the prices offered for them. His object should be to deliver them as free as possible from impurities which if present would detract from the value he should receive for them.

Perhaps I may be allowed to touch upon the Claudet iodide process used in conjunction with the ordinary Longmaid and Henderson wet copper process as practised in this class of ore, more especially as this process is now suffering a lingering death, and I have no interests in it, the patent having expired some years ago. I think I am correct in saying that no other chemical process in the world has ever been able to make a payable proposition out of an ore containing silver 1 to 1½ oz. per ton and gold (say) 3 gr., as the Claudet process did some years ago. This was only possible on account of the conditions and circumstances existing at the time. First, the price of silver was 5s. per oz. when the process was invented by my late father, Frederic Claudet; now the price is under 2s. 6d. per oz. Second, it was only applicable to copper ores when treated by the Longmaid Henderson process, these were practically limited to Spanish cupreous pyrites. The use of this silver process does not interfere with the subsequent cementation of the copper. The Longmaid Henderson process consisted in calcining the roasted pyrites, called "burnt ore," obtained from the sulphuric acid makers, containing 3 to 4½ per cent. copper with 10 to 15 per cent. of rock salt, and lixiviating the chloridised ore with acid water; these waters were then run into tanks and the copper precipitated by iron. The strong chloride liquors held the silver chloride in solution whilst silver iodide was found to be practically insoluble. The method adopted was to place a series of tanks in front of the copper precipitating tanks, and separate the silver therein as insoluble argentic iodide by means of a soluble iodide; the liquors were allowed to settle, decanted off and passed to the copper precipitating tanks. The silver iodide was collected and reduced to spongy metal by means of zinc, the zinc iodide being used for a further precipitation of silver. About 1 oz. of silver and 2 gr. or 3 gr. of gold per ton of original ore were saved, and large profits were made. Under normal conditions, about 10 to 15 per cent. of the iodide was lost. The only condition required in the iodide process was that the calcination of the burnt ore with salt required very careful regulation in order to prevent the formation of sub-chloride of copper, which, if formed in any considerable quantity, militated against the success of the process, cuprous iodide being produced and thus increasing the loss in iodide. The silver residue, containing 500 to 15,000 oz. of silver to the ton, was smelted in the usual way. The copper precipitate was smelted to obtain best selected copper. This is a case where the chemist and the metallurgist played equally important parts.

3. *Pyritic smelting.*—In this case it is the metallurgist who comes first. Pyritic smelting of low grade sulphuretted copper ores, perhaps containing small quantities of silver and gold, which by any other process would be of no value, is now carried on extensively in various parts of the world. The object to be attained is to conduct the smelting operations in such a way as by a first smelting to obtain a matte containing 20 to 25 per cent. of copper, then by a second smelting to obtain a matte containing 45 to 50 per cent. of copper, the slags from this operation being rich enough to add to the first smelting. This matte is then run into converters of the Bessemer type used in iron smelting, and by blowing air through, the combustion of the sulphur is effected, and a blister copper containing over 90 per cent. of the copper originally present in the ore, and 95 per cent. of the silver and gold, is obtained. Pyritic smelting has the further advantage of avoiding the first roasting operation, as it deals with the metallic sulphides direct, in place of their oxides, and by utilising the thermal values of a large proportion both of the sulphur and of the ferrous iron in the blast furnace, permits of a great reduction in the consumption of coke fuel, an expensive item in cupola melting. That portion of the iron which is oxidised forms a base for the silica and thus economises the consumption of extraneous flux. The portion of ferrous sulphide which remains unoxidised falls as matte, carrying the copper with it.

Pyritic smelting is also practised with pyritic gold and silver ores containing but little copper. Some proportion of the latter is, however, necessary to act as a "collector" of the precious metals, which the ferrous sulphide matte alone is incapable of doing with completeness. As small a quantity as ½ to ¼ per cent. of copper may, in certain cases, be sufficient to effect the collection of gold and silver into the matte. Pyritic smelting, in spite of its apparent simplicity, demands constant watchfulness on the part of the metallurgist to secure its maximum advantages. This product is sold to the electrolytic copper refiner and treated by electro-chemical means separating copper of 99·9 per cent. and over, almost free from impurities, the silver and gold with the impurities remaining in the form of a mud which is again sold to smelters of this class of material.

The electrolytic refining of the blister copper is where the chemist comes in, but nowadays he plays a more important part, and that is in the recovery of sulphur from the furnace gases evolved in huge quantities during the smelting process producing the copper mattes. This has been forced on the chemist on account of the devastating effects produced by the sulphurous acid gases on vegetation. Agricultural lands have suffered so much from their action that, unless some method for their elimination from the air were found possible, pyritic smelting in certain cases would have to cease, and large smelting works would be compelled to stop. The best way to suppress a nuisance is to turn the cause into a source of profit. During the last few years these deleterious gases have been turned to account, and large quantities of sulphuric acid are now made from them by the "contact" process, especially at Ducktown, Tennessee. In dealing with immense quantities of ore, as in pyritic smelting, every endeavour in the way of reducing working costs has to be made, and as the plant must be made and designed for as nearly automatic working as possible, the mechanical engineer takes a prominent place. I may mention here that the sulphuric acid is mainly used for the manufacture of superphosphates, the raw phosphates being freighted from long distances to the works. Thus, instead of pyritic smelting being a curse to the agriculturist, it becomes a blessing but thinly disguised in producing this important fertiliser.

4. Another instance of the chemist and the metallurgist being together concerned in the beneficial treatment of ores is the case of the well-known Broken Hill lead-zinc-silver sulphide ores. Here the whole treatment consists in the association of chemical and metallurgical processes gradually evolved during a period of many years. Roughly the treatment is as follows:—The ore consists of an almost intimate mixture of galena and zinc blende, and rock, but the rocky gangue has so high a specific gravity that it cannot be separated by ordinary methods from the blende. Hence for years the zinc tailings (after separation of the bulk of the lead) lay accumulating—in millions of tons—awaiting the advent of a suitable recovery process for zinc. So far as I am aware, at the present time the ore is crushed and jigged, and a concentrate produced containing 65 to 70 per cent. lead, zinc 5 to 10 per cent., and silver about 20 oz. per ton of concentrates. This is smelted to obtain lead containing the silver and a small quantity of gold. The lead is desilverised in the ordinary way, producing market lead almost pure, and silver bullion containing an amount of gold sufficient at least to pay the cost of refining and a possible additional profit. Here you will realise that the metallurgist and the chemist are equally necessary.

The lead concentrates are now more successfully smelted by interposing before smelting, an agglomeration process such as the pot roasting process, which consists in treating them with lime, sulphate of lime, and carbonate of lime, and the product is then in a suitable mechanical condition for smelting. The sulphurous acid is made more simply and cheaply. These various processes are known as "pot" or "lime roasting" methods. The first to prove the great efficacy and economy of these processes were Huntingdon and Heberlein, these inventors using lime. Carmichael and Bradford modified the method by the employment of gypsum. Savelsberg uses carbonate of lime. In essential features these various methods closely resemble one another. The crushed ore or concentrates, after partial roasting to a certain sulphur content (say 6 to 7 per cent.), are mixed with a suitable amount of reagent, charged into a "pot" (or other receptacle), ignited at the bottom, and "blown" by a strong air current. The reaction being strongly exothermic, no further fuel is required, and torrents of sulphurous acid are evolved which may be at once utilised for sulphuric acid manufacture. After the "blow" is complete the agglomerate is dumped out (broken by the fall into suitably sized lumps), and sent direct to the blast furnace for reduction to lead and silver bullion.

Not only is the necessary "agglomeration" economically effected in this way, but richer sulphurous acid gases are claimed to result for utilisation as acid, whilst finally the lead recovery is increased by some 6 or 7 per cent.

In producing the above concentrates, the zincy tailings (a product known locally as "middlings") carry considerably more zinc, weight for weight, than the original ore, considerably less lead, and about the same amount of silver. After years of experiment, physico-chemical processes have at length been devised for their treatment economically. These middlings are ground fine, pulped with slightly acid water, and are then stirred with a small quantity of oil. The oil coats the particles of sulphides (blende, etc.), with a minutely thin film, by various means according to the different patented processes used at the various mines (each now contending for the mastery). These oiled particles are brought to the water surface, which having once broken through they float by virtue of the surface tension of the water. In two or three instances the raising of the oiled sulphides to the surface is effected by causing small gas bubbles to become attached to them whilst submerged. The scums, films, etc., of valuable metals are removed by varying mechanical methods, whilst the gangue and valueless materials are left unaffected in the liquor pulps, and after subsidence and separation are sent to the waste heap. Over a million tons of these accumulated tailings have been treated at great profit by the essentially physical method, and Broken Hill has now become as great a zinc producer as it formerly was famous for its lead and silver. Already one mine alone then produces one-tenth of the world's total output of zinc ore. In such a way, a saleable product is obtained at the present time, which leaves a by no means inconsiderable profit. Here the physicist, the chemist, and the mechanical engineer help the metallurgist. If, however, these zinc concentrates are smelted for the production of spelter on the spot, then the metallurgist takes a prominent position, but scarcely less does the chemist; for in the production of spelter the concentrates must be roasted, and he has to endeavour to turn to account the sulphurous fumes from the roasting to form sulphuric acid to be used, if possible, in the production of superphosphates.

5. *The manufacture of copper sulphate.*—At first sight this would seem to be a chemical process, pure and simple, but on looking into it, various metallurgical operations are found to play a part in the process. Copper sulphate is produced on a very large scale, and either by the direct treatment of smelted copper or as a by-product from some other process, such as in the refining of silver and gold bullion, where copper is used, I may say, as a reagent from a chemical point of view, and has to be recovered.

As a direct process, the smelter in his operations produces copper bars which may contain silver and gold; these are granulated and treated with sulphuric acid and, with the aid of air, the copper is brought into solution, from which the copper sulphate is crystallised out. An insoluble mud is left, which is smelted for its silver and gold contents. An important factor in this process is that iron sulphate, the enemy of copper sulphate, is nearly absent from the copper sulphate crystals. As a by-product, this salt is obtained in the process of refining silver and gold bullion, a suitable alloy being made up by melting the bullion with silver 2½ times the weight of gold and copper ½ the weight. This mixture is granulated and boiled with sulphuric acid in suitable vessels; the gold remains as a mud, which is collected and melted into bars; the silver goes into solution and is precipitated by metallic copper, as a mud which is melted into silver bars. The liquors are then subjected to crystallisation and produce copper sulphate, thus recovering in a marketable form the original copper added in the refining process to precipitate the silver.

The cyanide process of gold extraction is an instance of the help that the chemist can give to the metallurgist. It is a purely chemical process, which both increases the extraction of gold from ores and enables profits to be made considerably greater than if any other chemical process were adopted. Although apparently simple in application and in the plant required, reactions of great complexity occur, and as the cyanide solutions are used over and over again they become highly complex in constitution and require careful study, because the compounds produced may accelerate or retard the solution of gold. The zinc gold mud produced has to be refined by acids, and smelted to produce bars of bullion. One process of refining this mud is cupellation with litharge in a large furnace, involving a purely metallurgical operation. One may hazard the opinion that, without the aid of the cyanide process, the gold obtained from the Rand would be 20 to 30 per cent. less than the present extraction. The application during the last few years of the process to purely silver ores must be noted, especially in Mexico and the United States. The large quantity of cyanide required for precious metal extraction necessitated improvements in its manufacture to reduce its cost of production, and thus the metallurgy of gold has benefited a large chemical industry.

It may be recalled that at the outset of the cyanide process potassium cyanide cost 4s. per lb., and the consumption of this chemical was high. Thanks to the aid of the industrial chemist, potassium cyanide now costs nearer 6d. per lb., whilst the consumption has been reduced (as regards loss) to but a very few oz. per ton of ore. In a recent case brought before the notice of the Institution of Mining and Metallurgy the total cost of extracting gold from one ton of ore, for potassium cyanide, power, and labour, only amounted to 11d.

6. *The Pearce process* of treating auriferous copper was the product of both chemist and metallurgist. The main feature in this process, which has now been replaced by later methods, was the discovery by Mr. Pearce that a granulated alloy of copper and gold when melted with iron pyrites yielded up some of its copper to form a matte, but the gold remained in the unattacked copper; by repeating the process a number of times the whole of the copper is separated from the gold. This method was worked in conjunction with the well-known Swansea smelting and the Ziervogel processes, the latter of which is of a purely chemical nature.

7. The arsenical cobalt and nickel silver ores now being mined in Ontario afford an interesting field for research work for the chemist and the metallurgist. These ores are very rich in silver, often yielding several thousands of oz. to the ton. Great difficulties have been met with in their satisfactory treatment; arsenic may reach up to 30 per cent., cobalt and nickel 10 to 15 per cent. in each case. Efforts have also been made to save not only the silver, but also the cobalt, nickel, and arsenic. The present treatment I believe, is to smelt these ores with lead, thereby extracting a large proportion of the silver; in this operation a speiss is obtained consisting of the arsenic, cobalt, and nickel, with several hundreds of oz. of silver to the ton. Various chemical processes have been suggested and are in course of experimental development, but I am not able to forecast the success which has been achieved.

I have endeavoured by this brief description of various processes to emphasise the close relationship which must always exist between Chemical Industry and Metallurgy, and I trust that discussion will bring out further evidence of this relationship, a proper appreciation of which is of the utmost importance.

Discussion.

The Chairman said Mr. Claudet had clearly established the proposition that the science of metallurgy in a large number of cases depended essentially on chemical processes, and that in many instances profit depended entirely on the utilisation, not in a metallurgical direction, but by purely chemical methods, of some of the products of the ores which had been snatched from mother earth. The conditions of profitable production formed the great feature of the paper, and economical production was undoubtedly the key to all successful metallurgical operations. When one noticed the very small amount of gold per ton of ore which could be extracted at a profit it was to an outsider a marvel, first, that it could be extracted at all on a commercial scale, and second, that considerable dividends could be paid from so small a product. Besides emphasising the importance of economical production, the paper presented another useful feature. Nowadays organic chemistry occupied a large space in the public eye and thrust itself very prominently also before the eye of the chemical student. This paper directed attention in a prominent manner to the very wide field which was still available to the student of inorganic chemistry, and claimed his attention to the importance of those savings of small percentages often based upon operations by which the atmosphere was purified and the surrounding country saved from being turned into the waste which in the past had so frequently characterised metallurgical operations. If he had any criticism to pass upon the paper it was in a direction that it was perhaps a little dangerous to introduce, viz., the subject of education, especially technical education. The author urged that the student, whether he were called metallurgical or chemical, should be taught yet a little more in school or college. They would all agree that the more a man knew—other things being equal—the better man he was; but was it not the fact that other things were not equal? The longer the period of studentship the more a man missed of that acquaintance with what might be called the practical operations of life, which in many instances could only be acquired while he was still young. No one would question the very large part which was played by mechanical operations and plant in connection with metallurgy, but he did think that in many instances a man would better gain that acquaintance with plant and machinery of special type if he were situated at a mining centre, say Johannesburg, Broken Hill, West Australia or India, or if he were engaged at Swansea, Middlesborough, or Newcastle-on-Tyne. Was there not a proper and natural limit to the time which a man should spend in the College or University?

Professor W. A. **Carlyle** spoke of the difficulty that existed in teaching all that was desirable in the time at the disposal of a student, and said that they could only hope to turn out men so equipped that they would be able to build upon the foundation of knowledge with which they started life. He assured Mr. Claudet that the Claudet process was not suffering a lingering death. On the contrary, it was in full use where ores suitable for its application were obtained.

Professor T. **Turner** said the author rather suggested that metallurgy did not make rapid progress, and was somewhat fixed as compared with modern science; but he found on looking over his old lecture notes that there was little which he taught twenty-five years ago that he could teach now. The chief centres of supply of copper, iron and other ores, had changed; and the means by which they were extracted had altered. Many methods, like cyanide extraction, or the production of aluminium, had been introduced or revolutionised during the last quarter of a century. Not merely from the point of view of output, but by radical changes in processes, wonderful progress had been made, and the chemist had commonly taken the first step. When the early failure of Bessemer's experiments disappointed the iron trade, it was the chemist who pointed out the rôle played by phosphorus. The basic process of steel production was launched by one who had been trained in chemistry in the old Royal School of Mines. In those early days, the chemist was extremely important, and Mr. Snelus, who was a chemist, introduced important improvements. But with certain of these older processes the time was past for the chemist to introduce revolutionary changes. It was the engineer now who made the changes, when it became a question more of handling the material, in order to produce rails, plates, or other materials at a rapid and cheap rate. In metallurgy it was usually the man with a scientific chemical training who pointed out the path, and the engineer then came and showed how they could more economically produce that which was desired. As an example of the application of chemistry he would suggest the reading of Sir William Roberts Austen's address to the British Association, on the Ziervogel process—a beautiful application of chemical and physical principles which had been referred to in the paper. He had only one word to say on the question of education. They were largely limited by time; and their pupils in a certain time, whatever that period might be, and whatever advantages were offered them, could only learn a certain amount. They could only make a selection from a great variety of subjects while they were being trained to take their place in the world. It was a great mistake in fact to specialise too soon. A man must have a groundwork of chemistry, physics, and some elementary mathematics. He should learn side by side with metallurgy some geology and some engineering, and that covered what he would suggest for the first two years of his career; if he were only to have three years' training, during the first two years he could study those preparatory subjects sufficiently to enable him to know where to find his information later in life. In his final year they tried to give him chiefly instruction in metallurgy; but also some knowledge of ore dressing, of the mechanical testing of metals, and of technical electricity.

Mr. F. W. **Harbord** said that 90 per cent. of metallurgical processes depended for their economic efficiency on exact chemical knowledge enabling the varied operations to be so controlled that both the necessary reactions could take place under the best conditions in the shortest possible time, and with the smallest possible waste of chemicals; the metallurgist had then to call for the assistance of the engineer to design the most efficient machinery for carrying out the necessary operations at the minimum cost. For example, in the cyanide process the metallurgist by his knowledge of chemistry had been able to determine the best preliminary treatments to render the gold in different classes of ore readily soluble, and also to remove from the ore those materials which destroyed the cyanide, thus reducing the consumption of cyanide to a minimum; then the engineer designed machines for fine grinding and the best appliances for economically handling and conveying enormous quantities of materials to the various parts of the plant; in this way it had become possible to deal with the immense outputs from modern mining plants. They must guard against attempting too much in the way of so-called practical education at their colleges, as the most a boy could hope to do well during a four years' college course was to gain a sound theoretical knowledge of those subjects which were essential to obtain a thorough grasp of the principles and the practice of modern metallurgy. If in three years a student obtained a sound knowledge of chemistry and physics, a fair knowledge of mechanics and mathematics and some knowledge of general engineering, it was as much as could be expected, and he could then in his fourth year devote himself to metallurgy and the special engineering problems associated therewith. Even if it were possible in other respects to teach metallurgical practice in colleges the time for so-called practical teaching was very limited, and it was only by experience in a works that practical experience which was likely to be of lasting value could be obtained, and where the student would acquire that knowledge which would enable him to appreciate the essential differences between what may be regarded as practical as distinct from theoretical processes.

Professor A. K. **Huntington** said that personally he did not see anything to separate chemical industry and metallurgy; they were one and the same thing. The real reason one had to consider metallurgy so much was that many students were brought up mainly in contact with organic chemistry, and had little to do with the practical treatment of metals. The real trouble as regards education was that it did not begin soon enough. Young men were not properly taught before they came to College, so that the teachers did not know how to deal with them. Those who had some knowledge had to be kept back on account of those who knew nothing at all.

Dr. T. K. **Rose** said that the position of the chemist towards metallurgy in the future had not been dealt with. In the remote past metallurgists did things (as they had been told), and chemists were fully occupied in trying to find an explanation for them. He might give as instances the manufacture of brass, the separation of silver from gold, the production of steel by the cementation process; all these processes were invented by practical men, and chemists subsequently had tried to explain the matter. He should like Mr. Claudet to explain what the function of chemists in regard to metallurgy was to be in the future, if the mechanical engineer was becoming so supremely important. He should be sorry to think that, having once caught up to practical men and assumed the direction of affairs, chemists must go back and content themselves with explaining the work of others.

Professor S. H. Cox said he was a mining engineer, and in the training incidental to that profession one learnt the elements of chemistry, as did a prospective chemist or metallurgist, and they also learnt a certain amount of metallurgy. After this preliminary education had been completed those who proposed to become either manufacturing chemists or metallurgists branched off into some particular line. It was seldom the case that an individual who reached the top of his profession in any one branch, had the same intimate knowledge of any other branch, although chemistry was the foundation of them all.

In each individual section engineering knowledge was of value, but applications of machinery which were of the greatest use in one branch might or might not apply to another, and this tended still further to specialisation. He had been wondering whilst listening to the paper what was supposed to be the exact difference between the chemist and the metallurgist. As far as he could gather, it would seem that the chemist had to deal with wet processes, and the metallurgist with dry; but that did not seem to him to be any distinction. The metallurgist required as intimate a knowledge of the principles of chemistry as the manufacturing chemist, and if he happened to be working under any conditions in which wet processes were used in the extraction of metals, from their ores, there was nothing at all to distinguish him from a chemist.

Mr. H. W. **Lake** emphasized the absolute necessity of giving a man entering into this class of work a sufficient practical mechanical training to realise how things looked, and how they worked. He had seen many processes in connection with metallurgical and mining business, wrecked from the mere fact that the man who originated the idea, perhaps a clever chemist, or an excellent metallurgist, did not realise how the thing would look when it was set up, and the wheels went round. As a man who had his living to earn by his profession, he was apt to look at the thing from the practical point of view, and he would plead earnestly that students should be given that practical knowledge, or at any rate they should be made to understand they had to acquire it. He recognised that it was a very difficult thing for a young man who had an excellent technical education, to realise that he had then to commence to learn how things looked, and how they would work.

Dr. W. **Rosenhain** said his work lay rather with the metal after it was extracted than with the actual extraction. Some years ago the chemist began to work out the theory of solutions, and it looked at first as if that question was extremely remote from metallurgy, but that was far from being the case. The developments of that theory came to be taken up in connection with the microscopic study of rocks, and had been very extensively applied to the microscopic study of metals. This had been built up into a theory of the constitution and structure of alloys, and that of itself was a matter which was of metallurgical importance. This line of work had been developed more in America and Germany than as yet in this country. Microscopy and pyrometry and the methods of physical chemistry generally had been applied in the first place to the study of rocks, or synthetical geology, and also now to the study of metallurgical products, such as ores, matte, speiss, and so on, which were referred to in the paper, and which were dealt with by metallurgical processes. The result was the growth of much important knowledge as to the nature and constitution of those bodies, which would enable the chemist to explain many of those processes, and ultimately to lay the foundation of a theoretical knowledge of the constitution of all these various bodies, which would be of the greatest possible use to those who had to deal with them in practice. Just as a metallurgist who had to deal with alloys would be lost if he was deprived of the knowledge of metallography, so he might predict that not long hence those who had to deal with these metallurgical products or chemical reactions would come to rely on the knowledge of their constitution, obtainable in this way.

Dr. O. J. **Steinhart** said he well remembered the time when first starting practical metallurgical work on a large scale, how on numerous occasions he was put to shame by practical suggestions and criticism of the foreman. He would impress on those who wished to pursue metallurgy the importance of learning how to use their hands as well as their heads at an early stage. In Nevada and Utah copper mines were worked containing only about 2½ per cent. of metal, and producing copper in the neighbourhood of £35 per ton—an amazing triumph of modern mining and metallurgical methods. In the old days when the consumption of the metal was less, they would not have attempted to work such low grade deposits; he believed it was the same at Rio Tinto. All this had only been possible by the co-operation of the chemist, metallurgist, and the miner. The pyritic smelting and bessemerizing of copper ores was invented by J. Hollway, who found that by utilizing the sulphur and also the iron contained in certain copper ores as fuel in a blast furnace, he could produce a copper matte without the aid of coke, and he also tried to blow the matte so obtained direct into copper in the same furnace. The first experiments, which were made in Sheffield on a large scale, failed, but several years afterwards the same principle was employed by others in America and elsewhere and with certain modifications proved an entire success, and to-day a large proportion of copper ores are smelted pyretically and bessemerized.

In connection with the utilisation of sulphurous fumes for calcining and blast furnaces, it must be remembered that if all such fumes were utilised to produce sulphuric acid the supply would far exceed the demand.

Mr. **Walter F. Reid** agreed to some extent with Drs. Steinhart and Rose with regard to the utility of practical observation. He did think that education should enable a man to understand what he saw; that he should have a good general education. One ought in the first instance to teach the student to think, and make researches for himself. Not long ago he had to address a number of students who were coming up to receive prizes, and the best advice he could give for the future was to continue studying, because they had only received sufficient education to enable them to understand what they saw; they should then make practical experiments, and if possible do something which nobody else had done before. The merely practical man undoubtedly often made important discoveries. Vitruvius told how to get mercury by beating certain stones found in Spain with iron rods until they sweated; the sweat was mercury. Undoubtedly the Romans made mercury in that way. The question of the extraction of metals from the ores was to some extent connected with the condensation of fumes. On account of the restrictions in Germany to the pouring out of the sulphurous gases into the atmosphere the amount of sulphuric acid produced had risen so considerably that the price had been much reduced. He had taken advantage of the cheap price of sulphuric acid in Upper Silesia for the extraction of zinc from very low grade ores, and they were now extracting on a large scale 10 per cent. zinc residues from the ancient mines and getting 8 per cent. of zinc out of it. Another great opening with regard to the extraction of metals from their ores was the use of electricity. Given a mine no matter how inaccessible, containing copper or zinc ore, and near a fall of water, metal could be produced without any other reagent. Nitric acid was obtained from the air; and with it the ore was treated, and the solution reduced from this by aid of electricity produced by the water power. Many years ago he went into a works at Burry Port in South Wales, which happened to be the only works where copper was being produced by electrolysis. It belonged to Elkington and Co. They had a Gramme machine, and produced copper of great purity for those days. There was a dirty black mud at the bottom of the tanks and every maker of electrolytic copper now knows the value of that mud. That was really the beginning of the enormous industry which now produced the bulk of the copper in the world. It was really the electrician to whom that particular industry was more indebted than to the engineer. With regard to the Claudet process for producing silver by the action of iodine in solutions, he called attention to the fact that the Japanese were developing the iodine industry on a very large scale, and to some extent were competing successfully with the Chilian iodine industry; also the electric process for producing nitric acid was looming in the future, and might altogether destroy the nitrate industry, and if that should be the case the Japanese would have almost a monopoly of their great iodine industry. With regard to the Broken Hill ores, the jigging of those ores, and the classification by mechanical means, he was almost inclined to think that purely chemical separation might be available without the necessity for the waste that ensued from that mechanical separation. The ore was very pure, and it was quite possible that a chemical process might be evolved which would utilise in a direct manner the bulk of the metals contained in them. The commercial aspect of education should not be lost sight of. Many of those who had been well educated and had brought important processes into work, had sometimes seen others make very large fortunes out of them, whilst they had made very little themselves In order to enable one to utilise knowledge, and to realise something from valuable processes, some commercial training would be of great assistance.

Mr. D. A. Louis said that the mechanical engineer in metallurgy simply provided the apparatus for conducting the metallurgical operations which in reality were chemical. It mattered not which process was taken, selecting, for example, the simple one which was going on constantly not far from London for the production of the sections which were used in the tube railways. They had to be of constant and special quality, nevertheless they were for the greater part cast direct from the blast-furnace without any intermediate treatment; but this metallurgical feat was only achieved by blending the materials of the charge with almost as much precision as the chemist exercised when mixing his reagents in the laboratory. Turning to blast-furnace practice in Russia, where those remarkable castings celebrated all the world over were produced, neither the furnace, nor the method of working it, could have produced these unless the charge was carefully compounded, and in this case the control of the quality and quantities of the materials employed was most interestingly painstaking. Microscopy and physics were of utmost importance in connection with the new steels, in controlling the quality of the products, but just the same the production of these materials was due to chemistry, and attempts to make them without chemical control would lead to lamentable results. Indeed the importance of chemistry in metallurgical operations had long been recognised, and that recognition was increasing; the larger metallurgical undertakings had long had great laboratories, but he was much struck recently at finding that a smaller works engaged in producing rails, girders, bars of different kinds, tyres for locomotives and railway carriage wheels, &c., were renewing and largely extending their laboratory accommodation. These people, in fact, found that they wanted chemistry more and more to control their metallurgical industry.

Mr. A. Gordon Salamon said that he supposed the application of cyanide at 4s. per lb. to gold recovery was impossible; but taking its reduction from about 1s. 6d. down to the present price of about 7d., it would be admitted that chemistry must have had an enormous influence on the gold winning industry of the world even in that one connection. The reduction of 1d. per lb. meant at least £70,000 a year to the expenditure of the gold industry. Consequently, if the price were reduced from 1s. 6d. to 7d. or 7½d., it was a matter of calculation to see what chemistry had done for the Transvaal industry and for gold recovery. It was not potassium cyanide, which was mainly used to-day, but sodium cyanide, which contained a greater proportion of available cyanogen per weight of cyanide, with a consequent saving in carriage. The achievement of the substitution of sodium cyanide for potassium cyanide had been very complicated and difficult, and chemistry had very materially helped the gold industry in this connection. So particular were they in respect of the purity of the product that in South Africa to-day they actually limited the amount of sulphide which a cyanide should contain to the second place of decimals per cent. The instance quoted was sufficient to show that chemistry and metallurgy were, in fact, not only combined and allied, but they were inseparable.

Dr. Divers said that the Japanese successfully liquated silver out of copper by melting the copper with a little lead, and beating the liquid silver lead out of the heated ingots of copper. The Japanese metallurgist had also practised the production of copper from copper matte by blowing air upon the melted matte under a layer of burning charcoal.

Mr. H. F. K. Picard wrote that he considered that though chemistry and metallurgy overlapped to some extent, each was essentially distinct from the other, in scope and method; and that there was still a large field in which industrial chemists could be of great assistance to metallurgists, and *vice versa*. Mr. Reid had suggested that Broken Hill ores might be treated by a chemical process, but in his opinion the wet treatment of these ores was quite beyond the range of practical politics. He thought that industrial chemists possessed a knowledge of certain large scale operations which, if known to the metallurgist, might provide him with new weapons with which to attack his problems. In his opinion there were many industrial chemical operations which could be applied with necessary modifications to metallurgy, if the metallurgists were familiar with them. For example, ammonia was practically unknown to the metallurgist as a commercial reagent; he was not familiar with the means of handling it without loss. The industrial chemist could show how that might be done, and thus introduce the use of this valuable agent to copper and zinc metallurgy.

Professor W. R. E. Hodgkinson wrote:—The statement that "chemical industry and metallurgy were looked upon as widely separated" is still only too true. All metallurgical processes are fundamentally chemical, and differ only from those of the laboratory in size of apparatus and mass of material. For many years the chemist proper has been more or less kept out of metallurgical works, and progress has only been made since the chemist has had a slight opening allowed to him. The point about mechanical engineering is the most important. The capability of designing or showing the lines on which to design a plant for a particular process is the making of the industrial chemist. It is too much to expect that a young man should be able to erect complicated machinery as well as invent processes, but he must have the clearest possible ideas as to what is wanted when his process is translated from the laboratory to the works. He must also know how to deal with waste and by-products, which may or may not be of value but which at any rate must be disposed of. This kind of capability can not be learnt (or even appreciated) by attendance at the best lectures in the world, not even in some of our newest fitted up technical schools where they have toy blast furnaces and diminutive Bessemer plant. All these things are merely glorified lecture apparatus. The only way to become a thorough metallurgist is to be first a student in a college, then have at least one year at actual practical work—in fact become a kind of apprentice—and afterwards take another course of theoretical (college) instruction. If this course could be alternated so much the better. In fact the plan of work used at some of the northern universities would be excellent for producing real technical students, viz., a study course in the four or five winter months, and the rest of the year in works actually working. A man must work day by day and see things going on time after time before he can appreciate them in their full details. Only then is he in a proper mind for making improvements or even seeing weak points in a process or its method of being carried out.

Mr. Richard Pearce wrote:—One can scarcely conceive the possibility of any important branch of metallurgical work being successfully conducted without the aid of a sound knowledge of the chemical changes involved, either in smelting operations where heat plays the chief part, or in what are commonly called "wet methods" which depend more particularly upon the solvent action of chemical solutions. The success of the operation in either case depends mainly on the result of chemical reactions which take place either in the furnace or in the vat, and unless these reactions are controlled in some degree by a process of sound chemical reasoning, there is little chance of success. Hence, metallurgy may for all practical purposes be considered inseparable from chemistry. By way of illustration, and as the author has mentioned my name in connection with them, I would refer to the methods which have been extensively used during a period of 50 years or more for the extraction of silver from copper mattes. Augustin, the manager of one of the Mansfeld works some 60 years ago found that by washing finely crushed copper mattes containing silver, with sodium chloride, silver chloride was formed, which could be dissolved and leached out by strong hot brine; the hot solution containing the silver chloride in solution was then allowed to flow through suitable tanks or tubs containing metallic copper on which the silver was precipitated in the form of cement silver. Later, Ziervogel, the manager of the copper works at Mansfeld, discovered that when finely crushed argentiferous copper matte is washed with great care and with a careful control of the temperature of the furnace, the silver could be converted into silver sulphate which may be leached out with hot water, and the silver precipitated on copper as in the Augustin method. The succession of reactions which takes place in the operation of washing is of the most interesting and delicate character, and to illustrate the magnitude of the operations conducted at Argo in Colorado, where I introduced the method in 1873, I find among my notes the following figures:—Silver extracted from copper matte from 1873 to 1906, 55,923.622 oz. fine silver representing a weight of 1917·42 tons (of 2000 lb.) which represents a product of 2770 tons of silver sulphate. Here we have an example of dry and wet methods combined, each depending for its success on the delicate chemical changes involved in the operation. Mr. Claudet does not refer in his paper to the immense advantages which the practical metallurgist has experienced during the last few years in the development of *quick* as well as reliable methods in the assay of ores and metals. If we compare the old methods for the determination of copper, lead, zinc, antimony, and arsenic, as practised 50 years ago, with modern practice, we find a great change for the better.

Mr. Claudet said that there was little to reply to arising out of the discussion, as none of those taking part in it appeared to differ from him on the points raised in the paper. This was, no doubt, owing to the material composing the paper being practically statements of fact. The future of the chemist would be probably the same as that of any other of the allied professions. He had selected the examples of the industries given in the paper as being those that appealed to him as illustrating his remarks; to have given many more such examples would have unnecessarily increased the length of the paper. The main part of the discussion dealt with technical educational matters, and he was glad to have had so many practically similar opinions given by the various speakers. He was pleased to hear that the Claudet process was by no means dead in the opinion of some of those present, but at the same time he could not see how it could be very profitable to work unless some of the conditions he had mentioned had been materially altered. With regard to the improving of technical education he would refer to the scheme inaugurated some few years ago by the Institution of Mining and Metallurgy in relation to the students of the Royal School of Mines and other similar schools. Every student obtaining his degree was advised to undertake a post-graduate course at one of the large mines and works for at least one year, where he would be put through all the departments in turn. During that period he was paid a salary sufficient to keep him. On the completion of this course a certificate was granted him on the advice of the general manager of the mine and works employing him. That course had proved so far a great success, and he thought that the same thing could be done in the case of chemical industry and the allied professions.

Meeting held at Burlington House, on Monday, December 5th, 1910.

MR. E. GRANT HOOPER IN THE CHAIR.

SOME INDIAN OILS AND FATS.

BY A. KESAVA-MENON, B.A.

The following fats and oils, received from reliable sources in India, were examined by me in the laboratory of Dr. Lewkowitsch.

Ghi.

"Ghi," as known in India, is the melted and clarified butter fat from which all the adhering water has been removed by evaporation. It is generally prepared from the milk of buffaloes, cows, sheep, etc., by adding fermented butter milk to boiled milk, when the "*thyre*," *i.e.*, a curdled mass, separates on the top. This "thyre" is skimmed off, churned, heated, and the clarified fat poured off for use.

Buffalo milk yields more ghi than does cow's milk. Buffalo ghi is also harder and whiter than cow ghi. One quart of buffalo milk yields 3—3½ ozs. of ghi.

An enormous amount of ghi is imported across the Northern Frontiers into India, as will be gathered from the following table:—*

Imports	1902-1903	1903–4	1904–5	1905–6	1906–7
Cwt.	130,628	164,262	165,463	168,264	185,752
£	353,905	427,042	479,598	505,760	604,895

There is also a large internal trade in ghi carried on, especially from Kashmir, where very little ghi is consumed on account of the religious beliefs of the people, to the rest of India. The Central Provinces, the United Provinces, and some parts of the Madras Presidency send considerable quantities of ghi to the port towns of Calcutta, Bombay and Madras, whence it is exported to Ceylon, to the Straits Settlements, Aden, Natal, British East Africa, and other places for consumption by Indian settlers.

The total exports from India to these places are given in the following table:—

	1902—1903	1903—1904	1904—1905	1906—1907
Cwt. ..	57,304	48,133	54,445	43,609
£.......	181,783	152,722	177,816	151,029

The coasting trade from Bengal and Madras to Burma was estimated at £113,440 during the year 1905—1906.

Besides the ordinary uses of ghi as a foodstuff, it is largely employed as a medicinal preparation for rheumatism. It is burned in the Hindu temples of Southern India, and used for anointing the idols. For this purpose only cow ghi is employed, as ghi from buffalo and other animals is considered impure and unholy.

The samples of cow ghi and buffalo ghi I have analysed were specially prepared for me in my home in India, so that I can guarantee their purity. The cow ghi was prepared from the milk of two cows of an age of six and eight years.

Physical and Chemical Characteristics of Ghi.

	Cow ghi.	Buffalo ghi.
Fat:—		
Specific gravity, d 100°/100°	0·8961	0·8965
" " d 100°/15°	0·8616	0·8619
Acid value	1·49	2·00
Saponification value	218·25	206·8
Reichert-Meissl value	25·70	18·24
Titration No. of insoluble volatile acids 1/10 KOH	2·07	0·74
Unsaponifiable matter per cent.	0·59	0·73
Butyro refractometer at 25° C "degrees"	49	—
" " 40° C "	40·6	44·5
" " 45° C "	—	42·0
Fatty Acids (total insoluble):—		
Per cent.	88·05	90·65
Titer test	39·75	45·30
Neutralisation value	210·4	204·9
Mean molecular weight	266·6	273·8
Iodine value	32·8	30·7

In the stearic acid test, cow ghi fatty acids yielded 1·21 per cent. of crystals melting at 61·1° C., while the buffalo ghi fatty acids gave 25·8—30 per cent. of crystals melting at 64·1° C. On again recrystallising from stearic acid solution, no crystals were obtained from cow ghi while the amount fell to 2·29—4·9 in buffalo ghi, thus showing that even buffalo ghi does not contain appreciable amounts of stearic acid. The melting point of the crystals was 65·6° C. instead of 68° C. of pure stearic acid.

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* Watts: "The Commercial Products of India."

Adulteration of ghi is practised to such an enormous extent in India that in some districts laws have been enacted or are in the course of being enacted to protect the genuine article against fraudulent practices. All the common oils, such as ground nut oil, sesamé oil, cocoanut oil, cotton seed oil, etc., are used as adulterants; but recently castor oil, illipe butter, and rice starch are being indiscriminately mixed with ghi.

Bassia oils.

The *Bassia* family yields solid fats which may become of commercial importance. Genuine seeds, of known origin, supplied to Dr. Lewkowitsch by Mr. D. Hooper of the Indian Museum, Calcutta, have been examined.

Bassia butyracea.—Ver. names: Phulvara, churi, yel, etc. (Hindustani). The fat is obtained from the seeds of *Bassia butyracea*, a tree indigenous to the Himalayas. The seeds are small, about 1 cm. in length. The kernels on extraction with petroleum ether yielded 64·8 per cent. of a solid fat having the consistence of lard. The fat has an agreeable odour and pleasant taste, and is used largely for edible purposes.

Bassia latifolia.—Ver. names: Illupi. Mowrah, Mowa, etc. *B. latifolia* is a tree widely distributed in the Northern Provinces of India, and especially in Bengal. The fruit encloses one to four seeds, which are almond-shaped, and about 2—3 cms. long. The kernels are reddish-brown and have a bitter taste. On extraction with petroleum ether, the kernels yielded 45·7 per cent. of a solid fat of a yellowish-white colour. The fat is used for various purposes in India, for burning, as an ointment for the skin and as an adulterant of ghi. The oil cake is used to poison fish and the smoke from burning it is said to kill insects and rats.

Bassia longifolia.—Ver. names: Illupi, Elupi, etc. *Bassia longifolia* is a tree commonly met with in Southern India, propagating itself by self-sown seedlings. No attempt has been made to cultivate this species in a systematic manner. The seeds are longer and less rounded than those of *B. latifolia*. Encased within a glossy, hard and strong shell, is the kernel, having a reddish-brown appearance and possessing a bitter taste. On extraction with petroleum ether the kernels yielded 53·0 per cent. of a white fat softer than that from *B. latifolia* and *B. butyracea*. The uses to which this fat is put are almost similar to those of the fat from *B. latifolia*. The oil cake known in India as "*Illipi poonac*," is rubbed on the body for cleansing purposes. A variety of the above species is *Bassia Malabarica* (ver.; Irupa (Mal.)), a tall tree found in the Western Ghats from Kanara to Travancore and the Anamalais. The fat has almost the same properties as that from *B. longifolia*.

The value of the exports of Mowa or Mowrah seeds from India to European countries from the year 1899—1909 is given in the following table:—

TABLE I.

Countries.	1899—1900	1900—1	1901—2	1902—3	1903—4	1904—5	1905—6	1906—7	1907—8	1908—9
	£	£	£	£	£	£	£	£	£	£
France	80,320	5,700	110,853	31,386	71,400	115,697	49,360	32,877	140,661	61,312
Belgium	18,147	5,261	25,898	26,262	58,648	48,581	11,667	6,697	88,746	57,490
United Kingdom	—	—	1,426	2,200	3,225	28,931	52,289	3,375	64,922	42,202
Other countries	2,422	20	57,073	40,707	31,831	12,209	5,988	7,470	2,763	5,157
Total	100,889	10,987	195,250	100,555	165,104	205,418	119,304	50,419	297,092	166,161

Payena oleifera.—Ver. name: Kansive oil. *Payena oleifera* is a tree met with in Burma. The seeds are smaller than those of *Bassia butyracea*, but have otherwise the same appearance. The kernels on extraction with petroleum ether yielded 56·34 per cent. of a white fat with a slight reddish tinge. The fat is used for various purposes.

In India, the fats from the Bassia family are indiscriminately sold under similarly sounding names as illupi, ellupai, mowa, mowrah, etc.

The value of the exports of mowa or mowrah seeds from India to European countries for the years 1899—1909 is given in Table No. I.

In the following tables comparative data regarding the four species are collated:—

TABLE II.

Name.	Average weight of one seed in grams.	Kernels per cent.	Husks per cent.	Fat extracted with petroleum ether on seeds per cent.	Fat extracted with petroleum ether on kernels per cent.	Residue extracted with ether on seeds per cent
Bassia butyracea	1·00	67·48	32·52	43·75	64·82	2·70
B. latifolia	2·00	70·93	29·07	32·42	45·70	1·45
B. longifolia	1·40	74·46	25·54	38·46	53·00	1·[illegible]
B. Payena oleifera	0·64	71·95	28·05	40·58	56·34	1·10

TABLE III.

Physical and Chemical Characteristics of Bassia Oils.

Name.	Specific gravity.		M.pt. 0° C.		Acid value.	Saponification value.	Reichert Meissl value.	Titration No. of insol. vol. acids. 1/10 KOH.	Iodine value.	Butyro-refractometer.		Unsaponifiable matter per cent.	Iodine value of unsap. matter.
	d100/100	d100/15	Capillary tube method.	Over Hg.						at ° C.	° Degrees.		
1. *B. butyracea* ..	0·8924	0·8580	46·70	43 to 51	66·4	194·[illegible]	1·25	0·54	41·22	40·0 45·0	44·0 42·5	2·29	77·24
2. *B. latifolia*	—	—	47·8	47·5	153·00	187·6–1[illegible]	1·6	0·36	5[illegible]·4	45·0	48·0	2·27	—
3. *B. longifolia* ..	—	—	30·2	26 to 29	26·63	185·60	1·75	0·33	58·24	40·0 45·0	5[illegible]·0 5[illegible]·0	2·13	66·13
4. *B. Malabarica**	0·8930	0·8586		32·0	12·10	187·2-188·5	1·35	0·55	63·6	40·0 45·0	[illegible] 49·5	2·55	58·56
5. *Payena oleifera*	0·9033	0·8685	29·1	—	54·0	18[illegible]–185·0	1·86	0·50	58·62	40·0 45·0	56·5 52·5	2·03	50·79

TABLE III.—*Physical and Chemical Characteristics of Bassia Oils.*—(*continued*).

Name.	Insoluble fatty acids.											
	per cent.	Melting point 0° C.	Iodine value.	Neutralisation value.	Mean molecular weight.	Liquid acids per cent.	Melting point 0° C.	Iodine value of liquid acids.	Neutralisation value of liquid acids.	M.M.W. of liquid acids.	Stearic acid in total acids.	Melting point 0° C.
1. *B. butyracea*	95·08	53·3	38·43	195·9	281·9	—	—	—	—	—	nil	—
2. *B. latifolia*	93·95	48·3	48·54	189·9	295·2	59·54	34·4	81·08	177·6	315·7	13 to 25	66·9
3. *B. longifolia*	93·7	45·6	52·07	188·7	297·1	20·50	30·2	87·33	173·8	322·7	12 to 20	67·2
4. *B. Malabarica**	94·00	45·8	59·50	192·1	291·9	—	—	—	—	—	—	—
5. *Payena oleifera* ..	91·65	40·0	59·05	192·2	291·7	—	—	—	—	—	nil	—

* The fat expressed from the seeds examined.

Arachidic acid is absent.

The kernels were extracted with petroleum ether so as to obtain the fats free from resinous substances for the analytical examination, and in order to reach this object as far as possible, the kernels had not been extracted exhaustively. The residual mass was further extracted with common ether to obtain the last quantities of fats which would, of course, be contaminated with resinous substances. That this was really the case is shown by the following abnormal results.

Name of fat.	Acid value.	Saponification value.	Unsaponifiable matter per cent.	Neutralisation value of fatty acids.	M.M.W.
B. butyracea	61·0	140·0	25·78	144	389·2
B. latifolia ..	135·5	209·9	8·9	186·4	300·9
B. longifolia	55·15	210·3	9·7	190	295·0
Payena oleifera ...	106·0	222·6	4·91	189·5	296·0

The following oils were received from the Government Museum, Madras. Oils expressed from the seeds have been examined, except in the case of the oil, from the seeds of *Sapindus trifoliatus*, which was obtained by extracting the seeds with ether. Hitherto no efforts have been made in India to prepare the oils for other purposes than for medicinal use. As large quantities of these seeds are available, there would seem to be a prospect of exploiting them commercially.

Jatropha glandulifera.—Vernacular names :—Addalai, Uddalai (Tamil); Nikumba (Sanskrit). *Jatropha glandulifera* is a shrub or small evergreen tree, common at the outskirts of villages in Bengal, Burma, the Northern Circars, and Deccan, but rare in Oudh and the Punjab. In the Lower Provinces the shrub forms one of the most abundant of hedge plants. The plant is also prevalent in the waste lands of tropical Africa. The fruit forms a capsule of the size of a hazel nut, and contains three to four seeds, each of which has the size of a pea. On extraction with ether the seeds yielded 21·3 per cent. of a light straw-coloured oil which was turbid at a temperature of 55° F. This oil is prepared in India by collecting the capsules when they just begin to split open and change their colour from green to brown. The seeds are then thrown on a mat and covered with another mat, and thus exposed for a few hours' bright sunshine when the seeds readily separate from the shell. The oil is then obtained from the seeds in the ordinary way by expression. The seeds form 29·8 per cent. of the capsule. The oil is chiefly used by the natives as an embrocation against rheumatism and paralysis. Like other oils of the Curcas family, it is employed as a purgative, and is considered a good remedy in cases of ulcers, ringworm, etc. The following characteristics have been ascertained :—

Fat:—Acid value, 15·79. Saponification value, 194·5. Reichert-Meissl value, 4·00. Insol. vol. acids titration no. 1/10 KOH, 0·41. Unsaponifiable matter, per cent., 1·38. Butyro-refractometer at 25° C. " Degrees," 76·5; at 40° C. " degrees," 68·5. *Fatty acids:* per cent., 89·01. Melting point, 35° C. Iodine value, 119·6. Neutralisation value, 187·3. Mean molecular weight, 299·4.

Luffa acutangula.—Ver. names :—Pikunkai (Tamil), Turi, Jurgi (Hindustani), Peechangai (Malayalam). *Luffa Acutangula* belongs to the family of Cucurbitacea, and is met with in North-Western India, Eastern Bengal, Sikkim, and is distributed to Ceylon and Malaya. It is also cultivated in most parts of India, chiefly for the green fruit, which is cooked. The fruits, seeds, and leaves are employed in their raw state in medicine as an emetic. The seeds are small (17 seeds weigh one gram), black, irregularly pitted, and two lobed at the base. The kernels form 48·0 per cent. of the seed. On extraction with ether the seeds yielded 20 per cent. of an oil of light green colour (= 41·6 per cent. calculated on the kernels).

The expressed oil is yellowish white in colour, and solidified at the ordinary temperature.

The following physical and chemical characteristics were ascertained :—

Fat.—Specific gravity (d 100/100) = 0·9363; (d 100/15) = 0·9002. Acid value, 93·7. Saponification value, 229·2. Reichert-Meissl value, 13·1. Titration no. of insol. volatile acids 1/10 KOH, 0·83. Iodine value, 40·12. Unsaponifiable matter, per cent., 1·09. Butyro-refractometer at 25° C. " Degrees," 73·0; at 40° C., 61·0. *Fatty acids* (insoluble) per cent., 82·3. Melting point, 44·1° C. Iodine value, 41·9. Neutralisation value, 215·0. Mean molecular weight, 260·9.

Mimusops elengi.—Ver. names :—Mulsari (Hindustani), magilamaram (Tamil). *Mimusops elengi* is a large evergreen tree belonging to the Sapotaceae. It is indigenous to the forests of the Northern Circars, Ceylon, and the Western Ghats as far north as Kandalla, and met with also growing wild in the Malay Peninsula.

The flowers contain a volatile oil which is used in perfumery. The fruit is a smooth ovoid containing a one-seeded berry, and is yellow when ripe and about one inch long. The kernel is of a yellowish-brown colour, and has a very bitter taste, and it is enclosed in a strong, glossy outer husk. The shells form 64·0 per cent. of the seeds. In Bombay a preserve is made from the fruits. On extraction with ether, the kernels yielded 18·47 per cent. of a yellowish-brown viscid oil (= 6·65 per cent. calculated on the seeds). The oil is used for culinary purposes, for burning, and is extensively employed in medicine for various purposes. The expressed oil has a light yellowish white colour, and " stearine " deposits on standing. The seeds are obtainable in fairly large quantities in Madras.

According to Col. Drury (" Drury's Useful Plants," p. 292), the oil is employed by painters; but its low iodine value of 66·5 would militate against its use as a drying oil.

The following physical and chemical characteristics were ascertained :—

Fat: Specific gravity (d 100/100) = 0·9129; (d 100/15) = 0·8777. Acid value, 45·5. Saponification value, 213·9. Reichert Meissl value, 10·6. Titration no. of insol. vol. acids 1/10 KOH, 0·68. Iodine value, 66·5. Unsaponifiable matter, per cent., 1·56. Butyro-refractometer at 25° C. " Degrees," 73·5; at 40° C., 67·0. *Fatty acids:* per cent., 89·4. Melting point, 35° C. Iodine value, 68·11. Neutralisation value, 202·06. Mean molecular weight, 277·6.

Pithecolobium dulce.—Ver. names :—Vilati (Hindustani), Amli (Bombay), Korukapilly (Tamil). *Pithecolobium dulce* is a middle-sized, ever-green tree introduced from Mexico and now cultivated throughout India, especially along the railway lines of the Madras Presidency. The fruit ripens from April to June, and contains a number of large seeds each of which is enveloped in a sweet, whitish pulp. The seeds are black, shiny, partly immersed in an arillus, and replete with an edible pulp of an yellowish white colour. The pulp on extraction with ether yielded 18·22 per cent. of a yellowish white oil, with a beany smell, which solidified at a temperature of 15° C. (= 13·20 per cent. calculated on the whole seed). The expressed oil is yellowish white, and very viscous, and "stearine" deposits on standing. The kernels form 72·4 per cent. of the seed. Church (Dictionary of the Economic Products of India, Watt, Vol. VI., Part I., p. 282) states that 100 parts of bean contain: water, 13·5 parts; albuminoids, 17·67 parts; starch, 41·4 parts; fatty matter, 17·1 parts; fibre, 7·8 parts; ash, 2·6 parts.

Physical and chemical characteristics of Pithecolobium dulce:—

Fat: Specific gravity (d 100/100) = 0·9106; (d 100/15) = 0·8756. Acid value, 63·9. Saponification value, 205·9. Reichert-Meissl value, 8·41. Titration no. of insol. vol. acids, 1/10 KOH, 0·31. Iodine value, 56·60. Unsaponifiable matter per cent., 1·17. Butyro-refractometer at 25° C. "Degrees," 69·5; at 40° C., 62·0.

Fatty acids: per cent., 87·64. Melting point, 14·7° C. Iodine value, 57·59; Neutralisation value, 198·7. Mean molecular weight, 282·2.

Psoralea corylifolia.—Ver. names: Bavanchi (Hindustani), Bakuchi (Uriya), Karguva arishi (Tamil).

Psoralea corylifolia is a common herbaceous weed found in the plains from the Himalayas, through India to Ceylon. The seeds are somewhat ovate, of a dark brown colour and have an aromatic odour and a slightly bitter taste. The seeds have usually come to this country as an oil seed under the name of Bawchan seed. They are used in India for the treatment of cutaneous affections, and are used in pharmacy as a laxative and stimulant.

On extraction with ether the seeds yielded 20·15 per cent. of a thick reddish brown oil with a pleasant and very strong aromatic odour. The expressed oil is clear, and of a light brown colour and "stearine" deposits on standing.

The following physical and chemical characteristics were ascertained:—

Fat: Specific gravity (d 100/100) = 0·9107: (d 100/15) = 0·8756. Acid value, 39·18. Saponification value, 204·6. Reichert-Meissl value, 6·9. Titration no. of insol. volatile acids 1/10 KOH, 0·71. Iodine value, 79·9. Unsaponifiable matter per cent., 1·73. Butyro-refractometer at 25° C. "Degrees," 79·5; at 40° C., 71·5.

Fatty acids (insoluble): per cent., 88·3. Melting point, 32·8° C. Iodine value, 83·06. Neutralisation value, 192·4. Mean molecular weight, 291·5.

Sapindus trifoliatus.—Soap nut tree of Southern India. Ver. names: Ritha (Hindustani), Puvandi (Tamil), Uruvangi kai (Malayalam).

Sapindus trifoliatus is a large, handsome tree commonly met with in the villages of Southern India and Ceylon.

The fruits are coriaceous or fleshy, two or three slightly united and each has the size of a cherry. The seeds are subspheroid. The pericarp contains Saponin which according to Dymock (Dymock, Warden and Hooper Pharmacographia Indica I—367) amounts to 11·5 per cent. and lathers strongly with water. Brannt (Dictionary of the Economic Products of India, Watt, Vol. VI., II. part, p. 470) is of the opinion that no saponin is contained in the woody stone, seed, or husk. The fruits are used by gold- and silversmiths in India for polishing ornaments. The fruits are also valuable for washing silk and woollen fabrics. The kernels on extraction with ether yielded 44·67 per cent. of a semi-solid, yellow oil (=15·8 per cent. calculated on the seeds=5·7 per cent. calculated on the fruit). The kernels form 12·5 per cent. of the whole fruit and the seeds form 36 per cent. of the fruit. The expressed oil had a dirty brown colour. It solidified completely at the ordinary temperature and exhibited a characteristic odour. The fat is employed medicinally, but its high price precludes its general use. The tree has not yet been cultivated with a view to the production of oil.

The following physical and chemical characteristics were ascertained:—

Fat: Specific gravity (d 100/100) = 0·8512; (d 100/15) = 0·8213. Acid value, 12·75. Saponification value, 191·8. Reichert-Meissl value, 1·61. Titration no. of insol. vol. acids 1/10 KOH, 0·37. Iodine value, 58·58. Unsap. matter per cent., 1·1. Butyro-refractometer at 25° C. "degrees," 74; at 40° C., 65.

Fatty acids (insoluble): per cent, 93·9. Melting point, 54·4° C. Iodine value, 57·0. Neutralisation value, 188·6. Mean molecular weight, 297·3.

Thespesia populnea.—Ver. name: Puvaras (Malayalam). *Thespesia populnea* is an evergreen tree of moderate size found in the coast forests of India, Burma, the Pacific Islands, the Andaman Islands, and Ceylon. It is largely cultivated along the roadside, especially in Madras. The tree is known in India as the Tulip or Portia tree. It is said to yield a gum and the capsules and flowers are said to give a yellow dye. The seeds are small, triangular shaped, a light slightly feathery shell enveloping a dark brown, soft mealy pulp. The latter on extraction with ether yielded 41·7 per cent. of a very viscid reddish brown oil possessing a characteristic odour (19·60 per cent. calculated on the whole seed). The kernels form 47 per cent. of the whole seed.

The expressed oil is dark red and of a syrupy consistency; on standing "stearine" deposits. The oil is used in India in the treatment of cutaneous affections.

The following physical and chemical characteristics were ascertained:—

Fat: Specific gravity (d 100/100) = 0·9018; (d 100/15) = 0·8670. Acid value, 48·10. Saponification value, 201·4—204·0. Reichert-Meissl value, 5·9. Titration no. of insol. vol. acids 1/10 KOH, 0·55. Iodine value, 71·5. Butyro-refractometer at 25° C. "degrees," 81·5; at 40° C., 73·0.

Fatty acids (insoluble): per cent., 93·5. Melting point, 43·9° C. Iodine value, 75·3. Neutralisation value, 196·9. Mean molecular weight, 284·7.

Vernonia anthelminitica.—Ver. names: Vapachi (Hindustani), Kattugirakam (Malayalam)

Vernonia anthelminitica is a tall, robust, leafy annual plant, met with throughout India to Ceylon and Malacca, ascending to 5,500 ft. in the Himalayas and Khasi mountains. The seeds are said to possess powerful anthelminitic and diuretic properties, and are also used as an ingredient of a powder prescribed in cases of snake bites. The seeds are cylindrical, tapering towards the base, marked with about 10 pale longitudinal ridges. They are about an eighth of an inch long and are of a brown colour. The taste is nauseous and bitter. The seeds are used for the treatment of cutaneous affections and for preserving woollen goods from the attacks of insects. In India, the oil is never prepared for sale. The seeds on extraction with ether yielded 18·25 per cent. of a dark brown coloured and strong smelling oil with some resinous matter. The expressed oil is of a light yellow colour and very viscid; "stearine" deposits on standing.

Physical and chemical characteristics of *Vernonia anthelminitica*:—

Fat: Specific gravity (d 100/100) = 0·9168; (d 100/15) = 0·8835. Acid value, 58·2. Saponification value, 202·88. Reichert-Meissl value, 7·88. Titration no. of insol. vol. acids 1/10 KOH, 0·35. Iodine value, 71·00. Unsaponifiable matter per cent., 1·79. Butyro-refractometer at 25° C. "degrees," 75·0; at 40° C., 67·5.

Fatty acids: per cent., 91·6. Melting point, 35·6° C. Iodine value, 73·4. Neutralisation value, 195·1. Mean molecular weight, 287·4.

Discussion.

The Chairman asked with reference to the previous discussion, whether the iodine determinations had been made with the Wijs solution and how long they had been allowed to stand. He thought some definite procedure should be fixed for the determination of these constants of fats and oils; and it was well that this procedure should be always indicated. He gathered that only one of these oils was being imported into Europe; but if they were cheap and plentiful in India, there should be a considerable opening for their export. All the oils struck him as being very rancid; was that a standing feature, or was it merely due to the fact that they were prepared on a very small scale and had therefore been exposed to oxidizing influences?

Dr. J. Lewkowitsch said that these oils, with the exception of the butter fats, had been prepared a long time ago and had then become rancid. The ghi showed how, by a natural process, those who were forced to eat fat of one kind or another hit upon a mode of preparing one of the most important foodstuffs in such a manner that it did not easily become rancid. The butter fats exhibited were obtained by simply taking out the water and the putrescible substances, so that the fat could be kept for a long time and could be transported over long distances. This process was also practised in Siberia, China, and Turkey, all of which countries consumed butter in the form of butter fat. In South Germany also butter fat was a well-known article of commerce and was sold in considerable quantities. The practice extended in South Germany even to the preparation of large quantities of "margarine fats" prepared in that way from margarine. The high veneration in which the ghi was held was shown by the fact that in Southern India butter fat was burned in the temples. This was also the case in the lamaseries of Tibet, where butter-fat was burnt before the idols. The commercial side of the question was undoubtedly of very great importance. The value of the exports of oil seeds and fruits from India, allowing for fluctuations in prices, amounted to from £8,000,000 to £12,000,000 per annum; the principal were linseed, cotton seed, rape seed, sesamé seed, arachis nuts, copra, and castor seed. It seemed curious that a country of that size and wealth was unable to produce the oils and fats which had to be manufactured in Europe. The habit of the natives, produced through the long oppression by the Mohamedans, of hoarding their silver had to a large extent militated against the erection of factories. The amount of adulteration which went on in small villages, where all those oils were produced by simply grinding the seeds between stone, was incredible. The natives had even found that linseed cake could carry any amount of stuff which was not linseed if put in so that the cake would not show it on simple inspection. Only recently Indian "Native linseed cake" had been exported to the Continent, the buyers believing that the name indicated that it was really pure linseed, but which contained heavy admixtures of mowra seed, which was bitter and most injurious to animals. All those things would have to be altered. What India wanted was, not only commercial enterprise exploitation of their natural resources, but also a staff of young men who were able to carry out scientifically all that was done now in the ordinary industrial procedure in this country.

Mr. E. R. Bolton said the Reichert-Meissl value of the buffalo butter seemed abnormally low; was that the only sample or had there been others of which that figure was an average? There were some figures published by Richmond some little time ago which were very high; and in a recent paper (Analyst, 1910, 343), of which he was joint author, they had obtained figures for pure ghi much higher than that now shown; but they had not the advantage of knowing for certain whether they were for buffalo or cow's butter. Their paper confirmed Mr. Menon's statement that ghi was largely adulterated. Out of a number of samples which they had analysed, they had only been lucky enough to find a few pure ones. He was continually impressed by the accuracy and reliability of Wijs' solution. When one once got into the way of working it, one could hardly go wrong and he hoped, for the sake of uniformity of results, that in time every analyst would use it.

Mr. E. Parry said he believed the remarks just made with regard to the Wijs solution were strictly accurate when dealing with the use of the solution on oils; but it was an admitted fact that with resins the Hübl figures and the Wijs figures differed. Dr. Langmuir agreed that dealing with resins, the figure was practically double with the Wijs solution.

Mr. Kesava-Menon, in reply said the question regarding the rancidity had already been answered by Dr. Lewkowitsch. These oils were prepared, most of them, four or five years ago. He did not see why these seeds should not have been sent before from India in large quantities; but perhaps the mere fact that they had not been investigated might account for it. Occasionally a consignment of one of them came; but perhaps the want of production in large quantities prevented a continuance of the trade. The iodine value was ascertained in every case with Wijs solution, which he thought gave accurate and concordant results in all cases. He had employed it solely and found it quite satisfactory. Dr. Lewkowitsch had said it was to some extent owing to the want of studying these products scientifically, according to up-to-date methods that no progress was made; and he hoped many of his fellow countrymen would follow his footsteps and come to England to study, and then return with their knowledge to their own country and exploit some of those vast untouched stores of natural products, such as that of oil seeds. With regard to Mr. Bolton's remarks, the buffalo ghi was specially prepared for him in his own home according to his directions by his brother, who owned large farms and took every care to make the ghi as pure as possible. The figures were rather low, but the ghis were not rancid; the acid value of cow ghi was 1·49; and of the buffalo ghi, 2; the figures showed that the fats had been well preserved and there was no doubt as to their origin.

Mr. Bolton said that after what Mr. Menon now said he might throw some light on the low Reichert-Meissl figure. Mr. Menon's brother, in his endeavours to prepare the sample as honestly and properly as possible, would no doubt heat it until quite free from water and might have over-cooked it, whereas the manufacturer, whose object was to obtain the minimum loss, would heat it only just sufficiently to drive out the water, and thus often under-cooked it. It was therefore possible that a difference in the amount of heating might account for the low figure as compared with some of the pure commercial samples.

Mr. Kesava-Menon said it was probable that the samples Mr. Bolton had examined were prepared commercially for the market. Many of such products were "under-cooked" in order that some amount of water might be left in. The samples he had shown had been properly cooked, neither "under-cooked" nor "over-cooked." There was no doubt that the samples sent to market in large cities would be always "under-cooked."

THEORY OF DYEING.

RESOLUTION AFTER TREATMENT WITH ACIDS, ETC.

BY W. P. DREAPER, F.I.C., AND A. WILSON, M.SC.

We have previously pointed out (this J., 1906, 22, 274, *ibid*, 1907, 26, 667), that well-defined differences in the degree of fixation of dyes by fibres come into play when the temperature of the dyebath is varied, and that these can be recognised by corresponding variations in the subsequent resolution of the dye from the fibre into selected solvents.

This work has been extended to cover the action of acids when present in the dyebath, as this is a matter of practical as well as theoretical importance. The increased dyeing effect of acids in the dyebath in the case of animal fibres is too well-known to need description. In the case of acid dyes when applied to animal fibres out of an acid bath, the colour acid is said to be set free, and in this or some other way the dyeing action is facilitated. We now bring forward evidence to show that this condition of the dyebath is not a necessary one when dyeing with acid colours, and have used the above mentioned method of resolution to investigate this and other actions, and to determine the inter-relation between the dye and fibre when the latter is dyed in the presence of acids in the dye solution.

We have before shown that the influence of increased temperature in dyeing gives an increased resistance of the dye against subsequent resolution into solvents, and indicates a closer and progressive combination between the dye and fibre under these circumstances. Elsewhere we have shown that this is accompanied by a decreased tendency for the dye to react chemically with acids, etc. (Dreaper and Wilson, this J., 1909, 57), and to resist certain physical changes (Dreaper and Stokes, J. Soc. Dyers and Col., 1909, 25, 10; this J., 1909, 137). The following results indicate the nature of the action of dyeing in the presence of acids and also in the presence of alkalis.

From the practical side it is of importance to determine whether there is any objection to the dye being forced on the fibre by acid, and the relation between the fibre and the dye in terms of subsequent resolution is important from a theoretical point of view.

The conditions of dyeing have been so arranged that in all cases the percentage of dye taken up as calculated on the weight of fibre has been kept constant, and the conditions necessary to obtain this constant adsorption have been determined. This eliminates certain difficulties, a standard shade being used for comparison which is produced in this case when exactly 1 per cent. of dye is present on the fibre. Any variation in tone, apart from depth of shade, can be eliminated by drying all samples to be matched out of a standard acid solution. The great variations in the reactions recorded make such minor differences of little importance for the purposes of this investigation.

First Series:—Influence of Acetic Acid in the Dyebath.—Conditions of experiments:—Dye on fibre, 1 per cent. Ratio of fibre to solution 1/200. Dye used Acid Anthracene, Red. Fibre, silk.

Results obtained:—(1) Dyed with 1 per cent. of dye at 100° C. in $N/5$ acid. All the dye was adsorbed by the fibre. This was taken as the standard shade for the remaining experiments. (2) Dyed at 18° C. in $N/5$ acid to same shade as (1). 4·5 per cent. of dyestuff was required to obtain standard shade. (3) Dyed at 100° C. in water to match (1) this required 1·7 of the dyestuff. (4) Dyed at 18° C. in water to standard shade. Dye required 20·8 per cent.

Conditions of resolution. (*a*). In a 1 per cent. solution of neutral soap at 55° C. for 30 minutes. (*b*). In alcohol (64 o.p.) for 60 minutes at 55° C. All samples were dried out of acid and at a temperature not exceeding 18° C. before resolution.

The dye removed from the fibre by resolution was as follows, the results being expressed in all cases as percentages of the total dye originally present on the fibre.

No.	Temp. of dyeing ° C.	Acid present.	Resolution.	
			With soap (*a*)	With alcohol (*b*)
			per cent.	per cent.
(1)	18°	$N/5$	90	85
(2)	18°	none	90	85
(3)	100°	$N/5$	20	10
(4)	100°	none	20	10

Second Series:—Sulphuric Acid replaced the Acetic Acid.—The following results were obtained:—

No.	Temp. of dyeing ° C.	Acid present.	Dye required to give standard shade on fibre.
			per cent.
(5)	100°	$N/5$	1·0
(6)	100°	none	1·5
(7)	18°	$N/5$	4·8
(8)	18°	none	20·8

The dye removed by resolution was as follows:—

No.	Dyed at ° C.	Acid	Resolution	
			Into soap (*a*)	Into alcohol (*b*)
			per cent.	per cent.
(5)	18°	$N/5$	92	88
(6)	18°	none	90	85
(7)	100°	$N/5$	20	20
(8)	100°	none	10	10

In this case there is evidence that the dye is even less fast against resolution when dyed in acid as compared with that dyed in water alone. Later on we show that this is in accordance with the results obtained when dyeing in alkaline solution.

The relative results obtained with acetic and sulphuric acids are as follows:—

Acid.	Strength.	Temp. ° C.	Resolution	
			a	(*b*)
			per cent.	per cent.
Acetic	$N/5$	18°	90	85
Sulphuric	$N/5$	18°	92	88
Acetic	$N/5$	100°	20	10
Sulphuric	$N/5$	100°	20	20

The nature of the acid does not seem to cause much variation in the action, and, as will be seen in the following table, where the result is expressed as the ratio of the total dye required in acid that required in water, the figures indicate that the relative action of acids varies as their combining weights.

Temp. of dyeing ° C.	Acid used $N/5$.	Ratio dye reqd. in acid/dye reqd. in water to give std. shade.
18°	Acetic	1·0/4·6
18°	Sulphuric	1·0/4·3
100°	Acetic	1·0/1·7
100°	Sulphuric	1·0/1·7

These results indicate that any extra dye adsorbed by the fibre, which is due to the presence of acid in the dyebath at low temperatures, is not fixed to the same extent as the extra dye adsorbed when the temperature of the dyebath is raised. Also that no extra fixing action can be traced as due to the acid when present at high temperatures, under the conditions specified. So that from a practical point of view high temperature of the dyebath is the essential factor in order that the dye may be fixed by the fibre, and not merely adsorbed. This is important when some of the modern conditions of dyeing silk more especially are remembered.

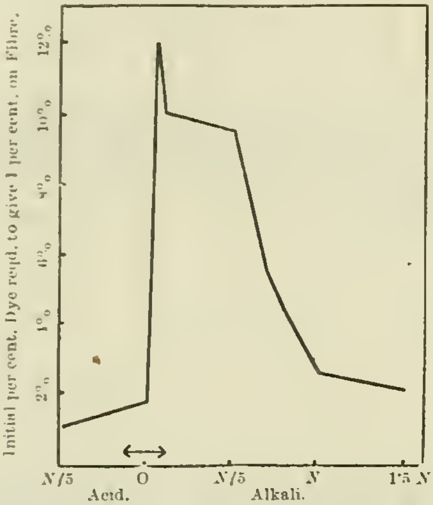
Dyeing in alkaline solutions with acid colours.—When tested by the method of subsequent resolution, unexpected results have been obtained. It is also important to note that the dyeing of these colours in alkaline solution shows an interesting reversal in stronger solutions. Only one case is given here, but the matter is under consideration on a wider basis.

Third Series.—Dye solution, sodium carbonate. Temp. of dyeing, 100° C. Dye, Acid Anthracene Red. Fibre, silk.

Nature of dye solution.	Dye to give standard shade (1 %)
	per cent.
Dyed in water	1·7
$N/20$ Sod. carbonate	12·0
$N/10$ do.	10·0
$N/5$ do.	9·5
$N/3$ do.	5·5
$N/2$ do.	4·4
N do.	2·6
1·5N do.	2·1

These results are as interesting as unexpected, and give no support to the idea that an acid dyebath is necessarily essential when dyeing animal fibres with ordinary acid dyes, nor to the suggestion that the free colour acid must be present in the dyebath. The dye is fixed under conditions which seem to give little support to the Perrin electrical theory of dyeing, or to a theory which assumes ionisation of the dye in the dyebath, but the alkali may play some part in determining an altered state of solution, or aggregation of the dye particles which may be favourable to dyeing. (See Fig. I.)

Fig. I.
Dyeing Chart.

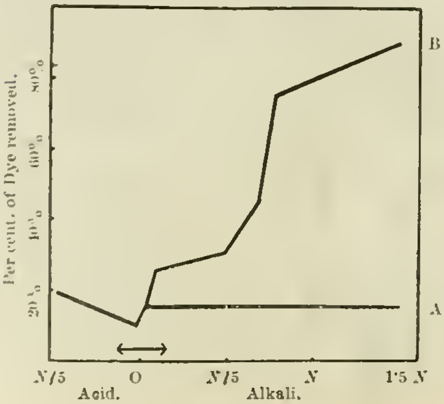


Abnormal results are also obtained when the dye fixed in an alkaline solution is subjected to resolution, as will be seen in the following table and resolution chart. (See Fig. II.)

Method of dyeing.	Resolution.	
	Loss in soap (*a*)	Loss in alcohol (*b*)
	per cent.	per cent.
N/5 acid	20	20
In water	10	10
N/20 Sod. carbonate	15	15
N/10 do.	15	25
N/5 do.	15	30
N/3 do.	15	45
N/2 do.	15	75
N/1 do.	15	80
1·5N do.	15	90

These results indicate that the dye may be held against subsequent resolution in different ways, depending upon the nature of the dye solution as compared with that of the solution used for resolution. When the former is alkaline the dye is comparatively fast against resolution into a similar solution, but not so when resolved into alcohol, as compared with the results originally obtained when dyed in acid solution. when with the conditions laid down the resolution results are very similar in degree. It would therefore seem that this difference must be taken into account, and the matter is receiving greater attention.

Fig. II.
Resolution Chart.



These experiments indicate that the present method of dyeing acid colours may be possibly modified in the future to obtain the maximum fixing effect. We are considering this matter in further detail and leave it for future consideration. It would seem that the whole nature of the fixation of the dye as disclosed by these experiments may vary according to the state of the dyebath, and that these differences may be brought out by fractional or selective resolution.

It is clear that such results are difficult to reconcile with any strictly chemical theory of dyeing, and that they may throw further light on the so-called secondary reactions which are receiving so much attention at the present time.

These experiments are being extended generally to cover all classes of dyes, other substances in the dyebath, the fibres generally and their condition at the time of dyeing.

Discussion.

Dr. J. C. Cain suggested that these phenomena might be explained by Witt's theory of dyeing according to which the fibre was regarded as a solvent. The distribution of the dye between the fibre on the one hand and the water, acid, or sodium carbonate on the other, was consistent with that theory, for if the dye were more soluble in sodium carbonate than in water, then one would expect more dye to be required to produce the same shade in the presence of sodium carbonate than was found necessary in its absence. The same theory would also explain the different dyeing power at different temperatures, for a solvent usually dissolved less material at 18° C. than at 100° C.

Dr. E. Feilmann thought the degree with which the dye went on the fibre in the presence of the stronger as against the weaker soda solution might be partially accounted for by a sort of salting out action of the kind Dr. Cain had suggested. Most colloidal or semi-colloidal solutions were precipitated on adding an electrolyte. If a colloid were precipitated in the presence of a substance having a large surface area, a large amount of precipitation usually occurred on that surface; and he thought something of that kind probably occurred here.

Mr. W. A. Davis did not think the Witt theory very well fitted in with the fact that the addition of a very small proportion of alkali caused so large an increase in the amount of dye required to give a standard shade on the fibre. He did not see how it could be brought into line with the fact that a very small proportion of sodium carbonate increased the figure from 1·7 to 12, and the subsequent reversion of that value caused by the addition of a larger proportion of sodium carbonate. The most striking result of these experiments was this reversion—the fact that the addition of quite a small proportion of alkali diminished the dyeing effect enormously. It would be interesting to know whether in the case of acid there was a similar reversion effect intermediate in concentration between pure water and N/5 acid. The influence of a small proportion of alkali rather suggested some catalytic action. It was an extremely interesting result, the explanation of which it was very difficult to discern.

The Chairman said that the effect of the reagents on the actual fibre had not been mentioned. Whether using acid or alkali, they might reasonably expect that though the effect on the fibre would be slight, so long as a weak solution was used, yet hydrolysis of the fibre might occur to some extent with the effect that the fibre was brought into a condition in which it more readily combined with the dyestuff than it would otherwise do. He put that forward with hesitation because he had no practical experience on the subject. The paper dealt with certain practical points of interest to the dyeing industry and was interesting also from the theoretical point of view.

Mr. **Dreaper**, in reply, said that the Witt theory of solid solution had not made much progress during recent years. In the case of these experiments it was difficult to explain on these lines the results obtained, and the subsequent variations in the degree of "fixation" observed, which in his opinion was the determining factor in dyeing. So far as the action of sodium carbonate was concerned, from results obtained even up to that day, although they were incomplete, there was some indication that this substance played the part of a salt rather than an alkali, and that it in some way altered the state of aggregation of the dye in solution and possibly brought into play conditions which favoured colloidal action. In the case of dyeing with sulphide dyestuffs, the alkali played a preliminary part in bringing the dye into solution, apart from any other action. It was difficult to express at the present stage an opinion as to the maximum effect being caused by catalytic action, but he thought there might be something in the suggestion. The exact course of the curve on the acid side when it went off the scale had not yet been accurately determined, but with strong acids more than the theoretical 1 per cent. of dye was required. Concentrated acids were known to cause a stripping action of the dye from the fibre. With regard to the chairman's remarks either strong acid or alkali had a hydrolysing action on animal fibres and also on cotton. How far this action might cause or influence the reversion noticed had not been determined, but they had this point in mind. In commercial operations economy was the order of the day, but a period had been reached in dyeing when questions of fastness, etc., received more attention and the prime cost of the dye was in many cases of less importance than formerly.

THE ANALYTICAL CONSTANTS OF SHELLAC, LAC-RESIN, AND LAC-WAX.

BY PURAN SINGH, F.C.S.

In connection with a recent investigation into shellac manufacture, I determined the chief analytical constants of pure shellac (free from orpiment and colophony), manufactured by myself from three different varieties of crude lac by extracting fairly large quantities of the latter with 98 per cent. wood spirit in a special lac extracting apparatus, described in my "Note on the manufacture of pure shellac" (Ind. Forest Mem., Chem. Ser., Vol. I, part II. ; see this J., 1909, 613). These crude lacs, which were received directly from the Forest Department, Central Provinces, India, were free from any foreign admixtures and were labelled "kusumi lac" (from *Schleichera trijuga*), "Palas lac" (from *Butea frondosa*) and "block (or coagulated) lac."[*] For the purpose of comparison, a sample of shellac manufactured in a well-known shellac factory at Mirzapore was also examined. This sample, which had been prepared by repeated melting, although absolutely free from rosin, contained a small proportion (about 0·3 per cent.) of yellow arsenic.

A. H. Allen (Com. Org. Anal., Vol. II., Part III., 1907, pp. 149 and 152) states that the analytical data referring to shellac as given by A. Rudling (this J., 1903, **22**, 428) and other observers, with the exception of E. J. Parry's figures, are not quite trustworthy, owing to the obvious impurity of most of the samples examined. This statement is perfectly justified, for with very few exceptions all the commercial forms of shellac, which are exported to Europe and America, are adulterated with a greater or smaller proportion of rosin or colophony. Again, all the finer grades of hand-made shellac, though generally free from rosin, contain a small quantity of yellow arsenic to which they owe their opacity and rich pale-straw colour. In times of scarcity, however, some of these high grades of shellac are also adulterated with 2 to 5 per cent. of rosin.

Although better methods of shellac analysis have recently been proposed by Endemann (J. Franklin Inst., 1907, **164**, 285—293 ; *ibid.* 1908, **165**, 217—221 ; Z. angew. Chem., 1909, **22**, 676—677) and McIlhiney (J. Amer. Chem. Soc., 1908, **30**, 867—862), the determination of the iodine value of the sample by Hübl's process, which is recommended by E. J. Parry (Chem. and Drug. 1901, 689 ; 1902, 670 ; 1903, 175) as the readiest and most accurate means of determining colophony in admixture with shellac, is still largely used both in India and abroad, and is still regarded as the best method of analysing adulterated shellac (see Ahrens, Chem.-Zeit., 1908, **32**, 996 ; this J., 1908, 1074). In this calculation the average iodine value of shellac[*] is taken as 9 (E. J. Parry) or 10 (J. C. Umney, and C. Ahrens), while that of colophony[†] is taken as 125.

In view of the above facts, I have thought it desirable to publish the results of my determinations of the analytical constants of pure shellac. The value of these results lies in the fact that they were obtained from unadulterated shellacs prepared from raw lacs of known purity. As the shellacs examined were prepared by extraction with wood alcohol, and not by repeated melting, an operation which can only be successfully performed by a skilled workman, they were undoubtedly free from the injurious effects of overheating, as good shellac should always be. They were examined for moisture, solubility in hot alcohol, acid number, saponification number, iodine value (Hübl), and also for a new constant, namely, the percentage of non-condensable resin and fatty acids as recently proposed by Dr. H. Endemann (*loc. cit.*). This last named figure, which is nearly constant (about 7 to 8 per cent.) for all the better qualities of shellac, I propose to call "Endemann Number."

In connection with the chemical examination of shellac, a determination was also made of the analytical constants of pure lac resin and lac wax, which, so far as I am aware, have not hitherto been recorded by previous observers.

The results obtained are embodied in the following tabular statement, to which are appended the necessary comments regarding the methods employed and the conclusions drawn.

	Moisture (expelled at 100° C.)	Matter insoluble in hot alcohol.	Acid number (A).	Saponification number (B).	Ester number (B—A).	Iodine absorption (Hübl) after 18 hours' action.	Endemann number.
	per cent.	per cent.				per cent.	
Shellac from Kusum lac	2·7	0·7	61·1	201·0	139·9	9·6	8·4
Shellac from Palas lac	3·8	0·8	60·8	202·4	141·6	9·3	8·0
Shellac from Block lac	3·9	1·1	63·1	201·6	138·5	8·2	9·2
Mirzapur Factory Shellac	2·0	0·6	64·4	203·6	139·2	8·6	7·4
Lac wax (m.p. 58°—59° C.)	—	—	22·1—24·3	79·2—85·0	57·1—60·7	8·8	—
Lac resin (desiccator dry)	—	—	52·1—59·2	193·5—198·4	139·2—141·4	6·8—7·3	7·3—8·1
Lac resin (melted)	—	—	54·9	190·0	135·1	5·9	—

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[*] This is ordinary crude lac compressed during transit through inconsiderate pressing and want of aeration into large compact masses, hard, ugly, dark-brown in colour and irregular in shape. For further information on the nature and origin of block lac, see my "Note on Shellac Manufacture," *loc. cit.*, pp. 12—13.

[*] D. Hooper (Ann. Rep. Ind. Museum, Indus. Sec., 1908–09) has reported the average iodine value of shellac resin (apparently not freed from wax) from four different varieties of crude lac to be 11·4.

[†] It has been pointed out that in making a determination it is best not to accept this average iodine value of colophony, but instead to take into account the variations in the iodine value of different samples of colophony. The iodine value of colophony may be regarded as ranging between 110 and 170. Thus a sample of shellac having an iodine value of 42 should be reported as containing from 21 to 33 per cent. of colophony.

The lac wax examined was prepared from dried crude Kusum lac by extraction with petroleum ether (boiling below 60° C.) and had a melting point of 58°—59° C. The lac resin was extracted from the same variety of crude lac. It was completely freed from all traces of wax, red dye, and insoluble matter by prolonged treatment of the lac with petroleum ether (lasting for 24—30 hours), washing away the red colour from the residue with hot water, and by repeated precipitation of the alcoholic solution of the wax-free lac with water until the brown amorphous powder obtained was of a perfectly white to yellowish grey colour. It was then thoroughly dried between filter papers and finally in a desiccator over sulphuric acid. A quantity of this anhydrous resin was kept at its melting point for about a quarter of an hour for the purpose of determining the effects of melting on the resin.

During the drying of the lac resin in an air oven it was found that keeping it at 100°—110° C. for 6 hours resulted in the formation of resin acid anhydrides which were insoluble in alcohol. A determination of the iodine absorption of this dehydrated resin gave an iodine value of 10·6.

The acid value in the above analyses was determined by boiling 1 grm. of the material for 5 minutes under a reflux condenser with 100 c.c. of neutralised 98 per cent. alcohol, and titrating when cold with standard aqueous potash, phenolphthalein being used as indicator. In the case of lac wax, however, the amount of the alcohol used was 200 c.c., and in order to keep the wax in a melted state the liquid was kept hot during the titration. The saponification value was determined on a separate quantity of the material in each case by boiling 1 grm. for a quarter of an hour with 25 c.c. of about half-normal alcoholic potash (prepared with 98 per cent. alcohol) under a reflux condenser, then adding to the liquid 100 c.c. of neutralised alcohol, and titrating back the excess of potash with $N/2$ hydrochloric acid, phenolphthalein being the indicator. The wax, however, was saponified by boiling it with 50 c.c. of the alcoholic potash over a naked flame for 1½ hour.

The iodine value was determined by dissolving 0·6 to 1 grm. in 25 c.c. of alcohol and 10 c.c. of chloroform (except in the case of lac wax, for which larger quantities of the solvents had to be employed), adding Hübl's solution in a large excess, letting stand for 18 hours in a dark place, and then titrating with $N/10$ thiosulphate after previously adding to the liquid the necessary amount of a 10 per cent. potassium iodide solution and 300—500 c.c. of water.

For the purpose of obtaining comparative results, it is absolutely necessary that the time of treatment with Hübl solution and other conditions of determining the iodine absorption of resins should always be identical. Want of observation of this rule alone renders the iodine value determinations of many observers useless for comparative purposes. Rudling in his examination of resins treated the latter with Hübl solution for 6 hours only. C. Ahrens recommends a treatment of 30 hours. I, however, find that the time of treatment (18 hours) as recommended by Smetham and Parry is quite sufficient for determining the iodine absorption of both colophony and shellac. The necessity of making a determination under identical conditions is very clearly shown by the exceedingly low iodine values (3·6—4·4) for pure shellac recently reported by the Imperial Institute, London (Report No. 30,827, May 1910, on six samples of shellac from the Imperial Forest Economist, India). It is apparent that the time of treatment with the iodine solution in these determinations was too short.

The Endemann number was determined according to the method described by Dr. Endemann (*loc. cit.*; see this J., 1907, 1207: 1908, 412; 1909, 483) by dehydrating 1·5 to 2 grms. of the material with 3—4 grms. of sand and concentrated hydrochloric acid under the influence of heat. It was, however, found that if shellac before hydrochloric acid treatment is heated for 2 hours at 100°—105° C. with precipitated silica which has been dried and calcined for 12 hours at a white heat, the process of dehydration can be effected far more readily than when the resin is treated with hydrochloric acid and sand without previous drying with silica.

Practically all the constants of pure shellac given in the above table agree pretty closely with the average figures for shellac as given by E. J. Parry, and all the figures ranging between 20 and 30 for the iodine value of shellac previously recorded by various observers were without doubt obtained from adulterated samples (see Allen, *loc. cit.*, pp. 193—194). Parry's value, 150, would, however, appear to be too high an average for the ester value of good shellac. In connection with the ester number of shellac, it must be pointed out here that the saponification values of pure shellac as reported by me in the Annual Report of the Board of Scientific Advice for India, 1908–09, p. 40, are too high on account of the use of a wrong factor by an oversight in their determination. In order to obtain the correct values they should be multiplied by the factor, 0·858.

While the acid and saponification values of lac wax are very considerably less than those of shellac, the iodine value of the former, it will be noticed, is about equal to that of ordinary shellac containing 3 to 5 per cent. of wax. The presence of lac wax even in abnormally large proportions will not, therefore, appreciably alter the iodine value of shellac.

The constants of pure lac resin, notably the iodine value, are, it will be noticed, lower than those generally obtained for shellac. This is explained by the absence of lac wax and other minor ingredients of shellac in the pure resin. When the pure anhydrous resin is melted and kept in the semi-liquid state for about 15 minutes, the iodine value is slightly lowered (from 6·8—7·3 to 5·9), thus showing that the operation of melting shellac tends to increase the proportion of saturated resin acid anhydrides, which are only slightly soluble in alcohol. It is, however, remarkable that when the same resin is dried at 100°—110° C. for 6 hours, its iodine value is considerably increased above that of pure unmelted resin, although more than 90 per cent. of such dried resin is insoluble in absolute alcohol. It would thus appear that the proportion of unsaturated compounds among the resin acids and anhydrides of the resin, produced through condensation by prolonged heating, is much greater than in the ordinary lac resin.

As a result of my analyses of shellacs besides those described above, I fully confirm Dr. Endemann's claim that a higher figure than 8 for the percentage of non-condensable resin and fatty acids in a given sample of shellac, as determined by his method, indicates in an unmistakable way the presence in the sample of added impurities or some naturally occurring hard resinous matter which detracts from the quality of shellac. For example, from the acid, saponification, and iodine values it would appear that the sample of shellac extracted from block lac, which is considered inferior to other varieties of raw lac, and which is never employed on that account for the manufacture of high grade shellacs, is of the same quality as shellac from Kusum and Palas lacs, which are greatly esteemed by the shellac manufacturer. The Endemann number, however, clearly distinguishes the shellac from block lac from the other shellacs and shows its inferiority as compared with the latter, inasmuch as it contains about 1 per cent. of the undesirable hard resinous matter referred to above.

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Discussion.

Mr. E. J. Parry said the problem which an analyst had to solve in dealing with samples of shellac as a matter of practice was, whether a given sample contained more or less than 3 per cent. of rosin. Shellac, known as "T.N.," which constituted 75 per cent. of the whole trade, might legitimately contain 3 per cent. of rosin; and all shellac contracts contained a clause stating that no allowance could be made if 3 per cent. was not exceeded. Therefore, the analyst's task was to decide whether a given sample contained more or less. Garnet lac was allowed to contain 10 per cent. Button lacs were of varying quality, and one had to determine as nearly as possible the amount of resin with reference to the given standard on which a sample was sold.

Chemists who reported figures before the year 1900, had obtained samples which could hardly be called shellac, often being samples of garnet lac or button lac, in ignorance of the fact that these admittedly contained 10 per cent. and up to 30 per cent. of resin respectively, and that the figures were taken indifferently as representing pure shellac. Those facts should now be generally known; but Dr. Vaubel had recently reproduced these figures, button lacs and garnet lacs being given with iodine values of 23 and 19, and the saponification values in the same way. The figures now given for moisture and solubility in hot alcohol had very little practical bearing. Shellac legitimately contained all the natural wax which filtered through the bags, which might be up to 5 or 6 per cent.; the natural product was a mixture of 5 per cent. of shellac wax and 95 per cent. of other ingredients. The author referred to his slightly lower ester values; but the speaker had pointed out in the original figures he published, showing an average of 150, that this figure was of very little value. Phenolphthalein was the only indicator which could be used; and, as all shellac contained a small amount of lac dye which reacted differently with acids and alkalis, it was obvious that a clean end action could not be obtained. It was not possible, therefore, to determine the really correct acid and ester values of a shellac. Even if it were, the acid value of shellac was, roughly, about 60, and that of resin was about 160, and the difference between those figures was not nearly so great as the difference between the iodine values of the two products. Therefore, the iodine value gave a far better basis for calculation. The Endemann value, although theoretically very pretty, was quite useless from the analyst's point of view. Dr. Endemann showed an average of 8 per cent. of uncondensible acids from pure shellac. The problem was, whether there were more or less than 3 per cent. of resin, and the figures yielded by a shellac, whether it contained 3 or 5 per cent. of resin, would be identical, and one could not distinguish between the two. He (Mr. Parry) put the iodine figure at 9 and 125; but Mr. Umney at his suggestion had published the later figures, 10; and taking 10 and 125, one might be doing a slight injustice either to the buyer or the seller. But that was an accepted figure on the London market; and on the basis of the iodine absorption values of lac and resin the reports were made out, and both seller and buyer were willing to accept the slight injustice of 1 per cent. which they might incur. The only real difference on the question was that expressed by Dr. Langmuir of New York, who preferred to use the Wijs solution, which gave higher absorption for both shellac and resin; they were not in exactly the same ratio as were obtained with the Hübl solution, but one always got a result about 2 per cent. higher of resin than by using the Hübl solution. When one considered the difficulty of observing the conditions laid down by Dr. Langmuir and his colleagues for the use of the Wijs process, it was better, he thought, to keep to a process by which any two chemists could obtain practically identical results. Dr. Vaubel had proposed to estimate the amount of resin by dissolving the sample in a solution of borax. It was true that resin, or colophony, was almost insoluble, whilst shellac was dissolved easily, but shellac wax was practically insoluble; and so, not only the colophony, but an unknown quantity of wax and other things, were included in the result. As the principal point for determination was whether there was more or less than 3 per cent. of resin, it was clear that a difference of from 2 to 3 or 5 per cent. of wax tended to vitiate the results entirely. MacIlhiney had also recently proposed a process based on the solution of shellac in petroleum ether, with the hope of extracting the colophony, if any quantity were present; but the shellac formed a protective coating on the resin, and one could not get out the whole of it. He did not think any process but the iodine one had been seriously suggested, and that was in his opinion the only one of any practical value to the analyst.

Dr. J. **Lewkowitsch** said he had found for genuine seed lacs the iodine values of 9 and 10 by Wijs' method. The figures for the ester value had best be omitted, having been found merely by difference. He agreed with Mr. Parry that the "Endemann figure" was useless. With regard to the iodine value, he would not say one could not get reliable values by Hübl's process, but certainly Wijs' process was much more expeditious. The calculation of "rosin" was, as Mr. Parry had stated, finally deduced from an entirely arbitrary value of 125 for rosin; thus one gave away with one hand all what had been obtained with the other.

The **Chairman** said it seemed to him that the most important point of the paper was connected with the determination of the iodine value. With regard to commercial practice, of course buyers and sellers ought to be bound, and they were bound, by some definite process. It would not do to sell according to one process, and when delivery was made to have the article subjected to test by another process giving a different result. As the result of a very extensive experience with oils, he was wholly in agreement with Dr. Lewkowitsch, that the Wijs solution was entirely satisfactory, and gave perfectly concordant results. His experience with shellac was not very extensive, but he wished to refer to an iodine value for shellac as determined by the Wijs solution. The sample was an old shellac, guaranteed as pure, and sufficiently old to have been prepared before the present age of somewhat keen sophistication. It was almost wholly soluble in alcohol and almost equally insoluble in benzol. The insolubility in benzol was in itself a useful means of differentiating between shellac and rosin. For example, with such a substance as sealing wax, a mixture of colophony and shellac with mineral matter, the colophony and shellac was dissolved out with alcohol, and on evaporation of the alcohol the mixed shellac and resin were obtained in a pure state. On now extracting this with benzol the resin was dissolved, leaving the shellac, which was insoluble in benzol to the extent of something like 98 per cent. In connection with a determination of the iodine value of such a substance two considerations at once arose. What solvent should be used, and what iodine solution should be employed? The iodine value by the Wijs' solution was higher than if the Hübl solution was used. The number 125 had been referred to as the recognised value for rosin by the Hübl method. The Wijs solution, in his experience, gave about 134—138, which was about the increase normally obtained in comparing the two methods. When the iodine value of shellac was determined by Wijs' solution using alcohol as a solvent, a value of something like 15·3 was obtained. But for the Wijs iodine value glacial acetic acid was a much better solvent, especially as the Wijs solution itself was made with glacial acetic acid. Using this solvent a value of 28·7—29·5 was obtained. This was practically the number referred to by the author as having been obtained by other observers, but which the author thought was due to impure lac. He would therefore suggest to those interested in the question, the advisability of testing whether or not the employment of the Wijs solution using glacial acetic acid as a solvent was not preferable to using Hübl with the mixture of chloroform and alcohol referred to by the author. Time was, however, of course an element in single iodine determinations. Probably the author had one advantage which many of his hearers did not possess: he was sure of the purity of the shellac with which he was working.

Newcastle Section.

Meeting held at the Technical College, Sunderland, on Tuesday, November 22nd, 1910.

MR. E. F. HOOPER IN THE CHAIR.

THE PRESENT POSITION OF THE COAL-TAR INDUSTRY.

BY ERNEST F. HOOPER.

In dealing with the present position of the coal-tar industry, it is very desirable to make a general survey of the industry as a whole, to enable us to see more clearly the facts as they are brought forward consecutively. Owing to the brilliant chemical researches conducted mainly during the last sixty years, resulting in the discovery of vast numbers of dyes, pharmaceutical, photographic, and other products, one may be led hastily to assume that the majority of tar products have commercial usefulness in this direction. The fallacy of this contention is shown by the following analysis of a typical tar :—

	Per cent. by weight.		
Water (ammoniacal)	3·00		
Naphtha light oil ..	3·10	Yields	1·0 per cent. benzol.
Middle oil	7·68	,,	1·5 per cent. toluol and solvent.
Creosote oil	10·15	,,	8·12 per cent. naphthalene.
Anthracene oil	11·64	,,	0·3 per cent. anthracene.
Pitch	61·00		
Loss	3·43		

From the above figures, crediting naphthalene with as much as one per cent. as used for colour-producing purposes, and assuming one-half the benzol and toluol goes for aniline and toluidine dye purposes, it appears that roughly two per cent. of tar products find their way into colour manufacturers' hands. From my own observation, I am inclined to think even this an outside figure.

It is also necessary to note that, unlike most other chemical products, and especially those of a natural character of well-known types, the supply of coal-tar is, in every country where produced, limited in its quantity. A heavy demand on a certain constituent will, under ordinary circumstances, enhance the value of that product, and the supply of such material is strictly within a very inelastic limit. To illustrate this fact, I need only refer to the remarkable synthesis of artificial indigo from toluene some years ago. After years of patient and unremitting work, it was found impracticable commercially to produce indigo by this means, owing to the fact that to produce indigo on a commercial scale would force the price of the limited supply of toluene to practically famine prices, and were such total supplies, even at a price, obtainable, the quantity available would be far too small successfully to build up a trade in competition with the natural product.

On the other hand, a supply of any product exceeding the normal demand is almost necessarily followed by a rapid drop in the value of such a product, as with few exceptions the separation of the constituents must proceed consecutively one with another. To this may, I think, be largely attributed the enormous fluctuations in the value of tar products, unequalled in short spaces of time by almost any other series of chemical manufactures.

Dr. Beilby, in his presidential address at Newcastle-upon-Tyne in 1899 (this J., 1899, 643 seq.), speaking of the excessive quantity of tar available if coal gas were extensively used and by-product coke ovens were widely erected, warned us as to the fact that no possible demand for dyes, narcotics, or febrifuges, or other hydrocarbon products could possibly absorb the increment of material produced already from the above sources. The table I have just alluded to confirms this point. He directed the attention of engineers and scientific men to the utilisation of tar as a fuel of high calorific value. Since that period, however, events have occurred, which have largely neutralised the danger of the excessive over-production of coal tar.

First, the production of tar has increased by no means proportionally to the production of coal gas at gas works, and the annual increment of the rate of tar production by gas works has not been so great as in past years, one reason being that owing to the change of burners from flat-flame to incandescent mantle burners, in many cases lower candle power gas is made, equivalent to a larger number of cubic feet of gas per ton of coal carbonised ; and another being that consecutively with the much greater illuminating power per burner, much less gas per burner is required. This argument is not materially affected by the fact that more lighting, and of a better quality, is, and probably ever will be, the demand of the public.

Moreover, during the last decade, it must be borne in mind that many gas works, rather than extend their plant, as regards retorting power, including naturally condensers, scrubbers, purifiers, and such necessary adjuncts to larger retort output, have resorted to the aid of a carburetted water gas, or other than coal gas type plant, which gives the gas required under special heavy load conditions, such as heavy fog or frost, but little tar. This applies to small gas works as well as those of a larger capacity.

A few words may now not be out of place as to the crude products dealt with. During the last twenty years, many changes have come over the industry as a whole. Coal tar two decades ago consisted almost entirely of tar produced from the destructive distillation of coal in the retorts of gas works. The quality of this tar varied mainly owing to the quality of the coal used in the process and the temperature of the fire-clay retorts. This comparatively simple factor does not by any means cover the present position. Owing to the much higher temperature of carbonisation, due no doubt to the ability of the executive staff of the gas companies in extracting the utmost calorific and illuminating value from the coal, gas works tar has a much higher free carbon or (more correctly, as we shall see later) coke dust content than formerly, to the material loss of the normal hydrocarbons and other products. Again, especially in the Midlands and the North of England, a great number of by-product coke ovens have been erected of late years, yielding large quantities of tar differing very materially from that produced from gas retorts, owing, naturally, to the different method of carbonisation.

The general tendency has been for the gas works to produce a relatively smaller percentage of tar year by year to gas made ; the loss, however, has been more than made up by the tar produced from the by-product coke ovens. A considerable quantity of tar, some 200,000 tons per annum is also produced by condensation from the waste gases of blast furnaces. The products from this source, as will be indicated presently, differ materially from gas works and coke oven products ; from reference to tar analyses it will be seen that only a small quantity of naphtha and light oil products can be obtained from the latter source.

Recently a new phase has arisen in respect to gas works tar ; I refer to the new system of vertical retorts. In Sunderland, we have the first installation erected in England on a large scale, of the Dessau pattern, and the results bear out fully the advantages the inventors have claimed, and the local engineers expected. It appears likely that within a few years gas works retort house practice will see a very extended use of the vertical retorts.

The subjoined analyses show comparative tar yields from a variety of sources. The chart is drawn up based on the relative densities of the tars indicated.

Diagram 1.

Type of tar.	Coal source.	Specific gravity.	"Free carbon."	Tar acids.	Distillate through open retort					Pitch.	Analyst.
					to 170° C.	to 230° C.	to 270° C.	to 300° C.	to 350° C.		
Blast Furnace	..	·954	..	..	..	2·9	..	6·97	33·0	55 to 60 per cent.	Hooper
"Coalite"	..	1·058	0·15	23·0	..	14·0	13·6	..	29·0	41·7	Hooper
"Coalite"	..	1·070	..	..	10·8	..	20·0	..	30·0	39·2	Warnes
Vertical retort	Silkstone	1·084	3·6	..	6·7	..	21·7	..	22·5	48·5	Lunge
Water gas tar	Durham	1·090	1·38	nil	..	5·8	9·16	..	34·34	34·91	Hooper
Water gas tar	..	1·092	trace	..	1·39	15·45	..	..	42·39	18·23	Tutweiler
Inclined retort (Bueb)	..	1·095	2·6	..	4·4	..	28·5	..	19·2	47·5	Warnes
Vertical retort	..	1·100	2·4	..	5·85	..	12·32	..	26·9	49·75	Lunge
Coke oven (Simon-Carvés)	Durham	1·106	..	..	1·6	4·7	..	18·0	34·0	30·5	Luage
Vertical retort (Dessau)	Durham	1·113	4·0	5·3	13·0	..	24·0	..	9·0	50·0	Hooper
Chamber retort	..	1·180	11·1	..	0·4	..	10·2	..	30·1	53·9	Warnes
Coke oven (Otto-Hilgenstock)	Durham	1·198	10.5	3	9·4	..	9·8	..	24·8	51·0	Hooper
North Country (horizontal)	Durham	1·220	17·25	3	4·9	..	18·4	..	9·0	60·6	Hooper

Blast furnace tar shows by far the lowest specific gravity, but this is not explained by a large percentage content of light, or naphtha products, but by the low specific gravity of all the distillates. The pitch contains 5 to 10 per cent. of ash, 65 to 70 of volatile matter and 15 to 20 per cent. of free carbon.

Coalite tar shows 12 to 14 per cent. of light paraffin bodies that are found in the earlier fractions, an abnormally low free-carbon content and bright, lustrous, brittle pitch. The tar acids are high but contain very little phenol.

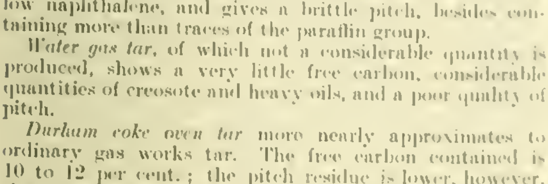
Vertical retort tar has a very low free carbon content, low naphthalene, and gives a brittle pitch, besides containing more than traces of the paraffin group.

Water gas tar, of which not a considerable quantity is produced, shows a very little free carbon, considerable quantities of creosote and heavy oils, and a poor quality of pitch.

Durham coke oven tar more nearly approximates to ordinary gas works tar. The free carbon contained is 10 to 12 per cent.; the pitch residue is lower, however, than in a normal tar by roughly 10 per cent.

Normal North Country gas tar.—Here we reach the highest specific gravity, greatest pitch yields, and consequently a higher volume of free carbon. Naphthalene is contained in large quantities in both the Durham coke oven and North Country coal gas tars.

DIAGRAM 2



In the accompanying diagram, which has been prepared after closely testing a variety of tars, we find that the percentage of free carbon can be closely and easily determined by the formula. Percentage of free carbon = 0·64 N-10, where N=degrees Twaddell. The statement is based on this figure. The figures are calculated on the tar free from water, and the free carbon content has been estimated by washing the tar with approximately 150 runnings through the Soxhlet apparatus, with first benzene, secondly pyridine bases testing by distillation in a Wurtz flask 90 per cent. at 140° C., and thirdly methylated spirit (unmineralised) in about 50 exhaustions each. These solvents seem to be the best for this purpose. The free carbon yielded no further soluble bodies to carbon bisulphide or other solvents by which it was tested, and the weight proved constant when dried at 120° C. for a considerable period. The composition of the free carbon is being investigated.

	Tar.	Degrees Twaddell.	Free carbon by formula 0·64 N-10.	Free carbon found experimentally.
1.	Coalite tar	15·0	0·4	0·15
2.	Water gas tar ..	18·0	1·52	1·38
3.	Vertical retort tar	21·5	3·77*	2·50
4.	Dessau Drhm. coal tar	22·0	4·08	4·00
5. *a*	Horizontal	35·0	12·40	10·97
6. *b*.	,, ...	39·0	14·83	14·91
7.	Average tar	41·2	16·36	16·08
8.	Inclined retort tar	41·0	16·24	16·54
9. *c*.	Horizontal retort tar	42·0	16·88	16·51
10 *d*.	,, ,, ,,	42·0	16·88	17·23
11 *e*.	,, ,, ,,	48·0	20·72	20·79
12 *f*.	,, ,, ,,	57·0	22·64	22·64
13 *g*.	,, ,, ,,	51·5	22.96	23·52
14 *h*.	,, ,, ,,	54·5	24·88	25·58

* This determination was not made in the author's laboratory, and he is unable to test its accuracy.

Beyond the tars mentioned, but still worthy of note, are those produced from Mond gas, oil gas, and producer gas.

Another process should not be passed over without notice, although the future of the process is hardly out of the experimental stage. I refer to low temperature carbonisation and its products, as exemplified in the "Coalite" process. The tar made under these conditions approaches very closely to the tar made in the earlier days of the gas industry with cast iron retorts. This tar is very thin and does not contain much free carbon.

Quantity of raw material available.—The Board of Trade figures show an output of coal for 1909 from the United Kingdom of 263,774,000 tons, giving direct employment to 1,013,998 persons, an increase over 1908 of 26,185 persons. Of this, 15,000,000 tons were used in the production of coal gas. This gives, based on the yields of 8·1 gallons of tar per ton of coal carbonised, an available quantity of tar equal to 750,000 tons. We may reasonably assume an output of not less than 150,000 tons from by-product recovery ovens, and not less than 200,000 tons of blast furnace tar is produced. Water gas tar, coalite, and other tars are at present an almost negligible quantity. We have, then, in sight a total of about 1,100,000 tons of coal tar available.

It must be borne in mind that very large quantities of tar are lost to the distillers annually to the gain of the surface of our highways. In the southern counties, especially round London, some thousands of tons, in a refined state, are being placed on the roads to preserve the surface and abolish the dust nuisance. This use is likely to develop largely in the future in other parts of the country.

Products generally prepared, and their uses.

From the first fraction and light oils we obtain:—(*a*) Carbon bisulphide (little is, however, prepared commercially from this source). (*b*) Benzene, toluene, and the xylenes, produced in a pure state for dye manufacturing and solvent purposes. Toluene is the base for artificial saccharin. Benzol, or "nineties" as it is known in the trade, is becoming more and more useful as a spirit for internal combustion engines of a motive character. (*c*) Carbolic and cresylic acids. The second fraction yields naphthalene, heavier solvents, besides phenolic bodies, and the third fraction yields lower grade naphthalene and oil most suitable for preserving timber. Of late years, one of the factors which relegates the possibility of tar, or even oil burning, to a distant future is the ever increasing demand of creosote for the American continent. For many years a considerable quantity of oil has been sent to the United States of America, but during the last five years the demand for timber preserving oil has grown so rapidly that the old method of cask packages has almost disappeared, and instead the oil is being sent to the other side of the Atlantic in properly fitted tank steamers. The collection, maturing, exporting, and the transit and distribution on the other side has grown to vast proportions. Over 25,000,000 gallons were received from England in 1909, and the demand is still growing. Six years ago, oil burners were installed at the Sunderland works to use up some of the excess of oil produced, which was over and above the demand of the local firms using creosote. Since then the vista has changed remarkably and now the oil has a steady outlet. The manipulation of this oil, liquid only at an elevated temperature, requires special experience and handling. There are now more than five shipping installations in Great Britain alone. The demand came at a very crucial time to tar distillers and has proved of value at a time when it would have been difficult to dispose of the excessive make.

The fourth fraction gives anthracene, not extensively separated of late years, and heavy oil. The latter is now being largely superseded in the manufacture of lubricating oil by imported petroleum bodies. Carbazol is also obtained from this source. To show the fall in the value of anthracene at the present time, in 1908 only £5,094 worth was exported, in 1909 material to the value of a few hundred pounds was wanted abroad.

Methods of separating the products.

By far the greater proportion of the tar is worked up in this country by the ordinary pot or intermittent stills. The usual design of a tar still is convex-concave—an upright cylinder with domed top outwards, on the top surmounted by a cast iron still head. The still bottom is domed upward inside to give a maximum of heating surface from underneath.

The capacity may vary from 8 to 20 tons. Steel or wrought iron is the material employed for the manufacture of the still, the thickness generally being used about half an inch. The top of the still below the head generally consists of a dome plate rivetted to gusset plates, these in turn being joined to the cylindrical shell plates. Below these the channel, or floor plates, are rivetted to the lower gusset plates and these again to the internal dome plate. Some distillers favour a single plate covering the bottom entirely; these large plates can now be procured. The fittings consist of still head, safety valve, inlet for tar, inlet for steam, testing cock, and pitch run-off pipe. Some 10 to 30 hours is required, according to circumstances, for the cycle of operations. Briefly, this is as follows:—The chargemen fill the stills to a certain mark and run the distillate with fire heat till the last fraction, the heavy anthracene oil, begins; then steam is injected and the distillation proceeds to the finish. The fractions are in some cases determined by a thermometer in the still dome, but generally by the specific gravity of the fraction and by the quantity of the distillate and its appearance on a steel blade. This factor is largely determined by the commercial requirements for the time being.

The main advantage of the pot form of still is that as a still becomes worn, and the wear and tear is great, one still or another can be put out of use without the plant, as a whole, lying idle. In some works the stills run under partial vacuum and consequently lower temperatures are required and more perfect condensation of the earlier products results.

The stills are sometimes fired with other fuel than coal, *viz.*, coke, oil fuel, or producer gas. With tars of a lower free carbon content no form of internal agitation in the still is necessary, but much may be said for this method with some denser tars.

The condensing arrangements for the distillates consist of steel or iron tanks containing a coil of steel or cast-iron pipes of requisite internal diameter, from 100 to 150 feet in length. The pipes terminate outside the tanks in a goose neck trap into a receiving chamber, whence the running of the stills may be observed, samples taken, and out of which the products may be transferred to their proper store tanks for further treatment. The first fractions are sent from their store boilers to a crude naphtha still, which is similar in design to a tar still, with the exception that it has, in the place of an ordinary still head, a fractionating column of some approved design. This still is worked, as a rule, by fire and the distillate tested and the fractions separated by control from the laboratory, by means of continuous specific gravity and distillation tests. The residues from the still are highly charged with naphthalene and are run into the creosote tanks. The distilled products from this plant go to the benzol washing house where, after treating with sulphuric acid to eliminate the basic bodies, and with caustic soda to remove the phenols, further acid treatment takes place to remove the more easily sulphonated bodies; from thence they pass to the steam rectifying still for the preparation of either benzol or toluol, or higher-grade benzene, toluene, and other xylenes.

The light oil and carbolic oil fractions are often re-distilled, as is the first fraction, and washed with sulphuric acid and soda also. From this source the later fractions give high-grade naphthalene; this latter product is passed to the naphthalene plant where, by means of hydraulic presses or centrifugal machines, a high melting-point "salt" is obtained, especially after re-distillation in a proper still, without difficulty.

The creosote fraction contains basic bodies of little commercial value, but considerable quantities of phenolic bodies may be secured by washing, and if necessary, naphthalene. The main bulk of the material, however, is utilisable without much treatment for timber preservation.

The anthracene fraction comes from the still as a dark yellowish green oil of buttery consistency when cold, and yields no basic or phenolic bodies of interest other than carbazole. When anthracene had a high commercial value this was an important fraction. At the present time, however, it does not pay most works to extract the anthracene, except to prepare heavy oil for lubricating purposes, only a high-grade "A" quality anthracene being worth any consideration.

Pitch residue.—The residue left in the still at the termination of the distillation is pitch. This body, or more correctly speaking, this combination of bodies, is used almost exclusively for the purpose of briquette manufacture.

Dehydrators.—Retracing our steps to the tar as first received at the works:—Of late years it has been found desirable to arrange some method for eliminating as much of the ammoniacal liquor as possible before the tar enters the still, and many means have been devised, the favourite one being to have a receptacle heated by waste steam or flue gases, or even conjointly with the condensers, to heat the tar to a point at which the water rises to the surface and distils over, or by means of a separate plant and series of various shaped stills to drive off some of the water and lighter products before the tar is conveyed into the tar stills for further distillation.

An engineering company in London has recently brought forward a plant capable to dealing with water in tar and also for the simultaneous extraction of the naphtha and light oils. The crude tar is pumped through a pre-heating coil, and thence to a coil still in which a temperature is maintained of over 100° C. Passing from this still, the vapours are drawn off and condensed and the tar, free from water, passes from the apparatus. The principle is good and might well be further developed.

Continuous stills.—First amongst this class of still in point of age, and also in the amount of tar worked through them at the present time, is the still designed by Mr. Frank Lennard, of Messrs. Forbes, Abbott, and Lennard. This still consists, in the first instance, of a long series of pipes laid in a furnace and carefully heated. The tar is pumped, under pressure, through this series of pipes running grid-iron fashion backwards and forwards from one side of the furnace to the other. The tar is heated by this means to pitch temperature and then, as the end of the furnace is reached, each fraction is allowed to condense in its order. The pitch remains at the first stage; next, the anthracene fraction is allowed to cool, and further creosote, then light oil and naphtha. The last condensing plant is wisely utilised to heat the crude tar before entering the furnace at the commencement of the operation.

It appears desirable to heat the furnace by means of some method other than by coal fire so as to obtain a regular temperature, which is the essence of the successful carrying out of the process. Properly speaking, this method should be indicated as a fractional condensation method of tar distillation. Another form of continuous still has been patented by W. Hugendick, of Essen-Ruttenscheid, who combines a pre-heater of pipes behind the still somewhat allied to the Lennard pattern, with a series of pot stills, and heats the tar before entering the pot stills with the chimney flue gases.

Another type of continuous plant is that designed by an Italian, Ettore Ray. This plant does not appear to have been extensively tested; its principle is that of heating the tar in a chamber at a considerable elevation and with one or more still heads. The light products are worked off in this chamber and thence to lower and still hotter chambers, eventually pitch being run off at the bottom as the final product. The characteristics of this form of fractional distillation appear to be of a correct type, but whether the plant can stand the crucial tests of present day practice, I have no information. Messrs. Poetter, of Dortmund, also have a plant of somewhat similar plan, but as far as I can learn, no large plant of this design has been erected.

In conclusion, a few figures which are submitted as to the general chemical trade of the country, and tar products export trade in particular, may be of interest.

Chemical exports for the United Kingdom have risen from £12,079,000 in 1903 to £17,059,000 in value in 1907, and later, but incomplete figures, point to a continued annual rise.

The imports of dyes and dyestuffs from January to December, 1909, were as under :—

	Cwt.	Value	£
Alizarine and anthracene	55,901	,,	244,196
Aniline and naphthalene	239,958	,,	1,318,727
Synthetic indigo	33,494	,,	117,100
Other coal tar dyes	713	,,	3,965
			1,683,988

United Kingdom :—Export of coal tar products from January to December, 1909 :—

—		Quantity.	Value.
			£
Aniline oil and toluidine	lb.	2,075,579	44,380
Anthracene	lb.	1,807,762	5,712
Benzol and toluol	galls.	2,374,681	80,987
Carbolic acid	cwt.	95,001	103,189
Coal tar, crude	cwt.	102,598	13,629
Refined tar and black varnish	galls.	2,692,080	43,630
Naphtha	galls.	773,240	27,089
Naphthalene	cwt.	90,376	21,880
Pitch	cwt.	9,959,629	595,651
Tar, oil, creosote	galls.	26,839,561	399,994
Other sorts	galls.	395,719	120,069
			£1,456,210

Theso figures point to the fact that while we import tar colours of considerable value, the balance of exports from the tar products industry goes a considerable way to pay for the material imported.

Uses for tar other than by distillation.—Having considered the coal tar distillation industry as such, it would, in conclusion, be worth while noticing briefly the uses of tar in other directions. As fuel, by itself or with coal or coke, it is consumed, especially at long distance from tar works. It is used in ever increasing quantities, but not with the best expert advice, in rendering roads dustless, especially where motor traffic is considerable. Those who have gained experience almost unanimously press for refined tar of make suitable to each district. Tar also finds its way into coal briquette factories, where the blocks are subsequently partially coked to get rid of the oily condition inseparable to the use of crude tar. A small quantity is also used in the manufacture of carbons for the electric arc.

New York Section.

Meeting held at Chemists' Club on Friday, October 21st, 1910.

DR. C. F. MCKENNA IN THE CHAIR.

DR. H. SCHWEITZER.

The following resolution was passed unanimously :

Whereas Dr. Hugo Schweitzer has resigned the office of Honorary Secretary of the New York Section of the Society of Chemical Industry, which Section was founded mainly through his instrumentality and effort, and

Whereas after sixteen years of unselfish and arduous service he is compelled by reason of pressure of other duties to retire from the office he has so successfully filled—

Resolved that we tender him the heartfelt thanks of the Section for his work in its behalf, and in accepting his resignation with great regret convey to him our earnest wishes for his future prosperity and happiness, and be it

Further Resolved that in token of the regard in which he is held by the Section, the Committee appointed for the purpose cause these resolutions to be spread in full on the Minutes of the Section, and present a copy thereof to Dr. Schweitzer in a permanent form signed by the officers of the Section and by the Committee.

Committee—T. J. Parker, E. G. Love.
Chairman—Charles F. McKenna.
Vice-Chairman—M. C. Whitaker.
Secretary—Parker C. McIlhiney.
Treasurer—F. C. R. Hemingway.

BUILDING UP AMERICAN CHEMICAL INDUSTRY.

BY DR. CHAS. F. MCKENNA.

In making my first appearance amongst you since this honour of the Chairmanship has been awarded to me, I cannot refrain from adding to my sincere words of appreciation some expression of views upon the prospects of our Society, upon our duties under the Charter by which we exist, and upon the hopes which we cherish of fulfilling them to advantage. It has seemed to me that this would go far towards vindicating your choice, for I cannot imagine that much more is required of your executive officers than that they shall be competent guides, who will pick the best roads, keep the lanterns bright, and show you what traps to avoid. In order that the views to be taken of chemical industry may have such perspective that the necessary appreciation of fullness, roundness, and extent may follow, I have asked more renowned members to take the floor with me to-night, and help marshal the facts which will enable all inside and outside the profession to survey the field which we are tilling, and see the rich rewards which are promised in it.

When this Society was founded in England in 1881 its principal object was thus stated :—" To advance applied chemistry in all branches." The same purpose guides the Society in Great Britain to-day ; the same impulse animates each of the sections. But it is only natural for us to say that we take an insular view of our position, and believe that one of the best and most direct ways for us to " advance applied chemistry in all branches " is to advance chemical industry in this country.

Though upon its establishment the Society grew to be almost world-wide, it is fair to assume that the men who assisted at its birth had chiefly their own country in view as the scene of its operations. We may be pardoned, therefore, for being ourselves provincial at times.

This country is the place in which we come in closest relation to the applications of chemical talent ; this is the field in which for us the possibilities are alike the encouragement and the cause of aspirations for grander development of our people. The chemical merchant, the chemical manufacturer, the professional chemist, must work together for the development of our department of human activity in our corner of the world. We feel that we can reach that development by healthy growth and stimulation of the chemical and technical activities of civilisation. Then if we would do so, let us look at the conditions.

The principal feature which always astonishes the economist in considering our material growth, the factor which always appeals to the American himself, is, the natural resources of America—the theme of the orator, the statesman, the editor, until we are threatened with exhaustion of our forests to supply the paper to print it all. Our beautiful and magnificent country affords us choice and diversified materials ; geological ages have stored up uncountable treasures—warm suns and moderate rainfalls bring horns of plenty annually. Nothing seems wanting but ourselves. These stored-up treasures and this periodic fertility are not met by us in the right spirit of responsibility and adequacy. Our resourcefulness is paralysed by the plenitude of our resources. We do not seem to think we need to learn how to adapt or trim down, or to consider relative proportions, or apply any of the means that meagre resources impose on the national economies of other peoples. We are lavish with our supplies, we cry for more and more kinds. We search for more and more minerals and neglect to study the possibilities of what we have. Instead of prospecting to add to the variety of our materials we should seek more keenly for diversified applications of those at hand, and above all for more efficiency with them.

Again, we should have more numerous factories, and we should have them better balanced topically. This was pointed out by Munroe (Trans. Am. Inst. Chem. Eng., 2, 99), who has found a surprising isolation of chemical and acid plants in the eastern part of the United States. This subject of location of factories is an interesting and many-sided one. There are two schools in the economic study of distribution, which is a study calling for special treatment in a country like ours, so spacious and yet so unevenly populated. One school would concentrate the producing units and increase the main lines of distribution; it would pay charges on crude material from mine or field or fishery to some manufacturing centre where skill is obtainable, and whence many lines—rail and water—radiate for carriage. The other school teaches a more altruistic doctrine, and ultimately the one that will rule. This is the utilization or treatment of the major raw material at each favourable point of occurrence, and the development of lines of distribution throughout its own vicinity. Some are apt to say: "Oh! this is no question of teaching or of doctrine." It is one of common-sense study of individual conditions: each manufacturer has to study:—Raw material supply; power or fuel supply; labour, competition, or market; and only last, distribution. But it must be admitted that the consideration in some cases given to this item is one-sided and thoughtful only of the near future. There has been too much following of custom; many are affected by inheritance of wrong ideas; locations have been made and are being made today which are ostrich-like in their self-protection, and leave out of consideration many factors of high value. For instance, the small market contiguous to a new factory can, by natural growth of the district to which the establishment itself will contribute, continue to grow and grow until it becomes a valuable market. If you want a large domestic market you must do everything yourself to make that consuming centre always prosperous. It is a principle in establishing a factory where a natural supply is to be used that the relation must be known which the term of exhaustion bears to the capital irretrievably planted there; why would it not be equally the part of wisdom to calculate for an indefinitely long term of prosperity in a given consuming centre by altruistically furthering a public improvement in that centre?

To illustrate: An investor in certain railway securities would oppose public aid for opening up an extensive new waterway; if he were at the same time the holder of securities covering a large coal-field to be drawn upon by the country along this waterway, would he not ultimately gain more by the establishment of factories there, and the introduction of a large coal consuming population? In other words, is not opposition to great public improvements as blind as it is selfish? Therefore, it seems to me that no special interests, particularly producing interests, should offer opposition to such enlightened struggles as are being made by the advocates of waterway extension, of new water routes, and of similar plans for increase of distributing facilities. Such improvements would rapidly and very materially change the appearance of a map showing locations of technical or chemical factories in this country. There is glory and profit enough for all, and I refuse to believe that the adventurous captain of industry who deserves more than the usual profit means by that to make himself a "hog," alone entitled to every acorn or nut that shall ever thereafter fall in the forest he has penetrated.

The basic mathematical principle of equity was ignored in the physical conception of economics to be effected by centralizing the plants for the purpose of reducing costs to the owning corporation.

It is now also important for our great merchants, and for manufacturers in the great technical industries, to consider the forces which are at work promising to modify commerce over the seas.

Opposition to the grandest improvement ever attempted to change land and water—the Panama Canal—has died away, because it is conceded that it will be ready for use within fifty months. What a stimulating effect it will have; what changes it will produce in commerce, and what the benefits of it will be to this country I have neither the knowledge of the world's commerce nor the time to set forth here; but I put the suggestion before you, and wish to express the hope that the astute minds of some may apprehend the effects clearly, and assure us that they will be immeasurably beneficial. Experts, let us hope, will soon begin to show how the directions of commerce will change, whether certain industries should settle in new localities to meet it, and what should be done by American shipowners, manufacturers, and merchants to avail themselves best of it.

Now, as to real progress in building up chemical industry, I think, next to the commendable development observable in the branches usually referred to as chemical, we can take most pride in the movement under way which is tending to tie the agricultural industry to ours. In our early days the mine was the first treasury drawn upon for technical exploitation, the field was left to provide sustenance alone, and few changes were made in the form of its products. Civilisation advancing brings large flocks of consumers, and brings also a larger consuming ratio; it is bringing now increasing demand for supplies other than alimentary which must be drawn from the tilled field. Corn is rising in price for the man who wants to eat it, because the small amount of oil in the germ goes to make some soap, some paint, and perhaps some rubber. So this and the other grains are also high-priced foods, because the industrial world wants a goodly proportion of the starch. The egg keeps its independent place in the market because, good or bad, it will be taken by the buyer of albumin. Gelatin would come more cheaply from the packers if there were only the old-time uses for it.

Now there are parallel influences at work in applied chemistry and agriculture, which, co-operating, will yet bring about marked changes affecting civilisation, and may even restore the millenium of low prices in foodstuffs. As such I would cite what chemical and allied sciences are doing to turn that agrarian institution called the farm, "Remote, unfriended, melancholy, slow," into an alimentary factory located at the very doors of the city.

Enjoying many of the comforts and pleasures of civilisation formerly denied them, farmers now apply a better knowledge of materials, processes, aids, power-applications, systems, cost studies, and economical distribution. Banding together, they acquire a power and mastery over resources that metropolitan capital would envy. Sought out in the back country by agents wanting their crops, they unite to produce from multiple acres, harvests which will attract the buyer or even bring about the location of a factory in their region.

The cane sugar "Centrale" and the beet sugar factory, where the farmer drives into the yard with his raw material, are now being imitated in rich pasture countries by the creamery and the factory for milk-powder, lactose, and casein. An extraordinary multiplication of this is promised by the success attained with vacuum driers of modest dimensions. One is also reminded of the advances which are coming in technical agriculture from the installation and operation of such apparatus at the harvesting of the grass crops. This change will increase the nutriment value, save loss by weather, and lessen transportation costs. These movements of solidification of the agricultural industry are going to be quickened by the incentive for the increase of yield per acre in every important crop. This increase will have its rise in the more plentiful supply of nitrogenous fertilisers from the electric furnace. It can be said with safety that a factor to keep ammonia at a low figure for fertilisers will be found in the great increase of by-product ovens in our country. Thus we can safely prophesy an agricultural heaven when water power is plentiful, electric nitrate cheap, when fields shall be watered by stored water, fertilised by products of the air, intensively cultivated, closely cropped, and when most of the products will be finished or treated on the farm or near by, and quickly distributed to large consuming centres by electrically operated railroad or boat. In the regions of special crops, such as cotton, flax, beet, etc., the fertilisation, harvesting, factory treatment and utilisation of wastes will present an unbroken chain. Could chemical industry furnish a higher example of triumphant economic forces acting with unison and harmony?

In the supplying of general lines of chemical substances or those produced from our technical establishments, there is no market equal to that springing from the agricultural demand.

I am reminded of a prophecy which I made seven years ago when writing the statistical article on Portland cement for Mineral Industry, Vol. XI., when the production was seventeen million barrels, and I said: "It is probable that if manufacturers to-day were not pressed to supply orders, but were rather seeking trade, the effort would take the form of supporting travelling schools of concreting. The influence of the good workmanship thus taught would spread from railroad engineering to farm engineering, house building, and other fields of activity where the economy of cement, its mode of treatment, and its successful applications have not yet been developed to their full values." Now in 1910, when the production has reached 62,500,000 barrels, Mr. Alfred Moyer of New York, an authority on market conditions of cement, writes: "The trade of the future is generally looked upon by cement interests, as coming from small users and especially from the farms. If every farmer in the United States was to put in a livestock feeding floor it would not only pay for itself in a year in saving fertilizer and feed, but the output of all the cement plants in the United States would be taken care of for one year. In other words, it would mean the consumption of more than 62,000,000 barrels. There are five and one-half million farms in the country, averaging 158 acres each, and it is the custom from these farms that cement manufacturers are thinking of when they build tremendous plants in such a year as this one has been." Why cannot similar things be predicted of the agricultural demand for fertilisers, fungicides, sterilisers, herbicides, cleansing agents, oils, and similar supplies, when we know what the experiment stations are doing to disseminate information?

Now, in considering how to build chemical industry to a higher plane, we might give a thought to the human element. The duties will not be overlooked of training better workmen and thinking more of these men after working hours and outside the factory gates, in striving for local civic improvement, avoiding discouragement, apathy, and cynicism, aiding education, advancing research. All of these are going to be performed as they have been in the past, but perhaps with a little more intensity, a little more enthusiasm and a little more perception of detail. There is none of us so humbly situated in the industry that we cannot find the occasion to do some of these things. Education of the learned and skilful chemist must be above all the object of earnest endeavour. Research must get all of the support for which it more and more craves. The movement for intensive studies of processes leading to utilisation of wastes hardly needs more encouragement than it is receiving under the stimulus of competition, but it is conceivable that a more generous attitude to investigators might prevail at times when the profitable outcome is not so evident. Truth for truth's sake has always been the cry of honest men; research for truth's sake is a good doctrine for the well run factory.

Finally, when we shall have perfected our approach to markets; when we shall have drawn more economically from the storehouses of the earth; when we shall have advanced scientific and technical education and quickened the civic conscience to a higher view of the industries and opportunities in them for good: then, indeed, we shall have fulfilled our destiny and leave to future generations a patrimony, not wasted, but conservatively used in the process of building up American chemical industry.

SOME ECONOMIC ASPECTS OF THE CHEMICAL INDUSTRY IN THE UNITED STATES.

BY DR. WM. H. NICHOLS.

When the results of the thirteenth census are made public it will be seen, I think, that the chemical industry of the United States has kept pace with the phenomenal growth of the country in other respects—in fact, being a basic industry, it depends so much upon manufactures in general, and these, in turn, depend so much upon it, that the mere growth of population will account in a large measure for its extension without looking elsewhere for reasons. The strides made in the development of our resources, however, have been an additional factor, and during the ten years just elapsed it will be found that many new industries have been established which depend more or less upon the chemical industry for their existence.

If a comparison were made between the chemical industry of this country and that of other countries, it would be found that the industry in this country in most respects is fully on a par with that of any other country, and in some respects is well in the lead. It is a public notion that our industry is coddled by the tariff, and is thereby based upon a somewhat insecure foundation. Like many other public notions, this is not true. It will be seen by casual examination of the imports that there are a number of chemicals which are not made in this country at all, and a number of others which are only made to a moderate extent. This is not due as much to lack of enterprise of the chemical manufacturers as the fact that the tariff is distinctly unfavourable to the manufacture of many chemicals which are produced in Europe on a large scale and whose manufacturers use this country as a "dumping ground." In our tariff all chemicals, unfortunately, are enumerated in Schedule "A." It has been the history of several revisions of the tariff that these revisions have been approached with a firm intention on the part of our legislators to lower the tariff, and they have begun on Schedule "A" with a great deal of enthusiasm. The rates of duty of this Schedule have been steadily reduced, and many articles placed upon the free list before the log-rolling, which is popularly supposed to form such an important part of all tariff inquiry, has begun to get in its work; hence the chemical industry has met with constantly lower tariff rates, while the materials which it has to use have often been left in a position unfavourable to chemical manufacturers. In the interest of fair play, it is to be hoped that when the tariff shall again be revised our legislators will begin at the other end of that document.

I think it may be stated safely that the chemical manufacturers of this country do not ask and have not asked any favours of the people which would result in any way in a fictitious advance in the values of their output. It is also fair to state that the chemical manufacturers of this country, while entirely friendly to one another, are in no way connected by agreements or "pools." While there may be exceptions to this of which I am not aware, I think this can be put down as a general statement, and I am sure it will be believed by all consumers of chemicals who come in contact with the active salesmen of the numerous companies.

In following the natural law of supply and demand,—which in my judgment is much more potent in the long run than any law produced by legislation—the prices in general which the manufacturers receive have been low enough to prevent the inordinate extension observed in some other industries, and I believe that to-day the production is about equal to the demand. Any considerable increase in the latter will have to be met by increase of production. This is an entirely healthy state of affairs, and I hope will continue for some time to come. There is no reason why consumers should have any fears as to obtaining their supplies; but I think they will not find them coming so readily and in some cases so cheaply as during the last few years. They may depend, however, upon getting them reasonably.

One of the extraordinary difficulties confronting the chemical manufacturer is the large first cost of factories as compared with the value of the product of those factories.

Some of the most important chemicals of all require so much expenditure in plant that the value of the output for a whole year, and in some cases for two years, would not equal the cost of the plant. This necessitates a calculation which is quite different from any other industry except agriculture. This is due partly to conditions which have always existed, and partly to the fact that consumers have become more and more exacting in their specifications as to purity of commercial chemicals, rendering necessary much larger investments than formerly. I look upon this fact as being creditable both to the consumer and to the chemical manufacturer, and believe that it is a condition which will become more and more apparent in the future. In this connection reference should not be omitted to the charges in processes and plant rendered necessary by the advance of chemical science itself. I can think of no other industry in which a plant or process may become obsolete in such a short space of time. The Chemical Company with which I have been so closely associated since its beginning has very little in the way of plant to-day which was in existence ten years ago. This is not due solely to the effects of wear and tear, but to the fact that advances of knowledge have been so considerable and the requirements of users of chemicals so much more exacting than ten years ago that what would do then will not do at all to-day. I think this will be found to be the case—at any rate in a large degree—with all the other chemical manufacturers, and is, perhaps, not generally understood by the public at large, although it has such a serious bearing upon the cost of manufacture.

The chemical manufacturer of this country is fairly well situated for his supply of raw materials in certain respects, and not so well in others. It has been said that sulphuric acid is the "pig iron" of the chemical industry. The production of that article in this country is enormous, but, unfortunately, the raw materials are, to a very great extent, imported. A large sulphur deposit is being worked in Louisiana by most ingenious engineering methods, and sulphur is said to be produced at a very low cost. However this may be, the consumer of sulphur has not up to the present time had any benefit from the low cost, and I presume there is no good reason why he should have. The great bulk of sulphuric acid, however, is made from various ores containing sulphur, and, unfortunately, certain of these do not occur to any great extent in this country, particularly in the Eastern portion, where the production of sulphuric acid is the greatest. Spain furnishes the great bulk of iron pyrites used here—some cupreous and some non-cupreous; and this, in a large measure, is true of that used in Europe. If the war with Spain had been of longer duration, and had been a more serious affair, the industries of this country would have been brought to a very sharp realisation of this fact. Metallurgical processes are also responsible for much of the sulphur which is used in the manufacture of sulphuric acid, and are likely to become more important in this regard, particularly in the middle West and West. We already have a considerable tonnage from the zinc industry in which sulphuric acid is a by-product, and lately from two copper mines in Tennessee which are utilising the sulphur of their ores quite ingeniously, and, I hope, successfully. Anyone who can add a cheap source of supply of sulphuric acid to this country will be doing a public service and will deserve encouragement. It will thus be seen that, taken as a whole, so far as raw materials are concerned, including nitrate of soda, we have no advantage in situation for the production of this "pig iron" of chemistry.

The largest branch of the chemical industry of the United States is that engaged in the manufacture of artificial fertilisers. In these the chief elements are sulphuric acid, phosphate rock, potash, and ammoniates. Of phosphate rock we have plenty to last for a number of years, and I have no fears in that regard so far as our children are concerned. I am beginning to think that our grandchildren may have a good deal of anxiety regarding this absolute essential to the growth of all crops unless chemistry again comes to the rescue. The potash, as is well known, is mined in Germany, and I hope that nothing, diplomatic or otherwise, will interrupt its steady flow in our direction, as this essential has not been found in large available quantities anywhere else in the world. Nitrogen we seem to have in increasing quantities, owing to the development of by-product coke ovens, tardy as this has been. It will, however, be a long time before we can feel assured of being able to fill the place of that most important source of nitrogen—nitrate of soda, the great deposits of which in Chili seem to be giving evidence that they are not limitless.

No important steps have yet been taken here to fix atmospheric nitrogen, although it is recognised that that source is absolutely necessary to the long-continued life of the race. With present knowledge, cheap electrical power is essential, and this is a problem not so easy of solution here as in Norway, due to the many industries able to outbid the chemist. The problem must be solved, however, and its difficulties make it all the more attractive.

The chemical industry of this country being so varied, I have thought best to confine my remarks to a very few of the economic aspects of the case. We have seen that it is not unduly assisted by the tariff; that it exists without price agreements or pools; that its production is about equal to the demand; that it labours under almost unique difficulties in cost of plant and changes made necessary by new conditions, and that as far as raw materials are concerned, it has nothing to boast of. In view of all this, the manufacturers have been equal to the demands upon them, which they have supplied without having to place values on the products which would act as a brake upon American industries in general. I think they will be found equal to the needs of the future, although all engaged in the industry realise the importance of many problems which are yet to be solved.

THE COLOUR INDUSTRY IN AMERICA.

BY HERMAN A. METZ.

RELATIONS BETWEEN THE METALLURGICAL AND CHEMICAL INDUSTRIES, WITH SPECIAL REFERENCE TO SULPHURIC ACID MANUFACTURE.

BY WALTER RENTON INGALLS.

The metallurgical industry may with some reason be called the predecessor of the chemical industry, not only historically, but also in the practice of the present day. When prehistoric man, emerging from the stone age, learned to make implements of iron and of bronze, he was utilising the discovery of some primitive metallurgist. In the middle ages, the alchemists seeking to produce gold became the fathers of chemistry, just as the astrologers were the earliest astronomers. In the history of every new country, our own included, one of the first branches of industry has been the production of metals. In almost all cases this has led, sooner or later, to the development of a chemical industry. This development has been natural, because without doubt the foundation of all chemical industry is the possession of sulphuric acid, and in the treatment of the largest class of ores the material for sulphuric acid is developed in the prosecution of metallurgical processes, conducted necessarily for the elimination of sulphur. We find in the operation of metallurgical works to-day a very large production of sulphuric acid which passes from those works into the chemical industry; and we may, therefore, rightly consider the metallurgist as the predecessor of the chemist, and the art of metallurgy as the trunk of a tree branching out into the wide expanse of modern industrial chemistry. Metallurgy is, in brief, the industrial chemistry of the metals.

Having drawn attention to sulphuric acid as the great link between metal production and chemical manufacture, I shall dwell chiefly upon this subject. It would be of value to all industries if we possessed up-to-date statistics of the production and consumption of sulphuric acid, but unfortunately we have neither. I deduced from the census report for 1900 that the production of sulphuric acid in the United States at that time was equivalent to 1,031,659 tons of pure acid, and computed that of the production about 49 per cent. was employed for the treatment of phosphate rock, 19 per cent. for petroleum refining, 6·8 per cent. for pickling iron and steel, 3·5 per cent. for the manufacture of nitric acid, 2·9 per cent. for hydrochloric acid, 1·8 per cent. for mixed acids, 1·6 per cent. for alum and aluminium sulphate, 1·5 per cent. for copper sulphate, 4·6 per cent. for ammonium sulphate, and about 6·3 per cent. for other purposes, including ferrous sulphate, chrome products, magnesium sulphate, etc.

During the last ten years the production of sulphuric acid has greatly increased. Perhaps I should not be far out of the way if I should surmise that it has doubled itself. If this idea be correct, the value of our sulphuric acid product at the present time is exceeded only by that of seven or eight other mineral substances. I have no means of outlining the proportionate consumption of sulphuric acid at the present time, and with a feeling of shame that we have to go back ten years for such statistical data, I refer to those figures merely as indicative. However, they show aptly the closeness with which the mining, metallurgical, and chemical industries are linked, because after being supplied with the acid the chemists go to the miners for the phosphate rock, sodium nitrate, bauxite, salt, chrome ore, and a number of other mineral products.

A particularly noteworthy feature of our metallurgical and chemical industry is the increasing extent of the production of sulphuric acid recovered as a by product. Although some of the pyrites concentrates coming from gold mills in Colorado and California have long been a source of sulphuric acid, the chief by-product acid in the United States until lately has been derived from zinc blende. The manufacture of acid from blende in the United States goes back to 1882 and was due to the initiative of Edward C. Hegeler, who died this year, leaving a name that will always be famous in the annals of zinc smelting. Thanks to him, this was a metallurgical and chemical development in which our country in no way lagged behind European practice. We not only begun this manufacture of sulphuric acid about as early as in Europe, but from the beginning we used an advanced method of blende roasting. In 1900 our production of sulphuric acid from blende was estimated at 60,000 tons, basis 60° B. In 1909, judging from the ore consumption of the zinc smelters making sulphuric acid, and the average grade of the ore, their production must have been in the neighbourhood of 200,000 tons.

This is a production of sulphuric acid that is destined to increase largely during the next five years, for the reason that the supply of natural gas in Kansas is rapidly waning, and a great expansion of the zinc smelting business in the coal fields of Illinois is to be anticipated. Every new works to be erected in Illinois will comprise a sulphuric acid adjunct. Three works, one of them of very large size, have been erected in that State during the last five or six years, and at the present time the plans for several very large works are being prepared.

The most important recent contribution of metallurgists to the chemical industry has been the manufacture of sulphuric acid from the gas of pyritic smelting furnaces. In the so-called pyritic process of smelting cupriferous sulphides, but little carbonaceous fuel is employed, and the heat of combustion of the sulphur and iron of the ore is utilised for the smelting. The gases discharged by such furnaces are fairly high in sulphur dioxide, running up to 6 per cent., and it was early considered that they might be utilised for sulphuric acid manufacture. There were, however, many difficulties of a metallurgical and engineering character to be solved, difficulties of the kind that generally appear when it is undertaken to perform two dissimilar operations as a continuous process. A furnace run for the best efficiency in ore smelting may not adjust itself naturally to the conditions of chambers and towers; and if adjustment be made to the latter, on the other hand, the primary process of ore smelting may suffer in efficiency. In this venture, moreover, the engineers were confronted by the process of adjusting to chambers and towers a pyrites burner, namely, the smelting furnace, of far greater size than had ever been previously employed in sulphuric acid manufacture, and the operation of chambers and towers with only a few burning units. These difficulties have been successfully solved, both at Copperhill and at Ducktown, and at the former place the Tennessee Copper Company will shortly be making 200,000 tons of tower acid per annum, while at the latter place the Ducktown Copper, Iron, and Sulphur Company is producing at the rate of about 60,000 tons per annum. This large production of acid, occurring in close proximity to one of the greatest phosphate fields of the United States, has had an important effect upon the fertiliser business and acid market.

Another recent development in sulphuric acid manufacture has been the increased utilisation of the cinder of non-cupriferous pyrites as iron ore. Up to the present time, this use is limited, but it is likely to increase. This, however, will be a case of utilising a by product of sulphuric acid manufacture for metallurgical purposes, rather than the reverse. A similar condition obtains with respect to sulphuric acid manufacture on the Atlantic coast in general. Pyrites containing a small percentage of copper is imported in great quantities especially for its sulphur content, but because of the copper existing in the residue the latter is passed on to metallurgical works. This condition has led to the development on the seaboard of metallurgical works as adjuncts to sulphuric acid works, whereas in the interior the acid works are the adjuncts to metallurgical works. On the Atlantic coast the value possessed by sulphur is often troublesome to the metallurgist, who sometimes finds himself hard pressed to obtain the sulphur required to make his matte, which is necessarily the first step in his process. The sulphur of the matte is eventually wasted as sulphur dioxide discharged from the converters. If it were feasible to make sulphuric acid from the converter gases, the smelter might be allowed to have all the sulphur required, leaving it for recovery in a later stage of his process. Experiments upon the manufacture of sulphuric acid from converter gases have been made at Mansfeld, in Germany, and have shown, I believe, that under the conditions existing there, sulphuric acid can be made from such gases. So far as I am aware, however, no work in this direction has been done elsewhere. In fact, at our great smelting centres there is no incentive toward experimentation in that direction, because in general there is a superfluity of sulphur rather than a dearth. The disposal of this superfluous sulphur, in a harmless way, is indeed one of the greatest metallurgical problems of the day. A large number of our most important smelters live in constant fear of litigation and injunctions over their smoke nuisances, alleged or real. In our own environs the Orford Copper Company has had trouble of this kind, while the smelters in Tennessee, Utah, California, and Montana have been, or are now, in trouble. At the present time, the Federal Government is prosecuting a case against the Anaconda Copper Company. The Federal Government has told that Company that it ought to render its gas innocuous by making sulphuric acid out of it. Inasmuch, however, as the Washoe works alone discharges enough sulphur to make 1,400,000 tons of tower acid per annum, and is considerably over 1000 miles distant from any important market, it is not clear how acid manufacture could be conducted successfully under such conditions. It is evident, however, from the fact, that this works, producing about 25 per cent. of the blister copper of the United States, throws away so large a quantity of sulphur, that there is not likely to be any scarcity of sulphuric acid in the interior of the United States, when the demand may justify its manufacture.

Journal and Patent Literature.

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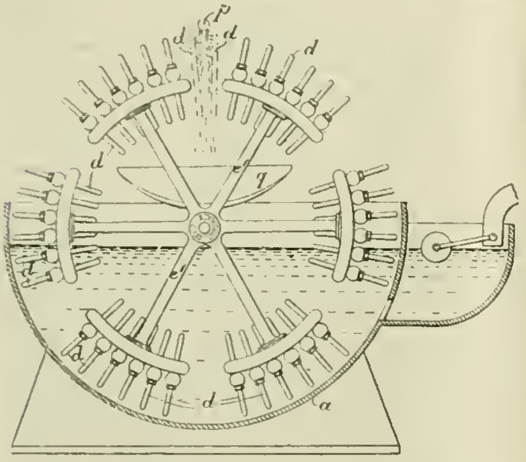
German.—1 mark each (with full particulars) to Kaiserlich Patentamt, Berlin, Germany.

I.—GENERAL PLANT; MACHINERY.

Patents.

Filtering apparatus. G. Johnston, Glasgow. Eng. Pat. 17,088, July 22, 1909.

The filtering frames, *d*, covered with suitable filter cloth, are rigidly fixed either singly or in groups to radial arms, *e*, projecting from a rotating hollow shaft so that the filtering frames are themselves radially disposed. As the shaft rotates, the frames enter the trough, *a*, placed below, and into which the liquid to be filtered is fed, in an almost horizontal position, pass through the liquid and emerge also in a horizontal position. During the time that the frames are immersed their interiors are connected through the hollow shaft to a vacuum pump which draws off the filtered liquid. As the frames rise out of the liquid, the vacuum is automatically cut off and when they are vertically over a trough, *q*, placed just above the axis, compressed air is supplied through another channel in the shaft and blows the cakes off, being assisted by a stream of water directed against the faces of the plates from the perforated pipe, *p*.—W. H. C.



Solids from liquids; Machine for collecting ——. H. Parker, Assignor to Improved Paper Machinery Co., Nashua, N.H. U.S. Pat. 974,989, Nov. 8, 1910.

The mixture of solids and liquids is fed into a drum, the shell of which is made of material pervious to liquids but impervious to solids and which is rotated horizontally in a trough. The solids are carried round by the shell of the drum as it is rotated and dropped into a centrally disposed trough provided with a screw conveying worm and situated just above the axis of the drum; they are discharged from the end of the trough by the screw. Several superposed troughs and drums are combined and worked in series. The liquid is discharged from the centre of each outer trough.—W. H. C.

Vapours and gases with liquids and molten substances; Apparatus for contacting of ——. F. Pritchard, Huyton, Lancs. Eng. Pat. 25,299, Nov. 3, 1909.

A dished plate having its convex side downwards is immersed just below the surface of the liquid in each segment or element of the apparatus and the gas which is delivered below the centre of the plate is compelled to take a tortuous path towards the periphery by an arrangement of spiral and zig-zag baffles projecting from the under side.—W. H. C.

Bringing a gas into contact with a liquid; Apparatus for ——. H. T. Durant and The Metals Extraction Corporation Ltd., London. Eng. Pat. 25,679, Nov. 6, 1909.

A vertical scrubber tower contains two or more pairs of conical or pyramidal contact-elements each comprising a series of overlapping conical or pyramidal rings spaced apart. The contact-elements are arranged base to base and apex to apex, the liquid flowing alternately over the outside of an upright, and over the inside of an inverted, element; while the gas passes respectively out of, or into, such element, through the spaces between the overlapping rings. Claim is made for the use of the apparatus in the treatment of roasted zinc (or other) ores by suspending them in water and subjecting the mixture to the action of the sulphur dioxide evolved during the roasting operation.—W. E. F. P.

Cooling water or air, or treating gases with liquids; Apparatus for ——. H. Heenan, Manchester. Eng. Pat. 28,656, Dec. 8, 1909. Addition to Eng. Pat. 6452, March 18, 1909.

The apparatus is similar to that described in the original patent (this J., 1910, 9) except that the corrugation of the sheet-metal spiral is longitudinal instead of transverse, resulting in a more continuous flow of the liquid over the metal surface.—W. E. F. P.

Liquefying gases with a low boiling point. G. Hildebrandt, Berlin. Eng. Pat., 3316, Feb. 10, 1910.

Compressed gas is caused to issue from an expansion valve into a conical nozzle, the cross section of which increases in such a way that the falling pressure and increasing velocity of the gas expands it to or below atmospheric pressure. The heat absorbed in this process causes the liquefaction of a portion of the gas. In order to avoid loss of heat and to obtain an almost adiabatic expansion, the expansion valve and the upper part of the nozzle are surrounded by a chamber through which the compressed gas has to pass on its way to the expansion valve. In this way the gas is cooled and any foreign gases of higher boiling point are liquefied in this chamber and are drawn off through a suitable valve, so that only the pure gas enters the expansion valve. In order to avoid friction, the part of the nozzle adjacent to the expansion valve is made cylindrical for a short distance so that the issuing gas does not come into immediate contact with the wall.—W. H. C.

Raising and forcing liquids. K. I. Crossley, Manchester, and J. Atkinson, Stockport. Eng. Pat. 3690, Feb. 15, 1910.

The claim is for an improved pump, operated by explosion, of the type described in Humphrey's Eng. Pat. 20,736 of 1906. It consists of an explosion chamber provided with inlet and outlet valves and an exploding device, connected by a short pipe or main with an air-vessel and by a long pipe or main with the delivery point; it is also connected by a valve with a supply of the water to be pumped. The proportions of the chambers and mains are so adjusted that four cycles occur in the explosion chamber, the short main and the air vessel, for two in the long delivery main. On an explosion taking place, the water is driven along the two mains but the velocity in the short main is greater and the air in the air-vessel is compressed and expands again, driving the water back into the explosion chamber and forcing out the products of combustion until the exhaust valve closes. During this time the water is moving outward, but slowly in the delivery main. The water continues to move outwards and draws after it the water from the explosion chamber, causing a fresh charge of gas to enter through the inlet valve. At the same time it draws in a fresh supply of water through the water inlet valve. After a certain time the outward motion of the water in the long main is brought to a standstill by the head against it and it returns, closing the water inlet valve and compressing the charge of gas in the explosion chamber ready for the next explosion.—W. H. C.

Impregnating liquids with coagulant ; Apparatus for ——. J. W. Ledoux, Swarthmore, Pa. U.S. Pat. 976,665. Nov. 22, 1910.

The apparatus consists of a container which is kept filled to a certain level with the liquid to be treated, the latter being fed into the container at a constant speed. The solution is also withdrawn at a constant speed. An inverted conical vessel is suspended over the tank and has its lower end immersed in the liquid. The "coagulant" or solid to be dissolved is fed into this vessel at a constant rate, so that there is always a constant quantity of the solid immersed in the liquid.—W. H. C.

Evaporating apparatus. L. Kauffmann. Ger. Pat. 225,682, Nov. 28, 1908.

The heating agent is supplied to the heating chamber in the lower part of the apparatus through a central pipe passing through a stuffing-box in the top of the evaporator and extending downwards through the evaporating chamber.—A. S.

Distilling apparatus ; Vertical —— *for the distillation of tar, oil, etc.* R. Barlen. Ger. Pat. 228,297, April 17, 1909.

Vertical distilling apparatus is provided with a number of heating tubes, which enter one side of the apparatus, pass through it horizontally, and pass out on the opposite side ; any number of these tubes are supplied, at convenient distances apart, so that intense heat may be applied when necessary. One end of each of the tubes is connected with a regulated supply pipe, through which the heating medium is introduced, whilst the other end leads into an annular channel which surrounds the apparatus, so fixed that the heating medium has to traverse this before it escapes.—T. F. B.

Crystals ; Process and apparatus for obtaining ——. Act.-Ges. für Vacuum-Verdampfanlagen. Ger. Pat. 228,663, Dec. 24, 1909.

The concentration of the solution and the cooling of the concentrated solution are effected in the same vessel, the lower cooling zone being at such a distance from the concentrating zone that the intermediate layer of liquid is of sufficient depth to prevent substantial exchange of heat between the portion of the solution being cooled and the portion being concentrated.—A. S.

Distilling ; Method of and apparatus for ——. A. G. Waterhouse, New York, and T. F. Bourne, Montclair, N.J., U.S.A. Eng. Pat. 25,638, Nov. 6, 1909.

See U.S. Pat. 939,361 of 1909 ; this J., 1909, 1322.—T. F. B.

Desiccation of air and other gases. Soc. L'Air Liquide, Paris. Eng. Pat. 18,698, Aug. 8, 1910. Under Int. Conv., Aug. 9, 1909.

See Fr. Pat. 416,556 of 1909 ; this J., 1910, 1363.—T.F.B.

Steam turbine blades made from pure iron and nickel. Eng. Pat. 27,217, 1909. *See* X.

IIa.—FUEL ; GAS ; MINERAL OILS AND WAXES

Benzene in petroleum spirit (petrol) used in motors ; Determination of ——. G. Halphen. Les Matières Grasses, 1910, 3, 1987—1990.

Numerous products have recently been put upon the market as substitutes for petroleum spirit (petrol) for motor cars, and are largely used, especially in Paris, owing to their lower price due to differences in the *octroi* duties. They consist of mixtures in varying proportions of benzene with petroleum spirit or of pure benzene. The sp. gr. of these mixtures (0·750 to 0·760) affords an indication of the presence of benzene (sp. gr. 0·880). According to Giron the types of petroleum spirit supplied to motorists have approximately the following characteristics :—

	Roumanian.	Austrian.	American.
Sp. gr. at 15° C.	0·725	[illegible]	0·7024
Per cent. distilling below 75° C.	17	9·5	[illegible]
Per cent. distilling from 75° to 125° C.	74	87	88
Per cent. distilling above 125° C.	9	3·5	8·6

Other petroleum spirits with a higher sp. gr. (about 0·735) are also frequently met with. The presence of 5 to 10 per cent. of benzene in such petroleum spirits might be detected by the fact that asphaltum is soluble in benzene but not in petroleum spirit. The method of Kramer and Böttcher, which is based upon the diminution in volume on shaking the petroleum spirit with a mixture of strong sulphuric acid and fuming sulphuric acid, is inaccurate, owing to simultaneous absorption of olefines and polymerisation of certain hydrocarbons. In the author's method of separation the benzene hydrocarbons are converted into mononitro-derivatives, which are then absorbed by sulphuric acid, and the amount of benzene is calculated from the increase in volume of the acid. In preliminary experiments it was found that the pure petroleum spirit gave apparent yields of benzene in the following proportions :—American petrol, 0·87 ; Roumanian, 1·74 to 3·48 (7 samples) ; and Russian, 3·04 per cent. (5 samples). It was therefore necessary to subject the samples to a preliminary shaking with an equal volume of sulphuric acid (66° B.) so as to remove, before the nitration, the bulk of the hydrocarbons capable of absorption by the acid. Ten c.c. of the petroleum spirit thus purified are placed in a flask closed with a stopper pierced with two holes, through one of which passes the stem of a stoppered funnel containing 10 c.c. of fuming nitric acid, whilst a long tube passes through the other. The acid is added 4 or 5 drops at a time, the flask being meanwhile continually shaken and cooled in water, and the shaking is subsequently continued for 5 to 7 minutes. After the nitration is complete, 10 c.c. of water are introduced, little by little, through the funnel, whilst the flask is still kept cool, and then 40 c.c. of water, which may be added in one volume, and the flask is well shaken and cooled, so that the nitrous vapours are absorbed. The products of the nitration are now transferred to a separating funnel, the flask being rinsed out with 10 c.c. of the purified petroleum spirit, and the whole shaken for a few seconds and allowed to stand for 30 minutes. The aqueous layer and any insoluble oil are then drawn off, and the petroleum spirit layer containing the nitro-derivatives in solution is transferred to a stoppered graduated cylinder with a capacity of 30 to 35 c.c., where it is shaken with 5 c.c. of sulphuric acid (65·5° B.). The cylinder is then allowed to stand for 30 minutes, after which the increase in volume of the acid is noted. This increase multiplied by 0·87 gives the volume of benzene in the quantity of sample taken. The following results illustrate the accuracy of the method :—Roumanian petroleum (containing 1·30 per cent. of substances behaving like benzene), with 5 per cent. of added benzene, yielded 4·78 per cent. ; and with 20 per cent. added, gave 19·14 per cent. Since about 8 volumes of petroleum spirit (of sp. gr. 0·7) are required to dissolve one volume of nitrobenzene the sample under examination must not contain more than 20 to 25 per cent. of benzene. When a greater proportion is present the sample must be diluted with petroleum spirit.—C. A. M.

Patents.

Combustion of mixed gases. W. A. Bone and J. W. Wilson, Leeds, and C. D. McCourt, London. Eng. Pat. 25,808, Nov. 9, 1909.

An explosive mixture of gases is passed through a porous diaphragm and burned on the outer surface, the flow being so regulated that combustion takes place substantially within the outer surface layer which is thereby maintained in a state of incandescence. The diaphragm may be of any form and may be arranged in any position according to the purpose to which it is to be applied, but the rate of flow of the gas must be sufficient to prevent firing back through the diaphragm, and the arrangements must be such that the inner portions of the diaphragm do not become heated to the ignition temperature of the gaseous mixture. For example a diaphragm suitable for working with a mixture of coal-gas with 6 or 7 volumes of air at a pressure of six inches of water is prepared by mixing 18 parts of powdered Stourbridge fireclay with 8 parts of English rape-seed and burning out the organic material: such a diaphragm, when made ¾ in. thick, admits of a flow of 6·4 cb. ft. per hour per sq. in. of heating surface. The apparatus may be applied to heating an incandescent surface for lighting purposes as well as to heating purposes of all kinds.—H. H.

Combustion of gaseous fuel. W. A. Bone and J. W. Wilson, Leeds, and C. D. McCourt, London. Eng. Pat. 29,430, Dec. 16, 1909.

The accelerating influence of an incandescent solid upon gaseous combustion is utilised in furnaces by causing a mixture of combustible gas and air in the proper proportions to ignite within a mass of refractory material surrounding, or partly surrounding, the body or chamber to be heated. For gases of low calorific value such as blast-furnace gas or producer gas, the refractory material may be calcined fireclay or ganister, but for gases such as coal-gas or hydrogen a more refractory material such as carborundum or calcined magnesite must be employed. The granules of refractory material, the sizes of which vary from about ⅛ in. to 2 in. in diameter according to the size of the furnace, may either be packed loose or fritted together. The passage through which the combustible mixture enters the furnace must be of such length and cross-section as to prevent back-firing through it, and the pipe leading to it may require to be water-cooled.—H. H.

Gas producers; Suction or other ——. H. J. Grice, Birmingham. Eng. Pat. 26,169, Nov. 12, 1909.

A divided boiler is fitted at the top of a gas producer, one part being used for raising low-pressure steam for the ordinary working of the plant, and the other for generating high-pressure steam which may be utilised for any other purpose. The grate upon which the fuel rests is composed of endless chains carrying scrapers, which may be operated by a hand-wheel to remove clinker.—H. H.

Gases from coke ovens or gas retorts; Treatment of ——. A. O. Jones, Whitley Bay, Northumberland. Eng. Pat. 26,428, Nov. 15, 1909.

The gases are passed at a temperature of about 110° C. through a body of liquid tar at a similar temperature. The tar and lighter hydrocarbons contained in the gas are extracted by this means, while the ammonia passes over with the gas and uncondensed water vapour to a vessel containing sulphuric acid at about 100° C. where the ammonia is fixed.—H. H.

Cooling coal gas and the like; Process and apparatus for ——. O. Benninghoff and A. Klönne, Dortmund, Germany. Eng. Pat. 13,978, June 9, 1910.

To prevent subsequent condensation of naphthalene, the gas after cooling to the atmospheric temperature is again heated before leaving the outlet pipe of the cooler. For this purpose the outlet pipe is arranged to pass through the hot gases near the gas inlet. A regulating valve controlling a branch opening is placed in that part of the outlet pipe which is inside the cooler at about the middle of its length, so that a portion only of the cooling surface may be utilised when a less thorough cooling is desired. —H. H.

Purifier for combustible gases with louvres at the gas inlet and outlet. E. Schmidt. Ger. Pats. 225,734, Sept. 9, 1908, and 225,946, Sept. 11, 1909.

The patents relate to purifiers in which louvre-partitions are disposed at the inlet and outlet. When the purifiers are working, the material soon balls together, leaving free spaces at the sides and top, through which the gas can travel directly from the inlet to the outlet, without passing through the purifying material. In order to prevent this, ∩-shaped partitions connected above and at the sides with the walls of the purifier are arranged adjacent to the louvre-partitions. In order to facilitate the emptying of the purifiers, the louvre-bars are made of some incombustible substance with a smooth surface, *e.g.*, enamelled iron, porcelain, or wire-glass.—A. S.

Distilling shale and other bituminous substances; Apparatus for ——. J. Noad, East Ham, Essex. Eng. Pat. 18,334, Aug. 9, 1909.

To secure gradual and uniform heating in vertical retorts, the sides of the retort are made of stepped cylindrical formation with the widest diameter uppermost, the lowermost part of the retort being subjected to the greatest heat. Inside the retort are arranged rotary arms adapted to sweep round the ledges and gradually work the material, which is fed from hoppers on to the highest ledge, downwards from ledge to ledge. The exhausted shale is discharged at the bottom, and the vapours evolved are led off from the still head to condensing plant in the usual manner.—H. H.

Coke-ovens; Burner for ——. F. W. C. Schniewind, New York. U.S. Pat. 976,929, Nov. 29, 1910.

See Eng. Pat. 10,482 of 1909; this J., 1910, 683.—T. F. B.

Coke-oven and heating arrangement therefor. F. W. C. Schniewind, New York. U.S. Pat. 976,930, Nov. 29, 1910.

See Eng. Pat. 10,484 of 1909; this J., 1910, 870.—T. F. B.

Coke-oven and door therefor. F. W. C. Schniewind, New York. U.S. Pat. 976,931, Nov. 29, 1910.

See Eng. Pat. 10,486 of 1909; this J., 1910, 683.—T. F. B.

Coal gases; Apparatus for removing tar from ——. F. J. Brougham, London. From Solvay et Cie., Brussels. Eng. Pat. 7915, April 1, 1910.

See U.S. Pat. 963,401 of 1910; this J., 1910, 936.—T.F.B.

Hydrocarbons; Process for solidifying liquid ——. V. Rosculet, Lassy, Roumania. Eng. Pat. 4337, Feb. 21, 1910.

See Fr. Pat. 412,892 of 1910; this J., 1910, 1096.—T. F. B.

Vertical distilling apparatus for tar, oil, etc. Ger. Pat. 228,297. *See* I.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Patents.

Incandescing bodies for use in incandescent gas lighting; Manufacture of ——. M. von Unruh, Berlin. Eng. Pat. 30,148, Dec. 24, 1909.

An incandescent material is prepared by mixing suitable fibres, which have been impregnated with "lighting salts," with organic or inorganic salts of thorium, cerium, erbium, zirconium, thallium, or their double salts, or a mixture of these salts with an organic binding substance, the material being given the desired form, dried, and subjected to sufficient heat to destroy the organic substance. Colloids may be used as the binding substance with the addition of sugar, glycerin, water, etc., and while in the plastic state the material may be forced through fine holes to obtain threads of 2 mm. diameter. If magnesium salts are added to the mixture the organic binding substance may be dispensed with.—H. H.

Filaments for use in metallic filament glow-lamps; Process for decarbonising ——. Wolfram Lampen Akt.-Ges., Augsburg, Germany. Eng. Pat. 14,116, June 10, 1910. Under Int. Conv., June 26, 1909.

Methane at a few millimetres pressure is admitted to the bulb containing the filament. An electric current is then passed and the filament raised to incandescence, when the carbon in the filament combines with the methane forming a gaseous compound richer in carbon which is removed when the bulb is exhausted.—W. H. C.

Electric filaments; Manufacture of ——. C. A. von Welsbach, Vienna. Assignor to Welsbach Light Co., Gloucester City, New Jersey. U.S. Pats. 976,526, 976,527, 976,528, and 976,616, Nov. 22, 1910.

(1). A filament for an electric incandescent lamp is composed of osmium particles electrically welded into a dense, coherent and elastic self-sustaining strip or thread, which will become incandescent at a temperature above that at which platinum melts. The filament may be coated with thoria. (2). A thread of osmium or other metal having a higher point of fusion than that of platinum is produced by associating the metal with an organic material, subjecting the thread to dry distillation, eliminating the carbon by the electric current in a suitable atmosphere and fritting the particles together at a temperature at which platinum would volatilise. (3). Electric lamp filaments are connected with the ends of the leading-in wires by a cement paste containing osmium and a carbonaceous agglutinant, the latter being removed by subjecting the paste to heat in the presence of reducing gases containing water vapour. (4). An electric lamp filament is formed of a number of superimposed minute layers of osmium. The layers may be deposited upon a metal wire which is subsequently volatilised at any temperature up to the volatilisation point of platinum, a hollow thread being thereby produced. Any metal which is infusible at the temperature of volatilisation of platinum may be used instead of osmium.—H. H.

Filament or resister for [electric] heating units or lamps. H. C. Parker and W. G. Clark, Assignors to Parker-Clark Electric Co., New York. U.S. Pat. 976,207, Nov. 22, 1910.

See Eng. Pat. 18,954 of 1909; this J., 1910, 1097.—T. F. B.

III.—TAR AND TAR PRODUCTS.

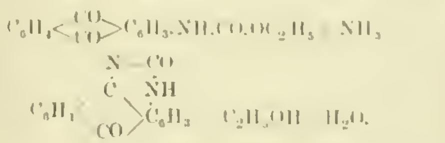
Patents.

Oxygen in fire-gases [for tar distillation]: Apparatus for the fixation of the free ——. F. Wolf. Ger. Pat. 228,208, Feb. 12, 1909.

In the continuous distillation of tar by direct contact with fire-gases, it is essential that the latter be free from oxygen and be kept under pressure, so that air cannot diffuse into the apparatus from outside. According to the present patent the pressure is produced by means of a fan, and in order to protect the latter from the heat, the fire-gases are first cooled somewhat by passing them through a coke filter, then passed to the fan, and afterwards forced under pressure through the coke filter again, in order to take up the heat previously withdrawn from them and to remove any free oxygen which they may contain.—A. S.

Anthrapyrimidines and anthrapyrimidones; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 225,982, April 11, 1908. Addition to Ger. Pat. 220,314, March 21, 1908 (this J., 1910, 552).

Anthrapyrimidines and anthrapyrimidones are obtained by the action of ammonia on α-aminoanthraquinones or their derivatives, the amino group of which is substituted by acidic groups, thus:—



$$C_6H_4<{}^{CO}_{CO}>C_6H_3.NH.CO.OC_2H_5 + NH_3 =$$

$$C_6H_4 \ldots >C_6H_3 + C_2H_5OH + H_2O.$$

—T. F. B.

Vertical distilling apparatus for tar, oil, etc. Ger. Pat. 228,297. See I.

IV.—COLOURING MATTERS AND DYES.

Patents.

Ortho-oxyazo dyestuffs; Production of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 532, Jan. 8, 1910.

o-Hydroxyazo dyestuffs of the pyrazolone series are obtained by combining the diazo-derivatives of o-aminophenol-sulphonic or carboxylic acids or their derivatives with ethyl acetoacetate or its analogues and condensing the monoazo-dyestuffs thus produced with hydrazines of the aromatic series. Example: 13 parts of ethyl acetoacetate are added to the diazo-compound produced from 22·3 parts of 4-chloro-2-aminophenol-6-sulphonic acid and the mixture is rendered slightly alkaline. 10·8 parts of phenylhydrazine are now added to this intermediate compound and the mixture is stirred for some hours at 80° C. On cooling, orange crystals separate which dye wool in orange shades becoming red when chromed. —J. C. C.

Vat dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2105, Jan. 27, 1910. Addition to Eng. Pat. 7819, April 1, 1909.

Dyestuffs possessing similar properties to those obtained according to the principal patent (this J., 1910, 81) are prepared by condensing dihalogen derivatives of indoxyl or their acetyl derivatives, with acenaphthenequinone or its halogen derivatives, in presence of nitrobenzene, chlorobenzene, or other solvent. The dyestuff prepared by condensing 5.7-dibromodiacetylindoxyl with acenaphthenequinone is identical with that described in Eng. Pat. 27,773 of 1909 (this J., 1910, 1296).—T. F. B.

Monoazo dyestuff specially suitable for the preparation of pigment colours; Manufacture of a new ——. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 19,000, Aug. 12, 1910.

The dyestuff is prepared by combining diazotised 2-naphthylamine-4:8-disulphonic acid with 2:3 hydroxynaphthoic acid in alkaline solution. The colour lakes produced from it by the usual means are of a very bluish red shade.—J. C. C.

Anthraquinone derivatives [*dyestuffs*]. E. Hepp and C. Hartmann, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 975,863, Nov. 15, 1910.

By heating 1:5-diaminoanthranol, preferably in the presence of a solvent, a dyestuff is obtained which gives a red vat; from this cotton and wool are dyed in grey to black shades.—J. C. C.

Monoazo dyestuffs; Process for preparing mordant ——. Anilinfarben- u. Extract-Fabr. vorm. J. R. Geigy. Ger. Pat. 226,242, Oct. 2, 1909.

The diazo compound of *p*-nitraniline-*o*-sulphonic acid is combined with salicylic acid or its homologues, either in presence of alkalis or of oxides or hydroxides of magnesium, zinc, or alkaline-earths; for example, the two components may be mixed together, with cooling, and the necessary quantity of sodium carbonate or ammonia solution very slowly added. The resulting dyestuffs are faster and more soluble than the dyestuffs from *p*-nitraniline and salicylic acid.—T. F. B.

Vat dyestuff: Process for preparing a red ——. Ges. f. Chem. Ind. in Basel. Ger. Pat. 226,244, Feb. 7, 1909. Addition to Ger. Pat. 212,858, Jan. 1, 1908 (see this J., 1909, 1029).

Acenaphthenone is condensed with 2.3-diketo-dihydrothionaphthene, $C_6H_4<\substack{S\\CO}>CO$; condensation takes place with the carbonyl carbon atom directly connected with the sulphur, the resulting dyestuff being identical with that described in Eng. Pat. 344 of 1908 (this J., 1908, 399).—T. F. B.

Indigo; Process for preparing chloro derivatives of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 226,319. Jan. 5, 1908. Addition to Ger. Pat. 160,817, Feb. 24, 1904.

Indigo or its mono- or di-halogen derivatives (or the corresponding Indigo White compounds) are treated with sufficient chlorine to form higher halogenated products, which are then treated with alkali hydroxide solutions. Tri- and tetrachloro-indigos are obtained in this manner. —T. F. B.

Azo dyes directly dyeing cotton; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 26,700, Nov. 17, 1909.

See Fr. Pat. 409,376 of 1909; this J., 1910, 686.—T. F. B.

Dyestuffs of the triphenylmethane series; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1411, Jan. 19, 1910.

See Fr. Pat. 411,709 of 1910; this J., 1910, 937.—T. F. B.

Dye. M. Weiler, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 976,417, Nov. 22, 1910.

See Fr. Pat. 411,306 of 1910; this J., 1910, 937.—T. F. B.

Monoazo dye for lakes. K. Schnitzspahn, Offenbach, Assignor to Chem. Fabr. Griesheim Elektron, Frankfort on Maine, Germany. U.S. Pat. 976,401, Nov. 22, 1910.

See Eng. Pat. 19,000 of 1910; preceding.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Oxycellulose; Properties and formation of ——. L. L. Lloyd. J. Soc. Dyers and Col., 1910, 26, 273—274.

The test for oxycellulose is best carried out as follows:—The cotton is boiled with water, about one-fifth the volume of Fehling's solution is added, and the vessel is suspended for about half an hour in boiling water. The cotton is removed and washed with water. With material which gives by tensile tests 5 per cent. tendering, a faint pink deposit is observed on the material; increase in the amount of oxycellulose will, in some cases, also cause cuprous oxide to be precipitated in the liquid. Oxycellulose is formed by the action of many metallic salts on moist cotton at 50° C. The amount produced depends on the time and temperature of ageing and on the amount and nature of the metallic salt present. The metals, the salts of which act in this case as catalysts, are, in the order of their activity, copper, cobalt, manganese, nickel, iron, and, to a small extent, chromium. Their most active salts are nitrates, then chlorides and finally sulphates. The oxycellulose produced may be reduced by various agents but the tendering remains unaltered.—J. C. C.

Paper making; Philippine fibres and fibrous substances: their suitability for —. G. F. Richmond. Philippine J. Sci., 1910, 5, 233—255.

Experimental trials under, as far as possible, factory conditions, with two-year old bamboo, showed that while a good yield of pulp could be obtained by the sulphite process, this could not be properly bleached by bleaching powder, even when an excessive quantity of the latter was used. By the use of the soda process, on the other hand, 43—45 per cent. of air-dried unbleached pulp could be obtained, which bleached well with 12—15 per cent. of bleaching powder. The fibre is strong and of good felting capacity. Since there is an abundant supply of bamboo in the Philippines, the problem resolves itself into a question of cost. Details are given of the cost of installation and probable cost of working for a soda pulp mill with a daily production of 20 tons, and it is estimated that unbleached air-dried bamboo pulp could be produced at a price of 21 dollars per short ton, f.o.b. Manila, and hence capable of competing with chemical wood pulp in Japan, Europe, Australia, and the Pacific coast of America. (Compare also Sindall, this J., 1907, 1157; and Raitt, this J., 1908, 35). Reference is also made to the abundance of lalang (cogon) grass in the Philippines and a report by J. S. Remington is quoted as to the suitability of this material for paper-making. (See also this J., 1906, 863; 1907, 274, 941.)—A. S.

Patents.

Cleansing by means of benzine, benzol and the like, and apparatus therefor; Method of chemical ——. H. J. Haddan, London. From F. Lüttgen Wwe., Bärendorf, Germany. Eng. Pat. 1641, Jan. 21, 1910.

The materials to be cleaned are placed in a rotatable drum which is partly filled with the benzine or other cleansing agent. The space above the surface of the liquor is filled with ammonia gas which has been previously dried. When the drum revolves on its axis, the materials inside it are alternately brought into contact with the cleansing liquor and with the ammonia.—P. F. C.

Silk fibroin; Process for obtaining ——. C. R. Baumann, Gavirate, Italy, and G. G. Diesser, Zürich, Switzerland. U.S. Pat. 976,977, Nov. 29, 1910.

See Fr. Pat. 396,305 of 1908; this J., 1909, 597.—T. F. B.

Retting process; Industrial microbiological vegetal —— *by pectic aerobic microbes in a gas current.* G. Rossi, Portici, Italy. U.S. Pat. 977,133, Nov. 29, 1910.

See Fr. Pat. 388,651 of 1908; this J., 1908, 977.—T. F. B.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing, tanning and vulcanisation; Comparison between the action of —. W. P. Dreaper. J. Soc. Dyers and Col., 1910, **26**, 268—273.

The author points out that there is much similarity between dyeing and tanning in that the solution phenomena are comparable and are closely concerned with the colloidal condition. The processes of adsorption, which are here involved are also paralleled in the case of vulcanisation.
—J. C. C.

Iron Buff, Prussian Blue and Manganese Bronze. E. Knecht. J. Soc. Dyers and Col., 1910, **26**, 266—267.

Level dyeings of these colours may be produced by employing tannic acid as the fixing agent for the iron or manganese and subsequently destroying the tannic acid on the fibre by suitable means. To produce a delicate shade of Iron Buff, cotton yarn is steeped overnight in a bath containing ½ per cent. of tannic acid. It is then wrung out and passed through a bath of nitrate of iron (1° Tw.). The destruction of the tannic acid and the better fixation of the iron is effected in another bath containing sodium peroxide. Prussian Blue is produced on the similarly tanned fibre by fixing in "black liquor" (acetate of iron) and transferring it to a bath containing acidified potassium ferricyanide. For the production of Manganese Bronze the tanned cotton is immersed in potassium permanganate solution. By treating the shades in a bath of hot dilute sodium hydroxide they are rendered faster.—J. C. C.

Mineral oils and waxes in textile fabrics which are to be subsequently printed or dyed; The presence of — and the difficulties arising therefrom. L. Lefêvre. Rev. Gen. Mat. Col., 1910, **14**, 341—343.

Mineral oils or waxes may occur in textile fabrics as the result of (*a*) splashes of lubricating oil from the machines; (*b*) the use of a mineral lubricant (usually paraffin wax) in the preparation of size for treating yarns; (*c*) the adulteration of animal or vegetable oils with mineral oils. If not removed from the material before the dyeing or printing operations, the presence of mineral oil almost invariably results in the production of stained or unevenly coloured goods. The ordinary bleaching process does not remove mineral oil stains. Scheurer (this J., 1903, 1344) recommends the addition of a mixture of sulphoricinoleate of sodium and sodium oleate to the caustic lyes used in the boiling process. This treatment removes stains which contain 33 per cent. of mineral oil, but if the quantity exceeds 50 per cent. the stain still remains after bleaching.
—P. F. C.

Patents.

Drying machines for wool and other fibres, textile materials and the like. J. F. White, Bradford. Eng. Pat. 227, Jan. 4, 1910.

The apparatus consists of a casing in which are arranged superposed forwarding tables for the fibre, each table consisting of two sets of inverted perforated channel irons. The channel irons of one set are arranged alternately with those of the other set and means are provided for imparting a compound to-and-fro and rising-and-falling motion to each set but in opposite directions, so that when one set is moving forward and upward, the other set moves backward and downward. The tables are alternately projected up to alternate ends of the casing so as to ensure that the fibres travel the full length of one table before they fall on to the next. Inside the casing a series of vertical air ducts connected with a fan and a heating apparatus deliver hot air through orifices in their walls into air chambers arranged under each table. The hot air can only escape by passing through the perforations in the channel irons and upward through the material resting upon them. Then in order to leave the machine the air is compelled to travel in an opposite direction to the material but along the same course and finally escapes through domes in the roof of the casing. The wet fibres are delivered on to the top table by a pneumatic conveyor.
—P. F. C.

Beam dyeing machine. J. H. Riley and Co., Ltd., and F. Riley, Bury. Eng. Pat. 3371, Feb. 11, 1910.

The floor of a tank is provided at each end with an opening for the entry of the dye-liquor. Above these openings bearings for the warp beam are fitted, through which the liquor can flow to gain admission to the interior of the hollow perforated beam. These bearings are such that the beam can rotate in them and the journals of the beam are hollow and formed with apertures through which the liquor can flow. At one end the tank is provided with a stuffing-box and a shaft which can be coupled with the beam to rotate it, but can be readily disengaged from it when it is desired to lift the beam out of the tank. The shaft is driven outside the vat and the liquor may be circulated through the material by steam pressure, by a pump or by suction.—P. F. C.

Cop or bobbin tubes for dyeing. H. Maly, Cottbus, Germany. Eng. Pat. 5373, March 3, 1910.

In order to obtain an elastically-acting fluid tight seal for the end of the perforated paper cop-tube which is slipped over a perforated metallic spindle, a wire screw is inserted in the upper end of the bobbin to form a nut and the thread of this nut is engaged by a wire screw fastened to the narrow end of a conical sealing plug.—P. F. C.

Textile goods; Apparatus for the treatment of — with liquids. C. Riesenfeld and H. Langfelder, Bielitz, Germany. Eng. Pat. 7051, March 21, 1910.

An apparatus is claimed for treating textile goods with liquids, having a receptacle for containing the goods through which the liquid can circulate. The novelty consists in that the space for the colour or dye which is provided above and below the material in the receptacle, is connected by a pipe with regulating valve for permitting a variable quantity of the liquid to pass through the pipe in either direction. By means of this pipe and valve the passage of the colour or dye in one direction or the other through the material, can be regulated, and thus prevent any injurious effect upon material, reservoir, or fittings.

Dyeing half-woollen goods; Process of —. G. Rudolph. Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U. S. Pat. 976,219, Nov. 22, 1910.

See Eng. Pat. 17,624 of 1909; this J., 1910, 942.—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Ammonium nitrite; Preparation of — by the sublimation in a vacuum of a mixture of ammonium chloride and alkali nitrites. P. Neogi and B. Bhusan Adhicāry. Chem. Soc. Proc., 1910, **26**, 297.

The authors have prepared in fairly large amount the compound, ammonium nitrate, by evaporating and subliming in a vacuum a concentrated solution of ammonium chloride and alkali nitrites. The method of preparation of the compound, its properties, and the results of vapour density determinations by Hofmann's method at different temperatures are described.

Phosphates; Production of trisodium —. E. Salkowski. Z. physiol. Chem., 1910, **69**, 475—478.

If a 10 per cent. solution of potassium dihydrogen phosphate be mixed with 33—40 per cent. of its volume of sodium hydroxide solution of sp. gr. 1·34, the liquid solidifies almost immediately to a mass of crystals. These crystals consist of practically pure trisodium phosphate. The same phenomenon is observed with a 10 per cent. solution of monosodium phosphate or disodium phosphate. The author made this observation when treating meat juice with sodium hydroxide. With 5 per cent. solutions of the acid phosphates the separation of crystals takes place more slowly; with 2·5 per cent. solutions no crystals are formed.—J. F. B.

Sulphur dioxide and carbon dioxide; Absorption of —— by rubber and by blood-charcoal. A. Reychler. J. Chim. phys., 1910, **8**, 617—629. (See also this J., 1910, 422.)

The author concludes that the absorption of carbon dioxide by Para rubber and blood-charcoal, and of sulphur dioxide by Para rubber is a case of solution only. Sulphur dioxide was absorbed by blood-charcoal less rapidly than by rubber: the process is very complex for blood-charcoal, as a chemical reaction also occurs.—H. E. P.

Colloidal sulphur; Colours of ——. R. E. Liesegang. Z. Chem. Ind. Kolloide, 1910, **7**, 307—308.

If a mixture of 15 c.c. of a 10 per cent. solution of gelatin and 5 c.c. of a 20 per cent. solution of sodium thiosulphate be allowed to dry as a film, and then a 20 per cent. solution of citric acid allowed to drop on to the film, sulphur is gradually separated as the acid diffuses into the gelatin. The spots appear white by reflected light, but deep lilac-blue, similar to the colour of some ultramarines, by transmitted light, or dark green when viewed at a certain angle. Preparations of this kind are stated to be much more suitable objects for the study of optical resonance effects than those containing metallic silver distributed in gelatin, now so frequently used. On keeping, the colours gradually disappear, probably owing to the transformation of the modification, $S\mu$ into $S\gamma$ (compare Smith and Brownlee, Proc. Roy. Soc. Edinb., 1907, **27**, 308) with an increase of size of the particles.—A. S.

Ozone; The homogeneous decomposition of —— in the presence of oxygen and other gases. D. L. Chapman and H. E. Jones. Chem. Soc. Proc. 1910, **26**, 294.

The authors have continued the work of Clarke and Chapman, in which it was shown that the decomposition of ozone in glass vessels of a sufficient size is a homogeneous change. The results obtained have demonstrated that: (*a*) Oxygen, nitrogen, carbon dioxide, and possibly water vapour have no effect on the rate of decomposition of ozone, that is, the rate of decomposition of ozone in the presence of these gases is a function of the concentration of the ozone only. (*b*) Nitrogen peroxide (Andrews) and chlorine accelerate in a marked degree the decomposition of the gas. (*c*) If the order of the change can be represented exactly by an integral ordinal number, that number is the second.

Iridiobisulphates; Action of pyridine on ——. M. Delépine. Comptes rend., 1910, **151**, 878—880.

Pyridine produces (unlike strong bases and ammonia) no immediate effect on solutions of iridiobisulphates; but, slowly in the cold, more rapidly at 100° C., it converts them, without change of colour, into "pyridinoiridiobisulphates," by substitution of pyridine for the intraradical water:— $(RSO_4)_2 : Ir.(C_5H_5N)OH$ instead of $(RSO_4)_2 : Ir.(H_2O).OH$ The ammonium salt, prepared by heating the aqueous solution of the iridiobisulphate to 100° C. with pyridine, dissolves in about 40 parts of water and gives crystalline precipitates with many metallic salts. All of these salts are more or less dark green in colour, and, where soluble, give green solutions, which are very slowly precipitated by hydrogen sulphide, and are decomposed by boiling with sulphuric acid, into pyridine sulphate and the corresponding iridiobisulphate.—J. T. D.

Lanthanum and cerium; Double sulphates of —— with the alkali metals. Barre. Comptes rend., 1910, **151**, 871—873.

From the solubility curves of lanthanum or cerium sulphate in solutions of the alkali-metal sulphates of increasing concentration, the existence of the following double salts is deduced:—

$La_2(SO_4)_3.K_2SO_4.2H_2O$; $La_2(SO_4)_3.5K_2SO_4$;
$La_2(SO_4)_3.Na_2SO_4.2H_2O$; $La_2(SO_4)_3.(NH_4)_2SO_4.2H_2O$;
$2La_2(SO_4)_3.5(NH_4)_2SO_4$; $La_2(SO_4)_3.5(NH_4)_2SO_4$;
$Ce_2(SO_4)_3.K_2SO_4.2H_2O$; $2Ce_2(SO_4)_3.3K_2SO_4.8H_2O$;
$Ce_2(SO_4)_3.5K_2SO_4$; $Ce_2(SO_4)_3.Na_2SO_4.2H_2O$;
$Ce_2(SO_4)_3.(NH_4)_2SO_4.8H_2O$; $Ce_2(SO_4)_3.5(NH_4)_2SO_4$.

The analogy between lanthanum and cerium is borne out by the composition, solubilities, and conditions of formation of these double sulphates.—J. T. D.

Rhodium; Halogen compounds of ——. G. Goloubkine. Bull. Soc. Chim. Belg., 1910, **24**, 388—396.

Rhodium bromide has been obtained by the author by the following method:—1 grm. of spongy rhodium is heated with 24 grms. of 40 per cent. hydrobromic acid and 7 grms. of bromine to 80°—100° C. for 48 hours in a sealed tube. The resulting solution is distilled, under reduced pressure (15—20 mm.), nearly to dryness. The residue is dissolved in water and again distilled under reduced pressure, this operation being repeated until the distillate is free from hydrobromic acid. The residue is then dissolved in the least possible quantity of water and the solution allowed to evaporate over sulphuric acid *in vacuo*. The product, after being kept for some time over fused potassium hydroxide *in vacuo*, has the composition, $RhBr_3,2H_2O$. It has a very dark red colour and is easily soluble in water. On heating to 100° C. it decomposes, losing water and hydrobromic acid. Heated to redness in a current of hydrogen, it is reduced to the metal. This forms a convenient method for obtaining rhodium free from zinc and bismuth (possibly also from iridium), the bromides of the latter metals being volatilised. Rhodium bromide is easily hydrolysed by an excess of potassium hydroxide, with precipitation of an oxybromide, in accordance with the equation:—

$$2RhBr_3,2H_2O + 2KOH = Rh(OH)_2Br,2H_2O + RhBr_3.2KBr.$$

With bromides of the alkalis and alkaline-earths, double salts are obtained, having the formula,

$$RhBr_3,2M'Br \text{ or } RhBr_3.M''Br_2.$$

Rhodium iodide, RhI_3, is obtained as a finely divided black precipitate on heating the bromide with a concentrated solution of potassium iodide, the liquid remaining coloured as the precipitation is incomplete. The already known rhodium chloride can be obtained in a similar manner to the bromide.—A. Sbld.

Swedish "culm" deposits; Exploitation of the ——. E. Norlin. Tekn. Tidskrift, Abt. f. Chem. und Bergw., 1910, **40**, 145. Chem.-Zeit., 1910, **34**, Rep., 573.

"Culm," a name given to a kind of coal sometimes found associated with alum-slate, contains about 50 per cent. of carbon, 3·8 of hydrogen, 3·2 of sulphur, 0·4 of nitrogen, and 35 per cent. of ash. It is now burnt at Islinge (Lidingö, Sweden), for the sake of the ash, which, consisting essentially of iron and aluminium silicates, contains 1—2 per cent. of uranium and a corresponding quantity of other radioactive substances, such as radium and actinium, besides varying quantities of vanadium, molybdenum, rare earths, lead, zinc, nickel, copper, and bismuth. The ash is treated so as to give a concentrate containing all the barium, radium, etc., and various by-products, such as ferrous sulphate, alum, and sodium hydroxide and the radium is then separated as barium-radium sulphate which is converted into the corresponding chloride. After fractionation, the radium chloride is converted into bromide, and this again into sulphate which is packed in tubes of platinum-iridium. 3—5 mgrms. of radium bromide are obtained from 1 ton of culm, and 3 tons per day are being treated at the Swedish factory; the price of the various preparations is reckoned on the basis of 400,000 francs (£15,875) per grm. of radium bromide. —F. Sodn.

Radium and radioactivity; Units of measurement of ——. A. Jaboin. J. Pharm. Chim., 1910, **2**, 494—497.

The Commission, appointed by the recent International Congress of Radiology at Brussels, proposes to define the

Curie as the quantity of emanation in equilibrium with a gram of radium (element), and to adopt an international radium standard to be preserved at Paris.—F. Sodn.

Reduction of calcium sulphate by carbon monoxide and carbon, and oxidation of calcium sulphide. Hofman and Mostowitsch. *See* X.

Potash industry of Austria. Chem. Trade J., Dec. 3, 1910. [T.R.]

Up to the present the mining operations on the potash salt deposits at Kalusz, Galicia, are developed only within an area of 1,148 by 1,800 feet, wherein four shafts have been sunk of less than 920 feet in depth. The quantity of potash (kainit, sylvin, and sylvinit) produced is regarded as a guarantee of future success. According to expert estimate, a supply of 33,000,000 lb. per annum may be obtained from existing shafts for eighteen years, but it is believed that greater depth of borings will show greater productiveness. This hypothesis is based on the geological resemblance of the Kalusz field to the fields at Stassfurt, Germany, where kainit, sylvin, sylvinit, and karnallit have only been found in shafts over 980 feet deep, the various shafts in Germany in nearly every case running from that to a depth of 2,438 feet. It is the purpose of the Austrian syndicate not only to dig deeper, but to open additional shafts and to introduce better mining methods. Up to the present time the Kalusz field has produced kainit and sylvinit chiefly, the kainit containing uniformly 12 per cent. to 15 per cent. of potash. During the years 1904 to 1908 the quantity of kainit sent from Kalusz to market amounted to 122,260,000 lb.; for the last of those years the amount was 24,840,000 lb., valued at £7,000. (See also this J., 1910, 1305.)

Norwegian nitrate industry. For. Office Ann. Series, Oct., 1910. [T.R.]

The Notodden works during the year 1909 produced 12,600 tons of saltpeter, 2,700 tons of sodium nitrate and about 370 tons of a mixture of sodium nitrate and sodium nitrite. Several extensions have been made during the year, including works for the production of nitrate of ammonia, as well as works for the testing of the furnaces of the Badische Anilin und Soda Fabrik in order to determine whether these or the Birkeland furnaces should be fitted up at the new works at Rinkan, which it is hoped will be opened during 1911. The total quantity of nitrate of soda exported from the Skiensfjord district during 1909 was 8,847,110 kilos., as compared with 6,407,740 kilos. in 1908. The figures for the whole country are as follows:—9,422,110 kilos. during 1909 and 7,053,410 kilos. in 1908.

Patents.

Sulphate and sulphuric acid; Process and apparatus for the production of calcined —— from bisulphate. C. Uebel. Ger. Pat. 226,110, Aug. 25, 1909.

A tower or tall chamber is used, at the bottom of which is a calcining hearth. Highly-heated gases (air, fire-gases, superheated steam) are forced in at the bottom of the tower, whilst the fused bisulphate is introduced at the top in a finely-divided condition, *e.g.* it is forced through jets by means of highly heated compressed air. The bisulphate is nearly completely converted into sulphate by the time it reaches the calcining hearth at the bottom, where the decomposition is completed, the material on the hearth being repeatedly turned over as it is moved towards the discharge opening.—A. S.

Sulphuric acid; Process for the manufacture of —— by the oxidation of sulphurous acid by means of oxides of nitrogen. E. W. Kauffmann. Ger. Pat. 226,219, Jan. 3, 1909.

Gases containing sulphur dioxide, oxides of nitrogen, and steam or atomised water are allowed to interact in a closed chamber at a temperature considerably above 100° C., the proportion of water being such that sulphuric acid of at least 78 per cent. and preferably of 98 per cent. strength is obtained directly. An iron chamber or tower, lined with acid-proof material is used, instead of lead chambers as in the ordinary process. There is a large saving in cost of plant and of ground space, and by using the smaller proportion of water and the higher temperature, acid of 66° B. is obtained directly, and thus the expense of concentrating is entirely avoided.—A. S.

Formic acid; [Process of making ——]. M. Neumann, Wiesbaden, Germany, Assignor to General Chemical Co., New York. U.S. Pat. 975,151, Nov. 8, 1910.

A formate and phosphoric acid are made to interact at a temperature below that at which the formic acid produced is decomposed, and the latter is then isolated. The reaction may be effected by mixing the materials, without the application of heat, and is allowed to proceed until there is no further rise of temperature.—F. Sodn.

Formic acid; Manufacture of ——. H. Howard, Boston, Mass. U.S. Pat. 975,866, Nov. 15, 1910.

The reaction of sulphur trioxide, or other similar reagent in the gaseous state, with a formate and water, with appropriate control of the temperature, is claimed.—J. T. D.

[Oxalic acid from sugar.] Oxidation processes in which nitric acid is used; Process for accelerating ——. Kinzlberger und Co. Ger. Pat. 228,664, Nov. 21, 1908.

In processes in which nitric acid is used as an oxidising agent, the presence of molybdenum compounds considerably accelerates the reaction. For example, in converting sugar into oxalic acid, 10 parts of sugar are dissolved, with cooling, in 75 parts of nitric acid of 40° B., and 1 part of molybdenum oxide (*e.g.*, the blue oxide) is added; after the mixture has stood for four days at the ordinary temperature, oxalic acid commences to crystallise, and at the end of a week it may be removed from the solution and purified. The residual solution, containing traces of nitric acid together with oxalic acid and the intermediate oxidation product of the sugar, may now be used in an absorption tower for recovering the nitrous fumes from another operation. It thus becomes enriched in nitric acid, and the intermediate oxidation product of the sugar is further oxidised to oxalic acid. When vanadium compounds are used as accelerators, this portion of oxalic acid cannot be recovered, as the intermediate compound is rapidly oxidised to carbon dioxide.—T. F. B.

Ammonia; Manufacture of ——. F. Haber, Karlsruhe, Germany. Eng. Pat. 14,023, June 9, 1910. Under Int. Conv., Sept. 13, 1909.

A mixture of nitrogen and hydrogen, at a pressure of at least 100 atmospheres, is passed over a suitable catalytic agent, such as finely divided uranium and osmium, and the ammonia produced is separated directly in the liquid state by the application of cold. Any or all of the materials employed, may be heated, so as to maintain the desired temperature.—F. Sodn.

Ammonia distilling apparatus; Device for the automatic, regulated introduction of slaked lime into ——. H. Kresz. Ger. Pat. 226,109, July 28, 1908.

The discharge pipe of the vessel containing the slaked lime is provided with a screw conveyor which discharges the lime into a pipe leading to the distilling apparatus. Into this pipe there also opens a pipe for the supply of spent liquor from the still, and a nozzle for the supply of the steam used for heating the still.—A. S.

Salt and by-products; Process of treating ——. C. Gerrard, Liscard, Cheshire. Eng. Pat. 25,082, Nov. 1, 1909.

Natural salt contains impurities, mainly calcium sulphate and usually a small quantity of magnesium and calcium chlorides, these chlorides adhering to the salt (sodium chloride) subsequently crystallised, and rendering it hygroscopic. The salt, whether evaporated brine, crushed rock salt, or salt crystals, and containing not more than 10 per cent. of moisture, is treated with a mixture comprising a saturated solution of sodium chloride and a saturated solution of sodium carbonate, phosphate, or sulphate, or any mixture of these; the calcium sulphate and other impurities are thus converted into non-deliquescent products, and the salt crystals are coated and rendered free from a tendency to cake.—F. Sodn.

Alkaline cyanides; Manufacture of ——, *and apparatus therefor.* Sir J. W. Swan, Warlingham, and J. A. Kendall, Streatham. Eng. Pat. 26,258, Nov. 12, 1909.

Nitrogen and alkali carbonate or hydroxide are fed, by pipes which join before they enter it, into the bottom of a conical reaction-vessel, which contains carbon, and is surmounted by, or connected with, a second conical vessel or condenser. This is provided with an outlet tube for the melted cyanide, ending in a cup-like expansion. The whole of the reaction-vessel, the lower part of the funnel at the head of the alkali-supply tube, the lower part of the condenser, and most of the cyanide efflux-tube, are contained in a furnace fed with gas (or oil) and air by injector burners; the upper part of the condenser projects through the top, and the cup-like end of the efflux-tube at the side, of the furnace, each having a space around it through which the furnace flame can play. The vessels in the furnace are made of a metal which can withstand the necessary temperature (about 1300° C.) of reaction, preferably of nickel plate containing about 0·5 per cent. of manganese. The reaction-vessel is filled with carbon, more being added when necessary through the top of the condenser, the lid of which is removable for the purpose. A pipe at the bottom of the reaction-vessel allows of the removal of ash, which when that is necessary is fluxed by means of alkali and borax (the nitrogen being stopped for the time) and allowed to flow away through this tube.—J. T. D.

Alkali aluminates; Manufacture of ——. D. A. Peniakoff, Brussels. Eng. Pat., 30,324, Dec. 28, 1909.

Into the upper end of a rotary kiln similar to a cement kiln is fed a mixture of alumino-ferrous mineral (such as red bauxite), common salt, and a reducing agent (ferrous sulphide or carbon), whilst at the lower end enter fuel (gaseous, oil-spray, or coal dust) and air, and if necessary at the beginning of the operation, sulphurous gases. The lower end of the upper half and the upper end of the lower half of the kiln enter a fixed chamber, and here additional air is blown in by a fan. Near the upper end of the kiln, the sulphur dioxide and oxygen convert the ferric oxide of the bauxite into ferrous sulphate, which reacts with the salt to form sodium sulphate and ferrous chloride; the latter with more sulphur dioxide and oxygen forms ferrous sulphate and chlorine (or, if water vapour be present, hydrochloric acid). A little ferrous sulphate can thus decompose a great deal of salt, and the chlorine or hydrochloric acid formed passes at the upper end of the kiln into condensing apparatus. Lower down in the hotter parts of the kiln the sodium sulphate and carbon or sodium sulphate and ferrous sulphide react with the alumina to form sodium aluminate, sulphur dioxide, and carbon dioxide or ferric oxide. The sodium aluminate (with associated ferric oxide, but containing no sulphate or chloride) drops into a cooling cylinder and is removed. The process is continuous, and as all the sulphur dioxide is regenerated, no sulphur compounds need to be added when the cycle is established, save only to make up for mechanical losses.—J. T. D.

Barium sulphate; Manufacture of ——. C. N. Exley, Gourock, N.B. Eng. Pat. 1585, Jan. 21, 1910.

A mixture of barytes and a reducing agent, such as bituminous coal, is allowed to burn, and the barium sulphide, thus formed, is dissolved out with water. Sodium sulphate is then added to the aqueous extract, and the sodium sulphide solution obtained, is treated with a metallic hydroxide or oxide, preferably ferrous hydroxide, when ferrous sulphide and sodium hydroxide are obtained.
—F. Sodn.

Potassium persulphate; Manufacture of ——. A. Pietzsch and G. Adolph, Munich. Eng. Pat. 23,157, Oct. 6, 1910. Under Int. Conv., Oct. 9, 1909.

Potassium sulphate is used instead of potassium carbonate in the production of potassium persulphate by double decomposition with ammonium persulphate.—J. T. D.

Litharge; Method of freeing —— *from metallic lead mixed with it.* L. S. Hughes, Assignor to Picher Lead Co., Joplin, Mo. U.S. Pat. 975,955, Nov. 15, 1910.

The molten mixture of litharge and metallic lead is allowed to fall from a height into a receptacle of such volume and depth that the metallic lead is able to separate by the action of gravity, the litharge overflowing. The walls of the receptacle are kept at a temperature below the melting point of litharge, so that they become coated with a protective lining of solid litharge.—A. S.

Emery; Process of treating ——. The Carborundum Co. Fr. Pat. 416,648, April 22, 1910.

A mixture of emery and powdered carbon sufficient to reduce the oxides present, other than alumina, is introduced between the electrodes of an electric furnace, and a current, strong enough to melt the alumina and reduce the other constituents to the metallic state, but insufficient to give a temperature at which alumina is reduced, is passed through the mixture. The pure molten alumina produced being a poorer conductor of electricity than the crude material, the zone of fusion, started in the lowest portion of the furnace, tends to rise automatically as the reduction proceeds; the electrodes also are slowly raised at the same time, and the pure alumina cools and crystallises very slowly, therefore, as the heating zone shifts upwards. The mass is subsequently crushed and the impurities are separated mechanically, or are run off from the furnace in the molten state. The alumina obtained is said to be very hard and refractory.—F. Sodn.

Ozone; Apparatus for the production of ——. Siemens und Halske A.-G. Ger. Pat. 225,923, Sept. 14, 1909.

The reservoir for the cooling water in an ozonising apparatus is connected with the supply pipe for the air or oxygen in such a manner as to act as a pressure-equaliser.—A. S.

Nitrous gases from gas mixtures; Process for separating ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 228,426, Dec. 12, 1909.

Wood charcoal is a very satisfactory material for the absorption of nitrous gases from mixtures, *e.g.* from the reaction products obtained in processes for the fixation of atmospheric nitrogen and for the combustion of ammonia to oxygen compounds of nitrogen. 1 kilo. of wood charcoal will absorb nitrous compounds equivalent to 122 grms. of nitric acid from a mixture containing 3 per cent. by volume of nitrous compounds, whilst for a 5 per cent. mixture, the corresponding figures are 133—174 grms. of nitric acid, of which 80 per cent. can be recovered by subjecting the charcoal to the action of superheated steam, warm air, or a vacuum.—A. S.

Sodium bichromate; Process for the preparation of granular —— *free from dust.* R. Wedekind und Co. Ger. Pat. 228,427, April 13, 1910.

Sodium bichromate crystals obtained by crystallisation in motion, or in any other suitable way, are heated nearly to the melting point, *e.g.* to about 110° C., in a rotating steam-jacketed drum, and a current of air is passed through until the crystals are partly or completely dehydrated. In this way a granular, dust-free salt of bright red colour, containing up to about 75 per cent. of chromic acid (CrO_3) is obtained, without any production of the injurious bichromate dust during the process. During the dehydration, a solution of bichromate may be introduced gradually into the drum, in such quantities that it dries almost immediately on the surface of the material being dehydrated, the supply of bichromate solution being continued until the particles of dehydrated salt have attained the desired size.—A. S.

Oxides of metals having a high heat of combustion; Process for the production of fused ——. F. Meidl. Ger. Pat. 228,481, Sept. 5, 1909.

In the production of oxides of such metals as aluminium, magnesium, beryllium, etc., by burning in oxygen, a considerable portion of the material is lost by volatilisation, owing to the high heat of combustion of the metal. According to the present patent the metal before being burned in oxygen is mixed with a quantity of its oxide, the heat of combustion of the metal then being utilised for the fusion of the admixed oxide. The claims cover the application of the process to mixtures of a metal with its own oxide or the oxide of another metal, and to mixtures of several metals with mixtures of oxides.—A. S.

Nitrates; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 30,502, Dec. 30, 1909.

See Fr. Pat. 411,674 of 1910; this J., 1910, 949.—T. F. B.

Sulphuryl chloride; Manufacture of ——. Akt.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 23,923, Oct. 15, 1910. Under Int. Conv., Oct. 18, 1909.

See Ger. Pat. 226,218 of 1909; this J., 1910, 1250.—T.F.B.

Chlorates; Process of purifying ——. R. Gartenmeister, Elberfeld, Germany. U.S. Pat. 975,613, Nov. 15, 1910.

See Fr. Pat. 392,604 of 1908; this J., 1909, 21.—T. F. B.

Production of ozone or hydrogen peroxide by means of electric discharges. Ger. Pat. 228,425. *See* XI.

VIII.—GLASS; CERAMICS.

Enamel undercoat; Importance of the ——. M. Mayer and B. Havas. Sprechsaal, 1910, 43, 727—728.

The reduction of enamels containing tin oxide when dusted on to iron without the intervention of an undercoat has usually been attributed to the carbon in the iron, but the authors point out the small percentage of carbon in iron and show by experiment that iron alone can reduce tin oxide. Chemically pure iron powder was mixed with tin oxide and fired in a porcelain crucible at 900° C. for 15 minutes in an electric furnace; half of the tin oxide was reduced. It follows that the further refining of iron for enamelling is to no purpose, and that an undercoat free from reducible substances is a necessity. The undercoat is also essential on account of the great difference in coefficient of expansion of metal and enamel. The use of cobalt oxide in the undercoat is defended on the ground that it is partially reduced, whilst oxidising the iron surface, and cohesion is considerably improved by the mixture of iron, cobalt, and their oxides.—H. H. S.

Patents.

Kilns or ovens for bricks, tiles and other ceramic ware. T. West and W. J. G. Lewis, Tamworth. Eng. Pat. 26,309, Nov. 13, 1909.

The construction of the kiln is such that, by means of suitable annular flues, a portion of the flue-gases is admitted to the interior, near to the top, whilst another portion enters at the base; both portions are under suitable control, and the products of combustion are withdrawn in a downward direction through a vertical flue arranged in the centre of the structure. It is claimed that by this method the firing is extremely uniform.—W. E. F. P.

Uniting pieces of glass, metals, and the like; Process for ——. Siemens und Halske A.-G. Ger. Pat. 226,004, July 23, 1909.

A product obtained by fusing together metaphosphoric acid and a metallic oxide, with or without addition of boric acid, and which is solid at the ordinary temperature, is rendered plastic by heating and is used as a cementing and sealing material. The solid material has a porcelain-like appearance and is very resistent.—A. S.

Fire-[illegible] of moulds, crucibles, and the like; Process for the manufacture of ——. Gebr. Siemens und Co., Lichtenberg, Germany. Eng. Pat. 1925, Jan. 25, 1910. Under Int. Conv., March 5, 1909.

See Fr. Pat. 412,208 of 1910; this J., 1910, 1012.—T. F.B.

IX.—BUILDING MATERIALS.

Ferro-concrete; Advantages and disadvantages of ——. P. Rohland. Chem. Ind., 1910, 33, 731—745. (See also this J., 1899, 146, 147; 1906, 985; 1909, 411, 425; 1910, 280.)

The strong adhesion of cement to iron (40—47 kilos. per sq. cm.) in ferro-concrete is stated to be due to the cellular, web-like structure of the colloidal hydroxides of iron, aluminium, and silicon, produced by the hydration of the cement, and the proposals to increase this adhesion by bending the iron, roughening its surface, etc., are in the author's opinion, quite unnecessary. The sand used should be free from soluble salts and organic, humus-like, substances, but should preferably contain loamy or clayey particles. The shape of the grains of sand is stated to be of no importance. Ferro-concrete as a building material has proved resistant to earthquake shocks in Messina and Reggio. Magnesium compounds, sulphur compounds, and acids and acid salts all act injuriously on ferro-concrete, and until it has been definitely settled whether humus-substances, peat soil, etc., act as acids or not, care should be exercised in using ferro-concrete for foundations in peaty soil. The iron in ferro-concrete corrodes under the influence of the electric current, *e.g.*, stray currents in the soil, but this disadvantage can be largely overcome by giving the concrete a water-resistant cement coating. —A. S.

Patents.

Slip, slurry, chalk, clay, limestone, and the like; Drying and burning or calcining of ——, and apparatus therefor. W. W. Hewitt, Greenhithe, Kent. Eng. Pats. 22,585, Oct. 4, 1909, and 25,146, Nov. 1, 1909.

The kiln is composed of fixed side walls, and of two series of travelling trays which form the top and bottom of the kiln: the trays are mounted to form an endless chain, and as they turn over, the discharged material is taken away by a conveyor. The trays move in the direction away from the chimney or exhaust. Two such kilns may be arranged side or side, and the trays made to travel in opposite directions, and means are provided for transferring the trays from one kiln to the other.—W. C. H.

Building material, paint and the like; Compositions for use as a ——. C. F. Mendez, San Luis Potosi, Mexico. Eng. Pat. 11,926, May 13, 1910.

Powdered iron pyrites, or one of its forms such as chalcopyrites, cobalto-pyrites, etc., is mixed with a calcareous or argillaceous binder, such as cement or plaster, or plaster of Paris, and made into a plastic semi-liquid mass with water at the ordinary temperature. The mass may be used as a paint or be moulded with or without pressure; it becomes hard and tenacious when dry. The colour of the material may be varied by using pyrites of different chemical composition and particles of different sizes and shapes and by varying the thickness of the layer used.—W. C. H.

Portland cement; Process for making waterproof ——, and product. M. Toch, Assignor to H. M. Toch, New York, U.S. Pat. 976,520, Nov. 22, 1910.

Portland cement is mixed with a fat and a suitable metallic compound, such as lead oxide. The calcium salt of the fatty acid is thus produced, the lead oxide combining with the glycerol liberated by the saponification.—W. E. F. P.

Moulded mass [artificial stone, etc.]. Process of producing a ——. A. Hof, Witten, and A. Pieper, Schmallenberg, Germany. U.S. Pat. 975,691, Nov. 15, 1910.

See Eng. Pat. 14,954 of 1908; this J., 1909, 837.—T. F. B.

Refractory material; Process of manufacturing ——. G. C., G. E., and A. W. Fludder, Colchester. U.S. Pat. 976,996, Nov. 29, 1910.

See Eng. Pat. 113 of 1909; this J., 1910, 630.—T. F. B.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Cast-iron; Physics of ——. H. M. Lane. Trans. Amer. Foundryman's Assoc., 1910, **19**, 201—237.

Whilst some of the physical properties of cast iron are dependent on the chemical composition yet the chemical composition suitable for one purpose is not that which should be chosen for a different class of castings, and the author emphasises the importance of the physical changes which take place as the metal cools, and the influence that these have on the output of the machine shop. Forty-four test-bars and wedges of a number of varieties of cast iron, including cylinder iron and that for piston rings, were received from several firms, having been cast to patterns made at one place and distributed to the foundries. A tabulated summary of the test-pieces and their chemical composition is given. Some of the wedges were cast so as to be chilled on one side, and they were all broken at various positions along their length in order to determine the influence of thickness and the chilling upon the physical structure. Photographs are given illustrating this influence, and the behaviour of each class of iron is discussed. With reference to a piston ring, since it is a spring it should not contain less than 0·65 per cent. of carbon, and may be considered as a steel spring containing such impurities as silicon, sulphur, phosphorus, manganese, and graphitic carbon. The graphite gives wearing qualities while the combined carbon gives the elasticity, and the phosphorus when in considerable quantities has hardening effects. Piston rings should be cast so as to require very little machining, and the mixture proportioned to give the proper amount of combined carbon in the thickness of the casting as it leaves the foundry. It is concluded that any given composition of the metal has a certain most efficient thickness, *i.e.*, if the castings are made thinner the metal will be chilled and the machine cost will rise, and if the casting be made thicker the grain will be more open and the strength rapidly reduced, and it is pointed out that greater co-operation between the designer, the foundry, and the machine shop will result in a better metal in the finished product, in the lightening of the castings, and considerable saving in expense to the firm.—A. H. C.

Malleable cast iron; Preparation of ——. F. Giolitti, F. Carnevali, and G. Tavanti. Rass. Min., Met., e Chim., 1910, 33, 1—51. Chem. Zentr., 1910, 2, 1574—1575.

In continuation of previous work (this J., 1909, 205, 245) and with reference to that of Hatfield (this J., 1909, 524), the authors heated a white cast iron containing 2·30 per cent. of carbon, without graphite, and having a fine crystalline structure of cementite and mixed crystals, in an electrically heated porcelain tube in a stream of varying mixtures of carbon monoxide and dioxide at temperatures between 800° C. and 1050° C. The loss of carbon was not gradual, but there was a sharp line of demarcation between the decarburised layer and the unchanged inner region. The carbon dioxide reacted with the carbon of the cementite, and at the line of demarcation the cementite crystals were smaller but not altered in structure. The less secondary separation of carbon took place the thicker was the decarburised layer. A grey iron containing 2·94 per cent. of carbon, of which 2·89 per cent. was graphite, was heated for from 3—6 hours at temperatures between 900° C. and 1000° C. in a current of pure carbon dioxide. The outer layer was ferrite with partially oxidised graphite, the inner layer was ferrite and changed graphite, while the interior was pearlite and unchanged graphite. Mixtures of carbon monoxide and dioxide oxidised the graphite at high temperatures, but the rate of oxidation was slow, and in the external layer no graphite was found, but only austenite containing 0·6 to 0·7 per cent. of carbon. Experiments in which five varieties of pig iron were placed around a central steel cylinder, containing 0·08 per cent. of carbon, and heated simultaneously in a stream of carbon dioxide, showed that the same gas which decarburised a graphitic pig iron cemented the steel cylinder up to 0·6—0·7 per cent. of carbon. By a comparison of the various pig irons it was shown that the separated temper carbon was not more easily oxidised than graphite and that cementite carbon was easily oxidised. Technically the decomposition of the cementite must be avoided, and then a gaseous mixture relatively rich in carbon monoxide will quickly decarburise without affecting the surface of the work, and a malleable layer 2 to 3 mm. thick will be obtained, the cementite decomposing into ferrite and carbon rendering the decarburisation of the interior difficult.—A. H. C.

Manganese in steel; Determination of —— by the Volhard-Wolff method. A. Kaysser. Chem.-Zeit., 1910, **34**, 1225—1226.

One gram of the steel is dissolved in 25 c.c. of hydrochloric acid (sp. gr. 1·12), and to the hot solution a compressed lozenge of potassium chlorate (1 grm.) is added, the heating being then continued until the salt has slowly dissolved. The oxidised solution is boiled for some minutes until all the free chlorine has disappeared, and then titrated whilst hot in the ordinary manner with permanganate, an excess of zinc being avoided. In this way it is possible to effect an accurate determination in 15 to 20 mins. In the case of pig-iron, it is necessary to use two to three, and with metals of very high carbon content, five to six chlorate lozenges in order to eliminate the carbon entirely. The process is just as applicable to alloys containing 80 per cent. of manganese as to steels with a manganese content of only 0·1 per cent.—C. A. W.

Metals; The wet oxidation of ——. Part I. The rusting of iron. B. Lambert and J. C. Thomson. Chem. Soc. Proc., 1910, 26, 290—291.

The work published up to the present time on the subject of the rusting of iron cannot be held to prove the fact that pure iron will not undergo visible oxidation in contact with pure water and pure oxygen. In almost all previous investigations, commercial iron of the highest obtainable degree of purity has been used, but, from a chemical point of view, the impurities contained in the iron must have been considerable, even in the most favourable circumstances. The authors have shown that pure iron, prepared from pure ferric nitrate by igniting to form the oxide and subsequently reducing in a pure iridium boat in a current of pure hydrogen, does not show visible oxidation after long exposure to pure water and pure oxygen. The experiments were carried out in vessels of clear fused silica, the water was distilled in a vacuum from a solution of barium hydroxide, and the oxygen was prepared by the electrolysis of a solution of highly purified barium hydroxide. It has been shown, further, that iron containing a slight trace of impurity will undergo oxidation under the same conditions, even when there is no possibility of an acid substance being either present or formed during the reaction.

Iron; Rusting of ——. V. Andström. Z. anorg. Chem., 1910, 69, 10—21.

The author's experiments show that the action of ordinary water, containing dissolved oxygen and carbon dioxide, on iron which is not appreciably affected by boiled water ceases in less than 60 hours when the system is closed, that is when the vessel containing the iron is completely filled with the water. The oxygen is quantitatively utilised in the production of a ferrosoferric compound, and the carbonic acid retains almost the calculated quantity of iron in solution as ferrous bicarbonate. The action of the carbonic acid appears to be a secondary one, for the interaction of carbonic acid and metallic iron proceeds very slowly indeed, even in concentrated solutions. The well known theory of rusting revived by Moody (this J., 1903, 745, 1352) is, therefore, rejected, carbonic acid being regarded as accelerating rusting merely by its tendency to clean the surface of the metal.—F. Sodn.

Metallography; Solid colloid systems in ——. C. Benedicks. Z. Chem. Ind. Kolloide, 1910, 7, 290—299.

The author amplifies the hypothesis put forward by him in 1905 (this J., 1905, 1069) that troostite is a pearlite in which the particles of cementite are ultra-microscopically small, in other words that it is a solid colloidal solution of cementite in iron (solid cementite-ferrosol) intermediate between the true solution, martensite, and the coagulum, pearlite. Heyn and Bauer's so-called "osmondite" (this J., 1906, 987), characterised by them as the constituent of annealed steel having the highest velocity of solution in sulphuric acid, probably corresponds to a condition where the troostite content is at a maximum. Owing to the much finer state of division of the cementite in the troostite, the latter will dissolve more rapidly in sulphuric acid than pearlite, and it will also dissolve more rapidly than martensite, since in the latter, which consists of a single phase (mixed crystals), the solution will not be aided by local couples between two different constituents (compare Ericson-Aurén, and Palmaer, this J., 1902, 125). On annealing steel at gradually rising temperatures, troostite is formed from the martensite in increasing quantities, until at about 400° C. all the martensite is converted into troostite; only then, and tolerably sharply, does the coagulation of the troostite, or formation of pearlite, begin. Sorbite is regarded as troostite which has been incompletely coagulated, or converted into pearlite. Similar colloidal constituents to troostite are probably present in nickel- and manganese-steels, and it is pointed out that the production of the colloid condition is accompanied by increase of elasticity and toughness. It is probable that colloid constituents are present in alloys much more widely than has been hitherto considered possible.—A. S.

Copper alloys; Gases occluded in ——. G. Guillemin and B. Delachanal. Comptes rend., 1910, 151, 881—883.

From the examination of several special forgeable brasses, bronzes, a phosphor-bronze, and two samples of tin, it is concluded that :—1. Special brasses retain occluded from 1 to 30 times their volume of gas, chiefly hydrogen, carbon monoxide and dioxide. 2. In sound castings, the gas is almost entirely hydrogen. 3. In unsound castings, a larger proportion of carbon oxides occurs. 4. Hot rolled bars contain less gas than castings. 5. The hydrogen in sound pieces, even when in notable amount, has no injurious effect on the mechanical properties of forgeable brasses. 6. Phosphor-bronze contains very little gas, chiefly carbon dioxide and hydrogen; phosphorus seems to diminish, as in cast iron and steel, the solubility of hydrogen in the metal. 7. Commercial tin contains a small volume of hydrogen and oxides of carbon. 8. None of these metals exhibits the phenomenon of "spitting."—J. T. D.

Bronzes; Quenching of ——. L. Grenet. Comptes rend., 1910, 151, 870—871.

Quenching a cast bronze lessens its hardness, and increases its resistance to shock. If this be because the quenching suppresses partly or entirely, the transformation on cooling, then a reheating to temperatures below that at which that transformation occurs should increase the hardness. This was found to be the case; two bronzes (1. copper 85, tin 15; 2. copper 80, tin 20), cast in plates, 3—5 mm. thick, gave the following figures for hardness, with a 10 mm. ball under a pressure of 1000 kilos. (Brinell test):

	1.	2.
Untreated	100	Broke.
Quenched at 750° C. in water	110	172
do. reheated to 100°, cooled in air	108	172
do. „ 200° „	130	225
do. „ 250° „	146	225
do. „ 400° „	118	180
Reheated to 750°, cooled in the furnace (about 200° per hour)	104	172

The general law for steels, which connects the hardness with the highest temperature to which the metal in its actual physico-chemical state has been subjected, seems to apply to bronzes.—J. T. D.

Zinc; Production of —— *in the fused condition directly from blende.* F. Thomas. Metallurgie, 1910, 7, 706—710.

To obtain liquid metallic zinc directly from zinc blende by electrolysis, the author tried as solvent an eutectic mixture of equal parts of potassium and sodium orthosilicates, R_4SiO_4, having a melting point of 743° C., with 6 per cent. of manganese silicate, which lowered the melting point to 700° C. Unfortunately the solubility of zinc sulphide in this composition amounted only to 0·5 per cent. at 900° C., nor was the velocity of solution great enough to enable a smooth electrolysis to be effected. A mixture of sodium sulphide and iron sulphide of the composition, Na_2S+FeS, to which sodium sulphide was added in amount equivalent to the iron sulphide passing into solution at the iron anode, also proved unsatisfactory. An attempt was then made in a bath of similar composition to effect the separation by means of a modification of the precipitation process, a product, composed of sodium sulphide and finely divided iron, being mixed with zinc sulphide and heated for some time at a constant temperature. But at temperatures from below 920° up to 960° C., there was no appreciable production of zinc. Even by employing, in all these cases, an increased temperature, with corresponding increase of pressure, the separation of the zinc for the most part in the form of dust could not be prevented; whilst the addition of lead sulphide to the bath, for the same purpose was found to affect injuriously the fluidity of the melt.—C. A. W.

Calcium sulphate; Reduction of —— *by carbon monoxide and carbon, and the oxidation of calcium sulphide.* H. O. Hofman and W. Mostowitsch. Trans. Amer. Inst. Min. Eng., 1910, 917—939.

The authors (this J., 1909, 246, and 886) have now examined the behaviour of calcium sulphate under reducing conditions, and the changes that calcium sulphide undergoes during an oxidising roast. In an atmosphere of carbon monoxide, calcium sulphate begins to be reduced to the sulphide at 700° C., and the reduction is complete at 900° C. When mixed with carbon and heated in a neutral atmosphere, reduction begins at 700° C., and is completed at 1000° C. At first the carbon burns mainly to carbon dioxide, but at higher temperatures partly to carbon monoxide. Calcium sulphide remains unchanged at ordinary temperatures in pure dry air, and in carbon dioxide, up to 100° C. When calcium sulphide is roasted in pure dry air, a product consisting of 76 per cent. of calcium sulphate and 24 per cent. of calcium oxide is formed, a loss of 32 per cent. of sulphur occurring :— $3CaSO_4 + CaS = 4CaO + 4SO_2$. This reaction (in a neutral or oxidising, but not in a reducing atmosphere) begins about 800° C., but is not complete. The reaction does not take place in zinc works because a reducing atmosphere is maintained in the retorts by the admixture of about 45 per cent. of reducing carbon to the ore. The gases issuing from the retorts contain from 95 to 97 per cent. of carbon monoxide, and no sulphur dioxide, which would be present if the sulphate-sulphide reaction took place. In the strongly reducing atmosphere of the iron blast furnace the calcium sulphide formed, enters the slag to the extent of 7 per cent. Calcium sulphate appears to be reduced to the sulphide even in the mildly reducing atmosphere of a lead blast-furnace, as the ferrous slags contain considerable amounts of calcium sulphide. In a reducing fusion of sulphide copper ore containing calcium sulphate, the calcium sulphide formed, is found partly in the matte, but mostly in the slag. In the smelting of oxide nickel-ore, with gypsum as sulphurising agent and little iron, it is essential that the gypsum be reduced by carbon monoxide and carbon in the upper part of the furnace at a temperature between 800° and 1000° C. and that the calcium sulphide react at once with the metallic oxide, before it can enter the slag.—W. C. H.

Tellurium; Alloys of —— with cadmium and tin. M. Kobayashi. Z. anorg. Chem., 1910, **69**, 1—9.

THERMAL analysis shows that tellurium and cadmium combine to form the compound, TeCd, which melts at about 1041° C., but exists in the melts only in equilibrium with an excess of tellurium. With tin, tellurium forms the compound, TeSn, melting at 780° C., and this forms a eutectic with tellurium, containing 86 per cent. of the latter and melting at 393° C.; this substantially confirms the work of Fay (this J., 1907, 1052) and of Biltz and Mecklenburg (Z. anorg. Chem., 1909, **64**, 226). Neither compound forms mixed crystals with its components. Cadmium dissolves tellurium up to 1·2 per cent. at 700° C., and, at higher temperatures, the solubility is probably greater. —F. SODN.

Constitution of Thomas slag. Blome. *See* XVI.

Norwegian nickel, copper and sulphur mines. For. Off. Ann. Series, Oct. 1910. [T.R.]

THE Evje nickel mine has been considerably extended, and an aerial ropeway built from the mine to the smelting hut; 6,600 tons of ore were treated during 1909 and 168 tons of nickel copper matte exported, assaying about 70 tons of metallic nickel. A new company, the Kristianssands Nickelraffineringsvaerk, has been formed, which will treat the ore from Evje and produce pure copper and nickel in accordance with Hybinette's methods. Orkla mine in Meldal produced about 5,000 tons during 1909. When all the dressing machinery is fitted up it is hoped that a production of 60,000 tons will be reached in 1910 and 150,000 tons in 1911: 500 men are employed at this mine. Meraker mine produced about 19,000 tons, assaying 45 per cent. sulphur and 1 per cent. copper. The number of men employed was 175. Ytteröen mine produced about 5,000 tons; Fosgruben about 1,800 tons; Svano mine about 1,250 tons. The new pyrites mine at Stordoen is expected to be in working order towards the end of 1910. It is hoped that 70,000 tons of ore of 42 per cent. sulphur can be produced at this mine. There are two zinc mines working in the south of Norway, namely, at Hadeland and in Hakedal. These two mines produced together 18,100 tons of zinc ore and employed about 200 men.

PATENTS.

Steel; Process and apparatus for the production of ——. H. Johnson, Sheffield. Eng. Pat. 26,551, Nov. 16, 1909.

A DOUBLE-ENDED, cylindrical converter is mounted to rotate about an axis at right angles to that of the converter, *e.g.*, on hollow trunnions, charging openings being provided in or about a line with the trunnions. One end of the converter is provided with ordinary tuyères and the other end with surface-blowing tuyères or with electrodes, the apparatus being first employed as an ordinary converter and finally inverted for the purification of the metal by surface-blowing or electrical means.—W. E. F. P.

Steam turbine blades made from pure iron and nickel. Akt. Ges. Brown, Boveri und Co., Baden, Switzerland. Eng. Pat. 27,217, Nov. 23, 1909. Under Int. Conv., Feb. 4, 1909.

THE blades are made of an alloy of pure iron and nickel, absolutely free from carbon.—W. E. F. P.

Iron; Process of extracting —— from its ores. S. G. Martin, Chicago, Ill., Assignor to W. O. Bartholomew, St. Louis, Mo., and E. Schaaf, St. Mary's, Mo. U.S. Pat. 975,625, Nov. 15, 1910.

THE process consists of smelting ores in the blast-furnace, using for the blast, air containing nitrogen peroxide.—T. ST.

Chrome steel and certain of its alloys; Application of —— to the manufacture of walls for strong boxes or steel chambers which cannot be melted by the jet of the oxyhydrogen flame, the acetylene flame or the like. F. Krupp Akt.-Ges. Fr. Pat. 416,051, April 4, 1910. Under Int. Conv., Aug. 23, 1909.

IN order to obtain a metal of great resistance, yet not too brittle, chromium is added to steel in greater quantity, the smaller the content of carbon. In general the minimum content of chromium is about $\frac{5{\cdot}42}{\sqrt{C}}$ per cent., where C is the percentage of carbon. It is, however, advantageous to add small quantities of silicon and tungsten, and, in this case, a smaller amount of chromium may be employed. By the addition of tungsten, a naturally hard alloy containing: carbon, 1; chromium, 9; and tungsten, 3 per cent.; can be obtained.—C. A. W.

Cementation; Method of —— and apparatus therefor. The New Departure Manufacturing Co. Fr. Pat. 416,106, May 19, 1910. Under Int. Conv., Jan. 10, 1910.

THE object, heated in a closed chamber with the exclusion of air, is brought into contact with a carboniferous vapour which has been previously heated to the same or a higher temperature. The apparatus consists of a cylindrical muffle, for the reception of the object, provided with holes at the base and with an outlet tube at the top. This muffle is raised slightly above the floor of an outer concentric cylinder containing a valved inlet tube for the admission of liquid hydrocarbon, and, finally, the whole arrangement is surrounded by a cylindrical chamber provided at the base with tangential oil and petrol burners. The air is first driven from the apparatus by admitting into the intermediate chamber a small amount of liquid hydrocarbon which volatilises into the muffle. When the object has been raised to the requisite temperature, as determined by a pyrometer suspended in the outlet at the top, a liquid hydrocarbon is allowed to flow slowly into the intermediate chamber, where it is volatilised and forced into the interior muffle. After some time, if it be desired to obtain in the object a more even distribution of carbon, in place of a highly carburised surface, the stream of vapour is cut off and the object is heated for a further period by itself. The gases emerging from the muffle may be passed into the exterior chamber and utilised for heating the furnace.—C. A. W.

Converters. H. A. Cinille. Fr. Pat. 416,771, Aug. 14, 1909.

AN ordinary converter, with an interior lining elliptical in section, is provided with one or several electrodes of the same, or opposite polarity. It may be fitted with tuyères at the bottom, in which case the electrodes are fixed in the side, under the mouth; or with tuyères at the side, the electrodes being then passed through openings in the cap. In the first case, the converter is placed in a horizontal position when the current is passed, in the second case, however, it is brought into the vertical position at once. Moreover, when lateral blowing is employed, two sets of tuyères are provided, one set, horizontally inclined, being arranged above the surface of the metal; whilst the other set, vertically inclined, open directly into the mass. Through these tuyères, different gases, oxidising, reducing or neutral, can be passed. Each electrode is constituted by a carbon rod composed of two separate pieces; the bottom piece with rounded end forms the true electrode, the top piece, which is entirely traversed by a metal conductor, serving only to support the lower one, and to convey the current. The electrodes are fixed at the top in collars lined with copper, and supported upon arms provided with ball-joints, so that the electrodes can not only be moved vertically but can be inclined in any direction in order to displace the arc on the surface of the bath. Alternatively, the metal conductor passing through the top carbon may serve as a terminal, or, in the case of large electrodes, it can be made hollow and traversed by a current of water in order to keep the lower electrode cool. When only one (or several of the same sign) is employed, the arc is made to pass between this electrode and the metallic envelope of the converter. In order to prevent induction currents and the production of short circuits between the electrodes, the metallic envelope at the top of the converter is made in several sections insulated from one another. The calculated amount of lime having been introduced into the converter, the metal is added and the casting orifice is closed. The electrodes are then lowered to the surface of the bath, the current is passed until the metal is sufficiently heated; when, finally, the electrodes are removed from the converter and the blast is passed through in the ordinary manner. The sulphur, phosphorus, manganese and silicon are thus eliminated before the complete disappearance of the carbon, the metal being cast through a tap-hole at the side when a test sample shows the required carbon content.—C. A. W.

Roasting of ores. A. Ramén and K. J. Beskow, Helsingborg, Sweden. Eng. Pat. 23,808, Oct. 9, 1909.

A SPECIAL furnace, with a stirring device, is described, by means of which, the greatest possible amount of the acids contained in the gases resulting from the chloridising roast, are obtained in a concentrated and pure condition, and at the same time, a large economy of fuel and labour is effected. An intimate mixture of the ore and chloride is first heated by direct contact with combustion gases to a temperature insufficient to cause the components of the charge to react with each other. It is then transferred mechanically to another compartment of the furnace, where by effective mechanical stirring, the oxidising air, and particles of ore and salt are brought into such intimate contact, that, without further heating, chemical action takes place. The heat developed by the reaction is sufficient in the case of an ore containing 2—4 per cent. of copper, and 3—6 per cent. of sulphur, mixed with 10—12 per cent. of common salt, to raise the temperature of the charge 300° C. As the chloridising process is preferably carried out at from 500° to 600° C., it is thus only necessary in the preliminary heating to raise the temperature of the charge to 200°—300° C. To suit special cases, additional heat may be supplied during the chloridising process, by leading the combustion gases around and under the chloridising compartment, or by introducing hot air. Again, ores low in metal and sulphur may be heated alone by the combustion gases, the salt being charged directly into the chloridising compartment. The ore can then be heated to a much higher temperature than would be possible with a mixture of ore and salt. In the chloridising furnace described, the chloridising compartment is situated immediately below the furnace into which the combustion gases are led. The charge is transferred through communicating channels. Shelves are placed below the channels so that these latter are kept always full of the charge, thus preventing the passage of gases between the two compartments. Adjustable scrapers, fixed to the stirring device of the chloridising compartment, continuously remove the charge from the shelves, whilst the feeding device in the upper compartment keeps the channels full.—T. St.

Ore-roasting furnace. J. B. F. Herreshoff, Assignor to Nichols Copper Co., New York. U.S. Pat. 976,175. Nov. 22, 1910.

THE cylindrical furnace casing contains a number of superposed floors and a central, vertical, hollow shaft extending through the bottom of the furnace and closed at its upper end. The shaft is surrounded by a sleeve, which extends through the top of the furnace and to which rabble-arms are attached, the latter being provided with internal cooling channels which communicate with the interior of the shaft and sleeve respectively. By the rotation of the shaft from below, the sleeve and rabble-arms are also rotated, suitable gearing being attached to the projecting upper end of the sleeve to operate the feeding mechanism of the furnace.—W. E. F. P.

[*Roasting ores*] *Sulphides or sulphates; Treating ——.* U. Wedge, Ardmore, Pa., Assignor to The Furnace Patent Co., Philadelphia, Pa. U.S. Pat. 970,525, Nov. 22, 1910.

IN roasting ores containing sulphides or sulphates, a relatively low temperature is maintained during the earlier stages, part of the heat developed being used for preheating the air employed in the later stages. During the latter, a suitable reducing agent is added to the ore which is then heated out of contact with the furnace gases; the sulphur is thus completely eliminated without the employment of the excessively high temperature usually necessary.—W. E. F. P.

Tin or other metals; Separation of —— from waste metal, old metallic ware, alloys and the like. C. A. Jensen, London. From G. Spitz, Brunn, Austria. Eng. Pat. 25,915, Nov. 9, 1909. Addition to Eng. Pat. 28,551, Dec. 31, 1908.

THE solution obtained at the end of the de-tinning process described in the chief patent (this J., 1910, 161) is contaminated with silica, alumina and lead. These substances reduce the dissolving action of the solution and contaminate the resulting oxide of tin. To free the solution from these impurities, tin-plate scrap is introduced, and if necessary, more oxidising material such as saltpetre, but no additional alkali. Oxide of tin is thus produced which is not dissolved by the small amount of free alkali present. This oxide of tin carries down with itself the greater part of the impurities in an insoluble condition.—T. St.

Furnaces for smelting ores. E. C. R. Marks, London. From Colorado Iron Works Co., Denver, Col., U.S.A. Eng. Pat. 30,425, Dec. 29, 1909.

THE improvement claimed consists in providing the heat necessary for the smelting of ores of copper, lead, etc., by burning fuel in a separate chamber to that containing the charge of ore, instead of having ore and fuel mixed, as is customary in blast-furnace smelting. Under present conditions, when it is desired to reduce oxidised ores, the air admitted for the burning of the fuel tends to arrest or even reverse the desired reduction. When sulphide ores are under treatment, and it is desired to oxidise sulphur or iron, the action is retarded owing to the selective combination of the oxygen with the fuel. The arrangement described consists of a furnace of the usual blast-furnace shape, standing on a second furnace, rectangular in shape, in which the fuel is completely and solely burnt for the supply of the necessary heat, and into which the products of the smelting descend from the upper furnace. The slag and reduced metal run in a fused state on to the bed of the lower furnace and can be tapped away. When sulphur or iron requires oxidising, air is admitted by means of tuyères placed at the base of the blast-furnace proper, so that the air immediately mixes with, and is heated by the hot gases produced in the combustion furnace below.—T. St.

Ores; Treatment of precious metalliferous ——. J. C. Clancy, New York, N.Y. U.S. Pats. 976,043, 976,044, and 976,045, Nov. 15, 1910, Nov. 15, 1910.

(1) A SUBSTANTIALLY non-acid solution containing a thiocyanate and ore, or "a thiocyanate and a cyanide containing the ore," is oxidised by means of ozone or other oxidising agent. (2) The ore is subjected to the action of a thiocyanate and a soluble iodine or other halogen compound, and the mixture oxidised with ozone or other oxidising agent. (3) The treatment consists in electrolysing the solution or mixture obtained by subjecting the ore to the action of a solution containing (*a*) a cyanogen-bearing material and an amidine or amide compound, (*b*) a cyanamide, (*c*) a cyanamide in presence of a halogen compound,

(*d*) cyanogen-bearing material and a cyanamide, (*e*) cyanogen-bearing material, a cyanamide and a halogen compound.—T. St.

Zinc; Process of producing metallic ——. O. B. Dawson, El Paso, Tex. U.S. Pat. 976,557, Nov. 22, 1910.

In the production of zinc in a vertical furnace, sufficient carbon monoxide or water gas is introduced into the zinc vapour, at or above the zone of combustion, to combine with the oxygen present; a suitable gas is also introduced near the outlet of the furnace to prevent oxidation and assist the flow of the vapour to the condensing chamber. —W. E. F. P.

Metals; Process for obtaining easily oxidisable ——. A. Zavelberg. Ger. Pat. 226,257, Feb. 23, 1908.

For the recovery of easily oxidisable metals such as zinc, a reaction chamber is heated to incandescence, then the supply of heat is cut off by a gas-tight damper, the charge of ore and reducing material is introduced, and the reaction chamber closed. The vapours of the metal pass through suitable openings into receivers.—A. S.

Magnesium and its alloys; Melting and casting of ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 416,534, May 30, 1910. Under Int. Conv., Nov. 19, 1909.

In order to prevent the attack of magnesium or its alloys by the oxygen and nitrogen of the air, especially during their melting and casting, from 0·1 to 0·5 per cent. of metallic calcium or strontium is incorporated with the metal beforehand—possibly during the electrolytic preparation. Instead of calcium or strontium, an equivalent amount of any one of their compounds (*e.g.*, limestone) which is decomposed by magnesium, may be employed; barium and its compounds are not, however, suitable. Treated in this way magnesium or its alloys may be cast at a temperature some distance above their melting points without the formation of oxide or nitride or the contamination of the metal with hydrogen, the calcium, in fact, forming a metallic hydride which floats upon the surface of the bath.—C. A. W.

Melting furnaces; Method of lining ——. Poldihütte Tiegelguss-stahl-fabr. Fr. Pat. 416,585, May 31, 1910. Under Int. Conv., June 11, 1909.

The interior of the furnace which comes into contact with the metallic bath or the slag is provided with a facing composed of aluminium silicate, pure alumina or a mixture of the two, according to the degree of refractoriness it is desired to obtain. This protective layer is mixed with certain foreign bodies, such as iron, manganese or their compounds, so that, while the proportion of these bodies is too small to damage the refractory quality of the lining, the latter is made sufficiently plastic and firm to resist the mechanical strains to which, especially when the charge is agitated, it may be submitted. In furnaces having a basic lining, the protecting layer may contain considerable quantities of magnesium compounds. In order to form the facing, a charge of metal, containing oxygen but poor in silicon, is melted in the furnace and subsequently reduced by means of aluminium or aluminium alloy free from silicon. By this means, a hard and adherent layer of almost pure alumina is obtained on the surfaces in contact with the bath. The furnace may then be employed for the treatment of more silicious charges.—C. A. W.

Radio-active metals; Extraction of —— *from ores.* J. B. Hannay. Fr. Pat. 416,588, May 31, 1910.

The method for the separation of radio-active metals is intended chiefly for application to ores containing sulphides, such as those of antimony, copper, lead, molybdenum, or uranium, which are more or less volatile at high temperatures. From an ore of this kind, the radio-active metals can be volatilised as sulphides by heating the material in a reducing atmosphere, such as that obtained at the upper part of a blast-furnace when sufficient coke is employed below. The fumes as they pass out of the furnace are brought into contact with air; by this means they are oxidised and made to deposit as a powder in chambers provided for the purpose. This powder, composed of a mixture of sulphides and oxides, is again heated in the same blast-furnace, if necessary after the addition of a small quantity of a volatile sulphide, the repeated distillations being continued until the desired concentration of radio-active metals is obtained. During the operation, the greater part of the accompanying metals are reduced and sink to the bottom of the furnace, where they can be collected free from radio-active metals.—C. A. W.

Separating ingredients of comminuted material [*ores, etc.*]; *Process of* ——. W. Fairweather, London. From Huff Electrostatic Separator Co., Boston, U.S.A. Eng. Pat. 25,768, Nov. 8, 1909.

See Fr. Pat. 411,116 of 1909; this J., 1910, 958.—T. F. B.

Magnesium and alloys thereof; Melting and casting ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 27,132, Nov. 22, 1909.

See Fr. Pat. 416,534 of 1910; preceding.—T. F. B.

Melting and refining furnaces. F. J. Brougham, London. From Poldihütte Tiegelguszstahlfabrik, Vienna. Eng. Pat. 5267, March 2, 1910.

See Fr. Pat. 413,207 of 1910; this J., 1910, 1113.—T. F. B.

Furnaces for the production of cast iron and steel. F. Resinelli, Vado Ligure, Italy. U.S. Pat. 975,998, Nov. 15, 1910.

See Fr. Pat. 404,026 of 1909; this J., 1910, 95.—T. F. B.

Carbonizing; Process of, and apparatus for ——. A. F. Rockwell, Assignor to The New Departure Manufacturing Co., Bristol, Conn. U.S. Pat. 975,076 and 975,077, Nov. 8, 1910.

See Fr. Pat. 416,106 of 1910; preceding.—T. F. B.

Pyrophoric mass [*alloy*]. C. Auer von Welsbach, Vienna, Assignor to Treibacher Chem. Werke Ges. m. b. H., Trieste, Austria-Hungary. U.S. Pat. 976,760, Nov. 22, 1910.

See Fr. Pat. 407,117 of 1909 and Addition thereto; this J., 1910, 574, 636.—T. F. B.

Bringing a gas into contact with a liquid. Eng. Pat. 25,679. *See* I.

XI.—ELECTRO-CHEMISTRY.

Zinc amalgams and the Clark normal cell. E. Cohen and P. J. H. van Ginneken. Z. physik. Chem., 1910, 75, 437—493. (See also this J., 1910, 358.)

The authors describe at length methods of preparing pure amalgams of zinc, and the electromotive and dilatometric methods of studying their behaviour and elaborating the zinc-mercury phase diagram. The results lead to the discovery of two temperatures (42·9° and 20° C.) at which there is equilibrium between two solid phases. The 10 per cent. (by weight) amalgam therefore shows a transition point at each of these temperatures. The change at 42·9° C. proceeds quite rapidly on cooling, and in any case does not affect the utility of the Clark cell, which is not used at such high temperatures. If however the amalgam is cooled below 20° C. there are two complications which affect its use in the Clark cell. (*a*). The change in the solid phase at 20° from one series of mixed crystals to another. This proceeds very slowly, requiring several days supercooling to 0° C. for its completion. (*b*). The alteration in the composition of the mixed crystals as the temperature changes. This change also takes place very slowly with falling temperature, but its effect is not so great as that of (*a*). The effect of these complications is to divide the range of the Clark cell into two parts. Above 20° C. the changes in the 10 per cent. amalgam are quite rapid and the cell can be used without trouble as a precision instrument. The expression used for its temperature coefficient must not be considered valid below 20° C. If the cell is to be used below this temperature the only certain method of producing the stable state is to cool in ice for ten days, and then to maintain for one day at the temperature of comparison. The expression for the temperature coefficient is then only valid up to 20° C. It is suggested that the changes might be more rapid, and the discontinuities less marked if a more dilute amalgam than 10 per cent. by weight of zinc were used.—W. H. P.

Apparatus for the rapid electro-analytical determination of metals. Glass-frame anode for use with silver and nickel cathode. Sand and Smalley. *See* XXIII.

PATENTS.

Furnaces; Electric ——. J. Thomson, New York. Eng. Pat. 11,716, May 11, 1910. Under Int. Conv., May 13, 1909.

The furnace is provided with a resistance, arranged above the material to be heated, in the form of a resister having a large radiant surface, and made up of a number of wedge-shaped elements alternately reversed and displaceable transversely with respect to each other under changes of temperature. Any variation of pressure through the resister is thus compensated for by the movement between the elements, and the resister automatically preserves a substantially constant contact resistivity. In an alternative form, one only of the elements is automatically movable with changes of temperature. The resister is supported at the ends, along each side of the chamber, by refractories, the latter having openings for the circulation of heat, thus connecting the melting chamber with the free space formed between the upper part of the resister and the cover of the furnace. Two parallel resisters, each formed of a number of elements, may be connected in series, with supports at the ends along the sides of the chamber, and intermediate supports rising from the furnace hearth for the inner ends of the elements. The intermediate supports are spaced apart, and the space thus formed, together with the openings in the outer supports, connects the spaces above and around the ends of the elements with the melting chamber.—B. N.

Furnaces; Electric ——. J. Thomson, New York, and F. A. J. FitzGerald, Niagara Falls, N.Y. Eng. Pat. 11,717, May 11, 1910. Under Int. Conv., May 13, 1909.

The present specification details another form of resister, such as is used in the furnace described in Eng. Pat. 11,716 of 1910 (see preceding abstract). The resister is composed of separable "staggered" round carbon rods, arranged between bevelled terminals fixed in the cover of the furnace, each rod being in lineal contact with one or more of the other rods, and the electric current is adapted to pass through the rods in direct series. The resister is separated by a space from the top of the furnace, and a layer of granular carbon covers the top of the resister, thus decreasing the current density on the upper side and rendering the upper face relatively cooler than the lower one presented to the furnace chamber. The resister may also progressively decrease in thickness from the ends to the centre, so as to obtain a gradually increasing temperature towards the centre of the furnace. The lower layer of rods acts as a support for the stack of rods, the individual members of the lower layer being provided with suitable supports. In order to increase the area of contact between the lower rods and the supports, the ends of the rods may be flattened or made square where they rest on the supports, or the latter may be provided with recesses into which the ends of the lower layer fit, thus reducing the pressure per unit area upon the supports. In alternative arrangements the lower layer of rods may be made of less diameter so as not to make contact with each other, and of a greater length so that they project over and rest upon the end supports, or they may be spaced apart to avoid contact and reduce the current flowing along their supports. In a further form the ends of the rods may be insulated from one another. The excessive temperature at the ends of the rods, resulting in the destruction of the refractories, is thus prevented.—B. N.

Furnace; Electric —— with magnetically rotated charge. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pats. 975,571 and 975,794, Nov. 15, 1910.

(1). The highly heated fused conducting material is stirred and thus caused to circulate, by inducing secondary currents within the body of the material, and at the same time producing a rotating force upon the induced currents by subjecting them to the action of an alternating rotating magnetic field. (2). An alternating induction "stator," having a chamber within which conducting material adapted to serve as a "rotor" is located, acts inductively through the chamber in a constantly varying rotating alternating magnetic field.—B. N.

Battery; Secondary ——. W. Morrison, Des Moines, Iowa. Re-issue No. 13,174, Nov. 22, 1910, of U.S. Pat. 916,575, March 30, 1909.

The reversible galvanic battery contains a suitable alkali solution, and a negative-pole electrode in contact with or containing zinc, disposed at or near the bottom of the cell in a practically horizontal position, so that the active material is maintained in contact with the negative-pole electrode by the action of gravity. The positive-pole electrode, which is substantially insoluble in the electrolyte, is placed above the negative electrode, with mercury in contact with the latter in order to re-amalgamate it during each successive charge. Insulating means are provided between the electrodes, in order to subdivide the body of the electrolyte, and the zinc is greatly in excess of that which the electrolyte can take up in solution. The greater portion of the zinc is thus oxidised by the electrolyte without being taken up in solution, thereby producing an electric current; the positive-pole is of sufficient size to maintain the flow of current produced.—B. N.

(1). *Battery; Alkaline —— containing chromium and mercury.* (2). *Alkaline battery.* (3). *Electrode for reversible galvanic batteries.* (4). *Reversible galvanic battery.* W. Morrison, Des Moines, Iowa. U.S. Pats. 975,885, 975,980, 975,981, and 976,092, Nov. 15, 1910.

(1). The alkaline reversible battery is provided with an anode containing an oxidisable metal, such as zinc, an oxygen compound of chromium and mercury. (2). The positive electrode comprises a conductor or support coated with a mechanically-applied intimate mixture of chemically precipitated finely-divided oxides of silver and mercury, the proportion of the latter being relatively large. The oxides are reduced electrolytically to silver and mercury. (3). The electrode is formed of one or more tubes of porous material electrically connected together. Each tube consists of an inside lining of paper surrounded by a layer of asbestos, bound on the outside with wire. A metallic rod extends through the centre, and a number of division plates, in the form of washers fixed on the rod, divide the tube into sections. An active material of a zinc chromium compound is placed in the sections surrounding the rod. (4). The anode is constructed as described in (1), and the positive-pole electrode contains silver and mercury.—B. N.

Electrolyte for alkaline batteries. W. Morrison, Des Moines, Iowa. U.S. Pat. 976,277, Nov. 22, 1910.

The battery contains a zinc negative-pole electrode, and an alkaline-hydroxide electrolyte containing an alkali metal chromite, capable of rendering the zinc substantially or largely insoluble in the electrolyte.—B. N.

Batteries; Process for manufacturing material for alkaline ——. W. Morrison, Des Moines, Iowa. U.S. Pats. 976,278 and 976,279, Nov. 22, 1910.

(1). A compound, for use as electrodes in reversible galvanic batteries, is produced by agitating a mixture

of zinc oxide and water, and adding a suitable amount of chromium sulphate during the agitation, whereby a compound containing zinc oxide and chromium sulphate is precipitated. This is treated with a strong alkaline solution, such as potassium hydroxide, to remove the sulphate, thus leaving a compound of zinc and chromium oxides. This is washed to remove traces of sulphate, dried, and packed into suitable grids. (2). To zinc oxide is added sufficient potassium bichromate to partially convert the zinc into chromate, and the mixture of zinc oxide and zinc chromate is electrolytically reduced in the presence of an alkaline electrolyte, or the substance before reduction may be mixed with oxide of mercury.
—B. N.

Electric arcs ; Process for the production of horizontal or approximately horizontal —— for gas reactions. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 228,422, May 8, 1909.

The gas is forced under pressure, through a series of louvre-like slits, so as to strike the arc at an angle. In this way the arc, which on starting tends to rise, is forced into an approximately horizontal position, its length increasing according to the number of slits through which the gas is forced. The reaction-products are quickly cooled by that portion of the gas which does not pass through the arc.—A. S.

Ozone or hydrogen peroxide ; Process for the production of —— by means of electric discharges. F. Fischer. Ger. Pat. 228,425, July 22, 1909.

The claim is for a process of obtaining ozone or hydrogen peroxide by blowing dry or moist air against a spark or arc discharge which is produced and maintained automatically. The following is a description of one method of carrying out the invention. Two metal arms are fixed on the axle of an electric motor, being insulated from the latter and from one another. One arm carries a rod of carbon or other suitable material acting as one electrode, whilst the other carries a metal spring, which so long as the motor is at rest or revolves only slowly, bears against the electrode on the other arm. The current used to produce the arc is led first through the field magnet coil and then to the metal arms. When the motor attains its normal speed, the metal spring moves away from the other electrode owing to the centrifugal force or to the force of the air current (or is withdrawn electromagnetically), and an arc is produced. If the arc becomes too long, the resistance increases, and the current strength falls both in it and in the field magnet coil ; hence the motor revolves more slowly, and the metal spring approaches the other electrode. If the arc is blown out, the motor stops, and the metal spring bears against the other electrode until the motor again acquires its normal speed. By suitable regulation of the spring, current strength, etc., either an intermittent or continuous arc can be produced.—A. S.

Electric arcs ; Production of long stable ——. O. Schönherr and J. Hessberger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 976,002, Nov. 15, 1910.

See Addition of April 26, 1906, to Fr. Pat. 357,358 of 1905 ; this J., 1906, 1053.—T. F. B.

Carbon bodies ; Protective coating for ——. H. Viertel, Lichtenberg, and G. Egly, Treptow, Assignors to Gebr. Siemens und Co., Lichtenberg, Germany. U.S. Pat. 976,319, Nov. 22, 1910.

See Eng. Pat. 12,425 of 1910 ; this J., 1910, 1064.—T. F. B.

Electrical element. A. T. K. Estelle, Assignor to Nya Ackumulator Aktiebolaget Jungner, Fliseryd, Sweden. U.S. Pat. 977,086, Nov. 29, 1910.

See Eng. Pat. 8195 of 1909 ; this J., 1910, 286.—T. F. B.

Electrolysis of aqueous solutions ; Apparatus for continuous ——. A. Pietzsch, Triberg, Germany, and E. Steinbuch, Monthey, Assignors to Soc. of Chem. Ind. in Basle, Basle. U.S. Pat. 977,125, Nov. 29, 1910.

See Fr. Pat. 408,565 of 1909 ; this J., 1910, 638.—T. F. B.

Furnace : Electric ——. J. Härdén, London. U.S. Pat. 977,303, Nov. 29, 1910.

See Eng. Pat. 8194 of 1909 ; this J., 1909, 1047.—T. F. B.

Process of treating vegetable matter. U.S. Pat. 976,037. *See* V.

Unhairing and tanning hides. U.S. Pat. 976,036. *See* XV.

XII.—FATS ; OILS ; WAXES.

Ammonium salts of fatty acids (oleic, palmitic, stearic), and separation of oleic acid from saturated fatty acids (palmitic and stearic). P. Falciola. Gaz. chim. ital., 1910, **40**, II., 217—229.

Ammonium stearate and palmitate were prepared by adding an excess of concentrated ammonia solution to a hot alcoholic solution of the corresponding acid, and allowing to cool. The normal salts thus obtained lost ammonia slowly even at the ordinary temperature and by the action of water were converted into the corresponding acid salts. Ammonium oleate was obtained by passing dry ammonia gas into an ethereal solution of oleic acid. It mixes with water to form a colloidal, gelatinous liquid, which cannot be filtered through paper, and which froths abundantly when shaken with a larger quantity of water. It is much more soluble in alcohol than the stearate and palmitate and the author bases on this behaviour a method of separating solid from liquid fatty acids. At a little above 0° C., 100 c.c. of absolute alcohol, rendered ammoniacal, will dissolve 31 grms. of ammonium oleate, but only 0·1 grm. of ammonium stearate and 0·5 grm. of ammonium palmitate. The proposed method is as follows :—The mixed fatty acids are dissolved in a small quantity of warm ether, a current of ammonia gas is passed through the solution, and the latter is cooled to the ordinary temperature. After expelling the ether, the residue is agitated with about four times its volume of ammoniacal alcohol cooled to 0° C., and after breaking up any clots and cooling in melting ice, filtered with the aid of the pump, and the precipitate is washed with a small quantity of cooled alcohol. From the filtrate and precipitate the liquid and solid fatty acids respectively are separated in the usual manner. The method whilst not giving entirely exact results, is stated to be sufficiently accurate for technical purposes, and the author has used it for determining the liquid and solid fatty acids of tallow, lard, sesamé oil, etc.—A. S.

Oleomargarine ; Production of —— in the United States. U.S. Inter. Rev. Report, 1909—1910. Oil, Paint, and Drug Rep., Nov. 28, 1910. [T.R.]

During the fiscal year ended June 30, 1910, there was produced 135,685,289 lb. of oleomargarine free from artificial colouration and 6,176,991 lb. of the product artificially coloured, or a total of 141,862,282 lb., as against a total of 92,282,815 lb. during the previous fiscal year. The production and withdrawals taxpaid of oleomargarine during the fiscal year 1910 were the largest since the inception of the original law imposing a tax upon the regular sale and manufacture of this product. The tax collected for the fiscal year 1910 amounted to $689,856.42, an increase of only $50,996.09 over the fiscal year 1909, while under the old law in 1902 there was collected on a smaller production the sum of $2,462,532.72. The small increase in tax collections during the fiscal year 1910, as compared with those for the fiscal year 1909, is due to the decreased amount of oleomargarine taxpaid at the rate of 10 cents per lb. Exports of the coloured product showed an increase of 317,302 lb., while there was a decrease of 15,383 lb. in the uncoloured, for the fiscal year ended June 30, 1910, over the former year.

Patents.

Emulsifying oils, fats, and the like ; Process for ——. A. Müller-Jacobs, Huntington, N.Y., and R. C. F. A. C. Bernhardt, Assignors to The Arabol Manufacturing Co., New York. U.S. Pat. 975,147, Nov. 15, 1910.

See Fr. Pat. 404,959 of 1909 ; this J., 1910, 222.—T. F. B.

Compositions for use as a building material, paint, or the like. Eng. Pat. 11,926. *See* IX.

Increasing the melting point of pitch from wool grease. Ger. Pat. 225,911. *See* XIII.

Preparing acidyl derivatives of castor oil. Ger. Pat. 226,111. *See* XX.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

White lead ; Falk's ——. J. F. Sacher. Chem.-Zeit., 1910, 34, 1261—1263.

The product, $5PbCO_3,2Pb(OH)_2,PbO$, stated by Falk to be the main constituent of Jaroslaw white lead and the product of his own process (this J. 1910, 768, 769, 890) is shown by the author not to be a definite stable chemical compound. In a series of laboratory experiments on the production of white lead, products were obtained, giving, on analysis, percentages of lead monoxide varying from 83·8 to 86·3 (the percentage found in normal white lead). Higher percentages were only obtained from products found to contain free lead monoxide, the presence of which is indicated by the reddish coloration imparted by phenolphthalein to white lead previously triturated with a few drops of water. Referring to the superior covering power claimed for Jaroslaw white lead and Falk's own product (*loc. cit.*), it is found that only products containing free litharge possess greater covering power than normal white lead, and then only when tested in the usual way with ultramarine, the yellowish tint of the product, due to the litharge, partly masking the blue colour and thus giving a lighter shade. No superiority, however, is found if red lead be substituted for the blue colour in the test. The presence of free lead monoxide also increases the speed of drying of white lead oil paint. With reference to Falk's statements that several kinds of chamber white lead were found to be strongly attacked by hydrogen sulphide with evolution of carbon dioxide, and that chamber white lead previously found to contain both crystallised and amorphous basic lead carbonate was attacked more slowly (this J., 1910, 1118), the author found that chamber white lead and pure white lead, prepared by himself (in the cold) in the wet way, were quite amorphous. Products strongly attacked by hydrogen sulphide would, it is stated, be found to contain small quantities of lead acetate, the acetic acid liberated by the gas, acting on the white lead to form lead acetate again, and so on. Chamber white lead usually contains only traces of lead acetate and is slowly attacked by hydrogen sulphide. (See also this J., 1910, 831, 1022.)—A. Seid.

Mineral paint imports of the U.S.A. U.S. Geological Survey. [T.R.]

The imports of ochre, umber, and sienna, crude, dry, and ground in oil were as follows :

Item.	Quantity. 1908. tons.	Quantity. 1909. tons.	Value. 1908.	Value. 1909.
Ochre	4,127	6,848	$75,076	$110,664
Umber	1,204	1,596	20,264	26,381
Sienna	887	1,205	28,865	33,334
Totals	6,218	9,649	$124,205	$170,379

The imports of zinc oxide were as follows :—

Dry	2,313	3,059	$262,876	$342,999
In oil	105	268	16,798	54,[illegible]85

The imports of chemically manufactured pigments were as follows :

	Quantity. 1908.	Quantity. 1909.	Value. 1908.	Value. 1909.
Corroded white lead ..	270	[illegible]47	$30,452	$3[illegible],963
Red lead	323	80	28,155	30,428
Litharge	48	45	[illegible],327	[illegible],740
Orange mineral ...	241	248	26,645	27,562
Venetian red	1,557	2,000	25,745	28,564
Totals	2,441	[illegible],020	$114,[illegible]24	$1[illegible],[illegible]57

Patents.

Sublimed white lead ; Process of and apparatus for manufacturing ——. L. S. Hughes, Assignor to Picher Lead Co., Joplin, Mo. U.S. Pats. 975,768 and 975,817, Nov. 15, 1910.

Lead sulphide ore or other lead-bearing material is smelted in one or more low cupola blast furnaces, and the furnace gases together with the lead fume and particles of burning sulphide, are passed, mixed with air, through a heated flue system in order to eliminate carbon and complete the oxidation of the lead sulphide. The lead sulphate fume produced is separated by a screen system consisting of a bag-house containing fabric bags into which the gases are led. The bag-house has closed walls, and gas exit openings only at the top, and means are provided for circulating the atmosphere of the bag-house in order to maintain a uniform temperature. The yield of lead sulphate pigment is increased and its quality improved by keeping the flue system at a temperature below that at which a substantial quantity of sulphur trioxide can be formed from the sulphur dioxide and oxygen present.—A. S.

Colour lakes ; Process for preparing ——. F. Schaaf. Ger. Pat. 227,905, Oct. 20, 1909.

Precipitated magnesium silicate, especially that obtained by precipitating magnesium sulphate solutions, is claimed as a basis for making colour lakes by means of dyestuffs. The sodium silicate solution used for the precipitation should contain only a small excess of silica ; if commercial water-glass solution is employed, it must be nearly neutralised by addition of alkali. Magnesium silicate has a great affinity for the acid and basic dyestuffs used for lake making ; when using such dyestuffs as Methyl Violet, Victoria Blue, and Diamond Green, it is not necessary to add tannin or other fixing agent, as in the case of lakes with a basis of alumina. T. F. B.

Pitch from wool grease ; Process for increasing the melting point of — without lowering its boiling point or diminishing its elasticity. A. F. Malchow, Leopoldshaller Dachpappen-, Holzzement- und Teerproduktfabrik. Ger. Pat. 225,911, May 25, 1907.

The pitch is mixed with sulphur and heated until distillation just begins ; or the pitch is melted and sulphur vapour or a mixture of sulphur vapour and air passed into the fused mass. The product can be used for the production of paints, or when mixed with fibrous substances, for the preparation of plastic masses.—A. S.

Colour lakes ; Manufacture of bluish-green ——. Farbwerke vorm. Meister, Lucius, und Bruning, Hochst on Maine, Germany. Eng. Pat. 17,615, July 25, 1910. Under Int. Conv., July 27, 1909.

See Ger. Pat. 224,442 of 1909 ; this J., 1910, 1120.—T.F.B.

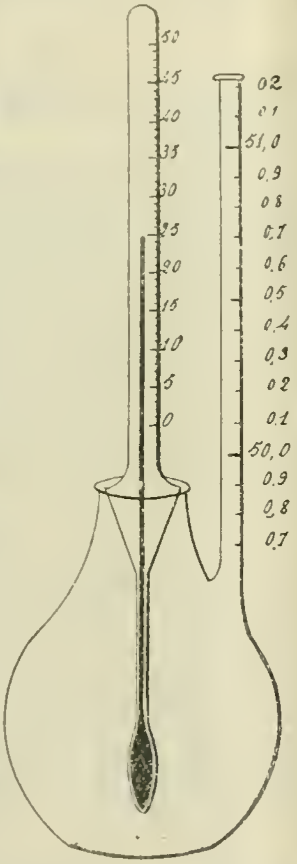
Zinc pigments from liquors obtained from pyrites or pyrites cinder and the like ; Process for producing ——. J. H. Thwaites, Peterborough. U.S. Pat. 975,907, Nov. 15, 1910.

See Eng. Pat. 27,426 of 1907 ; this J., 1908, 949.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Latex of Hevea braziliensis; Determination of concentration of —— from density measurements. G. Vernet. Caout. et Guttapercha, 1910, 7, 4549—4558.

The author has examined a large number of samples of *Hevea* latex, and has drawn up tables showing (1) the variation in the percentage of rubber (precipitable according to a standard method) with the density of the latex, and (2) the variation of the density of the latex with the temperature. By the use of such tables it is possible to estimate the percentage of rubber present in any given natural *Hevea* latex within 1 to 2 per cent., by a simple determination of density. The pyknodilatometer employed for measurements of density at various temperatures is shown in the figure; the actual volume of latex taken is read off on the open, graduated, vertical limb, instead of being always adjusted to 50 c.c. The standard method of precipitation (coagulation) adopted was as follows:—A quantity of alcohol (90°), equal in volume to the latex taken for density determination was measured out in a graduated cylinder. The latex was poured into a small crystallising dish. That adhering to the inner walls of the pyknometer, and to the thermometer bulb was coagulated by pouring alcohol from the measuring cylinder into the vessel and over the bulb, and the pellicle of rubber was carefully removed with a pair of forceps and transferred to the crystallising dish. The pyknometer was then washed out several times with alcohol, the whole of the measured quantity of which was thus transferred to the crystallising dish. After thoroughly mixing the contents of the latter, it was allowed to stand for six hours, when the rubber clot was removed and rolled out on an enamelled surface with a wooden roller, washed with 90° alcohol, and dried in a vacuum over sulphuric acid until constant in weight. In order to correlate the figures given by the tables with those obtained in actual practice when other modes of coagulation are employed, or when other latices than that of *H. braziliensis* are being dealt with, it is proposed to employ factors, depending on the mode of coagulation, or on the kind of latex. The results of density determinations in the case of latices which have been diluted with water, or which have become concentrated during the process of collection are not reliable on account of the alteration in the density of the serum effected by the addition or subtraction of water. For the determination of density a hydrometer may also be used provided that it be sufficiently sensitive, *e.g.*, one with a stem 2 to 3 mm. thick, graduated from 0·960 to 0·995. In all cases it is necessary for graduations of vessels to read from the top of the meniscus, the latex being opaque.
—E. W. L.



Latex of Hevea braziliensis; Coagulation of —— by means of acetic acid. J. Parkin. India-Rubber J., 1910, 40, 752.

In connection with a recent statement of Schidrowitz that at the present time probably 99¾ per cent. of all the plantation rubber produced is coagulated by means of acetic acid, it is pointed out that an excess of the acid, besides being uneconomical, has a deleterious effect upon the rubber. Experiments made on the subject in Ceylon showed that the optimum strength of acid is indicated by a clear "whey." The amount of acid added is independent of the amount of water added to the latex for dilution, but is naturally subject to increase if ammonia has been added to the latex for purposes of preservation. The Ceylon experiments showed that about 1 grm. of pure acetic acid is needed for 100 c.c. of original latex. It is suggested that control of the coagulation process should be exercised by making laboratory tests on small samples of the latex, the coagulation in this case being accelerated by heating, which does not affect the amount of acid required. The latex may require different amounts of acid at different times. The opinion is expressed that plantation Para rubber will never be wholly satisfactory, but will lack nerve and keeping qualities, until some method of "curing" is combined with coagulation. Smoked sheet is regarded as only a compromise.

In a footnote it is stated that planters have been in the habit of using strong solutions of acetic acid for coagulation, because the rubber so obtained dries more rapidly than that prepared by a slow process.—E. W. L.

Rubber; Funtumia —— from West Africa. Bull. Imp. Inst., 1910, 8, 261—263.

Two samples of *Funtumia* rubber from the Gold Coast, and one from Southern Nigeria, prepared by boiling the diluted latex, and rolling the freshly coagulated rubber into biscuits, have been examined.

Gold Coast samples.—No. 1 consisted of the portion which coagulated first on boiling, and weighed 1¼ lb., in the form of nine biscuits, light-brown, marked by dark patches, clean, well-prepared, elastic and tenacious. It was valued at 6s. to 6s. 6d. per lb., with fine hard Para at 7s. 7d. and Ashanti Lump at 1s. 11d. to 2s. 3d. Its value would be increased if the dark patches, probably due to slow drying, were absent. No. 2 consisted of the portion which coagulated last, and weighed 1½ oz. It was in the form of thin, light-brown sheets, very similar to sample No. 1. Its value would probably be about the same.

Southern Nigerian sample.—Twelve small, light-brown biscuits weighing 14 oz., rather rough, but clean and well-prepared. A little moisture was present in some of the thicker biscuits. Elasticity and tenacity very good. It was valued at 8s. per lb.; fine hard Para being 10s. 6d. per lb. and Lagos and Benin Lump (selected) 4s. 11d. to 5s. 3d. per lb.

The analytical results obtained are tabulated below:—

	Gold Coast samples.		S. Nigerian sample.
	No. 1.	No. 2.	
	per cent.	per cent.	per cent.
Moisture	0·8	0·5	0·4
Caoutchouc	89·8	88·0	88·0
Resin	7·0	9·2	9·0
Protein	2·0	2·0	2·2
Insoluble matter	—	—	0·4
Ash	0·4	0·3	0·4

—E. W. L.

Rubber; Landolphia —— from the Sudan. Bull. Imp. Inst., 1910, 8, 263—264.

A small consignment, from the Bahr-el-Ghazal, of rubber from the indigenous *L. owariensis* var. *tomentella*, was sorted into 4 lots as follows:—(1) Rough, irregular biscuits, well-cured, in fairly good condition, strong and clean

(150½ lb.); (2) similar, but rather inferior to (1) (313 lb.); (3) pale biscuits much better cured than (1) and (2), thin and in good condition (160½ lb.); (4) pressed sheet (23 lb.). All coated with powdered talc. The rubber reached prices varying from 6s. 9d. to 8s. 4d. per lb., fine hard Para selling at 10s. 4d. The analytical results were as follows:—

	Rubber as received.		Dry rubber.	
	Dark biscuits.	Light biscuits.	Dark.	Light
	per cent.	per cent.	per cent.	per cent.
Moisture	0·4	0·3	—	—
Caoutchouc	93·2	92·4	93·6	92·7
Resin	4·4	5·6	4·4	5·6
Protein ..	0·5	0·5	0·5	0·5
Ash	1·5	1·2	1·5	1·2

—E. W. L.

Rubber; Determination of —— as tetrabromide. Th. Budde. Gummi-Zeit., 1910, 25, 269—270.

ALTHOUGH the author's attention had already been drawn to the fact that the amount of silver nitrate specified in his detailed account of the tetrabromide process (viz., 25 c.c. of *N*/5 solution) was insufficient when more than 0·17 grm. of rubber was present as bromide, he had omitted to publish the fact, thinking that the error would be generally recognised and rectified. The recent publication of O. Korneck (this J., 1910, 1321) has shown, however, that this is not the case, for in several instances detailed by him it is clear that only a very slight excess of silver nitrate can have been present. As shown by Frerichs (Apoth.-Zeit, 1900, No. 64) in the case of the estimation of iodoform by means of nitric acid and silver nitrate, it is necessary, in order to bring about a complete reaction, to use a considerable excess of silver nitrate. Accordingly, in the case of samples containing a high percentage of rubber, the amount of the sample taken for analysis should be reduced to 0·10 to 0·15 grm., 25 c.c. of silver nitrate solution being added, or 0·15 to 0·20 grm. of substance and 30—40 c.c. of silver nitrate solution may be taken. In one instance given by Korneck the amount of bromine found was greater than that corresponding with the amount of silver nitrate added (0·4306 grm. against 0·40 grm.). This is probably due to an error in calculation. Korneck's results further appear to indicate that sources of error of a physical character play a part in the tetrabromide process, *e.g.*, imperfect bromination, due to imperfect subdivision of the sample. The presence of moisture in the samples would also seem to play a part, and to render the method less accurate. With reference to the influence of the presence of protein upon the result (cf. Spence, this J., 1909, 1320), the author has found that brominated egg-albumin contains 4·6 per cent. of bromine, and that the error due to this cause cannot, therefore, exceed 0·195 per cent., assuming the rubber under examination to contain 10 per cent. of protein.—E. W. L.

Absorption of sulphur dioxide and carbon dioxide by rubber and by blood-charcoal. Reychler. *See* VII.

Comparison of dyeing, tanning, and vulcanisation. Dreaper. *See* VI.

Extraction under pressure produced by a fluid. [*Extracting drugs and dissolving rubber.*] Bruns. *See* XX.

PATENTS.

Waste rubber, ebonite, vulcanite, etc.; Manufacture of articles from ——. H. H. Tarver, Branstone, Staffs. Eng. Pat. 1335, Jan. 18, 1910.

WASTE rubber, in a suitable state of comminution, is subjected to the action of the hot vapour of an organic acid, the result of which is to soften the particles of rubber, and enable them to be sheeted together and to take up such further quantities of sulphur and other compounds as may be necessary or desirable to produce on vulcanisation the required result. The process may be carried out (1) by adding about 20 per cent. by weight of the organic acid (e.g. phenol, etc.) to crumb waste, and heating the mixture, in a suitable closed vessel, for about 15 minutes at about 212° F. The mass may then be at once sheeted or moulded and vulcanised by ordinary methods, sulphur and other compounds being added if required. The amount of acid, and the time and temperature of heating are best determined, for any given sample of waste rubber, by small-scale experiments. (2) The hot vapour of the acid may be passed into the mass of crumb by any suitable means, instead of mixing the acid with the crumb. (3) The acid may be added either before or during the passage of the crumb between heated rollers, and the softening of the waste brought about by repeated passage of the mixture between the rollers.—E. W. L.

Rubber; Regeneration of vulcanised ——. A. L. Chodorowski. First Addition, dated May 20, 1910, to Fr. Pat. 409,482, Nov. 22, 1909 (this J., 1910, 770).

THE following may be employed as devulcanisers and solvents:—Aniline oil, aniline, toluidines, xylidines and their homologues. The devulcanisation and solution may be carried out, with constant agitation during the process, at a temperature of 120°—200° C., either in an autoclave or in a reflux apparatus. In the case of loaded rubber only two parts of solvent to one of rubber should be used.—E. W. L.

Vulcanised rubber; Regeneration of ——. C. P. Pary. First Addition, dated June 11, 1910, to Fr. Pat. 413,849, Mar. 18, 1910.

AN apparatus is described in which the process of regeneration described in the main patent may with advantage be carried out. The apparatus consists of a number (*e.g.* four) of vertical vessels, heated internally by means of steam coils and each provided with an agitator driven by means of a pulley at the top of the vessel. These vessels are arranged (*e.g.*) at the corners of a square, and in them the vulcanised waste is heated with a solvent such as xylene or carbon tetrachloride in presence of a metallic powder. By this means the rubber is slowly dissolved. The solution obtained is run off into a central jacketed vessel at a lower level, while the mineral deposit can be removed through a sludge-cock, and again treated for the recovery of the last traces of rubber. The solution is evaporated in the enclosed jacketed vessel, under reduced pressure, the solvent being condensed in a vessel above the four solution chambers, and run into one of them for further use. The rubber is thus obtained as a residue in the jacketed evaporator from which it can be readily removed. The whole apparatus is air-tight, in order to avoid loss of solvent, and minimise risk of fire.
—E. W. L.

Rubber; Treatment [purification] of crude ——. E. H. Neefe. Fr. Pat. 416,301, May 24, 1910.

CRUDE rubber is washed with water in a horizontal cylinder provided with an agitator, after which it is saturated with benzene by passing it backwards and forwards beneath a heavy roller in a bath of the solvent for from 4 to 6 hours. The solution is allowed to stand for about 24 hours in a covered vessel, during which period the mechanical impurities still present are deposited. The solution is then drawn off, and freed from benzene by pressure beneath a second, slowly-moving roller.—E. W. L.

Rubber and similar products; Process and apparatus for the manufacture of ——. Empire Cream Separator Co. Fr. Pat. 416,665, June 1, 1910.

THE process is one for the separation, by centrifugal action, of the rubber from latex or similar emulsions. The latex travels downwards through the central pipe of a rapidly revolving separating drum, and then upwards between the outside surface of this pipe and a cylindrical arrangement of a large number of annular conical plates, fixed one above the other at short distances apart. The separation occurs at the surfaces of the plates, the serum passing outwards into the space between the plates and the walls of the drum, and thence upwards over the conical cover and out through the top of the apparatus, whilst the rubber cream rises within the space inside the plates, gradually filling it with a mass containing at least 75 per cent. of rubber.—E. W. L.

Rubber; Production of substances with the properties of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 417,170, June 15, 1910. Under Int. Conv., March 19, 1910.

Substances having the properties of rubber are obtained by heating isoprene with or without the addition of neutral or alkaline substances, or substances acting as alkalis. For example, (1) isoprene is heated alone for 20 hours at 120° C. The product is cooled, the isoprene which remains is distilled off, and the residue is dissolved in benzene. On the addition of alcohol to this solution the rubber-like substance is precipitated. (2). Isoprene is heated for some time at 100° C. with 10 per cent. of its weight of concentrated alcoholic sodium hydroxide. The product is diluted with water and the unaltered isoprene distilled in a current of steam. The rubber-like product remains behind.—E. W. L.

Rubber substitute; Process for the manufacture of a ——. K. Mann and P. Burmeister. Ger. Pat. 226,032, Nov. 20, 1908.

Carrageen moss is heated with water, the solution is filtered, mixed with lime, heated, and syrup (molasses), glycerin, and a small quantity of walnut oil are added to the hot liquid, which is then allowed to cool.—A. S.

Monoazo dyestuff suitable for the preparation of pigment colours. Eng. Pat. 19,000. *See* IV.

Elastic product similar to rubber from animal materials. Fr. Pat. 416,644. *See* XV.

XV.—LEATHER; BONE; HORN; GLUE.

Wattle barks from the Transvaal and the East Africa Protectorate. Bull. Imp. Inst., 1910, 8, 245—252.

Up to the present time wattles have been cultivated for commercial purposes, mainly in Natal and the Australian colonies. Samples of wattle bark have now been received from the Transvaal and the East Africa Protectorate. (*a*) Samples from the Transvaal. The whole of the ten samples examined represent materials which would be readily saleable in England, and five of them represent materials which could be regularly marketed in quantity. The percentages of tannin range from 24 to 42, the maximum being obtained from trees 6—8 years old. The barks were valued at £5—£9 per ton. It seems clear from the results obtained that it would be possible and profitable to produce wattle bark in the Transvaal in plantations maintained for five or seven years. (*b*) Samples from the East Africa Protectorate. These five samples were taken from trees 3½—6½ years old and on analysis gave percentages of tannin from 36—44, and of non-tannins from 10—12. The leather tanned from each sample was of good colour and texture with no tendency to harshness. All the materials are described as readily saleable, and the estimated value per ton varies from £8 to £8 15s. An important feature of these barks is that a high percentage of tannin is obtained in growths of only 4 years.—J. R. B.

Colour in tanning extracts; Determination of ——. W. Eitner. Gerber, 1910, 36, 321—323.

The author gives a general outline and criticism of the methods of estimating the colour of tanning extracts. Practical experience has shown that a bright coloured extract not only produces a light coloured leather, but also a quicker and better tannage. There are two classes of methods for estimating the colour of extracts, the optical and the empirical. The optical method consists in the use of the tintometer. A standard solution of the extract is placed in a glass cell and the colour matched by placing side by side with this solution, glasses of standard depths of colour, red, yellow and blue glasses being used (compare Procter, this J., 1910, 663). This method, whilst giving the colour of the extract, does not give a definite indication as to the resulting colour of the leather tanned with it. One attempt to accomplish this is as follows:—Pieces of pelt are tanned in known strengths of the extract and the colour of the resulting leather is taken as an indication of the colouring properties of the extract. This method is open to the objection that with different pieces of pelt quite discordant results are obtained with the same extract. This is due to the impossibility of getting uniform pieces of pelt. A new method is described in which, instead of pieces of pelt, artificially prepared "animalised" cotton is used. The cotton material, which is felted on one side and covered with a fine tissue on the other (the grain) side, is 1 mm. thick and 11 cm. broad. Strips of this material are washed in boiling water, pressed and put on to reels. They are then drawn through a ½ per cent. solution of formaldehyde and afterwards through a 6 per cent. solution of gelatin and dried in a dust-free room. In this condition they can be preserved for a long time. For the examination of the extract, a solution is made of a strength of 6° Bé. and 5 grms. of the "animalised" cotton are placed in and allowed to stand for several minutes and then the whole churned in a rotating vessel for 12 hours. The material is taken out, washed in running water for 10 minutes, lightly squeezed and dried very slowly, at first at room temperature, and finally at 30° C. In this way quite uniform results and a clear indication of the colouring value of the extract can be obtained. The method may also be used for determining if the colour of the resulting leather is likely to be altered in strong light, by exposing the coloured strips to daylight and noting the effect. The author concludes that the optical method is suitable for controlling the manufacture of extract, but that this new method is much the better for determining the colour which is likely to be produced on the finished leather. —J. R. B.

Comparison of dyeing, tanning, and vulcanisation. Dreaper. *See* VI.

Determination of the amide-nitrogen in proteins. Denis. *See* XXIII.

Patents.

Unhairing and tanning hides or skins; Method of ——. G. D. Burton, Boston, Mass. U.S. Pat. 976,036, Nov. 15, 1910.

The hides are immersed in a solution of sal soda (sodium carbonate) and subjected to the action of an electric current, passed intermittently, the bath being agitated at the two ends, away from the hides, in order to cause the liquor to circulate. The gas developed by the electrolysis causes the globules of fat or oil on the hides to open and discharge their contents into the solution. The hides are next fleshed, cleansed in a weak acid bath, and then immersed in a tanning solution and again subjected to the action of an electric current.—A. S.

Elastic substance similar to rubber; Process of manufacture of —— from animal materials. Naamlooze Vennootschap Algemeene Uitvinding Exploitatie Maatschappy. Fr. Pat. 416,644, April 22, 1910. Under Int. Conv., Jan. 29, 1910.

Animal material, in particular fish or other fresh- or salt-water animals, or the intestinal mucous membranes of mammals, is heated in water, at a temperature of 90° to 100° C. for about 2 hours, and the extract is then filtered from fragments of flesh, etc. Acetic acid or lactic acid is then added and the precipitate of phosphorus-containing albuminoid thus obtained is filtered off. The filtrate is concentrated until it forms an elastic mass which can be drawn out into threads, and which is insoluble in the ordinary rubber solvents. This mass is treated with a 5 per cent. solution of formaldehyde (which merely serves as an antiseptic) and can then be vulcanised by heating with sulphur, giving a product similar to rubber, or, when higher proportions of sulphur are used, to ebonite.—E. W. L.

Tannic infusions of plants; Process of extracting and treating ——. H. Damköhler and H. Schwindt, Bremen, Germany. U.S. Pat. 975,835, Nov. 15, 1910.

SEE Eng. Pat. 24,899 of 1909; this J., 1910, 365.—T. F. B.

Elastic substance similar to rubber; Process of manufacture of —— from animal materials. W. van der Heyden, Amsterdam, and J. Jurgens, Nymegen, Holland. Eng. Pat. 9579, April 20, 1910. Under Int. Conv., Jan. 29, 1910.

SEE Fr. Pat. 416,644 of 1910; preceding.—E. W. L.

XVI.—SOILS; FERTILISERS.

Thomas slag; Constitution of ——. H. Blome. Metallurgie, 1910, 7, 659—667, 698—705.

THE citrate-solubility of the phosphoric acid contained in Thomas slags is considerably increased by the addition of sand, slags poor in silicic acid showing comparatively little tendency to dissolve. The author has made a number of fusion experiments with varying mixtures of tetracalcium phosphate and calcium orthosilicate, in order to establish what combination of lime, silica and phosphoric acid is the cause of this increased solubility. Tetracalcium phosphate, $4CaO.P_2O_5$, (m. pt. 1870° C.) was prepared by fusing together lime and tricalcium phosphate in the oxyhydrogen blowpipe flame; and then by employing varying mixtures of tetracalcium phosphate and calcium orthosilicate, there were obtained, in a series of experiments, by the quick cooling of the melt, two definite compositions each showing a maximum with reference to melting point and solubility in a 2 per cent. citric acid solution. The first (m. pt. 1710° C.) of these maxima corresponded to the composition, $4CaO,P_2O_5+2CaO,SiO_2$, and the second (m. pt. 1780° C.) to the composition, $4CaO,P_2O_5{-}4(2CaO.SiO_2)$. In both cases the melt was found to contain a definite amount of free lime (4·3 and 4·2 per cent.). By slowly cooling the melt corresponding to the composition, $4CaO.P_2O_5+2CaO.SiO_2$, a large increase in the citrate-solubility of the phosphoric acid, silicic acid and lime may be observed; at the same time the content of free lime is considerably augmented. In both cases, then, a calcium silico-phosphate of high citrate-solubility must have crystallised out, with separation of free lime; and it is probable that, if the cooling were effected even more slowly, a melt with a citrate-solubility of 100 per cent. would be obtained. The blue monoclinic crystals sometimes found in Thomas slag have been shown by Stead and Ridsdale to have the composition, $4CaO,P_2O_5+SiO_2$. A melt of this composition was found to have a melting point of 1700° C. and to show no disposition to split off lime, whilst it was totally soluble in a 2 per cent. solution of citric acid, the rate of cooling not affecting the composition. It is probable therefore that this product, a double compound of tetracalcium phosphate and calcium orthosilicate, is the combination whose presence in the Thomas slag conditions the citrate-solubility of that material. The influence of slow cooling on the citrate-solubility, however, is only noticeable between 1800° C. and 1900° C.; below this point the melt may even be cooled quickly without detrimental influence.
—C. A. W.

Molasses; Fertilising with ——. Biochemical investigations of Hawaiian soils. S. S. Peck. Report Expt. Stn. Hawaiian Sugar Planters Assoc., 1910, Bull. No. 34. Pp. 39.

To study the effect of carbohydrates on the various transformations of nitrogenous fertilisers, samples of soil were taken from the top of a furrow in a field of young sugar cane plants and from the outside edge and the middle of a field of mature canes. After cultivation for four days on dextrose peptone agar, they contained 30, 12, and 18 million organisms respectively per grm. of dry soil. To observe the action of the ammonifying, nitrifying and denitrifying organisms two methods were followed, viz., inoculating 100 c.c. of the solution with 10 grms. of dry soil, or treating 200 grms. of dry soil with the solution until it was two-thirds saturated. The tests were carried out in beakers and incubation effected in a hole 6 ft. deep sunk in the ground so that the cultures were in the dark. The effect of the addition of molasses and of dextrose on the decomposition of peptone was studied, and it was found that the addition of carbohydrates reduces the ammonification, favours the destruction of nitrates, and causes a loss in the immediately available nitrogen. It is concluded that molasses applied at intervals on land on which sugar cane is growing and fertiliser has been applied, will work harm by destroying nitrates already applied or preventing the formation of nitrates from other sources. Molasses applied several weeks prior to the planting of the crop may produce beneficial results by stimulating the nitrogen-fixing bacteria of the soil and thereby adding to the store of available nitrogen. The number of organisms in the soil falls off with increasing depth.—E. F. A.

PATENT.

Fertiliser. C. Ellis, Larchmont, N.Y. U.S. Pat. 976,793, Nov. 22, 1910.

SALTS containing nitrogen, phosphorus and potash are incorporated with Portland cement so as to form a granular product which is then mixed with granular, lime-coated peat. A small quantity of basic calcium formate is also added.—W. P. S.

XVII.—SUGARS; STARCHES; GUMS.

Sugar cane juice; Purification of —— by kieselguhr. W. Guerrero. Bull. Assoc. Chim. Sucr., 1910, **28**, 308—309.

KIESELGUHR, long known as a clarifying product which facilitates filtration, acts at the same time as a valuable purifying agent according to the author's experience at a sugar factory in Granada. He states that the calcined earth is strongly oxidising and consequently decolourises sugar juices and eliminates the reducing substances. The most convenient amount to use for cane juice is from one to two parts per thousand distributed in two purifications, one-half part per thousand on raw mill juice, and one part on the defecated or carbonated juice. The kieselguhr should be mixed intimately and most vigorously with the juice, *e.g.*, with a centrifugal pump or with jets of compressed air. The purity was increased by one or two degrees at each operation, representing an increased yield of 0·10 to 0·20 per cent. of sugar, and the reducing substances were diminished by 30 to 40 per cent.—L. J. DE W.

Sucrose; New method of determining —— in the presence of other sugars. A. Jolles. Z. Untersuch. Nahr. Genussm., 1910, **20**, 631—638.

THE optical activity of the sugars, arabinose, rhamnose, dextrose, laevulose, galactose, invert sugar, maltose, and lactose, is destroyed when solutions containing not more than 2 per cent. of sugar are heated with sufficient alkali to render the alkalinity of the solution one-tenth normal. Sucrose is not affected by such treatment, no matter what the concentration of its solution. In determining sucrose in a mixture of sugars or in substances containing various sugars, a solution is prepared containing not more than 2 per cent. of sugar other than sucrose, and is heated after the addition of the requisite quantity of sodium hydroxide; the heating may be carried out by boiling the solution under a reflux condenser for 45 minutes, or by placing the solution in a pressure flask and immersing the latter in a boiling water-bath for this period of time. The same object is attained by keeping the solution at a temperature of 37° C. for

24 hours. These periods of time are necessary for the complete alteration of the optical properties of the sugars mentioned. In the case of such materials as sweet wines, condensed milk, etc., the sample is suitably diluted, treated with lead acetate, the excess of lead is removed by means of sodium phosphate, and the resulting solution is treated as described. The results obtained by the method are stated to agree with those yielded by the ordinary methods employed in sugar analysis.—W. P. S.

β-Glucose [β-Dextrose]. R. Behrend. Annalen, 1910, **377**, 220—223.

As a result of further experiments (this J., 1907, 541) the author considers that the substance described as β-glucose is dextrose crystallising with a molecule of pyridine.—F. Shdn.

Inositol; Improvement in Scherer's test for ——. E. Salkowski. Z. physiol. Chem., 1910, **69**, 478—481.

A trace of inositol is dissolved in 1 or 2 drops of nitric acid of sp. gr. 1·2, and one drop of a 10 per cent. solution of (anhydrous) calcium chloride is added, together with one drop of a 1—2 per cent. solution of platinic chloride. The mixture is evaporated carefully on a porcelain crucible cover, the liquid being blown and moved about to assist evaporation without calcination. A rose to brick red colouration is thus developed, which on standing becomes orange, owing to deliquescence. If the residue be again heated the red colouration returns with a bluish shade; excessive heating causes the separation of platinum. The reaction is quite satisfactory with 0·1 mgrm. of inositol, and perceptible with 0·05 mgrm. The platinum appears to act as a catalyser, and Scherer's original test was performed on platinum foil, without recognition of its specific importance.—J. F. B.

Fertilising with molasses. Peck. *See* XVI.

Patents.

Starchy material; Process of converting —— into sugar. J. Takamine, New York. U.S. Pat. 975,656, Nov. 15, 1910.

A portion of the starchy material to be treated is extracted with water and the aqueous extract is separated. The extracted material is then mixed with the unextracted portion and the whole is heated, a quantity of a weak acid being added in order to liquefy and render the starch soluble. The acid is then neutralised, and the aqueous extract obtained previously is added, the ferments in the aqueous extract acting as saccharifying agents.—W. P. S.

Adhesive substances; Process for the preparation of —— forming a paste with cold water, from potatoes. J. Kantorowicz. Ger. Pat. 227,430, May 22, 1909.

Adhesive substances are obtained in the form of flocks by drying potato-flour or other amylaceous materials on surfaces heated to above 100° C., and are then mixed with alkaline or acid substances, substances (peroxides) capable of readily yielding oxygen, and substances (bleaching powder) capable of liberating oxygen, or with hygroscopic substances.—A. S.

Size-powder. F. Beckmann, Warsaw, Russia. U.S. Pat. 976,116, Nov. 15, 1910.

See Ger. Pat. 223,709 of 1908; this J., 1910, 1172.—T. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Malt; Colour of —— and its determination. Brand. Z. ges. Brauw., 1910, **33**, 577—581.

Various methods have been proposed for determining the colour of malt wort and beer. A rapid and fairly accurate determination can be effected by comparing the colour of the wort with that of a suitably coloured liquid contained in a glass vessel of the same shape. The comparison liquid may be a solution of iodine (cp. Hanow, this J., 1903, 1205) or other suitable material; Moufang has described the method of preparing an ammoniacal extract of barley husks for use as a colour-standard (this J., 1910, 506). If solutions of substances other than iodine are used, their colour-value should be controlled with $N/10$ iodine solution. For determining the colour of turbid worts, Reeder's method (this J., 1909, 487) is satisfactory; the barium sulphate adsorbs part of the colouring matter, but the author considers that the error thus introduced is negligible for practical purposes. With regard to malt of the Pilsener type, the demand for a very light coloured grain is not justifiable. The recommendation recently made that the colour-value of the laboratory wort from Pilsener malt should not exceed 0·25 c.c. of $N/10$ iodine solution, and that, as limit of error, 0·05 c.c. should be allowed, are supported by the author. It is a matter of indifference whether the laboratory wort from Pilsener malt has a colour corresponding to 0·15 or 0·2 c.c. of $N/10$ iodine; such small differences disappear in working on the practical scale. Attempts to obtain a malt of much lighter colour than corresponds to 0·2 c.c. of $N/10$ iodine generally lead to under-kilning, and under-kilned malt yields beer of inferior quality. The use of kilns heated with coke favours the production of pale malt owing to the bleaching action of the sulphurous acid derived from the coke. Where coke-heated kilns are not used, the malt is generally sulphured on the top kiln-floor in order to obtain the very pale colour desired; pure, arsenic-free sulphur should be used. The colour of Bavarian malts varies between considerably wider limits than that of Pilsener malts. It has been recommended that the colour of Bavarian malt should be equivalent to not less than 0·5 c.c. of $N/10$ iodine, but the author considers that this limit is too low. The author also discusses the various theories that have been advanced concerning the colouring substances of malt. According to Matthews and Lott (this J., 1908, 869) the nitrogenous substances are chiefly responsible for the colour, and the colour is mainly situated in the germ. Basing his view on the various theories that have been put forward, the author advances the following explanation of the formation of the colouring substances in malt:—In presence of moisture, lævulose, which is a normal constituent of green malt, darkens at a temperature lower than 212° F., and certainly undergoes a partial change of this kind during kilning. The protein substances possess great adsorptive power whereby they are enabled to take up, and retain the colouring matter formed by the decomposition. Hence, the strongest colouration occurs in and near the germ, where the proteins are chiefly situated.—L. E.

Yeast-gum; Behaviour of —— in autolysis and alcoholic fermentation. E. Salkowski. Z. physiol. Chem., 1910, **69**, 466—471.

The author has isolated yeast-gum from the solution produced by the autolysis of pressed yeast in presence of chloroform-water. The clarified solution was concentrated, treated with alcohol, and the gum was purified by conversion into its copper compound with Fehling's solution. The quantity of gum recovered from the autolysed solution amounted to 0·29—0·34 per cent. of the yeast. Practically the same quantity of gum was recovered in a similar manner from filtered solutions of sugar which had been completely fermented by yeast. The total quantity of gum present in yeast has been estimated at 2 per cent., but under certain conditions and with certain improved methods of extraction as much as 5·39 per cent. of gum has been found. Thus only a small proportion of the total gum goes into solution in autolysis; the remainder appears to remain unaltered in the cellular residues. (See also this J., 1894, 411, 1213; 1895, 376.)—J. F. B.

Denatured alcohol production of the United States. U.S. Inter. Rev. Rept. Oil, Paint, and Drug Rep., Nov. 28, 1910. [T.R.]

The withdrawal of distilled spirits free of tax for denaturation showed during the year a considerable increase, 10,598,749·2 gallons having been withdrawn for the purpose during the fiscal year 1910, as compared with 7,971,636·4 gallons for the fiscal year 1909. No industrial distilleries are in operation, however, and no considerable amount of denatured alcohol has been used for purposes other than in connection with certain lines of manufacturing. The following table shows the production of denatured alcohol by grades during the fiscal year ended June 30, 1909, the quantities being in taxable gallons :

Removed from	Rum.	Alcohol.	Commercial alcohol.
	gallons.	gallons.	gallons.
Distillery warehouses	5703·9	1,252,794·9	7,034,356·4
General bonded do. ..	–	7,121·5	–
Cistern rooms of distilleries by pipelines	523,397·9	–	1,782,496·1
Totals..........	529,101·8	1,259,916·4	8,816,852·5

Beers ; Preparation of —— of low alcohol-content and of beers free from alcohol. O. Reinke. Chem.-Zeit., 1910, **34**, 1253—1254.

Beer of low alcohol-content.—A 6 per cent. wort, prepared by the thick mash process, is subjected to vat fermentation, the attenuation being carried to a high degree ; the beer is kept in the cellar for 14 days in a tightly bunged cask, and then mixed with cold, unfermented 6 per cent. wort (also prepared by the thick mash process). The mixture is carbonated, cooled to a low temperature under a pressure of 1·5 atmospheres, and racked into cask under a pressure of 0·6 atmosphere. If the beer is to be kept long in bottle, it must be pasteurised at 145°—146° F. for half an hour ; if it is to be kept for a comparatively short time, a pasteurising temperature of 131° F. for half an hour, is sufficient. The composition of a beer prepared from equal parts of fermented and unfermented 6 per cent. wort, is as follows :—Saccharometer reading, 3·8 ; extract, 4·2 ; alcohol, 0·9 ; maltose, 2·4 ; dextrin, 1·0 ; ash, 0·2 ; phosphoric acid, 0·04 ; nitrogen, 0·04 ; protein, 0·25 per cent. *Beer free from alcohol.*—For the preparation of beer free from alcohol, the liquor known as "Brunswick Mumme" may be used ; to obtain this liquor, the feebly hopped wort obtained by immersing hops in the wort prepared by the triple thick mash process, is evaporated until its extract-content amounts to about 60 per cent., and then filtered ; the protein substances precipitated during the evaporation were, at one time, used as cattle-fodder, but are now often worked up into valuable nutriment. If the clear "Mumme" is diluted with water (35 grms. of "Mumme" and 300 grms. of water), carbonated, and racked into bottle under a pressure of 0·6 atmosphere, a fine, brown, clear beer, free from alcohol, giving a persistent head, and possessing a pleasant flavour, is obtained. The unpasteurised beer may be kept for 8 days or more in bottle, and in composition it resembles a full dark beer of 13 per cent. original gravity, save that it contains more maltose and practically no alcohol. It is free from the celery-like flavour almost always contracted by worts on standing or storing and further working up, through development of *Bacterium termo.* Moreover, it does not develop haze, and does not become turbid on pasteurisation even at a temperature of 158°—167° F. Filtered Dantzic Jopen beer (see this J., 1906, 131) may also be used for the preparation of alcohol-free beer.—L. E.

Mead. G. Filaudeau and F. Muttelet. Ann. Falsif., 1910, **3**, 470—471.

The beverage known as mead is prepared by submitting an aqueous solution of honey to alcoholic fermentation, this fermentation being produced by the introduction of specific wine yeasts into the boiled and cooled solution. Its alcoholic strength, composition, and aroma vary according to the concentration of the solution of honey employed. Mead is sometimes adulterated by the addition of invert sugar but this may be detected by the presence of furfural compounds. Characteristic constituents of pure meads are the dextrins derived from the honey. It is not improbable that hydromel is employed to adulterate wine, and any wine which is dextro-rotatory and contains an abnormal quantity of dextrins should be regarded with suspicion. The taste of such wine often affords useful information as to the presence of mead.—W. P. S.

Koumiss. B. Rubinsky. Zentralbl. Bakt. u. Parasitenk., II. Abt., 1910, **28**, 161—219. Chem. Zentr., 1910, **2**, 1628—1629.

In the production of koumiss by the fermentation of mare's milk, the lactose is converted on the one hand into lactic acid, and on the other into alcohol and carbon dioxide ; after 12—24 hours the fermented milk contains 0·5—0·6 per cent. of lactic acid and 0·7—0·9 per cent. of alcohol. Koumiss of average composition contains 0·7—0·8 per cent. of lactic acid and 1—2 per cent. of alcohol and only small quantities of lactose. Strong koumiss contains 0·8—0·9 per cent. of lactic acid and 1·8—3 per cent. of alcohol ; it is free from, or contains at the most, traces of lactose. The casein is profoundly modified, being converted partly into peptones, whilst the portion remaining as casein in the finished koumiss contains its mineral constituents in entirely different proportions from those of the original casein. Four kinds of micro-organisms are nearly always found in koumiss, viz., koumiss-yeast, koumiss-bacterium, *Streptococcus lactis* which causes the curdling of milk, and *Bact. aerogenes* (*Bac. acidi lactici*, Hüppe) ; besides these, *Bact. caucasicum*, Nicolajewa, is also occasionally observed. Only the koumiss-yeast and bacterium are necessary for the koumiss-fermentation, but the *Streptococcus* and *Bact. aerogenes*, by their production of acid, aid the former in their struggle against injurious organisms. Lactic acid of a concentration of 0·7—0·8 per cent. already acts injuriously on the *Streptococcus* and *Bact. aerogenes* ; consequently these organisms are not usually present in medium and strong koumiss. Koumiss-yeast grows well in milk, which it curdles to the extent of one-half to two-thirds ; it is of the bottom-fermentation type ; decomposes casein and albumin ; and produces aromatic ester-like compounds and volatile acids ; the ester-like compounds are the cause of the aroma of koumiss. Koumiss-bacterium appears to be closely related to the other lacto-bacilli of all kinds of fermented milk and to *Bac. acidophilus*, Moro ; it belongs to the third group of Löhnis' classification of lactic acid bacteria. It does not grow at temperatures below 23°—24° C. and, in general, not above 40° C. ; when freshly isolated from koumiss its optimum is at 32°—36° C. Normal koumiss can be prepared from mare's milk and camel's milk by pure cultures of koumiss-yeast and bacterium, but not from cow's milk ; probably the proteins of mare's milk are less resistant.—A. S.

Wines ; Sulphurous acid in white ——. P. Carles. Bull. Soc. Chim., 1910, **7**, 998—1001.

The author quotes the results of some experiments that have been made by a Bordeaux Commission concerning the action of sulphited white wine on dogs and on men. It is shown that wine containing as much as 0·4 grm. of total sulphurous acid (including 0·1 grm. in the free state) per litre, is not injurious.—L. E.

Absinthe ; Analysis of commercial ——. L. Ronnet. Ann. Falsif., 1910, **3**, 477—480.

A process is described which permits of both the determination of the "essences" and an examination of the alcohol employed in preparing the liqueur. The "essences" are determined iodometrically, and another portion of the sample is then shaken with olive oil ; the latter extracts the "essences" and the alcoholic liquid is then examined by the usual methods for the determination of esters, furfural, etc., in order to ascertain whether commercial alcohol or brandy has been used in the manufacture. A volume of 250 c.c. of the liqueur together with 25 c.c. of water is distilled, 245 c.c. of distillate being collected in a 250 c.c. flask and then diluted to the mark with water. After the alcoholic strength of the distillate has been determined, 50 c.c. are taken for the determination of the iodine value, Hübl's solution being used; the quantity of "essences" present may be calculated from the amount of iodine absorbed, as 1 grm. of the mixture of essential oils constituting the "essence" absorbs 1·328 grm. of iodine. The remainder of the distillate is now diluted with water until the alcoholic strength has been reduced to 50 per cent., and 200 c.c. of the resulting solution are shaken in a separating funnel with about 50 c.c. of olive oil which has been washed previously with alcohol and dried at a temperature of 100° C. At the end of 1 hour the alcoholic solution is drawn off and passed through a filter which has been moistened with 0·5 c.c. of 50 per cent. alcohol. Aliquot portions of the filtrate are then employed for determinations of the quantities of aldehydes, esters, higher alcohols, furfural, and free acid present. It is stated that the extraction with olive oil does not interfere with the determination of these constituents and that one extraction is sufficient to remove all the "essence." The method may be applied to the examination of other liqueurs; the class known as "aperitifs amers" are flavoured chiefly with orange oil, 1 grm. of which absorbs 3·42 grms. of iodine.—W. P. S.

Patents.

Beverages from grapes and raisins; Manufacture of ——. E. W. Kuhn, London. Eng. Pat. 20,489 of 1910; date of Application, Nov. 29, 1909. Addition to Eng. Pat. 27,831 of 1909, dated Dec. 2, 1908 (this J., 1910, 1267).

To each litre of the boiling liquid, consisting of diluted grape juice and hops, are added 20 grms. of finely powdered malt. The liquid is then cooled, malt extract is added, and the mixture is fermented.—W. P. S.

Brewing beer and other liquors; Art of ——. F. Rogerson, Streatham, Assignor to Ozonair, Ltd., London. U.S. Pat. 976,602, Nov. 22, 1910.

See Eng. Pat. 17,909 of 1906; this J., 1907, 630.—T. F. B.

XIXa.—FOODS.

Milk; Effect of boric acid on ——. Report of Government Bureau of Microbiology, New South Wales, 1909, 124—130.

Examination of the effect of addition of different proportions of boric acid to milk showed that 400 grains or more of boric acid per pint would be needed to sterilise the milk. By the addition of 10 grains or more of boric acid per pint, the only notable effect was to prevent or check the development of the lactic bacteria, and thus delay souring, and to allow putrefactive changes to take place more rapidly and to a greater extent.—A. S.

Determination of the amide-nitrogen in proteins. Denis. *See* XXIII.

Patents.

Whey; Utilisation of —— *for dietetic purposes.* F. T. Bond, Gloucester. Eng. Pat. 26,168, Nov. 12, 1909.

The acid whey obtained by the process described in Eng. Pat. 23,127 of 1909 (this J., 1910, 1327) may be concentrated under atmospheric or reduced pressure so as to form a syrupy liquid or a solid mass. The solid product may be ground and the powder pressed into the form of tablets. Or, the whey may be sprayed into a current of air having a temperature of about 300° F., and the finely divided dry powder thus obtained pressed into tablets.—W. P. S.

Bread poor in carbohydrates; Process for the production of ——. W. Stahl, Monte-Carlo, France. Eng. Pat. 17,417, July 22, 1910.

Finely divided wheaten or rye bread is boiled for a few hours with a very dilute solution of hydrochloric acid; the dissolved and agglutinated starch is then saccharified by treatment with malt, and the sugar produced is fermented with yeast. The resulting thick pulpy mass is mixed with dry powdered gluten so as to form a dough, and the latter is baked.—W. P. S.

Cow's milk; Method of reducing the proportion of salts and sugar contained in —— *without diminishing the content of fat and casein.* P. Müller, Frankfort on Maine, Germany. Eng. Pat. 3508, Feb. 12, 1910.

See Fr. Pat. 412,256 of 1910; this J., 1910, 1031.—T. F. B.

XIXb.—WATER PURIFICATION; SANITATION.

Essential oils in relation to their antiseptic powers. W. H. Martindale. Perfumery and Essential Oil Record, 1910, 1, 266—274.

In determining the antiseptic power of an essential oil, comparison was made with phenol according to the *Lancet* method. In this, the phenol coefficient is obtained by dividing the percentage strength of the weakest lethal dilution (for a specific organism) of a phenol solution by the figure representing the percentage strength of the weakest lethal dilution of the disinfectant under examination, when acting on the same organism under identical conditions (see this J., 1910, 1077 and 1344). An active agar culture of *Bacillus coli communis* was used throughout, and 24 hours filtered broth cultures were made for each day's use. Sterile broth and "McConkey's medium" were also used. Saponaceous and aqueous solutions of the oils were tested. Small amounts of the broth culture were mixed with the various dilutions of the antiseptic for 2 or 30 minutes. At the end of the time, a small amount of the mixture was transferred to a tube of McConkey's medium, which was observed after incubating for 24 hours at 37° C. The following figures are the average of the phenol coefficients for 2 minutes and 30 minutes. Origanum oil (water) 25·76; thymol (soap) 25·29; carvacrol (soap) 21·32; thymol (water) 19·41; thyme oil (soap) 14·85, (water) 13·38; geraniol (soap) 12·29; cinnamon leaf oil (soap) 9·66; oil of cinnamon bark, 52 per cent. of aldehyde, (soap) 8·91; oil of cloves (soap) 8·88; cinnamic aldehyde, (soap) 8·029; citronellol (soap) 8·117; oil of cinnamon bark, 82 per cent. of aldehyde (soap) 7·925, (water) 7·105; rosemary oil 5·94; otto of rose (soap) 5·94; cassia oil (soap) 5·35; wintergreen oil (soap) 4·64; *Eucalyptus amygdalina* oil (soap) 4·35; English lavender oil (soap) 4·94; lemon oil (soap) 3·94; almond oil, S.A.P. (soap) 3·76; eucalyptol (soap) 3·76; *Eucalyptus globulus* oil (soap) 3·55; light oil of tar, rectified, 2·175; sandalwood oil 1·67; birch tar oil 1·67; cade oil, less than 1.
—F. Shdn.

Patents.

Sterilising apparatus. V. Henri and D. Helbronner, Paris, and M. von Recklinghausen, Bas Meudon, France. Eng. Pat. 25,509, Nov. 5, 1909.

Means are described for thoroughly agitating liquids while the latter are being subjected to the action of ultraviolet rays. The tank in which the treatment takes place may be provided with baffle-plates adapted to guide and circulate the liquid. These baffle-plates may be arranged radially below the mercury lamp, and may have the form of truncated cones lying one within the other; the liquid is admitted tangentially near the periphery of the tank and passes over and under the plates alternately, leaving the tank through a pipe in the centre of the latter. Several other ways of fitting the baffle-plates in the tank are also described.—W. P. S.

Water; Apparatus for the purification of ——. F. and F. P. Candy, London. Eng. Pat. 27,607, Nov. 27, 1909.

An apparatus is described by means of which a solution of a reagent or a gas may be introduced into water which is flowing under pressure through a pipe. It consists of two closed tanks connected at the top by means of a pipe. The water conduit is provided with a valve so that a greater pressure of water is produced on one side of the valve than the other. One of the tanks is connected with the water conduit at the side of the valve where the greater pressure exists. The second tank is filled with the solution of the reagent to be added to the water. Water from the conduit is then allowed to enter the first tank; pressure is thus created in the apparatus, and, when the water is cut off and the second tank placed in communication with the conduit, the reagent is forced into the latter. The reagent may be passed through a chamber containing a ball-float before it enters the conduit in order to regulate the discharge of the solution. A somewhat similarly constructed apparatus is described for the introduction of a gas into the water conduit before the water is delivered on to a filter. Two sets of the apparatus may be provided so that the treatment of the water may be continuous, one set of tanks being in use while the other set is being emptied of water and filled with the solution.—W. P. S.

Sewage water; Apparatus for purifying ——. P. Koch, Villingen, Germany. Eng. Pat. 13,877, June 8, 1910.

The water is conducted into a channel whence it is delivered into a number of smaller channels placed below the delivery channel. Bundles of fibres or threads are fixed at intervals across the smaller channels, the ends of the threads hanging down over the outside of the channels. The water flows along the threads, the latter acting as capillary siphons, and the drops of water fall from the ends of the threads on to the surface of a filter. The water is thus aerated thoroughly before it comes into contact with the filter.—W. P. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Opium production in Northern China. L. van Itallie and M. Kerbosch. Arch. Pharm., 1910, 248, 614—615.

The cultivation of the poppy for opium is still carried on in Northern China, the plants being grown on the Loess near the villages and even in the gardens. When the ground has thawed, about the end of April or the beginning of May, it is ploughed in shallow furrows. The seeds are sown by a special implement, and the furrows rolled over. When the plants are a few centimetres high, the ground is hoed, and later on they are earthed up. The plants are 60—90 cm. high by July 20, when they begin to bloom. The green capsules are cut when the diameter is less than 4 cm. They are cut horizontally in the middle and the sap which flows out removed by the finger to a vessel. The heads are cut in the same way each day or every other day, till about ten cuts have been made. The sap, after collecting, is heated over a fire of straw, and the scum removed. The black viscous mass thereby produced is ready for use.—F. Shdn.

Papaver somniferum L.; Formation and distribution of certain alkaloids in ——. M. G. J. M. Kerbosch. Arch. Pharm., 1910, 248, 536—567.

The author arrives at the following conclusions respecting the occurrence and distribution of certain of the alkaloids in *Papaver somniferum* L. The seeds contain traces of narcotine and an amorphous alkaloid, whilst three days after germination notable amounts of narcotine are present. The alkaloids appear in the following order, narcotine, codeine, morphine, papaverine, thebaine, the first four being found when the plant is only 5—7 cm. high. The flowering plant, up till the time of ripening, contains narcotine, papaverine, codeine, and morphine in all its organs with the exception of the hairs. The latex varies in composition in different parts of the plant. Narcotine, codeine and morphine are found in all the organs of the ripe plant. Narcotine is produced from the albumin of the seeds and is found in seeds which have germinated in nitrogen-free soil. This alkaloid is present in moderate amount in very young plants; the quantity is much greater in the flower-heads than in the unripe seed capsules.—F. Shdn.

Opium, Composition of ——. L. van Itallie and M. Kerbosch. Arch. Pharm., 1910, 248, 609—613.

A number of samples of opium have been examined and the principal alkaloids present have been ascertained. Narcotine, papaverine, narceine, thebaine, codeine and morphine are present in samples from the following countries:—Asia Minor, India ("Malva"), China ("Taó Ky," "Kai-hou," "Sjong-hou"), America ("Jenesse"), France ("du Centre," "Aubergier," "de Vermont"), Persia, Egypt. The above alkaloids with the exception of papaverine, were also found in certain samples of Indian origin, viz.:—"Bengales," "Patna" and "Benares."—F. Shdn.

Thebaine, morphine and their ethers; Action of hydrogen peroxide upon ——. M. Freund and E. Speyer. Ber., 1910, 43, 3310—3311.

Under the action of a 30 per cent. solution of hydrogen peroxide on thebaine, morphine and other alkaloids at the temperature of the water-bath, stable oxides are formed. In these substances one atom of oxygen is attached to the nitrogen atom with the formation of amino-oxides. The oxides form stable salts even with hydriodic acid, and they do not give any blue coloration with starch and potassium iodide. Sulphurous acid reduces them to the original alkaloid. They have none of the characteristic physiological action of the parent substances. Thebaine-oxide melts at about 80° C., and the hydrochloride at 238°—239° C., the latter forming colourless needles. Morphine-oxide crystallises from dilute alcohol in small prismatic crystals, m. pt. 274°—275° C. The nitrate, $B.HNO_3.1{\cdot}5H_2O$, melts at 206°—208° C. Codeine-oxide crystallises from water in rectangular tablets, m. pt. 230°—231° C.; the hydrobromide melts at 196° C., and the nitrate at 187° C. Ethylmorphine-oxide crystallises from water in fine needles, m. pt. 220°—221° C.
—F. Shdn.

Narcotine and hydrastine. P. Rabe and A. McMillan. Annalen, 1910, 377, 223—258.

This paper contains a full discussion of the constitution of narcotine and hydrastine, the work of previous investigators being taken into account. Nornarceine (this J., 1907, 944) was converted into the isonitroso-compound by means of ethyl nitrite, and this when treated with phosphorus pentachloride, yielded hemipinic acid and a nitrile-base. The latter substance, 1-methylaminoethyl-2-cyano-3-methoxy-4.5-methylenedioxybenzene, $C_{12}H_{14}O_3N_2$, crystallises from ether as a colourless powder, m. pt. 61° C., and is alkaline to litmus. The methiodide, m. pt. 226° C., is identical with the corresponding compound obtained by Freund and Oppenheim in the decomposition of narceine (this J., 1909, 541). Isonitrosomethylhydrasteine was produced in a similar way, and melted at 189°—190° C. when crystallised from water. Under the action of phosphorus pentachloride it yielded hemipinic acid and 1-dimethylaminoethyl-2-cyano-4.5-methylenedioxybenzene. The latter was an oily base, the picrate melting at 188°—189° C., and the methiodide at 260° C. It is shown that the stereoisomeric substances, narcotine and gnoscopine differ in their chemical behaviour. The sodium salt of narcotine crystallises with 5 molecules of water, melts at 85°—87° C., and is soluble with difficulty in water. When treated with acids, narcotine is liberated. The sodium salt of gnoscopine is readily soluble in water. Under the action of acids it gives rise to the inner salt of the basic hydroxycarboxylic acid, which changes into gnoscopine at 100° C. Narcotine is decomposed by heating with dilute sulphuric acid as well as dilute acetic acid (this J., 1907, 944). With sulphuric acid cotarnine and meconin were formed, but no other alkaloids were isolated. Heating narcotine with barium hydroxide solution gave rise to small amounts of gnoscopine, nornarceine and meconin. Heating narcotine with either water, dilute alcohol, or absolute alcohol produces gnoscopine and meconin, but no other base. The authors state that a molecule of a substance derived from narcotine or hydrastine containing a tervalent nitrogen atom suffers decomposition or fission on hydrolysis. If the nitrogen on the

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other hand is quinquevalent, the molecule undergoes rearrangement as a result of hydrolysis, without being subdivided. A number of experiments are described in support of this. When hydrastine methyliodide is treated with silver oxide a solid, m. pt. 242° C. is produced. This the authors regard as an oxybetaine, and it gives no meconin or methylhydrastine on boiling with water. When hydrastine methyl chloride is treated with silver hydroxide, methylhydrastine is produced. The same substance when heated with acetic acid and sodium acetate gave the oxybetaine m. pt. 242° C., and a little methylhydrastine, but no meconin. Similarly no meconin resulted when the same reactions were applied to narcotine methyl hydroxide. Narcotine methyl chloride was treated with excess of sodium hydroxide solution, the precipitate taken up with ether, the solution rapidly dried and concentrated. Methylnarcotine was obtained in this way. It melts at 113°—115° C., is optically inactive, and behaves as an unsaturated compound. The methiodide (prepared in benzene solution) melts at 260° C. The hydrochloride melts at 128°—130° C. —F. Shdn.

Narcissine: an alkaloid from the bulb of the common daffodil (Narcissus Pseudonarcissus). A. J. Ewins. Chem. Soc. Proc. 1910, 26, 296—297.

A new alkaloid, *narcissine*, has been isolated from the bulb of the common daffodil (*Narcissus Pseudonarcissus*). It has been shown to possess the formula, $C_{16}H_{17}O_4N$, melts at 266°—267° C., and is lævorotatory ($[\alpha]_D = -95{\cdot}8^\circ$). It contains no methoxy-groups, and is characterised by great stability. The hydrochloride, $C_{16}H_{17}O_4N.HCl$, was also described.

Eriodictyol, homoeriodictyol, and hesperitin; Constitution of ——. F. Tutin. Chem. Soc. Trans., 1910, **97**, 2054—2062.

The formula originally assigned to homoeriodictyol by Power and Tutin (this J., 1907, 635) is confirmed. Eriodictyol and hesperitin bear a simple relation to homoeriodictyol, for on methylation each yields the substances, 2 : 4 : 6-trimethoxyphenyl 3 : 4-dimethoxystyryl ketone, and 2-hydroxy-4 : 6-dimethoxyphenyl 3 : 4-dimethoxystyryl ketone. These two substances have been prepared synthetically (see following abstract). 2 : 4 : 6-Trimethoxyphenyl 3 : 4-dimethoxystyryl ketone, $C_{20}H_{22}O_6$, crystallises from alcohol in yellow prisms melting at 85° C. when air-dried, and at 117·5° C. when anhydrous. The latter ketone crystallises from alcohol in yellow leaflets, m. pt. 154° C. Monomethyleriodictyol was prepared by the partial methylation of eriodictyol. It crystallises from alcohol in colourless needles, m. pt. 215° C., and has the constitution 2 : 6-dihydroxy-4-methoxyphenyl 3 : 4-dihydroxystyryl ketone. Homoeriodictyol has the constitution 2 : 4 : 6-trihydroxyphenyl 4-hydroxy-3-methoxystyryl ketone. The constitution of hesperitin is 2 : 4 : 6-trihydroxyphenyl 3-hydroxy-4-methoxystyryl ketone. Hesperitin forms a tetra-acetyl derivative, m. pt. 127° C.—F. Shdn.

Eriodictyol, homoeriodictyol, and hesperitin; Synthesis of a methyl derivative of ——. F. Tutin and F. W. Caton. Chem. Soc. Trans., 1910, **97**, 2062—2068.

Phloroglucinol trimethyl ether and acetyl chloride were first condensed and the resulting ketone condensed by means of sodium with vanillin methyl ether. The product thereby obtained was 2 : 4 : 6-trimethoxyphenyl 3 : 4-dimethoxystyryl ketone. This substance, $C_{20}H_{22}O_6$, melts at 85° C. when air-dry owing to the presence of a molecule of alcohol of crystallisation, the anhydrous substance melting at 117·5° C. It forms a deep red solution with hydrochloric or sulphuric acids, and distils without decomposition at 325° C. at 13 mm. It is hydrolysed on heating with aluminium chloride, being converted into 2-hydroxy-4 : 6-dimethoxyphenyl 3 : 4-dimethoxystyryl ketone, $C_{19}H_{20}O_6$, which crystallises from alcohol in deep golden-coloured plates, m. pt. 154° C.—F. Shdn.

Extraction under pressure produced by a fluid. [*Extracting drugs and dissolving rubber.*] W. Bruns. Ber. deuts. Pharm. Ges., 1910, 20, 506—508.

The author has found that substances rich in extractive matter can be extracted in a very satisfactory manner under pressure. This is maintained by connecting the apparatus, which may be of glass, to the water-supply. The material must be so arranged inside as not to be pressed against the lid of the apparatus. Para rubber can be dissolved in benzene in a few hours using this process. Drugs such as gentian and rhubarb can be extracted whole, without being previously powdered.—F. Shdn.

Peppermint in Germany; Cultivation of the Japanese ——. H. Thoms. Ber. deuts. Pharm. Ges., 1910, 20, 424—431.

During the spring of 1909, a number of roots of the Japanese peppermint (*Mentha canadensis* var *piperascens* Briq.) were received by the author and planted at Dahlem, near Berlin. A sufficient quantity of the plants grew this year for distillation, the yield of oil being about 0·5 per cent. of the dry weight of the plant. The constants of this oil were very close to those of peppermint oil produced in Japan.—F. Shdn.

Phenolphthalein; Volumetric determination of ——. V. Zotier. Bull. Soc. Chim., 1910, 7, 993—995.

One c.c. of $N/10$ sodium hydroxide is equivalent to 0·0159 grm. of phenolphthalein, and the author finds that the latter substance is soluble in water to the extent of 0·092 grm. per litre, within the ordinary limits of temperature. On these facts he bases the following method for determining phenolphthalein:—The phenolphthalein (0·1—0·2 grm.) or the material containing it, is triturated with some small pieces of sodium hydroxide (free from carbonate). The whole is dissolved in a little water, and filtered, the filtrate and washings being made up to 50 c.c. Twenty-five c.c. of this solution are introduced into a test-tube, and treated with dilute hydrochloric acid, added drop by drop, until the phthalein begins to be precipitated; this precipitate is re-dissolved by adding exactly the requisite quantity of $N/10$ sodium hydroxide (free from carbonate), and the solution is then treated with $N/10$ sulphuric acid until the colour changes. The total volume, V, of the solution is then measured. If n is the number of c.c. of $N/10$ sulphuric acid employed, the weight of phthalein, in grms., contained in the sample, is given by the formula,

$$2[(n\times 0{\cdot}0159)+(V-n)0{\cdot}000092].$$

It is advisable to make a control experiment; for this, the remainder of the filtrate is introduced into a second test-tube of the same diameter as the first, and treated with sufficient acid to produce a tint equal to that of the solution in the first tube.—L. E.

Iodoform; Oxidation of —— *by oxygen. Photochemical Studies, Part I.* J. Plotnikow. Z. physik. Chem., 1910, 75, 337—356.

The author has investigated the photochemical oxidation of iodoform in benzene solution, in a specially-constructed thermostat, at constant temperature, with constant monochromatic illumination and constant oxygen concentration. There is no separation of iodine in the absence of oxygen, and none in a solution which has never been exposed to light. In the light, under constant conditions, the iodine separated is proportional to the time, and if the illumination is removed the reaction still proceeds, but with smaller velocity. The special investigation of this "after reaction" shows that it has all the characteristics of a normal chemical action, *e.g.*, it has a normal temperature coefficient, and its velocity changes with the concentration in a fixed way. Its velocity, however, is somewhat diminished with increased illumination. On subtracting the effect of the dark reaction from the total effect in the light, the purely photochemical action may be studied; and it is found to have the usual characteristics of such reactions. The velocity as measured by the separation of iodine is linear, *i.e.*, the iodine formed is proportional to the time of exposure, the temperature coefficient is small (1·42 for 10° C.), the rate of iodine formation increases with more concentrated solution to a maximum, and is proportional to the intensity of the light. The most effective rays are the blue, λ=436, which account for 77 per cent. of the total activity of the spectrum. It is not possible exactly to identify the two reactions with stages of the total reaction: (1) $CHI_3+O=COI_2+HI$; (2) $COI_2=CO+I_2$, (3) $2HI+O=H_2O+I_2$, but the photochemical reaction is probably closely connected with (3). The whole reaction is the sum of a purely photochemical process and an indirect photochemical catalysis. (See also this J., 1906, 232 and 653.)—W. H. P.

Iodoform; Oxidation of —— by oxygen. (II.) J. Plotnikow. Z. physik. Chem., 1910, 75, 385—404.

The observations previously described (see preceding abstract) have been extended to different solvents. It is found that the nature of the solvent has a very great effect on the velocity and nature of the reaction. In carbon tetrachloride and ethyl acetate as in benzene, the reaction proceeds with diminished velocity in the dark after exposure, while in carbon bisulphide, ether, alcohol and acetone there is no after-reaction. In the latter solvents the reaction-velocity is very different from that observed in benzene, but the characteristic factors of a photochemical reaction remain, *i.e.*, low temperature coefficient (1·4 for 10° C.), increase of the velocity constant with concentration to a fixed limit, and the proportional activity of the blue (λ=436) rays (78 per cent. of the whole). The measurement of light absorption of solutions of iodoform in the various solvents gives a molar extinction coefficient which is for all rays independent of concentration and of the thickness of the solution layer, but which shows no apparent relation to the velocity constant in that solvent. Similar experiments with iodine show that only in some solvents with some rays, is the above-mentioned constancy observed, the fluctuations following no fixed rule. Incidentally it is stated that a 2 cm. layer of a 0·02-*N* solution of iodine in carbon tetrachloride is a very efficient filter for retaining blue rays and allowing violet ones (λ=405—408) to pass.—W. H. P.

Chloroamine reactions. Methylene chloroamine. C. F. Cross, E. J. Bevan, and W. Bacon. Chem. Soc. Trans., 1910, 97, 2404—2406.

Formaldehyde and chloroamine in aqueous solution react according to the equation, $CH_2O+H_2NCl=CH_2:NCl+H_2O$. The "methylene chloroamine" so formed separates in crystals, and can be recrystallised from chloroform. It is soluble in 20—30 parts of ether or of benzene. It is very unstable, spontaneously decomposing at the ordinary temperature, and exploding when heated to 50°—60° C.—J. T. D.

Acetaldehyde; Determination of —— by means of pyrrol and application of the method for the determination of lactic acid. W. Sobolewa and J. Zaleski. Z. physiol. Chem., 1910, 69, 441—451.

Ihl's qualitative test for aldehydes is based on the red colouration produced with an alcoholic solution of pyrrol and hydrochloric acid. With dilute solutions of aldehyde the red colouration is produced very slowly, but the solutions develop a white turbidity which subsequently settles as an amorphous precipitate. According to the conditions, this turbidity is produced in aqueous media in the presence of 0·5—0·2 mgrm. of acetaldehyde or formaldehyde. Ketones, *e.g.* acetone, give a similar reaction, but the presence of hydroxyl groups in aldehydes or ketones destroys the delicacy of the reaction. A quantitative method for the determination of acetaldehyde has been based on the above reaction, by observing in a series of test-tubes the smallest quantity of the aldehyde solution required to produce a visible turbidity. Two test solutions are employed: (*a*) a 2—4 per cent. solution of hydrochloric acid; (*b*) a solution of 1—2 c.c. of commercially pure pyrrol in 1 litre of water. These are kept in separate bottles and mixed just before use. The pyrrol solution must be standardised against an aldehyde solution of known strength:—5 c.c. of the pyrrol solution and 10 c.c. of the acid are placed in each of a series of test tubes with progressively increasing quantities of the aldehyde solution; the tubes are closed, thoroughly shaken and allowed to stand for half an hour. After that time the tube showing a turbidity with the smallest quantity of aldehyde is observed, and this quantity represents the aldehyde equivalent of the pyrrol solution. This value is constant for aldehyde solutions of concentrations between 0·035 and 0·015 per cent., and all solutions to be tested must be brought within these limits. For establishing the aldehyde equivalent, a suitable solution of aldehyde is first tested against the pyrrol solution, a portion of it is then treated for 24 hours with a quantity of standard bichromate insufficient to oxidise the whole of the aldehyde. The residual aldehyde is recovered by distillation in a current of air in a special apparatus, and the aldehyde in the distillate is again tested against the pyrrol. The quantity of bichromate used gives a basis from which the aldehyde-content of the solution may be calculated. Attempts to apply the method for the determination of lactic acid by Jerusalem's process have not given satisfactory results.—J. F. B.

Mercuricamphor compounds; The action of halogens on ——. J. E. Marsh. Chem. Soc. Proc., 1910, 26, 297.

Di-iodocamphor is formed by the action of iodine on each of the three mercuricamphor compounds, $C_{10}H_{14}O.Hg_2I_2$, $(C_{10}H_{14}O)_3Hg_4I_2$, and $(C_{10}H_{14}O)_4Hg_5I_2$. Di-iodocamphor is decomposed in solution by the oxygen of the air, with liberation of iodine and formation of camphorquinone. Di-iodocamphor and the mercuricamphors are thus shown to be *aa'*-derivatives of camphor. The action of bromine on dimercuricamphor compounds and on di-iodocamphor gives *aa'*-dibromocamphor.

Essential oils in relation to their antiseptic powers. Martindale. *See* XIXb.

Patents.

Benzoylsalicylic acid; Manufacture of ——. A. Einhorn, Munich, Germany. Eng. Pat. 25,470, Nov. 4, 1909. Under Int. Conv., Nov. 13, 1908.

Benzoylsalicylic acid, of m. pt. 132° C., is obtained in good yield by the action of benzoyl chloride on salicylic acid in presence of pyridine, dimethylaniline, or other tertiary base.—T. F. B.

Glycol monosalicylic esters; Process for preparing ——. C. F. Boehringer und Söhne. Ger. Pat. 225,984, Aug 13, 1909.

By heating the β-chloro-ethyl ester of salicylic acid, $HO.C_6H_4.CO.OCH_2.CH_2Cl$, preferably under pressure, with aqueous solutions of salts of weak acids, it is converted into glycol monosalicylic ester, without being resolved into glycol and salicylic acid.—T. F. B.

Monochloracetic acid; Manufacture of ——. G. F. Horsley, and The United Alkali Co., Ltd., Liverpool. Eng. Pat 6031, March 10, 1910.

In the chlorination of acetic acid in presence of sulphur (the amount of sulphur used being about one-fourth of the weight of the acetic acid), the yield amounts to only about 80 per cent. of the theoretical yield; higher yields are obtained when smaller quantities of sulphur are present, but the process is retarded considerably. It is found that the presence of a small quantity of acetyl chloride or acetic anhydride, greatly accelerates the chlorination of acetic acid in presence of one to two parts of sulphur. Steam-jacketed vessels each provided with an inlet tube for chlorine and with a condenser, are arranged in series. The outlet from each condenser can be connected with the inlet pipe of the next vessel of the series, or with the hydrochloric acid main. All the vessels are charged with glacial acetic acid, and one per cent. of sulphur is added to the first of the series; this is then heated and its contents treated with chlorine until no more is absorbed.

In this first vessel monochloracetic acid is produced, together with acetyl chloride only in very small quantity. The acetyl chloride produced, being volatile, passes into the second vessel of the series (which is not heated), part of it combining with the water in the acetic acid, and part of it dissolving. Any traces of acetyl chloride finally escaping from the system, along with the hydrochloric acid produced, pass through a condenser fed with glacial acetic acid, which retains the acetyl chloride, the hydrochloric acid passing on for condensation. When the reaction in the first vessel is complete, it is disconnected, and its contents distilled if necessary. Sulphur is then added to the second vessel of the series, and it is heated and chlorination is proceeded with as before. The vessel which was first used is re-charged with acetic acid, and placed at the end of the series, so that the process becomes a continuous one.—T. F. B.

Carbamic acid esters; Process for preparing substituted ——. Verein. Chininfabr. Zimmer und Co. Ger. Pat. 225,712. June 27, 1908.

Substituted carbamic esters, tasteless and non-volatile, and possessing hypnotic properties, are obtained either by the action of chloral on carbamic acid chloride, or by converting trichloro-ethyl alcohol, in which one of the hydrogen atoms attached to a carbon atom is replaced by alkyl or halogen, into the carbamic ester in the usual manner (*e.g.*, by the action of an isocyanate). The allophanic ester of tetrachloro-ethyl alcohol is obtained by the action of chloral on carbamic acid chloride; trichloro-isopropyl alcohol and carbamic acid chloride produce the allophanic ester of *a*-methyl-*β*-trichloro-ethyl alcohol; and trichloro-isopropyl alcohol and *p*-ethoxyphenyl isocyanate furnish the *p*-ethoxyphenylcarbamic ester of trichloro-isopropyl alcohol.—T. F. B.

Menthol; Process for preparing alkyloxyacetyl compounds of ——. A. Einhorn. Ger. Pat. 225,821, Oct. 24, 1909.

New alkyloxyacetyl derivatives of menthol are obtained by the action of alkyloxyacetic acids on menthol carbonic acid halogenides, preferably in presence of tertiary bases. The products are applicable to medicine.—T. F. B.

Carvacrolphthalein; Process for preparing ——. C. Ehrlich. Ger. Pat. 225,983. March 19, 1909.

Carvacrolphthalein is prepared by heating carvacrol with phthalic anhydride at temperatures not exceeding 120° C., either alone or in presence of a condensing agent. The product exhibits the same therapeutic action as do phenolphthalein and thymolphthalein. Further, it is suitable for use as an indicator, its colour change being considerably sharper than that of phenolphthalein, whilst it can also be used in the titration of alkalis in presence of carbonate.—T. F. B.

Castor oil; Process for preparing acidyl derivatives of ——. Verein. Chininfabr. Zimmer und Co. Ger. Pat. 226,111, June 7, 1908. Addition to Ger. Pat. 211,197, Dec. 28, 1907 (this J., 1909, 815).

Acidyl derivatives of castor oil, free from its taste, odour, and nauseating properties, are obtained either by treating castor oil with chlorides, phenol esters, or other derivatives of monobasic aromatic acids capable of esterifying its hydroxyl group, or by converting the oil into its allophanic ester by the action of urea chloride or by other suitable methods.—T. F. B.

Organic substances; Purification of —— by distillation or sublimation and subsequent treatment with a medium acting as a solvent for the impurities. K. Fankhaenel. Ger. Pat. 226,112, April 8, 1909.

A current of vapour of the medium used as solvent for the impurities is blown over the substance whilst it is being distilled or sublimed.—A. S.

Aldehydes and ketones from amino-acids; Process for preparing ——. K. Langheld. Ger. Pats. 226,226 and 226,227, Jan. 14 and 19, 1909.

(1) When amino-acids are treated with sodium hypochlorite solution containing no free chlorine, carbon dioxide and ammonia are eliminated and aldehydes formed. For example, acetaldehyde is obtained from alanine, and hydroxyphenylacetaldehyde from tyrosine. $R.CH(NH_2).COOH + HOCl \rightarrow R.CH(NHCl).COOH + H_2O \rightarrow R.CH : NH + CO_2 + HCl + H_2O \rightarrow R.CHO + NH_3$. (2) This is such a modification of process (1) the subject of Ger. Pat. 226,226, that in order to obtain ketones from amino-acids, such amino-acids as contain the two organic radicles united to the *a*-carbon atom, are oxidised by means of sodium hypochlorite solution, forming ketones, in a manner analogous to the foregoing.—T. F. B.

Allophanic esters; Process for preparing ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 226,228, Oct. 24, 1908.

Tertiary alcohols are converted into their allophanic acid esters by any of the usual methods. The ester obtained from amylene hydrate, for example, has the formula, $C_2H_5.C(CH_3)_2O.CO.NH.CO.NH_2$, and possesses the same hypnotic properties as the alcohol, but has the advantage of being solid and tasteless; it melts at 149°—150° C.—T. F. B.

Alkylamino-acetic acid santalol esters; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 226,229, May 22, 1909.

By treating the halogenacetyl derivatives of santalol with secondary amines, alkylamino-acetyl derivatives are obtained; they are of value in medicine, especially in the form of their salts, which are solid, odourless, and readily assimilated. Dimethylamino-acetylsantalol melts at 154° C.—T. F. B.

Nitro-o-anisidines; Process for separating p- and m- ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 228,357, Dec. 28, 1909.

Advantage is taken of the great difference in the solubilities of the sulphates of *m*- and *p*-nitro-*o*-anisidine, to effect the separation of the bases. For example, the mixture of the two nitro-acetanisidides, obtained by nitrating *o*-acetanisidide, is hydrolysed by heating with 70 per cent. sulphuric acid; sufficient water is then added to the mixture to reduce the concentration of the sulphuric acid to 40 per cent. On cooling, white crystals of *p*-nitro-*o*-anisidine sulphate separate, from which the base may be obtained (m. pt. 139° C.) by decomposition with caustic soda solution; the *m*-nitro-*o*-anisidine is then precipitated from the sulphuric acid solution by addition of alkali. —T. F. B.

Bismuth and thorium preparations; Process for the production of —— suitable for use with Röntgen rays. Valentiner und Schwarz. Ger. Pat. 228,375, Jan. 14, 1909.

Bismuth and thorium preparations mixed with inert materials are given to patients before examination with Röntgen rays, in order to obtain radiographs of hollow spaces, the bismuth and thorium preparations being opaque to the rays. According to the present patent, the inert or filling material, *e.g.*, *Bolus alba* or kieselguhr is mixed with a solution of a bismuth or thorium salt, and the solution is evaporated, or an insoluble compound of the metal is precipitated by addition of a suitable reagent; in either case the product is dried and ignited.—A. S.

Antimony compounds; Process of making organic ——. L. Kaufmann, Berlin. Eng. Pat. 18,896, Aug. 17, 1909. Under Int. Conv., Aug. 18, 1908.

See Fr. Pat. 406,138 of 1909; this J., 1910, 452.—T. F. B.

Antimony compounds; Process of making aromatic ——. L. Kaufmann, Berlin. Eng. Pat. 25,698 of 1910, dated Aug. 17, 1909.

See Fr. Pat. 406,138 of 1909; this J., 1910, 452.—T. F. B.

β-β-Diethylpropionic acid; Amide of ——. L. Taub, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 977,053, Nov. 29, 1910.

See Eng. Pat. 28,044 of 1909; this J., 1910, 1133.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Refractive indices of some substances in gelatin. R. E. Leisegang. Z. Chem. Ind. Kolloide, 1910, 7, 308.

Some years ago A. and L. Lumière found that a film prepared from an emulsion of barium sulphate in gelatin had practically no covering power, owing to the refractive indices of the gelatin and the emulsified barium sulphate being approximately the same. In the case of fine-grained silver chloride-gelatin emulsions and of gelatin in which starch is suspended, it is known that the films lose in opacity with the progress of the drying. A calcium fluoride-gelatin emulsion on the other hand is opaque when prepared and yields a dry film which is also opaque, but during the drying of such a film on glass, transparent zones can be observed in places where the drying is not yet complete; also a dried film when moistened becomes first clear and then turbid. In this case, therefore, the refractive indices of the gelatin and of the emulsified calcium fluoride are the same only in presence of a definite proportion of water.—A. S.

Patent.

Polychrome screen and process for making same. C. L. A. Brasseur, New York. U.S. Pat. 976,118, Nov. 15, 1910.

See Eng. Pat. 20,909 of 1908; this J., 1909, 260.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Explosives; Annual Report of the Chief Inspector of —— for the Transvaal for the year ended June 30, 1910. Major A. B. Denne.

The quantities given refer, in the case of explosives, to tons of 2000 lb.

Manufacture.—The British South African Explosives Co., at Moddersfontein, manufactured during the year 6384 tons, an increase on the previous year of 361 tons. They issued 6477 tons, an increase of 414 tons. This was due partly to an increased consumption in the Transvaal and partly to a shortage from Natal, owing to an accident at Messrs. Kynoch's factory at Umbogintwini (this J., 1910, 235). The explosives issued from Moddersfontein, together with the importations, totalled 16,703 tons. The Moddersfontein factory thus supplied 37 per cent. of the explosives consumed in the Transvaal. Small quantities of a chlorate explosive called "Eucalypt" were manufactured at Gumpold's factory.

Importations:—

Explosive, etc.	Imported from	Tons of 2000 lb.	Cases. (500 coils of 24 feet each.)	Number.
Blasting cartridges	Overseas	22	—	—
Blasting cartridges	Cape Colony	7006	—	—
Blasting cartridges	Natal	3198	—	—
Detonators No. 6 and No. 6D ..	Overseas	—	—	29,165,000
Detonators No. 8	"	—	—	2,910,000
" Electric	"	—	—	576,000
Safety fuse ..	Gt. Britain	—	8593	—
" " ..	Germany	—	4745	—
" " ..	Belgium	—	1882	—

It is proposed that safety fuse should be submitted to, and satisfy, the following tests:—

1. An immersion test of not less than 12 hours. 2. Comparative rate of burning of pieces from different coils. 3. Tube test, in and out of water. 4. Flash test. 5. Rate of burning to be between 90—110 secs. per yard.

There were, in all, 234 magazines in use. 155 samples of safety fuse were tested during the year, of which 140 were passed and 15 rejected (82 cases). 173 samples of explosives were examined in the laboratory. With the view of reducing the noxious fumes produced when explosives are fired in mines, one of the South African firms (this J., 1909, 162) patented a blasting gelatin containing proportions of sodium nitrate or other oxidising agents. This explosive is, in reality, a strong gelignite. The gases, however, have never been officially analysed. Another firm, having the same end in view, patented a primer for ensuring more complete detonation, and as a consequence the reduction of noxious gases. Reports as to the utility of these primers were conflicting. Dr. Moir, chemist to the Mines Department, was in communication with Mr. Mann, the Chief Inspector for Western Australia, who has devoted a good deal of time to the questions of mine gases. The Transvaal Government sent to Western Australia 12 cases of blasting gelatin, and 2 of gelignite of the composition as used in South African mines. Beyond the fact that the consignment arrived in good condition, but showed slight signs of exudation, no reports were to hand from Western Australia as to the behaviour of these explosives under mining conditions.—G. W. McD.

Explosives; Safety ——, employed in mines. J. Taffanel. Comptes rend., 1910, **151**, 873—876.

Various explosives were fired, either in holes bored in the earth and tamped, or in steel vessels, the explosive being contained in various wrappings, and the gases formed by the explosion were analysed. In some cases (in earth; in vessel with asbestos wrapping) these gases contained free oxygen; in most cases, however, the excess oxygen disappeared, being used up in oxidising the steel vessel, or the wrapping, where this was made of oxidisable material, such as paper, paraffined or otherwise. In these cases, combustible gases appear among the products (carbon monoxide, hydrogen, methane) in considerable quantities; these combustible gases are capable of inflaming when they mix with the surrounding air. Direct experiments have shown that much smaller charges will ignite coal-dust when wrapped in paraffined paper or aluminium than when in asbestos, tinplate, or tin-foil. It is thus important in a coal mine to clear as completely as possible from dust the hole in which the explosive is placed, and, whether in coal or rock, to remove the paraffined paper wrapping.—J. T. D.

Fulminic acid; Formation of —— from alcohol. H. Wieland. Ber., 1910, 43, 3362—3364.

Wöhler (Ber., 1910, 43, 754) has called in question the author's theory of the formation of fulminic acid from alcohol, according to which, acetaldehyde, isonitroso-acetaldehyde, isonitroso-acetic acid, and methylnitrolic acid are successively formed as the intermediate stages (Ber., 1907, 40, 418). Wöhler has been unable to obtain mercury fulminate from isonitroso-acetic acid, but the author asserts that if 1 grm. of mercuric nitrate is dissolved in 3 c.c. of nitric acid (sp. gr. 1·34) and 2 c.c. of water, and the solution is treated with 1·5 grm. of pure isonitroso-acetic acid, from 0·1 to 0·2 grm. of mercury fulminate is generally obtained. Silver fulminate may be prepared in considerably larger proportion by dissolving 1·5 grm. of silver nitrate and 3 grms. of isonitroso-acetic acid in 10 c.c. of cold nitric acid (sp. gr. 1·34) diluted with 5 c.c. of water, and gently heating the solution until the reaction takes place. The fact that nitromethane, even after the addition of nitrite, does not yield fulminate is regarded by Wöhler as a proof that methylnitrolic acid is not an intermediate product in the formation of fulminic acid; but the author points out that this reason is based upon the erroneous assumption that methylnitrolic acid is directly obtained from nitromethane and nitrous acid, whereas in reality only the *aci*-form of primary nitro-bodies reacts with nitrous acid.—C. A. M.

Patents.

Explosives. C. G. Demetriade, Bucarest, C. Jonescu, Galatz, and J. Coanda, Bucarest. Eng. Pat. 26,359, Nov. 13, 1909.

The explosive consists of potassium chlorate (60 parts), mononitrobenzene (24), picric acid (16), and collodion (4 parts). The method of manufacture is as follows. Potassium chlorate, contained in a cotton bag, is immersed in nitrobenzene containing either picric acid or trinitrotoluene in solution. The bag is allowed to drain and the contents are mixed with a collodion solution, the nitrocotton of which contains 10 per cent. of nitrogen. The mixture is thoroughly masticated at 35° C., until, after evaporation of the ether and alcohol, it has become of the consistence of jelly. This can be filled into cartridges. —G. W. McD.

Explosive. F. H. Briggs, Elyria, Ohio, Assignor to The American Dynamite Co., Cleveland, Ohio. U.S. Pat. 975,825, Nov. 15, 1910.

The explosive consists of an intimate mixture of potassium chlorate, nitrobenzene, pulverised slate, charcoal, and potassium nitrate.—G. W. McD.

Explosive. M. Delvigne, Namur, Belgium. U.S. Pat. 977,076, Nov. 29, 1910.

See Fr. Pat. 413,418 of 1910; this J., 1910, 1135.—T. F. B.

Explosives. E. C. R. Marks, London. From H. Maxim, Brooklyn, U.S.A. Eng. Pat. 2039, Jan. 26, 1910.

See U.S. Pats. 951,445 and 974,900 of 1910; this J., 1910, 518 and 1412.—T. F. B.

XXIII.—ANALYTICAL PROCESSES.

Sulphur in organic compounds; New process for determining ——. T. St. Warunis. Chem.-Zeit., 1910, 34, 1285—1286.

The process, which is a modification of that of Asbóth (this J., 1895, 1071), consists in heating an intimate mixture of 0·2 to 0·4 grm. of the substance, 10 grms. of pure, finely-powdered potassium hydroxide and 5 grms. of sodium peroxide in a silver, nickel or porcelain dish to 75°—85° C. in an oven. When the mixture fuses, the dish is gradually heated more strongly over a small flame until the melt is quite liquid, in which condition it is maintained for a short time. After cooling, the contents of the dish dissolve very readily in water, which is the chief advantage claimed over the method of Asbóth. The solution is acidified and oxidised with a solution of bromine in hydrochloric acid, filtered, and the sulphur estimated as barium sulphate in the usual way. A blank test is made to eliminate errors due to sulphur in the reagents and in the products of combustion of the gas. A list of references to the more important oxidation processes is given.—B. G. McL.

Electro-analytical determination of metals; New apparatus for the rapid——. A glass frame anode for use with silver and nickel cathodes. H. J. S. Sand and W. M. Smalley. Trans. Faraday Soc., Dec., 1910. [Advance proof.]

Electrodes have been designed to require only small quantities of platinum, for use in the manner previously communicated (see Sand, this J., 1907, 490 and 1908, 963). The anode is illustrated in Fig. 1A and requires only about 5 grms. of platinum. A is the glass tube in which the electrode rotates, B is a platinum gauze cylinder against which the glass holder is made to press by blowing when hot; the projections, *gg*, make the cylinder quite secure.

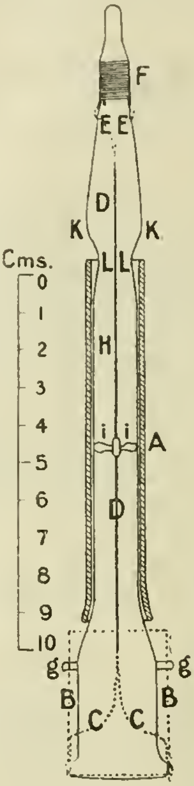


Fig. 1A.

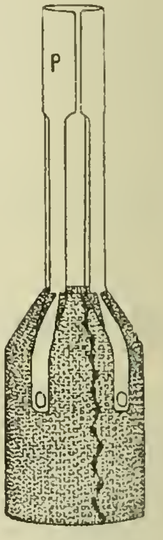


Fig. 1B.

The strips of platinum gauze, C,C, pass through the glass to the copper wire, D, which has an enamel support, *i,i*, and leads to the gauze strips, E, E, which pass out and are wound over by the platinum wire, F. This comes into contact with the blocks of the clutch. K is widened just enough to prevent A from sliding off, and still to allow the collar, P, of the cathode (Fig. 1B) to pass over it. The constriction, L, is for washing purposes. In determining copper the cathode may be made of silver, and in determining zinc of nickel. The collar, P, is first stamped, a gauze cylinder is made, then shaped by eight small pleats as shown, and finally rivetted to the collar. The nickel cylinder can be left unfinished, but the edges of the silver cylinder being soft and brittle must be fused down in the oxygen blowpipe. The mesh is 11 per linear cm. The silver electrode is cleaned by warm dilute sulphuric acid with a little hydrogen peroxide. Analyses are given which prove the utility of the electrodes, and it is also shown that the substitution of citric acid for acetic acid in zinc determinations reduces the tendency to high results, though the time required is longer.—W. H. P.

Proteins; Determination of the amide-nitrogen in —— W. Denis. J. Biol. Chem., 1910, 8, 427—435.

The author finds that Folin's method for the determination of ammonia in urine may be applied for the separation of the ammonia formed by the action of acids on proteins; this method consists essentially in the removal of the ammonia from an alkaline solution by means of a strong current of air, the ammonia thus removed being absorbed, in an excess of $N/10$ sulphuric acid and titrated in the usual way. It is sufficient to pass the current of air through the solution for two hours in order to obtain

all the ammonia. The solution may be used subsequently for the determination of the mono- and di-amide nitrogen by the Hausmann method as modified by Osborne and Harris (this J., 1903, 655). In the case of casein, edestin, and gelatin, which contain only traces of cystin, the amounts of ammonia found in the hydrolysed material by distillation with magnesia or by treatment with a current of air are practically the same, but substances rich in cystin, such as hair and horn, yield less ammonia by the Folin method than by distillation with magnesia. For instance, hair boiled for 15 hours with concentrated hydrochloric acid yielded 1·25 per cent. of nitrogen as ammonia by distillation, and 0·88 per cent. by the Folin method; horn shavings similarly treated gave 1·02 and 0·81 per cent. by the two methods, respectively. These results bear out the contention of certain workers that more ammonia is split off by the alkali than has been formed by the hydrolysis. Further experiments showed that the amount of ammonia produced during the hydrolysis does not increase even when the time of boiling is prolonged to 70 hours and that the addition of sodium chloride does not increase the percentage of amide-nitrogen.
—W. P. S.

Determination of benzene in petroleum spirit (petrol) used in motors. Halphen. *See* IIa.

Properties and formation of oxycellulose. Lloyd. *See* V.

Determination of manganese in steel. Kaysser. *See* X.

Ammonium salts of fatty acids and separation of oleic acid from saturated fatty acids. Falciola. *See* XII.

Determination of concentration of latex of Hevea brasiliensis from density measurements. Vernet. *See* XIV.

Determination of rubber as tetrabromide. Budde. *See* XIV.

Determination of colour in tanning extracts. Eitner. *See* XV.

Determining sucrose in presence of other sugars. Jolles. *See* XVII.

Improvement in Scherer's test for inositol. Salkowski. *See* XVII.

Analysis of commercial absinthe. Rouaet. *See* XVII.

Volumetric determination of phenolphthalein. Zotier. *See* XX.

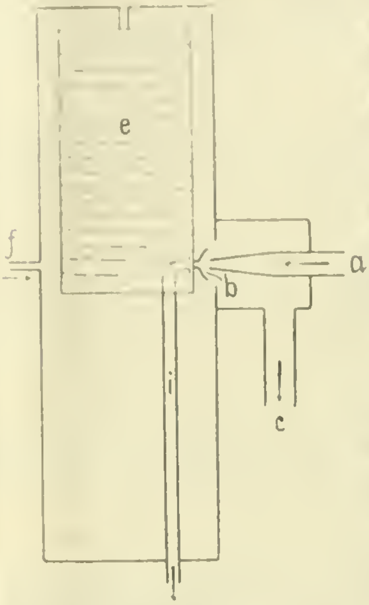
Determination of acetaldehyde by means of pyrrol and application to determination of lactic acid. Sobolewa and Zaleski. *See* XX.

PATENTS.

Measuring gas; Apparatus for ——. R. Inhoffer, Aix-la-Chapelle, Germany. Eng. Pat. 12,857, May 26, 1910. Under Int. Conv., Jan. 25, 1909.

THE claim relates to the type of "momentary gas meter" described in Eng. Pat. 19,767 of 1909 (this J., 1910, 478) and is for the employment of a cone in connection with the float which may be of spherical or oval shape.
—W. H. C.

Gases; Apparatus for the continuous determination of solid or liquid substances contained in ——. E. K. H. Borchers. Ger. Pat. 225,625, Jan. 14, 1910.



THE apparatus is shown in the accompanying figure. The gas enters at *a*, and leaves through *c*, its course being diverted at *b*, where any solid or liquid substances carried by it make a mark on the rotating drum, *e*; better results are obtained if the tube, *i*, is connected with a suction device. Air under a slightly greater pressure than that of the gas under examination, is forced in at *f*, in order to keep the surface of the drum, *e*, free from foreign substances.—A. S.

Process for preparing carvacrolphthalein [Indicator]. Ger. Pat. 225,983. *See* XX.

XXIV.—MISCELLANEOUS ABSTRACTS.

Propiolic compounds; cyanacetylene. C. Moureu and J. C. Bongrand. Comptes rend., 1910, **151**, 946—948.

PROPIOLAMIDE is formed by the direct action of aqueous ammonia, cooled below 0° C., on the methyl ester of propiolic acid; when purified by crystallisation from ether, it forms white plates, melting at 61°—62° C., readily soluble in water, alcohol or ether, but only slightly in chloroform, benzene, or carbon bisulphide. It gives with silver nitrate a white precipitate, with ammoniacal cuprous chloride a yellow one; both of these deflagrate when heated in air. When propiolamide is distilled with phosphoric anhydride in carbon dioxide gas at a pressure a little above atmospheric, propiolic nitrile, or, *cyanacetylene*, H.C:C.CN, is obtained, as a mobile liquid, freezing at about 5° C. and boiling at 42·5° C. It is very inflammable. It gradually assumes a brown tint, even apart from light and air, but without sensibly altering its other properties. It is hardly miscible with water, but completely with alcohol. With silver nitrate, it forms a white precipitate, which explodes violently when heated; the precipitate with ammoniacal cuprous chloride is olive green, and deflagrates on heating. Molecular weight determinations give C_3NH as the formula of cyanacetylene; it is remarkable as containing only one atom of hydrogen with three of carbon. Its copper compound, oxidised by potassium ferricyanide, yields a substance, still under investigation, which is possibly the compound, C_6N_2.—J. T. D.

Books Received.

RECORD OF THE FIRST SERIES OF THE BRITISH COAL DUST EXPERIMENTS. Conducted by the Committee appointed by The Mining Association of Great Britain. A Record of the Experiments carried out during 1908 and 1909 at the Altofts Experiments Station. Printed and published by the Colliery Guardian Company, Limited, 30 and 31, Furnival Street, Holborn, London, E.C. 1910. Price 10s.

4to volume, containing 204 pages of subject matter, lists of illustrations, plates, tables, and notes, and diagrammatic records of experiments; an alphabetical index of subjects concludes the work. The illustrations number 95, and the plates 25. The work is divided into two parts, Part I containing nine chapters, Part II, two. The subdivision is characterised by the following classification:—Part I, (i), Introduction, with history of previous experiments, etc. (ii), The experimental gallery and the methods of conducting the experiments. (iii), Explosive nature of coal dust when raised as a cloud in air. (iv), Chemical analysis of coal dust. (v), The "British Coal Dust" instruments for investigating the mode of propagation of coal dust explosions. (vi), Experiments with dustless and stone dust zones. (vii), Application of stone dust at Altofts collieries. (viii), Laboratory investigations. (ix), Microscopical investigations. Part II, (i), Mode of propagation of coal dust explosions. *Introduction*—(ii), Ditto.—*Experiments in the gallery.* Appendix. Experiments with Welsh, Scottish, and South African coals.

Evolution, Darwinian and Spencerian. The Herbert Spencer Lecture. Delivered at the Museum, 8th Dec., 1910. By Raphael Meldola, F.R.S. Oxford. At the Clarendon Press. 1910. Price 1s. 6d.

Contains 43 pages of subject matter and an appendix.

Das Oedem. Eine experimentelle und theoretische Untersuchung der Physiologie und Pathologie der Wasserbindung im Organismus. Von Dr. Martin H. Fischer, Professor der Physiologie an der Universität Cincinnati, Ohio, U.S.A., etc. Mit Autorisation der Trustees und des Verfassers, in deutscher Sprache herausgegeben von Karl Schorr und Wolfg. Ostwald. Theodor Steinkopff's Verlag. Dresden. 1910. Price M. 6, bound M. 7.

8vo volume, containing 220 pages of subject matter, with 51 illustrations, and alphabetical indexes of authors and subjects.

The Scientist's Reference Book and Diary for 1911. Published by James Woolley, Sons & Co., Ltd., Victoria Bridge, Manchester. 1911. Price 1s. 6d.

Is divided into two parts, Part I, containing lists of Associations, Institutes, Congress, International Exhibition (Turin), etc., Scientific Societies, Data as to First Aid, and in poisoning cases. Calendar, and a daily wants dictionary then follow, also a series of blank pages for memoranda, etc. A Diary for 1911, and blank pages for addresses, complete the part. Back to back with this, comes Part II., as a duplicate pocket book, and forming the "Scientist's Reference Book," with the following items:—(i) Notable facts of the world. (ii), Astronomy. (iii), Meteorology. (iv), British weights and measures. (v), Metric weights and measures, etc. (vi), Chemical terms, Synonyms, etc. (vii), Atomic weights. (viii), Specific gravities. (ix), Physical constants of the elements. (x), Formulæ and solubilities in water. (xi), Factors for use in volumetric analysis, etc. (xii), Alloys. (xiii), Scientific terms, etc., of general use, Laws and definitions in Chemistry and Physics, also (xiv), Botany. (xv), Human physiology, (xvi), Hygiene. (xvii), Chemical composition of food. A series of ruled blank pages complete the booklet.

Bulletin of the Imperial Institute. Vol. VIII. No. 3. Price 1s.

This issue of the Bulletin contains the results of investigations in connection with certain West African timbers, wattle barks from the Transvaal and the East Africa Protectorate, edible beans from the East Africa Protectorate, Funtumia rubber from West Africa, and Landolphia rubber from the Sudan; also notes on Mauritius hemp, Burmese black varnish or lacquer, the distribution and utilisation of chromium ores, etc.

A Study of Melting Point Determinations with Special Reference to the Melting-point Requirements of the U.S. Pharmacopœia. By George A. Menge. U.S. Hygienic Laboratory. Bulletin No. 70.

After indicating the deficiencies of the melting-point requirements of the U.S. Pharmacopœia, the various methods and apparatus at present in use for the determination of melting-points are discussed, and the considerable divergences in published results pointed out. A method is recommended as a standard, for adoption as the Pharmacopœia method, and melting-points of 24 pharmacopœial compounds, determined by its aid, are given, together with other published figures for the same substances.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—GENERAL PLANT; MACHINERY.

Applications.

28,004. Green, and Huncoat Plastic Brick and Terra Cotta Co. *See under* VII.

28,077. Rosculet. Process of solidifying liquids. [Addition to No. 4337 of 1910.]* Dec. 2.

28,248. Mueller. Cooling towers and the like. [U.S. Appl., April 9, 1910.]* Dec. 5.

28,514 and 28,516. Broadbent and Sons, Ltd., and Broadbent. Hydro-extractors and like centrifugal machines. Dec. 8.

28,609. Viola. Apparatus for producing vacuum. Dec. 8.

28,707. Schirm. Extracting devices for use in treating finely divided or powdered material.* Dec. 9.

Complete Specifications Accepted.

28,945 (1909). Breakall. Rotary filters for separating liquids from materials and for washing and saturating materials with liquids. Dec. 14.

30,080 (1909). Tiemann. Purification of solutions Dec. 7.

3171 (1910). Brownson. Filtering or separating solids from liquids or semi-liquids. Dec. 14.

5264 (1910). Henning, Flodin, and Co. Furnaces. Dec. 7.

5952 (1910). Davis. Apparatus for treating liquids with gases. Dec. 7.

6463 (1910). Acheson. Disintegrating or subdividing into fine particles insoluble bodies. Dec. 14.

8718 (1910). Savary. Furnaces. Dec. 7.

12,062 (1910). Arbuckle. Vats, tanks, or vessels for separating solids from liquids. Dec. 14.

12,748 (1910). Sinding-Larsen and Storm. Separating a single gas from a mixture of gases. Dec. 14.

13,297 (1910). Muchka. Apparatus for separating impurities from steam, gas, etc. Dec. 7.

16,156 (1910). Robacher. *See under* X.

17,899 (1910). Madeley (Richards). Apparatus for separating solids from liquids. Dec. 14.

II.—FUEL; GAS; MINERAL OILS AND WAXES. DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Applications.

27,645. Muller, and Veltener Schwemmstein-Ind. Ges. Utilising the residues of combustion of furnaces.* Nov. 28.

27,697. Everett. Obtaining products from coal, shale, peat, etc. Nov. 28.

27,755. Edmundson and Potts. Manufacture of filaments for electric incandescence lamps. Nov. 29.

27,873. Weil and Hutchins. Gas producers. Nov. 30.

28,007. Beard, and Dempster, Ltd. Apparatus for washing or scrubbing gas. Dec. 2.

28,032. Schaffer. Fuel. Dec. 2.

28,388. Duckham. Vertical retorts for carbonising coal, etc. Dec. 6.

28,528. Owen. Manufacture of incandescent gas mantles. Dec. 8.

28,534. Barton. *See under* X.

28,711. White and White. Gas generating plant. [Addition to No. 10,357 of 1910.]* Dec. 9.

28,763. Carroll. Manufacture of carburetted water gas.* Dec. 10.

Complete Specifications Accepted.

29,125 (1909). Johnson (Maschinen- und Armaturenfabrik vorm. H. Breuer und Co.). Apparatus for making gas by the dry distillation of coal, etc., for preventing the formation of thick tar. Dec. 14.

29,328 (1909). Ruthenberg. Distillation of coal. Dec. 7.

6487 (1910). Christie. Horizontal regenerative coke ovens. Dec. 7.

17,548 (1910). Otto-Hilgenstock Coke Oven Co. Otto und Co.). Separating tar from gases. Dec. 7.

22,961 (1910). Baldus. *See under* XXIII.

III.—TAR AND TAR PRODUCTS.

Applications.

28,159. Jones. Manufacture of quinoline and tetrahydroquinoline derivatives. Dec. 3.

28,178. Wallbaum. Manufacture of emulsion products from asphalt, coal-tar or petrol pitch, Montan wax, Japan wax, etc. Dec. 3.

Complete Specifications Accepted.

29,112 (1909). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of the thio-derivatives of diarylamines and their derivatives. Dec. 7.

4898 (1910). Newton (Bayer und Co.). Manufacture of halogen substituted anthraquinones. Dec. 7.

9955 (1910). Zimmer. Increasing the resistance to heat of tar, pitch, mineral resins, etc. Dec. 7.

IV.—COLOURING MATTERS AND DYES.

Applications.

27,627. Newton (Bayer und Co.). Manufacture of a disazo dyestuff. Nov. 28.

27,636. Meister, Lucius, und Brüning. Manufacture of yellowish green pigment dyes. [Ger. Appl., Dec. 11, 1909.]* Nov. 28.

27,637. Meister, Lucius, und Brüning. Manufacture of alizarin-red vat dyestuffs. [Ger. Appl., Jan. 26, 1910.]* Nov. 28.

27,639. Bloxam (Chem. Fabr. Griesheim Elektron). Manufacture of monoazo dyestuffs suitable for preparing pigment colours.* Nov. 28.

27,861. Newton (Bayer und Co.). Manufacture of azo dyestuffs for cotton. Nov. 30.

27,949. Bloxam (Act. Ges. f. Anilinfabr.). Manufacture of monoazo colouring matters and of pigment colours therefrom. Dec. 1.

28,677. Bloxam (Chem. Fabr. Griesheim Elektron). Manufacture of orange to orange-red cotton dyestuffs.* Dec. 9.

28,678. Bloxam (Chem. Fabr. Griesheim Elektron). Manufacture of disazo dyestuffs for wool.* Dec. 9.

28,679. Bloxam (Chem. Fabr. Griesheim Elektron). Manufacture of vat dyestuffs of the anthracene series.* Dec. 9.

28,680. Bloxam (Chem. Fabr. Griesheim Elektron). Manufacture of substantive disazo dyestuffs.* Dec. 9.

28,681. Bloxam (Chem. Fabr. Griesheim Elektron). Manufacture of an azo colouring matter.* Dec. 9.

28,781. Newton (Bayer und Co.). Manufacture of vat dyestuffs of the anthracene series. Dec. 9.

Complete Specifications Accepted.

28,043 (1909). Newton (Bayer und Co.). Manufacture of vat dyestuffs. Dec. 14.

28,718 (1909). Newton (Bayer und Co.). Manufacture of polyazo dyes. Dec. 14.

6153 (1910). Ransford (Cassella und Co.). Manufacture of new sulphonic acids and azo dyestuffs therefrom. Dec. 17.

7060 (1910). Ransford (Cassella und Co.). Manufacture of dyestuffs. Dec. 7.

7404 and 11,947 (1910). Le Sueur. Manufacture of substances to be used in making dyes. Dec. 7.

7632 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene colouring matters. Dec. 7.

7923 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Dec. 14.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Applications.

27,600. Verein. Glanzstoff-Fabr. Recovery of copper from the washing water obtained in making artificial products from cuprammonia cellulose. [Ger. Appl., June 18, 1910.]* Nov. 28.

27,878. Cie. Franç. des Applications de la Cellulose. Manufacture of cellulose. [Fr. Appl., Jan. 21, 1910.]* Nov. 30.

28,193. Silberrad. Isolation of plant fibres. Dec. 5.

28,594. Birkenstock. Treatment of ramie fibres to produce a batting suitable for spinning. Dec. 8.

28,603. Skeppstedt. Manufacture of paper, etc. Dec. 8.

28,779. Cie. Franç. des Applications de la Cellulose. Preparation of cellulose. [Fr. Appl., July 27, 1910.]* Dec. 10.

Complete Specifications Accepted.

27,950 (1909). Wilbuschewitsch. Manufacture of paper or cardboard from the husks of cotton seeds. Dec. 7.

28,701 (1909) and 3757 (1910). Stark. Treatment of cotton, silk, and like vegetable fibres. Dec. 14.

2560 (1910). Kron. Manufacture of paper pulp material and fibres for spinning from wood, woody plants, etc. Dec. 7.

18,479 (1910). Gebr. Schmid. Process of rendering jute woolly. Dec. 14.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

APPLICATIONS.

28,277. Niblett, and Electrical Apparatus Synd., Ltd. *See under* VII.

28,329. Hahn. Mercerising cotton, preferably in the form of skeins.* Dec. 6.

28,641. Roberts and Turner. Scouring, boiling, or washing textile fabrics and fibrous materials. [Addition to No. 10,792 of 1910.] Dec. 9.

28,766. Friedrich. Process of mercerising yarn. Dec. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

27,731 (1909). Heap. Machinery for washing, steaming, bleaching, dyeing, and drying yarn. Dec. 7.

28,126 (1909). Schiffers. Machines for dyeing, bleaching, and the like, of textile fibres or goods. Dec. 14.

13,740 (1910). Psarski. Dyeing machines. Dec. 7.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

APPLICATIONS.

27,690. Decamps. Manufacture of artificial emery (crystallised alumina) from bauxite.* Nov. 28.

27,867. Barton. *See under* XIII.

28,004. Green, and Huncoat Plastic Brick and Terra Cotta Co., Ltd. Gay-Lussac and Glover or other towers used in making sulphuric acid, and like towers where gases come in contact with liquids. Dec. 2.

28,261. Johnson (Chem. Fabr. Griesheim Elektron). Manufacture of alkali sulphides and alkaline earth sulphides. Dec. 5.

28,274. Niblett, and Electrical Apparatus Synd., Ltd. Apparatus for producing bleaching solution. Dec. 5.

28,570. Campbell. *See under* X.

28,772. McCall (Wilder). Treatment of alkaline cyanide solutions. Dec. 10.

28,773. Chem. Fabr. von Heyden. Manufacture of anhydrous hydrosulphites. [Ger. Appl., July 27, 1910.]* Dec. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

28,665 (1909). Laverty. Lime burning and lime gas producing kilns. Dec. 7.

8006 (1910). Edmunds. Apparatus for making sulphurous acid. Dec. 7.

9391 (1910). De Stucklé. Manufacture of dehydrated zinc sulphide. Dec. 14.

14,381 (1910). Brauer. Concentration of nitric acid. Dec. 7.

20,519 (1910). Johnson (McNitt). Electrolytic manufacture of alkali metals and their alloys. Dec. 7.

22,029 (1910). Doerbecker. Production of calcium phosphide. Dec. 7.

22,322 (1910). Pauling. Concentration of aqueous solutions of nitric acid. Dec. 7.

23,551 (1910). Pietzsch and Adolph. Manufacture of potassium persulphate and sodium persulphate. Dec. 14.

VIII.—GLASS; CERAMICS.

APPLICATIONS.

27,690. Decamps. *See under* VII.

28,617. Dressler. Ovens for use in making tiles, pottery, and analogous ware. Dec. 8.

IX.—BUILDING MATERIALS.

APPLICATIONS.

27,807. Pennington. Cement. Nov. 30.

28,264. Barrett and Renwick. Manufacture of artificial stone or the like. Dec. 5.

28,284. Hemingway. Process for treating stone and like building materials and for producing cement. Dec. 5.

COMPLETE SPECIFICATION ACCEPTED.

3119 (1910). Kühl. Manufacture of hydraulic cement or like material. Dec. 14.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

APPLICATIONS.

27,647. Cowper-Coles. Electrodeposition of zinc. Nov. 28.

27,648. Cowper-Coles. Removal of scale and oxide from iron and steel surfaces. Nov. 28.

27,688. Thiel. Manufacture of steel. [Addition to No. 10,199 of 1910.]* Nov. 28.

27,741. Gabrielli. Roasting ores to separate the metals. [Ger. Appl., Nov. 30, 1909].* Nov. 29.

27,963. Spadoni. Manufacture of armour plates.* Dec. 1.

28,008. Vaughan and Brandon. Manufacture of steel, etc. Dec. 2.

28,030. Ruthenburg. Extraction of antimony from ores. Dec. 2.

28,226. Cowper-Coles. Production of iron by electrodeposition. Dec. 5.

28,274. Bradley. Extraction of metals from ores. Dec. 5.

28,534. Barton. Treatment of minerals and production of hydrogen. Dec. 8.

28,570. Campbell. Treating galvanizers' or tinners' waste pickle. Dec. 8.

28,589. Lake (Universal Ore Reduction Co.). Extraction of metals from their ores.* Dec. 8.

28,592. Cowper-Coles. Apparatus for use in electro depositing iron. Dec. 8.

28,746. Boucher. Manufacture of iron and steel [Fr. Appl., Oct. 15, 1910.]* Dec. 10.

Complete Specifications Accepted.

27,806 (1909). Ramage. Recovery of iron from ores, and preparation of iron alloys. Dec. 7.

28,131 (1909). Coslett. Treatment of iron or steel to prevent oxidation or rusting. Dec. 14.

28,608 (1909). Rübel. Manufacture of alloys of low specific weight. Dec. 14.

28,611 (1909). Hommel and Durant. Extraction of metals from ores. Dec. 14.

28,933 (1909). Sulman, Higgins, and Ballot. Concentration of ores. Dec. 14.

674 (1910). Mulacek and Hatlanek. Electric induction furnaces. Dec. 7.

2364 (1910). Köhler. Arrangement of electrodes for the electrolytic refining of metals. Dec. 14.

5264 (1910). Brougham (Poldihütte Tiegelguszstahlfabrik). Electric induction furnaces. Dec. 7.

14,823 (1910). Ettlinger. Roasting furnaces. Dec. 7.

15,984 (1910). Daebritz. Hardening of iron and steel. Dec. 14.

16,156 (1910). Robacher. Filtering apparatus particularly for use in the cyanide process of extracting precious metals from their ores. Dec. 14.

XI.—ELECTRO-CHEMISTRY.

Applications.

28,069. Thomas. Electrically insulating compound. Dec. 2.

28,126. Ruthenburg. Electric furnaces. Dec. 3.

28,352. Mershon. Method of forming dielectric films. [U.S. Appl., Jan. 5. 1910.]* Dec. 6.

28,536. Ruthenburg. Electrodes for electric furnaces. Dec. 8.

Complete Specifications Accepted.

674 (1910). Mulacek and Hatlanek. *See under* X.

5266 (1910). Brougham (Poldihütte Tiegelguszstahlfabr.). *See under* X.

9964 (1910). Estelle. Manufacture of accumulator electrodes. Dec. 7.

20,519 (1910). Johnson (McNitt). *See under* VII.

XII.—FATS; OILS; WAXES.

Applications.

28,178. Wallbaum. *See under* III.

28,564. Bowling. Soaps. Dec. 8.

28,765. Borrill. Cleansing fluid or composition. Dec. 10.

Complete Specifications Accepted.

28,026 (1909). Hoey. Lubricant. Dec. 7.

7734 (1910). Napp. *See under* XV.

11,953 (1910). Fattinger. Manufacture of medicinal soap. Dec. 14.

22,961 (1910). Baldus. *See under* XXIII.

XIII. PAINTS; PIGMENTS, VARNISHES, RESINS.

Applications.

27,636. Meister, Lucius, und Bruning. *See under* IV.

27,639. Bloxam (Chem. Fabr Griesheim Elektron). *See under* IV.

27,867. Barton. Manufacture of lead oxide. Nov. 30.

27,936. Borchardt. Resinous compounds. Dec. 1.

27,949. Bloxam (Act.-Ges. f. Anilinfabr.). *See under* IV.

28,151. Davies and Richards. Manufacture of paint. Dec. 3.

28,155. Johnson (Bakelite Ges.). Manufacture of plastic bodies and moulded articles.* Dec. 3.

28,491. Kunisch and Bruhn. Manufacture of a substitute for amber and like material. Dec. 7.

28,553. Meurant. Production of oil colours. [Belg. Appl., April 1, 1910.]* Dec. 8.

Complete Specifications Accepted

7922 (1910). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter lakes. Dec. 7.

9391 (1910). De Stucklé. *See under* VII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Application.

28,489. Richards. Recovering and utilising worn or waste rubber or the like. Dec. 7.

Complete Specifications Accepted.

28,613 (1909). Grist. Artificial production of rubber. Dec. 14.

7139 (1910). General Caoutchouc Co. Separation of caoutchouc from resinous products. Dec. 14.

16,758 (1910). Van der Burg. Substitute for rubber. Dec. 7.

XV.—LEATHER; BONE; HORN; GLUE.

Applications.

28,275. Meygret. The varnishing of leather. Dec. 5.

28,373. Meygret. Manufacture of artificial leather or the like. Dec. 6.

Complete Specification Accepted.

7734 (1910). Napp. Obtaining calcium or barium salts of fatty acids from glue boiler residues. Dec. 7.

XVII.—SUGARS; STARCHES; GUMS.

Complete Specification Accepted.

13,320 (1910). Sluka. Machine for transforming boiled sugar into a creamy paste. Dec. 14.

XVIII.—FERMENTATION INDUSTRIES.

Applications.

27,782. Stevenson. Treatment of fermentable substances. Nov. 29.

27,845. Kruis. Manufacture of dry yeast.* Nov. 30.

XIX.—FOODS; WATER PURIFICATION; SANITATION.

Applications.

28,353. Gans. Clarifying water to purify it from germs. [Ger. Appl., Jan. 6, 1910.]* Dec. 6.

28,434. Grossmann. Treatment of sewage sludge. [Addition to No. 16,397 of 1908.] Dec. 7.

Complete Specifications Accepted.

28,067 (1909) and 25,883 (1910). Henri, Helbronner, and von Recklinghausen. Apparatus for sterilising liquids by ultra-violet rays. Dec. 14.

30,080 (1909). Tiemann. *See under* I.

14,129 (1910). Henri, Helbronner, and von Recklinghausen. Sterilisation of liquids. Dec. 7.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Applications.

27,868. Darrasse frères, and Dupont. Apparatus for use in subliming camphor. [Fr. Appl., Dec. 21, 1909.]* Nov 30.

28,049. Bayer und Co. Manufacture of mercuric compounds substituted in the nucleus of alkylated or halogenated benzoic acids. [Ger. Appl., March 21, 1910.]* Dec 2

28,159. Jones. *See under* III.

28,247. Newton (Bayer und Co.). Manufacture of cinnamic esters. Dec. 5.

28,378. Mathys (Bleiberger, Weber, and Co.). The menthylated oil of wintergreen and process of producing same.* Dec. 6.

28,538. Wellcome and Pyman. Manufacture of a physiologically active base. Dec. 8.

28,583. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of organic mercury compounds. Dec. 8.

Complete Specification Accepted.

24,480 (1910). Meister, Lucius, und Brüning. Manufacture of amino-oxyarylarsenoxides. Dec. 7.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

28,571. Hans. Process for making photographic pictures on objects of all kinds.* Dec. 8.

XXII.—EXPLOSIVES; MATCHES.

Complete Specification Accepted.

8769 (1910). Nobel's Explosives Co. (Wilson). Explosives. Dec. 14.

XXIII.—ANALYTICAL PROCESSES.

Application.

27,664. Barry. Ascertaining and recording the presence and percentage of gases other than those ordinarily contained in the atmosphere. Nov. 28.

Complete Specification Accepted.

22,961 (1910). Baldus. Viscosity meters. Dec. 14.

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Oscar Guttmann, 60, Mark Lane, London, E.C.

Henry Hemingway, 9, Albemarle Mansions, Hampstead, N.W.

Prof. G. G. Henderson, Technical College, Glasgow.

Prof. W. R. E. Hodgkinson, 89, Shooter's Hill Road, Blackheath, S.E.

D. Lloyd Howard, City Mills, Stratford, E.

Dr. Charles A. Keane, 119, Ladbroke Road, London, W.

Prof. W. R. Lang, University, Toronto, Canada.

Harold Van der Linde, c/o Continental Rubber Co., 111, Broadway, New York City, U.S.A.

B. E. R. Newlands, 2, St. Dunstan's Hill, London, E.C.

Dr. Julius Raschen, The Highlands, Runcorn, Cheshire.

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Editor.

Watson Smith, 34, Upper Park Road, Haverstock Hill, London, N.W.

LIST OF MEMBERS.

THE MEMBERSHIP ON FEBRUARY 28TH, 1910 = 4230.

NOTE: "O.M." MEANS ORIGINAL MEMBER.

A

1908. Abelli, Dr. Modesto, Avigliana, Torino, Italy, Director of Nobel Explosive Works.
1903. Abraham, Herbert, 13, West 89th Street, New York City, U.S.A., Chemist.
1909. Acheson, •Dr. Edward G., Niagara Falls, N.Y., U.S.A., President. Acheson Oildag Co.
1902. Acker, Chas. E., 80, Main Street, Ossining, N.Y., U.S.A., Manufacturer.
1903. Ackermann, Franz W., 86, Pierrepoint Street, Brooklyn, N.Y., U.S.A., Chemist.
1909. Acott, Richard H., c/o Porter Fibre Bottle Co., Lewiston, N.Y., U.S.A., Chemist.
1903. Acton, J. Rowland, India Store Depot, Belvedere Road, London, S.E., Civil Servant.
1907. Adam, Wm. A., c/o Mander Bros., Wolverhampton, Chemist.
1892. Adams, Arthur, Kelvin House, Edgbaston Road, Smethwick, near Birmingham, Science Lecturer.
1909. Adams, Chas., c/o John Cowan Co., Ltd., 9, Dalhousie Street, Montreal, Canada, Chemical Works Manager.
1897. Adams, Thos. H., Endon Villa, Victoria Avenue, Borrowash, near Derby, Analyst.
1895. Adamson, G. P., c/o The Baker and Adamson Chemical Co., Easton, Pa., U.S.A., Manufacturing Chemist.
1891. Adcock, S. R., St. Helens Smelting Co., Atlas Court, St. Helens, Lancashire, Analytical Chemist.
1901. Addison, Leonard, c/o Messrs. Burt, Boulton, and Haywood, Selzaete, Belgium, Chemist.
1908. Addleman, S. W., 505, West 135th Street, New York City, U.S.A., Chemist.
1898. Adgate, M., Naugatuck, Conn., U.S.A., Chemist.
1896. Adler, Dr. Leon N., Adler Colour and Chemical Works, 100, William Street, New York City, U.S.A., Manufacturing Chemist.
1907. Adley, Geo. S., Storer's Wharf, Poplar, London, E., Varnish Manufacturer.
1888. Adriance, Dr. John S., Williams College, Williamstown, Mass., U.S.A., Analytical Chemist.
1899. A lrot, Léon, 16, Palmer Avenue, Port Richmond, N.Y., U.S.A., Chemist.
1891. Airedale, Rt. Hon. Lord, Gledhow Hall, and (Jnls.) Monkbridge Iron and Steel Co., Ltd., Leeds, Iron and Steel Manufacturer.
1886. Aitken, J. B., Gerard's Fold Chemical Works, Widnes, Chemical Manufacturer.
1884. Akitt, Thos., Parkhill, Bishopton, Renfrewshire, Chemist.
1883. Albright, G. S., Bromesberrow Place, Ledbury, Chemical Manufacturer.
O.M. Albright, W. A., 29, Frederick Road, Edgbaston, Birmingham, Chemical Manufacturer.
1906. Alcock, Frank H., 9, Broad Street Corner, Birmingham, Analyst.
1907. Alcock, J. E., 51, Gill Street, Moston Lane, Blackley, Manchester, Chemist.
1902. Alden, Frederick W., 500, Madison Street, Waukesha, Wis., U.S.A., Chemist.
1898. Alden, John, Chemical Laboratory, Pacific Mills, Lawrence, Mass., U.S.A., Chemist.
1906. Alder, H. W., Hacienda Cartavio, Trujillo, Peru, Works Chemist.
1900. Aldrich, Roger C., c/o Franklin H. Kalbfleisch Co., Elizabeth, N.J., U.S.A., Mechanical Engineer.
1890. Aldrick, Edwin John, 53, Alpha Road, West Ferry Road. Millwall, E., Works Sub-Manager.
1909. Alén, Dr. J. E., Stadskemistens Laboratorium, Göteborg, Sweden, Public Analyst.
1899. Alexander, D. Basil W., 1000, Date Street, Los Angeles, Cal., U.S.A., Chemist.
1900. Alexander, Jerome, c/o National Gum and Mica Co., 502-510, West 45th Street, New York City, U.S.A., Chemist.
1883. Alexander, W. T., Crummock, Eccles, Manchester Drysalter.
1906. Allan, David, c/o Price's Patent Candle Co., Ltd., Belmont Works, Battersea, S.W., Chemist.
1891. Allan, F. H. Tielke, Ellesmere, Robin Hood, near Wakefield, Analytical Chemist.
1898. Allan, John, 77, Northen Grove, West Didsbury near Manchester, Chemist.
1909. Allan, Maurice, 95, Burford Street, Nottingham, Soapmaker.
1907. Allard, M. L., c/o Gutta Percha and Rubber Manufacturing Co., West Lodge Avenue, Toronto, Canada, Chemist.
1902. Allbright, Wm. B., 5139, Lexington Avenue, Chicago, Ill., U.S.A., Chemical Engineer.
O.M. Alldred, C. H., 8, St. Margaret's Road, Plumstead Common, Kent, Analytical Chemist.
1903. Allen, Chas. A., Fulwood, Sunnyhurst, Darwen, Lancashire, Chemist.
1908. Allen, Geo. Y., c/o British American Dyeing Co., Montreal, Canada, Manager.
O.M. Allen, J., 164, Upper North Street, Poplar, E., Manufacturing Chemist.
1907. Allen, J. Fenwick, 147, Withington Road, Whalley Range, Manchester.
1889. Allen, R. L., Hillside, and (Journals) c/o Brunner, Mond and Co., Ltd., Sandbach, Cheshire, Analytical Chemist.
1908. Allen, Simeon C., 81, Lake Avenue, Rochester, N.Y., U.S.A., Consulting Chemist.
1900. Allen, Wilfrid T., Allington, Bexley, Kent, Director.
1904. Allen, Wm. R., 709, Power Building, Montreal, Canada, Chemical Manufacturer.
1893. Allerton, Rt. Hon. Lord, F.R.S. (Journals), Allerton Hall, near Leeds; and c/o W. L. Jackson and Sons, Ltd., Buslingthorpe, Leeds, Tanner.
O.M. Allhusen, A., Gateshead-on-Tyne, Chemical Manufacturer.
1886. Allibon, G. H., Mayfield, Balmoral, Belfast, Ireland, Chemical Works Manager.
1887. Alliott, J. B., Messrs. Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.
1905. Allpass, Jas., c/o The Clayton Aniline Co., Ltd., Clayton, Manchester, Secretary.
1889. Alpiar, Agop, Smyrna, Asia Minor, Morphia Manufacturer.
1899. Alsop, Wm. K., Ridgway, Pa., U.S.A., Chemist.
1904. Alton, W. Lester, 11, Briar Walk, Putney, S.W., Chemist.
1905. Amory, L. H., c/o Messrs. J. Heathcoat and Co., Tiverton, Devon, Lace Manufacturer.
1900. Anderson, Jas. W., Howard House, Northfleet, Kent. Analytical Chemist.
1889. Anderson, Robt. T. R., 42, Roslea Drive, Dennistoun, Glasgow, Technical Chemist.

1894. Anderson, Dr. W. Carrick, 7, Scott Street, Garnet Hill, Glasgow, Consulting Chemist.

1905. Andreae, Dr. E. P., c/o British Glanzstoff Manufacturing Co., Ltd., Flint, North Wales, Chemist.

1907. Andrews, Chas. T., Estaçao do Miguel Burnier, E.F.C.B., Minas Geraes, Brazil, Chemist.

1889. Andrews, Clement W., c/o The John Crerar Library, Wabash Avenue and Washington Street, Chicago, Ill., U.S.A., Librarian.

1904. Andrews, Geo. D., c/o J. & J. Colman, Ltd., Carrow Works, Norwich, Chemist.

1903. Andrews, Wm. H., 79, Tonawanda Street, Buffalo, N.Y., U.S.A., Manager (Varnish Works).

1903. Antilogoff, N. A., 18, Hathaway Road, Grays, and (Journals) Central Wharf, Bow, E., Chemist.

O.M. Angell, J., 6, Beaconsfield, Derby Road, Withington, Manchester, Chemical Lecturer.

1892. Annandale, C. J. R., 126, Earnsdale Road, Darwen, Lancs., Paper Maker.

1883. Annandale, Jas. H., Polton Paper Works, Midlothian, N.B., Paper Maker.

1894. Ansbacher, L. A., 253, Broadway, New York City, U.S.A., Colour Manufacturer.

1902. Anthony, John, 82, Bay Street, Toronto, Canada.

1904. Appleby, Jos., Farnley, Moor Lane, Great Crosby, Liverpool, Flour Miller.

1895. Appleby, Prof. W. R., 911, 5th Street S.E., Minneapolis, Minn., U.S.A., Professor of Mining and Metallurgy.

1907. Appleton, Francis H., jun., P.O. Box 815, Franklin, Mass., U.S.A., Rubber Manufacturer.

1894. Appleton, H. A., 63, Rosedale Road, Forest Gate, E., Analytical Chemist.

1900. Appleyard, Geo. H., 4, Ash Grove, Beverley Road, Hull, Chemist.

1905. Appleyard, Jas. R., Royal Technical Institute, Salford, Lecturer.

O.M. Archbutt, Leonard, The Yews, Madeley Street, Derby, Analytical Chemist.

1899. Archdale, T. Henry, 77, Queen's Road, Blackburn, Manager of Tar and Ammonia Works.

1904. Archdale, Wm., 21, Oldham Road, Miles Platting, Manchester, Manager of Chemical Works.

1908. Archibald, E.M.B., 17, St. John Street, Montreal, Canada, Electrical Engineer.

1909. Archibald, H., Parkhead Forge, Glasgow, Metallurgical Engineer.

1901. Ardagh, Edw. G. R., Faculty of Applied Science, University of Toronto, Canada, Chemist.

1900. Ardern, Edw., Greengates, Davyhulme, Urmston, Manchester, Chemist.

1907. Armstrong, Chas. F., c/o Cawnpore Sugar Works, Ltd., Marhourah Factory P.O., Chupra, Sarun, India, Technical Chemist.

1902. Armstrong, Edward E., Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Manufacturing Chemist.

1905. Armstrong, Dr. E. Frankland, 98, London Road, Reading, Works Chemist.

1899. Armstrong, Richard, Saul Street Soap Works, Preston, Lancashire, Soap Manufacturer.

1905. Armstrong, Theodore, 115, Chestnut Street, Philadelphia, Pa., U.S.A., President, Penn. Salt Manufacturing Co.

1905. Arnold, Frank L., 32, School Street, North Woburn, Mass., U.S.A., Chemist

1901. Arnold, G. Edmund, 6, Kingsfield Terrace, Faversham, Kent, Manager (Cotton Powder Co., Ltd.).

1899. Arnott, Dr. G. W. Campbell, c/o Fertiliser Manufacturers' Association, 79, Mark Lane, London, E.C., Agricultural Chemist.

1903. Arnott, J. S., Moros, 42, 2°, Gijon, Spain, Chemist and Metallurgist.

1901. Arundel, A. S. D., 76, Collins Street, Hobart, Tasmania, Chemical Engineer.

1901. Asano, K., Ashio Copper Mine, Shimozuke, Japan, Mining Chemist.

1906. Ash, Chas. S., 180, Townsend Street, San Francisco, Cal., U.S.A., Chemist.

1908. Ashbury, J. W., c/o John Brown and Co., Ltd., Laboratory, Atlas Works, Sheffield, Chief Chemist.

1903. Ashley, Frank R., P.O. Box 1605, Denver, Colo., U.S.A., Manufacturing Chemist.

1900. Ashton, Jas., Rhodes Farm, Whitefield, Manchester, Chemist and Manager.

1890. Ashton-Bott, W. D. *See* Bott, W. D. Ashton

1885. Ashwell, J. H., Bleacher and Dyer

1894. Ashworth, Arthur, Fernhill Chemical Works, Bury, Lancs., Chemical Manufacturer

1908. Ashworth, D. Irving, P.O. Box 38, Wappingers Falls, N.Y., U.S.A., Chemist.

1908. Asmus, Grover E., 1011, Hudson Boulevard, West Hoboken, N.J., U.S.A., Chemist.

1907. Aspey, Urban, jun., New Station Soap Works, School Close, and (Journals) 11, Neville Street, Leeds, Works Manager and Chemist.

1898. Aspinall, Thos., 62, Gilnow Road, Bolton, Analytical and Manufacturing Chemist.

1900. Aston, Bernard C., 71, Devon Street, Wellington, New Zealand, Chemist.

1891. Atkins, C. E., Teigngrace, Byculla Park, Enfield, N., Chronometer Maker.

1885. Atkinson, A. J., 14, Stuart Street, Cardiff, Analytical Chemist.

1900. Atkinson, Jno. W., Betteravia, Cal., U.S.A., Chemist.

1905. Atteaux, F. E., 176, Purchase Street, Boston, Mass., U.S.A., Dyestuff Importer.

O.M. Attfield, Dr. J., F.R.S., Ashlands, Watford, Herts.

1900. Atwood, Frank W., 216 Milk Street, Boston, Mass., U.S.A., Chemist.

1895. Auchterlonie, Wm., c/o Clark Thread Co., Newark, N.J., U.S.A., Dyeworks Manager.

1907. Auchu, Henry, Emporium, Pa., U.S.A., Explosives Manufacturer.

1901. Auden, Dr. H. A., Westwood, Grassendale, Liverpool, Chemist.

1897. Auger, Chas. L., 125, Park Avenue, Paterson, N.J., U.S.A., Silk Dyer.

1902. Austin, J. H., Allscott, Wellington, Shropshire, Analytical Chemist.

1901. Auty, Albert M., c/o John Smith and Sons, Ltd., Field Head Mills, Bradford, Works Chemist

1902. Avery, D., Working Men's College, Melbourne, Vic., Australia, Teacher of Chemistry.

1910. Ayers, Gilbert F., Dynamite Factory, Modderfontein, Transvaal Chemist.

1890. Aykroyd, H. E., Scaitcliffe, Queen's Road, Ilkley, Yorks, Dyer.

1899. Aylsworth, Jonas W., 223, Midland Avenue, East Orange, N.J., U.S.A., Chemist.

B

1904. Babb, Edward E., 41, Central Wharf, Boston, Mass., U.S.A., Food Analyst.

1908. Babington, Fred. W., Customs Laby., Customs Dept., Ottawa, Canada, Analyst.

1895 Bacon, Nathaniel T., Peace Dale, Rhode Island, U.S.A., Chemical Engineer.

1897. Badock, Stanley H., Holmwood, Westbury on Trym, near Bristol, Smelter.

1898. Baekeland, Dr. Leo, Snug Rock, Harmony Park, Yonkers, N.Y., U.S.A., Research Chemist.

1903. Bailey, Prof. E. H. S., The Library, Kansas State University, Lawrence, Kas., U.S.A., Professor of Chemistry.

1885. Bailey, Edwin M., Almond Hill, Pumpherston, Mid Calder, N.B., Technical Chemist.

1908. Bailey, F. W., Overstone, Robertson Road, Buxton.

1883. Bailey, Dr. G. H., Kinlochleven, Argyll, N.B., Chemist.

1903. Bailey, Harold J., Maritime Coke Works, Pontypridd, S. Wales, Chemist.

1906. Bailey, Ralph W., 66, Cherry Street, Elizabeth, N.J., U.S.A., Chemist.

1888. Bailey, Dr T. Lewis, 13, St. Alban's Road, Swansea, H.M. Inspector of Alkali Works.

1910. Baillie, Thomas B., c/o Henry Tate & Sons, Ltd., Love Lane Sugar Refinery, Liverpool, Analytical Chemist.

1902. Bain, Prof. Jas. Watson, Faculty of Applied Science, The University, Toronto, Ont., Canada, Chemist.

1890. Baird, H. Harper, 14, Cross Street, Hatton Garden, London, E.C., Laboratory Furnisher.

1902. Baird, Dr. Julian W., Massachusetts College of Pharmacy, Boston, Mass., U.S.A., Professor of Chemistry.

1908. Baird, M. M., 18, Jedburgh Avenue, Rutherglen, Glasgow, Analytical Chemist.

1891. Baird, Wm., c/o Lewis Berger and Sons, Ltd., Homerton, N.E., Technical Chemist.

1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.

1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.

1903. Baker, Arthur, 2, Carlton Avenue, Horns Cross, Greenhithe, Kent, Chemist.

1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.

1901. Baker, F. Guy Stirling, Marryatt's Lodge, The Forest, Snaresbrook, Essex, Student.

1909. Baker, Frank, Royal Powder Factory, Waltham Abbey, Essex, Chemist.

1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.

1899. Baker, H. Fenimore, c/o Thomsen Chemical Co., Baltimore, Md., U.S.A., President.

1904. Baker, John T., c/o J. T. Baker Chemical Co., Phillipsburg, N.J., U.S.A., Manufacturing Chemist.

1892. Baker, Julian L., Stainesbury Holt, Kingston Road, Staines, Brewing and Sugar Chemist.

1909. Baker, Robert P., Ivydene, Bexley, Kent, Technical Chemist.

1886. Baker, Theodore, Fabr. Nacional de Polvoro Piquete, Est. de Sao Paulo, Brazil, Analytical Chemist.

1898. Baldwin, Abram T., Solvay Process Co., Detroit, Mich., U.S.A., Alkali Manufacturer.

1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.

1903. Baldwin, Dr. H. B., 927, Broad Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).

1903. Ball, S. F., Hull Avenue and 209th Street, New York City, U.S.A., Analytical Chemist.

1889. Ballantyne, Horatio, 75, Chancery Lane, London, W.C., Analytical and Consulting Chemist.

1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.

O.M. Ballard, Edw. G., 6, Grey Friars, Chester, Alkali Works Inspector.

O.M. Bamber, H. Kelway, Outram House, Addiscombe, Surrey, Consulting Chemist.

1894. Bamber, H. K. G., Ingress House, Greenhithe, Kent, Cement Works Chemist and Manager.

1898. Bamford, Harry, 70, Duckworth Terrace, Bradford, Yorks, Dyer.

1906. Bancroft, John, Wilmington, Del., U.S.A., Bleacher and Dyer.

O.M. Banister, H. C., Elmhurst, Blundellsands, near Liverpool, Chemical Works Manager.

1890. Banks, Jno. H., c/o Ricketts and Banks, 104, John Street, New York City, U.S.A., Mining Engineer.

1895. Bannan, John F., 59, Court Street, North Andover, Mass., U.S.A., Chemist (Woollen Mill).

O.M. Bannister, W., Burvale, Watford, Herts, Manufacturing Chemist.

1909. Barber, C. Douglas, Great Nelmes, Hornchurch, Essex, Chemist.

1908. Barber, Percy S., The Reform Food Stores, 84, Whitechapel, Liverpool, Chemist.

1901. Barber, Capt. René R., Georgetown, Ont., Canada, Analytical Chemist.

1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.

1907. Bardorf, C. F., c/o St. Lawrence Sugar Refining Co., Maisonneuve, P.Q., Canada, Chief Chemist.

1895. Bardwell, Fred L., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Assistant Professor of Chemistry.

1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park, Liverpool, Laboratory Furnisher.

1905. Barker, Perry, 93, Broad Street, Boston, Mass., U.S.A., Chemist.

1909. Barker, Richard F., Adams, N.Y., U.S.A., Chemist.

1895. Barlow, Clinton W., 84 and 86, Greene Street, New York City, U.S.A., Merchant.

1908. Barlow, Lt.-Col. Sir Hilaro W. W., Bart., R.A., 84, Shooter's Hill Road, Blackheath, S.E., Superintendent (Royal Laboratory, Woolwich).

1901. Barlow, John J., 177, Manchester Road, Accrington, Calico Printer's Chemist.

1899. Barlow, Wm., 2, Delamere Street, Higher Openshaw, Manchester, Analytical Chemist.

1908. Barnes, Alfred, Box 556, Pretoria, Transvaal, Dealer in Minerals.

1906. Barnes, A. G., c/o Hasland Coking Co., Grassmoor Collieries, Chesterfield, Colliery Proprietor.

1891. Barnes, Edward A., 194, Hammersmith Road, London, W., Technical Chemist.

1901. Barnes, Fred., 1, Richmond Villa, London Road, Milton Regis, Sittingbourne, Kent, Paper Mill Chemist.

1905. Barnes, F. V., Eastcroft Gasworks, Nottingham, Superintendent.

1884. Barnes, H. J., Phœnix Chemical Works, Hackney Wick, N.E., Manufacturing Chemist.

1884. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.

O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.

1902. Barnett, Marcus S., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Sugar Works Chemist.

1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).

1904. Baron, Wm. Briscoe, c/o Vulcan Boiler and General Insurance Co., 26, Pall Mall, Manchester, Chemist.

O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.

1905. Barraclough, C. E., 2, Wood View Terrace, Manningham, Bradford, Chemist.

1890. Barraclough, Wm. H., Beechwood, Mortomley, near Sheffield, Analytical Chemist.

1896. Barratt, J. Treeby, Bronheulog, Mostyn, North Wales, Chemist and Manager.

1890. Barrett, Arthur A., 139, Viale San Martino, Messina, Sicily, Manufacturer of Essential Oils.

1907. Barrett, John H., Technical School, College Street, Toronto, Canada, Superintendent.

1907. Barrett, Maurice, The Leeds Fireclay Co., Ltd., Burmantofts Works, Leeds.

1890. Barrie, D. McLaurin, P.O. Box 193, Germiston, Transvaal, Metallurgist.

1900. Barrow, Jos., 13, The Grove, Bebington, Cheshire, Chemist.

1906. Barrs, Chas. E., 3A, Downshire Hill, Hampstead, N.W., Analyst.

1905. Barry, Eugene, Ayer, Mass., U.S.A., Leather Manufacturer.

1893. Barton, G. E., c/o Whitall, Tatum, and Co., Flint Glass Works, Millville, N.J., U.S.A., Technical Chemist.

1903. Bartripp, Geo. F., 20, Grove Road, Wanstead, Essex, Analytical Chemist.

1905. Baruch, Edgar, 945, South Olive Street, Los Angeles, Cal., U.S.A., Chemical Engineer.

1909. Barzano, Carlo, 24, Via Bagutta, Milan, Italy, Patent Agent.

1895. Baskerville, Dr. Chas., College of the City of New York, New York City, U.S.A., Professor of Chemistry.

1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.

1908. Bassett, Henry, jun., Chemical Department, University of Liverpool, Assistant Lecturer.

1899. Bassett, Wm. H., 189, Litchfield Street, Torrington, Conn., U.S.A., Chemist.

1890. Bate, William, Upton Villa, Hayle, Cornwall, Technical Chemist (National Explosives Co., Ltd.).

1903. Bateman, A. H., 34, Bridge Avenue, Hammersmith, W., Chemist.

1885. Batty, R. B., Wharncliffe, Erdington, near Birmingham, Nickel Works Manager.

1903. Baty, E. J., Nunclose, Prince's Avenue, West Kirby, Cheshire, Chemist.

1903. Bauer, Geo. W., 660, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co.).

1900. Baur, Jacob, 440, Wells Street, Chicago, Ill., U.S.A., Liquid Carbonic Acid Manufacturer.

1910. Baxter, F. Stanley, 172, Hampstead Road, London, N.W., Chemist.

1898. Baxter, John G., Riverview, Burch Road, Rosherville, Gravesend, Kent, Chemist.

1899 Bayly, Francis W., Church Cobham, Surrey, Assayer.

1904. Bayly, Harold G., Moatside, Bedford, Analytical Chemist.

1908 Bayly, Percival G. W., Mines Dept. Laby., Spring Street, Melbourne, Victoria, Government Metallurgical Chemist.

1897. Beadle, Alec A., Wenden, Dawlish, South Devon, Electro-Chemist.

1886. Beadle, Clayton, Oakbank, Lansdown Road, Sidcup, Kent, Consulting Chemist.

1908. Bealey, Herbert C., c/o A. C. Bealey and Son, Radcliffe, near Manchester, Bleacher and Chemical Manufacturer.

O.M. Beanes, E., Moatlands, Paddock Wood, Kent, Manufacturing Chemist.

1908. Beardmore, Walter W., Acton West, Ont., Canada, Leather Tanner.

1907 Beardsloy, Dr. Alling P., 165, Minerva Street, Derby, Conn., U.S.A., Chemist (New Haven Gas Co.).

1909. Bearpark, Arthur F., 16, East Park Avenue, Hull, Works Manager.

1908. Beasley, Fred. G., 44, Green Street, Smethwick, near Birmingham, Metallurgical Chemist.

1905. Beasloy, Jno. K., c/o The Abbontiakoon Mines, Ltd., Tarkwa, Gold Coast Colony, W. Africa, Metallurgical Chemist.

1883. Beaven, E. S., 5, Boreham Terrace, Warminster, Wilts, Maltster.

1897. Beaver, Chas. J., Holme Lea, Ashley Road, Hale, Cheshire, Chemist.

1905. Beckers, Dr. Wm., 117, Hudson Street, New York City, U.S.A., Chemist.

1909. Becket, Fredk. M., 31, Sugar Street, Niagara Falls, N.Y., U.S.A., Chief Metallurgist, Electro Metallurgical Co.

O.M. Beckott, G. H., Hartford, 35, South Beach Road, Ardrossan, Scotland, Analytical Chemist.

1898. Beckett, Jos. H., Gable End, Upton Road, Moreton, Birkenhead, Analytical Chemist.

1899. Bedford, Alf. C., 26, Broadway, New York City, U.S.A., Chemical Merchant.

1891. Bedford, Chas. S., Rocella, Weetwood, Headingley, Leeds, Manufacturing Chemist.

1891. Bedford, Jas. E., Messrs. Wood and Bedford, Airedale Chemical Works, Leeds, Manufacturing Chemist.

O.M. Bedson, Prof. P. Phillips, Armstrong College, Newcastle-on-Tyne, Professor of Chemistry.

1909. Beer, G. Frank, 54, Glen Road, Rosedale, Toronto, Canada, Manufacturer.

1909. Beers, Frank T., Barksdale, Bayfield Co., Wis., U.S.A., Chemist.

1901. Beevers, Clifford J., 12, Parish Ghyll Road, Ilkley, Yorks, Analyst.

1899. Behr, Dr. Arno, 432, Arlington Court, Pasadena, Cal., U.S.A., Chemist.

1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.

O.M. Beilby, Dr. George T., F.R.S., 11, University Gardens, Glasgow, Chemical Engineer.

1906. Belden, A. W., U.S. Geological Survey, 40th and Butler Streets, Pittsburg, Pa., U.S.A., Coke Expert.

1906. Bell, H. N., Port Fairy, Victoria, Australia, Company Manager.

1884. Bell, Sir Hugh, Bart., Middlesbrough-on-Tees, Soda and Iron Manufacturer.

1900. Bell, Hugh P., 17, Tothill Street, Westminster, S.W., Chemist.

O.M. Bell, J. Carter, Bank House, The Cliff, Higher Broughton, Manchester, Public Analyst.

1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.

1907. Bell, Marcus, Explosives Dept., 423, Flinders Lane, Melbourne, Victoria, Chemist.

1905. Bell, Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.

1903. Bell, P. Carter, Millburn, N.J., U.S.A., Chemical Manufacturer.

O.M. Bendix, D., 371, Romford Road, Forest Gate, E., Managing Chemist, British Alizarin Co., Ltd.

1897. Benfey, Dr. Hans, 65, Birchfields Road, Rusholme, Manchester, Manufacturing Chemist.

1907. Bengough, Guy D., The University, Liverpool, Lecturer on Metallurgy.

1903. Benham, Keith, Deans Hill, Stafford, Analytical and Consulting Chemist.

1902. Benjamin, Albert A., Springbrook Works, Middleton Road, Oldham, Bleach and Dyeworks Manager.

O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist.

1908. Benkert, Arthur L., c/o Cassella Color Co., 182, Front Street, New York City, U.S.A., Chemist and Salesman.

1904. Benn, R. H. D., Barry's Bay, Ont., Canada, Analytical Chemist.

1899. Bennett, Alex. H., c/o G. H. Ogston & Moore, Catania, Sicily, Chemist.

1901. Bennett, Arnold, c/o Montreal Steel Works, Ltd., St. Patrick Street, Montreal, Canada, Chemist.

1907. Bennett, H. Garner, 18, Railway Street, Beverley, Yorks, Leather Chemist.

1902. Bennie, P. McN., P.O. Box 29, Niagara Falls, N.Y., U.S.A., Consulting Chemist.

1909. Benson, George F., Edwardsburg Starch Co., Cardinal, Ontario, Canada, President and Managing Director.

1906. Benson, Richard W., c/o Geo. Craddock & Co., Wakefield, Yorks, Analytical Chemist.

1901. Bentley, Wm. H., 12, Cromwell Terrace, Irlam, near Manchester, Technical Chemist.

1890. Bentz, Ernest, 107, Shaw Lane, Dinting, near Manchester, Lecturer on Dyeing.

1905. Berge, Henry vom, c/o Schoellkopf & Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Manager.

1884. Beringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.

1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.

1907. Berk, Paul F., 1, Fenchurch Avenue, London, E.C.

1908. Berlinerblau, Dr. Joseph, 8, Szpitalna Street, Warsaw, Russian Poland, Industrial Chemist.

1900. Bermingham, Jno., jun., Room 317, Union Trust Building, San Francisco, Cal., U.S.A., Superintendent.

1889. Bernard, Jas., jun., Ranipet, North Arcot, Madras Presidency, India, Chemical Works Manager.

1897. Berry, Albert E., Ontario, Snaresbrook, Essex, Works Manager.

1906. Berry, Arthur J., 5, University Gardens, Glasgow, Chemist.

1883. Berry, E. E., Bordighera, Italy, and (Journals) c/o C. H. Grinling, 17, Rectory Place, Woolwich, S.E., Technical Chemist.

1889. Berry, G. F., 9, Musgrove Road, Jerningham Road, New Cross, S.E., Chemical Works Manager.

1903. Berry, W. G., 329, West 83rd Street, New York City, U.S.A., Chemist.

1909. Beskow, K. J., Skanska Superfosfat och Svofvelsyre Fabriks A.B., Helsingborg, Sweden, Head Engineer.

1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.

1907. Bettermann, Heinrich, Doemitz-on-Elbe, Germany, Explosives Works Manager.

1901. Betts, Anson G., Troy, N.Y., U.S.A., Chemist.

O.M. Bevan, E. J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.
1900. Bevan, Jno. W., Morriston Spelter Works, Morriston, R.S.O., Glamorgan, Manager of Metallurgical Works.
O.M. Beveridge, Jas., c/o Miramichi Pulp and Paper Co., Ltd., Chatham, N.B., Canada, Pulp and Paper Manufacturer.
1910. Beveridge, Jas. B., 146, Mansfield Street, Montreal, Canada, Paper Maker.
1909. Bewick, R. M., c/o United Alkali Co., Ltd., 30, James Street, Liverpool, Traveller.
1909. Beynon, Donald E., c/o Continental Mexican Rubber Co., Apartado 176, Torreon, Coahuila, Mexico, Chemist.
1898. Bhattacharyya, Haripada, Gun and Shell Factory, Ishapore, Bengal, India, Chemist.
1902. Biach, Dr. Ludwig K., 223, Central Avenue, Norwich, Conn., U.S.A., Chemist and Colorist.
1896. Bibby, John, c/o J. Bibby & Sons, Formby Street, Liverpool, Chemist.
O.M. Bickerdike, W. E., Bryer's Croft, Wilpshire, near Blackburn, Manufacturing Chemist.
1907. Bickerstaffe, Robt., c/o Thomas and Green, Ltd., Soho Mills, Wooburn Green, S.O., Bucks., Chemist.
1903. Bierwirth, L. W., Randolph Avenue, Dover, N.J., U.S.A., Civil Engineer.
1884. Biggart, J. Wm., 29, Cathcart Street, Greenock, N.B., Analytical Chemist.
1891. Biggart, Wm. L., Rossarden, Kilmalcolm, N.B., Public Analyst.
O.M. Biggs, B., 66, Cannon Street, London, E.C., Chemical Merchant.
O.M. Billing, H. S., 42, Kingsley Road, Mutley, Plymouth, Analytical and Managing Chemist.
1896. Billings, Edgar F., 76, Freeport Street, Boston, Mass., U.S.A., Manufacturing Chemist.
1896. Billington, Chas., jun., Heimath, Porthill, Longport, Staffordshire, Metallurgist.
1903. Binns, John H., Thornfield, Mystic Pond, Methuen, Mass., U.S.A., Dyer and Finisher.
1896. Bird, Arthur W., c/o S. Berger & Co., Bromley-by-Bow, E., Works Engineer.
1907. Bird, Charles S., jun., East Walpole, Mass., U.S.A., Paper Maker.
1896. Bird, Jno. B., 3, Brookside, Cambridge, Manure Manufacturer.
1895. Bird, Wm. R., (communications) 125, Goddard Avenue; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts, Analytical Chemist.
1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.
1885. Birley, R. K., c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, India-rubber Manufacturer.
1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.
1884. Bishop, Fred. c/o Burmah Oil Co., P.O. Box 67, Rangoon, Burmah, Technical Chemist.
1903. Bishop, Howard B., 1054, Park Place, Brooklyn, N.Y., U.S.A., Chemist.
1903. Bishop, J. T. F., Chemical Club, Victoria Hotel, Manchester, Secretary.
1905. Bixby, Willard G., 194, Hester Street, New York City, U.S.A., Blacking Manufacturer.
1909. Blacher, Prof. Carl, Polytechnicum, Riga, Russia, Chemical Engineer.
1904. Black, J. Wyclif, 20, Mardale Crescent, Edinburgh, Analytical Chemist.
1902. Black, W. Geoffrey, St. John's House, Christchurch Road, Norwich, Chemist.
1908. Blackhall, Bertram, 48, Frontenac Street, Kingston, Ontario, Canada, Manufacturing Chemist.
1894. Blackmore, H. S., 612, F. Street, N.W., Washington, D.C., U.S.A., Industrial Chemist.
1896. Blagden, Victor, 50-51, Lime Street, London, E.C., Chemical Merchant.
1883. Blagden, W. G., The Manor House, Harting, near Petersfield, Hants, Chemical Merchant.
1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
1884. Blake, Jas., Thames Sugar Refinery, Silvertown, E., Manager.
1890. Blakey, A. J., Dudbridge Mills, Stroud, Gloucestershire, Dyer.
1893. Blears, John, c/o Langworthy Bros. and Co., Ltd., Greengate Mills, Salford, Dyer and Calico Printer.
1908. Blichfeldt, S. H., Merston House, South Road, Southall, Middlesex, Bacteriologist and Fermentation Chemist.
1905. Bliss, H. J. W., United University Club, Pall Mall East, London, S.W., Chemist.
1889. Bloede, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.
1908. Blomeley, Adam Y., Canada Sugar Refinery, Montreal, Canada, Chemist.
1891. Bloomer, Fred. J., Penpont, Clydach, R.S.O., Glamorgan, Nickel Works Manager.
1886. Blount, Bertram, Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.
1888. Bloxam, A. G., 105, Birkbeck Bank Chambers, Holborn, W.C., Chemist and Patent Agent.
1890. Bloxam, W. Popplewell, c/o Sulphate of Ammonia Committee, 4, Fenchurch Avenue, London, E.C., Research Chemist.
1903. Blumenthal, Lionel, The Lindens, Stanley Road Broughton Park, Manchester, Chemist.
1886. Blundstone, E. R., 79, York Street, Westminster, S.W., and (Journals) Heathfield, Park Road, Hampton Hill, Middlesex, Consulting Chemist.
1908. Blyth, Jas. R., c/o Penketh Tannery Co., Penketh, near Warrington, Leather Trades Chemist.
1906. Blyth, M. Wynter, The Lodge, Ardsley, near Barnsley, Yorks, Analytical and Consulting Chemist.
1905. Blyth, Thomas R., Uphall Chemical Works, Ilford, Essex, Analytical Chemist.
1908. Blythe, Fred. C., Holland Bank, Church, Lancashire, Chemical Manufacturer.
O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.
1888. Boake, Edmund J., Aberffraw, Nursery Road, Loughton, Essex, Manufacturing Chemist.
1899. Boehm, Fred., 16, Jewry Street, London, E.C., Chemical Agent and Merchant.
1910. Boehringer, Dr. Rudolph, 870, South 16th Street, Newark, N.J., U.S.A., Chemist.
1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Instructor in Organic Chemistry.
1903. Boissevain, Chas. E. H., 92, Van Eeghenstraat, Amsterdam, Holland, Chemical Manufacturer.
1903. Bolam, Dr. H. W., Queen Margaret College, Glasgow, Lecturer on Chemistry.
1909. Bolden, Wm., Dalmellington Iron Works, Dunaskin, Ayrshire, Chemist.
1907. Boley, Walter, Uerdingen am Rhein, Germany, Manufacturing Chemist.
1901. Bolton, E. Richards, 16, Flanchford Road, Shepherd's Bush, W., Manufacturing Chemist.
1905. Bond, John, Crowlands, Southport, Engineer.
1905. Bond, Josiah, Patagonia, Arizona, U.S.A., Mining Engineer.
1905. Bone, Dr. W. A., F.R.S., West House, Lidgett Park Road, Roundhay, Leeds, Lecturer in Chemistry and Metallurgy.
1892. Bookman, Dr. S., 9, East 62nd Street, New York City, U.S.A., Chemist.
1888. Boor, Leonard G., 21, Mincing Lane, London, E.C., Chemical Merchant.
1896. Boot, John C., Engineer's Office, Delft, Holland, Chemist and Director.
1908. Booth, Jos. W., Atlantic Mills, Providence, R.I., U.S.A., Superintendent.
1904. Booth, N. Parr, Laboratory, Cadbury Bros., Ltd., Bournville, near Birmingham, Chemist.
1894. Booth, Robt., 110, Cannon Street, London, E.C., Engineer.
1891. Boothby, Chas., Box 1127, G.P.O., Sydney, N.S.W. Chemist.

1903. Boral, Robin, Rhodes Mount, Rhodes, near Manchester, Works Manager.
1897. Borland, C. R., Concord, Mass., U.S.A., Smokeless Powder Manufacturer.
O.M. Borland, W. D., Beacon Lodge, Bean, *via* Dartford, Kent, Manufacturer of Explosives.
1906. Bornett, S., Andreaskloster 12, Köln, Germany, Technical Chemist.
1903. Boroschek, Dr. L., 416, East 52nd Street, New York City, U.S.A., Chemist.
1908. Bose, R., 92-95, Upper Circular Road, Calcutta, India, Chemical Works Manager.
1903. Bossi, Dr. Arnold L., Arnold Print Works, North Adams, Mass., U.S.A., Assistant Manager.
1890. Bost, W. D. Ashton, Cartvale Chemical Works, Paisley, N.B., Chemical Manufacturer.
O.M. Bothamley, C. H., Weston-super-Mare, Somerset, County Director of Technical Instruction.
1890. Bott, Dr. W. Norman. *See* Norman-Bott, Dr. W.
1881. Böttinger, Dr. H. T. von, Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Colour Manufacturer.
1901. Bottomley, Dr. J. Frank, c/o The Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, Consulting Chemist.
1906. Bottomley, W., c/o The United Alkali Co., Ltd., Fleetwood Salt Works, Fleetwood, Engineer.
O.M. Boulton, H. E., 64, Cannon Street, London, E.C., Chemical Manufacturer.
O.M Boulton, Sir Samuel B., Bart., 64, Cannon Street, London, E.C., Chemical Manufacturer.
1883 Boulton, T. S., 14, Freegrove Road, Caledonian Road, N., Manager.
1905. Bourne, Lyman M., c/o Goodyear Tire and Rubber Co., Akron, Ohio, U.S.A., Chemist.
1906. Boutwell, Arthur T., 67, Shawsheen Road, Andover, Mass., U.S.A., Bleacher and Dyer.
1905. Bowen, Henry, 28, Norwood Avenue, Buffalo, N.Y., U.S.A., Secretary.
1906. Bowen, Ralph A., c/o National Aniline & Chemical Co., 36, Purchase Street, Boston, Mass., U.S.A.
1885. Bowen, S. B., 1, Wilhelm Terrace, Sketley Road, Swansea, Chemical Manufacturer.
1888. Bower, Frank, Brewery House, Spitalfields, E., Analytical Chemist.
1909. Bower, Joshua, c/o Kynoch Ltd., Arklow, Co. Wicklow, Ireland, Chemist.
1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.
1906. Bowers, H. L., Port Hope, Ontario, Canada, Chemist and Metallurgist.
1892. Bowes, Harry, Staveley, Broomfield Road, Heaton Moor, Stockport, Analytical Chemist.
1889. Bowing, Jno., Church Walk, Wandsworth, S.W., Consulting Chemist.
1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, London, S.W., Chemical Manufacturer.
1899. Bowley, J. Plunkett, 63, Beaufort Mansions, Chelsea, London, S.W., Varnish Manufacturer.
1908. Bowman, Fred. C., c/o Nichols Chemical Co., Tweed, Ont., Canada, Chemist.
1883. Bowman, Dr. F. H., 4, Albert Square, Manchester, Chemical Manufacturer.
1884. Bowman, R., c/o Bowman's Ltd., Lythgoe's Lane, Warrington, Chemical Manufacturer.
1907. Bowman, Richard S., The Cerebos Works, Greatham, *viâ* Stockton-on-Tees, Chemist.
1896. Bowman, Walker, 39, Cortlandt Street, New York City, U.S.A., Chemist.
1904. Boyce, Framroze H., 40, Chaupaty, Bombay, India, Technical Chemist.
1893. Boyce, Frank, c/o Goodall, Backhouse, and Co., White Horse Street, Leeds, Technical Chemist.
1909. Boyd, Dr. Harold de H., Dunster House, Mincing Lane, London, E.C., Phosphate Merchant.
1909. Boyd, T. D., Jr., Los Mochis, Sinaloa, Mexico, Sugar Refiner.
O.M. Boyd, W., Mine Office, Frankfort, Pilgrim's Rest, Transvaal, Technical Chemist.
1899. Boyes, Herb. J., c/o Boyes & Kirk, Fabrica de Tecidos, Belemzinho, Sao Paulo, Brazil, Chemist
1905. Brabrook, G. Hale, Box 333, Taunton, Mass., U.S.A., Manufacturer.
1906. Bracegirdle, Harold W., 13, Man Road, Withington, Manchester, Chemist.
1885. Bradburn, J. A., 311, Montgomery Street, Syracuse, N.Y., U.S.A., Manufacturing Chemist.
1902. Bradbury, S., Fernville, Milton Grove, Glebelands Road, Ashton-on-Mersey, Chemist.
1895. Bradford, Henry, Strettington, Goodwood, near Chichester, Analytical Chemist.
1896. Bragg, Everett B., 1838, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.
1891. Braithwaite, Isaac, Holly Croft, Kendal, Westmoreland, Drysalter.
1897. Braithwaite, Jno. O., Holme Lacey, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.
1903. Brame, J. S. S., 67, Coleraine Road, Blackheath, S.E., Demonstrator in Chemistry.
O.M. Bramham, W., Bank Chambers, 300, Mare Street, Hackney, N.E., Chemical Engineer.
O.M. Bramwell, G. H., Cowley Hill, St. Helens, Lancashire, Alkali Manufacturer.
1904. Brandeis, R., Oesterreichischer Verein f. Chem. und Metall. Produkte, Aussig, Austria, Chemical Manufacturer.
1902. Branegan, Jas. Aug., 408, De Kalb Street, Norristown, Pa., U.S.A., Chemical Salesman.
O.M. Branson, F. W., Wynneholme, Far Headingley, Leeds, Pharmaceutical Chemist.
1903 Brassard, Fred à, 46, Vicar Lane, Bradford, Yorks, Aniline Dyestuff Importer.
1901. Brearley, Harry, c/o The Amalgams Co., Ltd., Attercliffe Road, Sheffield, Analytical Chemist.
1906. Breckenridge, John E., American Agricultural Chemical Co., Carteret, N.J., U.S.A., Chemist.
1888. Breffit, Wm., Glasshoughton, Castleford, Yorks, Glass Manufacturer.
1908. Bregowsky, Ivan M., c/o Crane Co., 1214, South Canal Street, Chicago, Ill., U.S.A., Chemist.
1909. Brentnall, John, c/o George Clark and Sons, Waterhouse Lane, Hull, Works Chemist.
1900. Brewis, E. T., 31, Belgrave Road, Leyton, E., Chemist.
1894. Breyer, Theodor, 725, Washington Avenue, Wilmette, Ill., U.S.A., Chemist.
1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.
1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.
1909. Brigden, George, 92, Bay Street, Toronto, Canada.
1894. Briggs, J. Burnett, Vauxhall Soap Works, 6, Blackstock Street, Liverpool, Soap Manufacturer.
1910. Briggs, John C., East View, Workington, Cumberland, Gas Engineer.
1893. Briggs, J. F., Auchmuty Paper Mills, Markinch, Fife, N.B., Technical Chemist.
1885 Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.
1905. Bristol, Dr. H. Stanley, Forest Products Laboratory, Madison, Wis., U.S.A., Chemist.
1886. Bristow, G. W., c/o Walter J. Crook, 10, Eastcheap, London, E.C., Chemical Manager.
1887. Broadbent, H., c/o Goodall, Backhouse, and Co., Sovereign Street, Leeds, Chemist.
1896. Broadhurst, W. Homer, 2112, Caton Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1889. Brock, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.
O.M. Brock, J., Gwern-Tyno, Colwyn Bay, North Wales, Chairman of United Alkali Co., Ltd.
1909. Bronnert, Dr. E., Dornach, near Mülhouse, Alsace, Germany, Artificial Silk Manufacturer.
1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
1900. Brooke, Jno. R., Government Opium Factory, Singapore, S.S., Superintendent.
1884. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Chemist.

1895. Brookman, Fred. W., 6, West Street, Rochdale, Manure Works Manager.

1906. Brooks, Cecil J., c/o The Borneo Co., Ltd., Kuching, Sarawak, Metallurgist.

1909. Brooks, Theodore, Guantanamo, Cuba, Cane Sugar Manufacturer.

1907. Broome, James S., 18, Seedley Park Road, Pendleton, Manchester, Science Lecturer.

1901. Broome, Jos., 315, Chestnut Street, Roselle, N.J., U.S.A., Chemical Engineer.

1909. Brothers, Wm., 8, Mayfield Road, Kersal, Salford, Chemical Manufacturer.

O.M. Brotherton, E, A., M.P., City Chambers, Leeds, Ammonia Distiller.

1884. Brown, Prof. A. Crum. F.R.S., 8, Belgrave Crescent, Edinburgh, Professor of Chemistry.

1905. Brown, Prof. Adrian J., West Heath House, Northfield, near Birmingham, Professor of Brewing.

1902. Brown, A. H. M., 133, Kent Street, London, Ont., Canada, Metallurgist.

1891. Brown, Cæsar R., 23, Gower Road, Forest Gate, E., Works Foreman.

O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.

O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.

1890. Brown, Edw. Hilton, c/o W. Ropes and Co., St. Petersburg, Russia, Analytical Chemist.

1903. Brown, Frank C., P.O. Box 222, South Framingham, Mass., U.S.A., Foreman.

1894. Brown, Geo. E., c/o "The British Journal of Photography," 24, Wellington Street, Strand, London, W.C., Chemist.

1906. Brown, Harry F., Room 917, Du Pont Building, Wilmington, Del., U.S.A., Chemist.

O.M. Brown, Henry, Benskin's Brewery, Watford, Herts., Brewing Chemist.

1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.

O.M. Brown, Dr. Horace T., F.R.S., 52, Nevern Square, Kensington, S.W., Brewing Chemist.

1905. Brown, Hugh B., c/o Jas. Robertson & Sons, Ltd., Thrushgrove Works, Paisley, Chemist.

O.M. Brown, Dr. J. Campbell, 8, Abercromby Square, Liverpool, Professor of Chemistry.

1891. Brown, J. Henry, Minas d'Aljustrel, Alemtejo, Portugal, Technical Chemist.

1901. Brown, Jos., Ashleigh House, Saville Town, Dewsbury, Manufacturing Chemist.

1905. Brown, Nicol, 4, The Grove, Highgate, N., Mining Director.

1906. Brown, Percy S., c/o Western Electric Co., West and Bethune Streets, New York City, U.S.A., Chemist.

1892. Brown, Reginald B., c/o Badische Co., Ltd., 2, Samuel Ogden Street, Manchester, Technical Chemist.

1889. Brown, Robt., The Firs, Hartford, Northwich, Engineer.

1901. Brown, Samuel B., Ruthven, Bowden Lane, Marple, Cheshire, Calico Printer.

O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.

1900. Brown, Walter B., Victor Chemical Works, 89, Board of Trade Building, Chicago, Ill., U.S.A., Chemist and General Superintendent.

1901. Browne, Dr. Arthur L., 213, Cortland Street, Baltimore, Md., U.S.A., Analytical Chemist.

1910. Browne, Philpot F., P.O. Box 2, Mount Morgan, Queensland, Chemist.

1906. Browne-Cave, E. J. C., "Strathallan," Bootle, Liverpool, Works Chemist.

1905. Browning, Prof. K. C. Medical College, Colombo, Ceylon, Professor of Chemistry.

O.M. Browning, W., Broad Oak, Accrington, Calico Printer.

1901. Brownlie, David, 452, Cheetham Hill Road, Cheetham Hill, Manchester, Chemist.

1902. Brownrigg, Marcus P., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

1902. Brownsdon, Dr. H. W., King's Norton Metal Co., Ltd., King's Norton, Birmingham, and (Jnls.), 81, Blenheim Road, Moseley, near Birmingham, Works Chemist.

1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.

1908. Bruce, Robert, 44, High Street, Leven, Fifeshire, Works Chemist.

1900. Bruce, Wm. T., 3, Lombard Court, London, E.C., Director.

1909. Bruce-Kingsmill, Major J., 196, Deansgate, Manchester, Consulting Chemical Engineer.

1892. Bruckmann, G. T., 109, 22nd Street, West New York, N.J., U.S.A., Chemical Engineer.

1905. Bruinier, A. G., 534, Canal Street, New York City, U.S.A., Agent for Kalle und Co.

O.M. Brunner, H., Holly Mount, Tarbock Road, Huyton, near Liverpool, Chemical Manufacturer.

1894. Brunner, H. Bertram, The Hollies, Hartford, Cheshire, Chemist and Electrician.

1887. Brunner, J. F. L., M.P., c/o Brunner, Mond and Co., Ltd., 39, Victoria Street, London, S.W., Chemical Manufacturer.

O.M. Brunner, Rt. Hon. Sir J. T., Bart., Silverlands, Chertsey; and (Journals) c/o Brunner, Mond and Co., Ltd., Northwich, Cheshire, Chemical Manufacturer.

1902. Brunner, Roscoe, The Winnington Hall Club, Winnington, Northwich, Alkali Manufacturer.

1909. Brunner, Rudolph A. J., c/o John Bennet Lawes & Co., Ltd., West Ferry Road, Millwall, E., Engineer.

1894. Brunton, J. Dixon, Wire Mill, Musselburgh, N.B., Wire Manufacturer.

1904. Bryant, Arthur P., c/o Clinton Sugar Refining Co., Clinton, Iowa, U.S.A., Chemist.

1903. Bryant, V. Seymour, Trelawne, Crowthorne, Berks., Analytical Chemist.

1908. Bryce, Chas. C., 43–45, Great Tower Street, London, E.C., Merchant.

1905. Bryce, Clarence H., c/o Benj. Moore and Co., 244, Water Street, Brooklyn, N.Y., U.S.A., Factory Superintendent.

1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.

1897. Bryson, Jas., Pumpherston Oil Works, Midcalder, N.B., Oil Works Manager.

1892. Buchanan, D. G., (Subs.) 40, St. Vincent Place, Glasgow, and (Journals) c/o La Associacion Salitrera de Propaganda, Iquique, Chili, Analyst.

1908. Buchanan, Duncan G., 24, Gwynne Avenue, Parkdale, Toronto, Canada, Chemist (Rubber Works).

1904. Buchanan, E. F., Chemist.

1888. Buchanan, Jas., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.

1904. Buchanan, John L., 3, The Wiend, Lower Bebington, Cheshire, Analytical Chemist.

1904. Buchanan, Joshua D., c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Chemist.

1897. Buck, Chas. A., 521, Locust Street, South Bethlehem, Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).

1906. Buckie, Robert H., c/o West Virginia Paper and Pulp Co., Mechanicville, N.Y., U.S.A., Works Chemist.

1909. Buell, W. H., c/o Winchester Repeating Arms Co., New Haven, Conn., U.S.A., Chemist.

1909. Buggy, Thos., Butte, Montana, U.S.A., Assayer and Chemist.

1900. Bull, Dr. Benjamin S., 104, Humber Road, Blackheath, S.E., Technical Chemist.

1902. Bull, Irving C., 100, Maiden Lane, New York City, U.S.A., Chemist.

1899. Bult, Herbert J., 18, Billiter Street, London, E.C., Chemist.

O.M. Bumby, H., Coltness Ironworks, Newmains, N.B., Ironworks Manager.

O.M. Bunker, H. E., 19, Napier Street, Toronto, Ont., Canada, Technical Chemist.

1901. Bunting, Henry H., Oficina de Ensayes F. C. C. del P., Callao, Peru, Analyst.

1894. Bunting, W. Lightfoot, Netherton, Selsey, Chichester, Calico Printer.
1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.
1886. Burdekin, G., jun., 10, Clifton Terrace, St Helens, Lancashire, Chemical Works Manager.
1896. Burford, Samuel F., Beechworth, Stoneygate Road, Leicester, Analytical Chemist.
1889. Bürger, Dr. J., 1, Birch Avenue, Talbot Road, Old Trafford, Manchester, Technical Chemist.
1901. Burgess, Prof. C. F., University of Wisconsin, Madison, Wis., U.S.A., Electro-chemical Engineer.
1889. Burgess, Geo., 4, Pittville Terrace, Ditton, Widnes, Chemist.
1889. Burgess, Wm. T., 20, Priory Road, Bedford Park, London, W., Analytical Chemist.
1902. Burkard, Dr. Ernst, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1899. Burkhardt, Dr. G. A., Württembergischestrasse 32, Berlin, W. 15, Germany, Chemist.
1897. Burland, Lt.-Col. Jeffrey H., 824, Sherbrooke Street, Montreal, Canada, Paper and Card Manufacturer.
1897. Burls, Frank B., 4, Dyer's Hall Road, Leytonstone, Essex, Chemist.
1898. Burls, Herbert T., (Journals) c/o Royal Societies Club, St. James Street, S.W., and (communications) c/o Riley and Harbord, 16, Victoria Street, Westminster, S.W., Mechanical Engineer.
1901. Burnand, Sydney, Manbré Saccharine Co., Ltd., Hammersmith, W., Manager.
O.M. Burnard, R., Plymouth Chemical Works, Plymouth, Chemical Manufacturer.
1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks., Sulphuric Acid Maker.
1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, Architect.
1909. Burnett, Arthur, c/o The Premier Waterproof and Rubber Co., Ltd., Bromley Street, Dantzic Street, Manchester, Chemist.
1907. Burnham, Frank E., c/o I. Levinstein and Co., 74, India Street, Boston, Mass., U.S.A., Chemist.
1893. Burnham, J. C., Analytical Chemist.
1900. Burnside, Chas. F., Du Pont Building, Wilmington, Del., U.S.A., Chemist.
1900. Burr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.
O.M. Burrell, B. A., 8, Springfield Mount, Leeds, Analytical Chemist.
1910. Burrell, Keith, Burrell's Wharf, Millwall, London, E., Analytical Chemist.
1906. Burrough, Ernest J., Cale Distillery, Hutton Road, Lambeth, S.E., Rectifier.
1892. Burrough, Horace, jun., 509, West Lombard Street, Baltimore, Md., U.S.A., Technical Chemist.
1888. Burrows, Edw., Home Villa, Low Fell, Gateshead-on-Tyne, Alkali Works Manager.
1901. Burton, Alf., Canadian Dyers' Association, 2-16, Liberty Street, Toronto, Canada, Dyer and Finisher.
1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.
1904 Burton, T. B., c/o Scott, Greenwood and Son, 8, Broadway, Ludgate Hill, London, E.C., Technical Journalist.
1889. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.
1906. Busby, Fred. E., Arnold Print Works, North Adams, Mass., U.S.A., Chemist.
1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.
1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.
1903. Butler, Fredk., Ditchfield Road, Hough Green, near Widnes, Manager (Ditton Copper Works).
1890. Butler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.
1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.
1905. Butler, T. H., c/o Wm. Butler and Co., Ltd., Crews Hole, Bristol, Chemist (Tar and Rosin Distillery).
1886. Butler, W. W., c/o Mitchells & Butlers, Ltd., The Brewers' Library, Cape Hill, Birmingham, Brewer.
O.M. Butterfield, J. C., 79, Endlesham Road, Balham, S.W., Analytical Chemist.
1892. Butterfield, W. J. A., 66, Victoria Street, Westminster, S.W., Analytical Chemist.
1897. Butters, Charles, 54, New Broad Street, London, E.C., and (Journals) Roselawn, Berkeley, Cal., U.S.A., Metallurgist.
1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.
1902. Butterworth, F. J., 31, Hawthorne Avenue, Nutley, N.J., U.S.A., Chemist.
1892. Buttfield, Horace V., 13, Wellington Road, Bush Hill Park, Enfield, N., Chemical Demonstrator.
O.M. Byard, A. G., c/o Burt, Boulton, and Heywood, Apartado 8, Bilbao, Spain, Technical Chemist.
1905. Byrne, F. A., 2, Ludgate Hill, Birmingham, Director of Chemical Co.
1899. Byrnes, Dr. Eugene A., 918, F. Street N.W., Washington, D.C., U.S.A., Patent Lawyer.
1893. Byrom, T. H., Laboratory, Wigan Coal and Iron Co., Wigan, Analytical Chemist.
1887. Bythway, M., 44, Lloyd Street, Albert Square, Manchester, Drysalter.

C

1884. Cabot, Godfrey L., 940, Old South Building, Boston, Mass., U.S.A., Manufacturing Chemist.
1907. Cabot, Samuel, 141, Milk Street, Boston, Mass., U.S.A., Chemical Manufacturer.
1906. Caddick, Arthur, The Rookery, Pye Bridge, Alfreton, Derbyshire, Works Chemist.
1889. Cadett, Jas., Ashtead, Surrey, Chemical Engineer
1903. Calman, Hal, c/o British Cigarette Co., Ltd., Shanghai, China, Chemist.
1905. Cain, Dr. J. C., 28, Pembury Road, Lower Clapton, N.E., Colour Chemist.
1891. Caines, G. S. A., 7, Rochester Terrace, Camden Road, London, N.W., Analytical Chemist.
1897. Cairns, Wm., 5, Carlton Place, Glasgow, Plumber.
1907. Caistor, J. W. Y., Sabará, E.F.C.B., Cuiabá, Est. de Minas, Brazil, Chemist.
1891. Caldecott, W. A., Box 1167, Johannesburg, Transvaal, South Africa, Metallurgist.
1905. Calder, Prof. Edwin E., Long Meadow, R.I., U.S.A., Professor of Chemistry.
1897. Calder, W. A. S., Ormidale, Little Moor Hill, Smethwick, Birmingham, Chemical Manufacturer
1908. Caldwell, Dr. Robert J., Coventry House, Wilton Avenue, Southampton, Chemist and Works Manager
1888. Caldwell, Wm., Murray Street, Paisley, N.B., Drysalter.
1902. Calm, Dr. Chas. E., 41-43, Warren Street, New York City, U.S.A., Manufacturing Chemist.
1904. Calvert, Dr. Harry T., West Riding of Yorkshire Rivers Board, Wakefield, Chemist.
1895. Cambier, Jacob, 1401, Carteret Avenue, Pueblo, Colo., U.S.A., Chemist.
1908. Cameron, H. Lovett, c/o Vales and Cameron, 20, Castlereagh Street, Sydney, N.S.W., Assayer.
1891. Cameron, Jas., 133, Netherfield Road North, Liverpool, Manufacturing Confectioner.
1904. Cameron, Walter S., 239, West 136th Street, New York City, U.S.A., Manufacturing Perfumer.
1908. Cameron, Wm., Pladjoe, Palembang, Sumatra, Sugar Refinery Manager.
O.M. Cammack, J., 34, Wolseley Road, St. Helens, Lancashire, Technical Chemist.
1910. Campagne, Emile, c/o Gildemeister et Cie., Petit Ronchin (Nord), France, Chemical Engineer.
1886. Campbell, Andrew, c/o Burmah Oil Co., Ltd., Dunneedaw, Rangoon, Burmah, Analytical Chemist.

O.M. Campbell, Archibald, Fairview, Rugeley, Staffordshire, Technical Chemist.

1902. Campbell, Ashley, Colonial Sugar Refining Co., Ltd., Pyrmont Refinery, Sydney, N.S.W., Australia, Analytical Chemist.

1908. Campbell, Fred. A., The Working Men's College, Latrobe Street, Melbourne, Victoria, Australia, Principal.

1907. Campbell, John A., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.

1901. Campbell, Kenneth F., M.Inst.C.E., 1, Peel Street, Huddersfield, Civil Engineer.

1908. Campbell, Max E., 629, Laughlin Building, Los Angeles, Cal., U.S.A., Chemist.

1909. Campbell, Peter, The Nairn Linoleum Co., Kearney, N.J., U.S.A., Linoleum Manufacturer.

1909. Campbell, Robt., The Nairn Linoleum Co., P.O. Box 32, Newark, N.J., U.S.A., Linoleum Manufacturer.

1904. Campion, A., Technical College, Glasgow, Chemist and Metallurgist.

1909. Candee, Chas. N., 47, Yonge Street, Toronto, Canada, Rubber Manufacturer.

1897. Canfield, F. D., jun., c/o Cuban Sugar Refining Co., Cardenas, Cuba, Sugar Refiner.

1908. Canning, Ernest R., 137, Great Hampton Street, Birmingham, Manufacturer.

1909. Cannon, George O., c/o The Pacific Phosphate Co., Ltd., 465, Collins Street, Melbourne, Victoria, Analytical Chemist.

O.M. Cannon, M., 25, Stormont Road, Clapham Common S.W., Vinegar Works Manager.

1891. Canziani, Enrico, 3, Palace Green, Kensington, W., Civil Engineer.

1891. Carden, Albert J., Dunster House, 12, Mark Lane, London, E.C., Distiller.

1893. Carey, Arthur, The Groves, Grassendale Park, near Liverpool, Chemist.

O.M. Carey, Enstace, The United Alkali Co., Ltd., 30, James Street, Liverpool; and (Journals) The Groves, Grassendale Park, near Liverpool, Chemical Manufacturer.

1906. Carey, William G., c/o Clinical Research Assoc., Watergate House, Adelphi, London, W.C., Chemist.

1904. Cargill, J. T., c/o Finlay, Fleming, and Co., Rangoon, Burmah, East India Merchant.

1907. Carlitz, Joseph S., 159, North Second Street, Philadelphia, Pa., U.S.A., Chemist.

1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.

1884. Carmody, Prof. Patrick, Government Laboratory, Port of Spain, Trinidad, Analytical Chemist.

1897. Carnell, Wm. C., c/o Tacony Chemical Works, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.

O.M. Caro, Dr. H., C. 8 N. 9, Mannheim, Baden, Germany, Technical Chemist.

1906. Caro, Dr. Nikodem, Meinekestrasse 20, Berlin, Germany, Analytical Chemist.

1893. Carpenter, C. C., South Metropolitan Gas Co., 709A, Old Kent Road, London, S.E., Civil Engineer.

1908. Carpenter, Edwin P., Culvert Works, Sheepcote Lane, Battersea, S.W., Manager of Casein, Ltd.

1900. Carpenter, Frank B., 11, South 12th Street, Richmond, Va., U.S.A., Chemist.

1900. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.

O.M. Carpenter, R. Forbes, Prestwich, Greencroft Gardens, West Hampstead, N.W., Chief Inspector under the Alkali, &c., Works Acts.

1904. Carr, Francis H., Kelvin Church Avenue, Sidcup and (Journals), Burroughs, Wellcome, and Co., Ltd., Dartford, Kent, Manufacturing Chemist.

1907 Carrier, C. F., jun., Sewaren, N.J., U.S.A., Manufacturing Chemist.

1901. Carson, Geo. C., 1201, First National Bank Building, San Francisco, Cal., U.S.A., Miner.

O.M. Carteighe, M., Oriel, Goring-on-Thames, Pharmaceutical Chemist.

1904. Carter, A., Cuba Street, Petone, Wellington, New Zealand, Works Manager.

1905. Carter, Robert A., c/o Roessler and Hasslacher Chemical Co., Box 68, South Amboy, N.J., U.S.A., Chemist.

1895. Carter, Stewart F., 315, Olney Street, Providence, R.I., U.S.A., Technical Chemist.

1903. Carter, Thomas, West End View, Ravensthorpe, Dewsbury, Yorks, Works Chemist.

1886. Carter, W. Chas., c/o Dominion Iron and Steel Co., Sydney, C.B., Canada, Analytical Chemist.

1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.

1906. Carveth, Dr. H. R., Niagara Electrochemical Co., Niagara Falls, N.Y., U.S.A., Works Manager.

1903. Caspari, Dr. W. A., Usines de Persan, Persan-Beaumont, France, Chemist and Physicist.

1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).

1909. Caulkin, Howard A., 26, Dairy House Road, Derby Analyst.

1896. Caven, Robt. M., University College, Nottingham, Lecturer in Chemistry.

O.M. Cawley, G., 25, Victoria Street, Westminster, S.W., Chemical Engineer.

O.M. Cawley, J., 278, Passaic Street, Newark, N.J., U.S.A., Analytical Chemist.

1897. Cawley, Thos. A., British Gelatin Works, New Bedford Road, Luton, Gelatin Manufacturer.

1902. Cerasoli, Alburto, Via Cavour 310, Rome, Italy, Engineer.

1891. Chadwick, Walter M., Thorneycroft, Westoe, South Shields, Chemical Works Manager.

1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.

1901. Chamberlain, G. E., 103, Waiola Avenue, La Grange, Ill., U.S.A., Chemist.

1910. Chambliss, Prof. Hardee, Dept. of Chemistry, Oklahoma A. and M. College, Stillwater, Oklahoma, U.S.A., Professor of Chemistry.

1902. Champion, Edmund C., 510, South Washington Avenue, Iola, Kansas, U.S.A., Chemist.

O.M. Chance, A. M., Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.

1909. Chance, Edwin M., 313, South 2nd Street, Pottsville, Pa., U.S.A., Chemist.

O.M. Chandler, Dr. C. F., Columbia University, West 116th Street, New York City, U.S.A., Professor of Chemistry.

1907. Chaney, Walter, The Gas Works, Nechells, Birmingham, Gas Engineer.

1893. Chaplin, Dr. Edw. M., Public Analyst's Laboratory, Wakefield, Yorks, Analytical Chemist.

1906. Chaplin, Wm. H., 13, Penywern Road, Earl's Court, London, S.W., Wine Merchant.

1890. Chapman, Alf. Chaston, 8, Duke Street, Aldgate, E.C., Analytical Chemist.

1906. Chapman, Arthur J., Baronsmere, Stanhope Avenue, Church End, Finchley, N., Analytical Chemist.

1906. Chapman, E. A., c/o Robert Heath and Sons, Ltd., Norton Works, Stoke-on-Trent, Works Chemist.

1903. Chapman, Geo. W., P.O. Box 21, R.F.D. No. 4, Atlanta, Ga., U.S.A., Superintendent.

O.M. Chapman, Spencer, 36, Mark Lane, E.C., Chemical Manufacturer.

1894. Charlier, A. C. J., 6, Talbot Road, South Tottenham, N., Consulting Chemist.

1902. Charlton, Thos., 252, Irvington Place, Denver, Colo., U.S.A., Manufacturing Chemist.

1900. Chase, March F., c/o Mineral Point Zinc Co., Depue, Ill., U.S.A., Chemist.

1889. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Manager.

1898. Chattock, Herbert E., 23, Apsley Road, Clifton Bristol, Oilcake Manufacturer.

1905. Cheesman, Frank P., 100, William Street, New York City, U.S.A., Paint Manufacturer.

1901. Cheetham, Howard, 18, St. Ann Street, Manchester Chartered Patent Agent.

1910. Cheke, Thomas W., Sawbridgeworth, Herts., Analytical Chemist.
1905. Chick, Oliver, 52, High Street, Hornsey, N., Analytical Chemist.
1890. Chorley, Jno. C., Bewsey, Oxford Road, Birkdale, Lancs., Analytical Chemist.
O.M. Christie, J., Leventfield, Alexandria, N.B., Dyer and Printer.
1903 Christie, John, c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Analytical Chemist.
1908. Christie, Malcolm, Ardenlea, Portland Park, Hamilton, N.B., Analytical Chemist.
1898. Christison, Geo., 13, Cambridge Drive, Glasgow, Engineer.
1907. Christopher, George, Walkden Works, Verney Road, South Bermondsey, S.E., Consulting Chemist.
1907. Christopher, J. E., Solvay Coke Works, Kirkless, Wigan, Assistant in Charge.
O.M. Chrystal, W. J., 7, West George Street, Glasgow, Chemical Manufacturer.
1908. Chrystall, E. R., c/o Curtis's & Harvey, Ltd., Cliffe at Hoo, Kent, Research Chemist.
1904. Chubb, H. M., Kirkgate House, Tadcaster, Yorks, Brewery Chemist.
O.M. Church, Sir Arthur, K.C.V.O., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.
1890. Church, Elihu D., jun., 63, Wall Street, New York City, U.S.A., Soda Manufacturer.
1906. Church, Sumner R., c/o Barrett Manufacturing Co., 17, Battery Place, New York City, U.S.A., Chemical Engineer.
1907. Churchill, Wm., Corning Glass Works, Corning, N.Y., U.S.A., Chemist.
1896 Claflin, Alan A., (Communications) 88, Broad Street, Boston: and (Journals) Littleton, Mass., U.S.A., Manufacturing Chemist.
1909. Claflin, Albert W., 190, Waterman Street, Providence, R.I., U.S.A., Manufacturing Druggist.
1900. Clamer, Guilliam H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.
1901. Clapham, Henry E., 15, St. Julian's Road, Kilburn, N.W., Technical Chemist.
1905. Clapp, Geo. A., 503, Walnut Street, Newtonville, Mass., U.S.A., Chemist.
1891. Clapp, Ralph R., c/o Standard Ammonia Co., Ltd., Sussex Wharf, East Greenwich, S.E., Manager.
1889. Clapperton, J., jun., Analytical Chemist.
1903. Clare, Henry, 23, Greenbank Road, Birkenhead, Schoolmaster.
1905. Clark, Alfred N., Box 696, Berlin, Ont., Canada, Technical Chemist and Engineer.
1906. Clark, Allan J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgist.
1904. Clark, Arthur W., c/o Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemist and Bacteriologist.
1908. Clark, Chas. T., 1303, Sixth Street, Bay City, Mich., U.S.A., Manufacturing Chemist.
1904. Clark, Prof. Friend E., Central University of Kentucky, Danville, Ky., U.S.A., Professor of Chemistry.
1909. Clark, Hubert A., 83, Amherst Street, Montreal, Canada, Canner.
1900. Clark, Jno., Broadway Works, Millwall Dock, London, E., Manufacturing Chemist.
1906. Clark, M. H., c/o Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1902. Clark, Robt. M., 138, Bath Street, Glasgow, Chemist.
1906. Clark, Wm. B., 42, Robertson Street, Greenock, Chemist.
1907. Clark, Wm. H., 78, Warrington Road, Elswick Road, Newcastle-on-Tyne, Analytical Chemist.
1903. Clark, Dr. W. Inglis, 104, South Canongate, Edinburgh, Manufacturing Chemist.
1904. Clarke, Alfred R., 613–617, Eastern Avenue Toronto, Canada, Leather Manufacturer.
1908. Clarke, Arthur F., 2, Ford Terrace, Beddington, Surrey, Analytical Chemist.
1908. Clarke, Dr. Latham, Boylston Hall, Harvard University, Cambridge, Mass., U.S.A., Instructor in Chemistry.
1903. Clarke, Robt. W., Avon House, Princes Road, Buckhurst Hill, Essex, Analyst.
1897. Clarke, Wm. B., c/o Edison-Swan U. E.L. Co., Ltd., Ponders End, N., Electro Chemist.
1908. Clarke, Wm. H. J., 16, Harley Street, North Perth, West Australia, Asst. Analyst (Govt. Laby.).
O.M. Claudet, A. C., 6 & 7, Coleman Street, London, E.C., Metallurgist.
1889. Claus, Wm. H., c/o Claus and Co., Ltd., Clayton, Manchester, Manufacturing Chemist.
O.M. Clayton, E. G., Chemical Laboratory, 23, Holborn Viaduct, London, E.C., Consulting Chemist.
1909. Clayton, Ellis, Hazeldene, Deerpark Road, Belfast, Ireland, Lecturer on Bleaching, Dyeing, and Printing.
1895. Clayton, Dr. G. C., Croughton, Upton, near Chester.
1909. Clayton, H., 15, North Cray Road, Bexley, Kent, Technical Chemist.
1894. Clayton, Robt. H., Woodleigh, Blackfield Lane, Kersal, Manchester, Chemist.
1905. Clayton, W. E., Royal Victoria Yard, Deptford, S.E., Superintendent.
1907. Clement, Leonard, Beamsley, Fairhaven, near Lytham, Lancs., Chemist.
1893. Clemes, J. H., Cheriton, Newquay, Cornwall.
1884. Clerk, Dugald, F.R.S., 18, Southampton Buildings, Chancery Lane, W.C., Engineer.
1905. Clexton, Thos. J., 285, Congress Street, Boston, Mass., U.S.A., Manager (A. Klipstein & Co.).
1906. Clifford, Jos., Survey Dept. Laboratory, Cairo, Egypt, Chemist.
1900. Clifford, Wm., Sewage Outfall Works, Wolverhampton, Sewage Works Manager.
O.M. Cloud, T. C., 4, Lloyd's Avenue, Fenchurch Street, London, E.C., Metallurgist.
O.M. Clowes, Dr. F., 40, Craven Street, Charing Cross, W.C.; and the Grange, College Road, Dulwich, S.E., Chief Chemist (L.C.C.).
1891. Clutton, J. H., Poste Restante, Lastours (Aude), France, Assayer.
1899. Coates, Chas. E., jun., Louisiana State University, Baton Rouge, La., U.S.A., Professor of Chemistry.
1888. Coats, Jno. T., 105, Broughton Street, Edinburgh, Manufacturing Chemist.
1893. Cobb, Jno. W., Farnley Ironworks, near Leeds, Technical Assistant to Managing Director.
1904. Coblentz, Lambert, 1849, Lyon Street, San Francisco, Cal., U.S.A., Chemist.
1894. Coblentz, Dr. Virgil, College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Professor of Chemistry.
1899. Cochran, Alfred, 559, Madison Street, Brooklyn, N.Y., U.S.A., Chemist.
1901. Cockburn, John A., 1, Wester Coates Terrace, Edinburgh, Analytical Chemist.
1902. Cocking, Allan T., Carhampton House, Four Oaks, Sutton Coldfield, Ammunition Manufacturer.
1905. Coes, Chas. S., 119, East River Street Hyde Park, Mass., U.S.A., Oil Chemist.
1909. Coffey, Æneas H., 21, Cardigan Road, Richmond, Surrey, Distiller.
1903. Cofman-Nicoresti, J., 24, St. Gabriel's Road, Cricklewood, N.W., Chemist.
1903. Coggeshall, Dr. G. W., Chestnut Street, Dedham, Mass., U.S.A., Chemical Manufacturer.
1887. Coghill, P. de G., Borax Works, Old Swan, Liverpool, Technical Chemist.
1884. Cogswell, W. B., Syracuse, N.Y., U.S.A., Chemical Engineer.
O.M. Cohen, Dr. J., 13, Cardigan Road, Leeds, Analytical Chemist.
1897. Cohn, Alfred J., 122, East 74th Street, New York City, U.S.A., Chemist.
1901. Cohn, Sigmund, 13, Dutch Street, New York City, U.S.A., Metallurgical Chemist.
1904. Cohoe, Prof. W. P., 148, Van Horne Street, Toronto, Canada, Professor of Chemistry.

1903. Colbert, W., British S.A. Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.

1891. Colby, Albert L., 447, Lehigh Street, South Bethlehem, Pa., U.S.A., Metallurgical Engineer.

1899. Colby, E. A., Baker Platinum Works, Newark, N.J., U.S.A., Metallurgical Chemist.

O.M. Colby, W. H., Carreg-wen, Aberystwith, Wales.

1893. Coleman, W. H., 18, Egerton Road, Fallowfield, Manchester, Tar Works Chemist.

O.M. Collens, E., Vinegar Works, Stourport, Worcestershire, Manager.

1905. Collett, John H., Summercroft, Tuffley, and (Jnls.) The Librarian, Free Library, Gloucester, Chemical Manufacturer.

1887. Collett, J. M., Hillfield, Gloucester, Chemical Manufacturer.

1901. Colley, Bernard T., c/o American S.S. Co., Asarco, Durango, Mexico, Superintendent.

1908. Collier, F. C., 437, Lansdowne Avenue, Westmount, Montreal, Canada, Analytical Chemist.

1902. Collier, Pierre, Companhia Industrial Pernambucana, Pernambuco, Brazil, Civil Engineer.

1893. Collin, Dr. C. A., Ferguslie Threadworks, Paisley, N.B., Textile Chemist.

1898. Collingridge, Frank, 73, Fountain Road, Edgbaston, Birmingham, Chemist.

1899. Collins, S. Hoare, Armstrong College, Newcastle-on-Tyne, Agricultural Chemist.

1888. Collins, W. Hepworth, Junior Constitutional Club, Piccadilly, London, W., Civil Engineer.

1899. Collis, Walter T., 89, Greenfield Road, Harborne, Birmingham, Chemist.

1910. Collitt, Bernard, 377, Metcalfe Avenue, Westmount, Montreal, Canada, Chemist.

1891. Colman, Dr. H. G., Elmside, Worcester Park, Surrey, Analytical Chemist.

1892. Colquhoun, Ludovic, Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.

1894. Colquhoun, W., Tapton Close, Tapton House Road, Sheffield, Engineer.

1901. Colwell, J. Kear, Finsbury Town Hall, Rosebery Avenue, E.C., Analytical and Consulting Chemist.

1906. Comber, A. W., Dinwaed, Victoria Avenue, Southend-on-Sea, Manager (Magnesite Works).

1900. Comey, Dr. Arthur M., 424, East 13th Street, Chester, Pa., U.S.A., Technical Chemist.

1906. Compton, Miss N. J., Library, University of Nebraska, Lincoln, Neb., U.S.A., Librarian.

1901. Connah, Jas., Laboratory, Custom House, London, E.C., Government Analyst.

1905. Conner, Arthur B., 217, West Boulevard, Detroit, Mich., U.S.A., Chief Chemist (Detroit Chemical Works).

1883. Connor, C. C., 10, College Gardens, Belfast, Ireland, Chemist.

1891. Conradson, Pontus H., Galena Oil Works, Franklin, Pa., U.S.A., Analytical Chemist.

1906. Conrau, Oliver, Dansk Svofvelsyre och Superfosfatfabrik, Mandelstrup, Denmark, Administrator.

1889. Conroy, Dr. Jas. T., 9, The Serpentine, Grassendale, Liverpool, Chemist.

1887. Constable, W. H., Australian Alum Works, Runcorn, Analytical Chemist.

1908. Conyngham, Wm. Boulton, 78, Hudson Street, New York City, U.S.A., Pharmaceutical Chemist.

1909. Cook, E. Bernard, 23, Cross Street, Finsbury, London, E.C., Manufacturing Chemist.

O.M. Cook, H. J., The Firs, Woodford Green, Essex, Soap Manufacturer.

1903. Cook, Jas. W., London and Provincial Dye Works, Hackney Wick, N.E., Dyer.

1899. Cook, Robt. A., Bleecker Place, New Brunswick, N.J., U.S.A., Chemist.

1898. Cook, Thos. Alex., East London Soap Works, Bow, E., Soapmaker.

1899. Cook, Walter G., 9, Hendon Lane, Finchley, N., Analytical Chemist.

1891. Cooke, Arthur W., c/o Brotherton and Co., Ltd., Holmes Street, Dewsbury Road, Leeds, Analytical Chemist.

1907. Cooke, J. J. Verdin, 9, James Street, Liverpool, Salt Manufacturer.

1904. Cooke, W. Ternent, The University, Adelaide, South Australia, Lecturer in Chemistry.

1910. Cooper, Leonard H., Fern Lea, Trafalgar Drive, Lower Bebington, Cheshire, Assistant Chemist (Lever Bros.).

1901. Cooper, T. S., 276, Dickenson Road, Rusholme, Manchester, Calico Printing Chemist.

1891. Cooper, Walter J., The Elms, Lavernock, South Wales, Cement Works Manager.

1907. Cooper, W. F., Research Laboratory, Water Lane, Watford, Synthetic Chemist.

1890. Corcoran, Bryan, 31, Mark Lane, London, E.C., Chemical Engineer.

1905. Cormack, Wm., c/o G. Nelson, Dale and Co., Ltd., Emscote Mills, Warwick, Chemist.

1899. Cornelison, Dr. Robt. W., P.O. Box 256, New Haven, Conn., U.S.A., Consulting Chemist.

1909. Cornell, Fred, 61, St. Sulpice Street, Montreal, Canada, Chemical Merchant.

1906. Cornwell, R. de Vere, Salisbury, Rhodesia, Chemist.

1889. Corrie, David, c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Technical Chemist.

1903. Cortright, R. M., Alsen's American Portland Cement Works, Alsen, N.Y., U.S.A., Chemist.

1894. Coste, J. H., 40, Craven Street, W.C., and (Journals) Utopia, Gloucester Road, Teddington, Analytical Chemist.

1891. Cotton, W. F., Hollywood, Dundrum, Co. Dublin, Gas Works Manager.

1906. Coupe, Miles, Rosebank, Thornfield Road, Waterfoot, near Manchester, Chemist.

1894. Court, Heywood, Staveley, Chesterfield, Analytical Chemist.

1898. Courtney, Samuel, Bizerta, Knockdene Park, Belfast, Ireland, Manager.

1894. Cousins, W. J., 17, Temple Chambers, Temple Avenue, E.C., Consulting Chemist and Director.

1909. Coventry, Bernard O., Dehra Dun, United Provinces, India, Forest Dept., India.

1903. Cowan, A. Wallace, c/o Redpath, Brown, & Co., Ltd., Riverside Works, East Greenwich, S.E., Analytical Chemist.

1906. Cowan, George D., Bridge House, Bridge Road, Millwall, E., Manager, Desilverising Works.

1893. Cowan, W. J., 12, Park Avenue, Wood Green, N., Fine Colour Manufacturer.

1910. Coward, Hubert F., Municipal School of Technology, Manchester, Lecturer in Chemistry.

1897. Cowburn, Arthur W., 29, Princess Street, Manchester, Chemical Merchant and Analytical Chemist.

1907. Cowburn, J. Robert, 10, Eastwood Road, South Woodford, Essex, Technical Chemist.

1904. Cowee, Harvey D., 161, River Street, Troy, N.Y., U.S.A., Chemist.

1891. Cowper-Coles, Sherard Osborn, Grosvenor Mansions, Victoria Street, Westminster, S.W., Metallurgical Engineer.

1905. Cox, Harold N., c/o Lalance & Grosjean Mfg. Co., Woodhaven, N.Y., U.S.A., Chemist.

1884. Craig, Geo., Chemical Laboratory, 95, Bath Street, Glasgow, Technical Chemist.

1895. Craig, Thos. J. I., c/o Peter Spence & Sons, Ltd., Alum Works, Manchester, Chemist.

1908. Craig, Wm. J., c/o Annable and Young, 114–116, Victoria Street, London, S.W., Analytical Chemist.

1901. Crane, Fred. D., 28, Hillside Avenue, Montclair, N.J., U.S.A., Consulting Chemist.

1902. Crane, Jasper E., c/o The Arlington Co., Arlington, N.J., U.S.A., Chemist.

1898. Cranfield, Wm., 11, Avondale Place, Halifax, Yorks, Teacher of Chemistry.

1903. Cranmer, Ridgeway, 170, 88th Street, Bay Ridge, Brooklyn, N.Y., U.S.A., Chemist.

1902. Craven, Alfd. B., 20, Edinborough Road, Upper Armley, Leeds, Analytical Chemist.

1906. Craven, J. A., 119, Town Street, Armley, Leeds, Chemist.

1891. Craven, Jno., jun., Netherlands Broughton Park, Manchester, Chemist.

1906. Craven, John L., 141, Wilmer Road, Heaton Bradford, Chemist and Salesman.

1885. Craw, John, 15, Cadogan Street, Glasgow, Drysalter.

O.M. Crawford, D., Langdale's Chemical Manure Co., Ltd., St. Lawrence, Newcastle-on-Tyne, Manager.

1908. Crawford, Lawrence, Lugar Iron Works, Old Cumnock, Ayrshire, N.B., Analytical Chemist.

1890. Crawshaw, E., 25, Tollington Park, London, N., Dye Merchant.

O.M. Cresswell, C. G., Ermyngarth, Ashtead, Surrey; and 9, Bridge Street, Westminster, S.W., Chemist.

1901. Cribb, Cecil H., 136, Shaftesbury Avenue, London, W., Analytical and Consulting Chemist.

1909. Crichton, Charles, c/o Afrikander Mine, Klerksdorp, Transvaal, Assayer.

1908. Crighton, Adam M., Wood Cottage, Middleton, Manchester, Calico Printer's Chemist.

1905. Crighton, W. H., c/o Ore Concentration Co., Ltd., Glebe Road, Kingsland Road, London, N.E., Chemist.

1890. Criper, Wm. R., c/o Messrs. D. Waldie and Co., Konnagar, near Calcutta, India, Manufacturing Chemist.

1908. Crites, Bert O., 1341, East 89th St. N.E., Cleveland, Ohio, U.S.A., Chemist.

1902. Croasdale, Dr. Stuart, 1574, York Street, Denver, Colo., U.S.A., Mining Engineer and Metallurgist.

1908. Crombie, W. A. E., 1, Westwood Park, Forest Hill, S.E., Consulting Engineer.

1889. Cronquist, Prof. A. Werner, Stocksund, Stockholm, Sweden, Inspector-General of Explosives.

1901. Cronquist, G. W., Hyllinge Grufva, Sweden, Fire Brick Works Manager.

O.M. Crookes, Sir Wm., F.R.S., 7, Kensington Park Gardens, Notting Hill, W., Analytical Chemist.

1896. Crosby, Thos., Llanelly Steelworks, Llanelly, South Wales, Metallurgist.

O.M. Crosfield, A. L., 46, Bidston Road, Oxton, Birkenhead, (Journals) c/o Prof. B. Moore, Biochemical Dept., The University, Liverpool, Analytical Chemist and Assayer.

1896. Crosfield, Capt. G. R., Volunteer Quarters, Sankey Street, Warrington, Soap Manufacturer.

1908. Crosland, Percy F., Dyeing Department, The University, Leeds, Technical Chemist.

1884. Cross, C. F., 4, New Court, Lincoln's Inn, London, W.C., Analytical Chemist.

1894. Crossley, Prof. Arthur W., Pharmaceutical Society, 17, Bloomsbury Square, London, W.C., Professor of Chemistry.

1904. Crossley, T. Linsey, 112, St. François-Xavier Street, Montreal, Canada, Technical Chemist.

1908. Crossley, Watson, c/o Newlands Bros., 2, St. Dunstan's Hill, London, E.C., Works Chemist.

1908. Croston, Henry, 178, Eckford Street, Greenpoint, Brooklyn, N.Y., U.S.A., Foreman.

1894. Crow, Henry W., 18, Northumberland Avenue, South Wanstead, Manor Park, Essex, Tar Distiller.

1884. Crow, Dr. J. K., Ivydene, Westcombe Park Road, Blackheath, S.E., Technical Chemist.

1893. Crowther, Edw., 20, Brookfield Place, Headingley, Leeds, Dyer.

1883. Crowther, Horace W., The Beeches, West Bromwich, Technical Chemist.

1906. Crowther, R. E., c/o Mark Fletcher and Sons, Ltd., Moss Lane, Whitefield, Manchester, Chemist.

1884. Crowther, Walter M., Chemical Works, Gomersal, near Leeds, Manufacturing Chemist.

1884. Crumbie, W. D., 146, Washington Street, East Orange, N.J., U.S.A., Analytical Chemist.

1906. Cruser, Dr. Fred. Van D., c/o Union Metallic Cartridge Co., Bridgeport, Conn., U.S.A., Chemical Engineer.

1902. Crush, E. H., Westcombe, Jordanhill, N.B., Technical Chemist.

1892. Cullen, Wm., Dynamite Factory, Modderfontein, Transvaal, Chemist.

1903. Cullen, W. H., The Castner-Kellner Alkali Co., Ltd., Wallsend-on-Tyne, Engineer.

1897. Culmann, D. J., 116, Vanderbilt Avenue, Stapleton, Staten Is., R.B., U.S.A., Chemist and Colourist.

1905. Culver, Ralph F., Box 162, Norwood, Mass., U.S.A., Chemist.

1883. Cuming, James, jun., Chemical Works, Yarraville, Melbourne, Australia, Chemical and Fertiliser Manufacturer.

1905. Cuming, R. Burns, Adelaide Chemical and Fertiliser Co., Ltd., Currie Street, Adelaide, South Australia, Manufacturing Chemist.

1897. Cunliffe, Albert J., Claytonfield, Clayton-le-Woods, Chorley, Lancashire, Calico Printer.

1907. Cunningham, James E., Minas Pena del Hierro, Provincia de Huelva, Spain, Analytical Chemist.

O.M. Curphey, W. S., 7, Derby Crescent, Kelvinside, Glasgow, Alkali Works Inspector.

1898. Curtis, Marvin, 108, Front Street, San Francisco, Cal., U.S.A., Wine Chemist.

1903. Cushing, Robt. P., "Rocky Nook," Hingham, Mass., U.S.A., Chemist.

1902. Cutbush, Chas. G., 73, Elliscombe Road, Charlton, S.E., Electrical Engineer.

1899. Cutler, Fred. F., 183, Essex Street, Boston, Mass., U.S.A., Publisher.

1901. Cutts, Henry E., c/o Stillwell and Gladding, 181, Front Street, New York City, U.S.A., Technical Chemist.

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O.M. Dacie, J. C., Soap Works, Putney, S.W., Soap Manufacturer.

1907. Daggett, W. W., c/o New Jersey Zinc Co., 71, Broadway, New York City, U.S.A., Chemical Engineer.

1906. Dains, Prof. F. B., Washburn College, Topeka, Kas., U.S.A., Professor of Chemistry.

1897. Dains, Herbert H., c/o J. E. Ferguson, 2, Union Court, London, E.C., Analytical Chemist.

1905. Dale, H. Gordon, Belmore, New Barnet, Herts., Analytical Chemist.

1907. Dalley, Henry, 9, East 69th Street, New York City, U.S.A., President.

1908. Dalton, Leonard V., 10, Dewhurst Road, West Kensington, W., Geologist (Petroleum).

1908. Dance, Edward L., 51, Hotspur Street, Tynemouth, Northumberland, Chemist.

1884. Daniell, Louis C., (Journals) Royal Standard Brewery, Tamworth, New South Wales; and (subs.) c/o W. T. Allen and Co., 132, Queen Victoria Street, London, E.C., Brewer.

1904. Danker, Dan. J., 247, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.

1903. Dannenbaum, Dr. H., c/o National Ammonia Co., Frankford, Philadelphia, Pa., U.S.A., Secretary and Treasurer.

1885. Darby, Jno. H., Manor House, Brigg, Lincolnshire, Ironmaster.

O.M. Darling, W. H., 26, Dover Street, Manchester, Analytical Chemist.

1910. Datt, John D., Foreign Y.M.C.A., 21, Kiukiang Road, Shanghai, China, Superintendent.

1887. Davenport, Dr. B. F., 161, Tremont Street, Boston, Mass., U.S.A., Consulting Chemist.

1900. Davidson, Alex., jun., 173, Colinton Road, Edinburgh, Analytical Chemist.

1899. Davidson, Charles, 65, Calder Street, Pollokshields, Glasgow, Analytical Chemist.

1901. Davidson, G. M., Chicago and N.W. Railroad Shops, P.O. Station E., Chicago, Ill., U.S.A., Chemist.

1883. Davidson, J. E., 10, Percy Gardens, Tynemouth, Chemical Manufacturer.

1891. Davidson, Richard, 133, Victoria Road, Dundee, Oil Merchant's Clerk.

O.M. Davidson, R. Holden, c/o United Alkali Co., Ltd., Ammonia Soda Works, Fleetwood, Manager.

1904. Davidson, Robert, c/o Dalgety and Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia.
1905. Davidson, Dr. Wm. B., City Gas Works, Saltley, Birmingham, Chemist.
1889. Davies, G. W., 8, Spring Hill, Stockport, Chemical Lecturer.
1906. Davies, Harry R., 58, Hamilton Street, Readville, Mass., U.S.A., Chemist.
1898. Davies, Herbert E., The Laboratory, 28, Chapel Street, Liverpool, Analytical Chemist.
1907. Davies, James, 221, Malpas Road, Brockley, London, S.E., Scientific Apparatus Maker.
1896. Davies, Llewellyn J., 103, Bute Road, Cardiff, Analytical and Consulting Chemist.
1886. Davies, M. Lloyd, North American Chemical Co., Bay City, Mich., U.S.A., Alkali Works Manager.
1897. Davies, Saml. H., c/o Rowntree and Co., Ltd., Cocoa Works, York, Research Chemist.
1903. Davies, Thomas, 56, Wellesley Street, Toronto, Ont., Canada, Manufacturer.
1908. Davies, T. H., c/o John Cox and Co.'s Successors, Stillhouse Lane, Bedminster, Bristol, Tanner.
O.M. Davis, A. R., 192 Wellington Road North, Stockport, Analytical Chemist.
1901. Davis, Bernard F., c/o H. F. Collins, Cerro Muriano, Cordoba, Spain, Metallurgical Engineer.
1902. Davis, Charles B., c/o National Brewers' Academy, 402, West 23rd Street, New York City, U.S.A., Technical Chemist.
1902. Davis, Emerson, 203, Clairmont Avenue, Detroit, Mich., U.S.A., Chemist.
1893. Davis, Fred., 51, Imperial Buildings, Ludgate Circus, London, E.C., Consulting Chemist.
1908. Davis, G. Keville, 265, Strand, London, W.C., Chemical Engineer.
O.M. Davis, H. W., Government Laboratory, Clement's Inn Passage, Strand, W.C., Analytical Chemist.
1907. Davis, Robt. W., jun., Indian Head, Md., U.S.A., Chemist.
1906. Davis, V. P., 221, West Exchange Street, Providence, R.I., U.S.A., Chemist.
1897. Davis, Wm. A., 2, Ashgrove Road, Bromley, Kent, Chemist.
1900. Daw, Fred W., Duffryn House, Ebbw Vale, Mon., Metallurgical Chemist.
1908. Daw, Hilder, 790, City Hall Avenue, Montreal, P.Q., Canada, Civil Engineer.
1903. Dawes, Arthur W., 3, Madison Place, Albany, N.Y., U.S.A., Chemist.
O.M. Dawson, C. A., 32, Elm Hall Drive, Mossley Hill, Liverpool, Technical Chemist.
1886. Dawson, W. Haywood, British Alizarin Co., Ltd., Silvertown, E., and (Journals), 15, Wrottesley Road, Woolwich, S.E., Technical Chemist.
1901. Day, Dr. David T., U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.
O.M. Deacon, H. Wade, 8, Ullet Road, Liverpool; and (Journals) c/o F. W. Wright, 22, Peel House Lane, Widnes, Alkali Manufacturer.
O.M. Deakin, H. T., Dewhurst, Egerton, near Bolton, Dyer.
1903. Dean, Harry, 23, Spinkfield Road, Birkby, Huddersfield, Chemist.
1906. Dean, Harry, Armstrong College, Newcastle-on-Tyne, Demonstrator.
1899. Deane, Leopold M., 21, Station Terrace, Abbey Village, Withnell, near Chorley, Lancs., Analytical and Consulting Chemist.
1905. Dearman, E., c/o The Lavers Manufacturing Co., Ltd., Woolwich, N.S.W., Australia, Tar Distiller.
1892. Deaville, B., Beech Avenue, Nottingham, Manufacturing Chemist.
1899. De Castro, J. Paul, 1, Essex Court, Temple, London, E.C., Consulting Chemist and Assayer.
1902. De Cew, J. A., Canadian Express Building, Montreal, Canada, Chemical Engineer.
1893. De Clerck, Maurice, Heule-lez-Courtrai, Belgium.
1884. Deering, W. H., 3, Broad Park Avenue, Ilfracombe, N. Devon, Analytical Chemist.
1900. Deerr, Noel F., Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, H.I., U.S.A., Analytical Chemist.
1902. Deghuée, Dr. Jos. A., 247, Harrison Street, Brooklyn, N.Y., U.S.A., Chemist.
1901. De Jonge, Cornelius, 36, Doughty Street, Brooklyn, N.Y., U.S.A., Pharmaceutical Chemist.
1893. Delahaye, Philibert, 94, Rue St. Lazare, Paris (IX.), Gas Engineer.
1909. De Laire, Edgar, 47, Quai de Moulineaux, Issy, Seine, France, Industriel.
1908. Delaney, Chas. R., c/o J. S. Young and Co., Ltd., Hanover, Pa., U.S.A., Chemical Engineer.
1901. Delany, Chas., c/o Elliott Bros., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Chemist.
1908. Dellschaft, Dr. F. H., Winnington, Northwich, Cheshire, Manufacturing Chemist.
1910. De Meeûs, Etienne, c/o Michelin Tire Co., Milltown, N.J., U.S.A., Chemist.
1888. Dempsey, Geo. C., 165, Market Street, Lowell, Mass., U.S.A., Chemist.
1904. Dempwolf, Chas., jun., 713, South George Street, York, Pa., U.S.A., Chemical Manufacturer.
1907. Demuth, Rudolf, c/o Guantanamo Sugar Co., Los Canos, Guantanamo, Cuba, Chemist.
1909. Demuth, Rudolph, 31–32, Budge Row, Cannon Street, London, E.C., Manufacturer.
1890. Denham, Wm. S., The United College, St. Andrews, N.B.
1891. Denison, Joseph R., c/o Denison, Preussner and Co., Valley Dyeworks, Bradford, Yorks., Analytical Chemist.
1908. Dennis, Martin, 859, Summer Avenue, Newark, N.J., U.S.A., Manufacturing Chemist.
1907. Dennison, Henry S., South Framingham, Mass., U.S.A., Manufacturer.
1898. Dent, Dr. Frankland, Government Analyst's Dept., Singapore, S.S., Government Analyst.
1905. Derby, Wallace G., c/o Nichols Copper Co., Laurel Hill, New York City, U.S.A., Assayer.
1901. Devas, Dr. Ernest W., Fairview, Hale Grove, Edgware, N.W., Technical Chemist.
1906. Deverell, Louis C., Brantwood, Shortlands Grove, Shortlands, Kent, Chief Chemist.
1908. Dew, Joseph A., Woodside, Windsor Road, Wanstead, Essex, Varnish Manufacturer.
1898. Dewar, Alex. H., c/o The Linoleum Manufacturing Co., Staines, Middlesex, Chemist.
O.M. Dewar, Sir J., F.R.S., Royal Institution, Albemarle Street, W. (Journals); and 1, Scroope Terrace, Cambridge, Professor of Chemistry and Physics.
1889. Dewey, Fred. P., Lanier Heights, Washington, D.C., U.S.A., Metallurgist.
1904. Dewhirst, J. A., Borough Laboratory, Halifax, Yorks., Analyst.
1909. Dewhirst, Wm. B., Avenue House, William Street, West End, Paisley, N.B., Analytical Chemist.
1891. De Wilde, Prof. P., 1, Quai du Léman, Geneva, Switzerland, Professor of Chemistry.
1903. Diamond, Wm., c/o John Bowes and Partners, Ltd., Marley Hill Colliery, Swalwell, R.S.O., Durham, Works Manager.
O.M. Dibdin, W. J., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.
1897. Dick, Jno., c/o Jno. Dick, Ltd., 77, York Street, Toronto, Ont., Canada, Manufacturer.
1902. Dick, Jno., Wharf Road, Cubitt Town, London, E., Manager and Chemist.
1904. Dick, W. D., c/o Hugh Baird and Sons, 29, St. Vincent Place, Glasgow, Analytical Chemist.
1898. Dickenson, F. M., c/o Broken Hill Proprietary Co., 3, Great Winchester Street, London, E.C., Secretary.
1904. Dickenson-Gair, C. J. *See under* Gair.
1902. Dickerman, Prof. Judson C., 36, North Walnut Avenue, Chicago, Ill., U.S.A., Chemical Engineer.
1893. Dickerson, E. N., 141, Broadway, New York City, U.S.A., Lawyer.
O.M. Dickinson, A. J., 57, Lewisham High Road, New Cross, S.E., Tar Distiller.

1905. Dickinson, Cyril, Southwark Town Hall, Walworth Road, London, S.E., Analytical Chemist.
1898. Dickson, Samuel, 2, Broadway, Westminster, S.W., Analytical Chemist.
1899. Dieckmann, Dr. Otto, 1182, Harrison Avenue, Cincinnati, Ohio, U.S.A., Chemist.
1901. Diehl, Oscar C., c/o Saginaw Salt Co., St. Charles, Mich., U.S.A., Chemist.
1908. Diekman, Dr. George C., 115, West 68th Street, New York City, U.S.A., Professor of Pharmacy.
1907. Dielman, Louis H., 106, West Mulberry Street, Baltimore, Md., U.S.A., Pharmaceutical Chemist.
1894. Diestel, Wm., 117, Hudson Street, New York City, U.S.A., Dyestuff Importer.
1908. Dill, Colby, Perth Amboy, N.J., U.S.A., Chemist.
1906. Dillon, Fred. N., 16, Prospect Street, Fitchburg, Mass., U.S.A., Engineer.
1898. Dillon, Wm., Pierremont, Denton Road, Ilkley, Yorks, Oil, Colour, and Varnish Manufacturer.
O.M. Divers, Dr. E., F.R.S., 3, Canning Place, Palace Gate, Kensington, W., Professor of Chemistry.
1903. Divine, Robt. E., 325, McLellan Avenue, Detroit, Mich., U.S.A., Chemist.
1899. Dixon, Fred W., 45, East 17th Street, New York City, U.S.A., Dyer.
1888. Dixon, Prof. Harold B., F.R.S., Owens' College, Manchester, Professor of Chemistry.
1902. Dixon, Wm. A., 97, Pitt Street, Sydney, N.S.W., Australia, Public Analyst and Assayer.
1909. Dixon, W. H., c/o Bryant and May, Ltd., Fairfield Works, Bow, London, E., Match Maufacturer.
1892. Dobb, Thos., c/o J. T. Dobb and Son, West Bar, Sheffield, Pharmaceutical Chemist.
O.M. Dobbie, Dr. J. J., F.R.S., Government Laboratory, Clement's Inn Passage, London, W.C., and (Jnls.), 4, Vicarage Gate, Kensington, W., Director.
O.M. Dobbin, Dr. L., Chemical Laboratory, University, Edinburgh, Professor of Chemistry.
1908. Dobbs, Ernest J., 125, St. Asaph Road, Brockley, London, S.E., Analytical Chemist.
1907. Dodd, Arthur, Lyndhurst, Woolwich Road, Belvedere, Kent, Assistant Works Manager.
1890. Dodd, A. J., Heathfield House, Belvedere, Kent, Works Manager.
1889. Dodd, W. Ralph, Trederwen, Village Road, Enfield, Middlesex, Chemical Works Manager.
1906. Dodds, Thos., c/o Reckitt & Sons, Ltd., and (Journals) 7, The Oval, The Garden Village, Hull, Works Manager and Chemist.
1900. Dodge, Dr. Francis D., 291, Henry Street, Brooklyn, N.Y., U.S.A., Chemist.
1907. Dodge, Frank E., Fornance and Markley Streets, Norristown, Pa., U.S.A., Chemist.
1906. Dodsworth, Walter A., Journal of Commerce, 32, Broadway, New York City, U.S.A., Editor.
1897. Doerflinger, Wm. F., 52, Beaver Street, New York City, U.S.A., Research Chemist.
1897. Dohme, Dr. Alf. R. L., Messrs. Sharp and Dohme, Baltimore, Md., U.S.A., Manufacturing Chemist.
1905. Dolan, H., Westbourne, Belvoir Road, Lower Walton, Warrington, Chemist.
1897. Dolge, Carl B., Westport, Conn., U.S.A., Manufacturer of Instruments and Antiseptics.
1903. Donald, Dr. Jas. T., 112, St. François Xavier Street, Montreal, Canada, Consulting Chemist.
1906. Donald, Richard A., 16, King Street West, Toronto, Canada, Wood Distiller.
O.M. Donald, W., Saltcoats, N.B., Analytical Chemist.
1900. Donald, Wm., Ridgefield Park, Bergen Co., N.J., U.S.A., Assayer and Chemist.
1902. Donaldson, Thos., c/o South African Explosives Co., Ltd., Modderfontein, Transvaal, Chemist.
1905. Donnan, Prof. F. G., Muspratt Laboratory, The University, Liverpool, Professor of Physical Chemistry.
1886. Doolittle, Orrin S., 476, Warburton Avenue, Yonkers, N.Y., U.S.A., Chemist.
1905. Doolittle, Roscoe E., 109, Hillside Avenue, Glen Ridge, N.J., U.S.A., Chemist.
1890. Dore, Jas., Copper Works, High Street, Bromley-by-Bow, E., Distiller's Engineer.
1896. Doremus, Dr. Chas. A., 55, West 53rd Street, New York City, U.S.A., Professor of Chemistry.
O.M. Dott, D. B., Ravenslea, Musselburgh, N.B., Analytical Chemist.
1897. Douglas, Geo., Farfield Hall, Addingham, Yorks, Dyer.
1894. Douglas, London M., 3, Lauder Road, Edinburgh, Chemical Manufacturer.
1909. Douglas, Robt. P., 121, Queensgate Chorley New Road, Bolton, Chemist.
1884. Douglas, William, Diamond Plantation, Demerara, British Guiana, Chemical Engineer.
1900. Doulton, H. Lewis, Royal Doulton Potteries, Lambeth, S.E., Potter.
1900. Dow, Allan W., 24, East 21st Street, New York City, U.S.A., Chemical Engineer.
1898. Dow, Herbert H., Midland, Mich., U.S.A., Manufacturing Chemist.
1908. Dow, John W., 561, Park Avenue West, Mansfield, Ohio, U.S.A., Manufacturing Chemist.
1905. Dowbiggin, James, Craiglands, Albert Park, Lancaster, Chemist.
1885. Dowson, J. Emerson, 39, Victoria Street, Westminster, S.W., Civil Engineer.
1901. Doxrûd, Christian, Technical School, Christiania, Norway, Professor of Chemical Technology.
1907. Doyle, B. W., 11, Pine Street, Leominster, Mass., U.S.A., Manufacturer.
1902. Drake, Bryant S., 1121, Eighth Avenue, Oakland, Cal., U.S.A., Chemist.
1885. Drake, Chas. A., Three Mills Distillery, Bromley-by-Bow, E., Brewer.
1886. Dreaper, W. P., 68, Victoria Street, Westminster, S.W., Consulting Chemist.
O.M. Drew, D., Lower House Print Works, near Burnley, Calico Printer.
1906. Drew, W. Newton, Ranclifle, Ecclesfield, near Sheffield, Chemical Manufacturer.
1896. Drewsen, Dr. Viggo B., 5, Beekman Street, New York City, U.S.A., Wood Pulp and Paper Expert.
1909. Dreydel, Alfred J., Lamp Department Laboratory, The Edison Swan U.E.L. Co., Ltd., Ponders End, Middlesex, Works Chemist.
O.M. Dreyfus, Dr. C., Clayton Aniline Co., Ltd., Clayton, Manchester, Dye Manufacturer.
1905. Dreyfus, Dr. Isaac, c/o Schoellkopf & Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Chief Chemist.
1904. Dreyfus, Dr. L. A., c/o The Muralo Co., New Brighton, S.I., N.Y., U.S.A., Chemist.
1893. Dreyfus, S., Highfield, Osborne Road, Levenshulme, Manchester, Chemist.
1899. Dreyfus, Dr. Wm., 57, East 96th Street, New York City, U.S.A., Chemist.
1899. Drobegg, G., 11, Bartlett Street, Brooklyn, N.Y., U.S.A., Superintending Chemist.
1898. Drummond, Dr. Isaac W., 436, West 22nd Street, New York City, U.S.A., Chemist.
1903. Dubuque, Edwin D., 416, Dillaye Building, Syracuse, N.Y., U.S.A., Chemist.
1899. Ducas, B. P., 151, Front Street (after Mar. 31st, 25–27, South William Street), New York City, U.S.A., Chemical and Dyestuff Importer.
1907. Ducca, Dr. Wilhelm, 41, Atlantic Street, Hackensack, N.J., U.S.A., Chemist.
1905. Duché, E., 6, Eastcheap, London, E.C., and (Jnls.) Usines Duché, Vilvorde, Belgium, Merchant.
1909. Duchemin, Réné P., 6, Rue Chanoinesse, Paris IV., France, Chemical Engineer.
1897. Duckham, Alex., Phœnix Wharf, West Ferry Road, Millwall, E., Works Chemist.
1908. Duckworth, G. F., Cobalt, Ont., Canada, Works Manager.
1905. Duckworth, Harry S., Hamilton Printworks, Lowell, Mass., U.S.A., Printworks Chemist.
1887. Dudley, Prof. W. L., Vanderbilt University, Nashville, Tenn., U.S.A., Professor of Chemistry.
1899. Duff, Wm. S., Merrie Lands, Westbury Road, Buckhurst Hill, Essex, Manufacturing Chemist.
1905. Duffus, W. B., Las Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.

1901. Dufty, Lawrence, 119, Rustlings Road, Sheffield, Analytical Chemist.

1905. Duggan, Edw. J., The Charles E. Sholes Co., 164, Front Street, New York City, U.S.A., Vice-President.

O.M. Duggan, T. R., 60, Foyle Road, Blackheath, S.E., Analytical Chemist.

1898. Duisberg, Dr. Carl, The Bayer Co., Ltd., (Journals) Elberfeld, Germany; (subscriptions) 19, St. Dunstan's Hill, London, E.C., Chemist.

1905. Dukes, Bernhard, 1, Great James Street, Bedford Row, London, W.C., Patent Agent.

1888. Dukes, T. William, Box 10, Vryheid, South Africa, Merchant.

1906. Duncalfe, Roger, Forge Mills, Bestwood Colliery, Nottingham, Glue Manufacturer.

1889. Duncan, Arthur W., c/o J. Woolley, Sons & Co., Ltd., Victoria Bridge, Manchester, Analytical Chemist.

1909. Duncan, Jas., c/o Steel Bros. & Co., Ltd., 6, Fenchurch Avenue, London, E.C., Merchant.

1909. Duncan, John, c/o Burroughs, Wellcome & Co., Waterloo, Sydney, N.S.W., Works Manager.

1904. Duncan, Robert A., P.O. Box 509, Honolulu, Hawaii, Chemist.

1908. Duncan, Prof. Robert Kennedy, University of Kansas, Lawrence, Kansas, U.S.A., Prof. of Industrial Chemistry.

1904. Duncan, W. W., 19, Upland Road, Watertown, Mass., U.S.A., Chemist (Hood Rubber Co.).

1906. Dunford, Jno. H., Trent Side Bone Works, Nottingham, Assistant Manager.

1898. Dunham, Dr. E. K., 35, East 68th Street, New York City, U.S.A., Professor of Bacteriology and Hygiene.

1905. Dunlop, Harry, 231, St. Vincent Street, Glasgow, Chemist.

1892. Dunu, Fred., 193, Collins Street, Melbourne, Victoria, Australia, Analytical Chemist.

O.M. Dunn, Dr. J. T., 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.

O.M. Dunn, P., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.

1908. Dünschmann, Dr. Max, c/o Meister, Lucius, und Brüning, Ellesmere Port, Cheshire, Manager.

1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.

1907. Dunstan, A. E., Technical College, East Ham, E., Head of Chemical Department.

1907. Dupré, F. H., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.

1907. Dupré, P. V., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.

1897. Durant, H. T., c/o British Metals Extraction Co., Llansamlet, Glamorgan, S. Wales, Metallurgist.

1905. Durfee, Winthrop C., 516, Atlantic Avenue, Boston, Mass., U.S.A., Manufacturing Chemist.

1897. Durkee, Frank W., Tuft's College, Medford, Mass., U.S.A., Professor of Chemistry.

1907. Durrans, Thos. H., 1, Cornwall Terrace, Regent's Park, London, N.W., Chemist.

1899. Duryea, Chester B., 80, Madison Avenue, New York City, U.S.A., Starch Manufacturer.

1906. Dushman, Saul, Faculty of Applied Science, University of Toronto, Canada, Electrochemist.

1891. Dvorkovitz, Dr P., 45, St. Mary Axe, London, E.C., Technical Chemist.

O.M. Dyer, Dr. B., 17, Great Tower Street, London, E.C., Analytical and Consulting Chemist.

1907. Dyes, Dr. W. A., 18, Exchange Street, Manchester.

O.M. Dyson, C. E., Flint, North Wales.

1902. Dyson, George W., 89, Cowlishaw Road, Sheffield, Analyst.

1892. Dyson, Septimus, 12, Fairmile Avenue, Streatham, S.W., Manufacturing Chemist.

E

1909. Eachus, Charles, 323, Academy Street, Newark N.J., U.S.A., Leather Trade Chemist.

1905. Eager, Chas. E., 77, Pearl Street, Boston, Mass., U.S.A., Merchant.

1904. Eames, Charles J., 99, Water Street, New York City, U.S.A., Consulting Chemist.

O.M. Earp, W. R., Preston Brook, near Warrington, Chemical Manufacturer.

1884. Eastick, C. E., 7, King Edward Street, Whitechapel, E., Sugar Works Manager.

1909. Eastick, J. C. N., 2, St. Dunstan's Hill, London, E.C., Analytical Chemist.

O.M. Eastick, J. J., Ashburton, Northfield Road, Stamford Hill, N., Analytical and Consulting Chemist.

1890. Eastlake, A. W., Grosmont, Palace Road, Streatham Hill, S.W., Petroleum Works Manager.

1909. Eastlake, William H., Continental Mexican Rubber Co., Torreon, Coahuila, Mexico, Chemist.

1885. Eastwood, Edw., 7, Bolton Road, Port Sunlight, Birkenhead, Soapmaker.

1902. Eastwood, Robert F., 90, Peel House Lane, Widnes, Chemist.

1906. Eaton, B. J., Government Chemist.

1909. Eberlin, Leon W., 11, First Street, Rochester, N.Y., U.S.A., Chemist.

1902. Eckel, Edwin Clarence, 209, Munsey Building, Washington, D.C., U.S.A., Geologist.

1907. Eckenstein, Thos. C., 19, Huskisson Street, Liverpool, Analytical Chemist.

1892. Eddy, Harrison P., Sewage Purification Works, Worcester, Mass., U.S.A., Superintendent.

1901. Eddy, W. Clifton, 53, Sanford Street, Dover, N.J., U.S.A., Chemist.

1885. Edge, Anthony, 79, Milton Street, Readville, Mass., U.S.A., Chemist.

1909. Edge, J. Harold, "Great Marld," Smithills, Bolton, Lancashire, Technical Chemist.

1902. Edison, Thos. Alva, Edison Laboratory, Orange, N.J., U.S.A., Inventor and Manufacturer.

1908. Edmunds, Wm. T., Church Road, Burry Port, Carmarthenshire, Assayer.

1909. Edwards, George M., 241, Pine Avenue West, Montreal, Canada, Paintworks Manager.

1902. Edwards, H. Seaton, 19, Park Road, Port Sunlight, Cheshire, Analyst.

1906. Egleson, J. E., c/o General Chemical Co., Camden, N.J., U.S.A., Chemist.

1895. Ehrenfeld, Prof. Chas. H., York Collegiate Institute, York, Pa., U.S.A., Professor of Chemistry.

1896. Ehrhardt, Ernest F., Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany, Research Chemist.

1910. Eilsberger, Dr. Ernst, Deutsche Solvaywerke, Bernburg (Anhalt), Germany, Director.

1909. Eisenhart, M. H., c/o Eastman Kodak Co., Kodak Park, Rochester, N.Y., U.S.A., Chemist.

1885. Elborough, T., 59, Mark Lane, London, E.C., Manure Manufacturer.

1901. Elkan, Leo A., 594, Dearborn Avenue, Chicago, Ill., U.S.A., Tanner.

1901. Elkins, Arthur W., 2329, College Avenue, Berkeley, Cal., U.S.A., Civil Engineer.

1884. Elliott, Dr. A. H., Consolidated Gas Co., 4, Irving Place, New York City, U.S.A., Chemist.

1907. Elliott, George K., c/o Lunkenheimer Co., Cincinnati, Ohio, U.S.A., Chief Chemist.

1896. Elliott, Dr. J. F., c/o Grimwade and Co., 6, Trinity Square, E.C.; and (Journals), O'Connell Street, Sydney, N.S.W., Manufacturing Chemist.

1902. Elliott, Victor G., Chemical Works, Rozelle, Sydney, N.S.W., Australia, Manufacturing Chemist.

1905. Ellis, Carleton, 143, Gates Avenue, Montclair, N.J., U.S.A., Chemical Engineer.

1885. Ellis, C. J., Almorah Villa, Milngavie, near Glasgow, Technical Chemist.

1893. Ellis, E. Victor, 7, Hillside Crescent, Edinburgh, Analytical Chemist.

1894. Ellis, G. Beloe, 70, Chancery Lane, London, W.C., Patent Agent.

O.M. Ellis, H., 120, Regent Road, Leicester, Chemical Merchant.

1907. Ellis, Theodore H., East Brooklyn Station, Baltimore, Md., U.S.A., Oil Refiner.

1891. Ellis, Prof. W. Hodgson, 71, St. Alban Street, Toronto, Ont., Canada, Professor of Applied Chemistry.

1891. Ellison, Henry, Northfield, Cleckheaton, Yorks., Manufacturing Chemist.

O.M. Elmore, A. S., 72, Gloucester Terrace, Hyde Park, London, W., Electro-Metallurgist.

1907. Elms, Jas. W., c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Chemist.

1907. Elsden, A. Vincent, 88, Elliscombe Road, Charlton, S.E., Analytical Chemist.

1904. Elson, J. Hugh, Monroe Drug Co., Quincy, Ill., U.S.A., General Manager.

1909. Ely, Benjamin, The Limes, Pye Bridge, near Alfreton, Tar Distiller.

1902. Emery, Arthur L., c/o Smith, Emery, and Co., 651, Howard Street, San Francisco, Cal., U.S.A., Chemical Engineer.

1899. Emery, E. G., Pinole, Contra Costa Co., Cal., U.S.A., Technical Chemist and Engineer.

1907. Emmons, Frank W., c/o Washburn Crosby Co., Minneapolis, Minn., U.S.A., Chemist.

1907. Emrich, Horace H., Perth Amboy Plant, Am. S. and R. Co., Mauser, N.J., U.S.A., Mining Engineer.

1907. Emslie, B. Leslie, 1102–1105, Temple Building, Toronto, Canada, Agricultural Chemist.

1894. Enequist, John, 3710, Avenue J., Brooklyn, N.Y., U.S.A., Chemical Engineer.

1904. Englehard, Charles, 30, Church Street, New York City, U.S.A., Platinum Importer.

1895. English, Frank H., 21, Shelley Avenue, Manor Park, E., Analytical Chemist.

1899. Enright, Bernard, 4036a, Laclede Avenue, St. Louis, Mo., U.S.A., Chemist.

1906. Ephraim, Dr. Julius, Königgraetzerstrasse 69, Berlin, S.W., Germany, Chemist and Patent Agent.

1909. Epps, Claude H. B., County Technical School, Stafford, Lecturer on Chemistry.

1909. Epstein, Harry M., c/o Watrous Varnish Co., 20th and Tasker Streets, Philadelphia, Pa., U.S.A., Works Manager.

1904. Erdmann, Prof. Dr. H., Bismarck Strasse 11n., Charlottenburg, Berlin, Professor of Inorganic Chemistry.

1907. Erdoes, Julius, 242, East 122nd Street, New York City, U.S.A., Chemical Engineer.

1902 Erhart, Wm. H., 81, Maiden Lane, New York City, U.S.A., Manufacturing Chemist.

1904. Ermen, Walter F. A., 10, Marsden Street, Manchester, Analytical Chemist.

1905. Ernst, C. A., 13, Widdrington Road, Coventry, Chemist.

1909. Erpf, V. P., Room 1103, Temple Building, Toronto, Canada, Manager (Nitrate Agencies Co.).

1888. Erskine, J. K., P.O. Box 88, Benoni, Transvaal, Analytical Chemist.

1897. Escher, Paul, 1319, Pearl Street, Alameda, Cal., U.S.A., Chemist.

1884. Esilman, A., 25, Roe Lane, Southport, Lancashire, Analytical Chemist.

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1905. Etheridge, Arthur T., 85, Hampton Road, Birchfields, Birmingham, Chemist.

1903. Euler, C. G., 18–20, Platt Street, New York City, U.S.A., Agent for Essential Oils.

1883. Evans, Enoch, 660, Coventry Road, Birmingham, Accountant.

1903. Evans, F. Sparke, Avonside Tannery, Bristol, Tanner.

1905. Evans, Geo. A., 832, Yonge Street, Toronto, Canada, Pharmacist.

1905. Evans, Jacob V. R., c/o Badger State Tanning Co., Sheboygan, Wis., U.S.A., Chemist.

1904. Evans, Jas. Rittenhouse, 3, High Street, Pottstown, Pa., U.S.A., Chemist.

1905. Evans, John, 67, Surrey Street, Sheffield, Analytical Chemist.

1908. Evans, Prof. Nevil Norton, Redpath Library, McGill University, Montreal, Canada, Associate Professor of Chemistry.

1889. Evans, R. F., 3, Glencoe, Stratford-on-Avon, Brewing Chemist.

1903. Evans, Wm. J., 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.

1898. Evans, Wm. Perceval, Canterbury College, Christchurch, New Zealand, Professor of Chemistry.

1909. Everette, Dr. W. E., 3512, South 11th Street, Tacoma, Wash., U.S.A., Consulting Chemical Engineer.

1904. Everitt, Walter, Norwood Wharf, Southall, Middlesex, Analyst.

1910. Everitt, William, Gas Works, Ilkley, Yorks., Manager.

O.M. Evershed, F., c/o Clarke, Nickolls, and Coombs, Hackney Wick, N.E., Chemist.

1907. Eves, Archie P., 762, East Buchtel Avenue, Akron, Ohio, U.S.A., Chemist.

1891. Ewan, Dr. Thos., c/o Cassel Cyanide Co., Shuna Street, Maryhill, Glasgow, Chemist.

1904. Ewing, Dr. A. Ramsay, 2, York Terrace, Shettleston, Glasgow, Technical Chemist.

1905. Eynon, Lewis, 57, Darenth Road, Stamford Hill, N., Chief Chemist (London Beetroot Sugar Association).

F

1898. Fadé, Louis, c/o Dr. F. Stockhausen, Weissfrauenstrasse 7–9, Frankfort a/M., Germany, Chemist and Director.

O.M. Fahlberg, Dr. C., Nassau a/Lahn, Germany, Manufacturing Chemist.

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1902. Faill, Jas., 51, Partickhill Road, Glasgow, Technical Chemist.

1902. Fairchild, Benj. T., P.O. Box 1120, New York City, U.S.A., Manufacturing Chemist.

1903. Fairhall, E. J., 175, Culverley Road, Catford, S.E., Chemist.

O.M. Fairley, T., 17, East Parade, and (Communications) 8, Newton Grove, Leeds, Analytical Chemist.

1901. Fairlie, Jas., Camelon Chemical Works, Falkirk, N.B., Manufacturing Chemist.

1908. Fairweather, J. H., Laboratory, 19 and 20, Aldgate, London, E.C., Analytical Chemist.

1902. Fairweather, Wallace C., 62 St. Vincent Street, Glasgow, Engineer.

1898. Falding, F. J., 55, Broadway, New York City, U.S.A., Chemical Engineer.

1908. Fales, Harold A., 308, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Secretary (The W. N. Fales Co.).

1910. Farr, Harry, Free Library, Cardiff, Librarian.

O.M. Farrant, N., c/o J. Nicholson and Sons, Chemical Works, Hunslet, Leeds, Chemist.

1897. Farrell, Frank J., 54, Wellesley Road, Great Yarmouth, Analytical Chemist.

O.M. Farrington, T., 5, Summerhill Terrace, Cork, Ireland, Chemical Engineer.

1909. Fassett, C. M., 209, Wall Street, Spokane, Wash., U.S.A., Analytical Chemist.

1909. Fath, Dr. Arthur, c/o Gerard und Co., Heerdt, near Düsseldorf, Germany, Engineer.

1909. Faulkner, John J., Hutchinson, Kansas, U.S.A., Chemist.

1908. Favre, A., 21, Mincing Lane, London, E.C., Laboratory Furnisher.

1884. Fawsitt, C. A., Atlas Chemical Works, East Nelson Street, Glasgow, Chemical Manufacturer.

1903. Fawsitt, Dr. Chas. E., The University, Sydney, N.S.W., Australia, Prof. of Chemistry.

1906. Feeley, Edward J., 88, Broad Street, Boston, Mass., U.S.A., Aniline Colour Dealer.

1903 Feilmann, Dr. M. E., 92, Victoria Street, Westminster, S.W., Chemist.

1892. Feld, Walther, Hauptstrasse 14, Zehlendorf-Warmseebahn, Germany, Chemical Works Director.

1909. Fell, Wm. M. W., 27, Clarendon Road, Garston, Liverpool, Chemist.

1905. Felton, Herbert L., 524, East Second Street, South Boston, Mass., U.S.A., Distiller.

1900. Ferguson, Prof. Geo. A., 121, West 42nd Street, New York City, U.S.A., Professor of Analytical Chemistry.

O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.

1896. Ferguson, J. Hart, Loch Katrine Distillery, Camlachie, Glasgow, Distillery Manager.

1910. Ferguson, Dr. Robert H., 9, North Munn Avenue, East Orange, N.J., U.S.A., Anæsthetist.

1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.

1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.

1905. Fernberger, Harry M., 1939, North 12th Street, Philadelphia, Pa., U.S.A., Chemist.

1909. Ferrey, Cuthbert E. C., Royal Chambers, Scale Lane, Hull, Analyst.

1908. Ferriz, Abraham, Dinamita (via Noé), Durango, Mexico, Government Inspector of Explosives.

1905. Fiebiger, Peter, 530, Canal Street, New York City, U.S.A., Colour Chemist.

1893. Fiebing, John H., 238, Reed Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.

1885. Field, E. W., Brewer.

1887. Field, S. S., 3, Glenluce Road, Blackheath, S.E. Manufacturing Chemist.

1891. Field, Wm. Eddington, Martin Street, Elsternwick, Melbourne, Victoria, Chemist.

1909. Fifield, Fred. A., 189, Dowling Avenue, Toronto, Canada, Superintendent.

1900. Fillis, Frank, 106, London Road, Neath, South Wales, Cement Works Manager.

1907. Finch, Archibald M., Vitriol and Chemical Works, Cwmbran, R.S.O., Monmouthshire, Chemical Manufacturer.

1904. Finch, Martin L., Vitriol and Chemical Works, Cattedown, Plymouth, Chairman of Directors.

1907. Finch, Wm. J., c/o Dominion Tar and Chemical Co., Box 599, Sydney, N.S., Canada, Works Chemist.

1910. Findlater, James, c/o Price's Patent Candle Co., Ltd., Bromborough Pool, near Birkenhead, Chief Chemist.

1905. Findlay, Dr. Alex., The University, Birmingham, Lecturer on Physical Chemistry.

1899. Fingland, Jno. J., Salmo, B.C., Canada, Analytical Chemist.

1904. Finn, Cornelius P., Hemsworth Colliery, near Wakefield, Yorks., Technical Chemist.

1903. Fischer, Dr. Carl, 213–215, Water Street, New York City, U.S.A., Chemist.

1903. Fish, Chas. C. R., 10, Park Square, Boston, Mass., U.S.A., Chemist.

1905. Fish, Chas. H., Garner Printworks and Bleachery, Wappinger's Falls, N.Y., U.S.A., General Manager.

1900. Fisher, Henry, 57, East 83rd Street, New York City, U.S.A., Teacher of Chemistry.

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1895. Fison, Jno., Messrs. Jas. Fison and Sons, Thetford, Norfolk, Chemical Manufacturer.

1904. Fitch, A. J., 1, Summerlands Mansions, Muswell Hill, N., Brewer's Chemist.

1902. FitzGibbon, Thos., 115, Harbord Street, Fulham, S.W., Analytical Chemist.

1907. Fitzhardinge, R. B., Elliott Bros.' Chemical Works, Rozelle, Sydney, N.S.W., Analyst.

1900. Fitz-Randolph, R. B., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.

1896. Flammer, E., c/o Kraemer und Flammer, Heilbronn a/N., Wurttemberg, Germany, Manufacturing Chemist.

1892. Fleming, J. Arnold, Britannia Pottery, 136, Glebe Street, Glasgow, Potter.

1903. Fleming, Jno. A., R.F.D. No. 2, Bethesda, Md., U.S.A., Engineer.

O.M. Fletcher, A. E., Coombe Lea, Dorking, Surrey, Ex-Chief Inspector Alkali, &c., Works.

1893. Fletcher, E. Morley, 30, Grosvenor Place, Newcastle-on-Tyne, Alkali Works Inspector.

O.M. Fletcher, F. W., c/o Fletcher, Fletcher, & Co., Ltd., Holloway, N., Manufacturing Chemist.

1891. Fletcher, R. Jaques, North Geelong, Victoria, Manufacturing Chemist.

1904. Fletcher, Wm. E., Box 83, Tamaqua, Pa., U.S.A., Chemist.

1899. Focht, Louis, 105, E. Hanover Street, Trenton, N.J., U.S.A., Civil Engineer.

1890. Foden, Alfred, 19, Lancaster Avenue, Sefton Park, Liverpool, Metallurgical Chemist.

1900. Foersterling, Dr. H., c/o Roessler Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemist.

1900. Fogetti, Lucien, 1714, Wilson Avenue, Chicago, Ill., U.S.A., Chemist.

1895. Fogg, Chas. A., Graythorne, Albert Road, Bolton-le-Moors, Lecturer on Chemistry.

1901. Folsom, Herbert A., 112, Water Street, Boston, Mass., U.S.A., Textile Chemist.

1900. Forbes, Eli, Lancaster, Mass., U.S.A., Chemist.

1895. Forbes, Paul R., 15, William Street, New York City, U.S.A., Chemist and Assayer.

1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte, Mich., U.S.A., Secretary and Treasurer.

1889. Ford, Jno. S., Abbey Brewery, Edinburgh, Analyst.

1905. Foregger, Dr. R. von, c/o Roessler & Hasslacher Chemical Co., 100, William Street; and (Journals) P.O. Box 1999, New York City, U.S.A., Chemist.

1899. Forel, Geo., 212, Route de Vienne, Lyon (Rhône), France, Chemist.

1885. Formoy, J. Arthur, Chestham, Grange Road, Sutton, Surrey, Oil Expert.

1904. Forrest, Chas. N., Maurer, N.J., U.S.A., Chemist.

1898. Forrest, J. Kerr, 271, Carlisle Street, St. Kilda, Victoria, Australia, Manufacturing Chemist.

1890. Forrester, A. M., c/o Richmond Guano Co., Richmond, Va., U.S.A., Analytical Chemist.

1905. Forrester, H. A., Usina de Gas, Retiro, Buenos Ayres, S. America, Chemical Works Manager.

1909. Forshaw, Arthur, 104, Holly Road, Handsworth, Birmingham, Works Chemist.

1902. Forstall, Alf. E., 58, William Street, New York City, U.S.A., Consulting Gas Engineer.

1901. Forster, Miss E. L. B., King's College, Strand, London, W.C., Analyst.

1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, and (Jnls.) The River House, Burton-on-Trent, Chemist.

1907. Forster, Francis, Tyne Lead Works, Hebburn-on-Tyne, Lead Manufacturer.

1899. Forster, Dr. M. O., F.R.S., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.

1884. Forster, Ralph C., c/o Messrs. Bessler, Waechter, and Co., Salisbury House, Finsbury Circus, London, E.C., Chemical Merchant.

1884. Forth, Henry, Meadowcroft, Marple, Cheshire, Drysalter.

1907. Forward, Charles C., Dept. of Inland Revenue Laby., 317, Queen Street, Ottawa, Canada, Chemist.

1908. Foster, Edward C., 273, Eddy Street, Providence, R.I., U.S.A., Chemical Manufacturer.

1906. Foster, Robt. K., Church Street, Middle Brighton, Melbourne, Victoria, Pharmaceutical Chemist.

O.M. Foster, R. Le Neve, Fulshaw Cottage, Wilmslow, Cheshire, Manufacturing Chemist.

1888. Foster, Wm., St. Martin's Terrace, Newton Park, Leeds, Manufacturing Chemist.

1906. Foucar, J. Louis, 15, Morden Road, Blackheath, S.E., Chemist.

1904. Foust, Thomas B., c/o Red River Furnace Co., Clarksville, Tenn., U.S.A., Chemist.

1907. Fowler, Chas., 10, Cunliffe Terrace, Bradford, Yorks., Colour Makers' Representative.

1891. Fowler, Dr. Gilbert J., Broad Oak, Urmston, near Manchester, Consulting Chemist (Manchester Corporation Rivers Committee).

1898. Fowler, Theo. V., P.O. Drawer 15, Buffalo, N.Y., U.S.A., Chemical Works Manager.

1909. Fowler, Wm., 3, Cranbrook Road, Victoria Docks, London, E., Chemist.

1896. Fox, A. Stanley, Greycote, Westcliff, Herne Bay, Kent, Chemist (Cotton Powder Co., Ltd.).

1898. Fox, Jno., Varuna, Grappenhall, Cheshire, Analyst.

1909. Fox, J. J., 9, Blackheath Rise, London, S.E., Managing Director, Tidman and Son, Ltd.

O.M. Fox, T., jun., c/o Fox, Bros. and Co., Ltd., Wellington, Somerset, Wool Manufacturer.

1905. France, Edward W., Philadelphia Textile School, Broad and Pine Streets, Philadelphia, Pa., U.S.A., Director.

O.M. Francis, E. G., 29, Matheson Road, West Kensington, W., Glucose Works Manager.

O.M. Francis, G. B., 38, Southwark Street, London, S.E., Wholesale Druggist.

O.M. Francis, W. H., 6F, Bickenhall Mansions, Gloucester Place, London, W., Wholesale Druggist.

1903. Francksen, Dr. Aug., 4803, Garden Street, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.

1906. Frank, Prof. Dr. A., Berlinerstrasse 26, Charlottenburg, Germany, Chemist.

1908. Frank, Dr. Fritz, Markgrafenstrasse 88, Berlin, S.W., 68, Germany, Public Analyst.

1894. Frank, Jerome W., 29, Broadway, New York City, U.S.A., Chemist.

1886. Frankenburg, Isidor, Greengate Rubber Works, Salford, Manchester, India-rubber Manufacturer.

1895. Frankforter, Dr. G. B., University of Minnesota, Minneapolis, Minn., U.S.A., Prof. of Chemistry.

1904. Frankl, A., Clothilde Chemical Works, Nagy Bocskó, Hungary, Chief Manager.

O.M. Frankland, H., Streonshalh, The Crescent, Linthorpe, Middlesbro', Analytical Chemist.

O.M. Frankland, Prof. P. F., F.R.S., The University, Birmingham, Professor of Chemistry.

1906. Fraps, Dr. Geo. S., Texas A. & M. College, College Station, Texas, U.S.A., Professor of Chemistry.

1901. Frasch, Hans A., 52, Broadway, New York City, U.S.A., Manager.

1900. Frasch, Herman, 82, Beaver Street, New York City, U.S.A., Oil Refiner.

1904. Fraser, Jas. D., 5, Millbrae Crescent, Langside, Glasgow, Chemist.

1891. Fraser, L. McG., 98, Commercial Road East, London, E., Chemical Engineer.

1909. Fraser, Wm., 3, Fenchurch Avenue, London, E.C., Chemical Merchant.

1907. Fraser, Wm. M., c/o The Texas Co., Port Arthur, Texas, U.S.A., Chemist.

1902. Frederick, Geo. E., jun., P.O. Box 1376, Providence, R.I., U.S.A., Chemical Merchant.

1885. Freear, H. M., Hardwick Road, Woburn Sands, Beds., Analytical Chemist.

1899. French, Alf., Dispenser.

1900. French, Thos., 1, Kelvinside Terrace West, Glasgow, Chemist.

1903. Frerichs, Dr. F. W., Herf and Frerichs Chemical Co.; and (Journals), 3828, Westminster Place, St. Louis, Mo., U.S.A., Manufacturing Chemist.

1907. Freytag, Henry, c/o O. Isler & Co., 35, Dickinson Street, Manchester, Chemical Merchant.

1886. Fries, Dr. Harold H., 92, Reade Street, New York City, U.S.A., Chemical Manufacturer.

1902. Fries, Jno. W., Winston Salem, N.C., U.S.A., Cotton Manufacturer.

1898. Frith, J. Mason, Linden Lodge, Runcorn, Cheshire, Lime Burner.

1899. Fritzsche, Karl, c/o Schimmel und Co., Miltitz, near Leipzig, Germany, Manufacturer of Essential Oils.

1890. Frost, Dr. Howard V., 3958, Drexel Boulevard, Chicago, Ill., U.S.A., Professor of Chemistry.

1884. Frost, Joe, Storth's Mill, Mold Green, Huddersfield, Manufacturing Chemist.

O.M. Fryer, Dr. A. C., 13, Eaton Crescent, Clifton, Bristol, Alkali Works Inspector.

1901. Fryer, Percival J., 27, Minster Road, West Hampstead, N.W., Analyst.

1906. Fuchs, Herman C., 714, Westminster Road, Brooklyn, N.Y., U.S.A., Dry Colour Chemist.

1903. Fudge, T., 32, West 38th Street, Bayonne, N.J., U.S.A., Chemist.

1889. Fuerst, Jos. F., 17, Philpot Lane, London, E.C., Chemical and Oil Merchant.

1895. Fuerst, W. F., 87, Nassau Street, New York City, U.S.A., Chemical Merchant.

1894. Fuller, Chas. J. P., 603, Chorley New Road, Horwich, near Bolton, Analytical Chemist.

1902. Fuller, Henry C., Bureau of Chemistry, Washington, D.C., U.S.A., Analytical Chemist.

1899. Fuller, Robt. F., Neston Park, Corsham, Wilts., Rubber Manufacturer.

1899. Fuller, W. M., c/o Morris and Griffin, Maindee, Newport, Mon., Chemical Manufacturer.

O.M. Fuller, Wm., Vanbrugh Cottage, Maze Hill, S.E., Chemist.

1898. Fulmer, Elton, Pullman, Wash., U.S.A., Professor of Chemistry.

1896. Fulton-Smith, I., 20, Bold Street, Warrington, Brewer.

1909. Fulweiler, W. H., c/o United Gas Improvement Co., Broad and Arch Streets, Philadelphia, Pa., U.S.A., Engineer.

1885. Fyfe, Jno., 7, West George Street, Glasgow, Oil Works Director.

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O.M. Gabbett, E. R., 64, Vanbrugh Road, Blackheath, S.E.; (Journals) Prince Regent's Wharf, Silvertown, E., Chemical Engineer.

1909. Gaede, Chas. W., c/o National Silk Dyeing Co., Ryle Avenue, Paterson, N.J., U.S.A., Silk Dyer.

1906. Gagnebin, Chas. L., 140, Oliver Street, Boston, Mass., U.S.A., Dyestuff Merchant.

1907. Gaines, Richard H., 147, Varick Street, New York City, U.S.A., Chemist (Board of Water Supply).

1904. Gair, C. J. Dickenson, 39, Cranston Road, Forest Hill, S.E., Analytical Chemist.

1890. Gajjar, T. K., Techno-chemical Laboratory, Girgaum, Bombay, India, Consulting Chemist.

1884. Gall, Henry, 4, Rue Albert Joly, Versailles, France, Technical Chemist.

1905. Gall, J. B., c/o Callender's Cable and Construction Co., Belvedere, Kent, Chemist.

1897. Galletly, J. C., Research Laboratories, The Diamond Rubber Co., Akron, Ohio, U.S.A., Rubber Chemist.

1901. Gallivan, Dr. Frank B., 184, Summer Street, Boston, Mass., U.S.A., Chemist.

1903. Gallum, Albert F., Milwaukee, Wis., U.S.A., Tanner.

1901. Gallup, W. Arthur, Arnold Printworks, North Adams, Mass., U.S.A., Printer.

1901. Galpin, Harry T., 57, West 57th Street, New York City, U.S.A., Chemist.

1891. Galt, Hugh Allen, Columbia Chemical Co., Barberton, Ohio, U.S.A., Works Manager.

1887. Gamble, Jas. N., The Laboratory, Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Soap Manufacturer and Oil Refiner.

1894. Gane, Eustace H., 91, Fulton Street, New York City, U.S.A., Pharmaceutical Chemist.

1888. Gans, Adolf, Farbenfabrik von L. Cassella & Co., Frankfort a/Main, Germany, Dye Works Manager.

1901. Gansser, Dr. A., c/o Messrs. Lepetit, Dollfus, & Gansser, Garessio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.

1896. Gardair, Aimé, 51, Rue St. Ferréol, Marseilles, France, Director of Chemical Co.

1907. Gardner, Edward, 70, Parliament Hill Mansions, Highgate Road, London, N.W., Metallurgical Chemist.
1905. Gardner, Franc E., 633, North Western Avenue, Chicago, Ill., U.S.A., President, Gardner-Barada Chemical Co.
1909. Gardner, Henry A., 3500 Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.
1891. Gardner, Prof. Walter M., Technical College, Bradford, Director of Chemical and Dyeing Departments.
1897. Garfield, Jos., Thackley, Bradford, Yorks., Civil Engineer.
1888. Garibaldi, Joachim A., 21, Church Place, Gibraltar, Chemist.
1907. Garland, Herbert, Dept. of Ordnance, E.A., Citadel, Cairo, Egypt, Chemist (Government Laboratory).
1905. Garle, John L., 17, John Street, Bedford Row, London, W.C., Consulting Chemist.
1904. Garnar, G. Lestor, Monticello, Sullivan Co., N.Y., U.S.A., Superintendent of Leather Works.
1890. Garrett, Dr. F. C., Armstrong College, Newcastle-on-Tyne, Teacher of Science.
1900. Garrigues, W. E., Foot of Lieb Street, Detroit, Mich., U.S.A., Chemical Engineer.
1906. Garroway, Major John, 58, Buchanan Street, Glasgow, Chemist.
1908. Garson, Jas. W., 12, Avenue Road, Crouch End, N., Managing Director, Lewis Berger & Sons, Ltd.
O.M. Garton, Sir Richard, Messrs. Hill, Garton, & Co., Southampton Wharf, Battersea, S.W., Glucose Manufacturer.
1886. Gascoyne, Dr. W. J., 27, South Gay Street, Baltimore, Md., U.S.A., Analytical Chemist.
O.M. Gaskell, Holbrook, Erindale, Frodsham, Cheshire, Alkali Manufacturer.
1902. Gaskell, Holbrook, jun., Hillcroft, Church Road, Woolton, near Liverpool, Engineer.
1908. Gatehouse, Frank B., 3, Lawrence Road, Romford, Essex, Chemist and Technical Journalist.
O.M. Gatheral, Geo., 174, Soho Hill, Handsworth, Birmingham.
1906. Gaunt, Percy, Macclesfield Corporation Sewage Works, Prestbury, near Macclesfield, Chemist.
1903. Gaylord, Wallace K., Throop Polytechnic Institute, Pasadena, Cal., U.S.A., Professor of Chemistry.
1904. Gazdar, J. J., Rosslyn, North End Road, Hampstead, N.W., Barrister-at-Law.
1907. Geer, William C., 23, Hawthorne Avenue, Akron, Ohio, U.S.A., Chemist.
1891. Geisler, Dr. Jos. F., New York Mercantile Exchange Building, 6, Harrison St., New York City, U.S.A., Consulting Chemist.
1901. Gemmell, G. H., 4, Lindsay Place, George IV. Bridge, Edinburgh, Analytical Chemist.
1907. Gemmell, Wm., Walpole House, Church Street, Teddington, Middlesex, Analytical Chemist.
1901. Gent, Percy W., Trentholme, Misterton, near Gainsboro', Chemist.
1897. Gent, Wm. T., Springfield, Misterton, near Gainsboro', Metallurgical Chemist.
1896. Genth, Fred. A., 222, Walnut Street, Philadelphia, Pa., U.S.A., Chemist.
1905. George, J. K., 345, Fifth Avenue, New York City, U.S.A., Manufacturer.
1903. Georgii, Max, 606, F Street N.W., Washington, D.C., U.S.A., Patent Attorney.
1906. Gerkensmeyer, Henry H., 210, First Avenue, Joliet, Ill., U.S.A., Chemist.
O.M. Gerland, Dr. B. W., 105, Plantation Street, Accrington, Consulting Chemist.
1910. Gessler, Dr. Albert, 59, Simonson Avenue, Clifton S.J., New York City, U.S.A., Chemist.
1905. Geussler, Dr. Otto, Tuchmanufactur Baron A.L. von Stieglitz, Narva, Russia, Chemist.
1903. Ghose, Anukul, 42, Shambazar Street, Calcutta, India, Analyst.
1908. Gianoli, Guiseppe, Piazza Cordusio 2, Milano, Italy, Chemical Engineer and Editor (L'Industria).
1903. Gibbings, Wm., Woodside, Halebank, Widnes, Works Manager.
1902. Gibbon, Edw., Belvedere, Park Road, Clydach, R.S.O., Glam., Works Chemist.
1904. Gibbs, A. E., Wyandotte, Mich., U.S.A., Manufacturing Chemist.
1883. Gibbs, D. Cecil, Soap Manufacturer.
O.M. Gibbs, Wm. P., Cyanamidfabriken, Odda, Hardanger, Norway, Analytical Chemist.
1893. Gibbs, W. T., Buckingham, Prov. Quebec, Canada, Manufacturing Chemist.
O.M. Gibson, Dr. J., 20, George Square, Edinburgh, Chemical Lecturer.
O.M. Gibson, J. M., c/o Buckley Brick and Tile Co., Buckley, *via* Chester, Brick and Tile Manufacturer.
1905. Gibson, John, Victorian Portland Cement Works, Burnley Street North, Richmond, Vic., Australia, Manager.
1906. Gibson, Robt. R., c/o Sherwin-Williams Co., 601, Canal Road N.W., Cleveland, Ohio, U.S.A., Chemist and Manager.
1905. Gibson, Wm. F., 18, Bushy Park, Totterdown, Bristol, Works Chemist.
1899. Gifford, Wm. E., 408, New Jersey Railroad Avenue, Newark, N.J., U.S.A., Chemist.
1892. Gilbard, J. Francis H., 245, Dalston Lane, Hackney, N.E., Analytical Chemist.
1905. Gilbertson, Isaac H., 5, Broad Street, Rhodes, near Middleton, Lancs., Calico Printer.
1903. Gilby, Joseph W., c/o Brotherton and Co., Ltd., Haigh Park Chemical Works, Stourton, Leeds, Works Chemist.
O.M. Gilchrist, Percy Carlyle, F.R.S., A.R.S.M., M.Inst.C.E. & M.E., Reform Club, Pall Mall, London, S.W.
1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.
1900. Gildersleeve, W. H., Middlesboro', Ky., U.S.A., Chemist.
O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.
1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Professor of Technical Analysis.
1909. Gill, John H., 10, Leslie Avenue, Leslie Road, Nottingham, Soapworks Chemist.
1901. Gill, Wm. S., c/o Farquhar and Gill, North of Scotland Colour Works, Aberdeen, Colour and Varnish Manufacturer.
1903. Gillean, R. Hampson, c/o The Watson Foster Co., Ltd., Maisonneuve, Quebec, Canada, Chemist.
1901. Gilles, Wm. S., The Cottage, Bocking, near Braintree, Essex, Technical Chemist.
1906. Gillies, Donald B., Apartado 125, Chihuahua, Mexico, Mining Engineer.
1888. Gillman, Gustave, Ferrocarril de Murcia á Granada, Aguilas, Prov. de Murcia, Spain, Civil Engineer.
1891 Gimingham, Edw. A., Croyland, Clapton Common, N., Technical Electrician.
1886. Girdwood, Dr. G. P., 111, University Street, Montreal, Canada, Professor of Chemistry.
1906. Girtin, Thomas, H. L. Raphael's Refinery, Thomas Street, Burdett Road, London, E., Bullion Refiner.
1903. Gladding, Thos. S., 181, Front Street, New York City, U.S.A., Analytical Chemist.
1886. Glaeser, F. A., Carpenters' Road, Stratford, E., Varnish Manufacturer.
1906. Glasel, Dr. Chas. J., Tanner.
1889. Glaser, Chas., 22, South Gay Street, Baltimore, Md., U.S.A., Consulting Chemist.
1906. Glass, A. Melville, 37, Chancery Lane, London, W.C., Patent Agent.
1907. Gleason, Fred. J., Walpole, Mass., U.S.A., Superintendent (Mass. Chemical Co.).
1901. Glegg, Robt., Agricultural Laboratory, Marischal College, Aberdeen, Analytical Chemist.
1894. Glen, Chas., Glengowan Printworks, Caldercruix, N.B., Calico Printer.

1900. Glendenning, Arthur, 31, Bright Street, Middlesbrough, Analytical Chemist.
1884. Glendinning, H., Winnington Park, Northwich, Cheshire, Technical Chemist.
1888. Gloag, Robt. F., Grove Hill, Middlesbrough, Secretary.
O.M. Glover, G. T., 24, Craven Hill Gardens, Lancaster Gate, W., Chemical Works Manager.
1896. Glover, H., c/o Powers, Weightman, Rosengarten Co., East Falls, Schuylkill, Philadelphia, Pa., U.S.A., Chemical Works Superintendent.
1905. Glover, Nathan H., 355, River Street, Mattapan, Boston, Mass., U.S.A., Gum Manufacturer.
O.M. Glover, William, Albareda 27, Seville, Spain, Technical Chemist.
1896. Goetz, Isidore, 5, Brondesbury Park, London, N.W., Mine Manager.
1907. Goldie, J. H. D., c/o Colonial Sugar Refining Co., Sydney, N.S.W., Australia, Chemist.
1898. Golding, Jno., Ashby Road, Kegworth, Derby, Agricultural Chemist.
1909. Goldman, M. Leon, The Crown Cork and Seal Co., 1511, Guilford Avenue, Baltimore, Md., U.S.A., Chemical Engineer.
1906. Goldschmidt, Dr. Karl, Chemical Works, Essen Ruhr, Germany, Manufacturing Chemist.
O.M. Goldschmidt, Dr. S. A., 43–51, Sedgwick Street, Brooklyn, N.Y., U.S.A., President (Columbia Chemical Works).
1897. Goldschmiedt, Dr. Guido, Laboratory, II Salmgasse 1, Prag, Austria, Professor in Imperial German University.
1895. Goldsmith, Byron B., 19, East 74th Street, New York City, U.S.A., Vice-President (American Lead Pencil Co.).
1899. Goldsmith, Dr. Jno. N., 67, Chancery Lane, London, W.C., Chemist.
1906. Goodall, Wm. Leslie, Finboro' Road, Stowmarket, Suffolk, Works Chemist.
1909 Goodban, Leonard, 43, Addison Gardens, Kensington, London, W., Works Chemist.
1900. Goodchild, Wm. H., 31, Etchingham Park Road, Finchley, N., Chemist.
1898. Goode, J. Archibald, 36, Trent Road, Brixton Hill, S.W., Analytical Chemist.
1906. Goodhue, Leonard H., c/o Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1904 Gooding, E. Claude, Willow House, Washford, Somerset, Chemical Student.
1898. Goodrich, Chas. C., 2, Rector Street, New York City, U.S.A., Rubber Manufacturer.
1884. Goodwin, C. C., Racefield, St. Margaret's Road, Altrincham, Cheshire, Soapmaker.
1894. Goodwin, Dr. W. L., The School of Mining, Kingston, Canada, Professor of Chemistry.
O.M. Goppelsroeder, Prof. Dr. F., Leimenstrasse 51, Basel, Switzerland, Professor of Chemistry.
1898. Gordon, Colin, Storers' Wharf, Wharf Road, Poplar, E., Chemical Engineer.
1884. Gordon, J. G., Queen Anne's Mansions, Westminster, S.W., Steel Manufacturer.
1908. Gordon, Read, c/o Gordon and Dillworth, 563–5, Greenwich Street, New York City, U.S.A., Food Manufacturer.
1905. Gorsline, Wm. H., 242, Culver Road, Rochester, N.Y., U.S.A., Secretary and Manager.
1891. Gorvin, Jno. C., 29, Bryn Road, Swansea, Assayer.
1897. Gossage, W. Winwood, Widnes, Lancashire, and (Journals), Abbots Lea, Woolton, Liverpool, Soap Manufacturer.
1909. Gosse, Abel, 122, Boulevard St. Germain, Paris, France, Engineer (Poulenc Frères).
1904. Gotthelf, August H., Hastings-on-Hudson, N.Y., U.S.A., Chemist.
1890. Goulding, Sir Wm. J., Bart., North Wall, Dublin, Manure Manufacturer.
O.M. Gowland, Prof. W., 13, Russell Road, Kensington, W., Professor of Metallurgy (Royal School of Mines).
1886. Goyder, G. A., 12, Pirie Street, Adelaide, South Australia, Chemist and Assayer.
1890. Grabfield, Dr. J. P., c/o Morris and Co., 35th Street and 11th Avenue, New York City, U.S.A., Chemist.
1906. Graesser, Norman H., Argoed Hall, Llangollen, N. Wales, Manufacturing Chemist.
1883. Graesser, R., Cefn, near Ruabon, North Wales, Manufacturing Chemist.
O.M. Graham, C. C., Oriel House, Scarborough, Yorks., Technical Chemist.
1908. Graham, Chas. W., 142, Bloor Street West, Toronto, Canada, Chemist.
1883. Grandage, H., India House, Whitworth Street, Manchester, Dyer.
1897. Granger, Dr. J. Darnell, 25, All Saints Street, Nottingham, and (Journals) Muggenhoferstrasse 44, Nürnburg, Germany, Analytical Chemist.
1905. Grant, Alexander, 13, Kilgraston Road, Edinburgh, Baker.
1896. Graves, Geo. H., c/o General Chemical Co., Bridgeport, Conn., U.S.A., Manufacturing Chemist.
1896. Graves, Walter G., 1950, East 90th Street, Cleveland, Ohio, U.S.A., Chemist.
1884. Gray, G. Watson, 8, Inner Temple, Dale Street, Liverpool, Consulting Chemist and Assayer.
1907. Gray, Henry M., Broompark, Duffield, Derby, Engineer.
1904. Gray, Jas., Heymann's Laboratory, P.O. Box 3127, Johannesburg, Transvaal, Chemist.
1901. Gray, J. Campbell, Glengoyt, Strines, near Stockport, Printworks Chemist.
1886. Gray, Jno., 3, Victoria Drive, Rock Ferry, near Birkenhead, Technical Chemist.
1903. Gray, Jno. Lathrop, c/o Tide Water Oil Co., East 22nd Street, Bayonne, N.J., U.S.A., Assistant Superintendent (Paraffin Works).
1910. Gray, Matthew A., c/o Ogilvie Flour Mills Co., Montreal, Canada, Chemist.
1896. Gray, Dr. Thos., The Technical College, Glasgow, Professor of Technical Chemistry.
1905. Gray, W. B., Messrs. Lever Bros., Balmain, Sydney, N.S.W., Australia, Analytical Chemist.
1903. Gray, Wm. S., 76, William Street, New York City, U.S.A., Chemical Merchant.
1908. Gray, Wm. T., Port Credit, Ontario, Canada, Starch Manufacturer.
1901. Greaves, Albert E., c/o P. Spence and Sons, Ltd., Goole Alum Works, Goole, Yorks., Works Chemist.
1891. Greaves, I. A. R., Brewer.
1894. Greaves, Wm., Coppée Coke Ovens, Pinxton, Alfreton, Chemical Engineer and Chemist.
1909. Greeff, Robert, jun., 20, Eastcheap, London, E.C., Chemical Merchant.
1894. Greeff, R. W., 20, Eastcheap, London, E.C., Chemical Agent.
O.M. Green, Prof. Arthur G., 49, Cardigan Road, Headingley, and Clothworkers' Department, The University, Leeds, Professor of Dyeing.
1907. Green, Clarence, c/o Nicholson and Co., Beaumont Works, St. Albans, Herts., Chemist.
1906. Green, Ernest, 113, Hulton Street, Moss Side, Manchester, Science Teacher.
O.M. Green, H., Hayle Mill, Maidstone, Paper Manufacturer.
1896. Green, Jno. Wilberforce, 22, Alwyne Road, Wimbledon, S.W., Technical Chemist.
O.M. Green, L., Lower Tovil, Maidstone, Paper Manufacturer.
1910. Green, Robert, 23, Park Street, Calcutta, India, Chemist.
1908. Green, Dr. W. Heber, Chemical Laboratory, The University, Melbourne, Victoria, Lecturer in Chemistry.
O.M. Greenaway, A. J., The Orchard, Chertsey, Surrey, Sub-Editor of Chemical Society's Journal.
1906. Greene, George M., c/o Colgate and Co., Jersey City, N.J., U.S.A., Chemist.
1909. Greenhough, George D., 21, Mincing Lane, London, E.C., Chemical Broker.

O.M. Greenway, T. J., c/o Potter's Sulphide Ore Treatment, Ltd., 369, Collins Street, Melbourne, Australia. Metallurgist.

1902. Greenwood. Conrad V., Noyna, Dowhills Road, Blundellsands, Liverpool. Cotton Mill Manager.

1907. Greenwood, Herbert W., 16, Longland Road, Liscard, Cheshire, Metallurgical Chemist.

O.M. Greenwood, Holmes, Regent House, Hartmann Street, Accrington, Lancashire, Technical Chemist.

1897. Gref, Anthony, 117, Hudson Street, New York City, U.S.A., Patent Lawyer.

1909. Gregory, Cecil H., The Morgan Crucible Co., Ltd., Battersea Works, London, S.W., Crucible Manufacturer.

1907. Gregory, Joshua C., 128, Wellington Street, Glasgow, Analytical and Consulting Chemist.

1890. Griffin, Jno. R., Kemble Street, Kingsway, W.C., Chemical Apparatus Maker.

1886. Griffin, Martin L., Emerson Laboratory, 177, State Street, Springfield, Mass., U.S.A., Consulting Chemist.

1909. Griffiths, E., Chemical Department. The University, Sydney, N.S.W., Australia, Demonstrator.

1902. Griffiths, Manfred E., 4, Temple Road, Stowmarket, Suffolk, Explosives Chemist.

1894. Griffiths, Thos., The Cedars, Clapham Common, S.W., Manufacturing Chemist.

1902. Grimwade, Wilfrid R., 335—343, Spencer Street, West Melbourne, Vic., Australia, Manufacturing Chemist.

1900. Grimwood, Robt. G., 43. Leaside Avenue, Muswell Hill, N., Analytical Chemist.

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1905. Grip, August E., 495. Columbia Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.

1888. Gripper, Harold. Great Central Railway. Gorton, Manchester, Analytical Chemist.

1909. Grist, John M., 10, Cumberland Avenue, Gravesend. Kent, Explosive Works Chemist.

1906. Groenewoud, Sidney H., 36, Grosvenor Road. Highbury, N., Analytical Chemist.

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1896. Grosvenor, W. M., jun., 1123, Broadway, New York City, U.S.A., Consulting Chemical Engineer.

1908. Grottanelli, Dr. F. W., Dinamite Nobel, Avigliana, Torino, Italy, Industrial Chemist.

1909. Grove, Daniel, Hampson's Buildings, Smith Street, Durban, Natal, Newspaper Proprietor.

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1907. Groves, J. Stuart, c/o E. I. du Pont de Nemours Powder Co., Experimental Station, Wilmington, Del., U.S.A., Chemist.

1903. Grundy, F. Barnes, Red Lodge, King's Road, Richmond, Surrey, Technical Chemist.

1899. Gudeman, Dr. E., 903. Postal Telegraph Building. Chicago, Ill., U.S.A., Chemist.

1906. Guess, Geo. A., c/o Tennessee Copper Co., Copperhill, Tenn., U.S.A., Chemist.

1898. Guess, Harry A., c/o Federal Lead Co., Flat River, Mo., U.S.A., Chemist and Manager.

1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.

1909. Gullick, Wm. A., Government Printing Office, Sydney, N.S.W., Government Printer.

1906. Gulline, Percy, Merrimack Manufacturing Co., Lowell, Mass., U.S.A., Printworks Superintendent.

1904. Gundlach. Walter, 843. West End Avenue, New York City, U.S.A., Superintendent of Colour Works.

1905. Gundlich, Dr. Charles, c/o Thorium Chemical Co., Maywood, N.J., U.S.A., Technical Chemist.

1908. Gunn, Andrew, c/o Gunn's, Ltd., West Toronto, Canada, Pork Packer.

1903. Gunn, Gilbert, 181, Bury New Road, Heywood, Lancs., Paper Mill Chemist.

1900. Günther, Chas. E., Liebig's Extract of Meat Co., Ltd., 4, Lloyd's Avenue, London, E.C., Merchant.

1910. Gunther, C. M., Pyrmont Sugar Refinery, Sydney, N.S.W., Sugar Chemist.

1894. Gurney, J. Clare, Fundicion de Plomo de D. Miguel Zapata, Portman, Prov. de Murcia, Spain, Analytical Chemist.

1899. Gutcher, Wm., Singapore Oil Mills, Singapore, S.S., Superintendent Engineer.

1903. Guthrie, Alan, c/o Cooper, Allen, and Co., Cawnpore, India, Leather Chemist.

1901. Guthrie. John M., 199, Ferry Road, Leith, N.B., Analytical Chemist.

1909. Guttmann, Camillo J., 18, Aberdare Gardens, West Hampstead, N.W., Chemical Engineer.

1903. Guttmann, Dr. Leo F., School of Mining, Queen's University, Kingston, Ont., Canada, Research Chemist.

1892. Guttmann, Oscar, 60, Mark Lane, London, E.C., Consulting Chemical Engineer, M.Inst.C.E.

H

1904. Hacking. D. H., Enfield Soap Works, Clayton-le-Moors, near Accrington, Lancs., Soap Manufacturer.

1900. Haddock, Arthur G., c/o The Castner-Kellner Alkali Co., Wallsend-on-Tyne, Technical Chemists.

1898. Haddow, Geo., Parkview, Redding, Polmont Station, N.B., Chemist.

1887. Hadfield, Sir Robert A., Hecla Works, Sheffield; 28, Hertford Street, Mayfair, London, W., and (Journals) Parkhead House, Sheffield, Steel Founder.

1884. Hadkinson, F., Pamphila Oil and Soap Works, Mitylene, Mediterranean, Oil Refiner and Soap Manufacturer.

O.M. Hadkinson, R., Smyrna, Asia Minor, Oil Refiner.

1904. Hadley, Geo., 58, Halesowen Street, Blackheath, Staffs., Spelter Works Manager.

1902. Haff, Max M., Laboratory, 188, Metcalfe Street, Ottawa, Canada, Chemist.

1906. Hagen, Dr. Carl, c/o E. I. du Pont de Nemours Powder Co., 14, Bishopsgate Street Within, London, E.C., Representative.

1887. Haig, Robert, Dollarfield, Dollar, N.B., Chemical Engineer.

1904. Haigh, B. Wilson, By-Product Coke Oven Dept., Barnsley Main Colliery, Barnsley, Yorks., Chemical Engineer.

1896. Haigh, De Laguel, 39, Hill Crest, Summit, N.J., U.S.A., Chemist.

1888. Hailes, A. J. de, 15, Red Lion Square, London, W.C., Analytical Chemist.

1889. Haines, Reuben, Haines Street, near Chew Street, Germantown, Philadelphia, Pa., U.S.A., Analytical Chemist.

O.M. Hake, C. N., Defence Department, Melbourne, Victoria, Australia, Chemical Adviser.

1908. Hakim Ali, Prof. M., Islamiah College, Lahore, Punjab, India, Professor of Physical Science.

1903. Halbert, Thos., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.

1888. Hale, Edw. P., Endmoor, near Kendal, Analytical Chemist.

1887. Hall, Allan T., c/o Sissons Bros. and Co., Ltd., Hull, Oil Refiner and Varnish Manufacturer.

1905. Hall, Archibald A., Armstrong College, Newcastle-on Tyne, Demonstrator in Chemistry.

1898. Hall, Clarence A., 412, Arcade Building, Philadelphia, Pa., U.S.A., Chemist.

O.M. Hall, Edgar, Silver Spur, Stanthorpe, Queensland, Australia, Technical Chemist.

1909. Hall, Harold, 98, Birkin Avenue, Nottingham, Analyst.

1902. Hall, Henry, c/o Booth and Co., Irk Vale Works, Middleton, Lancashire, Dyer and Finisher.

1893. Hall, Jas. W., Bombay, Baroda, and Central India Railway, Sabarmata, near Ahmedabad, India, Linseed Oil Mills Manager.

1885. Hall, Jno. A., Victoria Chemical Works, Victoria, British Columbia, Analytical Chemist.
1908. Hall, John S., Manor House, Overseal, Ashby de-la Zouch, Chemist.
1900. Hall, Jos. J., c/o T. M. Sinclair & Co., Cedar Rapids, Iowa, U.S.A., Chemist.
1896. Hall, S. Godfrey, East London Soap Works, Bow, E., Soap Maker.
1886. Haller, Geo., Sussex House, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1893. Haller, H. Loft, 26, Scale Lane, Hull, Analytical Chemist.
1895. Halliwell, Edw., c/o Ribble Joint Committee, 2, Stanley Place, Preston, Chief Inspector.
1900. Hallock, Dr. Albert P., 440, First Avenue, New York City, U.S.A., Chemist.
1892. Hamaguchi, Gihei, Hiro Mura, Arida Gori, Wakayama Ken, Japan, Soy Manufacturer.
1897. Hambly, Fred. J., Buckingham, Quebec, Canada, Chemist.
1901. Hambuechen, Carl, 217, South Mills Street, Madison, Wis., U.S.A., Electro-Chemist.
1910. Hamburg, Dr. Max, c/o The British Diamalt Co., Sawbridgeworth, Herts., Chemist and Manager.
1892. Hamilton, Robt., 40, Sefton Terrace, Beeston Hill, Leeds, Analytical Chemist.
1884. Hamilton, Robert, Glengarnock Chemical Co., Ltd., Glengarnock, N.B., Works Manager.
1898. Hammersley, W. Stanley, 5, Rue Scaffart, Soignies, Belgium, Tanner.
O.M. Hammill, M. J., The Gables, St. Helens, Alkali Manufacturer.
O.M. Hammond, J., Gas Works, Eastbourne, Sussex, Gas Manager.
1906. Hancock, H. Irving, Blue Point, N.Y., U.S.A., Chemist.
1905. Hancock, Thos. J., P.O. Box 303, Ishpeming, Mich., U.S.A., Chemist.
1900. Hancock, Walter C., 10, Upper Chadwell Street, Myddelton Square, London, E.C., Chemist.
1896. Hand, Daniel, 30, Mount Pleasant Avenue, Newark, N.J., U.S.A., Chemist.
1889. Handy, Jas. O., 325, Water Street, Pittsburg, Pa., U.S.A., Chemist.
1888. Hanks, Abbot A., 425, Washington Street, San Francisco, Cal., U.S.A., Assayer.
1901. Hanna, Charles E., P.O. Box 2572, Montreal, Canada, Secretary.
1905. Hanna, W. W., 109, North Water Street, Philadelphia, Pa., U.S.A., Aniline Colour Manufacturer.
1905. Hanson, H. Norman, Field Head, Brighouse, Yorks., Research Assistant.
1908. Hanson, W. G., c/o United States Glue Co., Milwaukee, Wis., U.S.A.
1909. Harbord, F. W., 16, Victoria Street, Westminster, S.W., Metallurgist.
1905. Harcourt, Prof. R., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.
1904. Hard, Dr. James M. B., 2a, del Canadá, Colonia de Sta. Julia, Mexico, D.F., Chemist and Pathologist.
1901. Hardcastle, G. Fred., 29, Normanton Road, Leicester, Teacher of Science and Technology.
1894. Harden, Dr. Arthur, F.R.S., 2, Marlborough Road, Richmond, Surrey, Lecturer in Chemistry.
1909. Harding, Herbert, 47, Streathbourne Road, Upper Tooting, S.W., Assistant Examiner (H.M. Patent Office).
1908. Hardman, Benj., c/o Kodak, Ltd., Wealdstone, Middlesex, Analytical Chemist.
1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Hackins Hey, Liverpool, Chemist.
1905. Hardy, Chas. H., c/o Reckitt & Sons, Ltd., Hull, Chemist.
1907. Harfeld, Louis E., 10, Elsworthy Terrace, London, N.W., Merchant.
1906. Hargreaves, Frank, Hough Green, Widnes, Chemist.
1896. Hargreaves, Jas., May Villa, Peel House Lane, Widnes, Lancashire, Chemical Engineer.
O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.
1904. Harker, Dr. George, 35, Boulevarde, Petersham, Sydney, N.S.W., Australia, Chemist.
1909. Harland, Robert M., 37, Lombard Street, London, E.C., Analytical Chemist and Assayer.
1893. Harlock, E. B., Newton House, Middlewich, Chemical Manufacturer.
1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M.Inst.C.E.
1905. Harper, Dr. Henry W., University of Texas, 2208, San Antonio Street, Austin, Texas, U.S.A., Professor of Chemistry.
1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.
1885. Harris, Booth, jun., Beeleigh, Victoria Road, Buckhurst Hill, Essex, Soap Maker.
O.M. Harris, David, F.R.S.E., Lyncombe Rise, Prior Park Road, Bath, Chemical Manufacturer.
1897. Harris, Fred. W., 38, Cochrane Street, Glasgow, Public Analyst.
1907. Harris, John B., Danforth Avenue, Toronto, Canada, Manufacturer of Glues and Fertilisers.
1906. Harris, Jonathan W., c/o Western Electric Co., 463, West Street, New York City, U.S.A., Chemist.
1907. Harris, Thos. E., c/o The Union Acid Co., 17, Cooper Street, Manchester, Chemical Merchant.
1906. Harris, Wm. G., jun., 25, William Street, Toronto, Canada, Metallurgist.
O.M. Harrison, A., Thames Sugar Refinery, Silvertown, London, E., Sugar Works Chemist.
1905. Harrison, E. F., Langholm, Edgar Road, South Croydon, Analytical Chemist.
1909. Harrison, Edwin D., 86, Harrison Place, Irvington, N.J., U.S.A., Celluloid Manufacturer.
1883. Harrison, G. Herbert, Hagley, Stourbridge, Chemist.
1892. Harrison, Prof. John B., C.M.G., Government Laboratory, Georgetown, British Guiana, Government Analyst.
1907. Harrison, W., 14, Devonshire Place, Ardwick, Manchester, Chemist.
1898. Harrison, Wm. H., Coimbatore, India, Agricultural Chemist (Government of Madras).
1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.
1886. Hart, Bertram H., Rosslyn, High Street, Sidcup, Kent, Analytical Chemist.
O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.
1905. Hart, George Adam, Sewage Engineers' Office, Municipal Buildings, Leeds, Civil Engineer.
1890. Hart, H. W., 5, Cambridge Road, Ansdell, Lytham, Lancashire, Analytical Chemist.
1897. Hart, Wm. Beamont, Manchester Laboratory, 8, Exchange Street, Manchester, Consulting Chemist.
1908. Hartley, Bernard C., 56, Wood View, Manningham, Bradford, Analytical Chemist.
1883. Hartley, Joseph, Avondale, Romiley, Cheshire, Technical Chemist.
1889. Hartley, R. Kent, Springwood House, Deganwy, near Llandudno, Chemical Works Manager.
O.M. Hartley, Prof. W. N., D.Sc., F.R.S., Royal College of Science, Dublin, Professor of Chemistry.
1905. Hartshorne, Wm. D., 40, Pleasant Street; and (Journals), Arlington Mills, Methuen, Mass., U.S.A., Agent.
1901. Hartwell, S. Warren, 119, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Chemist.
1901. Hartzell, Harry S., 126, North 4th Street, Allentown, Pa., U.S.A., Chemist.
1908. Harvey, Arthur J., 88a, East India Dock Road, Poplar, E., Chemist.
1885. Harvey, Ernest W., Stoneleigh, Grove Road, Clapham Park, S.W., A.R.S.M., Engineer.
1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.
1899. Harvey, Thos. F., 69, North Road, West Bridgford, Nottingham, Analyst (Drug Co.).
1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.

1908. Harvey, W . Ross, c/o R Lehmann and Co., Ltd., Peninsular House, Monument Street, London, E.C., Starch Manufacturer.

1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.

1906. Haskell, Walter F., 234, Bridge Street, Westbrook, Maine, U.S.A., Textile Chemist and Colourist.

1900. Haslwanter, Chas., 447, Spruce Street, Richmond Hill, Long Is., N.Y., U.S.A., Analytical Chemist.

1909. Hassan, E. A., 56, Somerset Street, Ottawa, Canada, Mechanical Engineer.

1897. Hasslacher, Jacob, P.O. Box 1999, New York City, U.S.A., President, Roessler-Hasslacher Chemical Co.

1903. Hatschek, Emil, c/o S. Bornett and Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Engineer.

1887. Hatton, Wm. P., c/o W. R. Hatton and Sons, Wormwood Scrubs, W., Starch Works Manager.

1906. Havercroft, Arthur E., Glenholme, Burton Road, Hornsea, Yorks., Chemist.

1899. Hawdon, H. S., Cleadon, near Sunderland, Manager.

1909. Hawes, Edward, 45, Howard Park Avenue, Toronto, Canada, Manufacturing Chemist.

1895. Hawker, E. W., Gladstone Chambers, Adelaide, South Australia, Metallurgist.

1910. Hawkes, Cornelius A., 7, Millman Street, Bedford Row, London, W.C., Analytical Chemist.

1902. Hawkins, Clement C., c/o The Texas Co., Port Neches, Texas, U.S.A., Chemist.

1897. Hawkins, Ernest M., Watling Chambers, Canterbury, Chemist.

1905. Hawkins, Henry, Moyola Villa, Lansdown, Limerick, Ireland, Gas Engineer.

1893. Hawkins, J. Dawson, c/o U. S. Reduction and Refining Co., Colorado Springs, Colo., U.S.A., President and General Manager.

1887. Hawliczek, Josef, c/o United Alkali Co., Sullivan Works, Widnes, Consulting Chemical Expert.

1899. Haworth, Dr. Edw., Sunnyside, Norman Road, Runcorn, Cheshire, Chemist.

1903. Haworth, Herbert, Crown Works, Appley Bridge, near Wigan, Director (Grove Chemical Co.).

1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.

1895. Hay, Alex. B., Kelvindock Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.

1909. Haydon, James R., 91, Ampthill Road, Aigburth, Liverpool, Works Manager and Chemist.

1894. Haynes, David O., 90, William Street, New York City, U.S.A., Proprietor, "Pharmaceutical Era."

1902. Hays, B. F., c/o E. R. Squibb and Sons, 80, Beekman Street, New York City, U.S.A., Pharmaceutical Chemist.

1906. Hayworth, W. P., 47, Highfield Road, Dartford, Kent, Chemist.

1905. Hazard, Fred. R., P.O. Box 2, Syracuse, N.Y., U.S.A., President (Solvay Process Co.).

1903. Hazen, Chas. R., 258, Prince Albert Avenue, Westmount, Quebec, Canada, Chemist.

1894. Heal, Carlton, Dalston House, Dumfries, N.B., Tanner.

O.M. Heath, R. C., Myton Grange, near Warwick, Chemical Manufacturer.

1905. Heathcote, Henry L., c/o Rudge-Whitworth, Ltd., Coventry, Research Chemist.

1904. Heaton, Noel, Denmark House, Stonebridge Park, London, N.W., Colour Manufacturer.

1895. Hebden, Jno. C., P.O. Box 465, Providence, R.I., U.S.A., Works Manager and Chemist.

1905. Heberlein, Dr. Edw., c/o H. T. Enthoven & Sons, Ltd., 247, Rotherhithe Street, London, S.E., Works Manager.

1889. Hecht, Jos. L., c/o French and Hecht, Davenport, Iowa, U.S.A., Analytical Chemist.

1900. Heckman, J. Conrad, Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.

1885. Hedley, Armorer, Durrant House, Bournemouth, Hants.

1902. Heebner, Prof. Chas. F., Ontario College of Pharmacy, Toronto, Canada, Professor of Pharmaceutical Chemistry.

1903. Hegeman, John W., 102, Barbey Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Hehner, Charles, 155, Dunn Avenue, Parkdale, Toronto, Canada, Assistant Manager.

O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.

1908. Heilmann, Dr. Ernst, Güstrow, Mecklenburg, Germany, Chemical Manufacturer.

1909. Heinke, Dr. J. L., Hilton Lane, Walkden, Manchester, Chemist.

1887. Hellier, E. A., Avonside Varnish Works, St. Philip's Marsh, Bristol, Varnish Manufacturer.

1885. Hellon, Dr. R., 40, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.

1903. Helps, D. H., c/o Reading Gas Co., King's Road Works, Reading, Engineer and Manager.

1908. Helps, James W., Gas Works, Waddon, Croydon, General Manager, Gas Co.

1898. Hemingway, Frank C. R., 133, Front Street, New York City, U.S.A.

1883. Hemingway, H., 9, Albemarle Mansions, Hampstead, N.W., Chemical Manufacturer.

1884. Hempleman, F. S., 39, Brunswick Terrace, Hove, Sussex, Manure Manufacturer.

1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.

1883. Henderson, Prof. G. G., The Technical College, George Street, Glasgow, Professor of Chemistry.

1902. Henderson, Prof. Jas. A. Russell, Chihli Provincial College, Paoting-fu, North China, Professor of Chemistry and Physics.

1900. Henderson, J. Brownlie, Government Analyst's Office, Brisbane, Queensland, Government Analyst.

1894. Henderson, Jos., Eskbank Ironworks, Lithgow, N.S.W., Australia, Blast Furnace Manager.

1894. Henderson, Norman M., Broxburn Lodge, Broxburn, N.B., Oil Works Manager.

O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.

1893. Hendrick, Jas., Marischal College, Aberdeen, Lecturer on Agricultural Chemistry.

1906. Henius, Dr. Max, 1135–1147, Fullerton Avenue, Chicago, Ill., U.S.A., Secretary, Brewers' School.

1904. Henley, Hon. F. R., 9, Beaufort Gardens, London, S.W., Brewers' Chemist.

1906. Henning, C. I. B., c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Chemist.

1894. Henshaw, Sam., Glenthorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.

1908. Henzell, Chas. G., 19, Cardigan Road, Leeds, Waterworks Engineer.

1906. Herig, Harry W., 35, Rose Avenue, Jersey City, N.J., U.S.A., Chemist.

1897. Heriot, T. H. P., Mount Edgecombe Estate, Natal, South Africa, Analytical Chemist.

1908. Herlin, Chas., Nitroglycerin Aktiebolaget, Stockholm 2, Sweden, Chemical Engineer.

O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.

O.M. Heron, John, 110, Fenchurch Street, London, E.C., Brewing Chemist.

1903. Herreshoff, J. B. F., 40, West 69th Street, New York City, U.S.A., Chemical Engineer.

1887. Herriot, Wm. Scott, Clarewood, Thorntonhall, Lanarkshire, Mechanical Engineer.

O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.

1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Assistant Professor of Metallurgy.

1898. Hersey, Dr. Milton L., P.O. Box 554, Montreal, Canada, Consulting Chemist.

1901. Hershey, Aldus N., c/o J. L. Hopkins and Co., 100, William Street, New York City, U.S.A., Chemist.

1903. Herstein, Dr. Bernard, Department of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A., Technical Chemist.

1906. Herty, Prof. Chas. H., University of N. Carolina, Chapel Hill, N.C., U.S.A., Professor of Chemistry.

1906. Herz, Dr. Albert, Rosemount, Hipperholme, Halifax, Yorks., Chemist.
1885. Hess, Dr. Adolph, Kirkstall Road, Leeds, Chemical Manufacturer.
1907. Hess, Arthur F., c/o A. Hess & Bro., Ltd., Kirkstall Road, Leeds, Oil Distiller.
1904. Hess, H. W., c/o Libbey Glass Co., Toledo, Ohio, U.S.A., Chemist.
1905. Hesse, Dr. Bernhard C., 90, William Street, New York City, U.S.A., Chemist.
1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.
1904. Heurich, Christian, 1307, New Hampshire Avenue N.W., Washington, D.C., U.S.A., Brewer.
1894. Hewitt, A. H., The Green Island Cement Co., Ltd., Hong Kong, China, Engineer.
O.M. Hewitt, Dr. D. B., Grove Mount, Davenham, Cheshire, Alkali Manufacturer.
1896. Hewitt, Dr. J. Theo., F.R.S., 11, The Avenue, Surbiton, Lecturer.
1890. Hewlett, John C., 40-42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.
1907. Hewson, Geo. W., 22, Palmer Street, Jarrow-on-Tyne, Analytical Chemist.
1893. Hey, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.
1906. Heys, Charles H., Toronto Arcade, Toronto, Canada, Consulting Chemist.
1906 Hibbert, John C., 19, Haddon Road, West Bridgford, Nottingham, Chemist.
1901. Hiby, Dr. Walter, c/o The Otto Hilgenstock Coke Oven Co., Ltd., Crigglestone, near Wakefield, Yorks, Chemical Engineer.
1906. Hicking, W. Norton, Queen's Road Works, Nottingham, Lace Dresser.
1906. Hickman, T. Moore, Holmdale, Penn Road, Wolverhampton, Analyst.
1897. Hicks, Edwin F., 4837, Fairmount Avenue, Philadelphia, Pa., U.S.A., Analytical Chemist.
1893. Hicks, Jas. A., c/o Sir Boverton Redwood, 4, Bishopsgate Street Within, London, E.C., Analytical Chemist.
O.M. Higgin, W. H., Hollywood, Lostock, near Bolton-le-Moors, Chemical Manufacturer.
1886. Higgins, C. L., 41, Knowsley Road, Cressington Park, Liverpool, Manufacturing Chemist.
1905. Higgins, Dr. Eric, 5, Rolleston Drive, Wallasey, Cheshire, Chemist.
1905. Higgins, John M., 39, Queen Street, Melbourne, Vic., Australia, Consulting Metallurgist.
1908. Higgins, S. H., Luncarty Bleachfield, Perth, N.B., Chemist and Asst. Manager.
1909. Higson, Frank, 52, Chapel Street, Salford, Manchester, Analytical Chemist.
1909. Higuchi, Ken-ichi, No. 9, Atagomachi Ichome, Shiba, Tokyo, Japan, Chemical Engineer, Japanese Department of Agriculture and Commerce.
1908. Hill, A. Bostock, 14, Temple Street, Birmingham, Public Analyst.
1908. Hill, A. Clarence, c/o Pinchin, Johnson, & Co., Ltd., Minerva House, Bevis Marks, London, E.C., Managing Director.
1909. Hill, Arthur E., c/o Glamorgan Coal Co., Ltd., Constantinople, Technical Chemist.
1903. Hill, Chas. Alex., c/o British Drug Houses, Ltd., 22–30, Graham Street, City Road, E.C., Chemist.
1897. Hill, Dr. Herbert M., 21, Niagara Street, Buffalo, N.Y., U.S.A., City Chemist.
1907. Hill, James A., 70, York Street, Runcorn, Cheshire, Technical Chemist.
1908. Hill, J. H. F., c/o Broken Hill Proprietary Co., Broken Hill, N.S.W., Australia, Mining Engineer.
O.M. Hill, J. K., 13, Osborne Place, Copland Road, Govan, near Glasgow, Manufacturing Chemist.
1892. Hill, Sydney, Eastholme, Prince's Avenue, and (Journals) c/o Blundell, Spence, & Co., Ltd., Hull, Analytical Chemist.
1903. Hill, W. Basil, Foss Islands Tannery, York, Tanner.
1902 Hill, Wm. C. H[illegible]jon, American Rubber Co., East Cambridge, Mass., U.S.A., Chemist.
1898 Hill-Jones, Thos., Invicta Mills, Bow Common Lane, London, E., Manufacturing Chemist.
O.M. Hills, C. H., Anglesea Copper Works, Low Walker, Newcastle-on-Tyne, Copper Smelter.
1894. Hills, Harold F., Commercial Gas Works, Stepney, London, E., Analytical Chemist.
O.M. Hills, W., Oxford Works, Tower Bridge Road, London, S.E., Pharmaceutical Chemist.
1899. Hinchley, J. W., 85, Gracechurch Street, London, E.C., Chemical Engineer.
1904. Hinckley, J. F., 550, East 7th Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dye-works Manager.
1909. Hinks, Edward, 16, Southwark Street, London, S.E., Analyst.
1899. Hinks, Percy J., Danger Building Dept., Royal Laboratory, Woolwich Arsenal, S.E., Chemist.
1891. Hinman, Bertrand C., Coventry House, South Place, Finsbury, London, E.C., Metallurgical Chemist.
1905. Hiorns, A. H., Riga, Gravelly Hill, near Birmingham, Science Teacher.
1909. Hirsch, Fritz, 49, Coach Road, Wallsend-on-Tyne, Analytical Chemist.
1895. Hirst, H. Reginald, Bank House, Staincliffe, Batley, Yorks, Works Chemist.
1907. Hirt, Wilhelm B., c/o Cuming, Smith, & Co., Ltd., Yarra Junction, Vic., Australia, Analytical Chemist.
1907. Hirtz, Dr. Heinrich, 18, Avenue Road, London, N.W., Chemist.
1896. Hislop, Geo. R., (Journals) Gas Works, (communications Greenhill House, Underwood Road, Paisley, N.B., Gas Engineer and Manager.
1900. Hobbs, Alex. F., c/o The United States Finishing Co., Box A, North Station, Providence, R.I., U.S.A., Printworks Superintendent.
1900. Hobbs, Dr. Perry L., Western Reserve Medical College, and (Journals) 2047, East 9th Street, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1906. Hobsbaum, Isaac B., c/o Lockett Bros. and Co., Iquique, Chile, Analytical Chemist.
1905. Hobson, Alfred, Dantzic Brewery, Imperial Street, Regent Street, Leeds, Brewer and Wine Manufacturer.
1907. Hochstetter, Robt. W., Oak and Bellevue Avenues, Mount Auburn, Cincinnati, Ohio, U.S.A., Superintendent.
1909. Hodgart, Matthew, Vulcan Works, Paisley, N.B., Engineer.
1894. Hodge, Andrew, Brookfield House, Whaley Bridge, near Stockport, Printworks Chemist.
1890. Hodges, Harry B., Long Island Railroad Co., Long Island City, N.Y., U.S.A., Chemical Engineer.
O.M. Hodgkinson, Dr. W. R., 89, Shooters Hill Road, Blackheath, S.E., Professor of Chemistry.
O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.
1897. Hodgson, Matthew, Ardmore, Church Hill, Wicklow, Ireland, Technical Chemist.
1890. Hodgson, Wm., 66, Deansgate, Manchester, Oil and Colour Broker.
1906. Hogarth, Julius W., The University, Sydney, N.S.W., Australia, Demonstrator of Chemistry.
1886. Hogben, W., Post Office, Port Talbot, South Wales, Chemical Expert (Celluloid, etc.
O.M. Hogg, T. W., c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne, Metallurgical Chemist.
1905. Holcroft, Harold, Parkdale, Wolverhampton, Ironfounder.
1899. Holden, Archie Neill, c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Chemist.
1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.
1904. Holden, Norman N., c/o Hardman and Holden, Ltd., Colliery Lane, Clayton, Manchester, Manufacturing Chemist.

1902. Holdsworth, Ernest T., 10, Merton Road, Bradford, Dyer.
1904. Holgate, Arthur, c/o Wm. Holgate and Sons, Ltd., 15, Earle Street, Liverpool, Corn Miller.
1885. Holgate, T. E., 173, Hollins Grove, Darwen, Lancashire, Metallurgist.
1884. Holgate, Thos., 5, Victoria Street, Westminster, S.W., Gas Engineer.
O.M. Holland, Philip, 22, Taviton Street, Gordon Square, London, W.C., Analytical Chemist.
1892. Holland, Philip H., 546, Sherbrooke Street West, Montreal, Canada, Merchant.
1901. Hollick, Herbert, 304, The Robeson, Camden, N.J., U.S.A., Chemical Engineer.
1909. Holliday, F. E., 81, Fulton Street, New York City, U.S.A.
1902. Holliday, Lionel B., Lunnclough Hall, Huddersfield, Chemical Manufacturer.
1896. Hollings, J. Spencer, Vrondeg, near Wrexham, North Wales, Works Manager.
1909. Hollingworth, David V., Gas Offices, Bloom Street, Salford, Gas Works Analyst.
1903. Hollinshead, Peter, 19, The Hollow Way, Runcorn, Cheshire, Chemist.
1900. Hollinshead, Dr. W. H., Wingrove Avenue, Nashville, Tenn., U.S.A., Teacher of Chemistry.
1904. Holloway, E. G., c/o Jas. S. Kirk and Co., 360, North Water Street, Chicago, Ill., U.S.A., Chemist.
1890. Holloway, G. T., 57-58, Chancery Lane, London, W.C., Analytical and Consulting Chemist.
1883. Holmes, Ellwood, Wyncote, Jesmond Park East, Newcastle-on-Tyne, Colour Manufacturer.
O.M. Holmes, F. G., Northcroft, Tewitwell Road, Harrogate, Yorks., Technical Chemist.
1900. Holthouse, Harold B., 12, Melton Grove, West Bridgford, Notts., Chemist.
1902. Holton, Alf. L., Chemical Dept., Gas Works, Bradford Road, Manchester, Chemist.
1892. Holton, E. C., 601, Canal Road N.W., Cleveland, Ohio, U.S.A., Chemist.
1893. Holzapfel, Max, Kenton Lodge, Newcastle-on-Tyne, Manufacturer.
1893. Homfray, D., The Ings, Misterton, near Gainsborough, Analytical Chemist.
1909. Hook, Russell W., 8, Holton Street, West Medford, Mass., U.S.A.
1904. Hooker, A. H., c/o The Development and Funding Co., Niagara Falls, N.Y., U.S.A., Manufacturing Chemist.
O.M. Hooper, E. Grant, 16, Royal Avenue, Sloane Square, S.W., Chemist.
1889. Hooper, Ernest F., c/o Brotherton and Co., Ltd., Wear Tar Works, South Dock, Sunderland, Technical Chemist.
1888. Hope, Jas., The Nickel Co., Kirkintilloch, N.B., Nickel Works Manager.
1904. Hopewell, Fredk., 59, William Street, Montreal, Canada, Manager.
1892. Hopkins, Erastus, Ocala, Fla., U.S.A., Consulting Chemist.
1905. Hoppenstedt, A. W., c/o Elk Tanning Co., Ridgway, Pa., U.S.A., Chemist.
1895. Home, Dr. W. D., 175, Park Avenue, Yonkers, N.Y., U.S.A., Consulting Chemist.
1904. Hornsey, J. W., 27, William Street, New York City, U.S.A., Chemical Engineer.
1900. Horsfall, Jno., 4, Grange Avenue, Rawtenstall, Manchester, Analytical and Consulting Chemist.
1902. Horsfall, L. H., Carnbuck Club, Perambur Barracks, Madras, N. India, Chemist.
1901. Horton, Edw., jun., 10, Smith Street, Chelsea, S.W., Student.
1906. Hoseason, Jas. H., Sun Buildings, Bridge Street, Manchester, Chemical Manufacturer.
1890. Hoskins, A. Percy, Clonlee, Rosetta Park, Belfast, Ireland, Analytical Chemist.
1899. Hoskins, Wm., Room 54, 81, South Clark Street, Chicago, Ill., U.S.A., Chemist.
1899. Houlder, Bertram E., 50, Lady Margaret Road, Southall, Middlesex, Chemist.
1892. Houston, John, 26, Princess Street, Manchester, Drysalter.
O.M. Howard, A. G., Burnt House, Chigwell, Essex, Chemical Manufacturer.
1901. Howard, Bernard F., Quantocks, Montalt Road, Woodford Green, Essex, Chemist.
O.M. Howard, D., Devon House, Buckhurst Hill, Essex, Chemical Manufacturer.
1887. Howard, D. Lloyd, City Mills, Stratford, E., Chemical Manufacturer.
1898. Howard, Henry, 36, Amory Street, Brookline, Mass., U.S.A., Chemical Engineer.
1902. Howard, Nelson A., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.
1904. Howard, T., 24, Bulstrode Road, Hounslow, W., Chemist.
O.M. Howard, W. D., 11, Cornwall Terrace, Regent's Park, London, N.W., Chemical Manufacturer.
1906. Howe, Chester A., 124, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.
1905. Howe, Roland E., 15, Highland Street, Concord Junction, Mass., U.S.A., Explosives Chemist.
1909. Howell, Harry, c/o W. C. Holmes & Co., Whitestone Ironworks, Huddersfield, Chemical Engineer.
1904. Howell, Walter L., Room U., Custom House, New Orleans, La., U.S.A., Chemist.
1899. Howles, Fred., c/o McDougall Bros., 66-68, Port Street, Manchester, Chemist.
1889. Howorth, F. Wise, 46, Lincoln's Inn Fields, W.C., Technical Chemist and Chartered Patent Agent.
1907. Howroyd, Richard R., c/o Calder Mersey Extract Co., Ltd., Ditton, near Widnes, Chemist.
1909. Howse, Geo. H., 67, Union Street, Smethwick, Birmingham, Paint Manufacturer.
1906. Hoyler, Fritz, 49, Market Street, Perth Amboy, N.J., U.S.A., Chemist.
1896. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.
1900. Hübner, Julius, Ash Villa, Cheadle Hulme, Cheshire, Director of Dyeing and Papermaking Departments (Municipal School of Technology).
1909. Hudson, Baker, Public Library, Middlesbrough, Librarian.
1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.
1905. Hudson, O. F., The University, Edgbaston, Birmingham, Lecturer on Metallurgy.
1909. Huether, David J., c/o Continental-Mexican Rubber Co., Torreon, Coahuila, Mexico, Chemist.
O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.
1909. Hughes, L. S., c/o Picher Lead Co., Joplin, Mo., U.S.A., Chief Chemist.
1898. Hughes, Raymond M., Miami University, Oxford, Butler Co., Ohio, U.S.A., Professor of Chemistry and Physics.
1908. Hughes, Wm. E., Chemical Laboratory, Messrs. W. Canning and Co., Great Hampton Street, Birmingham, Electro Chemist.
1906. Hulme, Robert B., c/o Phoenix Cotton Oil Co., Memphis, Tenn., U.S.A., Chemical Engineer and Manager.
1905. Hulton, H. F. E., 11, Colinette Road, Putney, S.W., Chemist.
1905. Humel, Edward J., Lake Avenue, cor. Edward Street, Lakewood, Cleveland, Ohio, U.S.A., Chemist.
1893. Humfrey, Chas., Hilderstone, Hartford, Cheshire, Alkali Works Manager.
1901. Humphrey, Henry C., c/o Corn Products Refining Co., 26, Broadway, New York City, U.S.A., Chemist.
1902. Humphrey, Rich. L., 1001, Harrison Building, Philadelphia, Pa., U.S.A., Civil Engineer.
1903. Humphreys, A. C., 165, Broadway, New York City, U.S.A., Engineer.
1908. Humphries, Albert E., Coxes Lock Mill, Weybridge, Surrey, Flour Miller.

O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts., Gas Engineer.

1900. Hunt, Arthur V., 284, New Chester Road, Port Sunlight, Cheshire, Analytical Chemist.

O.M. Hunt, Bertram, 709, Mills Building, San Francisco, Cal., U.S.A., Technical Chemist.

O.M. Hunt, Chas., 17, Victoria Street, Westminster, London, S.W., Gas Engineer.

1909. Hunt, Edwin J., The Grange, Walsall, Staffs., Managing Director, Chance and Hunt, Ltd.

1883. Hunt, J. S., Appleton, Widnes.

1903. Hunt, P. C. Holmes, Metropolitan Gas Co., Flinders Street, Melbourne, Vic., Australia, Gas Engineer.

O.M. Hunt, W., Hampton House, Wood Green, Wednesbury, Staffordshire, Chemical Manufacturer.

1903. Hunter, H. B., Dennery Factory, St. Lucia, West Indies, Sugar Works Manager.

1893. Hunter, Prof. Matthew, Rangoon College, Rangoon, Burmah, Professor of Chemistry.

O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.

1902. Huntly, Geo. N., 14A, Finsbury Square, London, E.C., Analytical and Consulting Chemist.

1904. Huntzinger, Alfred, Route de Condette, Pont de Briques, Pas de Calais, France, Chemist and Colourist.

1904. Hurren, F. H., c/o The Rover Co., Ltd., Coventry, Analytical Chemist.

1894. Hurry, E. H., Goodwyns, Haslemere, Surrey, Mechanical Engineer.

O.M. Huson, C. W., 18, Batavia Buildings, Hackins Hey, Liverpool, Analytical Chemist.

1908. Hutcheson, John, c/o Farbenfabriken of Elberfeld Co., 14, Front Street East, Toronto, Canada, Local Manager.

1894. Hutcheson, Jno. F., 22, St. Enoch Square, Glasgow, Chemical Manufacturer.

1906. Hutchings, W. Maynard, Easedale, Elmfield Road, Gosforth, Newcastle-on-Tyne, Metallurgist.

O.M. Hutchinson, C. C., 3, Harcourt Buildings, Temple, E.C., Barrister-at-Law and Chemical Engineer.

1900. Hutchinson, E. George, Gas Dept. Engineer's Office, Workington, Manager.

O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.

1909. Hutchison, Chas. F., Eastman Kodak Co., Kodak Park, Rochester, N.Y., U.S.A., Photographic Emulsion Maker.

1909. Huttman, G. H., Gasverket, Värtan, Sweden, Gas Engineer.

1909. Hütz, Dr. R., 32, India Street, Boston, Mass., U.S.A., Colour Chemist.

O.M. Huxley, Jas. H., c/o Vickers, Son, and Maxim, Ltd., River Don Works, Sheffield, Metallurgical Chemist.

1906. Huyett, Miles C., 1005, Morgan Building, Buffalo, N.Y., U.S.A., Mechanical Engineer.

1897. Hyams, Godfrey M., 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.

1902. Hyde, Austin T., Box 98, Rumford Falls, Maine, U.S.A., Chemical Engineer.

1897. Hyde, B. T. Babbitt, 82, Washington Street, New York City, U.S.A., Soap Manufacturer.

1899. Hyde, Fred. S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.

1899. Hyde, Wm. Grantley, Garden Wharf, Church Road, Battersea, S.W., Assayer.

1901. Hyman, Leonard W., 342, South Pearl Street, Albany, N.Y., U.S.A., Analytical Chemist.

I

1898. Ibbotson, E. C., jun., 28, Westwood Road, Sheffield, Metallurgist.

1900. Ichioka, Dr. Tajiro, 19, Maruyama Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).

1906. Iddings, Richard P., Arlington Mills, Lawrence, Mass., U.S.A., Chemist.

1885. Idris, T. H. W., M.P., 120, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.

1909. Imison, C. S., Heatherlea, Runcorn, Cheshire, Chemist, United Alkali Co.

1900. Imrie, John, 83, Horndean Road, Firth Park, Sheffield, Producer Gas and By Product Plant Manager.

1900. Ingalls, Walter R., (Communications) 505, Pearl Street, New York City; and (Journals) Bement Avenue, West New Brighton, Staten Is., N.Y., U.S.A., Mining Engineer and Metallurgist.

1889. Ingle, Dr. Harry, Creskeld, Balwearie Road, Kirkcaldy, Fifeshire, Organic Chemist.

1909. Ingleby, G. W., c/o John L. Seaton & Co., Ltd., Sculcoates, Hull, Director.

1906. Inglis, Dr. Jno. K. H., University College, Reading, Berks., Lecturer.

1884. Inglis, R. A., Culrain, Bothwell, N.B., Analytical Chemist.

1909. Innes, R. Faraday, c/o International Salt Co., Ltd., Eden, near Carrickfergus, Ireland, Chemist.

1906. Innes, Dr. W. Ross, 6, Griffiths Road, Wimbledon, S.W., Chemist.

1904. Irlam, H. A., Long View Villa, 162, Hitchin Road, Luton, Beds., Manager and Chemist.

1910. Irvine, Prof. J. C., Chemical Research Laboratory, The University, St. Andrews, Scotland, Professor of Chemistry.

1884. Irving, J. M., 17A, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.

1906. Irwin, John T., Cledford, Middlewich, Cheshire, Manufacturing Chemist.

O.M. Irwin, W., Inglehurst, Stand, near Manchester, Analytical Chemist.

1893. Isaac, J. F. V., Research Chemist.

1901. Isakovics, Alois von, Synfleur Scientific Laboratories, Monticello, N.Y., U.S.A., Manufacturing Chemist.

1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.

1908. Ives, Herbert, 125, Pearl Street, Boston, Mass., U.S.A., Manager (Dyestuffs, etc.).

J

1890. Jackman, E. J., 60, Belgrave Road, Ilford, Essex, Technical Chemist.

1898. Jackson, Alf. George, 65, Ann Street, Brisbane, Queensland, Electro-Chemical Engineer.

O.M. Jackson, Edward, Ravens Clift, Oxford Road, Moseley, Birmingham, Alkali Works Inspector.

1904. Jackson, Ernest W., Godrevy, Saltburn, Yorks., Analytical Chemist.

1891. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Bleacher and Dyer.

1883. Jackson, Frederick, 14, Cross Street, Manchester, Laboratory Furnisher.

1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.

1901. Jackson, Percy G., c/o National Boiler and General Insurance Co., 22, St. Ann's Square, Manchester, Chemist.

1890. Jackson, Saml., c/o Binny and Co., Madras, India, Analytical Chemist.

1902. Jackson, Samuel, c/o Wm. Metcalf, Ltd., Church, near Accrington, Director (Tar Distillery).

1898. Jackson, Thos., Thornton View, Clayton, Manchester, Chemical Manufacturer.

1900. Jackson, Victor G., 21, Frankfort Road, Herne Hill, S.E., Chemist.

1903. Jackson, Wm. D. N., 27, Woodbine Avenue, Wallsend-on-Tyne, Analytical Chemist.

1900. Jackson, Dr. W. Hatchett, Radcliffe Library, Oxford, Librarian and Science Tutor (Keble College).

1893. Jackson, Rt. Hon. W. L., F.R.S. *See* Allerton, Rt. Hon. Lord.

1899. Jackson, W. Morton, c/o British Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.

O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works Manager.
1901. Jacobsen, Rudolph C., 154, Lake Street, Chicago, Ill., U.S.A., Editor of "Hide and Leather."
1900. Jacoby, Areli H., c/o American Dyewood Co., 84, William Street, New York City, U.S.A., Chemist.
1897. Jacqué, Maurice, "La Cantabrica," Galdacano, cerca Bilbao, Spain, Chemical Engineer.
1901. Jadhava, Khasberao B., Nausari, Bombay, India, Collector and District Magistrate.
1900. Jäger, B. M., c/o Geo. Jäger and Sons, 77, Burlington Street, Liverpool, Sugar Chemist.
1886. Jago, Wm., 1, Garden Court, Temple, London, E.C., Barrister-at-Law.
1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.
1893. James, Lawrence S., 32, Hawley Street, Boston, Mass., U.S.A., Gas Inspector.
1905. James, Oscar S., 227, George Street, Toronto, Canada, Analytical Chemist.
O.M. Japp, Dr. F. R., F.R.S., The University, Aberdeen, Professor of Chemistry.
1890. Jarmain, Geo. S., Dalton Lodge, Huddersfield, Wool Extractor.
O.M. Jarmay, G., Hartford Lodge, Hartford, Cheshire, Alkali Manufacturer.
1900. Jarvie, Jas., Ferndale, Kenmure Avenue, Bishopbriggs, N.B., Chemist.
1907. Jatar, S. B., 219, Upper Brook Street, C. on M., Manchester, Student.
O.M. Jayne, Dr. H. W., c/o Barrett Manufacturing Co., Frankford, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1908. Jeffery, John H., 10, Daysbrook Road, Streatham Hill, London, S.W., Chemist and Metallurgist.
O.M. Jekyll, J., Castle Moat House, Lincoln, Chemical Manufacturer.
1892. Jenkin, W. A., 5, Bella Vista, Minas de Rio Tinto, Provincia de Huelva, Spain, Metallurgical Chemist.
1905. Jenkins, Chas. D., 9, Lakeview Road, Winchester, Mass., U.S.A., Chemist.
1894. Jenkins, John H. B., Laboratory, G.E.R. Works, Stratford, E., Analytical Chemist.
1894. Jenks, Robt. L., Kasauli, Punjab, India, Chemist.
1908. Jennison, George, Derby House, Heaton Chapel, Stockport, Chemist.
1905. Jennison, Jas., Mountfield, London Road, Greenhithe, Kent, Chemist.
1907. Jensen, Chas. W. L., "Lauriston," Grand Avenue, Southbourne, Bournemouth, Brewer and Maltster.
1904. Jepson, John Elliott, c/o Star Paper Mill Co., Ltd., Feniscowles, near Blackburn, Chemist.
1899. Jerdan, Dr. David S., Temora, Colinton, Midlothian, Chemist (Gelatin Works).
1899. Jessop, Louis V., Holmlea, Woodville Road, Leytonstone, Essex, Chemist.
1904. Jewson, F. T., Earith, near St. Ives, Hunts., Chemist.
1896. Job, Robt., Ambler, Pa., U.S.A., Analytical Chemist.
1906. John, David, Haileybury, Ontario, Canada, Chemist.
1908. Johnson, Arthur, 2, Maple Street, Nursery Street, Pendleton, Manchester, Chemist.
1886. Johnson, A. E., Claremont, Lyndhurst Road, Wolverhampton, Analytical Chemist.
1904. Johnson, Cedric, West House, Hartford, Cheshire, Chemical Engineer.
1906. Johnson, Chas. C., Tunstall Bay, *viâ* Vancouver, B.C., Canada, Chemical Engineer.
1891. Johnson, Edmond E., c/o S. H. Johnson & Co., Ltd., Stratford, E., Chemical Engineer.
1900. Johnson, Edw., c/o Herdeiros Bowman, Ltd., Caixa 57, Pernambuco, Brazil, Sugar Works Manager.
1908. Johnson, Dr. Edw. S., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Chemist.
1902. Johnson, Emil F., 96–98, Maiden Lane, New York City, U.S.A., Consulting Chemist.
1904. Johnson, Dr. F. M. G., 286, Peel Street, Montreal, Canada, Chemist.
1904. Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist.
1906. Johnson, Dr. Harold, 5 and 6, Fowkes' Buildings, Great Tower Street, London, E.C., Chemist.
1907. Johnson, H. Finnis, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Sales Manager.
1908. Johnson, Horton, Ridgway, Pa., U.S.A., Tanner.
O.M. Johnson, J. E. J., 133, Earlham Grove, Forest Gate, E., Manufacturing Chemist.
1895. Johnson, Jesse F., Vaudreuil Station, P.Q., Canada, Chemical Engineer.
1900. Johnson, John, c/o John Johnson and Co., 37th Street and Second Avenue, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1900. Johnson, Jno. W. H., York House, Thornhill, Dewsbury, and (Journals) West Riding Rivers Board, Wakefield, Yorks., Chemist.
1906. Johnson, Oliver L., c/o The Aspinook Co., Jewett City, Conn., U.S.A., Dye Works Manager.
1904. Johnson, S. Hearon, 7, Church Street, Liverpool, Wholesale Chemist.
1895. Johnston, Alex. R., 18, Percy Street, Ibrox, Glasgow, Analytical Chemist.
1906. Johnston, A. McA., Box 108, Germiston, Transvaal, Metallurgical Chemist.
1894. Johnston, G. Lawson. *See* Lawson-Johnston, G.
1904. Johnston, J. H., 8, Leopold Road, Wimbledon, S.W., Chemist and Bacteriologist.
1904. Johnston, Thos. J., c/o The Sulphate of Ammonia Co., Ltd., Carnlough, Co. Antrim, Ireland, Chemist.
1890. Johnston, Wm. A., The S. S. White Dental Manufacturing Co., Princess Bay, Staten Island, N.Y., U.S.A., Dental Enamel Manufacturer.
1894. Johnston, W. E. Lawson. *See* Lawson-Johnston, W.E.
O.M. Johnston, Wm. G., Anchor Chemical Works, 1005, Garngad Road, Glasgow, Technical Chemist.
O.M. Johnstone, Jas., Shawfield Works, Rutherglen, Glasgow, Technical Chemist.
1905. Johnstone, J. Swanston, National Distilleries Co., Bond Street, Durban, Natal, Distiller.
1903. Johnstone, S. J., 15, Springfield Road, New Southgate, N., Research Chemist.
O.M. Johnstone, W. G., Chemist.
1907. Jolliffe, Ernest H., 16, Maitland Street, Toronto, Canada, Works Chemist.
1905. Jolliffe, Frank, 27, Roseldine Street, Honor Oak Park, S.E., Chemist.
1908. Jones, Andrew U., 334, Notre Dame Street West, Montreal, Canada, Mechanical Contractor.
1909. Jones, Arthur, c/o Grout & Co., Ltd., Silk Crape Works, Great Yarmouth, Technical Chemist.
1904. Jones, Arthur B., Garden City, N.Y., U.S.A., Superintendent.
1902. Jones, David R., Triton Chemical Works, Upper Clapton, London, N.E., Chemical Engineer.
1908. Jones, D. Trevor, c/o Brotherton and Co., Ltd., Litherland, Liverpool, Works Chemist.
1902. Jones, E. Strangways, Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Australia, Metallurgical Chemist.
1909. Jones, E. Willis, Coleshill Terrace, Llanelly, South Wales, Chemical Manufacturer.
O.M. Jones, E. W. T., 10, Victoria Street, Wolverhampton, Analytical Chemist.
1897. Jones, Fred. W., 39, Pembury Road, Clapton, N.E., Technical Chemist.
1896. Jones, G. Cecil, 41, London Road, Forest Hill, S.E., Consulting Chemist.
1904. Jones, Geo. Poole, Emporium, Pa., U.S.A., Chemical Engineer.
1905. Jones, Harold, Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Analyst and Assayer.
O.M. Jones, H. Chapman, Royal College of Science, South Kensington, S.W., Senior Demonstrator in Chemistry.
1907. Jones, Henry Williams, Westbourne, Gravelly Hill, Birmingham, Manufacturing Chemist.
1893. Jones, Herbert. *See* Sefton-Jones, H.
1901. Jones, Herbert J., c/o Brechfa Chemical Co., Ltd., Nantgaredig, R.S.O., South Wales, Chemist.

1905. Jones, J. E. Stacey, Masonic Buildings, Coventry, Consulting Chemist and Technical Metallurgist.
1904. Jones, J. Shirley, Moscow, Idaho, U.S.A., Chemist.
1899. Jones, Llewellyn J. W., 323, North J. Street, Tacoma, Wash., U.S.A., Metallurgist.
1894. Jones, M. W., The Cottage, Brislington, Bristol, Manager (Oil and Colour Works).
1887. Jones, T. Tolley, Australian Explosives and Chemical Co., Ltd., 135, William Street, Melbourne, Victoria, Australia, Explosives Manufacturer.
O.M. Jones, Walter Norris, Lancashire Metal Works, Widnes, Technical Chemist.
1903. Jones, Wm. App, c/o Boston Artificial Leather Co., Metropolitan Building, New York City, U.S.A., Chemist.
1905. Jones, W. Ellis, 80, Arundel Avenue, Liverpool, Sugar Refiner.
1904. Jordan, Stanley, 100, William Street, New York City, U.S.A., Importer of Chemicals.
1908. Joselin, Percy H., 81, Bennerley Road, New Wandsworth, S.W., Chemist.
1905. Joseph, A. F., Ceylon Technical College, Colombo, Ceylon, Lecturer on Chemistry.
1900. Josephson, Edgar, c/o Pantazote Leather Co., Passaic, N.J., U.S.A.
1906. Joshua, Dr. Walter P., c/o Tracey Bros., Medellin, Colombia, South America, Chemist.
1891. Joslin, Omar T., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A., Chemical Engineer.
1887. Joüet, Dr. C. H., 238, East 2nd Avenue, Roselle, Union Co., N.J., U.S.A., Technical Chemist.
1889. Journaud, Louis, 8, Place St. Maurice, Vienne (Isère), France, Technical Chemist.
1904. Jowett, Dr. H. A. D., Phœnix Mills, Dartford, Kent, Research Chemist.
1903. Joyce, Clarence M., c/o Arlington Co., Arlington, N.J., U.S.A., Chemist.
1887. Jürgensen, Dr. Rolof, Nerudagasse 14, Prag-Weinberge, Austria, Chemist.
O.M. Justice, Philip M., 55–56, Chancery Lane, London, W.C., Patent Agent.

K

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1896. Kalbfleisch, Franklin H., Metropolis Building, Broadway and 16th Street, New York City, U.S.A., Chemical Manufacturer.
1908. Kalenski, Edmund, 27, rue Cité Derrière, Lausanne, Switzerland, Chemist.
1908. Kaliski, Dr. Maximilian S., 118 West 119th Street, New York City, U.S.A., Technical Chemist.
1884. Kalle, Dr. Wm., Biebrich-am-Rhein, Germany, Colour Manufacturer.
1901. Kauder, Dr. E., c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.
1903. Kauffman, Milton H., American Smelting and Refining Co., Durango, Colo., U.S.A., Chemist.
1892. Kaufmann, Dr. Herbert M., c/o Mutual Chemical Co., Jersey City, N.J., U.S.A., Chemist.
1904. Kaus, Dr. Emil, c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.
1904. Kawai, I., 54, Shirokane, Shidamachi, Shiba, Tokyo, Japan, Chemist (Camphor Monopoly).
1885. Kawakita, Prof. Michitada, Imperial Engineering College, Tokio, Japan, Professor of Applied Chemistry.
O.M. Kay, Wm. E., The Thorns, Prestwich Park, near Manchester, Printworks Chemist.
1905. Kaye, Fred., Clonmell, Silverdale Avenue, Westcliff-on-Sea, Research Chemist.
1910. Kaye, Henry R., c/o Cuming, Smith, & Co., Port Melbourne, Vic., Australia, Analytical Chemist.
1904. Kaye, Thos., Westerfield, Perth, Scotland, Analytical Chemist.
1884. Keane, Dr. Chas. A., Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., Principal.
O.M. Kearns, H. W., Baxenden, near Accrington, Dyer.
1897. Kenny, Jos. S., Cowpe Mills, Waterfoot, near Manchester, Chemist and Dyer.
1894. Kebler, Lyman F., 1322, Park Road, Washington, D.C., U.S.A., Chief of Drug Laboratory, Department of Agriculture.
1908. Keeble, A. J., Wereham Hall, Stoke Ferry, Norfolk, Land Owner.
1908. Keller, P. A., c/o Colombo Commercial Co., Ltd., Colombo, Ceylon, Agricultural Analyst.
1886. Keiser, Prof. E. H., Washington University, St. Louis, Mo., U.S.A., Professor of Chemistry.
1908. Keith, Jas. W., c/o C. Tennant and Co., Ltd., Carnoustie, Forfarshire, Analytical Chemist.
1907. Keller, Dr. Edward, P.O. Box 363, Perth Amboy, N.J., U.S.A., Chemist and Metallurgist.
1905. Keller, Robt. J., 88, Broad Street, Boston, Mass., U.S.A., Dye-stuff and Chemical Merchant.
1885. Kellner, Dr. Wm., 135, Victoria Road, Old Charlton, S.E., Chemist to War Department.
1908. Kellogg, B. W., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., General Manager.
1909. Kelso, Jas. A., 15, Bourbonniere Street, Maisonneuve, Montreal, Canada, Chemist.
1908. Kemp, Edw. S., Aucklands, Inglemire Lane, Hull, Analyst.
1907. Kendall, G. F., Chemical Works, Stratford-on-Avon, Chemical Manufacturer.
1901. Kennedy, Alex., Kenmill House, Bothwell, N.B., Rosin Distiller.
1903. Kenyon, Percy S., Park House, Cheadle Hulme, Cheshire, Drysalter.
1889. Kenyon, Thos., The Shrubbery, Hilton Park, Prestwich, near Manchester, Manufacturing Chemist.
1906. Kepner, S. H., 149, 12th Street, Long Island City, N.Y., U.S.A., Superintendent.
1888. Ker, Alan D., 14, Wilton Mansions, Glasgow, Chemical Manufacturer.
1899. Kern, Walter P., 275, Lafayette Avenue; and (Journals) c/o General Chemical Co., Dundee Works, Passaic, N.J., U.S.A., Chemist.
1906. Kerr, Charles H., c/o American Optical Co., Southbridge, Mass., U.S.A., Ceramic Engineer.
1890. Kerr, Saml. T., 516, North Delaware Avenue, Philadelphia, Pa., U.S.A., Salt Manufacturer.
1897. Kerr, Wm. M., c/o General Chemical Co., 608, Philadelphia Bourse, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1896. Kershaw, Jno. B. C., West Lancashire Laboratory, Waterloo, Liverpool, Analytical Chemist.
1909. Kesava Menon, A., 26, Canfield Gardens, South Hampstead, N.W., Chemist.
1902. Kessler, Henry W., 317, Electric Building, Cleveland, Ohio, U.S.A., Manufacturing Chemist.
1893. Kestner, Paul, 7, Rue de Toul, Lille, France, Chemist.
1898. Keswick, Wm., M.P., 3, Lombard Street, London, E.C., Merchant.
1900. Kewley, Jas., Arbory Road, Castletown, Isle of Man, and (Journals) Balik Papan, Dutch Borneo, Technical Chemist.
1890. Keys, W. H., Hall End Works, West Bromwich, Oil and Chemical Manufacturer.
1892. Kibble, W. Oakes, Charlotte, N.C., U.S.A., Chemical Engineer and City Biologist.
1900. Kilgore, Benj. W., Raleigh, N.C., U.S.A., Chemist.
1901. Kilmer, Fred. B., c/o Messrs. Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemical Manufacturer.
1905. Kimball, Herbert S., 46, Cornhill, Boston, Mass., U.S.A., Mill Engineer.
O.M. Kinch, E., Royal Agricultural College, Cirencester, Professor of Chemistry.
1905. King, Capt. Alex. F., R.A., Egyptian Army Citadel, Cairo, Egypt, and (Journals) c/o Cox & Co., 16, Charing Cross, London, W.C., Inspector of Explosives.
O.M. King, A. J., (Journals) Ingersley Vale, and (communications) Rock Bank, Bollington, near Macclesfield, Bleacher and Finisher.
1907. King, C. A., c/o The Farnley Iron Co., Farnley, near Leeds, Technical Chemist.

1884. King, Col. C. M., Campsie Alum Works, Lennoxtown, N.B., Alum Manufacturer.

1905. King, Frank E., 75, Graceehurch Street, London, E.C., Analytical Chemist.

O.M. King, J. Falconer, 30, Chambers Street, Edinburgh, Consulting Chemist.

1887. King, Col. Robt., 115, Wellington Street, Glasgow, Chemical Manufacturer.

1895. King, Sidney J., Hazeldene, Avenue Road, Bexley Heath, Kent, Colour and Dyestuff Traveller.

O.M. King, Walter R., 16, Mineing Lane, London, E.C., and (Journals) Holford Lodge, Trinity Avenue, Southend-on-Sea, Chemical Manufacturer.

1905. King, Warren C., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Salesman,

1903. King, William, South Coast Junction, Natal, S. Africa, Analytical Chemist.

1896. Kingdon, Holman, c/o Joseph Crosfield and Sons, Warrington, Technical Chemist.

1908. Kingsbury, Percy C., 622, West 135th Street, New York City, U.S.A., Civil Engineer.

1883. Kingsford, T. P., Oswego, N.Y., U.S.A., Starch Manufacturer.

O.M. Kingzett, C. T., Newlands, St. George's Avenue, Weybridge, Surrey, and (Journals) Sanitas Co., Ltd., Loeksley Street, Limehouse, E., Technical Chemist.

1906. Kinnersley, H. W., Branscombe, Merry Hill Road, Bushey, Herts, Chemist and Manufacturer.

1892. Kinnicutt, Professor L. P., 77, Elm Street, Worcester, Mass., U.S.A., Professor of Chemistry (Worcester Polytechnic Institute).

1897. Kipping, Dr. F. Stanley, F.R.S., University College, Nottingham, Prof. of Chemistry.

1908. Kirkhope, T. Bertram, c/o Mrs. Wade, Connordowns, Hayle, Cornwall, Explosives Works Chemist.

1898. Kirkland, Archd., 78, High Street, Irvine, N.B., Baker.

1905. Kirkland, John, 105, Holmdene Avenue, Herne Hill, S.E., Technical Instructor.

1900. Kirkpatrick, Prof. Stafford F., 24, Frontenac Street, Kingston, Ont., Canada, Professor of Metallurgy.

1902. Kitchen, Wm. J., Port Melbourne North, Vic., Australia, Soap and Candle Manufacturer.

1891. Kitson, Rt. Hon. Sir James, Bart., M.P. *See* Airedale, Lord.

1883. Kitto, B., 26, Lancaster Road, Finsbury Park, London, N., Analytical Chemist.

1900. Kittredge, H. G., c/o The Kay and Ess Co., Dayton, Ohio, U.S.A., Chemist.

1908. Klaber, Wm., c/o Castle Kid Co., Camden, N.J., U.S.A., Chemist.

1900. Kleber, Dr. Clemens, Union Avenue, Clifton, N.J., U.S.A., Director (Fritzche Bros.' Laboratory).

1888. Kleemann, Dr. S., Farben Fabrik, Forchheim, Bavaria, Analytical Chemist.

1908. Klein, Friedrich, 762, Melrose Avenue, New York City, U.S.A., Chemist.

1908. Klein, John Shorkley, Floral Park, Long Island, N.Y., U.S.A., Chemist.

1909. Klemm, Wilfred E., 25, Marmion Road, Liverpool, S., Chemist.

1908. Klien, Dr. J. L., c/o Celluloid, Ltd., Port Talbot, South Wales, Works Manager.

1903. Kline, Clarence M., 429, Arch Street, Philadelphia, Pa., U.S.A., Wholesale Druggist.

1889. Klipstein, A., 122, Pearl Street, New York City, U.S.A., Chemical Manufacturer.

1902. Klipstein, Ernest C., 116, Prospect Street, East Orange, N.J., U.S.A., Chemical Merchant.

1891. Knaggs, Alfred B., 2, Bradley Lane, Huddersfield, Technical Chemist in Dyeworks.

1905. Knapp, Sewell A., 2831, Woolsey Avenue, Berkeley, Cal., U.S.A., Mine Manager.

1892. Knecht, Dr. E., Beech Mount, Marple, Cheshire, Professor of Tinctorial Chemistry.

1904. Kniffen, Frederick, c/o International Smokeless Powder Co., Parlin, N.J., U.S.A., Chemist.

1887. Knight, A. H., 51, Highfield Street, Liverpool, Assayer.

1903. Knight, Harley F., 64, Amhurst Park, Stamford Hill, N., Analyst.

1884. Knight, Henry, Stanley House, 73, Anfield Road, Liverpool, Colour and Varnish Manufacturer.

O.M. Knight, J. Baillie, Royal Primrose Soapworks, Silvertown, London, E., Soap Manufacturer.

1887. Knights, J. West, 67, Tenison Road, Cambridge, Analytical Chemist.

1885. Knipler, F., c/o R. Harper and Co., Port Melbourne, Victoria, Australia, Starch Manufacturer.

1907. Knoedler, E. L., c/o Welsbach Co., Gloucester City, N.J., U.S.A., Factory Foreman.

1883. Knowles, Joshua, Stormer Hill, Tottington, near Bury, Calico Printer.

1904. Knowles, W. R., The Hollies, Wood Green, Wednesbury, Chemical Works Manager.

1886. Knox, E. W., Colonial Sugar Refining Co., Sydney, N.S.W.; and (subs.), c/o Parbury, Henty and Co., 20, Eastcheap, London, E.C., Sugar Manufacturer and Refiner.

1906. Knudsen, Kristian Hy., 1095, Lincoln Place, Brooklyn, N.Y., U.S.A., Chemist.

1905. Koch, Dr. Geo. W., 905, Willoughby Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1904. Koch, J. A., Bluff and Pride Streets, Pittsburg, Pa., U.S.A., Chemist.

1909. Koekkoek, Patrick R., 104, Sinclair Road, West Kensington, W., Works Chemist.

1904. Koerner, H. Theo., Beyerstrasse 28, Chemnitz, Germany, Student of Chemistry.

1884. Kohn, Dr. Charles A. *See* Keane, Dr. Chas. A.

1902. Kohnstamm, Lothair S., 87, Park Place, New York City, U.S.A., Chemist.

1908. Kotibhaskar, A. S., c/o The Alembic Chemical Works Co., Ltd., 68, Shamshet Street, Market, Bombay, India, Chemist and Managing Agent.

O.M. Kraftmeier, E., 54, Parliament Street, Westminster, S.W., Explosives Manufacturer.

1906. Krais, Dr. Paul, 60, Nauclerstrasse, Tuebingen, Germany, Chemist.

1894. Krause, Dr. Albert H., 1444, West 98th Street, Cleveland, Ohio, U.S.A., Chemist (Grasselli Chemical Co.).

O.M. Krause, Prof. Dr. G., Cöthen (Anhalt), Germany, Chemist.

O.M. Krause, O. H., c/o American Sugar Refining Co., Jersey City, N.J., U.S.A., Chemical Engineer.

1898. Krebs, H. J., 806, Franklin Street, Wilmington, Del., U.S.A., Manufacturing Chemist.

1906. Kremers, William, Holland, Mich., U.S.A., Sugar Mill Superintendent.

1908. Kress, Otto, 438, West 116th Street, New York City, U.S.A., Teacher of Science.

O.M. Kühl, W. H., 82, Königgrätzerstrasse, Berlin, S.W. XI., Germany, Bookseller.

1900. Kunheim, Dr. Erich, 32, Dorotheenstrasse, Berlin, N.W., Germany, Chemist.

1904. Kunz, Dr. George F., c/o Tiffany and Co., 37th Street and 5th Avenue, New York City, U.S.A., Gem Expert.

1905. Kurt, Franklin T., 458, Boylston Street, Boston, Mass., U.S.A., Professor of Chemistry, B.Y.M.C.A.

1907. Kutsch, Dr. Wm. A., c/o Corn Products Manufacturing Co., Pekin, Ill., U.S.A., Chemist.

1910. Kuttroff, Arthur, 17, East 69th Street, New York City, U.S.A., Colour and Chemical Merchant.

1900. Kuttroff, Fred., 128, Duane Street, New York City, U.S.A., Merchant.

1909. Kwoh, See Kwain, 125, Acomb Street, Manchester.

O.M. Kynaston, J. W., 3, Oak Terrace, Beech Street, Liverpool, Chemical Engineer.

1907. Kynaston, Wm. C. R., 9, Harland Road, Higher Tranmere, Birkenhead, Analyst.

L

1897. Labonde, Dr. Leon, 3418, South Flower Street, Los Angeles, Cal., U.S.A., Consulting Chemical Engineer.

1906. Lacell, Harold G., Ardoch, Nether Street, Finchley, N., Chemist.

1890. Lacey, E. C., St. Julian's Lodge, St. Julian's Farm Road, West Norwood, Manufacturing Chemist.

1903. Lachman, Dr. Arthur, 3037, Wheeler Street, Berkeley, Cal., U.S.A., Chemical Engineer.

O.M. Laidler, C. P., 20, Noble Terrace, Gateshead-on-Tyne, Analytical Chemist.

O.M. Lake, G., jun., Leo Mount, Glossop, Derbyshire, Analytical Chemist.

1907. Lake, Henry B., Laboratory, Canadian Pacific Railway Co., Winnipeg, Canada, Chemical Engineer.

1900. Lamar, Wm. R., 5656, Clemens Avenue, St. Louis, Mo., U.S.A., Chemist.

1898. Lamb, Morris Chas., Leathersellers' Technical College, 176, Tower Bridge Road, London, S.E., Chemist.

1900. Lambert, Walter S., Park Road, Clydach, R.S.O., Glamorgan, Analyst.

1907. Lancaster, Harry M., Faculty of Applied Science, The University, Toronto, Canada, Chemist.

1904. Lancey, Darragh de, c/o Waterbury Buckle Co., Waterbury, Conn., U.S.A., Secretary.

1904. Lane, C. Cyril P., c/o The Avon India-Rubber Co., Melksham, Wilts., Chemist.

1903. Lane, Nathaniel J., U.S. Laboratory, 641, Washington Street, New York City, U.S.A., Chemist.

1893 Lang, Dr. Wm. R., University of Toronto, Canada, Professor of Chemistry.

O.M. Langdon, Dr. M. J., c/o Cocheco Manufacturing Co., Dover, N.H., U.S.A., Analytical Chemist.

1892. Langer, Dr. Carl, Ynyspenllwch, Clydach, R.S.O., Glamorganshire, Analytical Chemist.

1897. Langmuir, Arthur C., c/o Marx and Rawolle, 9, Van Brunt Street, Brooklyn, N.Y., U.S.A., Factory Manager.

1902. Langmuir, F. Leighton, 350, Bloor Street West, Toronto, Canada, Chemist.

1898. Langstaff, Wm., c/o Grasselli Chemical Co., Tremley, N.J., U.S.A., Chemist.

1900. Lant, Herbert, "Ivy Bank," Wath-on-Dearne, near Rotherham, Yorks., Chemist and Manager.

1909. Lantsberry, Fred. C. A. H., Birmingham Small Arms Co., and (Journal) 63, Walford Road, Sparkbrook, Birmingham, Metallurgical Chemist.

1906. Lantz, Alfred, 139, Rue La Fayette, St. Denis sur Seine, France, Colour Works Manager.

1903. Larter, Alfred T., 86, Inderwick Road, Stroud Green, N., Chemist.

1907. Lasché, Prof. Alfred, The Lasché Institute, 2809, Vine Street, Milwaukee, Wis., U.S.A., Chemist and Bacteriologist.

1904 Lasher, F. G., 34, Bowne Street, Brooklyn, N.Y., U.S.A., Chemist.

1884 Latham, Baldwin, Parliament Mansions, Victoria Street, Westminster, S.W., Civil Engineer.

1889 Latham, J. J., Mill House, Bold, Widnes, Chemical Works Manager.

1907. Lathwood, Arthur, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Chemist.

1908. Lauder, A. Gilbert, c/o Nelson and Lauder, O'Neil Building, Binghampton, N.Y., U.S.A., Consulting Chemist.

1909. Law, Douglas J., Trent Bridge Leather Works, Nottingham, Chemist.

1907. La Wall, Chas. H., 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical Chemist.

1907. Lawrence, James, c/o W. T. Glover and Co., Trafford Park, Manchester, Chemist.

O.M. Lawrence, Jas., Box 737, Joplin, Mo., U.S.A., Explosives Manufacturer.

1904. Lawson, Jos. H. S., Britannia Mills, Hulme, Manchester, Salesman.

1900. Lawson, Wm. L., c/o Great Western Sugar Co., Sterling, Colo., U.S.A., Chemist.

1894. Lawson Johnston, G. (Journals) 29, Portman Square, W., and 15, George Street, Mansion House, London, E.C., Vice Chairman.

1894. Lawson-Johnston, W. E., c/o Bovril, Ltd., 152, Old Street, London, E.C., Director.

1893. Lawton, Thos., Perry Villa, Perry Bar, Birmingham, Chemical Works Manager.

1890. Laycock, Dr. W. F., 16, Boar Lane, Leeds, Analytical Chemist.

1907. Leach, Dr. F. P., Claremont, Penns Lane, Erdington, Warwickshire, Research Chemist.

1907. Leach, Paul F., c/o Lactic Process Co., 117, Fulton Street, New York City, U.S.A., Secretary.

1908. Leake, Percy C., 8, St. Cuthbert's Terrace, Ferryhill Village, Co. Durham, Tar Works Manager.

1898. Lean, Geo., 15, Park Terrace, Glasgow, Chemist.

1897. Leathart, Thos. H., Lead Works, Newcastle-on-Tyne, Lead Manufacturer.

O.M. Leather, Dr. J. Walter, Agricultural Research Institute, Pusa, Bengal, India, Government Chemist.

1893. Le Boutillier, Clement, c/o Taylor Iron and Steel Co., High Bridge, N.J., U.S.A., Chemist.

1907. Lecco, Prof. Marco T., Belgrade, Servia, Professor of Chemistry.

1904. Le Chatelier, Prof. H., 75, Rue Notre Dame des Champs, Paris, France, Professor (l'Ecole des Mines).

1896. Lecomber, W. G., Cambridge Works, Knott Mill, Manchester, Engineer.

1896. Lederle, Dr. E. J., 471, West 143rd Street, New York City, U.S.A., Chief Chemist.

1892. Ledoff, Prof. A., Technological Institute, Kharkoff, Russia, Professor of Chemistry.

1895. Ledoux, Dr. Albert R., 99, John Street, New York City, U.S.A., Chemist.

1903. Ledoux, Aug. D., 15, William Street, New York City, U.S.A., Importer of Pyrites.

1905. Lee, Ashton, Lawrence, Mass., U.S.A., Manufacturing Chemist.

1905. Lee, Frank W., Lawrence, Mass., U.S.A., Manufacturing Chemist.

1905. Lee, John C., Mountford Street, Brookline, Mass., U.S.A., Assistant Engineer (American Telegraph and Telephone Co.).

1898. Lee, Jno. L., Woodfield, Lytham, Lancashire, Dyer and Bleacher.

1885. Lee, S. Wright, 6–10, Whitechapel, Liverpool, Wholesale Druggist.

1906. Lee, William, 28, Sherard Gardens, Eltham, Kent, Works Chemist.

1903. Leerburger, Henry, 295½, Pearl Street, New York City, U.S.A., Essential Oil Merchant.

1903. Leese, Jos., jun., 3, Ash Grove, Victoria Park, Manchester, Analytical and Technical Chemist.

1901. Leffler, Rudolf L., c/o Thos. Firth and Sons, Ltd., Norfolk Works, Sheffield, Metallurgical Chemist.

1907. Lehmann, Dr. Adolf, University of Alberta, Strathcona, Alberta, Canada, Prof. of Chemistry.

1888. Leigh, Cecil, Birmingham Metal and Munition Co., Adderley Park Rolling Mills, Birmingham, Technical Chemist.

1906. Leigh, Edw. Collier, c/o North Brazilian Sugar Factories, Ltd., Tiuma, Pernambuco, Brazil, Chemical Engineer.

1902. Leighton, A. E., Dept. of Defence, Melbourne, Victoria, and (Journals) Whitcott, Edgware, Middlesex, Analytical Chemist.

1894. Leitch, Jno. W., Milnsbridge Chemical Works, near Huddersfield, Aniline Dye Manufacturer.

1904. Le Maistre, Fred J., Room 727, Du Pont Building, Wilmington, Del., U.S.A., Research Chemist.

1898. Leman, Wm. T., P.O. Box 900, St. Louis, Mo., U.S.A., Oil and Asphalt Agent.

1908. Lemeland, Dr. P., 8, Rue Alfred de Vigny, Paris, France, Chemist.

1901. Lengfeld, Dr. Felix, 1804, Fillmore Street, San Francisco, Cal., U.S.A., Manufacturing Chemist.

1883. Lennard, F., Iford Manor House, near Lewes, Sussex, Chemical Manufacturer.

1884 Leonard, Wm. J., 1, Lindfield Gardens, Hampstead, N.W., Naphtha Distiller.
1903. Lepsius, Prof. Dr. B., Kurfürstendamm 62 II, Berlin, W., Professor of Chemistry.
1888. Lequin, E., Directeur Général des Usines de Produits Chimiques de la Société de St. Gobain, 1, Place des Saussaies, Paris (VIIIe.), France.
1904. Lesley, R. W., 604, Pennsylvania Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.
1907. Leslie, Dr. Fred. A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Chemist.
1894. Leslie, Hugh M., Marikuppam, Mysore State, South India, Chemical Engineer.
1904. Lessing, Dr. Rudolf, Southampton House, 317, High Holborn, London, W.C., Consulting Chemist.
1900. Lessner, Chas. B., Carrill, Spain, Metallurgical Chemist.
1892. Lester, J. H., Royal Exchange, Manchester, Analytical Chemist.
1899. Le Sueur, Dr. Henry R., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Demonstrator.
1909. Lever, J. D'Arcy, jun., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.
1891. Lever, Wm. H., M.P., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.
1909. Lever, W. Hulme, Thornton Manor, Thornton Hough, Cheshire, Soap Manufacturer.
1901. Levett, Walter, Holmlands, Stanford-le-Hope; and (Journals) Mines Safety Explosives Co., Stanford-le-Hope, Essex, Factory Manager.
1903. Levi, Dr. Louis E., c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Chemist.
1906. Levinstein, Edgar, 74, India Street, Boston, Mass., U.S.A., Chemical Manufacturer.
1901. Levinstein, Dr. Herbert, Hawkesmoor, Wilbraham Road, Fallowfield, Manchester, Chemist.
O.M. Levinstein, Ivan, Hawkesmoor, Fallowfield, Manchester, Colour Manufacturer.
1903. Levy, Arthur G., 1927, Madison Avenue, New York City, U.S.A., Chemist.
1909. Levy, Louis S., 100, William Street, New York City, U.S.A., Editor, "American Perfumer."
1905. Lévy, René J., 2, Netherton Road, St. Margarets-on-Thames, Managing Director (British Liquid Air Co.).
1901. Levy-Mond, Dr. Albert. *See* Mond, Dr. Albert L.
1887. Lewes, Prof. Vivian B., Royal Naval College, Greenwich, S.E., Professor of Chemistry.
1898. Lewin, H. James, Royal Clarence Yard, Gosport, Hants, Analytical Chemist.
1896. Lewis, Daniel C., c/o Millville Manufacturing Co., Millville, N.J., U.S.A., Dye Works Chemist.
1904. Lewis, Edw. W., c/o J. G. Ingram and Sons, London India Rubber Works, Hackney Wick, N.E., Chemist.
1900. Lewis, Ernest A., 310, Dudley Road, Birmingham, Chemist and Metallurgist.
1905. Lewis, F. W., Aetna Powder Co., 143, Dearborn Street, Chicago, Ill., U.S.A., Secretary.
1900. Lewis, John, 35, Mundania Road, Honor Oak, S.E., Cashier (Print Works).
1909. Lewis, Reginald J., Govt. Explosives Office, 423, Flinders Lane, Melbourne, Australia, Chemist.
1900. Lewis, Dr. S. Judd, 122, Newington Causeway, London, S.E., Analytical Chemist.
1889. Lewkowitsch, Dr. Julius, 71, Priory Road, West Hampstead, N.W., Consulting Chemist.
1907. Leyson, Lewis T., Penscynor, near Neath, South Wales, Analytical Chemist.
1901. Lichtenstein, Alf. F., c/o Geisenheimer and Co., P.O. Box 994, New York City, U.S.A., Chemist.
O.M. Lichtenstein, Theodore, Chemical Works, Silvertown, E., Manufacturing Chemist.
1904. Lichtenthaeler, Robt. A., Rhode Island, Agricultural Experiment Station, P.O. Box 112, Kingston, R.I., U.S.A., Chemist.
1892. Liddle, G. A., George Hotel, Castletown, Isle of Man, Chemist, Dyewood Extract Works.
1885. Liddle, W. T., 14, Willows Avenue, Ansdell, Lytham, Chemist and Manager.
1904. Lieber, Hugo, 1, Platt Street, New York City, U.S.A., Chemist.
O.M. Liebmann, Dr. A., 16, Darby Avenue, West Didsbury, Manchester, Analytical Chemist.
O.M. Lightfoot, T. E., Fernleigh, Accrington, Calico Printer's Chemist.
1905. Liley, Thos. A., 37, Aston Road, Bramley, Leeds, Chemist.
1909. Lillie, W. H., Merton, Marple, Cheshire, Cloth Finisher.
1898. Lilly, Josiah K., c/o Eli Lilly and Co., Indianapolis, Ind., U.S.A., Manufacturing Pharmacist.
1885. Lilly, Oliver M., The Croft, Spondon, Derby, Colour Manufacturer.
1904. Lindemann, Ottocar, 53, Victoria Street, Westminster, S.W., Managing Director (Korting Bros., Ltd.).
1906. Linder, S. E., Leodholt, The Drive, Buckhurst Hill, Essex, Analytical Chemist.
1908. Lindfield, James H., 107, Putney Bridge Road, Putney, S.W., Technical Chemist.
1897. Lindsay, Robt., Goldenhuis Deep G. M. Co., P.O. Cleveland, Transvaal, Chemist.
1890. Ling, Arthur R., Laboratory, 74, Great Tower Street, London, E.C., Consulting Chemist.
1908. Linthicum, J. Francis, c/o The Spanish-American Iron Co., Felton, Oriente, Cuba, Chemist.
1901. Lippencott, Warren B., 345, Lafayette Street, Denver, Colo., U.S.A., Chemist.
1905. Lips, Dr. Carl H., 99, Hart Street, Brooklyn, N.Y., U.S.A., Chemist.
1896. Lishman, Geo. P., Lambton Coke Works, Fence Houses, Co. Durham, Colliery Chemist.
1905. Little, Arthur D., 93, Broad Street, Boston, Mass., U.S.A., Consulting Chemist.
1889. Little, Wm. G., Chemical Manufacturer.
O.M. Littlejohn, Jas., c/o Littlejohn and Whitby, P.O. Box 849, Johannesburg, Transvaal, Analytical Chemist.
1904. Livermore, W. D., Washington Mill, Lawrence, Mass., U.S.A., Chemist.
1886. Liversedge, A. J., c/o Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.
1906. Liversedge, S. G., City Laboratory, Castle Street, Dublin, Ireland, Analytical Chemist.
1904. Liverseege, J. F., Council House, Birmingham, Public Analyst.
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1907. Liversidge, Bernard, Rossholme, Clifton Lane, Rotherham, Yorks., Analytical Chemist.
1883. Livingston, W. J., London County Council, Spring Gardens, London, S.W., Analytical Chemist.
1909. Livingstone, Fred., c/o The Molassine Co., Ltd., Tunnel Avenue, Greenwich, S.E., Merchant.
1903. Llewellyn, Ivor P., Goole Alum Works, Goole, Chemist.
1907. Llewellyn, W. B., Rock Villa, New Hey, near Rochdale, Chemist.
1899. Lloyd, Charles, (subscriptions) c/o Lake View Consols, Ltd., Salisbury House, London, E.C.; and (Journals) c/o Manager, Lake View Consols, Ltd., P.O. Box 99, Finiston, West Australia, Secretary.
1909. Lloyd, Edward, 27, Broomgrove Road, Sheffield, Chemical Engineer.
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1900. Lloyd, Thos. H., c/o Quibell Bros., Newark, Analyst.
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1890. Lord, F. J., Winmarleigh, Southbourne, Christchurch, Hants., Analytical Chemist.
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1904. Loveland, Jas. W., 115, Passaic Street, Hackinsack, N.J., U.S.A., Superintendent of Soap Works.
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1897. Low, Albert H., P.O. Drawer 1537, Denver, Colo., U.S.A., Metallurgical Chemist.
1900. Low, Prof. Wilson H., Cudahy Packing Co., South Omaha, Neb., U.S.A., Chemist.
1887. Lowe, Clement W., Thorneyholme, Knutsford, Cheshire, Manufacturing Chemist.
1905. Lowe, Houston, The Lowe Bros. Co., Dayton, Ohio, U.S.A., Paint and Varnish Maker.
1906. Lowe, James, c/o Auckland Gas Co., Auckland, New Zealand, Gas Engineer.
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1885. Lowson, Dr. J. G. F., Snitterfield House, Stratford-on-Avon, Paper Maker.
1906. Lowson, Wm., The University, Leeds, Chemical Lecturer.
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1892. Lucas, Bernard R., Winnington Park, Northwich, Alkali Works Manager.
O.M. Luck, A. Courtenay, Laboratorio de Polvoras, Ministerio de Marina, Darsena Norte, Buenos Aires, Argentina, Explosives Chemist.
1900. Lummus, Walter E., 88, Broad Street, Boston, Mass., U.S.A., Manager.
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1910. Lumsden, William W., 39, Caledonia Road, Saltcoats, Scotland.
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1903. Lye, Ernest B., Leagrave Hall, near Luton, Beds., Straw Plait Dyer and Bleacher.
1885. Lye, W. T., Leagrave Hall, near Luton, Beds., Straw Dyer.
1884. Lyle, James Ardesco, West Silvertown, E., Sugar Refiner.
1885. Lyle, Jno., 21, Mincing Lane, London, E.C., Sugar Refiner.
1902. Lyle, Robert F., Berry Yards Sugar Refinery, Greenock, N.B., Analytical Chemist.
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1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.
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1906. Lyons, Robert H., Emporium, Pa., U.S.A., Chemist.
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1909. McCarthy, Harold H., Sorab House, Apollo Bunder, Bombay, India, Chemist and Druggist.
1905. McCaw, Major W. D., Library, Surgeon General's Office, Washington, D.C., U.S.A., Officer, Medical Department, U.S. Army.
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1900. McCulloch, John, Glencoe, Lostock Gralam, Cheshire, Chemical Engineer.
1903. McCully, R. E. J., 65, Pelham Road, Gravesend, Kent, Analytical Chemist.
1909. McCune, W. H., American Sheet and Tin Plate Co., Vandergrift, Pa., U.S.A., Chief Chemist.
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1897. MacDonald, G. W., Geddes House, Burch Road, Gravesend, Kent, Explosives Chemist.
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1902. Macdonald, Peter, c/o Mazapil Copper Co., Ltd., Concepcion del Oro, Saltillo, Zacatecas, Mexico, Analytical Chemist.
1899. MacDonald, S. Fremont, c/o Ashtabula Hide and Leather Co., Ashtabula, Ohio, U.S.A., Tanner.
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1906. Macdougald, Geo. D., City Laboratory, 13, Shore Terrace, Dundee, City Analyst.
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1906. McDowall, Wm., 42, Herriet Street, Pollokshields, Glasgow, Analytical Chemist.
1889. MacEwan, Peter, 64, Southwood Lane, Highgate, N., Editor of "Chemist and Druggist."
1901. McEwen, Duncan C., Sak-ju Mine, Sak-ju, Korea, Metallurgical Chemist.
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1901. McFarlane, Walter, Sunnyside, Thornliebank, Renfrewshire, Printworks Manager.
1890. McFarlane, W. W., East 20th Street, Chester, Pa., U.S.A., Dyeworks Manager.
1909. McFetridge, Jos., Acid Dept., American Sheet and Tin Plate Co., Vandergrift, Pa., U.S.A., Chemist and Superintendent.
1893. McGhie, T. Burns, c/o Quirk, Barton and Co., Normandy Wharf, Rotherhithe, S.E., Analytical Chemist and Assayer.
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1906. McGregor, Russell, 86, High Street, Scunthorpe, near Doncaster, Analytical Chemist.
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1896. McIlhiney, Dr. Parker C., 7, East 42nd Street, New York City, U.S.A., Chemist.
1894. McIlwaine, Alf. W., Stoneferry, Hull, Oil Manufacturer.
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1903. Macintire, Benj. Gould, c/o E. I. du Pont Powder Co., Henry Clay P.O., Del., U.S.A., Chemist.
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1904. McKechnie, R. D., Minas de Rio Tinto, Provincia de Huelva, Spain, Chemical Engineer.
1887. McKellar, W. G., c/o United Alkali Co., Ltd., St. Rollox Works, Glasgow, Technical Chemist.
1895. McKenna, Dr. Chas. F., 50, Church Street, New York City, U.S.A., Chemist.
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1893. McKerrow, C. A., Wingfield, Wilmslow, Cheshire, Consulting Chemist.
1905. McKerrow, W. J., 67, Coldharbour Road, Redland, Bristol, Analytical Chemist.
1893. McKesson, John, 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.
1891. Mackey, W. McD., Victoria Chambers, Leeds, Analytical Chemist.
1900. McKillop, George F., Broxburn Oil Works, Broxburn, N.B., Works Chemist.
1890. McKillop, Jno., 32, Aynho Road, Hammersmith, W., and (Jnls.), c/o W. Müller, 16, Grape Street, Oxford Street, W., Metallurgist.
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1908. Macleod, Alex., Mount Pleasant, Old Kilpatrick, N.B., Analytical Chemist.
1892. McLeod, Jas., Gas Works, Greenock, N.B., Manager.
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1889. McMurtrie, J. M., 212, West Regent Street, Glasgow, Brass Founder.

1900. McMurtrie, Dr. Wm., 480, Park Avenue, New York City, U.S.A., Chemist.
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1909. McWhirter, James, c/o Wm. Beardmore and Co., Laboratory, Parkhead Forge, Glasgow, Metallurgical Chemist.
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1885. Mahon, R. W., N.Y. Central and Hudson River Railroad, West Albany, N.Y., U.S.A., Chemist.
1898. Main, Wm., Piermont, N.Y., U.S.A., Chemist.
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1896. Mann, E. A., Government Laboratory, Perth, Western Australia, Government Analyst.
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1906. Marsden, Oliver, Manor Road Mill, Victoria Road, Leeds, Cashier.
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1895. Marshall, Arthur, Naini Tal, India, Chief Chemical Examiner.
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1908. Marshall, John, Cudbear Street, Hunslet, Leeds, Dyeware Manufacturer.
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1884. Marshall, Wm., Barkley, Teddington, Middlesex, Analytical Chemist.
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1887. Martineau, Sydney, Streatham Grove, Norwood, S.E., Sugar Chemist.
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1906. Mason, M. Edgar, 541, Orleans Street, Chicago, Ill., U.S.A., Chemist.
1906. Massa, Corradino, Castelguelfo Parmense, Parma, Italy, Sulphuric Acid and Fertiliser Manufacturer.
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1904. Mather, J. Cecil, c/o Langwith By-Product Co., Langwith, near Mansfield, Works Chemist.
1900. Mather, Wm., Westlea, Queen Street, Alexandria, Dumbartonshire, Chemist.
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1890. Matheson, W. J., c/o Cassella Color Co., 182, Front Stieet, New York City, U.S.A., Chemical Merchant.
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1900. Mathews, Dr. Jno. A., c/o Halcombe Steel Co., Syracuse, N.Y., U.S.A., Works Manager and General Superintendent.
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1899. Matthews, Dr. J. Merritt, 3, Bow Street, Taunton, Mass., U.S.A., Professor of Chemistry and Dyeing.

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1903. Maxwell, Orin P., c/o West Virginia Pulp and Paper Co., Fuke, Md., U.S.A., Chemist.

1897. May, George H., c/o Fabrikoid Co., Newburgh, N.Y., U.S.A., Assistant Chemist.

1884. Mayenfeld, Dr. E. von Salis. *See* Salis-Mayenfeld, Dr. E. von.

1903. Mayer, Andrew, jun., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.

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1896. Mayfield, A. S., Thirlmere, Newland, Hull, Analyst.

1892. Mayfield, H. B., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.

1885. Mayhew, E. W. A., High Street Freemantle, Western Australia, Manufacturing Chemist.

1900. Maywald, F. J., 89, Pine Street, New York City, U.S.A., Technical Chemist.

1904. Meads, Charles J., 19, Park Place West, Sunderland, Inland Revenue Officer.

1909. Meanwell, Chas. W., 15, Woodlands Crescent, Muswell Hill Road, London, N., Analytical Chemist.

1898. Meeds, Alonzo D., 2424, Harriet Avenue, Minneapolis, Minn., U.S.A., Analytical Chemist.

1896. Meggitt, Loxley, Wheatsheaf Works, Alexandrina, Sydney, N.S.W., Australia, Analytical Chemist.

1901. Meier, Dr. Franz, c/o Society of Chemical Industry in Basle, Basle, Switzerland, Chemist.

1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.

1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Research Chemist.

O.M. Meldola, Prof. R., F.R.S., 6, Brunswick Square, London, W.C., Professor of Chemistry.

1901. Meldrum, Dr. And. N., Chemical Department, The University, Manchester, Lecturer on Chemistry.

O.M. Mellon, W. W., Woodlands, Blackrock, Co. Dublin, Ireland, Manufacturing Chemist.

1884. Melville, D., 2, Melville Avenue, Delray, Detroit, Mich., U.S.A., Chemical Works Manager.

1909. Melville, Robt. L., Westfield Chem. Works, Otahuhu, Auckland, N.Z., Chemist.

1909. Menozzi, Prof. A., R. Scuola Superiore di Agricoltura, Milano, Italy, Prof. of Chemistry.

1893. Mensching, Dr. C., Mersey Chemical Works, Bromborough, Cheshire, Chemist.

O.M. Menzies, R. C., Inveresk Mills, Musselburgh, N.B., Paper Maker.

1892. Mercer, C. A., 34, Camomile Street, London, E.C., Chemical Apparatus Maker.

1886. Mercer, J. B., 4, Tabley Road, Knutsford, Cheshire.

1890. Merck, Dr. E., Darmstadt, Germany, Manufacturing Chemist.

1905. Merck, George, Merck and Co., University Place, New York City, U.S.A., Manufacturing Chemist.

1899. Merrill, Frank H., 2424, Ocean View Avenue, Los Angeles, Cal., U.S.A., Factory Superintendent.

1906. Merrils, Fred. J., 25, Figtree Lane, Sheffield, Analytical Chemist.

1909. Merriman, C. E. B., 129, Trent Boulevard, West Bridgford, Nottingham, Technical Chemist.

1909. Merriman, H. J., 244, Victoria Park Road, South Hackney, N.E., Research Chemist.

1905. Merrin, A. C., 44, Bishopsgate Without, London, E.C., Assistant Editor and Analyst.

1904. Merry, Jno. B., 112, Greenfield Road, Harborne, Birmingham, Metallurgical Chemist.

1903. Mersan, Ferdinand de, Fairfield, Chestnut Avenue, Boston Spa, Yorks., Chemist.

1905. Merz, Eugene, P.O. Box 216, Newark, N.J., U.S.A., Superintendent, Heller and Merz Co.

1897. Meslans, Prof. M., 6, Rue de Navarin, Paris, France, Professor of Chemistry.

O.M. Messel, Dr. R., 147, Victoria Street, London, S.W., Chemical Manufacturer.

1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.

1886. Metcalf, Jno., Moorfield Chemical Works, Altham, near Accrington, Tar Distiller.

1908. Metcalfe, Ernest D., 3, Gracechurch Street, London, E.C., Secretary.

1909. Metcalfe, Frank E., Gloucester House, Stonebridge Park, London, N.W., Dyer and Cleaner.

1906. Methley, Bernard, 1, Eslaforde, Doncaster Road, Rotherham, Yorks., Engineering Chemist.

1898. Metz, Herman A., P.O. Box 753, New York City, U.S.A., Chemical Merchant.

1905. Metzis, Josef, Anglicia Petroleum Co., Drohobycz, Galicia, Austria, Manager of Refinery.

1900. Mewborne, Robt. G., c/o Kentucky Tobacco Products Co., Louisville, Ky., U.S.A., Chemist.

1907. Meyer, Dr. Erwin, c/o Morgan and Wright, Detroit, Mich., U.S.A., Chemist.

1898. Meyer, Dr. Franz, c/o R. Wedekind und Co., Uerdingen a/Rhein, Germany, Metallurgical and Chemical Engineer.

1904. Meyer, Prof. Dr. Richard, Technische Hochschule, Braunschweig, Germany, Professor of Chemistry.

1902. Meyrick, L. J., 137, City Road, Birmingham, Assistant Analyst.

1909. Michie, John L., 3, Townhead Terrace, Paisley, N.B.

1907. Micklethwait, Miss Frances M. G., Penhein, Chepstow, Mon.: and (Journals) Royal College of Science, London, S.W., Chemist.

1904. Mighill, Dr. Thos. A., 15, Exchange Street, Boston, Mass., U.S.A., Chemist.

1896. Miles, G. Wellington, 29, Central Street, Boston, Mass., U.S.A., Analytical Chemist.

1889. Milestone, W. C., 7, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.

1899. Millar, Jas. H., Box 120, Durban, Natal, Manufacturing and Analytical Chemist.

1909. Millar, Jas. Hill, Chief Chemist's Laboratory, St. James' Gate Brewery, Dublin, Chemist.

1903. Millen, J. Dunlop, Mount Bischoff Mine, Waratah, Tasmania, Assistant General Manager.

1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.

O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.

1889. Miller, Geo., Thornlea, Beaconsfield Road, Farnworth, Widnes, Technical Chemist.

1893. Miller, Dr. Harry E., 305, Palm Avenue, Oakland, Cal., U.S.A., Chemist.

1883. Miller, Dr. H. von. *See* Miller-Aichholz, Dr. H. von.

1894. Miller, Dr. John A., 44–45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.

1908. Miller, Lt.-Col. John B., 98, Wellesley Street, Toronto, Canada, Lumber and Iron Manufacturer.

1894. Miller, J. Carlile, 188, St. Vincent Street, Glasgow, Manufacturing Chemist.

1888. Miller, J. Hopkins, 86, North Frederick Street, Glasgow, Dyeworks Chemist.

1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.

1907. Miller, R. H., c/o The Flavell Co., Box 924, Asbury Park, N.J., U.S.A., Chemical Manufacturer.

1901. Miller, Stuart B., c/o E. I. du Pont de Nemours Powder Co., Marquette, Mich., U.S.A., Chemical Engineer.

1901. Miller, Dr. W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.

1884. Miller, W. M., Caledonia Estate, Prov. Wellesley, Penang, S.S., Sugar Chemist.

1883. Miller-Aichholz, Dr. H. von, Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.

1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.

1901. Millroy, Alfred T., 6, Marquette Street, Montreal, Canada, Laboratory Furnisher.

O.M. Mills, Prof. E. J., F.R.S., 64, Twyford Avenue, West Acton, W., Emeritus Professor of Technical Chemistry and Consulting Chemist.

1909. Mills, Harry P., c/o Continental-Mexican Rubber Co., Torreon, Coahuila, Mexico, Chemist.

1904. Mills, Dr. J. E., University of North Carolina Chapel Hill, N.C., U.S.A., Associate Professor of Chemistry.

1905. Mills, Wm. Henry, 15, Wall Street, New York City U.S.A., Merchant.

1906. Mills, Wm. Hobson, Northern Polytechnic Institute, Holloway, London, N., Lecturer in Chemistry.

1905. Milne, Thomas, c/o The Gas Light and Coke Co., Ltd., 4, Fenchurch Avenue, London, E.C., Chemical Products Salesman.

1903. Milnes, Cresswell, Arlesey, near Hitchin, Herts., Cement Works Manager.

1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.

1902. Milnes, Ernest E., c/o Joseph Smithson, Ltd., India Buildings, Halifax, Yorks., Chemist.

1909. Mindeleff, Chas., c/o American Smelting and Refining Co., Maurer, N.J., U.S.A., Chemist.

1895. Miner, Harlan S., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.

1889. Miniati, T. K., Penketh, near Warrington, Chemist.

1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.

1901. Mitchell, Frank H., 6428, North Park Avenue, Philadelphia, Pa., U.S.A., Tutor in Chemistry.

1898. Mitchell, G. D. H., c/o S. S. White Dental Manufacturing Co., Prince's Bay, Staten Island, N.Y., U.S.A., Chemist.

1906. Mitchell, Oswald H., c/o Basil Turner, Woolwich, Sydney, N.S.W., Australia, Assayer.

1904 Mitsugi, R., Münchnerstrasse 22, Dresden, Germany, Chemist.

O.M. Mitting, E. Kennard, 38, Harold Road, Norwood, S.E., Technical Chemist.

1908. Miyake, Hanzaburo, Girls' School, Kami-Nagarekawa, Hiroshima, Japan, School Teacher.

1909. Miyoshi, K., Imperial Steel Works, Yawatamachi, Chikuzen, Japan, Engineer.

1909. Mock, Hugo, 220, Broadway, New York City, U.S.A., Lawyer.

1905. Modi, Dr. E. M., Opposite Grant Road Station, Sleater Road, Bombay, India, Manufacturing and Analytical Chemist.

1910. Moe, Carl, Windsor Mills, Quebec, Canada, Chemist.

1906. Moe, Eldor H., Box 266, Salt Lake City, Utah, U.S.A., Chemist.

O.M. Mohr, Dr. B., 69a, Parliament Hill, Hampstead, N.W., Consulting Chemist and Metallurgist.

1894. Mole, Herbert B., St. Anne's, Morgan Road, Reading, Brewer.

1902. Molesworth, F. H., Jersey Road, Artarmon, N.S.W., Australia, Analytical Chemist.

1906. Moller, Emil A., 22, Teresa Place, Stapleton, Staten Is., N.Y., U.S.A., Manager (Sanitas Co.).

1901. Mond, Dr. Albert L., c/o Hubers and Mond, 19, Southampton Buildings, Chancery Lane, London, W.C., Chemical Engineer.

1899. Mond, Emile S., 22, Hyde Park Square, London, W., Technical Chemist.

1891. Mond, Dr. Robt. L., Winnington Hall, Northwich, Chemist.

1906. Monier-Williams, G. W., Chessington, Surrey.

1908. Monk, Chas. W., 102, Bloomfield Road, Plumstead, Kent, Chemist.

1909 Monk, Reginald H., 388, Grosvenor Avenue, Westmount, P.Q., Canada, Chemical Engineer.

1909 Monro, Irwin W., c/o W. E. Smith and Co., Ltd., Madras, India, Manufacturing Chemist.

1890 Moodie, Wm. E., Alexandria Works, Alexandria, N.B., Analytical Chemist.

1901. Moody, Chas. J., Analyst and Assayer.

1905. Moody, Dr. Gerald T., Lorne House, North Dulwich, S.E., Lecturer on Chemistry.

1898. Moody, Dr. Herbert R., College of the City of New York, and (Journals) 23, Hamilton Terrace, New York City, U.S.A., Professor of Chemistry.

1903. Mooney, F. M., 118, Pembroke Road, Dublin, Chemical Manure Manufacturer.

1903. Mooney, Geo. A., 310, St. Paul Street, Montreal, Canada, Chemical Merchant.

1887. Moore, Chas. C., 33, Clarendon Road, Garston, Liverpool, Chemist.

1901. Moore, Dr. Chas. W., Wellcome Chemical Research Laboratories, 6, King Street, Snow Hill, London, E.C., Chemist.

1907. Moore, Ernest P., Burlington, Ont., Canada, Chemist.

1902. Moore, Fred., Victoria Chemical Co., Ltd., Victoria, B.C., Canada, Manufacturing Chemist.

1906. Moore, F. H., 39, Lime Street, London, E.C., Analytical Chemist.

1892. Moore, Dr. Geo. D., 201, Salisbury Street, Worcester, Mass., U.S.A., Professor of Chemistry.

1905. Moore, Leslie R., 173, Oakleigh Road, Newton, Mass., U.S.A., Chemist.

1899. Moore, Quintin, jun., c/o Wm. Beardmore & Co., Ltd., Parkhead Forge, Glasgow, Works Manager.

1885. Moore, R. T., 142, St. Vincent Street, Glasgow, Mining Engineer.

1899. Moore, Dr. Russell W., 25, East 30th Street, New York City, U.S.A., Chemist (U.S. Appraiser's Office).

1890. Moore, Thos., Laboratoire du Service Local, Noumea, New Caledonia, Analytical Chemist.

1905. Moorwood, F. Colin, c/o W. H. Dyson, The Amalgams Co., Ltd., Attercliffe Road, Sheffield, Steel Manufacturer.

1903. Moran, Geo. A., 61½, Central Avenue, Dover, N.H., U.S.A., Chemist.

1890. Mordle, F. Dare, Guilderoy, Matlock Bath, Derbyshire, Starch Manufacturer.

1902. More, Andrew, Ellesmere, King's Road, Walton-on-Thames, Analytical Chemist.

1906. Morewood, C. Darcy, Frodingham Ironstone Mines, Scunthorpe, near Doncaster, Analytical Chemist.

1908. Morfey, Harold, 68, Barnsley Road, Wombwell, near Barnsley, Yorks., Manager of By-Products Works.

1901. Morgan, Dr. Gilbert T., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.

1905. Morgan, Prof. Jerome J., Stevens Institute of Technology, Hoboken, N.J., U.S.A., Instructor in Engineering Chemistry.

1890. Morgan, J. Jas., Laboratory, Church Road, Harrington, Cumberland, Assayer.

1907. Morgan, Leonard P., United States Mint, Philadelphia, Pa., U.S.A., Electro-Chemist.

1906. Morgan, Thos., "Merrion," Dovedale Road, Mossley Hill, Liverpool, Manufacturing Chemist.

1898. Morgan, T. M., 370, Wood Avenue, Westmount, Quebec, Canada, Cement Works Manager.

O.M. Moritz, Dr. E. R., 45, Great Tower Street, London, E.C., Brewing Chemist.

1885. Morley, Dr. H. Forster, 5, Lyndhurst Road, Hampstead, N.W., Professor of Chemistry.

1902. Morrell, Dr. R. S., Messrs. Mander Bros., Colour and Varnish Works, Wolverhampton, Chemist.

1884. Morrice, Jas. A., 1, Prince's Terrace, Dowanhill, Glasgow, Starch and Gum Manufacturer.

1908. Morrill, George E., 6, Lemoyne Street, Montreal, Canada, Local Manager (Badische Co.).

1906. Morris, A. H., 72, Chorley New Road, Bolton, Lancs., Brewer.

1898. Morris, Edgar F., c/o Cornbrook Chemical Co., Ltd., Colour Works, Stockport, Research Chemist.

1897. Morris, Harry, The Hall, Hexthorpe, Doncaster, Chemical Merchant.

1890. Morris, Herbert N., Gorton Brook Chemical Works, Manchester, Technical Chemist.

O.M. Morris, J. Haydn, 22, Largo das Fontanhas, Lisbon, Portugal, Technical Chemist.

1908. Morris, Wm. J., 31, Prince Alfred Road, Wavertree, Liverpool, Chemist.

1902. Morrison, Jos., Wellfield, Farnworth, Widnes, Manager.

1906. Morrow, Jas. M., 49, Townsend Place, Kirkcaldy, N.B., Analytical Chemist.

1901. Morse, Willard S., Seaford, Del., U.S.A., Manager.

1909. Morson, Leslie J., Summerfield Works, Ponders End, Middlesex, Manufacturing Chemist.

1904. Morson, Thos. D., 14, Elm Street, Gray's Inn Road, London, W.C., Chemist.

1906. Morsen, T. Pierre, 14, Elm Street, Gray's Inn Road, London, W.C., Chemical Manufacturer.

1907. Morton, George A., 43, Bryanston Road, St. Michael's, Liverpool, Chemist.

1889. Morton, Jas., Dalquhurn Works, Renton, N.B., Dyeworks Manager.

1897. Morton, Jno., North Road, St. Helens, Lancashire, Analytical Chemist.

1902. Mosbangh, F. R., c/o Anglo-Canadian Leather Co., Huntsville, Ont., Canada, Chemist.

1905. Moseley, F. A. D. H., Box 1657, Johannesburg, Transvaal, Analytical Chemist.

1888. Mosenthal, Henry de, 220, Winchester House, Old Broad Street, E.C., Explosives Company Manager.

1906. Moss, Wm., Moss Chem. Manuf. Co., Foot of Carlaw Avenue, Toronto, Canada, Chem. Manufacturer.

1894. Moszczenski, J. B., 216, Silliman Place, Brooklyn, N.Y., U.S.A., Consulting Chemist.

1897. Motion, Jno., c/o The Joseph Dixon Crucible Co., Jersey City, N.J., U.S.A., Assistant Superintendent.

1887. Moul, Frank, Aldersgate Chemical Works, Southall, Technical Chemist.

1901. Moule, Jno. W., c/o The Chillagoe Co., Ltd., Chillagoe, Queensland, Metallurgist.

1884. Moult, J., Underhill, Low Fell, Gateshead-on-Tyne, Secretary.

1898. Moulton, Prof. Chas. W., Vassar College, Poughkeepsie, N.Y., U.S.A., Professor of Chemistry.

1905. Moulton, Rt. Hon. Sir J. Fletcher, F.R.S., 57, Onslow Square, London, S.W., Lord Justice of Appeal.

1892. Mount, Edw., Oaklands, Aughton, near Ormskirk, Assistant Secretary (United Alkali Company).

1905. Mrazsek, F. M., 31, West Cromwell Road, London, S.W., Consulting Chemist.

1904. Muckenfuss, A. M., c/o University of Mississippi, University, Miss., U.S.A., State Chemist.

1907. Mueller, Dr. Carl, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.

1890. Muir, Jas. Stanley, 23, Lilybank Gardens, Glasgow, W., Chemist.

O.M. Müller, Dr. H., F.R.S., 13, Park Square East, Regent's Park, London, N.W., Research Chemist.

1896. Mundy, Lionel, 27, Merton Road, Kensington, W., Importer of Unfermented Wines.

1887. Munroe, Prof. Chas. E., George Washington University, Washington, D.C., U.S.A., Professor of Chemistry and Dean.

1900. Munsell, Dr. Chas. E., c/o Devoe and Raynolds Co., 110, Horatio Street, New York City, U.S.A., Colour Chemist.

1900. Munton, Fred T., The Oak House, Winsford, Cheshire, A.R.S.M., Analytical Chemist.

1897. Murch, D. Wilshin, Selby House, Victoria Road, Wednesbury, Staffs., Chemist.

1904. Murdoch, Alexander, 557, Alexandra Parade, Dennistoun, Glasgow, Analytical Chemist.

1886. Murdoch, R. H. M., Nobel Villas, Stevenston, Ayrshire, Explosives Chemist.

1899. Murphy, Albert J., 26A, Great George Street, Leeds, Brewer's Chemist.

1906. Murphy, Frederic W., Standard Sugar Refinery, Granite Street, South Boston, Mass., U.S.A., Chemist.

1901. Murray, Benjamin L., c/o Merck and Co., University Place, New York City, U.S.A., Chemist.

1903. Murray, Chas. B., 407, Perry Payne Building, Cleveland, Ohio, U.S.A., Chemist.

1901. Murray, Jas. P., Toronto Carpet Manufacturing Co., Ltd., King Street, and Fraser Avenue, Toronto, Canada, Carpet Manufacturer.

1898. Murray, Rd., c/o Brotherton and Co., Ltd., Ammonia Works, Holmes Street, Leeds, Analyst.

1908. Murray, Dr. Thos. J., The University, Birmingham, Lecturer on Chemistry.

1905. Murray, Wm. Wallace, c/o Union Abattoir Co., Baltimore, Md., U.S.A., Chemist.

1905. Murrill, Dr. Paul I., P.O. Box 986, Wilmington, Del., U.S.A., Representative, E.I. du Pont Co.

O.M. Muspratt, Dr. E. K., Seaforth Hall, near Liverpool, Alkali Manufacturer.

1894. Muspratt, Max, M.P., The Grange, Fulwood Park, Liverpool, Technical Chemist.

O.M. Muspratt, S. K., 14, Northgate, Regent's Park, N.W., Alkali Manufacturer.

1907. Musso, Louis A., Department of Agriculture, 140, George Street North, Sydney, N.S.W., Australia, Assistant Viticulturist.

O.M. Muter, Dr. Jno., Winchester House, Horley, Surrey, and (Journals) 325, Kennington Road, London, S.E., Chemical Lecturer.

1895. Muurling, I. J. R., 117, Hudson Street, New York City, U.S.A., Dyestuff Importer.

1891. Myers, Dr. Wm. S., 71, Nassau Street, New York City, U.S.A., Director.

N

1902. Naef, Dr. Ernest E., Clydach, Swansea, South Wales, Chemist.

1903. Nagel, Dr. Oscar, c/o John Naday, 79, Fifth Avenue, New York City, U.S.A., Chemist.

1903. Nagel, Oskar H. L., P.O. Box 385, New York City, U.S.A., Superintendent (Chemical Works).

1908. Nagle, J. C., Southampton Wharf, Battersea, London, S.W., Glucose and Starch Manufacturer.

1897. Nairn, Michael, Ben Dhu, Kirkcaldy, N.B., Linoleum Manufacturer.

1901. Nakagawa, Sosuke, c/o Tokyo Ryusan Kwaisha, Kameido Oshimacho, near Tokyo, Japan, Chief Engineer.

1909. Nakai, S., Miike Colliery, Omuta-machi, Chikugo, Japan, Engineer.

1901. Nanabhai, Krishnalal, 8-10, Nepean Sea Road, Malabar Hill, Bombay, India, Technological Chemist.

1893. Napier, Jno. W., Gas Works, Alloa, N.B., Manager and Chemist.

1904. Napper, Sidney S., c/o S. Courtauld and Co., Ltd., Foleshill Road, Coventry, Chemist.

1903. Nash, A. Douglas, 280, State Street, Flushing, N.Y., U.S.A., Glass Manufacturer.

1897. Nash, Leonard M., Westlands, Princess Road, Finsbury Park, N., Works Chemist.

1910. Nash, N. C., Treleaven, Darling Street, Balmain East, Sydney, N.S.W., Works Chemist.

1905. Nash, W. A., Corn Exchange Bank, New York City, U.S.A., President, Corn Exchange Bank.

1908. Nasmith, M. E., 66, Jarvis Street, Toronto, Canada, Baker.

1900. Nathan, Lt.-Col. Sir Frederic L., R.A., Ardeer, Stevenston, Ayrshire, Superintendent Nobel's Explosives Works.

1907. Nauckhoff, Sigurd, c/o Nitroglycerin Aktiebolaget, Vinterviken, Stockholm, Sweden, Chemical Engineer.

O.M. Naylor, W. A. H., The British Drug Houses, Ltd., 22–30, Graham Street, City Road, London, N., Manufacturing Chemist.

1909. Neal, C. S., Acme White Lead and Colour Works, Detroit, Mich., U.S.A., Manager.

1899. Neate, Percy J., 1, Holly Mount, Hampstead, N.W., Director of Cement Co.

1902. Neave, Dr. Geo. B., Technical College, Montrose Street, Glasgow, Assistant to Professor of Chemistry.

1905. Neech, Herbert R., 20, Colegrave Street, Lincoln, Chemical Engineer.

1905. Needham, Edward R., 48, Paton Street, Glasgow, Manufacturing Chemist.

1905. Neff, Robert W., 22, India Square, Boston, Mass., U.S.A., Chemical Manufacturer.

1906. Neil, Dr. Archibald A., 82, Eccles Old Road, Manchester, Chemical Engineer.

1890. Neill, Geo. D., Drumslea, Greenock, N.B., Sugar Refiner.

1898. Neilson, Alex. McG., Umbilo, Durban, Natal, Analytical Chemist.

1902. Neish, Dr. Arthur C., Columbia University, New York City, U.S.A., Chemist.

1897. Nelson, Walter, Emscote Mills, Warwick, Gelatin Manufacturer.

1906. Nestell, Raymond J., 237, Lenox Avenue, New York City, U.S.A., Analytical Chemist.

1901. Neufville, Dr. Rudolf de, c/o Metallurgische Gesellschaft, Frankfort a/M., Germany.

1902. Neumann, Dr. Edgar, 7 and 8, Idol Lane, London, E.C.

1903. Neumann, Dr. Max, Capellenstrasse 51, Wiesbaden, Germany.

O.M. Newall, F. S., Washington Station R.S.O., Co. Durham, Chemical Manufacturer.

1905. Newall, Joseph, Greenway Road, Runcorn, Cheshire, Chemist.

1889. Newberry, Spencer B., Sandusky Portland Cement Co., Sandusky, Ohio, U.S.A., Manager.

1909. Newbert, Alonzo M., 88, Broad Street, Boston, Mass., U.S.A., Dyewood Extract Merchant.

O.M. Newlands, B. E. R., 2, St. Dunstan's Hill, London, E.C., Analytical and Consulting Chemist.

O.M. Newlands, W. P. R., 10, Cricklade Avenue, Streatham Hill, S.W., Sugar Chemist.

O.M. Newton, Jno., Manor Works, Rotherhithe New Road, London, S.E., Manure Manufacturer.

1901. Nibelius, Axel W. T., c/o Emporium Powder Co., Emporium, Pa., U.S.A., Chemist.

1904. Nichols, C. W., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.

1905. Nichols, E. Remington, 25, Broad Street, New York City, U.S.A., Treasurer (Nichols Chemical Co.).

1884. Nichols, J. A., Stanley Mount, New Mills, near Stockport, Teacher of Science.

1888. Nichols, Dr. Wm. H., 25, Broad Street, New York City, U.S.A., Chemical Manufacturer.

1905. Nichols, W. H., jun., 25, Broad Street, New York City, U.S.A., President, San Carlos Copper Co.

1904. Nicholson, Wilfred E., Hunslet Chemical Works, Leeds, Chemical Manufacturer.

1897. Nicholson, Wm. J., Ardeer, Stevenston, Ayrshire Chemist.

1903. Nicoll, Frank, 238, Burnley Road, Accrington, Chemist.

1905. Nieghorn, Albert, c/o Canada Chemical Manufacturing Co., Toronto, Canada, Agent.

1900. Nield, J. H., c/o General Chemical Co., Edgewater, N.J., U.S.A., Superintendent.

1906. Nielsen, Dr. Carl, c/o T. Bertelsmann, Kurze Wallfahrt 13, Bremen, Germany, Chemist.

1898. Nightscales, Geo., 37, Jalland Street, Hull, Oil Merchant.

1899. Nihoul, Dr. Edw., Waremme, Belgium, Director of the Liège Tannery School.

O.M. Nimmo, Jas., 8, Lawrence Road, South Norwood, S.E., Analytical Chemist.

1907. Nims, H. E., c/o The Fiberloid Co., Indian Orchard, Mass., U.S.A., Chemist.

1885. Nishigawa, T., 12, Yamamoto Dori, Nichome, Kobe, Japan, Director of Sulphuric Acid and Soda Works.

1898. Nishikawa, T., Nishikatamachi, 10, Hongo-ku, Tokio, Japan, Chemist.

1908. Noble, Sir Andrew, Bart., K.C.B., F.R.S., Jesmond Dene House, Newcastle-on-Tyne.

O.M. Nölting, Dr. E., Ecole de Chimie, Mulhouse, Alsace, Germany, Professor of Chemistry.

1905. Norden, Julius, 44, Farringdon Street, London, E.C., Chemical Manufacturer.

O.M. Norman, F. J., Lyndhurst, Higher Runcorn, Cheshire, Chemical Manufacturer.

1892. Norman, J. T., 23, Leadenhall Street, London, E.C., Consulting Chemist.

1890. Norman-Bott, Dr. Wm., 16, St. Helen's Place, London, E.C., Consulting Chemist.

1898. Norris, Albert P., 760, Massachusetts Avenue, Cambridgeport, Mass., U.S.A., Assistant Chemist.

1908. Norris, Wm. H. H., 27, Moss Road, Winnington, Northwich, Chemist.

1902. North, Barker, 22, Horton Park Avenue, Bradford, Assistant Professor of Chemistry.

1903. North, Henry A., 34, East Elm Street, Chicago, Ill., U.S.A., Chemist.

1909. Northcote, Reginald S., 64, Admiral Road, Toronto, Canada.

O.M. Northing, J., The Murrough, Wicklow, Ireland, Technical Chemist.

1905. Norton, Arthur L., 36, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.

O.M. Norton, Dr. S. A., 363, East Town Street, Columbus, Ohio, U.S.A., Professor of Chemistry (Ohio State University).

1887. Norton, Dr. T. H., c/o Wm. Bryce, 54, Lothian Street, Edinburgh, U.S. Consul.

1899. Noyes, Henry, c/o J. C. Lanyon and Sons, Coronation House, Lloyd's Avenue, London, E.C., Engineer.

1901. Noyes, Prof. Wm. A., University of Illinois, Urbana, Ill., U.S.A., Editor (J. Amer. Chem. Society).

1909. Nuckolls, Asa H., 207, East Ohio Street, Chicago, Ill., U.S.A., Chemical Engineer.

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1905. Oakes, F. J., jun., 141, Milk Street, Boston, Mass., U.S.A., Secretary, Oakes Manufacturing Co.

1904. Oberländer, Dr. Otto, 29, Queen Street, London, E.C., Research and Consulting Chemist.

1904. O'Brien, Claude H., Mulgrave, Cairns, North Queensland, Supervising Chemist.

1900. O'Brien, Frederick, Lynwood, Grange Road, Bishopsworth, near Bristol, Analytical Chemist.

1905. Oburg, W. F., 33, Broad Street, Boston, Mass., U.S.A., Assistant Treasurer (Merrimac Chem. Co.).

1900. O'Byrne, L. C., 996, Washington Boulevard, Chicago, Ill., U.S.A., Chemist.

1902. Ockel, Reinhold, Baesrode, chez Ternoude, Belgium, Technical Chemist.

1901. O'Connor, Chas. P., 7, Fairfield Street, Montclair, N.J., U.S.A., Analytical Chemist.

1908. O'Day, John, 32, India Street, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.

1887. Oddie, Jas., School of Mines, Ballarat, Australia, Chemical Lecturer.

1888. Oddy, Robert W., Abbey Street, Toad Lane, Rochdale, Chemist.

1888. Ogata, Saburo, Nippon Ginko, Tokyo, Japan, Assayer.

1906. Ogilvie, Alex. M., 9, Belmont Drive, Giffnock, Renfrewshire.

1908. Ogilvie, Jas. P., Ashmount, Sylvester Road, East Finchley, N., Chemist.

1901. Ogston, Alex. G., Heath Park, near Aberdeen, N.B., Soap Manufacturer.

1903. Ohlenschlager, J. G., jun., Shanghai House, Botolph Lane, London, E.C., Chemical Merchant.

1905. Ohliger, Willard, c/o F. Stearns & Co., Detroit, Mich., U.S.A., Chemist.

1909. Oilar, Rozier D., 68, Highwood Terrace, Weehawken, N.J., U.S.A., Cotton Seed Products Chemist.

1907. Oke, Alfred W., Orielton, 32, Denmark Villas, Hove, Sussex, Solicitor.
1884. Oliver, F., 31, Horsley Hill Road, Westoe, South Shields, Analytical Chemist.
1888. Oliver, Wm. Letts, 101, Vernon Street, Oakland, Cal., U.S.A., Mining Engineer.
1910. Oliver, Willie, 11, Midland Road, Swinton, near Rotherham, Works Chemist.
1901. Olivier, Dr. Louis, 18, Rue Chauveau-Legarde, Paris, 8^e, Director (Revue Générale des Sciences).
1905. Ollenbach, D. S., Cordite Factory, Aruvankad, Nilgiris, India, Assistant Government Surgeon.
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1906. Olmsted, Fred. A., 93, Broad Street, Boston, Mass., U.S.A., Chemical Engineer.
1904. Olney, L. A., 118, Riverside Street, Lowell, Mass., U.S.A., Professor of Chemistry and Dyeing.
1904. Olshausen, B. A., 1505, St. Andrew's Place, Los Angeles, Cal., U.S.A., Chemist.
1902. O'Neill, Chas., c/o Bleachers' Association, Ltd., 4, Norfolk Street, Manchester, Chemist and Colourist.
1907. Oppen, Wm. A., Vera Chemical Co., Stoneham, Mass., U.S.A., Chemist and Superintendent.
1905. Ormandy, Dr. W. R., Bewsey Cottage, Warrington, Consulting Chemist.
1898. Ormerod, Dr. Ernest, Oak Lodge, St.-Anne's-on-Sea, Lancashire, Consulting Chemist.
1891. Ormerod, John, Globe Leather Works, Castleton, Manchester, Tanner and Currier.
O.M. Orr, A., 35A, Bligh Street, Sydney, New South Wales, Analytical Chemist.
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1899. Orr, Thos. W., Esperanza Nitrate Co., Taltal, Chile, and (communications), c/o W. Orr, 50, Wellington Street, Glasgow, Chemist.
1907. Ortved, Niels C., c/o Hiram Walker & Sons, Ltd., Walkerville, Ont., Canada, Chemist and Fermentologist.
1900. Osbourne, Jno. P., 6, Garrioch Drive, Maryhill, Glasgow, Analytical Chemist.
1900. O'Shaughnessy, Francis R., Home Farm, Tyburn, Birmingham, Chemist.
1885. O'Shea, Prof. L. T., Dept. of Applied Science, St. George's Square, Sheffield, Professor of Applied Chemistry (University of Sheffield).
1908. Osland, Clarence R., 164, West Huron Street, Buffalo, N.Y., U.S.A., Chemist.
1883. O'Sullivan, J., High Bank, Burton-on-Trent, Brewing Chemist.
1905. Otsuki, Prof. Chiri, Photochemical Laboratory, Imperial School of Art, Neno Park, Tokyo, Japan, Professor of Applied Chemistry.
1898. Oushkoff, John P., c/o P. K. Oushkoff and Co., Moscow, Russia, Chemical Manufacturer.
1904. Owen, Halsall, Newholme, Latchford; and (Journals) c/o W. H. Smith and Son, 76, Sankey Street, Warrington, Engineer.
1906. Oxley, Horace F., Church Green, Lymm, Cheshire, Chemist.
1908. Oxley, John C., Kelcliffe House, Guiseley, near Leeds, Aniline Colour Merchant.
1903. Ozias, Ramon E., 732, Clinton Avenue, Newark, N.J., U.S.A., Assayer.

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1904. Packard, C. T., Millbank, Bramford, near Ipswich, Manager of Chemical Works.
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1904. Page, Edwin P., 31, Market Street, Stourbridge, Worcestershire, Chemist.
1886. Pagès, Albert, 34, Boulevard Henri IV., Paris, Technical Chemist.
1892. Paine, Augustus G., 200, Fifth Avenue, New York City, U.S.A., President of Paper Making Co.
1906. Palm, Otto G., 41, Colborne Street, Toronto, Canada, President (Atteaux Dye and Chemical Co.).
1903. Palmenberg, O. W., 120, Liberty Street, New York City, U.S.A., Consulting Chemist and Fuel Engineer.
1902. Palmer, Fred. G., Athelstan Road, Faversham, Kent, Analyst.
1887. Palmer, T. Chalkley, c/o American Dyewood Co., Chester, Pa., U.S.A., Manufacturing Chemist.
1887. Palmer, Thos. C., 98, Commerical Road East, London, E.; and (Journals) Westlington, Hatch End, Middlesex, Engineer.
1907. Palmer, Wm. J., c/o W. H. Holmes and Sons, Portland Road, Newcastle-on-Tyne, Analytical Chemist.
1906. Parke, Jas., Gow Ganda, Ont., Canada, Chemist.
1888. Parker, Chas. E., Penketh, Warrington, Tanner.
1898. Parker, Charles H., 106, Tettenhall Road, Wolverhampton, and (Journals) c/o British Coalite Co., Ltd., Wedensfield, Staffs., Chemist.
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1897. Parker, Prof. Matthew A., University of Manitoba, Winnipeg, Canada, Professor of Chemistry.
1901. Parker, Richard H., 231, West 134th Street, New York City, U.S.A., Analytical Chemist.
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1903. Parker, Wm. B., 96, Murray Road, Rugby, Chief Chemist (British Thomson-Houston Co., Ltd.).
1901. Parker, Dr. Wm. Huntington, 177, State Street, Boston, Mass., U.S.A., Chemist (U.S. Appraisers).
1901. Parkes, Albert E., 43, Whitehorse Street, Stepney, E., Analytical Chemist.
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1898. Parrish, Saml., 80, Grange Avenue, Chapeltown Road, Leeds, Teacher of Chemistry.
1901. Pass, James, Onondaga Pottery Co., Syracuse, N.Y., U.S.A., Pottery Manufacturer.
1909. Passmore, Dr. Francis W., 63, Queen Victoria Street, London, E.C., Consulting Chemist.
1902. Patch, Prof. Jas. A., Syrian Protestant College, Beirût, Syria, Professor of Chemistry.
1897. Patchett, Col. Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.
1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.
1887. Paton, J. M. C., Messrs. Manlove, Alliott and Co., Ltd., Nottingham, Mechanical Engineer.
1886. Paton, W. Grant, Airlie, Huyton, near Liverpool, Alkali Works Manager.
1901. Patterson, Chas. A., c/o E. I. du Pont de Nemours Powder Co., Pinole, Cal., U.S.A., Analytical Chemist.
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1909. Patterson, G. H., Ivanhoe, Linden Grove, West Hartlepool, Works Manager.
1893. Patterson, Harry J., College Park, Prince George's Co., Md., U.S.A., Agricultural Chemist.
O.M. Patterson, T. L., Maybank, Finnart Street, Greenock, N.B., Sugar Works Manager.
1902. Patterson, Wm. Hamilton, c/o Mond Nickel Co., Clydach, S.O., Glam., Technical Chemist.
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O.M. Pattison, Jas., Drimnamona, Kilmalcolm, N.B., Chemical Merchant.
1889. Pattison, Percy J., St. Budeaux, Devonshire Road, Hornchurch, Essex, Technical Chemist.
1909. Patton, H. G., c/o Fred Rueping Leather Co., Fond du Lac, Wis., U.S.A., Chemist.
1901. Patz, E. O., 215, Water Street, New York City, U.S.A., Manager, Berlin Aniline Works.

1908 Paul, David M., c/o Curtis's and Harvey, Ltd., Powder Works, Tonbridge, Kent, Explosives Chemist.

1891. Paul, Jas. H., 11, Glenluce Road, Blackheath, S.E., Analytical Chemist.

1900. Paul, Dr. L. Gordon, Market Hall Chambers, King Street, Huddersfield, Consulting Chemist.

1902. Pay, Walter H., P.O. Box 943, Durban, Natal, Government Inspector of Explosives.

1904. Payne, A. G. C., 11, West Terrace, Penarth, near Cardiff, Chemist.

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1906. Payne, J. H., Box 76, Yorktown, Va., U.S.A., Chemical Engineer.

1894. Pearce, Jas. Stanley, Clements, Snaresbrook, Essex Chemical Manufacturer.

1897. Pearce, Richard, 98, Cornwall Gardens, London, S.W., Metallurgist.

1883. Pearce, W., M.P., Chemical Works, Bow Common, London, E., Chemical Manufacturer.

1903. Pearcy, A. C., 43, Marlborough Mansions, Cannon Hill, London, N.W., Director, Explosives Co.

1903. Pears, Thos., The Laboratory, Soap Works, Isleworth, Soap Manufacturer.

1904. Pease, Fred N., P.O. Box 503, Altoona, Pa., U.S.A., Chemist.

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1898 Peck, Dr. Ernest L., 18, Woodhey Road, Rock Ferry, Cheshire, Chemist.

1909. Peck, Lieut. Sydney C., Royal Artillery Mess, Woolwich, S.E., Lieut., R.A.

1898 Peckham, Stephen F., 127, Franklin Street, New York City, U.S.A., Chemist.

1894. Peden, Jno., 30, Ardgowan Street West, Greenock, N.B., Analytical Chemist.

1909. Pederneiras, Lieut.-Col. A., Fabrica de Polvora, Piquete, Lorenci, Sao Paulo, Brazil, Director Smokeless Powder Factory.

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1886. Pedler, J. R., 47, Tregunter Road, South Kensington, S.W., Clerk.

1905. Peet, Wm. J., Stockyards Station, Kansas City, Kas., U.S.A., Superintendent.

1903. Peffer, Harry C., c/o Aluminium Co. of America, East St. Louis, Ill., U.S.A., Manufacturing Chemist.

1906. Peile, Henry, Millburn House, Newcastle-on-Tyne, and (Journals) c/o Andrew Short, Patent Ovens Dept., Ottovale, Blaydon-on-Tyne, Colliery Owner.

1899. Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.

1897. Pellew, Chas. E., Columbia University, New York City, U.S.A., Adjunct Professor of Chemistry.

1904. Pelly, Russell George, 3, Wingate Road, Hammersmith, W., Analytical Chemist.

1896. Penney, Mulgrave D., 11, High Street, Hull, Analytical Chemist.

1890. Pennock, J. D., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Technical Chemist.

1885. Pentecost, S. J., Alexandra Mount, Mapperley Hill, and (Journals), Sherwood Hill Works, Sherwood Rise, Nottingham, Lace Dresser.

1887. Pentermann, H. T., 37, Clifton Crescent, Peckham, S.E., Brewing Chemist.

1892. Peploe, D. H. T., Underriver House, Sevenoaks, Kent.

1899. Peppel, S. Vernon, 2437, South Robey Street, Chicago, Ill., U.S.A., Chemist.

1885. Perkin, A. G., F.R.S., Grosvenor Lodge, Grosvenor Road, Leeds, Technical Chemist.

1898. Perkin, Dr. F. Mollwo, 199, Piccadilly, London, W., Head of Chemical Department, Borough Polytechnic.

1887. Perkin, Dr. W. H., F.R.S., Fairview, Wilbraham Road, Fallowfield, Manchester, Professor of Chemistry.

1903. Perkins, Frank C., 413, Dean Building, South Bend, Ind., U.S.A., Starch Manufacturer.

1893. Perkins, T. S., 30, Tiffany Place, Brooklyn, N.Y., U.S.A., Chemist.

1899. Perks, Walter G., Lisnalee, Woodcote Grove Road, Coulsdon, Surrey, Manufacturer.

1906. Perrow, Mosley G., Lynchburg, Va., U.S.A.

1901. Perry, Chas. M., Greene, Kent County, R.I., U.S.A., Bleach and Dyeworks Chemist.

1887. Perry, D., Norwood, Lenzie, N.B., Manufacturing Chemist.

1895. Perry, Jos. H., 276, Highland Street, Worcester, Mass., U.S.A., Teacher of Chemistry.

1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W., Australia, Manufacturing Chemist.

1903. Perry, Robt. Swain, 3500, Grays Ferry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A., President (Harrison Bros. and Co.).

1901. Persons, Ashton C., Willimantic, Conn., U.S.A., Chemist.

1897. Peter, Dr. A. H., 105, East 91st Street, New York City, U.S.A., Chemist.

1908. Peters, John M., 184, Front Street, New York City, U.S.A., White Lead Manufacturer.

1893. Pethybridge, Walter, 3, Rhodesia Road, Clapham Rise, S.W., Chemist and Assayer.

1909. Petrie, A. Swanston, c/o Gibbs and Co., Iquique, Chile, S. America, Analytical Chemist.

1903. Petrie, Dr. Jas. M., The University, Sydney, N.S.W., Australia, Chemist.

1902. Petsche, B. W., 60, Glenwood Avenue, Yonkers, N.Y., U.S.A., Chemist.

1906. Pettee, Chas. L. W., c/o Hartford Laboratory Co., Hartford, Conn., U.S.A., Chemist.

1892. Pettigrew, Robert, c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electro-Chemist.

1902. Pettitt, Alf., 457, State Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Peuchen, Arthur G., Standard Chemical Co., Ltd., 509, Manning Chambers, Toronto, Canada, Chemical Manufacturer.

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1900. Peyton, Wm. C., c/o Peyton Chemical Co., Room 657, Mills Building, San Francisco, Cal., U.S.A., Chemist.

1888. Philip, Arnold, Chemical Laboratory, H.M. Dockyard, Portsmouth, Electro-Metallurgist and Electrical Engineer.

1908. Philip, Dr. James C., Imperial College of Science and Technology, Sth. Kensington, S.W., Chemist.

1903. Philipp, Herbert, 84, High Street, Perth Amboy, N.J., U.S.A., Chemist and Electrochemical Engineer.

1886. Phillips, A. G., 11, Essex Villas, Phillimore Gardens, Kensington, W., Barrister-at-Law.

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O.M. Phillips, Harcourt, Lynwood, Turton, Lancs., Analytical Chemist.

1910. Phillips, Prof. Percy P., Thomason College, Rurki, United Provinces, India, Professor of Chemistry.

1895. Phillips, S. Chas., 47, Cannon Street, London, E.C., Chemical Engineer.

1904. Phillips, V. C., 35, Morris Avenue, Manor Park, Essex, Chemist.

1898. Phillips, Wm. H., 100, Milton Avenue, East Ham, E., Soap Works Chemist.

1894. Picard, Hugh F. K., 44, London Wall, London, E.C., Metallurgist.

1904. Pickard, Glenn H., c/o The Spencer-Kellogg Co., Buffalo, N.Y., U.S.A., Chemist.

1905. Pickard, Greenleaf W., Amesbury, Mass., U.S.A., Electrical Engineer.

1902. Pickard, R. H., Isca, Merlin Road, Blackburn, Teacher and Analyst.

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1894. Pilling, John E., 229, Hornby Road, Blackpool, Chemist.
1906. Pincott, Emile S., 222, St. James Street, Montreal, Canada, Manager (Nichols Chemical Co. of Canada, Ltd.).
1905. Pinnock, H. T., 29, Victoria Road, Tipton, Staffs., Chemist.
1883. Pipe, Jas., Woodburn, Irvine, N.B., Chemical Manufacturer.
1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1907. Pitman, Brig.-Gen. John, 167, Berkeley Avenue, Orange, N.J., U.S.A., U.S. Army (retired).
1902. Pittard, Jno., 30, Mansfield Road, Ilford, Essex, Chemical Manufacturer.
1884. Pittuck, F. W., 19, Stratford Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.
1909. Piutti, Prof. Dr. Arnaldo, Instituto Chimico-farmaceutico, R. Universita, Napoli, Italy, Director.
1899. Pizey, Jas. H., Bella Vista 19, Minas de Rio Tinto, Prov. de Huelva, Spain, and (temporarily) 22, Duke's Avenue, Muswell Hill, N., Chemist.
1894. Platten, Frank, 12, Montague Road, Edgbaston, Birmingham, Metallurgical Chemist.
1890. Platts, Jno. C., 12, Alton Terrace, Fairfield, Manchester, Metallurgical Chemist.
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1888. Playfair, David J., 7, Victoria Crescent, Dowanhill, Glasgow, Manufacturing Chemist.
1908. Plows, G. H., 14, Regent Park Avenue, Headingley, Leeds, Tar Distiller.
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1907. Poetschke, Paul, 26, West Spruce Street, Corona, N.Y., U.S.A., Chemist.
1901. Pollard, Wm., Museum, Jermyn Street, London, S.W., Chemist (H.M. Geological Survey).
1904. Pollitt, Dr. Geo. P., Winnington, Northwich, Cheshire, Chemist.
1902. Pollitt, Jas. C. T., 7, Grosvenor Road, Handsworth, Birmingham, Managing Chemist.
1893. Pollitt, R. B., c/o Compania Nacional Mexicana de Dinamita y Explosivos, Dinamita (*vià* Noé), Durango, Mexico, Civil Engineer.
1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.
1890. Pomeroy, Dr. Chas. T., 55, Broad Street, Newark, N.J., U.S.A., Ink Manufacturer.
1909. Pond, Francis J., 86, Valley Road, Montclair, N.J., U.S.A., Assoc. Professor of Chemistry.
1896. Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.
O.M. Pond, J. A., 99, Queen Street, Auckland, New Zealand, Analytical Chemist.
1906. Pont, A. Felix du, Box 31, Wilmington, Del., U.S.A., Explosives Manufacturer.
1895. Pont, Pierre S. du, Wilmington, Del., U.S.A., Explosives Manufacturer.
O.M. Pope, S., 34, Clarendon Road West, Chorlton-cum-Hardy, Manchester, Chemical Works Manager.
1899. Pope, Thos. H., The University, Birmingham, Chemist and Lecturer on Brewing.
1910. Pope, Walter B., 344, Harvard Street, Cambridge, Mass., U.S.A.
1900. Pope, Prof. W. J., F.R.S., University Chemical Laboratory, and (Journals) Holmesdale, Brooklands Avenue, Cambridge, Professor of Chemistry.
1900. Popplewell, Jos. M., Provan Chemical Works, Provanmill, Glasgow, Chemist.
1899. Porter, A. Felix, c/o E. I. du Pont de Nemours Powder Co., Haskell, N.J., U.S.A., Superintendent.
1902. Porter, J. Edw., P.O. Box 785, and 205, W. Genesee Street, Syracuse, N.Y., U.S.A., Chemist.
1901. Porter, Jno. L., Water Purification Station, P.O. Box 791, Station B., New Orleans, La., U.S.A., Chemist.
1884. Potter, Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.
1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.
O.M. Potter, E. P., Salwick Hall, near Preston, and (Journals) c/o E. P. Potter and Co., Ltd., Little Lever, near Bolton, Alkali Manufacturer.
1906. Potter, Dr. H. Noel, Hollywood, Cal., U.S.A., Electrical Engineer.
1899. Potter, Rowland S., c/o Defender Dry Plate Co., Germantown, Philadelphia, Pa., U.S.A., Chemist.
1900. Potts, Geo. E., 18, Tremont Street, Pottsville, Pa., U.S.A., Explosives Manufacturer.
1900. Pough, Frank H., (subs.) 82, Beaver Street, New York City, and (Journals) 149, Columbia Heights, Brooklyn, N.Y., U.S.A., Assistant Secretary.
1900. Powell, Harry J., 125, Thurlow Park Road, Dulwich, S.E., Glass Manufacturer.
1884. Powell, L. S., The Old Manor House, Ashley, Stockbridge, Hants, Electrician.
1897. Power, Dr. Fred. B., Wellcome Research Laboratories, 6, King Street, Snow Hill, London, E.C., Director.
1907. Powers, Wm. R., c/o A. T. and S. F. R. R. Co., Topeka, Kans., U.S.A., Chief Chemist.
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1897. Prentice, Dr. Bertram, Royal Technical Institute, Salford, Lecturer on Chemistry.
1902. Prentice, Dr. David, The Nook, Whitefield Road, Stockton Heath, Warrington, Chemist.
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1905. Prentiss, G. L., c/o Parson Manufacturing Co., 299, Broadway, New York City, U.S.A., Treasurer.
1900. Prescott, Saml. C., 739, Boylston Street, Boston, Mass., U.S.A., Instructor in Bacteriology.
1905. Preston, Jas. F., Lowell, Mass., U.S.A., Manufacturing Chemist.
1906. Preston-Jackson, J. W. A., 210, City Road, Bradford, Yorkshire, Consulting and Analytical Chemist and Druggist.
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1905. Price, Dr. T. Slater, The Technical School, Birmingham, Lecturer on Chemistry.
1904. Prichard, Norman B., 40, Quebec Street, Sherbrooke, Quebec, Canada, Superintendent.
1904. Prideaux, Dr. E. B. R., Muspratt Laboratory, The University, Liverpool, Research Chemist.
1905. Priest, Geo. Wesley, Mansfield, Mass., U.S.A., Manufacturer.
1899. Prinsen-Geerligs, H. C., Wanningstraat 17, Amsterdam, Holland, Director of Sugar Cane Experimental Station.
1893. Pritchard, Edgar J., 11, Cumberland Road, Kew, Surrey, Works Manager.
1903. Pritchard, Philip M., Chief Engineer's Office, United Alkali Co., Ltd., Widnes, Engineer.
1896. Prochazka, Dr. Geo. A., 138, West 13th Street, New York City, U.S.A., Colour Manufacturer.
O.M. Procter, Prof. H. R., The University, Leeds; and (Journals) Rowangarth, Ben Rhydding, near Leeds, Lecturer on Tanning.
1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.
1890. Proctor, Miss Anne J., Free Library, Widnes, Librarian.
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1901. Propach, C., 146, West Kinzie Street, Chicago, Ill., U.S.A., Colour Merchant.
1907. Pryce, Geo. A., c/o Philip Harris & Co., Ltd., 144 & 146, Edmund Street, Birmingham, Manager of Apparatus Department.
1907. Puckhaber, Geo. C., 805, Prospect Place, Brooklyn, N.Y., U.S.A., Glue Maker.

1906. Pudney, Sydney H., 156, Bellwood Avenue, Toronto, Canada, Foreman.
1905. Pugh, John V., Guiting House, Allesley, near Coventry, Works Director (Rudge Whitworth, Ltd.).
1899. Pullar, Edmund, Keirfield, Bridge of Allan, N.B., Manufacturer.
1894. Pullar, Herbert S., Pullar's Dyeworks, Perth, N.B., Dyer.
O.M. Pullar, Sir Robert, M.P.; Journals to Jas. Craigie, Sandeman Public Library, Perth, N.B., Dyer.
O.M. Pullar, R. D., Pullar's Dyeworks, Perth, N.B., Dyer.
1903. Pullin, Sydney R., c/o Palmarejo and Mexican Goldfields, Ltd., Chinipas, Chihuahua, Mexico, Chemist.
1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.
1894. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, N.B., Professor of Chemistry.
1905. Pyman, Dr. Frank Lee, Carlee, Selborne Road, Sidcup, Kent, Chemist.
1908. Pyne, Albert R., 134, Carlton Street, Toronto, Canada, Chemist.

Q

1903. Queeny, Jno. F., Monsanto Chemical Works, 1806—1818, South 2nd Street, St. Louis, Mo., U.S.A., Chemical Manufacturer.
1903. Queneau, Augustin L., c/o Wetherill Co., Erie Avenue, East of Erie Street, Philadelphia, Pa., U.S.A., Mining Engineer.
1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.
1902. Quinan, Kenneth B., Cape Explosives Works, Somerset West, C.C., South Africa, Chemist.
1897. Quinan, Wm. R., (Journals) General Manager, Cape Explosives Works, Dynamite Factory, Cape Colony, South Africa; and (subscriptions) c/o Cape Explosives Works, Ltd., 15, St. Swithin's Lane, E.C., Superintendent (Powder Works).

R

1907. Rabino, Jos. F., Sugar Factory, Abou-Kourgas, Upper Egypt, Sugar Maker.
1898. Radcliffe, Lionel G., 929, Chester Road, Stretford, Manchester, Chemist.
1904. Rademacher, Dr. Ferdinand, Prag-Carolinenthal, Austria, Chemical Manufacturer.
1900. Radley, Ernest G., 49, Ernest Street, West Norwood, S.E.
1895. Raegener, Louis C., 141, Broadway, New York City, U.S.A., Patent Lawyer.
1901. Ralston, Wm., 3, Windsor Terrace, Linthouse, Glasgow, Government Chemist.
1902. Ramsay, A. Alexander, Laboratory, Department of Agriculture, 136, George Street, Sydney, N.S.W., Australia, Assistant Chemist.
O.M. Ramsay, Sir William, K.C.B., F.R.S., University College, London, W.C.; Journals to 19, Chester Terrace, N.W., Professor of Chemistry.
1885. Ramsay, W., c/o Cammell, Laird and Co., Ltd., Birkenhead Ironworks, Birkenhead, Chemist and Assayer.
1906. Ranck, Samuel H., Ryerson Public Library Building, Grand Rapids, Mich., U.S.A., Librarian.
1909. Randall, George, "Kingsley," Station Road, Kenilworth, Warwickshire, Tanner.
1910. Ranken, Charles, 19, Stockton Road, Sunderland, Analytical and Consulting Chemist.
1901. Ransom, Francis, The Chilterns, Hitchin, Herts., Manufacturing Pharmaceutical Chemist.
1905. Ransom, H. B., St. Stephen's House, Victoria Embankment, Westminster, S.W., Consulting Engineer.
1904. Rapelje, Walter S., 568, Jamaica Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1898. Raschen, Dr. John, The Highfield, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).
1905. Raschig, Dr. F., Ludwigshafen a/Rhein, Germany, Manufacturing Chemist.
1908. Rassow, Prof. Dr. Berthold, Dorrienstrasse 13, Leipzig, Germany, General Secretary, Vereins Deutscher Chemiker.
1893. Ratcliff, Frank D., Medina, Widney Road, Knowle, near Birmingham, Vinegar Brewer.
1901. Ratcliffe, C. F., Haigh Park Chemical Works, Stourton, near Leeds, Tar Distiller.
1904. Ratcliffe, Mrs. F. A., Haigh Park Chemical Works, Stourton, near Leeds.
1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.
1901. Rawlins, Herbert J. L., The Cottage, Rainhill, Lancashire, Managing Director.
1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100, William Street, New York City, U.S.A., Chemist.
O.M. Rawson, Chris., Battenberg Avenue, Leicester, Consulting Chemist.
1909. Rawson, H. Wyatt, c/o Woodhead and Co., 44, Charing Cross, London, S.W.
1909. Rayner, Arthur B., Normanhurst, Alexandra Park Road, Muswell Hill, N., Chemical Broker.
1895. Read, E. J., Portland, Belmont Road, Westgate-on-Sea, Analyst.
1890. Reade, Thos., 20, Harborne Road, Edgbaston, Birmingham, Manufacturing Chemist.
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1908. Reavell, J. Arthur, 181, Queen Victoria Street, London, E.C., Engineer.
1907. Rebhun, Frank E., c/o Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Chemist.
1902. Redfern, C. G., 4, South Street, Finsbury, London, E.C., Patent Agent.
1890. Redgate, J. G., Traffic Street, Nottingham, Aerated Water Manufacturer.
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1884. Redwood, Iltyd J., 21, Erith Road, Belvedere, Kent, Technical Chemist.
1887. Redwood, Robt., 4, Bishopsgate Street Within, London, E.C., Secretary.
1886. Rée, Dr. A., 15, Mauldeth Road, Withington, Manchester, Aniline Dye Manufacturer.
1884. Reed, Albert E., The Grange, Leigham Court Road, Streatham, S.W., Paper Works Chemist.
1902. Reed, Herbert C., c/o Stamford Manufacturing Co., Stamford, Conn., U.S.A., Chemist.
1895. Reed, Dr. J. Hastings, Hambledon Mill, *via* Cairns, North Queensland, Sugar Manufacturer.
1906. Reed, William, Bridge House, Bridge Road, Millwall, E., Foreman (Desilverising Works).
1893. Reekie, J. A., Woodhouse, Hayfield, Derbyshire, Calico Printer's Colour Mixer.
1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.
1897. Rees, W. H., c/o Alameda Sugar Co., Alvarado, Cal., U.S.A., Chemist.
1906. Rees, Walter J., c/o Chance Bros. and Co., Ltd., Smethwick, near Birmingham, Glass Works Chemist.
1900. Reese, Dr. Chas. L., Eastern Laboratory, P.O. Box 424, Chester, Pa., U.S.A., Chemist.
1897. Reid, Andrew, c/o L. and J. McLellan, 65, Port Dundas Road, Glasgow, Chemist.
1909. Reid, David E., Kodak Park, Rochester, N.Y., U.S.A., Chemist.
1909. Reid, Howard E., c/o Lawrence Portland Cement Co., Siegfried, Pa., U.S.A., Chemist.
1906. Reid, James, Moffat Mills, Airdrie, N.B., Chemist.
1905. Reid, Dr. John H., Cranford, Barton Heys Road, Formby, Lancs., Chemist.
1907. Reid, Robert, Agencia de Tharsis, Huelva, Spain, Analytical Chemist.
1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemist.

O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.
1893. Reid, Wm., jun. Bombay Dyeworks, Dadur, Bombay, India, Dyer.
1907. Reimarus, Dr. C., Chemische Fabrik auf Actien (vorm. E. Schering), Müllerstrasse 170–171, Berlin, N. 39, Germany, Manager.
1904. Reinherz, Otto, 9, Heaton Grove, Bradford, Yorks., Chemist.
1906. Reinhold, Gustave, 11, Hervey Road, Blackheath, S.E., Works Manager.
1898. Reitmeyer, Robt. E. D., 63, Crutched Friars, London, E.C., Chemical Merchant.
1904. Remington, Prof. Joseph P., 1832, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S. Pharmacopœia.
1900. Remington, J. Stewart, Aynsome, Grange-over-Sands, R.S.O., Lancs., Consulting Chemist.
1903. Remsen, President Ira, Johns Hopkins University, Baltimore, Md., U.S.A., President.
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1901. Renwick, Frank F., Norland House, Avenue Road, Brentwood, Essex, Chemist (Photographic Works).
1907. Reoch, Robert A. S., Cocheco Manufacturing Co., Dover, N.H., U.S.A., Printworks Superintendent.
1894. Rettie, Theodore, 16, Great King Street, Edinburgh, Metallurgical Chemist.
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1904. Rhett, Edmund, c/o Virginia-Carolina Chemical Co., Charleston, S.C., U.S.A., Works Manager.
1908. Rhoads, J. Edgar, Box 961, Wilmington, Del., U.S.A., Leather Chemist.
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1892. Rhodes, P. J., Bridge House, Church, Accrington, Dye and Print Works Manager.
1889. Richards, Edgar, 60, Ayrault Street, Newport, R.I., U.S.A., Analytical Chemist.
1910. Richardson, C. Gordon, 137, Jarvis Street, Toronto, Canada, Chemist.
1888. Richardson, Dr. Clifford, 30, Church Street, New York City, U.S.A., Chemical Engineer.
1903. Richardson, F. J., Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.
1884. Richardson, F. W., County Analyst's Office, Bradford, Yorkshire, Analytical Chemist.
1900. Richardson, Jno. H., c/o H. D. Pochin and Co., Ltd., Salford, Manchester, Manager.
1905. Richardson, L. G., Newtown View, Glenpatrick, Elderslie, Johnstone, N.B., Chemist.
1889. Richardson, S. M., 415, Main Street, Bonhill, N.B., Analytical Chemist.
1891. Richardson, Walter W., Aldingham, Park View Crescent, Roundhay, Leeds, Manufacturing Chemist.
1903. Richardson, Wm., 2, Thornfield Road, West Park, Headingley, Leeds, Drysalter.
1894. Richardson, Wm. H., Newsky Thread Mills, Malaja, Bolotnaja, St. Petersburg, Russia, Textile Chemist.
1886. Richmond, H. D., Mex, Avondale Avenue, Woodside Park, N., Chief Chemist (Aylesbury Dairy Co.).
1898. Richmond, Jno. R., The Hollies, Blurton, Longton, Staffs., Alkali Works Manager.
1901. Richmond, Sylvester O., Royal William Yard, Plymouth, Analytical Chemist.
1907. Ricketts, Guy D. *See* Bengough, Guy D.
1886. Riddell, R., 87, Horninglow Street, Burton-on-Trent, Brewer.
1884. Rideal, Dr. Samuel, Laboratory, 28, Victoria Street, Westminster, S.W., Consulting Chemist.
1905. Ridge, H. M., 62, London Wall, London, E.C. Mining Engineer.
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1889. Riederer, Emil J., Forcite Works, Landing, N.J., U.S.A., Works Chemist.
1902. Riederer, Dr. Herman S., 251, West 95th Street, New York City, U.S.A., Chemist.
1908. Rigby, Wm. T., County Analyst's Laboratory, Temple Street, Birmingham, Public Analyst.
1907. Rigg, Gilbert, c/o New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A., Chemist.
1892. Riker, Jno. J., 46, Cedar Street, New York City, U.S.A., Merchant.
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1905. Riley, Louis J., 8, Newton Road, London, W., Chemist.
1899. Rink, Arnold, 11, Bridgewater Street, Barbican, London, E.C., Tannin Extract Manufacturer.
1889. Rintoul, Wm., "Lauriston," Ardrossan, Ayrshire, Explosives Chemist.
1901. Ripley, Philip F., 7, Abbott Street, Andover, Mass., U.S.A., Chemist.
1909. Rising, Albert E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
1909. Roberts, Alfred R., c/o Sunbeam Incandescent Lamp Co., 225, Dufferin Street, Toronto, Canada, Chemist.
1907. Roberts, Chester, Swarthmore College, Swarthmore, Pa., U.S.A., Superintendent.
O.M. Roberts, F. G. Adair, Oak Hill Lodge, Frognal, N.W., Chemical Manufacturer.
1901. Roberts, H. E. U., c/o British Explosives Synd., Pitsea, Essex, Chemist.
1907. Roberts, Percy R., c/o Blumenthal & Co., Wilmington, Del., U.S.A., Leather Chemist.
1885. Roberts, R. Wightwick, Plazuela Justicia 30, Valparaiso, Chili, Analytical and Consulting Chemist.
1900. Roberts, Wm. Brittain, Wilderspool House, Warrington, Brewer and Analyst.
1902. Roberts, Wm. H., 4, Sugnall Street, Liverpool, Analytical Chemist.
1902. Robertshaw, Chas D., c/o Chas. Price and Co., Oilworks, Belvedere, Kent, Analytical Chemist.
1891. Robertson, Alex. A., Riversdale, Cressington Park, Liverpool, Technical Chemist.
1897. Robertson, Andrew J., 2, North Ninth Street, Richmond, Va., U.S.A., Analytical Chemist.
1909. Robertson, F. A., 492, Euclid Avenue, Toronto, Canada, Chemist.
1900. Robertson, Jas., Barncraig, South Medrox, by Glenboig, N.B., Analytical Chemist.
1910. Robertson, Joseph G., Messrs. Ewing and Robertson, Empire Works, Carntyne, Glasgow, Manufacturer.
1891. Robertson, Dr. Robt., Research Dept., Royal Arsenal, Woolwich; and (Journals) 29, Charlton Road, Blackheath, S.E., Analytical Chemist.
1910. Robertson, William, Chemical Dept., Central Technical College, Exhibition Road, London, S.W., Lecturer and Research Assistant.
1897. Robinson, Clarence J., Westerleigh, West New Brighton, N.Y., U.S.A., Chemist.
1904. Robinson, Prof. Franklin C., Bowdoin College, Brunswick, Maine, U.S.A., Professor of Chemistry.
1902. Robinson, Hy. Fishwick, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.
O.M. Robinson, H. H., 42, Penywern Road, Earl's Court, S.W., Analytical Chemist.
1907. Robinson, Herbert W., Robinson Bros., Ltd., Ryders Green, West Bromwich, Staffordshire, Tar Distiller.
O.M. Robinson, Jno., 8, Kalundah Terrace, Albert Road, Widnes, Chemical Engineer.
O.M. Robinson, Jos., Farnworth, Widnes, Chemical Manufacturer.

1887. Robinson, Thomas, (Journals) 101, West Street, Glasgow; and (communications), The Villa, Nitshill, N.B., Chemical Works Manager.

1902. Robitschek, Carl, 200, Worth Street, New York City, U.S.A., Scientific Brewer.

1884. Rodger, Edw., 1, Clairmont Gardens, Glasgow, W.

1904. Rodger, Robert, Government Laboratory, Clement's Inn Passage, Strand, London, W.C., Chemist.

1905. Rodger, R. L., Suffolk House, Cannon Street, London, E.C., Manager (Peña Copper Mines).

1909. Rody, Franz A., 132, Condit Street, Hammond, Ind., U.S.A., Chemist.

1904. Roeber, Dr. E. F., 239, West 39th Street, New York City, U.S.A., Editor (Metallurgical and Chemical Engineering).

1903. Roelofsen, Dr. J. A., c/o Coal Distillation Co., Middlesbrough, Yorks., Works Manager.

1910. Roessler, Dr. F., c/o Roessler & Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.

1905. Rogers, Dr. Allen, Pratt Institute, Brooklyn, N.Y., U.S.A., Research Chemist.

1900. Rogers, Geo. J., Pembrey Copper Works, Burry Port, South Wales, Chemist.

1890. Rogers, Harry, 5, Stoke Newington Common, London, N.

1908. Rogers, Harry V., Ash Street, Ilkeston, Derbyshire, Engineer.

1907. Rogers, Henry L., c/o Ingeniero Residente, Ferro Carril de Buenos Aires al Pacifico, 25 de Mayo 277, Buenos Aires, Argentina, Analyst and Cement Expert.

1909. Rogers, Herbert, Stenning House, Colwell Road, Retford, Notts, Rubber Works Chemist.

1899. Rogers, John, c/o Nobel's Explosives Co., Ltd., Nobel House, Glasgow, Chemist.

1909. Rolker, Herman F., c/o Amer. Naval Stores Co., Savannah, Ga., U.S.A., Chemist.

1907. Roller, Frank R., 525, 31st Street, Oakland, Cal., U.S.A., Powder Works Superintendent.

1898. Roller, H. C., 493, Central Avenue, Newark, N.J., U.S.A., Superintendent.

1899. Rollin, Chas., Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.

1909. Rollin, Hugh, 6, Hollis Terrace, Riding Mill-on-Tyne, Chemical Manufacturer.

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1907. Rolph, George M., c/o California and Hawaiian Sugar Refining Co., Crockett, Cal., U.S.A., Sugar Refiner.

1905. Romanes, J. W., Casa Colon, Huelva, Spain, Chemical Engineer.

O.M. Roscoe, Rt. Hon. Sir Henry, F.R.S., 10, Bramham Gardens, South Kensington, S.W., Consulting Chemist.

1904. Rose, Jno., Wicken House, Stretton, near Warrington, Technical Chemist.

1901. Rose, Jno. Leonard, 45, De Parys Avenue, Bedford, Chemist.

1902. Roseburgh, Prof. T. R., 150, West Newell Street, Syracuse, N.Y., U.S.A., Professor of Electrical Engineering.

1897. Rosengarten, Dr. Geo. D., P.O. Box 1625, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1896. Rosenheim, Dr. Otto, 68, Belsize Park Gardens, Hampstead, N.W., Research Chemist.

1887. Ross, Alex. J. J., Tayavalla, Camelon, Falkirk, N.B., Chemical Manufacturer.

1893. Ross, Arthur, 1, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.

1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.

1906. Rossi, Auguste J., c/o Roessler Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Mining Engineer.

1906. Rossi, Louis M., c/o Perth Amboy Chemical Works, Perth Amboy, N.J., U.S.A., Mining Engineer.

1906. Rossiter, E. C., 4, Park Road, West Smethwick, Birmingham, Chemical Engineer.

1888. Rothwell, C. F. Seymour, Photographic Works, Mobberley, Cheshire, Chemist.

1908. Rothwell, Herbert E., Standard Varnish Works, Elm Park, Staten Is., N.Y., U.S.A., Chemist.

1905. Rothwell, Robert R., 88, George Street, Moss Side, Manchester, Chemistry and Physics Teacher.

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1899. Rouse, H. W., Anglo-Continental Guano Co., Victoria Docks, E., Foreman.

1903. Rouse, Wm., 46, Hermitage Road, Crumpsall, Manchester, Chemist.

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1908. Rowley, Frank, 4, Doughty Street, London, W.C., and (Jnls.) The Sanatorium, Frimley, Surrey, Metallurgist.

1901. Rowley, Walter Eugene, c/o National Aniline and Chemical Co., 100, William Street, New York City, U.S.A., Chemist.

1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Chemist.

1896. Royal-Dawson, H., 6, Wimbourne Road, City Road, Edgbaston, Birmingham, Chemist.

1898. Royle, Chas. L., 1, Wigram Road, Wanstead, Sugar Chemist.

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1902. Rücker, Dr. Hermann von, 91, Lancaster Avenue, Buffalo, N.Y., U.S.A., Chemist.

1896. Ruddock, Fred. G., Corporation Street, Warrington, Analytical Chemist.

1895. Rudge, Alfred, Sutton Alkali Works, St. Helens, Lancs., Analytical Chemist.

1908. Rudolf, Prof. Norman S., Dept. of Applied Chemistry, Indian Institute of Science, Bangalore, India, and (Journals) Royal Societies Club, 62, St. James Street, London, S.W., Professor.

1909. Rudorf, Dr. G., 34, Cranley Gardens, Muswell Hill, London, N., Manufacturing Chemist.

1884. Ruffle, Jno., Musley, Ware, Herts., Consulting Chemist and Electrician.

1905. Rüger, Richard, 93, Hale Road, Walton, Liverpool, Chemist.

1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co., P.O. Box 1999, 100, William Street, New York City, U.S.A., Chemical Merchant.

1909. Ruiloba, J. A., c/o U.S. Steel Corporation, 71, Broadway, New York City, U.S.A., Engineer.

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1899. Rumbold, Wm. R., Calverley Lodge, Tunbridge Wells, Kent, Electro-Metallurgist.

1895. Rump, Ernest, The Leeds Phosphate Works, Hunslet, Leeds, Manager.

1903. Runyan, Elmer G., Hutchins Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.

1899. Rushby, Wm., Oak View, Batley, Yorks., Analyst.

1906. Russell, David, Cadham, Markinch, Fife, Scotland, Paper Maker.

1908. Russell, Walter M., Office of Gas Inspector, City Hall, Dallas, Texas, U.S.A., Industrial Chemist.

1910. Russell, William, 146, Peel House Lane, Widnes, Lancashire.

1901. Rust, Robt. R., 312, West 97th Street, New York City, U.S.A., Chemist.

1905. Ruttan, Prof. R. F., Medical Faculty, McGill University, Montreal, Canada, Professor of Chemistry.

1909. Ryall, W. E., 109, Burford Road, Nottingham, Soapworks Chemist.

1905. Ryan, Prof. F. G.: (Journals) c/o Parke, Davis and Co., Detroit, Mich., U.S.A., and (subscriptions) c/o Parke, Davis and Co., Beak Street, Regent Street, London, W., Manufacturing Chemist.

1910. Ryan, Leo G., 27, Bishop Street, Montreal, Canada, Druggist.

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1895. Saarbach, Dr. L., 114, Pearl Street, New York City, U.S.A., Consulting Chemist.
1908. Sabbaton, Frederic A., c/o Laurentide Paper Co., Ltd., Grande Mère, P.Q., Canada, Paper Manufacturer.
1905. Sabin, Alvah H., 432, Sandford Avenue, Flushing, N.Y., U.S.A., Chemist, Varnish Works.
1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.
O.M. Sadler, Sir Samuel A., Middlesbrough-on-Tees, Colour Manufacturer.
1908. Sadtler, Philip B., 945, Monadnock Building, Chicago, Ill., U.S.A., Consulting Chemist and Engineer.
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1885. Salamon, Jno., Rainham, S.O., Essex, Manufacturing Chemist.
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1907. Samuel, Marcus R. A., 12, Minories, London, E.C., Merchant.
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1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.
1904. Sand, Dr. Henry J. S., University College, Nottingham, Lecturer and Demonstrator.
1909. Sandberg, Sixten, Skutskärs Sulphite and Sodapulp Mills, Skutskär, Sweden, Chemist and Mill Manager.
1906. Sanders, J. McConnell, c/o Direción General de Aduanas, Palacio Nacional, Mexico, D. F., Analytical Chemist.
1902. Sanders, Warren W., 127, Vernon Street, Gardner, Mass., U.S.A., Chemist.
1895. Sanderson, John, c/o B. S. Cohen, Ltd., 15, Clerkenwell Close, London, E.C., Chemist.
1898. Sanderson, T. Crisp, Dubois Avenue, West New Brighton, N.Y., U.S.A., Chemical Engineer.
1907. Sandig, A., P.O. Box 702, Chicago, Ill., U.S.A., Sales Manager.
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1890. Saniter, E. H., Strafford Villa, Moorgate, Rotherham, Analytical Chemist.
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1899. Schaefer, Dr. L., Maywood, N.J., U.S.A., Manufacturing Chemist.
1903. Schanche, H. G., 3401, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.
1908. Schatzmann, Dr. Paul, Isleben bei Fluelen, Switzerland, Chemist.
1908. Scheele, Edward H., 3, Lloyds Avenue, London, E.C., Chemical Merchant.
1903. Scheidel, Dr. Aug., Mutual Life of New York Building, Martin Place, Sydney, N.S.W., Australia, Managing Director.
1886. Schellhaas, Henry Alf., Thornhill, Beach Road, Hartford, Northwich, Mechanical Engineer.
1904. Schenck, Henry, 15, University Place, New York City, U.S.A.
1894. Schidrowitz, Dr. P., 57, Chancery Lane, London, W.C., Research Chemist.
1905. Schill, Dr. Emil, c/o G. Siegle Co., Rosebank, Staten Island, N.Y., U.S.A., Chemist.
1909. Schlagintweit, Theo., 94, Market Street, Manchester, Imperial German Consul.
1902. Schlegel, Jno. Wm., cor. Main and Toledo Avenues, Elmhurst, Long Island, N.Y., U.S.A., Chemist.
1893. Schleicher, Francis J., 38, West Tenth Street, Long Island City, N.Y., U.S.A., Technical Chemist.
1902. Schlesinger, Basil E., Brookline, Mass., U.S.A., Chemist.
1901. Schlichting, Emil, 38, Cranberry Street, Brooklyn, N.Y., U.S.A., Chemist.
1908. Schmatolla, Ernst, 317, High Holborn, London, W.C., Consulting Chemical Engineer.
1905. Schmidt, Herman B., 2523, Essex Place, East Walnut Hill, Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1906. Schmidt, J., 52, Camberwell Green, London, S.E., Works Manager.
1907. Schmitt, Charles A., The Carter's Ink Co., 172, Columbus Avenue, Boston, Mass., U.S.A. Chemist.
1906. Schneible, Joseph, 842, Elk Street, Buffalo, N.Y., U.S.A., Chemical Engineer.
1901. Schneider, Edw. J., c/o Electro-Metallurgical Co., Niagara Falls, N.Y., U.S.A., Chemist.
1899. Schniewind, Dr. F., c/o German American Coke and Gas Co., 17, Battery Place, New York City, U.S.A., President.
1904. Schniewind, Heinrich, Jun., Susquehanna Silk Mills, 18, West 18th Street, New York City, U.S.A., Vice-President and Treasurer.
1907. Schober, Prof. W. B., Lehigh University, South Bethlehem, Pa., U.S.A., Professor of Chemistry.
1897. Schoder, Dr. Robt., 6, Brandreth Road, Balham, S.W., Chemist.
1904. Schoeller, Dr. Walter R., (subsn.) 27, Rue de la Justice, Antwerp, Belgium, and (Jnls.) c/o Alff and Co., Hankow, China, Analytical Chemist.
1902. Schofield, Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.
1908. Scholefield, Fred., c/o R. P. Lawson and Sons, Britannia Works, Hulme, Manchester, Works Chemist.
O.M. Scholefield, H. E., Edge Hill Chemical Works, Liverpool, Chemical Manufacturer.
1906. Schroeder, C. M. E., 221, Pearl Street, New York City, and (Journals) Rutherford, N.J., U.S.A., Analytical Chemist.
1895. Schroeder, E. August, c/o Church and Dwight Co., 36, Ash Street, Brooklyn, N.Y., U.S.A., Chemist.
1908. Schüll, Gustav, Messrs. Carl Schleicher & Schüll, Düren, Rheinland, Germany, Filter Paper Manufacturer.
1906. Schulten, Dr. C., P.O. Box 279, Calcutta, India, Analytical Chemist.

1904. Schultz, Carl R., 410, First Avenue, New York City, U.S.A., Mineral Water Manufacturer.

1901. Schultze, Wm., c/o General Chemical Co., Laurel Hill, Long Island, N.Y., U.S.A., Chemist.

1893. Schüpphaus, Dr. R. C., 1466, Dean Street, Brooklyn, N.Y., U.S.A., Consulting Chemist.

1893. Schwab, Dr. L. C., Sedanstrasse 53, Bernburg, Anhalt, Germany, Technical Chemist.

1908. Schwalbe, Dr. Carl G., Rossdorferstrasse 86, III, Darmstadt, Germany, Professor (Technische Hochschule).

1907. Schwamm, Chas. A., c/o Antoine Chiris, 20, Platt Street, New York City, U.S.A., Chemist.

1902. Schwarz, Gustav A., Grasselli Chemical Co., 60, Wall Street, New York City, U.S.A., Manager.

1889. Schweich, Emile. *See* Mond, Emile S.

1903. Schweickert, Karl, 36, Jacques Avenue, Rahway, N.J., U.S.A., Chemist.

1894. Schweitzer, Dr. H., 117, Hudson Street, New York City, U.S.A., Chemical Expert.

1906. Schwerin, Lorenz R., c/o Casein Co. of America, Bainbridge, N.Y., U.S.A., Vice-President, Casein Co.

1906. Scott, Alex. C., c/o Messrs. Haslam and Schentheil, Western Mail Chambers, Cardiff, Explosives Manufacturer.

1891. Scott, Andrew, Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.

1906. Scott, A. Putnam, c/o General Electric Co., Research Laboratory, Schenectady, N.Y., U.S.A., Metallurgist.

1889. Scott, Ernest G., c/o George Scott & Son (London), Ltd., Northern Assurance Buildings, Albert Square, Manchester, Soap Works Chemist.

1898. Scott, Jas., Cawnpore Woollen Mills, Cawnpore, India, Chemist.

1894. Scott, Jno. Gillespie, Annislea, Clermiston Road, Corstorphine, Edinburgh, Analytical Chemist.

1902. Scott, Walter, c/o The Powell Duffryn Steam Coal Co., Ltd., Aberaman, near Aberdare, Chemist.

1907. Scott, Wm. F., c/o Madison Woollen Co., Madison, Maine, U.S.A., Manager.

1889. Scovell, M. A., Agricultural Experiment Station, Lexington, Kentucky, U.S.A., Agricultural Chemist.

1904. Scoville, Wilbur L., c/o Parke, Davis, & Co., Detroit, Mich., U.S.A., Analytical Chemist.

O.M. Scudder, F., Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Chemist.

1906. Seabury, Richard W., c/o Boonton Rubber Co., Boonton, N.J., U.S.A., Factory Superintendent.

1909. Seager, Dan G., Box 57, Thebes, Ill., U.S.A., Chemist.

1889. Searl, Albert, Montreux, Victoria Road, Sidcup, Kent, Technical Chemist.

1898. Searle, Alfred B., Cliftonville, Claremont, Sheffield, Analytical Chemist.

1905. Seaver, Joshua, 7, West Seventh Street, South Boston, Mass., U.S.A., Dealer in Dyestuffs and Chemicals.

1901. Sederholm, Erik, K. Flottans Varf, Stockholm, Sweden, Chemist (Royal Navy Board).

1905. Seebohm, H. C. A., 117, Hudson Street, New York City, U.S.A., Importer of Dyestuffs and Chemicals.

1905. Seeker, A. F., 160, Midwood Street, Brooklyn, N.Y., U.S.A., Food Analyst.

1907. Seelemann, Dr. A., Uhlenhorsterweg 3, Hamburg, Germany, Managing Director of Explosives Works.

1893. Sefton-Jones, Herbert, 285, High Holborn, London W.C., Chemist and Patent Agent.

1907. Seidensticker, Lewis J., c/o Warner Sugar Refining Co., Edgewater, N.J., U.S.A., Chief Chemist.

1896. Seldner, Rudolph, 1395, Dean Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.

1904. Seligman, Dr. Richard, Thanet House, 231, Strand, London, W.C., Chemist.

1908. Sellen, Elijah, Gasworks Laboratory, Elm Station, Montreal, Canada, Chemist.

1905. Sellers, Geo. E., Rock View, Milnsbridge, near Huddersfield, Aniline Colour Maker.

1898. Sen (Gupta), Nagendra Nath, 19, Lower Chitpur Road, Calcutta, India, Physician and Chemist.

1910. Sen, Rajendara Nath, The University, Leeds, Research Student.

1899. Senior, Francis L., Box 31, Sanford, Maine, U.S.A., Mill Chemist.

1906. Setz, C. F., Herculaneum, Mo., U.S.A., Chemist and Metallurgist.

1905. Sewell, B. F. Brooke, P.O. Box 70, Washington, D.C., U.S.A., Chemical Engineer.

1896. Seyler, Clarence A., Public Analyst's Office, Nelson Terrace, Swansea, Chemist and Assayer.

1907. Seymour, Tom G., 26, Karslake Road, Wavertree, Liverpool, Analytical Chemist.

1903. Shacklady, T. G., c/o Curtis's and Harvey, Ltd., Cliffe at Hoo, Kent, Technical Chemist.

1906. Shadbolt, Fred., c/o South Metropolitan Gas Co., Chemical Works, East Greenwich, S.E., Chemical Engineer and Manager.

1906. Shah, Prof. S. J., Dhanasutar's Street, Dehra's Pole, Ahmedabad, India, Professor of Science.

1905. Shainwald, R. L., jun., Bound Brook, N.J., U.S.A., and (Journals) Paperhuderstrasse 3, Hamburg, Germany, Chemist.

1906. Shankland, George A., Edge Hill, Mansfield Woodhouse, Notts., Manager.

1892. Shanks, Arch., Bridgend Mills, Dalry, Ayrshire, N.B., Chemist.

1908. Shanks, John, Dalmeny Hook, Barrhead, N.B., Sanitary Engineer.

1883. Sharp, James, Shirley Manor, Wyke, near Bradford, Yorks., Dyer.

1909. Sharp, James B., Thorn Bank, Marple, Cheshire, Chemical Representative (Meister, Lucius, und Brüning).

1904. Sharples, C. H., Holly Villas, Sutton Lane, Middlewich, Cheshire, Works Chemist.

1905. Sharples, Philip P., 22, Concord Avenue, Cambridge, Mass., U.S.A., President (Natl. Coal Tar Co.).

1881. Sharples, Stephen P., 26, Broad Street, Boston, Mass., U.S.A., Analytical Chemist.

1900. Sharwood, Wm. J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgical Chemist.

1900. Shattuck, A. F., c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.

1906. Shaw, H. G., Box 373, Barberton, Ohio, U.S.A., Chemist.

1908. Shaw, Dr. T. P., 1022, Dorchester West, Montreal, Canada, Doctor of Medicine.

1904. Shedden, Frank, 5, Belvidere Road, Walsall, Science Master.

1905. Sheldon, John C., 8, Glenbank Terrace, Lenzie, N.B., Chemist.

1903. Sheldon, Dr. N. L., Cordite Factory, Aruvankad, Nilgiri Hills, India, Works Manager.

1892. Shenton, Jas. P., 37, Torbay Road, Chorlton-cum-Hardy, near Manchester, Analytical Chemist.

1889. Shepard, Dr. Chas. U., (communications) P.O. Box 42, Summerville, S.C.; and (Journals) P.O. Box 284, Charleston, S.C., U.S.A.

1906. Shepard, Jas. H., Experimental Station, Brookings, S. Dak., U.S.A., Agricultural Chemist.

1907. Shepheard, Fred. G., 5, University Road, Galway, Ireland, Chemist.

1901. Shepherd, A. B., Copenhagen Oil Mills, Limehouse, London, E., Analytical Chemist.

1900. Shepherd, E. Sanger, 68, Adelaide Road, London, N.W., Scientific Instrument Maker.

1893. Shepherd, H. H. B., Northcote, Mount Pleasant Lane, Upper Clapton, N.E., Chemist.

1898. Shepherd, Reginald des F., Central Laboratory, Rhodes, Manchester, Printworks Chemist.

1909. Shepherd, Stephen W., Bradford Corporation Chemical Works, Frizinghall, Bradford, Yorks., Works Manager.

1899. Shero, John E., c/o Aluminium Co. of America, Niagara Falls, N.Y., U.S.A., Chemist.

1906. Sherwin, R. S., c/o Aluminium Ore Co., East St. Louis, Ill., U.S.A., Chemist.
1893. Shields, Dr. John, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1907. Shilstone, Herbert M., c/o Penick and Ford, Ltd., 416, South Front Street, New Orleans, La., U.S.A., Analytical Chemist.
1896. Shimomura, K., Shinkarasumaru Kojinguchi Sagaru, Kyoto, Japan, Professor of Chemistry.
1886. Shimosè Masachika, 110, Hakusan-Gotenmachi, Koishikawa, Tokyo, Japan, Chemical Engineer.
1888. Shishkoff, Sergius A., Perm, Russia, Glass Manufacturer.
1905. Shoffstall, Arthur S., c/o Orford Copper Co., New Brighton, S.I., N.Y., U.S.A., Chemist.
1899. Sholes, Chas. E., 164, Front Street, New York City, U.S.A., Chemical Agent.
1900. Shonk, Albert, 87, Dartmouth Road, Hendon, N., Analytical Chemist.
1897. Shores, Dr. Jeff. H., King's Road, Wallsend-on-Tyne, Chemist.
1904. Short, Andrew, Choppington, Morpeth, Works Chemist.
1902 Shoubridge, Sydney Y., M.I.C.E., Gasworks, Lower Sydenham, S.E., Gas Engineer.
1901. Shukoff, Dr. Alexis A., Borowaja No. 86, St. Petersburg, Russia, Technical Chemist.
1899. Shuler, Darius P., Sudbury, Ont., Canada, Chemist.
1890. Shutt, Frank T., Central Experimental Farm, Ottawa, Canada, Agricultural Chemist.
1906. Shuttleworth, E. B., 220, Sherbourne Street, Toronto, Canada, Chemist.
1901. Sian, Raymond L., Springfield Brewery, Wolverhampton, Research Chemist.
1902. Sibley, Samuel E., 13, Cook Road, Centennial Park, Sydney, N.S.W., Australia, Technical Chemist.
1907. Siebel, Fred. P., 1422, Montana Street, Chicago, Ill., U.S.A., Analytical Chemist.
1902. Siebold, Alfred, 59, Elms Road, Clapham Common, S.W., Technical Chemist.
1901. Silberrad, Dr. Oswald, Sunny Croft, Buckhurst Hill, Essex, Research Chemist.
1892. Silvester, Harry, 78, Holyhead Road, Handsworth, Birmingham, Analytical and Consulting Chemist.
1901. Sim, Wilfrid A., c/o Wm. Sim and Sons, 40, Jane Street, Leith, N.B., Colour Manufacturer.
1903. Simmons, Wm. H., Oakleigh, Stoke Newington Common, N., Analytical Chemist.
1898. Simon, Dr. A., 55-56, Bishopsgate Street, London, E.C., Chemical Engineer.
1905. Simons, Albert J., Pontianak, Dutch West Borneo, viâ Singapore, S.S., Engineer.
1902. Simonson, Wm., 126, West 9th Street, Cincinnati, Ohio, U.S.A., Chemist.
1905. Simpson, Henry, 34, Kimbolton Avenue, Lenton Sands, Nottingham, Works Chemical Assistant.
O.M. Simpson, W. S., The Gables, Cannon Hill, Southgate, N., Analytical Chomist.
1900. Sims, W. Edgar, c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Assistant Manager.
1894. Sinclair, Dr. W., 250, Ferry Road, Leith, N.B., Chemist.
1890. Sindall, R. W., 201, Wellmeadow Road, Catford, S.E., and (Journals) Oxford Court, Cannon Street, E.C., Paper Chemist.
1889. Singer, Ignatius, 3, Parkfield Road, Manningham, Bradford, Manufacturing Chemist.
1899. Singmaster, J. Arthur, c/o New Jersey Zinc Co. of Penna., Palmerton, Pa., U.S.A., Chemist.
1901. Sinnatt, Frank S., Glenside, Church Lane, Moston, Manchester, Demonstrator of Chemistry.
1885. Skaife, Wilfred T., 3, Trafalgar Avenue, Montreal, Canada, Sugar Chemist.
1894. Skelton, John R., c/o Norwich Crape Co., Ltd., St. Augustine's, Norwich, Managing Director.
1897. Skertchly, W. P., Laboratory, 11, Billiter Square, London, E.C., Analytical Chemist.
1891. Skilton, C. F. E., c/o Beamish and Crawford, Ltd., Cork, Ireland, Brewer.
1901. Skinner, Hervey J., c/o A. D. Little, 93, Broad Street, Boston, Mass., U.S.A., Chemist.
1908. Skinner, Wm., 38, Sauchiehall Street, Glasgow, Analytical Chemist.
1904. Skirrow, Dr. F. W., 17, Curzon Avenue, Victoria Park, Manchester, Research Chemist.
1904. Skowronski, S., c/o C. L. Constant Co., 42, New Street, New York City, U.S.A., Chemist.
1891. Skurray, Thos., The Brewery, 40, Ock Street, Abingdon, Berks, Brewer.
1904. Slator, Dr. Arthur, The Priory, Burton-on-Trent, Lecturer and Demonstrator.
1887. Slatter, Geo. W., 241, Carlton Terrace, Nab Wood, Shipley, Yorkshire, Analytical Chemist.
1906. Sleeper, Robt. R., 112, Charles Street, Lowell, Mass., U.S.A., Instructor in Dyeing.
1895. Slocum, Dr. Frank L., 401, South Linden Avenue, E.E., Pittsburg, Pa., U.S.A., Chemist.
1883. Smail, J. I., Warren Wood, Hayes Common, Beckenham, Kent, Chemical Manufacturer.
1908. Small, Bertram G., Beechlands, Timperley, Cheshire, Engineer.
1898. Small, Fritz H., c/o Graton and Knight Manufacturing Co., Worcester, Mass., U.S.A., Chemist.
1904. Smart, Bertram J., Chem. Research Laboratory, Royal Arsenal, Woolwich, S.E., Chemist.
1906. Smart, Leslie A., 720, McIntyre Building, Winnipeg, Man., Canada, City Analyst.
O.M. Smetham, A., 16, Brunswick Street, Liverpool, Analytical Chemist.
1905. Smith, Prof. Albert W., Case Library, Cleveland, Ohio, U.S.A., Prof. of Chemistry.
1898. Smith, Alf. B., Ryecroft, Glossop, Derbyshire, Bleacher and Dyers' Manager.
1897. Smith, Allan, c/o Kellner-Partington Paper Pulp Co., Hallein, bei Salzburg, Austria, Chemist.
1896. Smith, Andrew T., c/o Castner-Kellner Alkali Co., Ltd., 43, Castle Street, Liverpool, General Manager.
1905. Smith, Arthur, Town End Chemical Works, Bramley, Leeds, Chemical Manufacturer.
1893. Smith, Edgar B., Box 599, Sydney, Nova Scotia, Canada, Chemist.
1906. Smith, E. A. Cappelen, c/o Baltimore Copper Smelting and Rolling Co., P. O. Station J., Baltimore, Md., U.S.A., Metallurgical Engineer.
1895. Smith, Dr. E. Ellsworth, 26, East 29th Street, New York City, U.S.A., Consulting Physiological Chemist.
1892. Smith, Ernest A., The Assay Office, Leopold Street, Sheffield, Assayer.
1903. Smith, Ewing, 4, Queen Street, Craigie, Perth, N.B., Analytical Chemist.
1903. Smith, F. M., 100, William Street, New York City, U.S.A., President (Pacific Coast Borax Co.).
1891. Smith, Francis P., 24–26, East 21st Street, New York City, U.S.A., Chemist.
1907. Smith, Frank Morse, 100, William Street, New York City, U.S.A., Chemical Merchant.
O.M. Smith, G., Roschall Terrace, Falkirk, N.B., Explosive Works Manager.
1908. Smith, George A., 1069, Prospect Place, Brooklyn, N.Y., U.S.A., Chemist (Printing Ink Manufacturing).
1907. Smith, George D., 216, Milk Street, Boston, Mass., U.S.A., Salesman.
1897. Smith, Sir Geo. J., c/o Bickford, Smith, and Co., Ltd., Tuckingmill, Cornwall, Fuse Manufacturer.
1906. Smith, Geo. Thos., 94, Leadenhall Street, London, E.C., Chemical and Colour Merchant.
1890. Smith, Harry, Tower House, Freshfield, near Liverpool, Cons. Chemist (Paints and Pigments).
1890. Smith, Harry E., 80, Knowles Street, East Cleveland, Ohio, U.S.A., Analytical Chemist.
1904. Smith, Henry, 83, Brownlow Road, Horwich, Bolton-le-Moors, Lancs., Analytical Chemist.
1902. Smith, Hy. Geo., Technological Museum, Harris Street, Ultimo, Sydney, N.S.W., Australia, Assistant Curator and Chemist.

1905. Smith, H. Melville, Ammunition Works, Abbey Wood, Kent, Engineer and Superintendent.
1901. Smith, H. Procter, Shotton Lane, Shotton, Flintshire, Metallurgical Chemist.
O.M. Smith, H. R., 1, Aubert Park, Highbury, London, N., Analytical Chemist.
1890. Smith, H. Wood, c/o John Batt and Co., Ltd., 39, Old Broad Street, London, E.C., Chemist.
1905. Smith, Hugh Dunford, 8 and 10, The Side, Newcastle-on-Tyne, Analytical Chemist.
1906. Smith, Irwin J., P.O. Box 506, Troy, N.Y., U.S.A., Salesman.
O.M. Smith, Jas., Ash Grove House, Radcliffe, Manchester.
1897. Smith, James, 80, Ampthill Road, Aigburth, Liverpool, Analytical Chemist.
1903. Smith, James, Brentwood, Frodsham, and (Jnls.) Ditton Copper Works, Widnes, Metallurgist.
1907. Smith, Jas. C., c/o Edward Ripley and Son, Ltd., Bowling Dyeworks, Bradford, Dyer.
1893. Smith, Jas. F., 131, Seamer Road, Scarborough, Yorks, Analytical Chemist.
1901. Smith, J. Cruickshank, Holmdene, Colebrooke Avenue, West Ealing, W., Technical Chemist.
O.M. Smith, Dr. J. H., 60, Rue de la Côte St. Thibault, Bois Colombes, Seine, France, Chemist.
1896. Smith, Joseph Kent, 3, Palatine Road, Birkdale, Southport, Lancashire, Chemist.
1888. Smith, J. Tertius, Richmond House, Plaistow, Essex, Technical Chemist.
O.M. Smith, Jno. W., 7, Brookfield Street, Roslindale, Boston, Mass., U.S.A., Analytical Chemist.
1890. Smith, J. Wm., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.
1910. Smith, L. Hewgill, The White House, Norwood, Beverley, Yorks, Technical Chemist.
1898. Smith, R. F. Wood, 9, Lower Thames Street, London, E.C., Consulting Chemist.
1890. Smith, Dr. R. Greig, Linnean Society's House, Elizabeth Bay, Sydney, N.S.W., Bacteriologist and Chemist.
1890. Smith, R. W., c/o New Transvaal Chemical Co., Delmore, Transvaal, S. Africa, Chemical Works Manager.
1897. Smith, Theophilus R., c/o Brotherton and Co., Ltd., The Wear Tar Works, South Dock, Sunderland, Chemist.
1907. Smith, Thorn, 33, Mullet Street, Detroit, Mich., U.S.A., Chemist.
1910. Smith, Vincent, Vine Cottage, Bently Street, Lockewood, Huddersfield, Technical Chemist.
1896. Smith, Walter E., 141, Cypress Street, Providence, R.I., U.S.A., Instructor in Chemistry.
1903. Smith, Dr. Warren R., Lewis Institute, Chicago, Ill., U.S.A., Teacher.
O.M. Smith, Watson, 34, Upper Park Road, Haverstock Hill, N.W., Editor of Society's Journal.
1908. Smith, Dr. Watson, jun., Cape Explosives Works, Somerset West, C.C., South Africa, Chemist.
O.M. Smith, Wilfred, 182, West Street, Glasgow, Chemical Manufacturer.
1909. Smith, Wm. G., c/o R. W. Greeff and Co., 20, Eastcheap, London, E.C., Chemical Merchant.
1896. Smith, Dr. W. Stanley, Hollies House, Marchwiel, near Wrexham, North Wales, Brewer.
O.M. Smithells, Prof. A., F.R.S., The University, Leeds, Professor of Chemistry.
O.M. Smithers, F. O., Dashwood House, 9, New Broad Street, London, E.C., Chemical Agent.
1902. Smoot, Albert M., 99, John Street, New York City, U.S.A., Analytical Chemist.
1909. Smoot, Chas. C. III., c/o C. C. Smoot and Sons Co., North Wilkesboro', N.C., U.S.A., Tanning Chemist.
1902. Smythe, Dr. Jno. A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.
1902. Smythe, Dr. J. S., Rantallard, Lance Lane, Wavertree, Liverpool, Analytical Chemist.
1888. Snape, Dr. H. Lloyd, Balholm, Lathom Road, Southport, Director of Education for Lancashire.
1908. Snell, Professor John F., Macdonald College P.O., Prov. Quebec, Canada, Professor of Chemistry.
1896. Snowdon, J., jun., Messrs. Snowdon, Sons & Co., Millwall, E., Chemical and Oil Manufacturer.
1900. Sodeau, Dr. Wm. H., 19, East Parade, Newcastle-on-Tyne, and (Journals) Torpedofabrik, Fiume, Hungary, Chemist.
1903. Sohlman, Ragnar, Bofors, Sweden, Manager (A. B. Bofors Nobelkrut).
1894. Sohn, Chas. E., 52, Fore Street, London, E.C., and (Journals) 82, Wightman Road, Harringay, N., Analyst.
1906. Solomon, M., 45, Newhall Street, Birmingham, Manager (Carbon Works).
1895. Solvay, Armand, 25, Rue Prince Albert, Brussels, Gérant de la Société Solvay et Cie.
1884. Solvay, Ernest, 13, Rue des Champs Elysées, Brussels, Alkali Manufacturer.
1897. Somerset, H. St. John, jun., Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Assayer.
1884. Sommer, Adolf, Corner 1st and Binney Streets, East Cambridge, Boston, Mass., U.S.A., Pharmaceutical Chemist.
1909. Sommer, Dr. Albert, 17, Battery Place, New York City, U.S.A., Engineer Chemist (The Texas Co.).
1904. Southall, A. W., Lower Priory, Birmingham, Manufacturing Chemist.
1896. Souther, H., 440, Capitol Avenue, Hartford, Conn., U.S.A., Chemical and Metallurgical Engineer.
1904. Southerden, F., 11, Gordon Road, Exeter, Teacher of Chemistry.
1892. Southern, Thos., Wheathill Chemical Works, St. Simon Street, Salford, Manufacturing Chemist.
1883. Soward, A. W., 28, Therapia Road, Honor Oak, S.E., Principal Clerk (Legacy Duty Office).
1890. Sowerby, Thos. H., Canal Soap Works, Verney Road, Rotherhithe, S.E., Soap Manufacturer.
O.M. Sowerby, W. M., c/o United Alkali Co., Ltd., Allhusen Works, Gateshead-on-Tyne, Manager.
1887. Spackman, Chas., Rosehaugh, Clitheroe, Lancashire, Portland Cement Manufacturer.
1904. Sparre, Fin, 606, West 20th Street, Wilmington, Del., U.S.A., Chemist.
1904. Speiden, C. C., 46, Cliff Street, New York City, U.S.A., Chemical Merchant.
1905. Speight, W. E., Sewage Works, Deighton, Huddersfield, Chemist.
1909. Speirs, Wm., c/o W. N. Gemmill and Co., 142, Queen Street, Glasgow, Chemical Broker.
1883. Spence, D., Manchester Alum Works, Manchester, Alum Manufacturer.
1900. Spence, Howard, (Journals) Audley, Broad Road, Sale, Cheshire; and Alum Works, Manchester, Chemical Manufacturer.
1909. Spence, Jno., 113, West Regent Street, Glasgow, Analyst.
1883. Spence, Jno. W., Tiviot Colour Works, Manchester Road, Stockport, Drysalter.
1903. Spencer, A. Gordon, Central Experimental Farm, Ottawa, Canada, Chemist.
1909. Spencer, George, c/o The Gerton Rubber Co., Ltd., Openshaw, Manchester, Managing Director.
1884. Spencer, Jno., Globe Tube Works, Wednesbury, Tube Manufacturer.
1902. Sperry, Elmer A., 100, Marlborough Road, Prospect Park South, Brooklyn, N.Y., U.S.A., Electrical Engineer.
1897. Sperry, Erwin S., "The Brass World," 260, John Street, Bridgeport, Conn., U.S.A., Metallurgist and Editor.
1884. Spiegel, Dr. Adolf, Messel, bei Darmstadt, Germany, Analytical Chemist.
1903. Spielmann, Dr. P. E., 21, Cadogan Gardens, London, S.W., Chemist.
1906. Spiera, Dr. V. G., c/o Inchiostrificio Veneto, Treviso, Italy, Chemist.
1889. Spies, Adolph, 102, Fenchurch Street, London, E.C., Chemical Merchant.

1884. Spies, Hermann, 102, Fenchurch Street, London, E.C., Chemical Merchant.

1885. Spiller, A., Edison-Swan Electric Co., South Benwell Works, Newcastle-on-Tyne, Electrician.

O.M. Spiller, J., 2, St. Mary's Road, Canonbury, London, N., Consulting Chemist.

1896. Spoor, J. L., Rede Court, Rochester, Kent, Portland Cement Manufacturer.

1909. Sprague, F. O., c/o Marden, Orth, and Hastings, Rear 208, Summer Street, Boston, Mass., U.S.A., Chemist.

1900. Spurge, Edw. C., University Club, Niagara Falls, N.Y., U.S.A., Chemist.

O.M. Squire, P. W., 413, Oxford Street, London, W., Pharmaceutical Chemist.

1896. Stafford, Chas H., c/o The Birkacre Printing Co., Chorley, Lancs., Colourist.

O.M. Stahl, Dr. K. F., 57th Street and A. V. Ry., Pittsburg, Pa., U.S.A., Chemical Works Manager.

1905. Stahl, Dr. Paul G., 13, Square de Jussieu, Lille (Nord), France, Chemical Manufacturer.

1905. Stalmann, Otto, 317, McCornick Building, Salt Lake City, Utah, U.S.A., Metallurgical Engineer.

1904. Standfast, Jno. T., c/o Messrs. Burt, Boulton, and Haywood, Ltd., Eling Works, Totton, Hants, Chemist.

1906. Stanley, Wm., Great Barrington, Mass., U.S.A., Engineer.

1888. Stantial, Frank G., c/o Cochrane Chemical Co., Everett, Mass., U.S.A., Technical Chemist.

1885. Staples, H. J., The Old Hall, Spondon, Derby, Colour Manufacturer.

O.M. Stark, J. F., Rosedale, Bromborough, Cheshire, Works Manager.

1896. Statham, Noel, c/o The West Virginia Paper and Pulp Co., Mechanicville, N.Y., U.S.A., Engineer.

1908. Statiropoulos, Dr. John G., Anatolia College, Marsovan, Turkey-in-Asia, Chemist.

1907. Staud, Joseph E., c/o W. W. Lawrence & Co., Pittsburgh, Pa., U.S.A., Chemist.

1904. Stauffacher, W., 64, Oberwilerstrasse, Basle, Switzerland, Chemical Works Manager.

1908. Staye, Charles A., 8, East Center Street, South Manchester, Conn., U.S.A., Silk Colour Mixer.

1895. Stead, J. Christopher, 55, Chancery Lane, London, W.C., Technical Chemist.

O.M. Stead, J. E., F.R.S., 11, Queen's Terrace, Middlesbrough-on-Tees, Analytical Chemist.

O.M. Stebbins, Dr. J. H., 3, West 29th Street, New York City, U.S.A., Analytical Chemist.

1896. Steel, Fred. W., c/o General Chemical Co., Ltd., Clyde, Sydney, N.S.W., Australia, Chemist.

1900. Steel, Jno. S., Achernar, Blackburn, Melbourne, Vic., Australia, Chemist.

1884. Steel, R. Elliott, Cameron House, Sherborne, Dorset, Headmaster.

O.M. Steel, Thos., Colonial Sugar Refining Co., O'Connell Street, Sydney, N.S.W., Australia, Sugar Chemist.

1906. Steers, Thornton, 224, Grand Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1909. Stehle, Chas., 5010, Penn Street, Frankford, Philadelphia, Pa., U.S.A., Proprietor of Dye Works.

1905. Steiger, George, c/o U.S. Geological Survey, Washington, D.C., U.S.A., Chemist.

1897. Stein, Sigmund, 214, Upper Parliament Street, Liverpool, Sugar Refinery Manager.

1897. Steinhart, Dr. Oscar J., 2 and 3, West Street, Finsbury Circus, London, E.C., Manufacturing Chemist.

1903. Stell, S. F., 25, Henry Street, Keighley, Yorks, Teacher of Chemistry.

1887. Stenhouse, T., 166, Drake Street, Rochdale, Analytical Chemist.

1908. Stenhouse, Thos., jun., Chemical Laboratory, H.M. Dockyard, Portsmouth, Analytical Chemist.

1904. Stephen, A. E., 33, Victoria Street, Ashfield, Sydney, N.S.W., Australia, Analytical Chemist.

1884. Stephens, H. Chas., M.P., Avenue House, Finchley, N., Ink Manufacturer.

1892. Stephens, M. E., 4, Carlton Gardens, London, S.W.; and (Journals) 57–60, Aldersgate Street, London, E.C., Ink Manufacturer.

1909. Stephenson, Henry H., Royal Doulton Potteries, Lambeth, S.E., Technical Chemist.

1909. Stephenson, Herbert F., 7, Winifred Road, Merton Park, S.W., Analytical Chemist.

1889. Stern, Arthur L., 148, High Street, Burton-on-Trent, Brewing Chemist.

1906. Sternberg, Frank J. N., 155, Dunn Avenue, Toronto, Canada, Analytical Chemist.

O.M. Steuart, D. R., Osborne Cottage, Broxburn, West Lothian, N.B., Oilworks Chemist.

1903. Steven, A. B., The Technical College, Glasgow, Lecturer on Dyeing.

1907. Steven, Michael M., c/o The Distillers' Co., Ltd., 12, Torphichen Street, Edinburgh, Analytical Chemist.

1899. Stevenot, G. A., c/o H. A. Metz Co., 122, Hudson Street, New York City, U.S.A., Chemist.

1898. Stevens, Arthur F., 96, Newgate Street, London, E.C., Paper Examiner.

1902. Stevens, Dr. Hy. P., Laboratory, 15, Borough, London Bridge, S.E., Consulting Chemist.

1894. Stevens, Jno. H., 295, Ferry Street, Newark, N.J., U.S.A., Manufacturing Chemist.

1908. Stevens, J. Venn, 34, Linthorpe Road, Stamford Hill, London, N., Analytical Chemist.

1902. Stevens, M. White, H.M. Patent Office, Chancery Lane, London, W.C., Chemist.

1903. Stevens, T. R. B., P.O. Box 57, Kalgoorlie, West Australia, Metallurgical Chemist.

1884. Stevens, Wm., The Native Guano Co., Ltd., 29, New Bridge Street, London, E.C., Secretary.

O.M. Stevenson, W., Standard Works, 95a, Southwark Street, London, S.E., Chemical Manufacturer.

1901. Stewart, David B. D., Aberdeen Comb Works, Hutcheon Street, Aberdeen, Managing Director.

1903. Stewart, Jas., "The Gas World," 8, Bouverie Street, Fleet Street, London, E.C., Editor.

1909. Stewart, Jeffrey, India Refining Co., McKean and Swanston Streets, Philadelphia, Pa., U.S.A., Works Manager.

1890. Stewart, Robt., Westbourne Road, Luton, Chemical Works Manager.

O.M. Stewart, S., c/o Michael Nairn and Co., Ltd., Kirkcaldy, Fife, Technical Chemist.

1906. Stickland, Oliver W., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Works Chemist.

1904. Stieglitz, Dr. Julius, University of Chicago, Chicago, Ill., U.S.A., Associate Professor of Chemistry.

1904. Stiff, John T., 60, Parrock Street, Gravesend, Kent, Works Chemist.

1908. Stillman, Dr. Thos. B., Stevens Institute of Technology, Hoboken, N.J., U.S.A., Professor of Engineering Chemistry.

1903. Stillwell, Albert G., 164, Front Street, New York City, U.S.A., Chemist.

1903. Stingelin, Dr. Fritz, c/o Dr. E. Bäuziger, Romanshorn, Switzerland, Chemist.

1886. Stirk, Jos., The Sunnyside Hydro, Southport, Brewer's Engineer.

1893. Stock, F. W. Keating, County Analyst's Office, Darlington, Analytical and Consulting Chemist.

1900. Stockdale, Edgar, c/o R. Dewhurst and Co., Ltd., Printworks, Batley, Yorks, Colour Mixer.

1888. Stockdale, Wm., Rosebank Printworks, Ramsbottom, near Manchester, Calico Printer.

1887. Stocks, H. B., 12, Victoria Road, West Kirby, Cheshire, Analytical Chemist.

1903. Stoddard, Jesse D., Detroit Testing Laboratory, 1111, Union Trust Building, Detroit, Mich., U.S.A.

1885. Stoddart, F. Wallis, Grafton Lodge, Sneyd Park, Bristol, Analytical Chemist.

O.M. Stoker, G. N., 9, Lessar Avenue, Clapham Common, S.W., Analytical Chemist.

1899. Stokes, Alf. W., Laboratory, Town Hall, Paddington Green, W., Public Analyst.

1906. Stokes, Francis J., 17th and Cambria Streets, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1900. Stone, Geo. C., c/o New Jersey Zinc Co., 55, Wall Street, New York City, U.S.A., Engineer.
1899. Stone, I. F., 100, William Street, New York City, U.S.A., Chemical Merchant.
1888. Stone, Thos. W., Chemical Works, St. George, Bristol, Chemical Manufacturer.
O.M. Storey, I. H., Haverbreaks, Lancaster, Chemical Manufacturer.
1902. Storr, Bertram V., 117, Coventry Road, Ilford, Essex, Chemist.
1888. Stowe, W. T., Government Laboratory, 280, George Street, Glasgow.
1909. Strachan, Jas. T., c/o Hendon Paper Works Co., Ltd., Sunderland, Works Chemist.
1883. Strangman, J. Pim, 9, Clydesdale Road, Notting Hill, W., Bleacher.
1908. Stratford, Alfred W., 37, Cleveland Road, Crumpsall, Manchester, Chemist.
1903. Strayor, D. W., 428, West King Street, York, Pa., U.S.A., Chemist.
1903. Strickler, Emorson H., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemist.
1909. Strivons, Percy R., Oil Mills, Horbury Bridge, near Wakefield, Analytical Chemist.
1910. Strong, Ralph K., c/o Standard Chemical Co., St. Henri, Montreal, Canada, Works Chemist.
O.M. Stuart, C. E., 29, Moseley Street, Newcastle-on-Tyne, Chemical Apparatus Dealer.
1905. Stuart, H. E., 176, Purchase Street, Boston, Mass., U.S.A., Vice-President, Mercantile Corporation.
1896. Stuart, Harry T. R., Know Mill House, Entwistle, near Bolton, Printworks Manager.
O.M. Stuart, T. W., 7, Livingston Drive, Sefton Park, Liverpool, Alkali Works Manager.
1901. Stuart, Dr. W. Theophilus, 197, Spadina Avenue, Toronto, Canada, Professor of Chemistry.
1896. Stubbs, Augustus J., Sars 35, Gracia, Barcelona, Spain.
1890. Studor, Jos. S., Helvetia, Stockton Heath, near Warrington, Technical Chemist.
1903. Sturrock, Capt. G. C., R.A., Indian Cordite Factory, Aruvankad, Nilgiris, India, Assistant Superintendent.
1908. Suart, Arthur B., c/o Johnson and Sons' Smelting Works, Paul Street, Finsbury, London, E.C., Bullion Refiner.
1896. Suckert, Dr. J. J., 30, Church Street, New York City, U.S.A., Manufacturing Chemist.
1895. Sudborough, Dr. J. J., Edward Davies Chemical Laboratories, Aberystwith, Lecturer in Chemistry.
1889. Sulman, H. L., 44, London Wall, London, E.C., Chemist and Metallurgist.
1895. Summers, Bertrand S., c/o The Summers Fiber Co., Port Huron, Mich., U.S.A., Electro-Chemist.
1907. Sundarram, Minakshi, c/o Parry & Co., Ranipettai, N. Arcot, Madras, India, Agricultural Chemist.
1896. Sunderland, A., The Moorlands, Cullingworth, near Bradford, Yorks., Teacher of Chemistry.
1899. Sundström, Carl, c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.
1906. Sutermeister, Edwin, c/o Forest Service, Madison, Wis., U.S.A., Chemist.
1884. Sutherland, D. A., 26, Victoria Street, Westminster, S.W., Consulting Technical Chemist.
1909. Sutherland, Daniel M., Ashgrove, Sunbury Common, Middlesex, Works Manager.
1894. Sutherland, Geo., Croft Cottage, Bonhill, N.B., Chemist.
1887. Sutherland, Jas., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
1906. Sutherland, John, The British Aluminium Co., Ltd., Baker Street, Greenock, N.B., Manager of Carbon Factory.
O.M. Sutherland, R. M., Lime Wharf Chemical Works, Falkirk; and Solsgirth, Dollar, N.B., Chemical Manufacturer.
O.M. Sutton, Dr. Francis, Norfolk County Laboratory, Redwell Street, Norwich, Analytical Chemist.
1886. Sutton, F. Napier, 6, Grosvenor Gardens, Cricklewood, N.W., Alkali Works Inspector.
1900. Sutton, W. Lincolne, Hillcroft, Eaton, Norwich, Public Analyst.
O.M. Swan, Sir Jos. W., F.R.S., Overhill, Warlingham, Surrey, Chemist and Electrician.
1906. Sweet, Everell F., 52, Union Street, Boston, Mass., U.S.A., Importer.
1905. Swenarton, W. Hastings, Broadway Chambers, 277, Broadway, New York City, U.S.A., Patent Lawyer.
1904. Swindells, Seth, 181, Orford Lane, Warrington, Chemist.
1901. Swinton, Ralph S., c/o W. J. Bush, Incorporated, Linden, N.J., U.S.A., Analytical Chemist.
1902. Sylow, Paul L. P. G., New Farm Sugar Refinery, Brisbane, Queensland, Analytical Chemist.
O.M. Syme, W. B., Elm Cottage, Addiewell, West Calder, N.B., Oil Works Chemist.
1906. Symes, Langford P., Pareora Freezing Works, Timaru, New Zealand, Chemist.
1906. Symonds, Abram E., Wick Lane Colour Works, Old Ford Road, Bow, E., Colour Manufacturer.

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1895. Taber, G. H., 814, Frick Building, Pittsburg, Pa., U.S.A., General Manager (Gulf Refining Co.).
1908. Tachikawa, H., Mitsu Bishi Dockyard and Engine Works, Kobe, Japan, Electrical Engineer.
1910. Tainsh, Peter, 8, Franklin Road, Saltcoats, Ayrshire, Technical Chemist.
1909. Tait, Walter Scott, 1000, Massachusetts Avenue, Cambridge, Mass., U.S.A., Works Manager.
1896. Takagi, T., 10, Nishikatamachi, Hongo, Tokyo, Japan, Chemical Engineer.
O.M. Takamatsu, T., 13, Nishikatamachi, Hongo, Tokyo, Japan, Analytical Chemist.
O.M. Takamine, Dr. Jokichi, 550, West 173rd Street, New York City, U.S.A., Engineer.
1890. Takayama, Jintaro, Nando Machi 26, Ushigome, Tokyo, Japan, Director (Imperial Industrial Experiment Station).
1905. Talbot, Prof. Henry P., Mass. Institute of Technology, Boston, Mass., U.S.A., Professor of Inorganic Chemistry.
1898. Tanaka, Keishin, Matsuba Hotel, Kudansaka, Uye, Tokyo, Japan, Chemist.
1900. Tankard, Arnold R., City Analyst's Office, 40, Lowgate, Hull, and (Journals) 12, Feren's Avenue, Cottingham Road, Hull, Analytical Chemist.
1907. Tartar, Herman V., Corvallis, Oregon, U.S.A., Analytical Chemist.
O.M. Tate, F. H., 9, Hackins Hey, Liverpool, Analytical and Technical Chemist.
O.M. Tatlock, R. R., 11, Bellshaugh Road, Kelvinside West, Glasgow, Consulting Chemist.
1902. Tatters, Hugh Lee, 10, Birchfield Road, Widnes, Analytical Chemist.
1906. Tattersfield, Frederick, 96, Bewick Road, Gateshead-on-Tyne, Analyst.
1907. Taussig, Dr. Rudolf, Würthgasse 8, Vienna XIX., Austria, Chemist.
1905. Taveau, René de Mortemer, "The Preston," Preston and Guildford Streets, Baltimore, Md., U.S.A., Chemist.
1901. Tayler, Jno. Bernard, Anglo-Chinese College, Tientsin, North China, Chemist.
1903. Taylor, Alvin M., c/o General Chemical Co., Station F., Box 12, Cleveland, Ohio, U.S.A., Chemist.
1902. Taylor, Arthur P., c/o John Taylor and Co., 531, Front Street East, Toronto, Ont., Canada, Soap Manufacturer.
1907. Taylor, C. Marshall, c/o Philadelphia and Reading Railway Co., Tie Treating Plant, Philadelphia, Pa., U.S.A., Chemist.
1902. Taylor, Edward R., Penn Yan, N.Y., U.S.A., Manufacturing Chemist.
1886. Taylor, G. Crosland, Ravenscar, Helsby, near Warrington, Electrical Engineer

1894. Taylor, G. Midgley, Caxton House, Westminster, S.W., Analytical Chemist.

1893. Taylor, G. W., Dinting Vale Printworks, Dinting, near Manchester, Printworks Chemist.

O.M. Taylor, H. E., 1, Alexandra Park Gardens, Glasgow, Lead Works Manager.

1883. Taylor, Jas., "Adderton," Dundas, N.S.W., Australia, Government Metallurgist.

1898. Taylor, Jas. M., Tynevale, Groes Road, Cressington, Liverpool, Analytical Chemist.

1901. Taylor, Jno., c/o Brotherton and Co., Ltd., Tar Works, Litherland, Liverpool, Chemist.

1888. Taylor, J. Scott, North London Colour Works, Spring Place, Kentish Town, N.W., Technical Chemist.

1896. Taylor, Martin, "The Clough," Buckhurst Hill, Essex, Chemical Works Manager.

1901. Taylor, Sidney H., 65, Newbridge Road, Weston, Bath, Works Chemist.

1898. Taylor, Walter, 475, Grosvenor Place, Limefield, Bury, Lancs., Technical Chemist.

1905. Taylor, Wm. H., 36, Glenhouse Road, Eltham Park, Kent, Chemist.

1887. Teanby, G. W. A., Elvin Lodge, East Dereham, Norfolk, Analytical Chemist.

1899. Teas, Wm. Holmes, Ridgeway, Pa., U.S.A., Chemist.

O.M. Teed, Dr. F. L., Chem. Laby., 9, Mincing Lane, London, E.C., Analytical Chemist.

1905. Teeple, Dr. J. E., 50, Church Street, New York City, U.S.A., Director.

1908. Teichfeld, Arnold, Pruszkow, near Warsaw, Russian Poland, Chemist in Ceramic Industry.

1904. Teller, George L., The Columbus Laboratories, 103, State Street, Chicago, Ill., U.S.A., Chemist.

1906. Tempany, Harold A., Government Laboratory, St. John's, Antigua, West Indies, Analyst.

1884. Tennant, Jas., Alex. Fergusson and Co., Ltd., 34–38, McAlpine Street, Glasgow, Lead and Colour Manufacturer.

1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., 206, Bay Street East, Savannah, Ga., U.S.A., Chemist.

1908. Terleski, Fred. H., 40, Hugh Oldham Drive, The Cliff, Manchester, Technical Chemist.

1884. Terry, Hubert L., (Journals) 3, Herbert Street, Moss Side, Manchester; and (Laboratory) 23, Hopwood Avenue, Manchester, Technical Chemist.

O.M. Tervet, R., 68, Windsor Road, Leyton, Essex, Oil Works Manager.

1893. Tetley, C. F., Messrs. Jos. Tetley and Son, The Brewery, Leeds, Brewer.

1897. Tetlow, Dr. Wm. E., Ash Cottage, Ashfield, Dunblane, N.B., Chemist.

1908. Thatcher, Dr. C. J., 1352, Hudson Terminal Building, New York City, U.S.A., Consulting Chemist and Patent Expert.

1903. Thatcher, Ed. J., The Manor House, Chew Magna, near Bristol, Merchant and Manufacturer.

1909. Thaxter, Gerald N., c/o Brewer and Co., Worcester, Mass., U.S.A., Chemist.

1908. Theis, Dr. Friedrich C., Konigsteinerstrasse 60, Höchst a/Main, Germany, Chemist.

1908. Thiele, Dr. Ludwig, Holland, Mich., U.S.A., Manager, Holland Gelatine Works.

1908. Thom, Wm. H., 78, Dunn Avenue, Toronto, Canada, Chemist.

1894. Thomas, H. Russell, Broad Plain Soap Works, Bristol, Soap Manufacturer.

1909. Thomas, John, 2, Dudley Road, Brierley Hill, Staffs., Analytical Chemist.

O.M. Thomas, J. W., Overdale, Shortlands, Kent, Analytical Chemist.

1902. Thomas, Nehemiah M., Roseville Avenue, Pymble, N.S.W., Australia, Inspector.

1901. Thomas, Octavius, Gas and Water Offices, Pentre, Glamorganshire, Gas and Water Engineer.

1908. Thomas, Oswald J. D., 9, Wanstead Park Avenue, Manor Park, Essex, Analytical Chemist.

1888. Thomas, S. Percy, 2, Landrock Road, Hornsey, N., Technical Chemist.

1898. Thomas, Wm. Harrison, jun., Mount Royal Spinning Co., St. Paul, Montreal, Canada, Printworks Chemist.

1905. Thomlinson, Wm., Seaton Carew Ironworks, West Hartlepool, Ironmaster.

1905. Thompson, Alf. J., Bernina, Friern Lane, Whetstone, N., Chemical Buyer (R. W. Greeff and Co.).

1885. Thompson, Prof. Claude M., 38, Park Place, Cardiff, Professor of Chemistry.

1898. Thompson, Edw. C., Froyle House, Westcombe Park Road, Blackheath, S.E., Manufacturing Chemist.

1909. Thompson, Edwin, 1, Croxteth Grove, Liverpool, Manufacturing Chemist.

1893. Thompson, G. Rudd, 69, Dock Street, Newport, Mon., Analytical and Consulting Chemist.

1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.

1907. Thompson, Jas. G., Donegall Quay Mills, Belfast, Ireland, Corn Miller.

1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.

1907. Thompson, Milton S., 72, Broad Street, Boston, Mass., U.S.A., Manufacturer.

1885. Thompson, W., Sankey Hill, Earlestown, Lancashire, Sugar Refiner.

O.M. Thompson, W. P., Patent Office, 6, Lord Street, Liverpool, Patent Agent.

1896. Thomsen, Alonzo L., Maryland Club, 1, East Eager Street, Baltimore, Md., U.S.A., Manufacturing Chemist.

1884. Thomson, G. Carruthers, 53, Bedford Road, Rock Ferry, Birkenhead, Engineer.

1907. Thomson, H. N., c/o International Smelting and Refining Co., Tooele, Utah, U.S.A., Metallurgist.

1891. Thomson, Jas. M., Royal Gunpowder Factory, Waltham Abbey, Essex, Manager (Cordite Branch).

1884. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.

1899. Thomson, Thos., c/o Waterproofing Co., Barrhead, near Glasgow, Manufacturer.

O.M. Thomson, W., Royal Institution Laboratory, 79A, Princess Street, Manchester, Analytical and Consulting Chemist.

1890. Thomson, Wm. Thos., Royal Gunpowder Factory, Waltham Abbey, Essex, Explosives Chemist.

1902. Thorburn, Jas., 30, Cromartie Avenue, Newlands, Glasgow, Analytical Chemist.

O.M. Thorne, Dr. L. T., 2, Denbigh Gardens, Richmond-on-Thames; and (Journals) Southampton Wharf, Battersea, S.W., Technical Chemist.

1907. Thornewell, A. R., 352, Oldbury Road, West Smethwick, Birmingham, Works Chemist.

O.M. Thorneycroft, Wallace, Plean House, Plean, Stirling, Technical Chemist.

1904. Thornley, Thomas, 19, Hope Street, Glasgow, Chemical Manufacturer.

1887. Thornton, H., Redbourn, Ashford, Middlesex, Analytical Chemist.

1899. Thornton, Wm., c/o Fresno Copper Co., Box C., Clovis, Fresno Co., Cal., U.S.A., Chemist.

1895. Thorp, Dr. Frank H., Mass. Inst. of Technology, Boston, Mass., U.S.A., Assistant Professor of Industrial Chemistry.

1907. Thorp, Thos., Moss Bank, Whitefield, near Manchester, Engineer.

1906. Thorp, Walter, Sorrentoville, Dalkey, Co. Dublin, Ireland, Analytical Chemist.

O.M. Thorpe, Sir Edward, C.B., F.R.S., 61, Ladbroke Grove, Notting Hill, W., Professor of Chemistry.

1905. Thorpe, Dr. J. F., F.R.S., 5, Endcliffe Hall Avenue, Sheffield, Lecturer.

1905. Thresh, Dr. John C., Chelmsford, Essex, Medical Officer of Health and Sanitary Expert.

1902. Thurlow, Nathaniel, 78, Warburton Avenue, Yonkers, N.Y., U.S.A., Chemist.

1898. Thurnauer, Dr. Gustav, c/o Aurora Metal Co., Aurora, Ill., U.S.A., Chemist.

1904. Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist.

1908. Thwaites, John H., Market Chambers, Peterborough, Chemical Engineer.

1904. Tickle, Thos., Laboratory, 83, Queen Street, Exeter, Analyst.

O.M. Tilden, Sir William A., F.R.S., The Oaks, Murray Road, Northwood, Middlesex, Professor of Chemistry.

1908. Tillberg, Erik W., Westervik, Sweden, Extract Manufacturer.

1900. Tilley, Jas. W., 95A, Southwark Street, London, S.E., Research Chemist.

1906. Tillson, Henry E., 75, Abbott Street, Laurence, Mass., U.S.A., Dyer.

1901. Timmans, W. G., The Basford Chemical Co., Ltd., Basford, Nottingham, Chemical Works Manager.

O.M. Timmis, T. Sutton, Widnes, Chemical Manufacturer.

1905. Tindall, W. B., 39, St. Mary Street, Toronto, Canada, Secretary and Treasurer.

1907. Tingle, Dr. J. B., McMaster College, Toronto, Canada, and (Journals) Y. L. Kwong, Tao Tai, Colliery, Ping Hsiang, Hunan, China, Professor of Chemistry.

1908. Tingle, J. Grantley, c/o Pacific Phosphate Co., Ltd., A.M.P. Building, Collins Street, Melbourne, Victoria, Assayer.

1894. Tipler, Fred. C., 48, Brooklyn Street, Crewe, Analytical Chemist.

1907. Tischbein, Dr. Robert, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.

1890. Tobey, C. H., Burks Falls, Ontario, Canada, Tannery Chemist.

1894. Toch, Maximilian, 52, 9th Street, Long Island City, N.Y.; and (Journals) 320, Fifth Avenue, New York City, U.S.A., Chemist.

1886. Todd, A. M., c/o The A. M. Todd Co., Kalamazoo, Mich., U.S.A., Manufacturing Chemist and Distiller of Essential Oils.

1905. Tolson, Stanley, The Croft, Abbey Wood, S.E., Chemist.

O.M. Toms, F. Woodland, States Analyst's Office, St. Heliers, Jersey, Analytical Chemist.

1902. Tone, Frank Jerome, c/o The Carborundum Co., Niagara Falls, N.Y., U.S.A., Manager.

1909. Tonry, Wm. S., 58, Euclid Avenue, Hackensack, N.J., U.S.A., Chemical Engineer.

1907. Torrey, Dr. Joseph, Craigie Lea, Blundellsands, Liverpool, Engineer.

1905. Torrey, Prof. H. A., Harvard Chemical Laboratory, Cambridge, Mass., U.S.A., Assistant Professor of Chemistry, Harvard University.

O.M. Towers, J. W., Widnes, Lancashire, Analytical Chemist.

1907. Towler, A. E., c/o Sulphide Corporation, Cockle Creek, near Newcastle, N.S.W., Australia.

1909. Townend, Harry, Public Library, Bury, Lancashire, Librarian.

1892. Townsend, Chas. W., 19, Crawford Street, Port Dundas, Glasgow, Chemical Manufacturer.

1897. Towse, Walter, Elmwood, Killowen Street, Low Fell, Gateshead-on-Tyne, Technical Chemist.

1904. Toyne, Francis D., c/o Kelsall and Kemp, Ltd., Woodhouse Mills, Norden, near Rochdale, Chemist.

1899. Trantom, Dr. Wm., Hawthorne Lodge, Latchford, near Warrington, Chemist.

1894. Traphagen, Dr. Frank W., Colorado School of Mines, Golden, Colo., U.S.A., Professor of Metallurgy and Assaying.

1900. Traquair, Jno., Glenfield Starch Works, Paisley, N.B., Analytical Chemist.

1904. Trautwein, A. P., Carbondale, Pa., U.S.A., President (Carbondale Chemical Co.).

1906. Travell, Norman E., 26, Forest Road, Nottingham, Lace Dresser.

1893. Travers, Prof. Morris W., F.R.S., Indian Institute of Science, Bangalore, India, Professor of Chemistry.

1889. Trechmann, A. O., Halling Lime and Cement Works, near Rochester, Kent, Cement Manufacturer.

1885. Trechmann, Dr. C. O., Warren Cement Works, Hartlepool, Cement Manufacturer.

1895. Treharne, F. Gwilym, Wraybrook, Llanishen, near Cardiff, Analytical Chemist.

1885. Trewby, Herbert, 62, St. John Street, London, E.C., Analytical Chemist.

1909. Trier, Torvald G., 237, West 22nd Street, New York City, U.S.A., Technical Chemist.

1901. Trigger, Oliver, Chem. Dept., Royal Arsenal, Woolwich, S.E., Analytical Chemist.

1898. Tripp, Dr. E. Howard, 26, Chaucer Road, Bedford, Science Master.

O.M. Trobridge, A., c/o Trobridge and Co., Ltd., Heworth Shore, Felling-on-Tyne, Technical Chemist.

1907. Trostel, Geo. M., Canton, N.C., U.S.A., Chemist.

1897. Trotman, Saml. R., The City Laboratory, 1, Regent Street, Nottingham, City Analyst.

1900. True, Percival E., 279, Douglas Avenue, Elgin, Ill., U.S.A., Chemical Engineer.

1887. Tsukiyama, S., 2nd of No. 2116, Fukiai-chō, Kobe, Japan, Paper Mills Chemist.

1894. Tucker, Alex. E., Norwich Union Chambers, Congreve Street, Birmingham, Metallurgist and Chemist.

1897. Tucker, Samuel A., Columbia University, New York City, U.S.A., Tutor in Industrial Chemistry.

1907. Tudor-Williams, G., 90, Gadbys Road, Aberdare, South Wales, Chemist.

1886. Tuer, Arthur H., Douglas House, Worthington, near Wigan, Analytical Chemist.

1903. Tufts, C. G., c/o Semet-Solvay Co., Syracuse, N.Y., U.S.A., Chemical Engineer.

1907. Tufts, John L., P.O. Box 22, Winchester, Mass., U.S.A., Chemical Engineer.

1909. Tulloch, Capt. T. G., 54, Parliament Street, London, S.W., Director of Public Companies.

1901. Tulloch, Wm. F., 30, George Square, Glasgow, Merchant.

1909. Tunks, Dr. F. R., Borthwen, Minffordd, N. Wales, Manager, Steelite Explosives, Ltd.

1904. Tunnell, Raymond W., 251, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Manufacturer.

1899. Turnbull, Dr. Andrew, 18, Hackins Hey, Liverpool, Consulting Chemist.

1888. Turnbull, G.W., Ash Cottage, North Road, Carnforth, Lancashire, Metallurgical Chemist.

1905. Turnbull, John, 44, Wolseley Street, Toronto, Canada, Manufacturer of Food Products.

1904. Turnbull, R. H., c/o MacAndrews and Forbes Co., Camden, N.J., U.S.A., Analytical Chemist.

1884. Turnbull, W. S., 38, Bath Street, Glasgow, Chemical Manufacturer.

1902. Turner, Basil, 83, Pitt Street, Sydney, N.S.W., Australia, Metallurgist.

1902. Turner, Jos., c/o Read Holliday and Sons, Ltd., Huddersfield, Chemist.

1905. Turner, Prof. Thomas, Springfields, Selly Hill, Birmingham, Professor of Metallurgy.

1897. Turney, Fred. N., 10, Dieghem Straat, Saventham, near Brussels, Belgium, Leather Dresser.

1887. Turney, Sir J., Trent Bridge Leather Works, Nottingham, Tanner.

1908. Turnill, Thos. W., Stibbington, Wansford, Northants, Works Chemist.

1906. Tuttle, Dr. Franklin E., 125, East Maxwell Street, Lexington, Ky., U.S.A., Professor of Chemistry.

1903. Tutton, Henry Ralph, 12, Woodland Place, Penarth, S. Wales, Chemist.

1905. Tutwiler, Carrington C., 1706, North Broad Street, Philadelphia, Pa., U.S.A., Chemist.

1890. Tweedy, Jas., 245, Burdett Road, Limehouse, E., Metallurgical Chemist.

1905. Twigg, Geo. F., 29, Fairfax Road, Derby, Gas Works Chemist.

1891. Twitchell, E., Wyoming, Ohio, U.S.A., Candle Works Manager.

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1904. Tyler, Chas. R., c/o Dr. Francis Wyatt, 402, West 23rd Street, New York City, U.S.A., Analytical Chemist.

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O.M. Tyrer, Thos., Stirling Chemical Works, Stratford, E., and (Journals) 14, Sandwell Mansions, West End Lane, N.W., Chemical Manufacturer.
1889. Tysoe, Jos., South Metropolitan Gas Co., East Greenwich, S.E., M.Inst.C.E., Gas Engineer.

U

1907. Udal, John P., Ridge Road, Berea, Durban, Natal, Engineer.
1894. Uhlig, E. C., Citizens' Gas Works, Fifth and Hoyt Streets, Brooklyn, N.Y., U.S.A., Chemist.
1900. Uhlig, W. C., c/o Hygeia Distilled Water Co., 349, West 12th Street, New York City, U.S.A., Chemist.
O.M. Umney, C., (Journals) Fernbrake, Branksome, Wood Road, Bournemouth; and (communications) 50, Southwark Street, London, S.E., Manufacturing Chemist.
1905. Umney, John C., 48, Southwark Street, London, S.E., Wholesale Druggist.
1889. Underhill, Thos. J., "Stanley," Quernmore Road, Bromley, Kent, Inspector of Stores.
1885. Underwood, G. R., 4, Emerson Street, Peabody, Mass., U.S.A., Glue Works Chemist.
1908. Underwood, Norman, Bureau of Engraving and Printing, Treasury Dept., Washington, D.C., U.S.A., Chemist.
1908. Unglaub, Adolf, 5120, Chestnut Street, Philadelphia, Pa., U.S.A., Chemical Engineer.
1908. Upton, Wm. C., Sara Cook Street, Rawdwick, N.S.W., Australia, Soap and Candle Manufacturer.
1904. Uyeda, Toyokitsu, Takasago, Harima, Japan, Chemist.

V

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1896. Van der Linde, Harold, c/o Continental Rubber Co., 111, Broadway, New York City, U.S.A., Chief Chemist.
1895. Vanderpoel, Dr. Frank, 175, Park Avenue, Orange, N.J., U.S.A., Chemist.
1903. Van Dyck, Edwin M., c/o Ault & Wiborg Co., 534, Pearl Street, New York City, U.S.A., Chemist and Ink Maker.
1907. Van Essen, E. C., c/o Hemingway and Co., Marsh Gate Lane, Stratford, E., Technical Chemist.
1897. Van Gelder, Arthur P., c/o E. I. du Pont de Nemours Powder Co., Landing, N.J., U.S.A., Superintendent.
1891. Van Gundy, Chas. P., Laboratory, B. and O. R. R., Baltimore, Md., U.S.A., Metallurgical Chemist.
1896. Van Laer, Norbert, Truman's Brewery, Burton-on-Trent, Brewer and Chemist.
1897. Van Marken, J. C., Poste Restante, The Hague, Holland, Chemical Engineer.
1908. Van Trump, Isaac, 2337, South Paulina Street, Chicago, Ill., U.S.A., Chemist.
1888. Vargas-Vergara, J. M., Apartado No. 237, Bogota, Colombia, S. America, Metallurgical Chemist.
1905. Varshnei, Ishwar Das, Talegaon, G. I. P. Railway, Poona District, India, Chemical Engineer.
1898. Verity, Ben, Magog, Prov. Quebec, Canada, Print Works Chemist.
1897. Verity, Victor, 10, Minot Street, North Woburn, Mass., U.S.A., Chemical Works Foreman.
1910. Verner, E. P., Parker Laboratory, 40, Broad Street, Charleston, S.C., U.S.A., Chemist.
1904. Vernon, R. H., Student.
1908. Vickers, Benj. Threlfall, Gascoigne Street, Boar Lane, Leeds, Oil Merchant.
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1907. Vietinghoff-Scheel, Dr. Karl Freiherr von, "Chemiker-Zeitung," Cöthen (Anhalt), Germany, Editor in Chief.
1908. Vieweg, Dr. Walter, Gross Auheim, bei Hanau a/M., Germany, Chemist.
1909. Virolleaud, Leopold, 16, Quai de Suresnes, Suresnes, Seine, France, Chemical Engineer.
1897. Vlies, Leonard E., Belmont, Gowan Road, Alexandra Park, Manchester.
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1887. Voelcker, Dr. J. A., 20, Upper Phillimore Gardens, Kensington, W., Agricultural Chemist.
1901. Vogel, G. C., c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Tanner.
1897. Vogel, Julius L. F., 27, Old Jewry, London, E.C., Engineer.
1899. Vogeler, Gustav, 17, Philpot Lane, London, E.C., Merchant.
1897. Voorhees, Louis A., 111, Carroll Place, New Brunswick, N.J., U.S.A., Agricultural Chemist.
1899. Voorhees, Samuel S., Technologic Branch, U.S. Geological Survey, Washington, D.C., U.S.A., Chemist.
1902. Vorisek, Dr. Anton, College of Pharmacy, 115–119, West 68th Street, New York City, U.S.A., Instructor.
1888 Vörster, Fritz, Cöln-Marienburg, Germany, Manufacturing Chemist.
1885 Voss, Hermann, 19, Beckenham Road, Beckenham, Kent, Manure Works Manager.
1899. Voss, Walter A., Carlton Chemical Works, Glengall Road, Millwall, E., Manufacturing Chemist.

W

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1902. Wade, Frank, 26, St. Ronan's Avenue, Southsea, Analytical Chemist.
1890. Wade, Jas. L., 28, West Kensington Gardens, London, W., Chemical Manufacturer.
1889. Wadman, W. E., 102, Lord Avenue, Bayonne, N.J., U.S.A., Manufacturing Chemist.
1897. Wagner, Dr. Theodore B., 746, Marquette Terrace, Chicago, Ill., U.S.A., Chemist.
1893. Wagner, W. G., 12, North Common Road, Ealing, W., Manufacturing Chemist.
1906. Wagstaffe, Dr. E. A., 22, Blackfriars Street, Manchester, Analytical Chemist.
1906. Wahl, Dr. Robert, 1135–1147, Fullerton Avenue, Chicago, Ill., U.S.A., President, Brewers' School.
1903. Wainwright, J., 15, Bolton Road, Port Sunlight, near Birkenhead, Soap Works Manager.
1884. Wainwright, Dr. J. H., 22, West 46th Street, New York City, U.S.A., Analytical Chemist.
1906. Wainwright, R. E., Woodside Dyeworks, Horsforth, near Leeds, Dyer.
1895. Wainwright, Wm., c/o Spooner and Bailey, Manure Works, Eling, near Southampton, Chemist.
1908. Wait, Douglas, c/o R. Gay and Co., Ltd., Langthorne Works, Stratford Market, London, E., Analytical Chemist.
1901. Waite, C. Nelson, c/o The Jessup & Moore Paper Co., Delaware Mills, Wilmington, Del., U.S.A., Chemist.
1899. Wakefield, Wm. C., Overthorpe, Thornhill, near Dewsbury, Chemist.
1905. Waldenberger, Dr. C. A., c/o Independent Baking Powder Co., 322-328, Warren Street, Jersey City, N.J., U.S.A., Chemist.
1894. Waldman, Louis J., P.O. Box 162, Albany, N.Y., U.S.A., Aniline Dye Manufacturer.
1895. Waldstein, Dr. Martin E., 100, William Street, New York City, U.S.A., Manufacturing Chemist.

1887. Walker, Archibald, Newark Castle, Ayr, N.B., Distiller.
1908. Walker, George, c/o Burmah Oil Co., P.O. Box 67, Rangoon, Burmah, Analytical Chemist.
1897. Walker, H. S., 586, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1894. Walker, Dr. Jas., 5, Wester Coates Road, Edinburgh, Professor of Chemistry.
1897. Walker, Jas. W., Marine Lodge, Irvine, N.B., Chemical Manufacturer.
1906. Walker, Jas. W., Stonydale, Oakamoor, Stoke-on-Trent, Assayer.
1902. Walker, Jno. H., Gourepore Works, Naihati, E.B.S.R., Bengal, India, Chemist.
1910. Walker, John S., Hiratsuka, Sagami, Japan, Chemist.
1884. Walker, S. R., Fern Bank, Seedling Road, Radcliffe, Manchester, Foreman Dyer.
1900. Walker, Dr. Wm. H., Mass. Institute of Technology, Boston, Mass., U.S.A., Chemical Expert.
1895. Walker, W. Sloane, c/o Walker, Ltd., Litherland, near Liverpool, Tanner.
1897. Wallace, Edwin C., 306, South Street, Jamaica Plain, Boston, Mass., U.S.A., Chemist.
1897. Wallace, Robt. A., 12, Avonmore Mansions, West Kensington, W., Chemical Manufacturer.
1883. Wallace, Robert, 20, Murrayfield Avenue, Edinburgh, Distiller.
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1906. Wallerstein, Leo, 105, East 91st Street, New York City, U.S.A., Chemist.
1899. Wallerstein, Dr. Max, 105, East 91st Street, New York City, U.S.A., Chemist.
1886. Walsh, F. T., 12, Valentine Street, West Newton, Mass., U.S.A., Colour Printer.
1901. Walsh, Lionel O.P., c/o Burt, Boulton, and Haywood, Ltd., Prince Regent's Wharf, Silvertown, E., Chemist.
1903. Walsh, Peter H., P.O. Box 569, Magog, Quebec, Canada, Analytical Chemist.
1907. Walsh, Philip C., 19, Grant Street, Newark, N.J., U.S.A., Electro-Chemist and Metallurgist.
1904. Walther, Wm., Holzapfel's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.
1908. Walton, Robert H., Railway Stores, Eveleigh, Sydney, N.S.W., Analyst.
1902. Walton, Thos. U., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1895. Want, W. Philip, 44, Bishopsgate Street Without, London, E.C., Pharmacist and Editor.
1901. Warburton, Frank, 50, Rosebery Road, Muswell Hill, N., Manager.
1904. Warburton, George H., 77, Kingsgate Road, West Hampstead, N.W., Analytical Chemist.
1896. Warburton, Thos., 14, Sunny Bank Road, Rusholme, Manchester, Chemist.
O.M. Ward, Geo., Messrs. Hirst, Brooke, and Hirst, Ltd., Millgarth Mills, Leeds, Chemical Manufacturer.
1891. Ward, G. J., Hallam Fields, Ilkeston, Notts., Civil Engineer.
1898. Ward, John, Barnstone Blue Lias Lime Co., Ltd., Barnstone, Notts., Manager.
1899. Ward, Wm. J., 77, Chapel Road, Sale, Manchester, Chemist.
1908. Wardleworth, Theo. H., 168, Côte Saint Antoine Road, Westmount, Montreal, Canada, Manufacturing Chemist.
1902. Waring, W. Geo., Webb City, Mo., U.S.A., Metallurgical Chemist.
1899. Warnes, Arthur R., c/o Josiah Hardman, Ltd., Aston Church Road, Nechells, Birmingham, Chemist.
1890. Warren, Fiske, c/o S. D. Warren and Co., Cumberland Mills, Westbrook, Maine, U.S.A., Paper Manufacturer.
1901. Warren, Jno. E., Eagle Chemical Works, Barchester Street, Poplar, E., Tar Distiller.
1907. Warren, W. H., Gas Works, Beckton, E., Gas Engineer.
1885. Waterfall, W. B., c/o Avon Manure Co., Bristol; and (Journals) Thurlmere, Clavering Road, Redland, Bristol, Manure Manufacturer.
1902. Watkins, E. J., Works Chemist.
1898. Watkins, Willard H., c/o Schoellkopf, Hartford, and Hanna Co., P.O. Drawer 57, Buffalo, N.Y., U.S.A., Chemist.
1894. Watmough, Benj., 1, Ryeburn, Stanley Road; and (Journals) c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Chemist.
1884. Watson, Chas., Fairfield, Washwood Heath Road, Birmingham, Manufacturing Chemist.
1891. Watson, Chas. Ernest, 28, Highfield Road, Stretford, Manchester, Chemical Assistant.
1908. Watson, C. I. Wilkinson, 20, Finlay Drive, Dennistoun, Glasgow, Chemist.
1890. Watson, Eric E., c/o Straits Trading Co., Butterworth, Penang, S.S., Chemist.
1901. Watson, Herbert J., 38, Peel House Lane, Widnes, Chemist.
1903. Watson, H. W., Rose Villa, Roper Avenue, Gledhow, Leeds, Analytical Chemist.
1903. Watson, Hugh M., 22, Coleraine Road, Blackheath, S.E., Paint Manufacturer.
1894. Watson, Jas., Tyne View, Hebburn-on-Tyne, Alkali Works Manager.
1905. Watson, James, 5, Kendrew Street, Darlington, Manager.
1891. Watson, Jno., Langdon, Beaconsfield Road, Blackheath, S.E., Analytical Chemist.
O.M. Watson, Jno. C., P.O. Box 523, North Adams, U.S.A., Manager.
1904. Watson, Percy, 551, Somerset Avenue, Taunton, Mass., U.S.A., Chemist and Dyer.
O.M. Watt, A., c/o Macfie and Sons, 34, Moorfields, Liverpool, Sugar Works Chemist.
1901. Watt, Francis L., 10, Northcote Chambers, Reiby Lane, Circular Quay, Sydney, N.S.W., Australia, Analytical Chemist.
1906. Watt, Dr. H. E., Blandfield Chemical Works, Wheatfield Road, Edinburgh, Chemist.
1893. Watts, Jno. Isaac, Fairleigh, Hartford, Cheshire, Alkali Works Manager.
1908. Watts, Jno. Wm., Newcastle Tar Works, Blaydon-on-Tyne, Manager.
1907. Waumsley, Harry, Devon House, Hamlet Road, Chelmsford, Chemical Engineer.
1903. Wayland, Wm. A., 12, Albert Road, Brockley, S.E., Manufacturing Chemist.
1906. Webb, Frank H., 7, Dustin Street, Haverhill, Mass., U.S.A., Chemist.
1905. Webber, W. J., 55, Kilby Street, Boston, Mass., U.S.A., Manufacturing Chemist.
1901. Webster, Geo. J., 115, Delaware Avenue, Toronto, Canada, Secretary.
1902. Webster, Jno., Laboratory of Pathological Chemistry, St. Mary's Hospital, London, W., Analyst.
1908. Webster, John H., Metallurgist and Salt Works Manager.
1906. Weddell, George, 20, Grainger Street West, Newcastle-on-Tyne, Manufacturing Chemist.
1901. Wedekind, Rud., Uerdingen, Niederrhein, Germany, Manufacturer of Alizarin and Bichromates.
1897. Wedge, Utley, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., U.S.A., Chemist.
1902. Weed, Hy. T., 181, Prospect Park West, Brooklyn, N.Y., U.S.A., Teacher of Chemistry.
1893. Weeks, H. B., 2, Infield Park Road, Barrow-in-Furness, Analytical Chemist.
1898. Weeple, Lawrence, Pinchin's Wharf, Stratford, E., Colour Works Chemist.
1904. Weil, Jacob A., c/o The Power Gas Corporation, Ltd., 39, Victoria Street, Westminster, S.W., Chemist.
1902. Weiskopf, Dr. Erich, c/o Japanese Explosives Co., Ltd., Hiratsuka, Japan, Works Manager.
1908. Weissmüller, Edward F., Hill Crest, Runcorn, Cheshire, Chemist.
1905. Weissmüller, Ernest C., Hill Crest, The Heath, Runcorn, Cheshire, Research Chemist.

1899. Weldon, Leonard E., 154, Egypt Road, New Basford, Nottingham, Dyer.
1907. Welham, Samuel D., c/o Brotherton and Co., Ltd., Church Road, Litherland, near Liverpool, Technical Chemist.
1903. Wellcome, Henry S., Snow Hill Buildings, London, E.C., Manufacturing Chemist.
1891. Wells, Jas. Gray, Carlton Lawn, Chester Road, Stretford, Manchester, Brewing Chemist.
1894. Wells, Pierson L., 86, Joralemon Street, Brooklyn, N.Y., U.S.A., Patent Lawyer and Engineer.
1885. Welsh, Jas., Standard Mills, Ferguson Road, Bombay, India, Printworks Manager.
1890. Welsh, Thos. L., 3, Prince's Gardens, Dowanhill, Glasgow, Analytical Chemist.
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1905. Welt, Dr. Ida, 694, Madison Avenue, New York City, U.S.A., Chemist.
1906. Wenger, Francis E., Clivedon, Wolstanton, Stoke-on-Trent, Ceramic Colour Manufacturer.
1909. Wentworth, Henry A., c/o Huff Electrostatic Separator Co., 60, India Street, Boston, Mass., U.S.A., Mining Engineer.
1909. Wescott, J. P., jr., 55, Washington Park, Newtonville, Mass., U.S.A., Manager, Atlas Chemical Co.
1903. Wesener, Dr. John A., 103, State Street, Chicago, Ill., U.S.A., Consulting Chemist.
1889. Wesson, D., c/o Southern Cotton Oil Co., 24, Broad Street, New York City, U.S.A., Technical Chemist and Cotton-Oil Expert.
1908. West, Chas. A., c/o American Camphor Refining Co., 14, Fulton Street, Boston, Mass., U.S.A., President.
1903. West, Leonard, Shottle Hall, near Derby, Manufacturing Chemist.
1909. West, Percy C. H., 35, Bouverie Street, Chester, Analytical Chemist.
1900. Westenfelder, B. D., 1414, Race Street, Cincinnati, Ohio, U.S.A., Chemist.
1885. Westmoreland, J. W., 12, Arthington Terrace, Hunslet, Leeds, Metallurgical Chemist.
1898. Weston, David B., Sharon, Mass., U.S.A., Chemist.
1894. Weston, Robt. S., 14, Beacon Street, Boston, Mass., U.S.A., Chemist and Bacteriologist.
1885. Weston, Wm., 2, Ulundi Road, Blackheath, S.E., Analytical Chemist.
1908. Westwood, Arthur W., The Assay Office, Birmingham, Assay Master.
1890. Wetter, Jasper, 37–39, Essex Street, Strand, London, W.C., Patent Agent.
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1909. Wharton, Fredk. M., Hope Point House, Cliffe at Hoo, Kent, Explosives Chemist.
1908. Wheaton, H. J., 21, Chesterton Road, Cambridge, Chemical Engineer.
1909. Wheeler, Edward, 113, Highbury Quadrant, London, N., Demonstrator of Chemistry.
1898. Wheeler, Dr. Edwd. J., 79, Chapel Street, Albany, N.Y., U.S.A., Analytical Chemist.
1903. Wheeler, Ernest, 4, Fairfield Terrace, Higher Openshaw, Manchester, Metallurgical Chemist.
1906. Wheeler, Frank G., Trenton, Mich., U.S.A., Chemist.
1907. Wheeler, R. Vernon, The Colliery, Altofts, near Normanton, Chemist.
1895. Wheelwright, Dr. E. W., 24, Stanmore Road, Edgbaston, Birmingham.
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1905. Whetton, John, 77, Front Street East, Toronto, Canada, Manager of Canadian Branch of Read Holliday & Sons, Ltd.
1909. Whiffen, G. Goodman, Lombard Road, Battersea, London, S.W., Chemical Engineer.
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1893. Whitaker, Alf., Waltaire, Horsforth, Leeds, Dyer.
1899. Whitaker, Milton C., 825, Monmouth Street, Gloucester City, N.J., U.S.A., Chemist.
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O.M. Whitaker, Thorpe. (Journals) Bradford Dyers' Association, Ltd., and 35, Pemberton Drive, Bradford, Yorks., Dyer's Chemist.
1893. White, Arthur F., 2, Melbourne Grove, Thornbury, Bradford, Yorks., Manufacturing Druggist.
1908. White, George, Oilworks Chemist.
1910. White, G. D., c/o Patton Paint Co., Newark, N.J., U.S.A., Manager.
1901. White, H. Graham, Mere Cottage, Oxton, Birkenhead, Works Chemist.
1889. White, Henry, 245, Western Road, Crookes, Sheffield, Manufacturing Chemist.
1898. White, Jno., County Offices, St. Mary's Gate, Derby, Public Analyst to County of Derby.
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1905. White, William, Beloeil Station, Province Quebec, Canada, Chemist.
1903. Whitehouse, P. L., c/o W. H. Keys, Ltd., West Bromwich, Staffordshire, Oil Chemist.
1909. Whitehouse, Wm., Albany House, Bradmore, Wolverhampton, Lecturer on Chemistry.
1906. Whiteley, C. E., 21, Brudenell View, Leeds, Demonstrator of Chemistry.
1885. Whiteley, R. Lloyd, The Institute, West Bromwich, Staffordshire, Principal.
1892. Whiteside, Jno. L., 376, St. Helen's Road, Bolton le-Moors, Chemical Lecturer.
1908. Whiting, Jasper, 131, State Street, Boston, Mass., U.S.A., Chemical Engineer.
1885. Whittaker, C. J., Winthrop, Ansdell Road, Lytham, Lancashire, Chemical Engineer.
1904. Whittier, Charles T., 322, Warren Street, Jersey City, N.J., U.S.A., Manager.
1901. Whitton, Jas. T., c/o Nobel's Explosives Co., Ltd., Ardeer, Stevenston, N.B., Chemist.
1884. Whowell, F., Croich Hey, Tottington, Bury, Lancs., Bleacher.
1899. Wiarda, Jno. C., 259–273, Green Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1897. Wiborg, F. B., The Ault and Wiborg Co. of New York, 534, Pearl Street, New York City, U.S.A., Manufacturer.
1908. Wiekes, Clarence S., 28, Franklin Avenue, Merchantville, N.J., U.S.A., Factory Superintendent.
1905. Widmann, Eugene A., 495, Eighth Avenue, Brooklyn, N.Y., U.S.A., Dyestuff Merchant.
1904. Wieler, Eric E., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1904. Wiener, William, 62½, Nelson Place, Newark, N.J., U.S.A., Analytical and Consulting Chemist.
1906. Wiffen, Henry J., 17, Albany Road, Manor Park, Essex, Manufacturing Chemist.
1883. Wiggin, W. W., Wiggin Street Works, Birmingham, Nickel Refiner.
1908. Wiggins, Elmer W., c/o E. I. du Pont Powder Co., Gibbstown, N.J., U.S.A., Chemist.
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1906. Wikner, Sigurd A., 39, Margaret Street, Hull, Tar Works Chemist.
1899. Wild, Roland C., The Grange, New Eltham, Kent, Analytical Chemist.
1893. Wilder, F. L., Morro Velho, Villa Novo de Lima, Estado de Minas Geraes, Brazil, Assayer.
1902. Wilder, Salmon W., jun., 33, Broad Street, Boston, Mass., U.S.A., Treasurer.
1899. Wildman, Arthur J., 133, Central Park Road, East Ham, E., Chemist.
1902. Wiley, Dr. Harvey W., Bureau of Chemistry, Department of Agriculture, Washington, D.C., U.S.A., Chief.
1906. Wilke, Wm., 86, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemical Engineer.

1899. Wilkens, H. A. J., c/o New Jersey Zinc Co., 55, Wall Street, New York City, U.S.A., Mining Engineer.
1903. Wilkie, Jno. M., 38, South Road, West Bridgford, Nottingham, Analytical Chemist.
1885. Wilkin, Sir Walter, K.C.M.G., Appold Street, Finsbury, E.C., Yeast Manufacturer.
1895. Wilkins, Charles, 40, Church Lane, Hornsey, N., Manufacturing Perfumer.
1904. Wilkinson, Prof. J. A., Transvaal University College, P.O. Box 1176, Johannesburg, Transvaal, Professor of Chemistry.
1886. Wilkinson, J. B., Tong Street, Dudley Hill, Bradford, Yorks., Chemical Manufacturer.
1906. Wilkinson, John E., 69, Lombard Street, Toronto, Canada, Gold and Silver Refiner.
1903. Willard, C. T., 29, Chestnut Street, Newark, N.J., U.S.A., Chemist.
1893. Willcox, Benjamin, 47, Lincoln's Inn Fields, London, W.C.; (Journals) 34, Hamilton Terrace, St. John's Wood, N.W., Patent Agent.
1903. Williams, Chas. E., Thornhayes, Sleaford, Seed Crusher.
1895. Williams, David T., 42, Finsbury Square, London, E.C., Chemist and Assayer.
1891. Williams, Henry J., 161, Tremont Street, Boston, Mass., U.S.A., Chemical Engineer.
1908. Williams, Herbert E., 23, Kenilworth Road, Beckenham Road, Penge, Chemist.
1904. Williams, Jno. T., Engineering Building, 114, Liberty Street, New York City, U.S.A.
1904. Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.
1902. Williams, Percy, c/o The Wilhelmina Co., Pontianak, Dutch West Borneo, *viâ* Singapore, Chemist.
1885. Williams, Rowland, Hale Cote, Albert Park, Lancaster, Analytical Chemist.
1900. Williams, Saml. H., Glastonbury, Conn., U.S.A., Soap Manufacturer.
1903. Williams, S. M., 269, Springdale Avenue, East Orange, N.J., U.S.A., Chemist.
1885. Williams, T. Howell. *See* Idris, T. H. W.
1884. Williams, Prof. W. Carleton, Broomgrove, Goring-on-Thames, Professor of Chemistry.
1902. Williams, Walter Scott, 14, Springate Street, Utica, N.Y., U.S.A., Chemical Engineer.
1887. Williams, W. Collingwood, 36, Dansie Street, Liverpool, Analytical Chemist.
O.M. Williams, W. J., 5004, Franklin Street, Frankford, Philadelphia, Pa., U.S.A., Analytical Chemist.
1894. Williamson, J. Alex., The Croft, Chase Court Gardens, Enfield, N., Analytical Chemist.
O.M. Williamson, Robt., Low Walker, Newcastle-on-Tyne, Technical Chemist.
1903. Wills, J. Lainson, 133, Midwood Street, Brooklyn, N.Y., U.S.A., Technical and Brewing Chemist.
1905. Wills, Wm. H., 162, Main Street, Waltham, Mass., U.S.A., Dyer.
1895. Willson, Thos. L., St. Catherine's, Ont., Canada, Electrical Engineer.
1890. Wilson, Alf., c/o Messrs. J. and E. Sturge, 18, Wheeley's Lane, Birmingham, Chemist.
1884. Wilson, Anthony W., 20, Westcott Street, Hull, Colour Works Manager.
1888. Wilson, Cecil H., c/o Sheffield Smelting Co., Ltd., Royds Mills Street, Sheffield, Chemist.
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1888. Wilson, Dr. David, Carbeth, Killearn, by Glasgow.
1910. Wilson, Dr. Forsyth J., Technical College, Glasgow, Lecturer.
1885. Wilson, Frank, 7, Bedford Square, London, W.C., Brewer.
1903. Wilson, Geo. C., 298, Byars Road, Hillhead, Glasgow, Chemist.
O.M. Wilson, G. E., The Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
1902. Wilson, Geo. W., Simmondley, Glossop, Derbyshire, Works Chemist.
1899. Wilson, Gordon, Benallan, Kirkintilloch, N.B.; and (Journals) British Club, Mexico, D.F., Chemist and Assayer.
1886. Wilson, Jno., Tyneside, Hagley Road, Birmingham, Technical Chemist.
1896. Wilson, Jno., The Vines, Oxford Road, Runcorn, Chemical Engineer.
1909. Wilson, Jno., Battersea Polytechnic, London, S.W., Head of Chem. Dept.
1905. Wilson, J. E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemical Salesman.
1906. Wilson, J. Murray, c/o Hamilton Powder Co., Beloeil Station, Prov. Quebec, Canada, Technical Chemist.
1902. Wilson, Leonard P., 19, Widdrington Road, Coventry, Technical Chemist.
O.M. Wilson, R. H., Egglecliffe P.O., Co. Durham, Chemical Manufacturer.
1900. Wilson, Walter A., c/o Hamilton Powder Co., Beloeil Station, P.Q., Canada, Chemist.
1909. Wilson, Wm. J., 12, Vicarage Park, Plumstead, Kent, Chemist.
1908. Wilson, William James, c/o Wilson's Portland Cement Co., Ltd., Warkworth, Auckland, New Zealand, Cement Works Manager.
1890. Wilson, W. W., Dalmonach House, Alexandria, Dumbartonshire, Analytical Chemist.
1884. Wilton, Thos., Winsor House, Beckton, E., Tar Works Manager.
1892. Wingfield, T. R., 5, Bromwich Street, Bolton, Brewer.
O.M. Wingham, A., 57, Victoria Road South, Southsea, Hants., Metallurgical Chemist.
1908. Winkler, Hermann, Metallgesellschaft, Frankfurt a/Main, Germany, Merchant.
1906. Winkler, S. M., 38 and 40, Main Street, Cincinnati, Ohio, U.S.A., Chemical Merchant.
O.M. Winser, P. J., Heath House, Knutsford, Cheshire, Consulting Chemist.
1907. Winsloe, Louis S., 114, The Albany, Liverpool, Manufacturing Chemist.
1892. Winstanley, Hy., Bridge House, Cheadle Hulme, Cheshire, Technical Chemist.
1886. Winstone, E. H., Members' Mansions, 36, Victoria Street, London, S.W., Ink Manufacturer.
1907. Winther, Dr. A., Chemische Fabrik Griesheim-Elektron, Werk Oehler, Offenbach a/Main, Germany, Chemist.
1892. Wirtz, Dr. Quirin, 28, Great Ormond Street, London, W.C., Consulting Chemist.
1889. Wishart, Jno., 39, St. Vincent Place, Glasgow, General Manager (Oakbank Oil Co., Ltd.).
1900. Wishart, Harlan L., c/o The Potts Powder Co., Tamaqua, Pa., U.S.A., Chemist.
1902. Withers, Prof. W. A., State A. and M. College, West Raleigh, N.C., U.S.A., Professor of Chemistry.
1906. Witley, Wm. S., Eldorado Banket Gold Mine, Lomagundi, South Rhodesia, Chemist.
O.M. Witt, Dr. Otto N., Ebereschenallee 10, Westend, bei Berlin, Professor of Chemistry.
1892. Witthaus, Dr. R. A., Cornell Medical College, 470, First Avenue and 28th Street, New York City, U.S.A., Professor of Chemistry.
1907. Wolcott, Townsend, 39, Whitehall Street, New York City, U.S.A.
1904. Wolf, August S., 206, West 95th Street, New York City, U.S.A., Chemist.
1903. Wolf, Jacques, c/o Jacques Wolf and Co., Passaic, N.J., U.S.A., Manufacturing Chemist.
1903. Wolton, Wm. R., c/o Joseph Fison and Co., Ltd., Ipswich, Manager.
1906. Wood, E. Escott, Hurricane House, Brymbo, near Wrexham, North Wales, Chemist and Metallurgist.
1900. Wood, Frank, Osborne House, Barnsley, Yorks, Assistant Manager (Glass Works).
1901. Wood, Frank S., Chin Chu, Heathcote Street, Newland, Hull, Cement Works Chemist.
1909. Wood, Hubert R., c/o Fenner and Alder and Co., Fenner's Wharf, Millwall, E., Works Chemist.

1887. Wood, Jos. T., 62, Park Road, Nottingham, Tanner.

1886. Wood, Wm., 20, Rue Général van Merlen, Antwerp, Belgium, Bleacher and Dyer.

1908. Woodbridge, Walter B., c/o Macleod and Co., 213, East Pearl Street, Cincinnati, Ohio, U.S.A., Chemist.

1906. Woodall, Corbet, Palace Chambers, Westminster, London, S.W., Civil Engineer.

O.M. Woodcock, R. C., c/o Sanitas Co., Ltd., Locksley Street, Limehouse, London, E., Technical Chemist.

1910. Woodhead, Arthur E., Dyeing Dept., The University, Leeds, Research Student.

1902. Woodhead, Chas. E., 458, Edge Lane, Droylsden, Manchester, Chemist.

1884. Woodhead, Jas., Inglewood, Slaithwaite, near Huddersfield, Tar Distiller.

1900. Woodrow, John, 84, Harpenden Road, South Wanstead, Essex, Chemist.

1906. Woodward, Horace A., Cowell Avenue, West Orange, N.J., U.S.A., Chemist.

1904. Woolcott, Geo. H., Lady's Well Brewery, Cork, Ireland, Brewer's Chemist.

1904. Woolcott, Herbert, c/o H. and G. Simonds, Ltd., The Brewery, Reading, Brewer's Chemist.

1896. Woolf, Julian, 51, Buckland Crescent, South Hampstead, N.W., Manufacturer.

O.M. Woolley, G. S., Victoria Bridge, Manchester, Pharmaceutical Chemist.

1905. Woore, N. L., P.O. Box 12, Mount Morgan, Queensland, Australia, Assayer.

1901. Worden, Edw. C., c/o Clark Thread Co., Newark, N.J., U.S.A., Analytical Chemist.

1909. Work, Charles O., 22, Cambridge Road, Great Crosby, Liverpool, Analytical Chemist.

O.M. Worrall, H., Crimsworth, Upper Chorlton Road, Manchester, Dyer.

1903. Worstall, Robt. A., 121, La Salle Street, Chicago, Ill., U.S.A., Paint and Varnish Specialist.

1900. Worthington, Arthur, Lynwood, Green Lane, Bolton, Chemist and Sub-Manager.

1896. Wrampelmeier, T. J., 2253, Piedmont Avenue, Berkeley, Cal., U.S.A., Chemist.

O.M. Wray, O. J. P., Hazlemere, Coleraine Road, Blackheath, S.E., Technical Chemist.

1904. Wright, Allister M., Box 617, G.P.O., Christchurch, N.Z., Chemist (Christchurch Meat Co.).

1895. Wright, Arthur C., c/o Turner, Morrison, and Co., 6, Lyons Range, Calcutta, India, Chemist.

1908. Wright, C. Harold, Government Laboratory, Port of Spain, Trinidad, B.W.I., Analytical Chemist.

1904. Wright, Chas. L., c/o U.S. Geological Survey, 40th and Butler Streets, Pittsburg, Pa., U.S.A., Chemical Engineer.

1908. Wright, Gilbert, Chemical Laboratory, University of Sydney, N.S.W., Demonstrator in Chemistry.

1901. Wright, Harold E., c/o Sir B. Samuelson and Co., Ltd., Middlesbrough, Chemist.

1907. Wright, J. G. E., c/o Edison & Swan United Electric Light Co., South Benwell Works, Newcastle-on-Tyne, Technical Chemist.

1907. Wright, John Henry, 22, Norwood Avenue, Shipley, Yorks., Technical Chemist.

1885. Wright, Jos., 19, Arboretum Street, Nottingham, Lace Dresser.

O.M. Wright, L. T., c/o The Mountain Copper Co., 150, Pine Street, San Francisco, Cal., U.S.A., Chemical Engineer.

1900. Wright, Walter J., c/o Mitchellite Explosives Co., Ltd., Clayknowes, Bonnybridge, near Glasgow, Explosives Chemist.

1890. Wülfing, Dr. Charles, Hönningen a/Rhein, Germany, Technical Chemist.

1907. Würster, Oscar H., The M. Werk Co., 411, Poplar Street, Cincinnati, Ohio, U.S.A., Soap Works Chemist.

1906. Wuth, Dr. Berthold, 76, Wettsteinplatz, Basle, Switzerland, Chemist.

1890. Wyatt, Dr. Francis, 402, West 23rd Street, New York City, U.S.A., Consulting Chemist.

1905. Wyer, Malcolm G., The Library, State University, Iowa City, Iowa, U.S.A., Librarian.

O.M. Wyld, Jno., The Avenue, Lidgett Park, Roundhay, Leeds, Chemical Works Manager.

1908. Wyler, Dr. Max, 65, Cecil Street, C. on M., Manchester, Manufacturing Chemist.

1906. Wynne, Prof. W. Palmer, F.R.S., The University, Sheffield, and (Journals) 17, Taptonville Road, Sheffield, Professor of Chemistry.

Y

1900. Yamaoka, S., 10, Nishikatamachi, Hongo, Tokyo, Japan, Chief Engineer.

1901. Yardley, Frank, c/o Henry Jutson and Sons, Liverpool Street, Birmingham, Chemical Manufacturer.

1899. Yates, Arthur, Lebong Donok, Benkoelen, Sumatra, Netherlands Indies, Metallurgist.

1897. Yates, Wm. H., 119, Hawkshead Street, Southport, Lancashire, Technical Chemist.

1910. Yeh, T. H., 51, Charlotte Road, Edgbaston, Birmingham, Student.

1906. Yerkes, Leonard A., c/o Jos. Bancroft and Sons Co., Wilmington, Del., U.S.A., Bleacher and Finisher.

1898. Yetton, Thos., 86, Bow Road, London, E., Consulting Distiller's Chemist.

1894. Yocum, Dr. Jno. H., 359, Halsey Street, Newark, N.J., U.S.A., Chemist.

1886. Yoshida, Prof. H., Imperial University of Kyoto, Kyoto, Japan, Professor of Chemistry.

1900. Yoshitake, E., 18, Tatsuokacho, Hongo, Tokyo, Japan, Chemist.

1885. Young, Alfred C., 17, Vicar's Hill, Lewisham, S.E.

1885. Young, Brougham, 2A, Sigdon Road, Dalston, N.E., Analytical Chemist.

1902. Young, Chas. C., c/o Continental Color & Chemical Co., 32, India Street, Boston, Mass., U.S.A., Colourist.

1890. Young, Dr. Geo., 79, Harvard Court, Honeybourne Road, West Hampstead, N.W., Chemist.

1904. Young, James, 2A, Dartmouth Road, Brondesbury, N.W., Chemist.

O.M. Young, Jno., 2, Montague Terrace, Kelvinside, Glasgow, Technical Chemist.

1886. Young, Jno., Claremont House, Beverley Road, Hull, Gas Engineer.

1909. Young, John, Highfield, Stanley Road, Teddington, Middlesex, Analytical Chemist.

1904. Young, Jno. H., c/o The Cassel Cyanide Co., Ltd., Shuna Street, Maryhill, Glasgow, Technical Chemist.

1898. Young, J. W., 3, Murray Street, Higher Broughton, Manchester, Inspector under Alkali Acts.

1909. Young, R. F., c/o Abosso G. M. Co., Abosso, Gold Coast, West Africa, Chemist and Metallurgist.

1883. Young, Prof. Sydney, F.R.S., University Chemical Laboratory, Trinity College, Dublin, Professor of Chemistry.

O.M. Young, W. C., Laboratory, 19–20, Aldgate, London E.C., Gas Examiner and Consulting Chemist.

1898. Young, W. Gathorne, Analyst's Dept., G.N.R., Doncaster, Yorks., Chief Chemist.

Z

1899. Zabriskie, C. B., c/o Pacific Coast Borax Co., 100, William Street, New York City, U.S.A., Manager.

1897. Zacharias, Dr. P. D., Philhellinon Street 22, Athens, Greece, Industrial Chemist.

1906. Zaremba, Edw., 1044, Ellicott Square, Buffalo, N.Y., U.S.A., President (Zaremba Co.).

1906. Zdanowicz, Joseph, 9, Knaresborough Place, Earl's Court, S.W., Chemical Engineer (Artificial Silk).

1899. Zilz, Henry, 20–26, Brunswick Place, City Road, London, E.C., Agent (Badische Anilin und Soda Fabrik).

O.M. Zimmermann, A., 3, Lloyd's Avenue, London, E.C., Chemical Agent.

1905. Zimmermann, Chas., 9 & 10, St. Mary-at-Hill, London, E.C., Chemical Merchant.

1897. Zinsser, Dr. Fred. G., Hastings-upon-Hudson, N.Y., U.S.A., Manufacturing Chemist.

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